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Starcosa GmbH
Ein Unternehmen der BASF Gruppe

STARCOSA

UNIDO
United Nations Industrial
Development Organization
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Our Reference
SC-Fi/Ru

Braunschweig
18.11.1993

Project DP/ANG/86/004
UNIDO CONTRACT No. 89/72
Activity Code: J 13103
Industrial Engineering Design for the Baker's Yeast Factory
Fermentos Holandeses, Luanda, P. R. Angola

FINAL REPORT

Content of Container

4 (four) files

each containing 1 (one) copy

of the following documentation and drawings:

- Letter of Transmittal
- Table of Content

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2.0	List of Statement of Staff	(2 pages)
3.0	Yeast Factory weekly working progamme	(1 page)
4.0	Fermentation Sheet for pure culture fermentation	(1 copy) (1 transparent)
5.0	Fermentation Sheet for mother yeast and trade yeast fermentation	(1 copy) (1 transparent)
6.0	Technological Handbook / 1	(68 pages)

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7.0	P & I Drawings	
7.1	Drawing No. 3.03.50 430 rev. No. 7	Storage and Preparation of Molasses
7.2	Drawing No. 3.03.50 431 rev. No. 4	Ammonia Water System
7.3	Drawing No. 3.03.50 442 rev. No. 3	Sulphuric Acid Dilution and Distribution
7.4	Drawing No. 3.03.50 411	Antifoam Oil Handling System
7.5	Drawing No. 3.03.50 433 rev. No. 7	Fermentation
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7.9	Drawing No. 3.03.50 416 rev. No. 4	Process Water Equipment
7.10	Drawing No. 3.03.50 417 rev. No. 5	Water Recooling

Yours faithfully,

Starcosa GmbH

i.V. Fischer

Encl.

Table of Content

Consumption Materials

for one month for the baker's yeast plant

Fermentos Holandeses

(calculated for 5 operating days per week)

1.	Sugar cane molasses (with 50 % assimilable sugar)	300	t
2.	Monoammoniumphosphate (60 % P_2O_5, 10 % N)	3.500	kg
3.	Ammonia water (25 % by weight)	22.000	kg
4.	Magnesium sulphate	1.200	kg
5.	Sodium chloride	3.500	kg
6.	Sulphuric acid (96 % by weight)	2.500	kg
7.	Calcium pantothenate	2,5	kg
8.	Malt extract	250	kg
9.	Potato starch	3.500	kg
10.	Caustic soda flakes	2.500	kg
11.	Formalin	300	kg
12.	Nitric acid	700	kg
13.	Benzylpenicillin potassium salt	1,5	kg
14.	Antifoam oil "Structol J 673"	1.200	kg
15.	Emulsifying agent "J 600"	1.000	kg
16.	Heating oil	25.000	kg
17.	Alginates	250	kg
18.	Sodium hypochlorite	350	kg
19.	Packing material	sufficient amount must be provided by customer	

Statement of Staff

required for the operation, operational control and maintenance of the baker's yeast factory with a processing capacity of 8.000 kg/24 hours fresh baker's yeast.

Designation or sphere of work	Qualification	Shift I	Shift II	Shift III	Total
works manager	Process Engineer	1			1
assistant	Microbiologist	1			1
microbiological laboratory	Microbiologist	1			1
chemical laboratory	Chemist	1	1	1	3
shift leader fermentation	Skilled Worker	1	1	1	3
molasses preparation	Semiskilled Worker	1	1	1	3
fermentation	Semiskilled Worker	1	1	1	3
separation	Semiskilled Worker	1	1	1	3
shift leader filtration	Skilled Worker	1	1		2
filtration and packing	Semiskilled Worker Unskilled Worker	1 2	1 2		2 4
steam generating water supply, ice water generating	Skilled Worker	1	1	1	3
chief electrician	Engineer	1			1
electric works	Electrician	1	1	1	3
chief mechanics	Engineer	1			1
mechanic works	Mechanics	1	1	1	3
					37

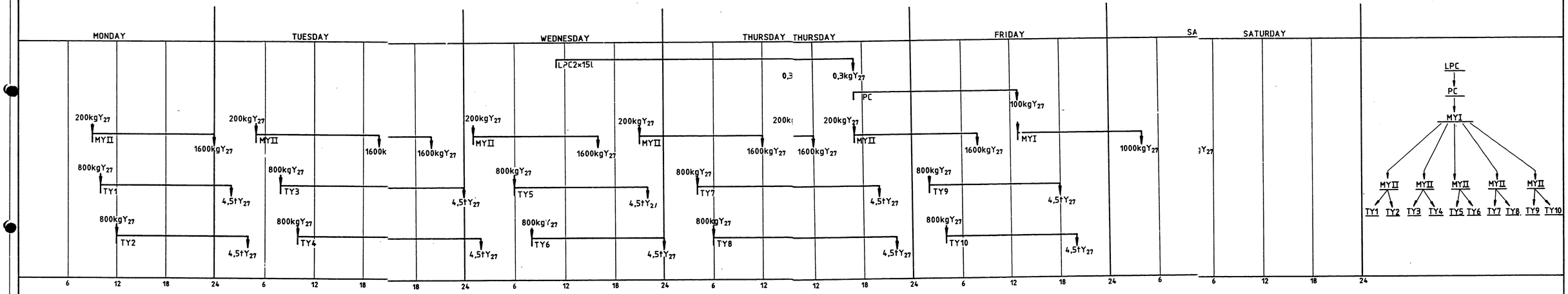
(statement of staff) - 2 -

The above statement does not comprise the staff for store, gate house, workshop and transport service. In addition, it has been assumed that the operating staff carries out the cleaning of the plant after every shift.

The statement contains only the actual staff requirement per shift or, respectively per day. In the event of the plant operating seven days/week or the staff being allowed to work only a specific number of hours/week, substitutes must be employed in accordance with the local regulations. This applies also to substitutes in case of loss or working hours as a result of illness of holiday.

YEAST FACTORY - WORKING PROGRAMME

FERMENTOS HOLANDES, LUANDA - ANGOLA



LEGEND :

LPC = LABORATORY PURE CULTURE

PC = FACTORY PURE CULTURE

MYI = MOTHER YEAST NO. ONE

MYII = MYII = MOTHER YEAST NO. TWO

TY = TRADE YEAST

YEAST STRAIN
Hefestamm

FERMENTATION No.
Fermentation Nr.

DATE:
Datum

FERMENTER
Fermenter

_____ l x _____ = _____ kg MOLASSES

MOTHER YEAST : KARLSBERG FLASK
Stellhefe
Karlsbergkolben

_____ l WORT
Würze

_____ kg MONOAMMONIUM PHOSPHATE
Monoammonphosphat

_____ kg MAGNESIUM SULPHATE
Magnesiumsulfat

_____ l PROCESS WATER
Prozeßwasser

_____ l ANTIFOAM OIL
Antischaumöl

_____ kg MALT EXTRACT
Malzextrakt

_____

_____

_____

_____ l FINAL QUANTITY
Endbefüllung

H	TIME Zeit	BRIX	°C	AIR Luft	pH			
PRE-CHARGE Vorlage								
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								

PRODUCTION
Erzeugung

YEAST
Hefe

_____ g/l

_____ kg

ALCOHOL
Alkohol

_____ V%

_____ l

PROTEIN
Protein

_____ %

P_2O_5

_____ %

YEAST STRAIN
HEFESTAMM

FERMENTATION NO.
FERMENTATION NR.

DATE:
DATUM

FERMENTER
FERMENTER

_____ l x _____ = _____ kg

N - BILANCE
N-Bilanz

MOLASSES _____ kg × _____ NAF = _____ kg N

MOTHER Y. _____ kg × 0,27 × _____ N = _____ kg N
Stellhefe

_____ kg YEAST NET
Erntehefe

_____ kg MOTHER YEAST
Stellhefe

_____ kg × 0,27 × _____ N = _____ kg N

$$\frac{\text{kg}}{0{,}2 \times 0{,}9} = \text{l AMMONIA - SOL.}$$

MOTHER YEAST NO. _____
Stellhefe Nr.

_____ kg

_____ l

_____ kg MONOAMMONIUM PHOSPHATE
Monoammonphosphat

_____ kg MAGNESIUM SULPHATE
Magnesiumsulfat

_____ kg AMMONIA SOLUTION
Ammoniakwasser

_____ kg H_2SO_4

_____ g

_____ g CALCIUMPANTOTHENATE
Kalziumpantothenat

_____ kg MOLASSES

_____ l SODIUM HYPOCHLORITE
Natronbleichlauge

SECTION 1

H	TIME Zeit	BRIX	°C	AIR Luft	pH	H_2SO_4	AMMONIA SOLUTION	NOVEM	AIR Luft	pH	H_2SO_4	AMMONIA SOLUTION	MONOAM. PHOSPHATE	$MgSO_4$	MOLASSES
PRE-CHARGE Vorlage															
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
TOTAL Summe															

PRODUCTION
Erzeugung

YEAST CREAM TANK NO. _____ = _____ l
Hefemilchbehälter Nr

_____ l x _____ g/l = _____ kg

pH = _____

QUALITY
Qualität

PROTEIN
Protein _____ %

P_2O_5 _____ %

D.S. TEST CAKE
HTS Nutsche _____ %

FERMENTATION POWER
Triebkraft _____ ml CO_2

_____

D.S. YEAST BLOCK
HTS Hefeblock _____ %

pH _____

SECTION 2

Starcosa GmbH

Ein Unternehmen der BMA-Gruppe

TECHNOLOGICAL HANDBOOK /1

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MAI 88

OPERATIONS MANUAL

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5. Instructions for Operation of Fermentation Plant

5.1 Process Pure Culture
5.1.1 Pure-culture Fermenter 70.20 B1
5.1.2 Sterilizing and Cooling
5.1.3 Seeding
5.1.4 Fermentation and Transfer of Pure-culture Solution into Fermenter 70.20 B4
5.1.5 Cleaning of Pure-culture Fermenter 70.20 B1

5.2 First Mother Yeast
5.2.1 Mother-yeast Fermenter 70.20 B4
5.2.2 Filling of Fermenter 70.20 B4
5.2.3 Fermentation of 1st Mother Yeast
5.2.4 Fermentation Scheme for 1st Mother Yeast
5.2.5 Calculation of Fermentation Scheme for 1st Mother Yeast

5.3 Second Mother Yeast
5.3.1 Mother-yeast Fermenter 70.20 B7
5.3.2 Filling of Fermenter 70.20 B7
5.3.3 Fermentation of 2nd Mother Yeast
5.3.4 Fermentation Scheme for 2nd Mother Yeast
5.3.5 Calculation of Phosphate Addition
5.3.6 Calculation of Ammonia Solution Addition

5.4 Trade Yeast
5.4.1 Trade-yeast Fermenter 70.20 B7
5.4.2 Filling of Fermenter 70.20 B7
5.4.3 Fermentation of Trade Yeast
5.4.4 Fermentation Scheme for Trade Yeast
5.4.5 Calculation of Phosphate Addition
5.4.6 Calculation of Ammonia Solution Addition

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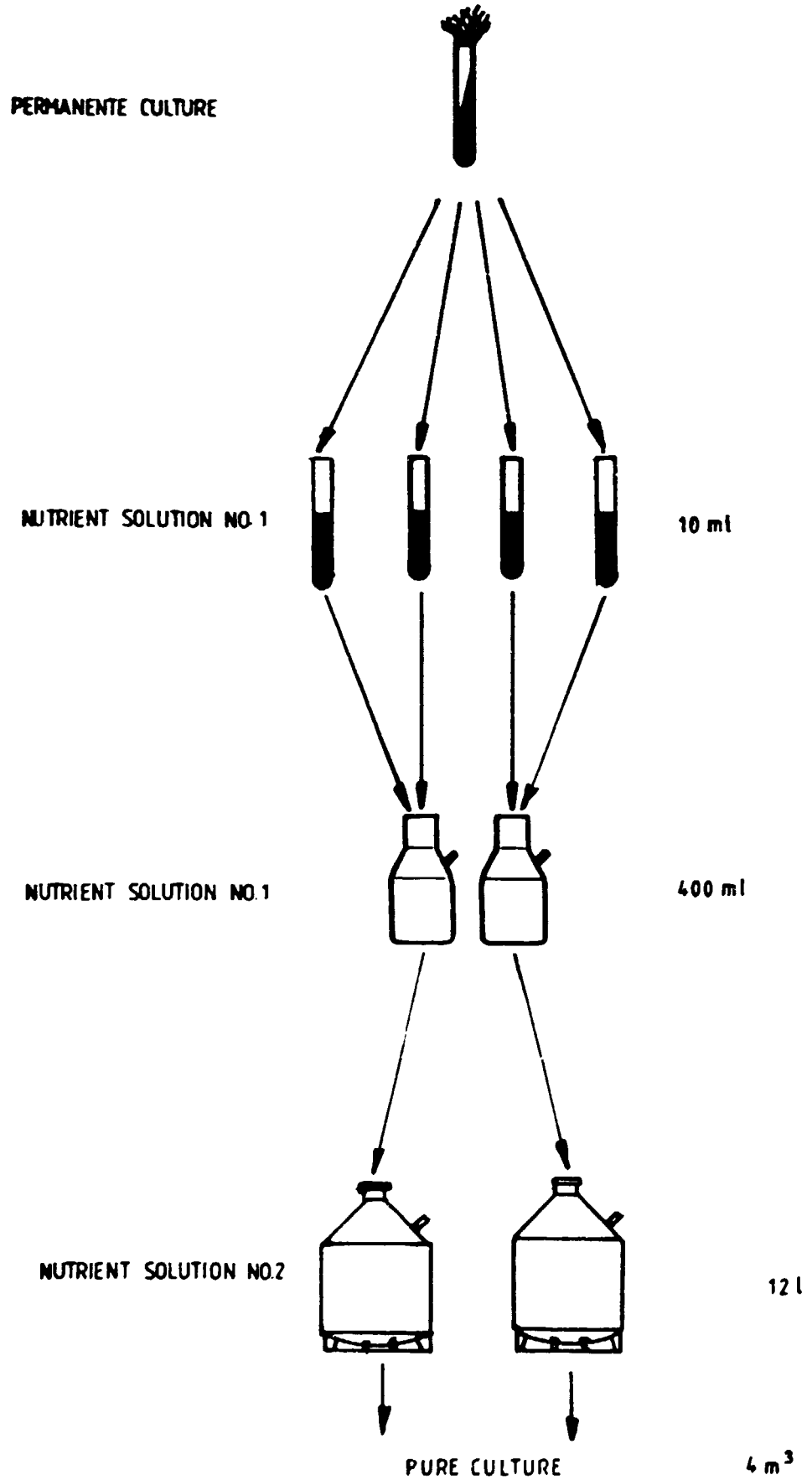

		1990	Datum	Name	Benennung
		Bearb.	13. 2.		LABORATORY PURE CULTURE
		Gepr.			
		Norm			
		STARCOSA G. m. b. H. Braunschweig			Nr. 3.03.50428
Zust.	Änderung	Datum	Name	Urspr.	Ers. für: / Ers. durch:

1. Operational Fermentation

1.1 Non-alcoholic Yeast Fermentation

At any modern yeast factory, culturing is based on a single-cell yeast culture. This single yeast cell is provided with nutrient solutions and optimum conditions to reach a final stage of multiplication where the quantity and quality is that of trade yeast. The process from the single-cell culture through to the trade yeast is one single unit operation which, for functional reasons only, is divided into several stages. The physiological condition of the yeast in one stage always has a considerable influence on the following stage, and this results in a continuity of multiplication from the single-cell culture through to the trade yeast.

The individual process stages are:

(1) pure culture,
(2) first mother yeast,
(3) second mother yeast,
(4) trade yeast.

In this yeast multiplication process, the trade yeast is the only one that is "run" non-alcoholically, while for pure culture and mother yeasts the formation of alcohol is necessary and partly even desired. The alcohol protects the yeast against bacterial infections which would deteriorate its quality.

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For the final hours of 2nd mother yeast and trade yeast production, the process has to be non-alcoholic, as the formation of alcohol would deteriorate the quality of the yeast and reduce its yield.

Dosing of molasses (wort), i. e. the amount of molasses to be fed into the fermenter per hour, is subject to the measure by which a given quantity of yeast can multiply within one hour (H-factor). In non-alcoholic fermentation, the H-factor that can be achieved with certainty is H = 1.18, i. e. under non-alcoholic conditions x kg of yeast yield x . 1.18 kg per hour.

Conditions affecting the H-factor are the amount of air made available, the amount of nutrient salts and the required quality of the yeast. A high quality with regard to leavening and keeping properties, can be ensured only if during the final hours of fermentation the H-factor is reduced to 1.10 - 1.05. This means the molasses dosing equipment has to be designed in a manner ensuring an optimum H-factor. For verification of the calculated design (see fermentation plans for mother and trade yeast), hourly yeast multiplication as well as the alcohol content in the fermenter have to be checked as well. In case alcohol develops, the feed has to be reduced accordingly.

A rule of thumb to be applied to designing the molasses dosing equipment is that the formation of 1 kg of Y27 requires approx. 1 kg of concentrated molasses containing 50 % assimilable sugar or 1.62 litres of wort of 42 °Brix (or of 80 °Brix in case of pure molasses).

. . .

So, when non-alcoholic yeast multiplication in the fermenter has been checked, the hourly feed has to be established.

In general, addition of molasses for yeast multiplication can be summarized as follows:

(a) Prior to fermentation proper, approx. 100 to 200 litres of wort are added to the water in the fermenter. This amount is necessary to provide the seed yeast (pure culture or mother yeast) with a small amount of molasses before yeast multiplication begins. The alcohol developing at this stage can be disregarded.

(b) Fermentation begins with addition of molasses in conformity with the attached plan for mother yeasts and trade yeast. One has to make sure that during the initial hours of fermentation the H-factor is H = 1.18. Towards the end of yeast multiplication the H-factor should be reduced to 1.10 - 1.05. To avoid losses, no alcohol should develop during fermentation.

Nutrient salts are imperative for the yeast metabolism. Too large or too small an amount of nutrient salts, however, would considerably affect the quality of the yeast.

1.2 Nitrogen

Supply of the yeast with nitrogen is of utmost importance, the more so as one half of the dry yeast substance is composed of nitrogen compounds which come under the term

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proteins. The nitrogen required by the yeast is supplied by inorganic compounds (e. g. ammonia water, monoammonium phosphate) and organic compounds (amino acids) of the molasses. As the molasses contain very little amino acids (to be determined by the NAF method), the balance has to be supplied by inorganic nitrogen compounds.

In general, addition of nitrogen for yeast multiplication can be summarized as follows:

(a) The nitrogen or protein content of the yeast is a factor having a decisive influence on yeast quality and multiplication. A protein content exceeding 50 % (equivalent to 8 % nitrogen in dry substance) enhances the H-factor, but deteriorated the keeping quality of the yeast. On the other hand, a protein content of less than 40 % diminishes the leavening power, but improves the keeping quality.

(b) The protein in the pure culture and in the mother yeasts should be approx. 50 % (equivalent to approx. 8 % nitrogen in the dry yeast substance).

(c) The trade yeast should contain min. 6,75 % nitrogen in dry yeast substance.

(d) During fermentation the nitrogen in the trade yeast should be controlled continuously.

(e) Due to the varying content of amino acid in the molasses, the addition of inorganic nitrogen has to be conformed accordingly.

. . .

(f) Addition of nitrogen shall be such that no more nitrogen is added for the final 2 to 3 hours of fermentation.

(g) The amount of nitrogen required per hour (see fermentation plan for mother yeast and trade yeast) shall be fed into the fermenter continuously.

1.3 Phosphate, Magnesium

Cane molasses contain just small amounts of phosphoric acid and magnesium salts, and for this reason the yeast has to be supplied with inorganic phosphorus and magnesium compounds.

With regard to the addition of phosphorus one has to bear in mind that at the end of the fermentation process any excess amount of phosphate (addition resulting in more than 3.5 % P_2O_5 in dry yeast substance) is not absorbed by the yeast and gets lost in the wort.

Too small an addition of phosphate (less than 2.5 % P_2O_5 in dry yeast substance) delimits the factor of maximum hourly multiplication and reduces the yield.

The magnesium content in the yeast varies considerably (0.15 - 0.3 % MgO in dry yeast substance). There is no substantial influence of magnesium on the quality of the yeast, but on the yield.

In general, supply of the yeast with nutrient salts can be summarized as follows:

. . .

(a) The pure culture should contain approx. 3.5 % P_2O_5 in dry yeast substance.
For mother yeasts, this figure should be reduced to approx. 3.5 - 3.0 % P_2O_5.
Trade yeast should have a P_2O_5 content of approx. 2.5 %.
In this connection, please refer to the fermentation plans for mother and trade yeasts.

(b) Magnesium does not have a decisive influence on the quality of the yeast; but the MgO/P_2O_5 ratio should be a constant one.

1.4 Growth Promoters

Baker's yeast requires growth promoters which it cannot develop itself. The advantageous influence of growth promoters becomes apparent by an increased growth rate and, as a result, a higher yield. Since molasses contain just small aomunts of growth promoters, an additional amount has to be introduced for fermentation. In general, it is sufficient to add 10 g of calcium pantothenate per 1.000 kg of Y 28 - 30. The growth promoters dissolved in tap-water with a few drops of caustic soda (for a pH-value of 8.0) have to be added during the first hour of fermentation.

1.5 pH-value during Fermentation

The pH-value is of decisive importance to the fermentation process. A pH-value below 4.5 inhibits yeast growth and causes formation of alcohol; pH-values exceeding 6.0 result in a higher susceptibility to infections.

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At the beginning of the fermentation process the pH-value of the wort should not be less than 4.5 and should not exceed 4.8. By an appropriate addition of nutrient salts and control of the pH-value of the feed molasses, the pH-value may be raised gradually, but should not be higher than 6.5 at the end of the fermentation process.

1.6 Aeration

Aeration is imperative for non-alcoholic fermentation. The amount of yeast to be produced per hours in proportion with the quantity of air introduced. If a jet pipe aerating system is employed, one kg of yeast containing 27 % dry substance requires approx. 12 m³ of air. The exact figure has to be ascertained when checking the yeast multiplication, because several factors (level in the fermenter, distribution of air, etc.) influence the specific air requirements. If these specific requirements should not be met and an addition of molasses equivalent to the intended yeast growth should not be maintained, this results in the facts that there is no sufficient yeast growth and that the molasses not required for yeast growth are fermented into alcohol.

(a) When a jet pipe system is employed, the quantity of yeast growing per hour requires a 12-fold quantity of air.

(b) After fermentation it may be expedient to subject the trade yeast to secondary aeration in the fermenter. Such secondary aeration (without feed of molasses and nutrient salts) is aimed, in the first place, at improving the

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leavening and keeping qualities. The time and the air necessary for secondary aeration have to be determined by trial and error.

(c) The maximum quantity of air to be fed into the fermenter during separation should be 1.000 m^3/h, which shall provide for uniform distribution of the yeast in the wort; otherwise separation would proceed unevenly.

(d) The aerators are designed for a level of approx. 4 m in the fermenters. Therefore the fermenters should not be filled beyond this level.

1.7 Antifoam Oil

Aeration is closely connected with an appropriate foam blanket. The larger the quantity of air blown into the fermenter, the intenser the development of foam.To prevent fermentation liquid from escaping through the manhole or the air exhaust, the foam level in the fermenter has to be controlled by an antifoaming system. The setting of this system must be such to keep the foam blanket just below the manhole. If too much antifoam oil is fed into the fermenter, oxygen transfer in the wort might be affected adversely, and this would result in less yeast growth caused by oxygen deficiency, less yield because of formation of alcohol and, consequently, an inferior quality of the resultant yeast.

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1.8 Temperature of Fermentation

The temperature of fermentation has a decisive influence on yeast multiplication and quality.
Normally, the temperature should be 30 - 32 °C. A temperature of less than 28 °C would diminish the yeast growth rate.

The heat of fermentation is dissipated by outside sprinkling water and by the plate heat exchangers 70.20 W6/70.20 W9-01/ 70.20 W9-02. If the temperature of fermentation of 30 - 32 °C should be exceeded, pumps 70.20 P5/70.20 P8-01/70.20 P8-02 therefore have to be cut in. The temperature of fermentation can be maintained by regulating the quantity of cooling water passing through the heat exchangers.

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2. Raw Material
(Cane Molasses)

2.1 Molasses Characteristics

Molasses are one of the most essential raw materials which are required for the production of yeast. As the composition of molasses can vary considerably, the advantages and disadvantages of its constituents have to be known:

2.1.1 Dry substance:
The dry substance content can vary quite considerably, but should not be less than 76.5 °Brix in view of the keeping quality of the yeast.

2.1.2 Sugar:
Molasses containing less than 47 % sugar are designated non-commercial. Molasses containing more sugar (50 % total sugar) have an advantageous effect on the yeast yield only.

2.1.3 pH-value:
It is not advisable to use molasses having a pH-value < 5.0, since such molasses have a poor keeping quality.

2.1.4 Nitrogen:
Assimilable nitrogen has a very great influence on the yield and quality of yeast. In general, the minimum amount is 0.15 %.

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2.1.5 Constituents detrimental to yeast:
For yeast production the maximum permissible percentages are as follows:

SO_2	max. 0.01	% by wt.
NO_2	max. 0.001	% by wt.
formic acid	max. 0.1	% by wt.
acetic acid, propionic acid, butyric acid	max. 1.0	% by wt.

Higher percentages would be detrimental to yeast growth.
The above constituents can be removed in part by expanding the sterilized molasses.

The volatility of steam is as follows:
sulphite < nitrite < formic acid < acetic acid < propionic acid < butyric acid

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3. Molasses

3.1 Intermediate Storage of Molasses

The molasses from the road tanker is unloaded by gravity through the opening of the underground storage tank (70.10 B1), which is inserted with a filter screen for separating impurities.

To facilitate molasses flow from the underground storage tank into the preparation tank (70.10 B3) an electric heating device is provided in tank (70.10 B1) above the discharge spout. The temperature indicated by the thermometer (TI 70.10 B1.1) must not exceeded 50 °C.

The pump (70.10 P2) delivers the molasses into the preparation tank (70.10 B3). Make sure the valves upstream and downstream of the pump are still opened when the pump is started.

3.2 Preparation of Molasses

The method commonly practised by yeast factories for molasses preparation is the hot-acid clarification process: the concentrated molasses are mixed with an equipvalent amount of water and sulphuric acid and heated with steam to flocculate the colloids and impurities. The molasses solution is aerated in the preparation tank (70.10 B3) to allow volatile acids to escape. Separation of the

. . .

flocculated colloids and impurities proceeds in the clarifying separator (70.10 S6). Before that, the hydrocyclon (70.10 F6) provides for removal of any sand from the molasses solution. The clarified molasses solution is then stored in the intermediate storage tank (70.10 B12) until further use.

3.2.1 Dilution

Water is added to the molasses to compensate variations of dry substance and sugar content and to maintain a constant dry substance content. This allows the feed of diluted molasses into the fermenters to be controlled easily. Usually, the diluted molasses (wort) have a dry substance content of 42.0 °Brix, which means that 1 kg of molasses containing 80 % dry substance is equivalent to 1.62 litres of wort.

3.2.2 Acidification

Sulphuric acid shall be used to acidify the molasses to a pH-value of 4.5 (range: 4.3 to 4.7) and to maintain it at this value, as this greatly facilitates pH-control during yeast growth. Microorganisms being sensitive to acid are extinguished at this stage. If the molasses are acifified to a pH-value of less than 4.0, subsequent heat treatment can result in sugar destruction and, consequently, a small yield.

3.2.3 Clarification

After dilution and acidification, the molasses solution is heated in the reaction tank (70.10 B3) to a temperature of approx. 90 °C. To remove so-called

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impurities, the heated molasses solution is fed to the claryfying separator (70.10 S6) and then sent to intermediate storage in tank (70.10 B7). If these impurities should not be removed from the wort or should be encountered during the culturing process, they will be absorbed in part at the surface of the yeast cell, and this causes problems with regard to colour and keeping quality.

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4. Instructions for Operation of Molasses Preparing Plant

4.1 Setting of Molasses Solution

The molasses solution has to be set to the following values:

Dry substance	42 °Brix
pH-value	4,3 - 4,7

For this purpose, fill the preparation tank (70.10 B3) with the necessary amount of warm water by means of pump (70.10 P15). Acidification to the required pH-value takes place by sulphuric acid from the metering tank (70.10 B4). The molasses heated to 40 - 50 °C is conveyed by pump (70.10 P2) from the underground tank (70.10 B1) into the preparation tank (70.10 B3). The amount of molasses is checked by adjusting the flowmeter (FIQ 70.10 P2.2) in such a way that at a molasses concentration of 80 °Brix, and with regard to subsequent dilution by condensate introduced during heating, the molasses solution will have 42 °Brix.

By the supply of steam the molasses solution is heated to near boiling temperature and vented by injection of air from the air station (70.20 V11).

After the necessary retention time of the molasses solution in the preparation tank (70.10 B3), put the separator (70.10 S6) into operation.

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4.2 Clarification of Molasses Solution

The molasses solution heated to 90 °C flows through the hydrocyclon (70.10 F6) to the clarifying separator (70.10 S6), where the precipitated turbid matter is separated. For operation and start-up of these machines, please refer to the specific instructions.

From the clarifying separator (70.10 S6) the clarified molasses solution (wort) is pressure-fed to the intermediate storage tank (70.10 B12), wherefrom the pump (70.10 P13) delivers it to the plate heat exchanger (70.10 W11) where it is cooled with process water to approx. 35 °C and is then sent to the fermentation station. The heated process water flows into tank (70.10 B14) for further use.

To check the density and the pH-value, take samples from tank (70.10 B12) every hour, and reset the values, if necessary.

4.3 Start-up of Molasses Preparing Station

- Open the valves between 70.10 B14 and 70.10 B3.
- Switch on pump 70.10 P15 for warm water to tank 70.10 B3.
- After filling of tank 70.10 B3 with warm water switch off pump 70.10 P15.
- Close the valves between 70.10 B14 and 70.10 B3.
- Let flow diluted H_2SO_4 from tank 70.12 B5 through the flowmeter (FI 70.10 B3.3) into tank 70.10 B3 and switch on the agitator 70.10 R3.

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- Start the electric heating device in tank 70.10 B1 and check the molasses temperature (TI 70.10 B1.1).
- Open the valves between 70.10 B1 and 70.10 B3.
- Switch on pump 70.10 P2 for molasses to tank 70.10 B3.
- After filling of tank 70.10 B3 with molasses switch off pump 70.10 P2.
- Close the valves between 70.10 B1 and 70.10 B3.
- Open the valve in steam pipe DN 32 CS86.
- Switch off the agitator 70.10 R3.
- After the necessary retention time of the molasses solution in tank 70.10 B3 open the valves between 70.10 B3 and 70.10 B12.
- Set PC 70.10 P5.3 to approx. 4,0 bar.
- Start up 70.10 P5, 70.10 F6 and 70.10 S6 (in accordance with separate instructions).
- Set the delivery rate according to FI 70.10 P5.2.
- Fill 70.10 B12.

4.4 Operational Checks

During continuous operation of the molasses preparing plant the following valves should be checked at regular intervals:

- Level and temperature of 70.10 B1
- Pressure of PI 70.10 P2.1
- Levels in 70.10 B3, 70.10 B12, 70.10 B14, 70.10 B17
- pH-value and density in 70.10 B3 and 70.10 B12
- Temperature in 70.10 B3, 70.10 B12, 70.10 B14 and 70.10 B17
- Clarifying efficiency of 70.10 F6 and 70.10 S6.

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If the clarifying efficiency dimished, this indicates that the hydrocyclon and/or the separator are contaminated and have to be cleaned.

4.5 Stopping of Molasses Preparing Plant

- Switch off 70.10 P5.
- Drain 70.10 B3 and rinse with warm water through pipe DN 25 SS 54.
- Clean the plant by a CIP program.
- Stop and drain the plant. After prolonged operation, check if manual cleaning (mainly 70.10 W6 and 70.10 S6) is required.
- Drain 70.10 B3 and rinse with water through pipe DN 25 SS 54, then steam it out.
- When 70.10 B12 is empty, rinse the tank and pipes with water.
- Clean with soda lye from 70.10 B17 through 70.10 P18.
- Circulate the soda lye through the pipes and pump 70.10 P18 back into the tank to be cleaned.
- Use pump 70.10 P18 to feed the soda lye back into 70.10 B17.
- Rinse the plant with water through pipe DN 65 SS 118, and drain it; then steam it out.
- It is advisable that the whole plant (from 70.10 B3 --> 70.10 B12 --> wort pipes DN 50 SS 172/173/DN 40 SS 174/175/ 177/193/DN 50 SS 197/194/198/DN 25 SS 199/DN 25 SS 200/ DN 20 SS 201/DN 25 SS 202) be filled with a disinfectant solution.
- Prior to re-starting the plant, this disinfectant solution has to be removed, and all tanks and pipings have to be rinsed with water.

5. Instructions for Operation of Fermenting Plant

5.1 Process Pure-Culture

The process pure-culture is made in the pure-culture fermenter (70.20 B1).

5.1.1 Pure-Culture Fermenter (70.20 B1)

Prepare the following solution in the cleaned and sterilized fermenter:

Wort (42 °Brix)	650	l
Monoammonium phosphate	10	kg
Magnesium sulphate	0,6	kg
Process water approx.	3.200	l
Malt extract	20	kg
to be set to	7,5	°Brix
Antifoam oil	0,2	l

Feed the wort by means of pump (70.10 P13) from tank (70.10 B12) to the fermenter (70.20 B1), dilute the wort with process water and add the nutrient salts (monoammonium phosphate, magnesium sulphate, malt extract) by hand. Molasses is fed through the pipe DN 25 SS 202 (quantity of diluted molasses will be measured by indication marks inside the pure culture fermenter) and process water through the counter (FQ 70.20 B1.6) which allow the flow rate to be set.

Use diluted sulphuric acid to set the pH to 4,5 -4,8. To prevent excessive foaming during subsequent aeration, add approx. 0,2 l of antifoam oil to the wort.

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5.1.2 Sterilizing and Cooling

When the fermenter has been filled, heat the whole preparation with steam to 0,4 atm.g. (approx. 110 °C). For this purpose, close the manhole and open the valves in the following order:
Vent valve 16,
Vent valve 17
(a little to let just a small amount of steam escape),
Steam valve 1
Seeding socket 14
(a little to let just a small amount of steam escape).
Keep all the other valves closed.

As soon as large quantities of steam escape from the pipe to the water feed tank and the temperature of the wort is 100 °C, close the vent valve 16 to such a dregree that just a small amount of steam can still escape. When the pressure has reached 0,4 atm.g., close the steam valve 1 to a degree that this pressure is maintained.

Terminate sterilization after 30 minutes by closing valve 1 and slowly opening vent valve 16.

Begin with cooling by carefully opening the cooling water valve 9 or the ice water valve 10.

As soon as the pressure in the fermenter has dropped to 0,2 atm.g., begin with aeration by opening valve 3. Make sure not to blow in too much air to prevent fermenter contents from escaping through the open vent valve 16.

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ITEM - No.		70.20 F3	70.20 B1	70 20 B 2	
DESIGNATION		AIR FILTER	PURE CULTURE FERMENTER	TANK	
TECHNICAL DATA		150 Nm³/h	6 m³	50 l	
MATERIAL		SS	SS	SS	
NOTE			EXISTING PROPAGATOR B		

SECTION 1

AMMONIUM WATER TO 70.20 B7-02 — DN25SS253

AMMONIUM WATER TO 70.20 B7-01 — DN25SS252

70.20F3.1 PI — 70.20F3.2 PI

WORT — DN25SS199

WORT — DN50CS219 / DN25SS200

WORT — DN20SS201

WORT — DN25SS202

70.20 F3

DN50CS219 — DN50CS217

DN15

ANTIFOAM OIL — DN15SS148

AMMONIA WATER TO 70.20 B4 — DN25SS254

TO MOLASSES PREPARATION — DN50CS219

DIAMMONPHOSPHATE AND $MgSO_4$ — DN15SS144

DN25SS41

DN20CS94 — DN40CS220 — DN25SS202 — DN80SS40

70.20B1.8 RV — DN65

ICE WATER — DN65CS70

70.20B1.7 RV — 70.20B1.3 PI — 70.20B1.1 FIQ

70.20 B1.2 FI — DN10SS111 — DN65 SS7 — DN25SS112 — DN1 65 SS204

70.20B1.4 TI

ICE WATER — DN65CS70

70.20 B1.2 FI — DN10SS111 — DN65 SS7 — DN25SS112 — DN1 65 SS204

70.20B1.4 TI — DN20

70.20 B1

70.20 B2

DN65SS110 — DN40CS220 — DN25SS362 — DN25SS361

TO ICE WATER TANK — DN100CS72 — DN50 SS205

DN20CS398

DN20CS94 — DN65SS7 — DN80SS14 — DN40SS203 — DN80 SS40

SECTION 2

STEAM — DN80CS83

COOLING WATER FROM COOLING TOWER — DN250 SS4

FQ 70.20

PROCESS WATER — DN80 SS32

WARM WATER — DN65SS53

CIP — DN65 SS110

To 70.10 B3 — DN25SS54

CIP RETURN — DN80 SS 130

FQ 70.20B1.5

SITUATION OF VALVES FERMENTATION

3.03.50426 Bl.1

During the cooling process, take a sample at valve 18 to measure the pH-value and the brix.

Close the cooling water valve 9 (ice water valve 10) as soon as the temperature is 30 °C. Also, close the air valve 3 to such a degree that just a small amount of air can still enter the fermenter. Fill the seal water tank with water, and add approx. 100 ml formalin.

The finished preparation should have the following characteristics:

temperature		30 °C
Brix	approx.	7,5 °Bx
pH-value		4,5 - 4,8

5.1.3 Seeding

The finished preparation has to be seeded with approx. 2 x 12 l of laboratory pure-culture under sterile conditions. Prior to seeding, disinfect the pipe at cock 14 and connect the hose of the laboratory pure-culture to the seeding socket 14.
Close the valve 3.
When the connection between the lab pure-culture flask and the pure-culture fermenter has been established, open the seeding cock 14 and transfer the contents of the 2 lab pure-culture flasks into the fermenter (70.20 Bl).

After seeding close the cock 14, detach the hose and disinfect the socket 14 again.

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5.1.4 Fermentation and transfer of pure-culture solution into fermenter 70.20 B4

After seeding, open the air valve 3 again and mix the tank contents intimately with air. Aeration should be gentle for the first four hours, but should be increased thereafter.

During yeast multiplication the temperature of the wort to be yeasted should be 30 °C. The temperature can be controlled with cooling water (valve 9). Check the Brix drop by taking samples during yeasting (valve 18). Fermentation is finished when the Brix has dropped to 2 - 3 °Bx.

Transfer the whole preparation with the aid of air into the mother yeast fermenter (70.20 B4). Be sure to maintain the following conditions:

Clean and disinfect the DN 50 SS 205 pipe from the pure-culture fermenter (70.20 B1) to the mother yeast fermenter (70.20 B4). Check if the connection between the pure-culture and the mother yeast fermenter has been properly established, and proceed as follows:
close the vent valves 16 and 17,
open the drain valve 22,
open the feed valve 18 of fermenter (70.20 B4).
Carefully open the aeration valve 3,
watch the contents in the fermenter to make sure that the pure-culture solution does not foam too heavily.

When the pure-culture fermenter (70.20 B1) has been emptied, close the feed valve 18 of fermenter (70.20 B4) and the valve 3.

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5.1.5 Cleaning of pure-culture fermenter 70.20 B1

To remove any residues of wort left in the pure-culture fermenter, detach the connection at the mother yeast fermenter (70.20 B4) and provide for discharge into the sewer.

Thoroughly rinse the socket of the feed valve 18 of fermenter (70.20 B4) with water and soda lye. Then disinfect the socket.

Thoroughly rinse the pure-culture fermenter with warm water and discharge the rinsing water into the sewer.

The soda lye heated to 70 - 80 °C is delivered by pump (70.10 P18) from tank (70.10 B17) through the open valve 12 via spray gun into the pure-culture fermenter (70.20 B1) and is recycled through pipe DN 50 SS 141 (changed over to DN 80 SS 138) into tank (70.10 B17). Moreover, part of the soda lye is sent by way of the open valve 2 through the air pipe and the spray pipes.

Rinse with process water, and steam the tank (70.10 B1) by means of pipe DN 40 CS 220 through the open valve 1; open valve 16 and open valves 14, 17, 18 and 22 a little to let just a small amount of steam escape.
Close valves 1, 14, 17 18 and 22, and the pure-culture fermenter (70.20 B1) is ready for a new cycle.

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5.2 First Mother Yeast

The first mother yeast is made in the fermenter (70.20 B4).

5.2.1 Mother Yeast Fermenter 70.20 B4

Fill an appropriate amount of process water into the cleaned and sterilized fermenter. This water shall meet the following specification:

(1) Non-infected
(2) Temperature 30 °C
(3) pH 4,2 - 4,5
(after addition of pure-culture).

To make sure that the process water should be free of infections, approx. 0,6 l sodium hypochlorite have to be added to the water in the fermenter along with the injection of air. Allow the sodium hypochlorite to react for about 30 minutes. If the temperature of the water should be below 30 °C, use steam to heat the water to the required temperature, along with the injection of air. Add the necessary amount of wort, and set the appropriate pH-value with diluted sulphuric acid. Inject air to provide for intimate mixing. Then add the process pure-culture. Fermentation may now commence.

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5.2.2 Filling of Fermenter 70.20 B4

Prepare the following solution in the cleaned and sterilized fermenter:

Process water	6.300 l
Wort	30 l
Yeast	the whole process pure-culture yeast wort

The solution should have the following characteristics:

Temperature	30 °C
pH-value	4,2 - 4,5

5.2.3 Fermentation of 1st Mother Yeast

Be sure to maintain the following conditions during mother yeast fermentation:

Temperature	30 - 32 °C	
pH-value	beginning of fermentation	4,2 - 4,5
	end of fermentation	5,0 - 5,2

Nutrients and auxiliaries have to be added in accordance with the attached fermentation scheme.

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5.2.4 Fermentation Scheme for 1st Mother Yeast

	1	2	3	4	5	6	7	
Hrs	Y_{27} kg	Y_{27} kg	Wort 42 °Bx l	$NH_4H_2PO_4$ kg	Ammonia solution l	Magnesium sulphate kg	Air Nm^3	
Charge 0	100		30	14,5	5	4,2	500	9 g calcium pantothenate
1			-	-			150	
2	Until the 15th hour		15	-			200	
3	the hourly yeast		30	5			240	
4	growth rate cannot		40	5			400	
5	be determined exactly		50	5			480	
6	because of excessive		60	5			600	
7	addition of nutrients		70	10			660	
8	during the first few		85	10			780	
9	hours. Simultaneous		100	10			950	
10	formation of alcohol		115	10			1.100	
11	gives rise to		140	20			1.300	
12	different pH-values.		160	18			1.500	
13			195				1.800	
14			230				2.100	
14.30			140				2.250	
15							1.700	
16								
							500	
	1.000		1.460	14,5	103	4,2		

5.2.5 Calculation of Fermentation Scheme for 1st Mother Yeast

Production

Column 1
indicates the total yeast (containing 27 % dry substance).

Column 2
indicates the amount of yeast produced per hour.

Column 3
The wort feed is based on the assumption that 1 kg molasses yields 1 kg yeast containing 27 % dry substance. 1 kg molasses containing 80 % dry substance is equivalent to 1,62 l wort containing 42 % dry substance.

Column 4
Calculation of phosphate addition:

Precondition: P_2O_5 content in mother yeast
= approx. 3,2 % P_2O_5 in DYS (dry yeast substance)

Production of mother yeast:
900 kg Y_{27} ≙ 243 kg DYS at 3,2 % P_2O_5 in DYS
= 7,8 kg P_2O_5 in DYS
P_2O_5 content of monoammonium phosphate $NH_4H_2PO_4$
= 60 %, i. e. the amount of monoammonium phosphate to be added is 14,5 kg.

Column 5
indicates the amount of ammonia solution to be added per hour.

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Calculation of Ammonia Solution for 1st Mother Yeast

Preconditions: (1) Nitrogen in mother yeast
= approx. 8 % in DYS
(2) Nitrogen in $NH_4H_2PO_4$
= 10 %
(3) Organic nitrogen in molasses assumed to be 0,15 NAF

Production of 1st mother yeast:

900 kg Y_{27} ≙ 243 kg DYS	
at 8 % N in DYS	19,44 kg N
minus nitrogen in molasses (0,15 NAF):	
900 kg molasses at 0,15 NAF	1,35 kg N
minus nitrogen in monoammonium phosphate:	
14,5 kg $NH_4H_2PO_4$ at 10 % N	1,45 kg N
Total nitrogen from ammonia solution:	16,64 kg N

103 l ammonia solution therefore have to be added.

Column 6
indicates the amount of magnesium sulphate.

Column 7
indicates the quantity of air required per hour.

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5.3 Second Mother Yeast

The second mother yeast is made in one of fermenters 70.20 B7

5.3.1 Mother Yeast Fermenter 70.20 B7

Fill an appropriate amount of process water into the cleaned and sterilized fermenter. This water shall meet the following specification:

(1) Non-infected	
(2) Temperature	30 °C
(3) pH	4,5 - 4,7

Proceed as described in 5.2.1 above, but use 1 l sodium hypochlorite.

5.3.2 Filling of Fermenter 70.20 B7

Prepare the following solution in the cleaned and sterilized fermenter:

process water	9.500 l
1st mother yeast	200 kg Y_{27}
= approx. 300 l (subject to the dry substance content of the yeast milk)	
wort (42 °Bx)	50 l

The solution should have the following characteristics:

temperature	30 °C
pH-value	4,5 - 4,7

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5.3.3 Fermentation of 2nd Mother Yeast

Be sure to maintain the following conditions:

temperature	30 - 32 °C
pH-value	4,5 - 5,5
formation of alcohol	not to exceed 0,1 % (0,0 % at the end of fermentation)

Nutrients and auxiliaries have to be added in accordance with the attached fermentation scheme.

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5.3.4 Fermentation Scheme for 2nd Mother Yeast

	1	2	3	4	5	6	7	
Hrs	Y_{27} kg	Y_{27} kg	Wort 42 °Bx l	$NH_4H_2PO_4$ kg	Ammonia solution l	Magnesium sulphate kg	Air Nm^3	
Charge 0	200		50	23	5	6,5	500	13 g calcium pantothenate
1	224	24	-		-		300	
2	255	31	50		5		380	
3	296	41	65		5		300	
4	350	54	90		10		650	
5	412	62	100		10		750	
6	487	75	120		15		900	
7	574	87	140		15		1.050	
8	678	104	165		20		1.300	
9	800	122	195		20		1.500	
10	944	144	233		20		1.750	
11	1.094	150	243		20		1.800	
12	1.244	150	243		17		1.800	
13	1.394	150	243				1.800	
14	1.544	150	243				1.800	
14.30	1.619	75	120				1.800	
15							1.350	
16							500	
	1.619	1.419	2.300	23	162	6,5		

(5.3.4) Column
indicates the total yeast (containing 27 % dry substance) per hour. The hourly yeast growth is based on an H-factor (coefficient of multiplication per hour) of H_{max} = 1.18.

Column 2
indicates the amount of yeast produced per hour.

Column 3
The wort feed is based on the assumption that 1 kg molasses yields 1 kg yeast containing 27 % dry substance.
1 kg molasses containing 80 % dry substance is equivalent to 1,62 l wort containing 42 % dry substance.

Column 4
Calculation of phosphate addition (see 5.3.5).

Column 5
indicates the amount of ammonia solution to be added per hour (see 5.3.6).

Column 6
indicates the amount of magnesium sulphate.

Column 7
indicates the quantity of air required per hour.

. . .

5.3.5 Calculation of Phosphate Addition for 2nd Mother Yeast

Precondition:
P_2O_5 content in mother yeast = approx. 3,2 % in DYS

Production of 2nd mother yeast:
1.419 kg Y_{27} ≙ 383 kg DYS at 3,2 % P_2O_5 in DYS
= 12,3 kg P_2=$_5$ in DYS.

P_2O_5 content of monoammonium phosphate $NH_4H_2PO_4$
= 60 %, i. e. the amcunt of monoammonium phosphate to be added is 23 kg.

5.3.6 Calculation of Ammonia Solution to be added for 2nd Mother Yeast

Preconditions:
(1) Nitrogen in mother yeast = approx. 8 % in DYS
(2) Nitrogen in $NH_4H_2PO_4$ = 10 %
(3) Organic nitrogen in molasses assumed to be 0,15 NAF

Production of 2nd mother yeast:

1.419 kg Y_{27} ≙ 383 kg DYS at 8 % N in DYS	30,65 kg N
minus nitrogen in molasses (0,15 NAF):	
1.419 kg at 0,15 NAF	2,13 kg N
minus nitrogen in monoammonium phosphate:	
23 kg $NH_4H_2PO_4$ at 10 % N	2,30 kg N
	26,22 kg N

162 l ammonia solution therefore have to be added.

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5.4 Trade Yeast

The trade yeast is produced in the fermenters 70.20 B7.

5.4.1 Trade-yeast fermenter 70.20 B7

Fill an appropriate amount of process water into the cleaned and sterilized fermenter. This water shall meet the following specification:

(1) Non-infected
(2) Temperature 30 °C
(3) pH 4,5 - 4,7

Proceed as described in 5.2.1 above, but use 2,5 l sodium hypochlorite.

5.4.2 Filling of fermenter 70.20 B7

Prepare the folowing solution in the cleaned and sterilized fermenter:

Process waer 25.000 l
Mother yeast 700 kg Y_{27}
= approx. 1.050 l (subject to dry substance content of yeast milk)
Wort (42 °Bx) 100 l

The solution should have the following characteristics:

Temeprature 30 °C
pH-value 4,5 - 4,7

. . .

5.4.3 Fermentation of trade yeast

Be sure to maintain the following conditions:

Temperature	30 - 32 °C	
pH-value	beginning of fermentation	4,5 - 4,7
	end of fermentation	5,0 - 6,5
Formation of alcohol	not to exceed 0,1 % (0,0 % at the end of fermentation)	

Nutrients and auxiliaries have to be added in accordance with the attached fermentation scheme.

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5.4.4 Fermentation Scheme for Trade Yeast

	1	2	3	4	5	6	7	
Hrs	Y_{27} kg	Y_{27} kg	Wort 42 °Bx l	$NH_4H_2PO_4$ kg	Ammonia solution l	Magnesium sulphate kg	Air Nm³	
Charge 0	700		100	20	10	19	1.000	38 g calcium pantothenate
1	784	84	50	-	10		1.000	
2	894	110	170	10	15		1.300	
3	1.037	143	230	-	20		1.750	
4	1.223	186	300	10	20		2.250	
5	1.444	221	350	-	25		2.650	
6	1.703	259	420	10	30		3.100	
7	2.010	307	500		35		3.700	
8	2.370	360	580		40		4.300	
9	2.770	400	650		40		4.800	
10	3.170	400	650		40		4.800	
11	3.570	400	650		40		4.800	
12	3.970	400	650		43		4.800	
13	4.370	400	650				4.800	
14	4.700	330	530				4.800	
14.30							3.600	
15							1.000	
	4.700	4.000	6.480	50	368	19		

(5.4.4) Column
indicates the total yeast (containing 27 % dry substance) per hour. The hourly yeast growth is based on an H-factor (coefficient of multiplication per hour) of H_{max} = 1.18.

Column 2
indicates the amount of yeast produced per hour.

Column 3
The wort feed is based on the assumption that 1 kg molasses yields 1 kg yeast containing 27 % dry substance.
1 kg molasses containing 80 % dry substance is equivalent to 1,62 l wort containing 42 % dry substance.

Column 4
Calculation of phosphate addition (see 5.4.5).

Column 5
indicates the amount of ammonia solution to be added per hour (see 5.4.6).

Column 6
indicates the amount of magnesium sulphate.

Column 7
indicates the quantity of air required per hour.

. . .

5.4.5 Calculation of Phosphate Addition for Trade Yeast

Precondition:
P_2O_5 content in trade yeast = approx. 2,6 % in DYS

Production of trade yeast:
4.700 kg Y_{27} ≙ 1.269 kg DYS at 2,6 % P_2O_5 in DYS
33 kg P_2O_5

minus mother yeast phosphate:
700 kg Y_{27} = 189 kg DYS
at 3,2 % P_2O_5 6,05 kg P_2O_5

26,95 kg P_2O_5

P_2O_5 content of monoammonium phosphate $NH_4H_2PO_4$ = 60 %, i. e. the amount of monoammonium phosphate to be added is 50.

5.4.6 Calculation of Ammonia Solution for Trade Yeast

Preconditions:
(1) Nitrogen in mother yeast = approx. 8 % in DYS
(2) Nitrogen in trade yeast = approx. 6,75 % in DYS
(3) No addition of nitrogen during last 2 hours of fermentation.
(4) Nitrogen in $NH_4H_2PO_4$ = 10 %
(5) Organic nitrogen in molasses assumed to be 0,15 NAF.

. . .

Production of trade yeast:	
4.700 kg Y_{27} ≙ 1.269 kg DYS	
at 675 % N in DYS	85,66 kg N
minus nitrogen in mother yeast:	
700 kg Y_{27} = 189 kg DYS	
at 8 % N in DYS	15,12 kg N
minus nitrogen in monoammonium phosphate:	
50 kg at 10 % N	5 kg N
Total nitrogen from ammonia solution	59,54 kg N

368 l ammonia solution therefore have to be added.

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NOTE:

The above fermentation schemes are based on theroretical findings and experience and shall be considered a guideline for operation of the fermentation plant.

Subject to operational conditions and to the quality of the raw materials it might be necessary to correct these figures.

The figures applied should be checked during operation of the fermentation plant and should be corrected, if necessary, with the aid of the afore-mentinend calculations.

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5.5 Technical Instructions for Operation of Fermentation Plant

5.5.1 Filling of 70.20 B4

- Set FQ 70.20 B1.6 and FQ 70.20 B1.7 to the required quantity of water, and fill the fermenter 70.20 B4.
- Set the required amount of wort on FQ 70.20 B4.1 and let same flow into the fermenter.
- Open valve 1.
- Switch on blower 70.20 V11-01/02/03 or /04 to provide for intimate mixing.
- Switch on the wort pump 70.20 P5 to circulate the fermenter contents through the plate-type heat exchanger 70.20 W6.
- Add the nutrient salts.
- Gently add H_2SO_4 through the flowmeter FI 70.20 B4.6 until the required pH-value has been reached.
- If necessary, correct the temperature of the fermenter contents either by injection of steam of by cooling.
- When the necessary values have been reached, add the contents from 70.20 B1.
- Fermentation may now commence.

5.5.2 Fermentation 70.20 B4

- Set the required quantity of air in accordance with the fermentation scheme.
- Put the wort feed unit FQ 70.20 B4.1 into service.
- Switch on the automatic antifoam oil unit LSA 70.20 B4.2.

. . .

(5.5.2) - Set FI 70.20 B4.5 to the required quantity of ammonia solution and let same flow into fermenter 70.20 B4.
- Check and, if necessary, correct the temperature, the pH-value and the quantity of air during operation.

5.5.3 Termination of Fermentation 70.20 B4

- Stop the flow of ammonia solution according to the fermentation scheme.
- When the fermentation cycle is finished, valve off the wort feed pipe DN 20 SS 201 at themolasses battery and rinse with warm water by means of DN 32 hose 142.
- Set the air flow rate to approx. 500 Nm^3/h.
- Before steam out pipes DN 100 SS 234/DN 100 SS 224 to the separation station.
- Check the connection DN 100 SS 234/DN 100 SS 224, open valve 25 and close valves 26 and 32, to feed fermented wort by pump 70.20 P5 to the separators.
- When the liquid level has dropped below the aeration pipes, valve off the supply of air as well.

5.5.4 Cleaning and Disinfection of Fermenter 70.20 B4

When the fermenter has been emptied, rinse with water. Open valve 26 and close valve 25. Flush the fermenter by hand.

Let pump 70.20 P5 deliver the accumulated liquid through the heat exchanger 70.20 W6 and discharge the liquid through valves 19, 22 and 30 into the sewer (with the pump standing still).

. . .

(5.5.4) Conduct a CIP cleaning cycle. For this pupose, pump 70.10 P18 delivers 3 % soda lye through valve 9 into the fermenter where it is sprayed through a nozzle. (Make sure to keep the manhole shut during this cleaning operation! Burn hazard!) The soda lye solution from tank 70.10 B17 is sprayed in the fermenter, and pump 70.20 P5 delivers it through the heat exchanger 70.20 W6. Open valve 34 to utilize part of the soda lye for cleaning the aeration system. Open the CIP-valve in pipe DN 20 SS 132 to clean the wort pipe DN 20 SS 201. After about 15 minutes, close valve 15 and open valve 23 and pump the soda lye back into tank 70.10 B17.
Rinse with water, and drain the water.

For fermenter and plate heat exchanger steaming-out, proceed as follows:
Drain off the cooling water from the plate heat exchanger.
Fill approx. 1 l formalin into the fermenter.
Open the steam valves 2, 7 and 21,
open the valve 15,
open valves 1, 18, 19, 22, 30 and 31 a little to let just a small amount of steam escape.

Heat the fermenter with steam to approx. 90 to 100 °C; then close the steam valves.

. . .

70.20 F12-03	70. 20 B4	70.20 P5		70.20 W6	
AIR FILTER	FERMENTER	SPECIAL PUMP		HEAT EXCHANGER	
1500 m³/h	19 m³	50 m³/h		100.000 kcal/h	
		20 m			
SS	SS	SS		SS	
	EXISTING				
	FERMENTER C				

SECTION 1

DN 25 SS 253

DN 25 SS 252

DN 25 SS 199

DN 25 SS 200

DN 40 SS 218

P I

P I

70.20F12-03.2

70.20F12-03.1

DN 50 CS 217

11 70.20F12-03

DN 200 CS 213

DN 15 CS 163

DN 15 SS 148

DN 25 SS 254

150

DN 200 CS 213

37 DN15

13

12

DN 15 CS 163

DN 15 SS 148

DN 25 SS 254

DN 15 SS 150

DN 80 SS 40

DN 15 SS 144

DN 20 CS 95

2

DN 200 CS 216

DN 15 SS 145

DN 15 CS 163

DN 20 SS 201

DN 60 SS 42

DN 65 SS 110

DN 25 CS 307

70.20B4.1

DN 25 SS 114

LSA

70.20B4.2

14

FQ

70.20W6.2

TI

70.20B4.6

ETOH I

DN 25 CS 206

DN 125 SS 223

F I

DN 100 SS

70.20B4.3

DN40

P I

70.20B4.4

65/50

70.20B4.5

F I

DN 15

DN 15

SECTION 2

DN 100 SS 224

DN 100 SS 234

DN 15

DN 100 SS 224

DN 25 SS 306

DN 20 CS 206

70.20 B4

18

70.20B4.7

TI

DN 100 SS 222

70.20W6.1

TI

DN 15

70.20W6.3

TI

DN 200 CS 216

DN 40 CS 95

DN 65 SS 8

DN 40 SS 141

DN 100 SS 15

DN 80 CS 368

DN 50 SS 57

70.20P5.1

P I

M

DN 20 CS 310

DN 65 SS 140

DN 100 SS 221

DN 100 SS 222

65/100

DN 125 SS 223

DN 80 SS 16

DN 40 CS 365

70.20W6.4

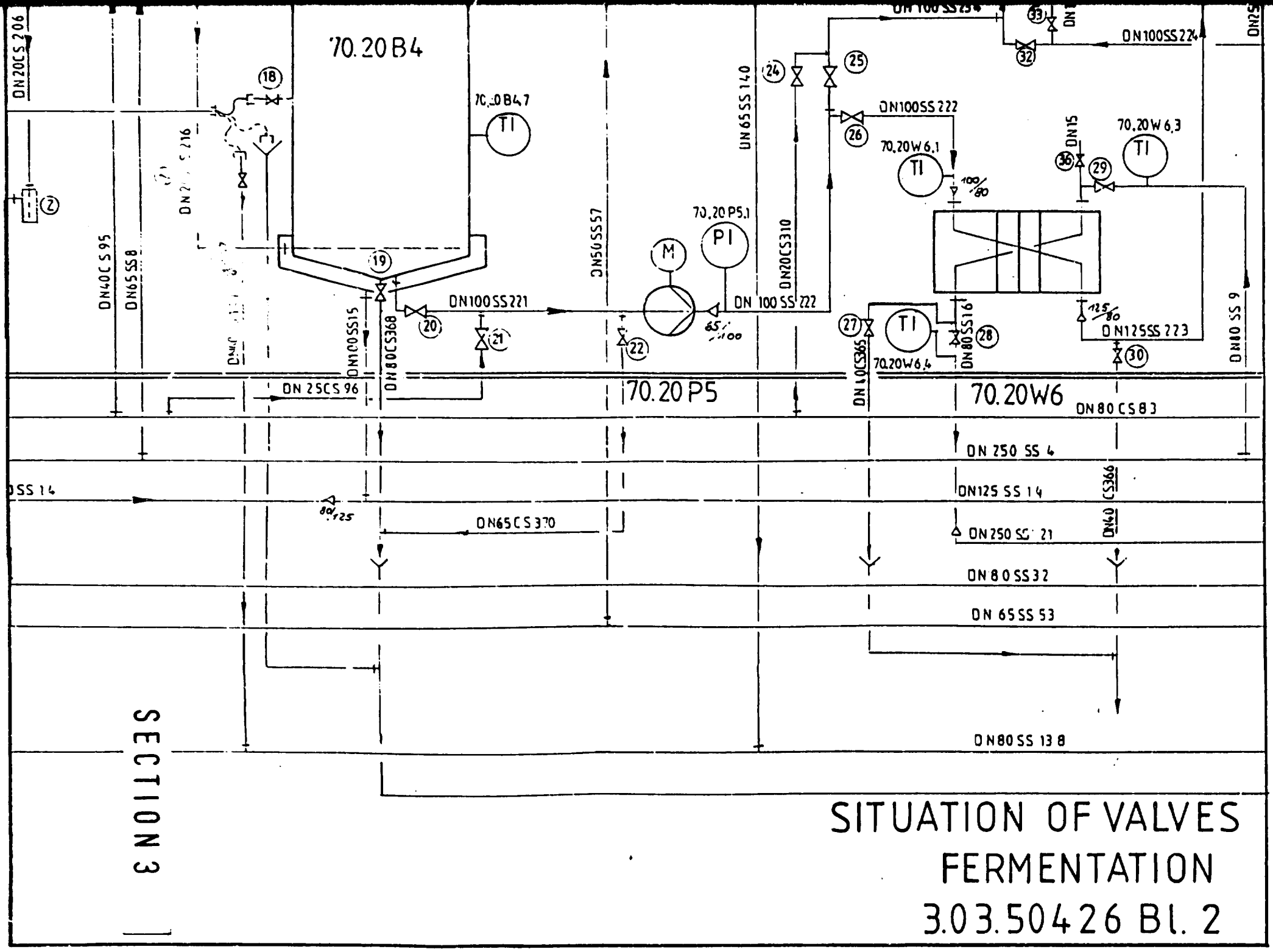
DN 10 SS 9

DN 25 CS 96

70.20 P5

70.20W6

DN 80 CS 83


70.20 B4
70.20 B4.7
TI
PI
M
70.20 P5.1
70.20 P5
70.20W6
70.20W6.1
70.20W6.3
70.20W6.4
DN 20 CS 206
DN 40 CS 95
DN 65 SS 8
DN 100 SS 15
DN 80 CS 368
DN 100 SS 221
DN 50 SS 57
DN 65 SS 140
DN 20 CS 310
DN 100 SS 222
DN 100 SS 224
DN 15
DN 125 SS 223
DN 80 SS 16
DN 10 CS 365
DN 80 SS 9
DN 25 CS 96
DN 65 CS 370
DN 80 CS 83
DN 250 SS 4
DN 125 SS 14
DN 250 SS 21
DN 80 SS 32
DN 65 SS 53
DN 80 SS 13 8
CS 366
DN 40
SECTION 3
SITUATION OF VALVES
FERMENTATION
3.03.50426 Bl. 2

5.5.5 Filling of 70.20 B7-01/02

- Set FQ 70.20 B1.6 and FQ 70.20 B1.7 to the required quantity of water, and fill the fermenter 70.20 B7-01/-02.
- Set the required amount of wort on FQ 70.20 B7-01.1/ FQ 70.20 B7-02.1 and let same flow into the fermenter.
- Open valve 1.
- Switch on blower 70.20 V11-01/-02/-03 or -04 to provide for intimate mixing.
- Switch on the wort pump 70.20 P8-01/-02 to circulate the fermenter contents through the plate-type heat exchanger 70.20 W9-01/-02.
- Gently add H_2SO_4 through the flowmeter FI 70.20 B7.01.6/ 70.20 B7.02.6 until the required pH-value has been reached.
- If necessary, correct the temperature of the fermenter contents either by injection of steam or by cooling.
- When the necessary values have been reached, add the yeast milk from tank 70.30 B7-06 for production of 2nd mother yeast, or the yeast milk from tank 70.30 B7-07 via pump 70.30 P9 for production of trade yeast.
- Fermentation may now commence.

5.5.6 Fermentation 70.20 B7-01/-02

- Set the required quantity of air in accordance with the fermentation scheme.
- Put the wort feed control unit FQ 70.20 B7-01.1/ FQ 70.20 B7-02.1 into service.
- Switch on the automatic antifoam oil unit LSA 70.20 B7-01.2/70.20 B7-02.2.

. . .

(5.5.6) - Set FI 70.20 B7-01.5/70.20 B7-02.5 to the required quantity of ammonia solution and let same flow into the fermenter.
- Start with the required nutrient salt dosing.
- Check and, if necessary, correct the temperature, the pH-value and the quantity of air during operation.

5.5.7 Termination of Fermentation 70.20 B7-01/-02

- Stop the nutrient salt dosing according to the fermentation scheme.
- Stop the flow of ammonia solution according to the fermentation scheme.
- When the fermentation cycle is finished, valve off the wort feed pipe DN 25 SS 199/DN 25 SS 200 at the molasses battery and rinse with warm water by means of DN 32 hose 142.
- Set the air flow rate to approx. 500/1.000 Nm^3/h.
- Before steam out pipe DN 100 SS 224.
- Check the pipe DN 100 SS 224, open valves 22, 33 and 32 (in pipe DN 100 SS 224) and close valve 23 to feed fermented wort by pump 70.20 P8-01/-02 to the separators.
- When the liquid level has dropped below the aeration pipes, valve off the supply of air as well.

5.5.8 Cleaning and Disinfection of Fermenters 70.20 B7-01/-02

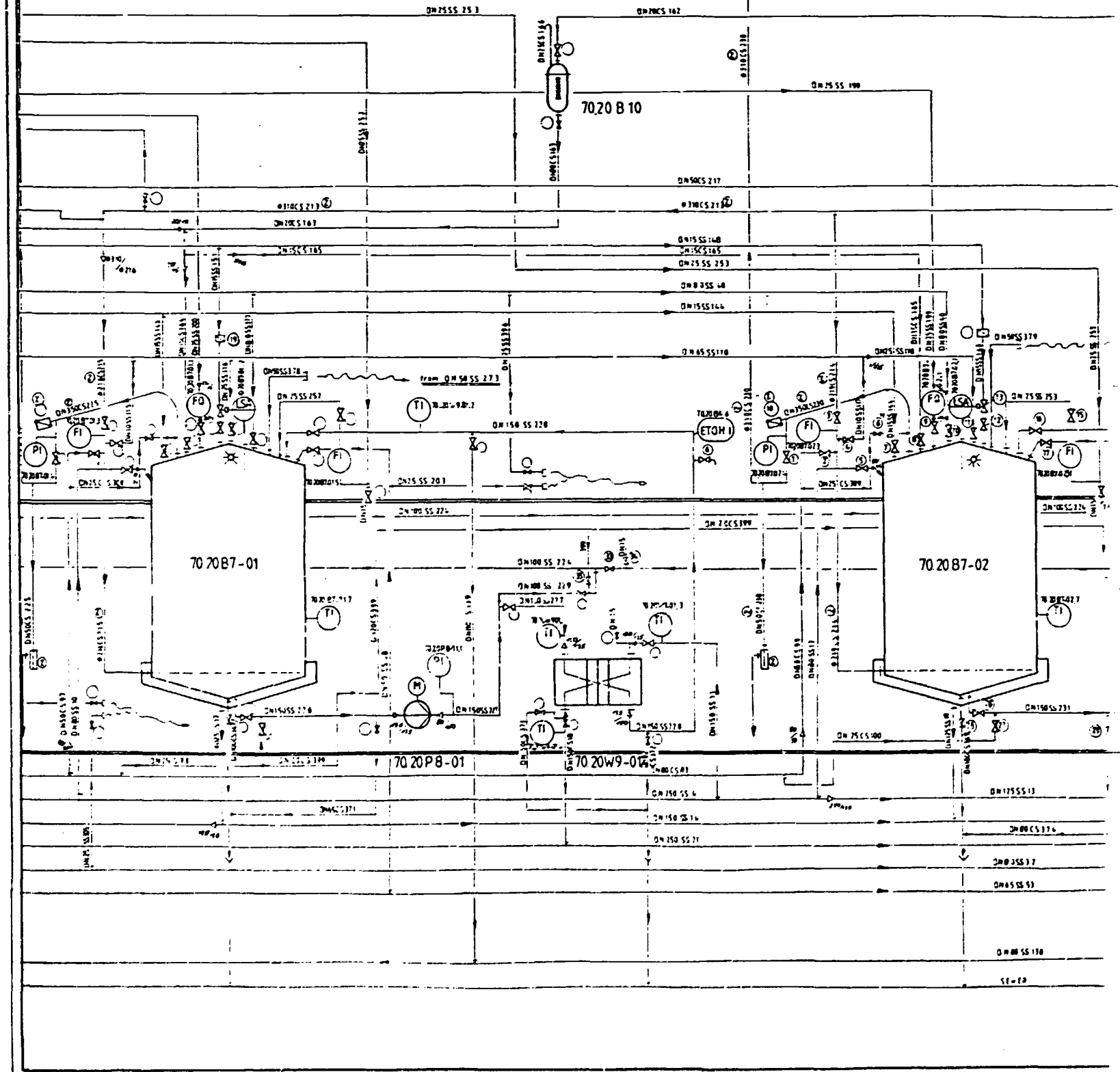
When the fermenter has been emptied, rinse with water. Flush the fermenter by hand.

. . .

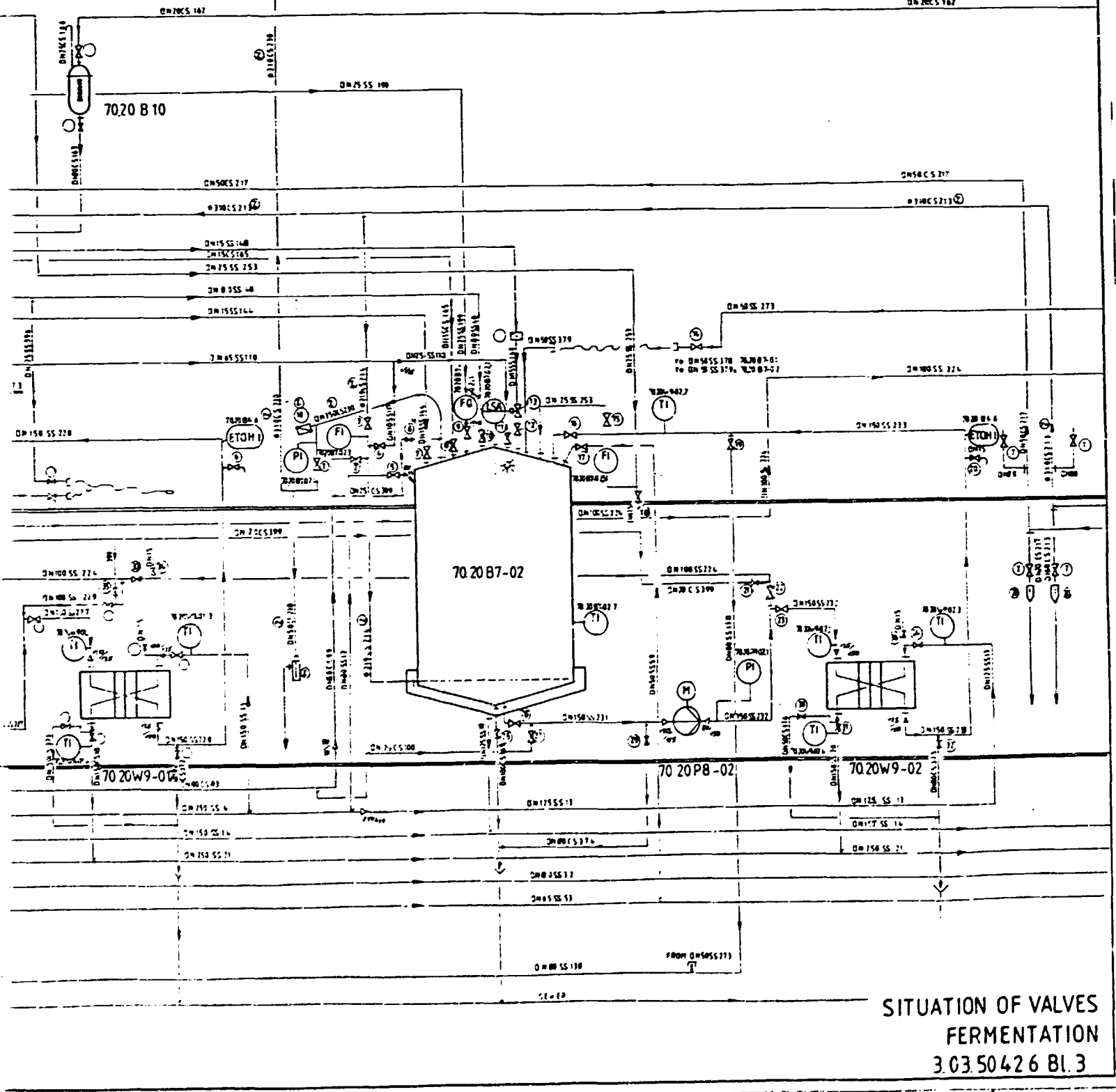
70.20 B7-01	70.20 P8-01	70.20 W9-01	70.20 B 10	70.20 B7-02
FERMENTER	SPECIAL PUMP	HEAT EXCHANGER	METERING TANK	FERMENTER
53m³	165 m³/h	380 000 kcal/h	50 l	53m³
	20 m			
SS	SS	SS	GLASS	SS
EXISTING		EXISTING		EXISTING
FERMENTER 01				FERMENTER 02

70.20 W9-01	70.20 B 10	70.20 B7-02	70.20 P8-02	70.20 W9-02
HEAT EXCHANGER	METERING TANK	FERMENTER	SPECIAL PUMP	HEAT EXCHANGER
380 000 kcal/h	50 l	53m³	165 m³/h	380 000 kcal/h
			20 m	
SS	GLASS	SS	SS	SS
EXISTING		EXISTING		EXISTING
		FERMENTER 02		

SECTION 1



SECTION 2



SITUATION OF VALVES
FERMENTATION
3.03.50426 Bl. 3

(5.5.8) Let pump 70.20 P8-01/-02 deliver the accumulated liquid through the heat exchanger 70.20 W9-01/-02 and discharge the liquid through valves 25, 29 and 32 into the sewer (with the pump standing still).

Conduct a CIP cleaning cycle. For this pupose, pump 70.10 P18 feeds 3 % soda lye through valve 11 into the fermenter where it is sprayed through a nozzle. (Make sure to keep the manhole shut during this cleaning operation! Burn hazard!) The soda lye solution from tank 70.10 B17 is sprayed in the fermenter, and pump 70.20 P8-01/-02 delivers it through the heat exchanger 70.20 W9-01/-02. Open valve 4 to utilize part of the soda lye for cleaning the aeration system. Open the CIP-valve in pipe DN 25 SS 130/131 to clean the wort pipe DN 25 SS 199/200. After about 15 minutes, close valve 16 and open valve 19 and pump the soda lye back into tank 70.10 B17. Rinse with water, and drain the water.

For fermenter and plate heat exchanger steaming-out, proceed as follows:
Fill approx. 1 l formalin into the fermenter.
Open the steam valves 2, 6 and 27,
open the valve 16,
open valves 1, 25, 29, 32 and 20 a little to let just a small amount of steam escape.

Heat the fermenter with steam to approx. 90 to 100 °C; then close the steam valves.

Subject to the degree of contamination and incrustation in the fermenter, manual cleaning or CIP cleanig with HNO_3 solution might become necessary from time to time.

. . .

6. Separation and Storage of Yeast Milk

After fermentation, the fermented molasses have to be subjected to separation which proceeds in two stages. In the first stage, separator 70.30 S2-01 provides for separating the yeast from the fermented wort. In the second stage, separator 70.30 S2-02 provides for washing and finally concentrating the yeast to approx. 700 to 850 g Y_{27} per litre.

The yeast obtained from separator 70.30 S2-01 is mixed with water by the washing nozzle 70.30 A3 and delivered to the washing separator 70.30 S2-02.

The washing process provides for a good keeping quality and colour of the resultant yeast.

After separation, the yeast is stored at a temperature of about +4 °C which ensures an optimum storage life of the yeast milk. The yeast is stored in tanks 70.30 B7-01/-02/-03/-04. Each tank is equipped with a stirrer which helps produce homogeneous and evenly cooled yeast milk. Any temperature rise can be reduced again by way of internal tank cooling with ice water.

Separation and storage of yeast milk require the following instructions to be duly followed:

. . .

6.1 Separation of Fermented Molasses

Put the separators into operation (in accordance with the specific instructions) about 10 to 15 minutes before separation work begins. As soon as all of the separators run at optimum speed, change over from water to fermentation solution (open valves 2, 7, 18 and the valve of the respective yeast milk tank and close valve 5). At the same time, inject approx. 500/1.000 Nm^3/h air into the fermenter to ensure homogeneity of the yeast in the fermentation solution.

The concentration of the yeast milk in the concentrate deaerator can be regulated by way of valves 7 and 11. When the concentration of the yeast milk leaving separator 70.30 S2-01 is too low/high, open/close valve 7 a little more. Make sure the deyeasted wort does not contain any yeast (drop test). And this applies to separator 70.30 S2-02 as well.

When separator 70.30 S2-01 has been adjusted as described above, open the process water valve 11 to mix the yeast with process water in the washing nozzle 70.30 A3, which delivers this mixture to separator 70.30 S2-02. The quantity of process water added must be such that the outgoing product is concentrated and the separated washing water does not contain any yeast.

. . .

SECTION 3

ITEM No.		70.30 F1		70.30 S2-01	70.30 A3 01	70.30 A3	70.30 S2-02		70.30 P5	70.30 W6		70.30 X7-01	70.30 B7-01	70.30 R7-0
DESIGNATION		STRAINER		SEPARATOR	WASHING NOZZLE	WASHING NOZZLE	SEPARATOR		DEFOAMING PUMP	HEAT EXCHANGER		CLEANING NOZZLE	TANK	AGITATOR
TECHNICAL DATA				25 m³/h			25 m³/h		6 m³/h 30 m	120.000 kcal/h			6,5 m³	
MATERIAL		SS		SS	SS	SS	SS		SS	SS			SS	
NOTE										EXISTING			EXISTING	EXISTING

01	70.30 R7-01	70.30 X7-02	70.30 B7-02	70.30 R7-02	70.30 X7-03	70.30 B7-03	70.30 R7-03	70.30 B7-04	70.30 R7-0	70.30 B7-04	70.30 R7-04	70.30 X7-04				70.30 B7-06	70.30 R7-06	70.30 X7-07	70.30 B7-07
	AGITATOR	CLEANING NOZZLE	TANK	AGITATOR	CLEANING NOZZLE	TANK	AGITATOR	TANK	AGITATOR	TANK	AGITATOR	CLEANING NOZZLE				TANK	AGITATOR	CLEANING NOZZLE	TANK
			6,5 m³			2,5 m³		2,5 m³		2,5 m³						1 m³			1,5 m³
			SS			SS		SS		SS									SS
	EXISTING		EXISTING	EXISTING		EXISTING	EXISTING												

SECTION 1

SECTION 2

SECTION 4

SECTION 5

ICE WATER RETURN FROM 70.20 B1 DN80 CS 69

CIP DN65 SS 119

CIP DN65 SS 124

FERMENTED WORT DN100 SS 124

H₂SO₄ DILUTED DN25 PVC 167

500 kg

DEYEASTED WORT

TUBE CONNECTION

TO FERMENTERS

70.30 F1 · 70.30 S2-01 · 70.30 A3 · 70.30 A3 · 70.30 S2-02 · 70.30 P5 · 70.30 W6

70.30 R7-01 · 70.30 R7-02 · 70.30 R7-03 · 70.30 R7-04 · 70.30 B7-01 · 70.30 B7-02 · 70.30 B7-03 · 70.30 B7-04 · 70.30 R7-07 · 70.30 B7-07 · 70.30 P9

ICE WATER	DN 80 CS 67
STEAM	DN 80 CS 83
WARM WATER	DN 65 SS 53
COOLING WATER	DN 65 SS 8
COOLING WATER RETURN	DN 80 SS 21
PROCESS WATER	DN 80 SS 32
ICE WATER RETURN	DN 100 CS 72
CIP RETURN TO 3.18	DN 65 SS 135

SEWER · SEWER II · SEWER I

1993	Anton	Ing.	SITUATION OF VALVES SEPARATION		
Appr.	10				
Appr.			STARCOSA	3.03.50 425	
Appr.			Braunschweig		
1. REV.	08.97	Anton			
Ref.	Amendment	Date	Name	Sh.	Rev.

6.2 Cooling of Yeast Milk

Pump 70.30 P5 delivers the yeast milk from the deaerator of separator 70.30 S2-02 through the plate-type heat exchanger 70.30 W6 into the respective yeast milk tank. For yeast milk cooling, charge the heat exchanger 70.30 W6 with ice water having a temperature of about +1 °C to cool the yeast milk down to its storage temperature. If the yeast milk has to be aftercooled, this can be done by charging the internal cooling coils of the yeast milk tanks with ice water as well.

6.3 Storage of Yeast Milk

Tanks 70.30 B7-01/-02/-03/-04 serve for storing the yeast milk. After separation, start the stirrer and open the ice water valve 30 to cool the yeast milk down to +4 °C. This temperatur of +4 °C should be maintained.

Mother yeasts required for second mother yeast and for trade yeast fermentation flow by gravity into tanks 70.30 B7-06/-07 (for acidification), which are then fed by pump 70.30 P9 into the fermenters 70.20 B7-01/-02.

The cooled yeast milk flows by gravity to the filter station.

. . .

6.4 Cleaning and Sterilization of Plant Components

6.4.1 Separators 70.30 S2-01/-02

When separation work is finished, rinse pipe DN 100 SS 224 and the separators with water for a few minutes. Let the yeast milk pump 70.30 P5 deliver water from separator 70.30 S2-02 through the heat exchanger 70.30 W6 into the yeast milk tanks 70.30 B7-01/-02/-03/-04 until the liquid is clear. Then discharge the liquid into the sewer and conduct a CIP cleaning cycle.

If need be, clean the separator plates by hand. Prior to the next separation cycle, steam out pipings DN 100 SS 222/DN 100 SS 234/DN 100 SS 224/DN 100 SS 229 by opening the steam valve 24 (fermenter 70.20 B4), valve 35 (fermenter 70.20 B7-01) or valve 21 (fermenter 70.20 B7-02) and by opening the outlet valve of the strainer 70.30 F1 a little to let just a small amount of steam escape. Also, steam out pipings DN 80 SS 261/DN 50 SS 261/DN 50 SS 262/DN 80 SS 263/DN 40 SS 263, 265, 266, 267.

6.4.2 Yeast Milk Tanks 70.30 B7-01/-02/-03/-04/-06/-07

Whenever a tank has been emptied, flush it by hand, and fill in an amount of water (via valve 25) sufficient to clear the yeast milk pipings.

. . .

6.4.3 Cleaning of Yeast Milk Tanks 70.30 B7-01/-02/-03/-04/ -06/-07 with Soda Lye

Let pump 70.10 P18 feed soda lye heated to approx. 70 - 80 °C through the open valve 26 into the yeast milk tanks.

Make the connection between the CIP-outlet pipe and pump 70.30 P9 by means of DN 65 hose 342, open the respective outlet-valve and let pump 70.30 P9 deliver the cleaning solution back into tank 70.10 B17.

Open valve 29 to clean pipings DN 50 SS 326/DN 50 SS 327. Open valve 35 and close valve 36 to clean pipe DN 50 SS 273.

Tank 70.30 B7-06 will be cleaned after cleaning of tank 70.30 B7-04 by filling it through pipe DN 50 SS 327.

Also open valve 29 to clean pipe DN 65 SS 274.

After cleaning with lye, flush the tank with water and rinse the pipings.

Close valve 30 and open valves 27 and 32 to drain the cooling jackets of the tanks. Any residues have to be discharged through valves 29 or 34.

Fill approx. 200 ml formalin into the cleaned tank, and steam out for about 10 minutes at 90 - 100 °C.

Open the respective steam valve to steam out pipings DN 50 SS 326/DN 50 SS 327 or DN 65 SS 339/340/DN 65 hose 341/DN 65 SS 341/DN 50 SS 273 or DN 65 SS 268/269/ DN 65 SS 274.

. . .

7. Filtration and Packing of Yeast

7.1 Dewatering of Yeast Milk

Dewatering of the yeast milk to a dry substance content of approx. 28 - 30 % proceeds in vacuum filter 70.40 F1 and this is by the salting process. The addition of common salt to the yeast milk reduces the osmotic pressure of the extracellular water, and the yeast cell tries to equalize the pressures and gives off intracellular water which is largely removed by filtration. In conjunction with pump 70.40 P3, the spray system arranged at an appropriate distance from the yeast cake removing device allows extracellular salt residues to be washed out with process water, without giving rise to re-adsorption of extracellular water.

7.1.1. Putting into Operation of Rotary Filter 70.40 F1

The yeast milk is prepared with NaCl in the respective yeast milk storage tank and flows by gravity into the trough of the rotary vacuum filter. When the precoat layer has been applied to filter 70.40 F1 (see specific instructions), filtration proper may commence.

Set the amount of spray water on FI 70.40 P3.2 and open the outlet-valve of the respective yeast milk storage tank to feed yeast milk into the filter trough 70.40 F1.

. . .

(7.1.1) The maximum level in the filter trough is regulated by hand.

The vacuum generated by the vacuum pump 70.40 V2 provides for application of the yeast milk to the filter drum and for dewatering. After one full revolution of the drum the dewatered yeast is removed by an adjustable scraper and sent into the troughs 70.40 B8.01/02/03 for further use.

Cooler 70.40 W4 serves for cooling the spray water used to wash NaCl out of the yeast. If the yeast leaving the filter 70.40 F1 still does not have the required dry substance content, the amount of NaCl has to be increased.

7.1.2 Operation of Rotary Filter 70.40 F1

During operation the hourly performance of the filter has to be maintained by adjusting its speed. If the yeast does not have the required dry substance content, or if there are wet spots on the surface, remove a thin layer of the filter aid until these wet spots vanish.

When the filter aid is exhausted and filter 70.40 F1 does not reach its full capacity, the filter has to be precoated anew.

(For filter operation, see specific instructions.)

. . .

7.1.3 Cleaning of Rotary Filters

After filtration, rinse the rotary filter with water. To prevent deposits of dirt or lime, clean the filter once a week with soda lye or HNO_3 solution (see specific instructions).

7.2 Bagging of Yeast

The filtered yeast falls from the filter into the troughs 70.40 B8.01/02/03 for further bagging.

The with yeast filled bags are transported by means of the lifting cart 70.40 H14 into the cold room for storage until dispatch.

. . .

8. Cleaning

Any cleaning and disinfecting work on surfaces can be done with the aid of the high-pressure spray unit 70.80 Q10.

. . .

9. Yeast Plant Cooling Systems

9.1 Recooling of Water

Cooling water circulating through the cooling tower 70.70 W2.01/02 is used to dissipate the heat of fermentation via outside sprinkling water, via the plate-type heat exchangers 70.20 W6, 70.20 W9-01/-02 and to dissipate the heat of condensation of the refrigerating system 70.30 W10.

9.2 Cooling of Yeast Milk and Pure Culture Fermenter 70.20 B1

Ice water from tank 70.30 B11 is used to cool the yeast milk and the pure culture fermenter 70.20 B1. The refrigeration compressors 70.30 W10 serve to produce an ice cover on the evaporator plates of tank 70.30 B11. The ice water circulating through the consumers flows past the ice-covered plates (with the aid of stirrers) and thus thaws the ice. The refrigeration compressors 70.30 W10 are controlled by ice cover limiters, thus providing for a maximum storage capacity at any time. For operation of the refrigerating system 70.30 W10, see specific instructions.

9.3 Cooling of Yeast Store

The refrigerating systems 70.30 W13-01/-02 and the ceiling fans serve for cooling the yeast store. For operation, see specific instruction.

. . .

10. Preparation of Solutions

10.1 Soda Lye Solution (CIP)

Prepare the 3 % NaOH solution in tank 70.10 B17:

Water	3.500 l
NaOH solids	150 kg (add gently)
Add water for a final volume of	5.000 l

Pump 70.10 P18 serves to circulate the NaOH-solution for dissolving.

ITEM No.		70.10 B1	70.10 P2	70.10 B14	70.10 P15	70.10X3	70.115	70.10X3	70.10 B3	70.10 R3	70.10 P5	70.10 F6	70.10 H16	70.10 S6
DESIGNATION		UNDERGROUND TANK	DISPLACEMENT PUMP	TANK	CENTRIFUGAL PUMP	CLEANING NOZZLE	T SAL	CLEANING NOZZLE	TANK	AGITATOR	CENTRIFUGAL PUMP	HYDRO CYCLON	HOIST	SEPARATOR
TECHNICAL DATA		20m³/h Ø 1932 x 7815	18m³/h 20m	10m³	20m³/h 22m		8		8m³		1,5m³/h 4,0m	1,5m³	500kg	1600 l/h
MATERIAL		MS	SS	MS	CAST IRON		SS%		SS		SS	SS		SS
NOTE		EXISTING												

ITEM No.		70.10 B12	70.10X12	70.1
DESIGNATION		TANK	CLEANING NOZZLE	CEN
TECHNICAL DATA		8m³		3 2
MATERIAL		SS		
NOTE				

ITEM No.		70.10 B12	70.10X12	70.10 P13	70.10 W11
DESIGNATION		TANK	CLEANING NOZZLE	CENTRIFUGAL PUMP	HEAT EXCHANGER
TECHNICAL DATA		8m³		3m³/h 20 m	180 000 kcal/h
MATERIAL		SS		SS	SS
NOTE					EXISTING

ITEM No.		70.10 B17	70.10 P18
DESIGNATION		TANK	CENTRIFUGAL PUMP
TECHNICAL DATA		5m³	20m³/h 30 m
MATERIAL			SS
NOTE		EXISTING	

LEGEND

VALVES:

- Butterfly valve with lever, disc SS
- Butterfly valve with gear, disc SS
- Butterfly valve with gear, disc CS
- Diaphragm valve (CI) — SS
- Diaphragm valve, rubber coating — PVC
- Ball valve (SS)
- Globe valve (SS PCH) (3) M Globe valve with hydraulic shaft (CIRCS)
- Steam trap (CI)
- Check valve (SS)
- Sediment separator (SS) — CI
- Sample cock — SS
- Cock with hose connection — PVC
- Float valve (SS)
- Gate valve (CS)
- Cock (PVC)
- Ball valve (PVC)
- Air filter
- Relief valve

(4) SUD supplier

(5) Existing

Material of pipes:

- CS Carbon Steel
- SS Stainless Steel
- PVC Poly Vinyl Cloride

Material of valves:

- CI Cast Iron
- SS Stainless Steel
- PVC Poly Vinyl Cloride

SAUNDER DIAPHRAGM VALVE

RUNGER VALVE

SECTION 1

SECTION 2

SECTION 3

AIR

H_2SO_4 DILUTED

From P.O 70.10 B12 (warm water)

MOLASSES

STEAM

PROCESS WATER

TO SEWER

550m

70.10 H16

500kg

70.10 B14

70.10 R3

70.10 B1

70.10 P2

70.10 P15

70.10 B3

70.10 P5

70.10 F6

70.10 S6

70.10 B12

70.10 P13

70.10 W11

70.10 B17

70.10 P18

+ 5.50m

CIP RETURN

WORT to fermenter 101-02

WORT to fermenter for 201-02

WORT to fermenter 301

WORT to pure culture fermenter

CIP

CIP to yeast steam room

CIP to fermenter 101-02

No OH

STEAM

WARM WATER

PROCESS WATER

SEWER

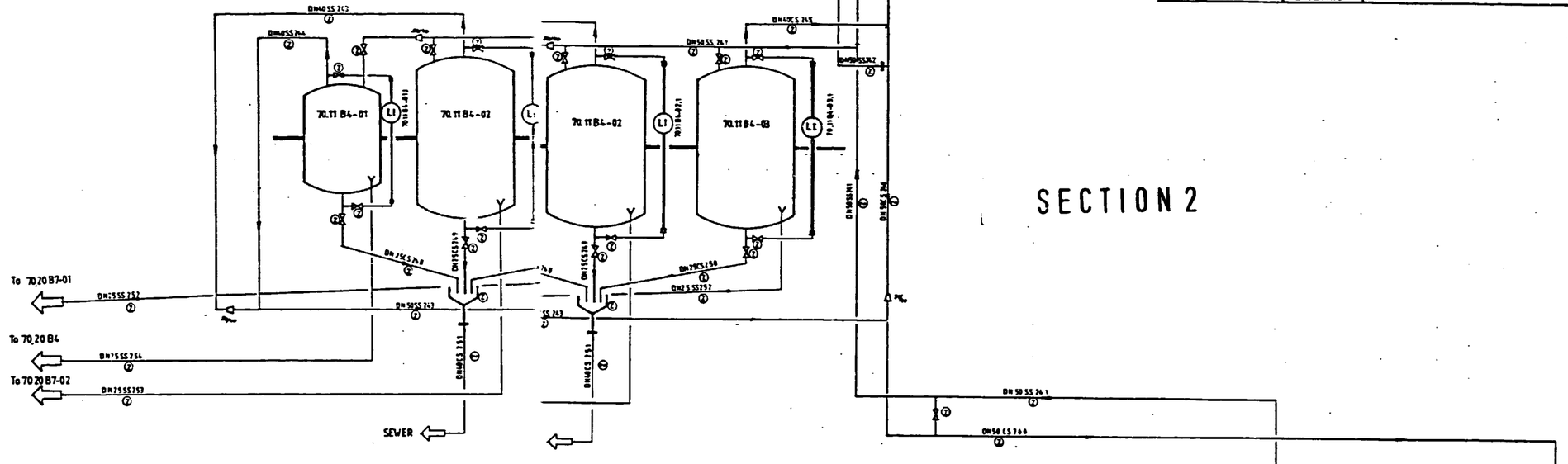
STORAGE AND PREPARATION OF MOLASSES P&I DIAGRAM

STARCOSA

3.03.50.430

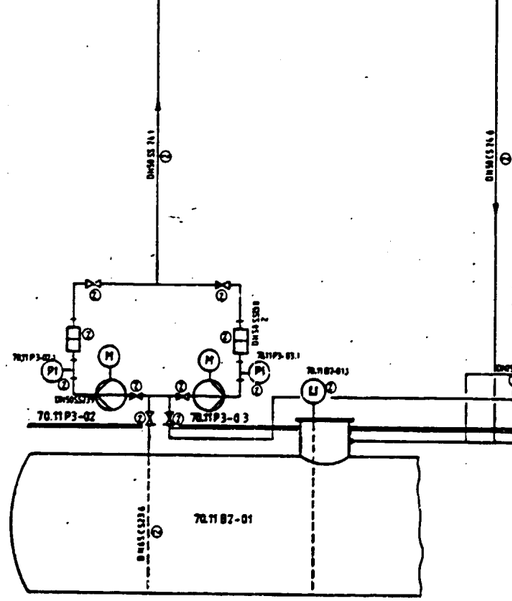
ITEM-No.				70.11 B4-01	70.11 B4-02	70.11 B4-03
DESIGNATION				RECEIVER	RECEIVER	RECEIVER
TECHNICAL DATA				200l	400l	400l
MATERIAL				SS	SS	SS
NOTE				EXISTING	EXISTING	EXISTING

70.11 P3-02	70.11 P3-03
CENTRIFUGAL PUMP	CENTRIFUGAL PUMP
6 m³/h	6 m³/h
19 m	19 m
EXISTING	EXISTING

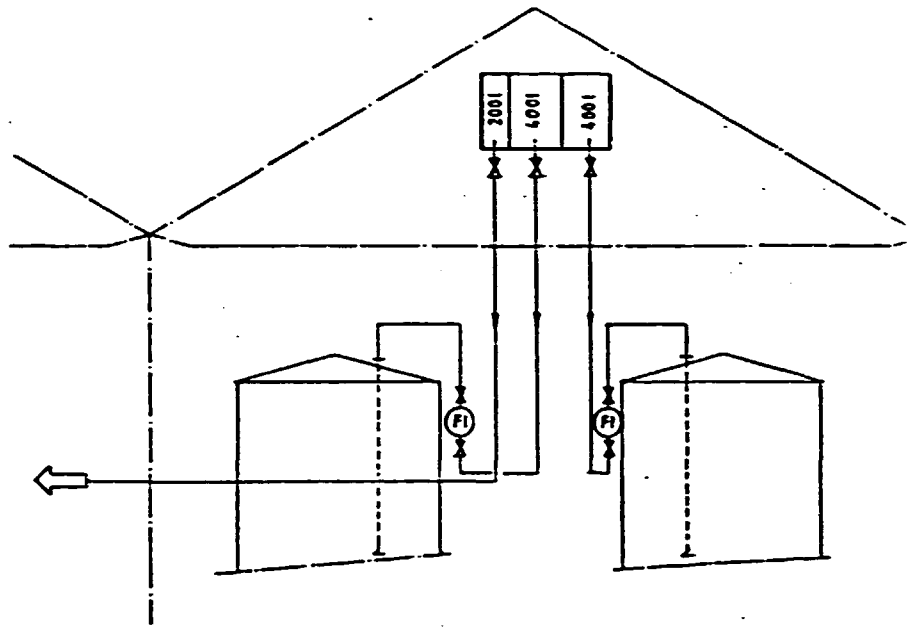


SECTION 2

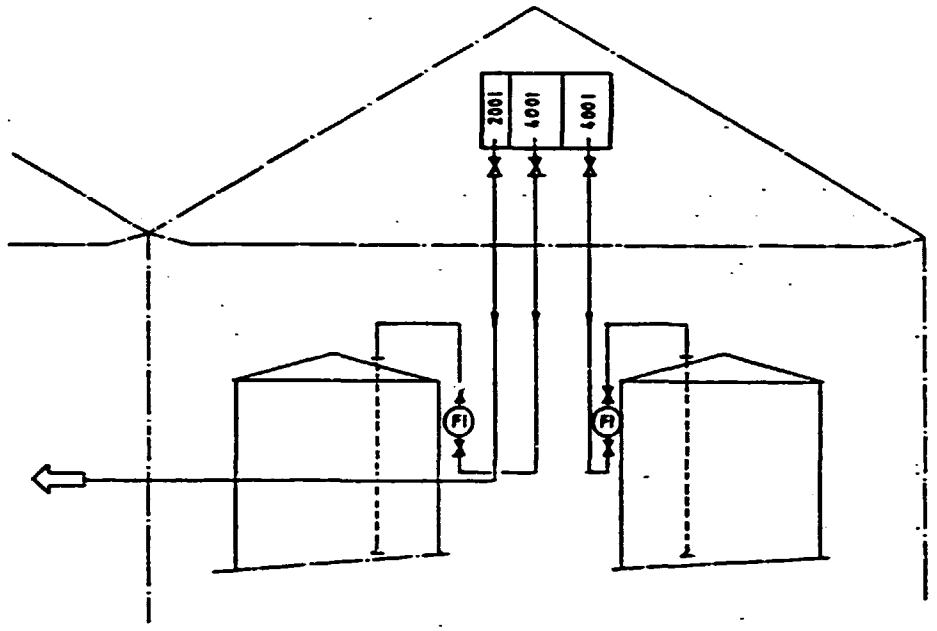
SECTION 1



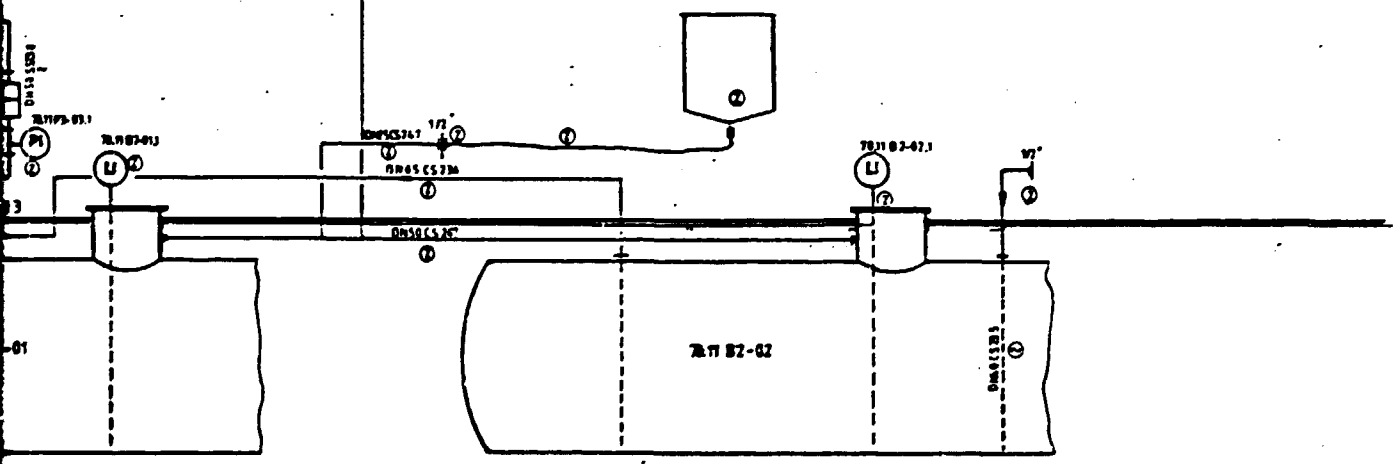
		70.11 B2- 01 02	
		UNDERGROUND TANK	
		30 m³	
		MS	
		EXISTING	

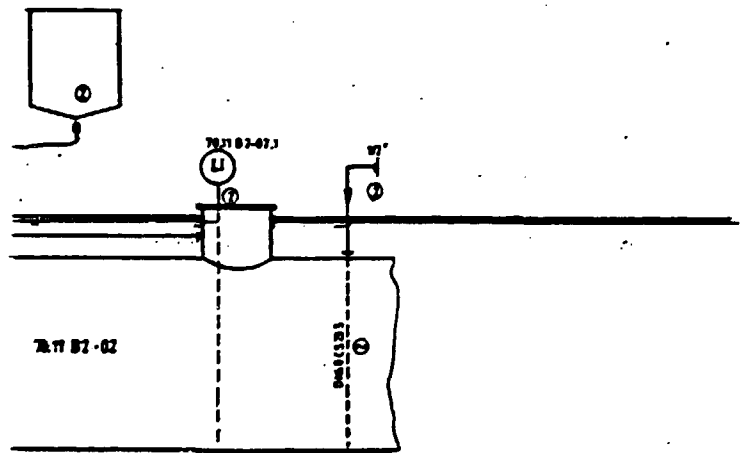


		70.11 B2- 01 02	
		UNDERGROUND TANK	
		30 m³	
		MS	
		EXISTING	



SECTION 3





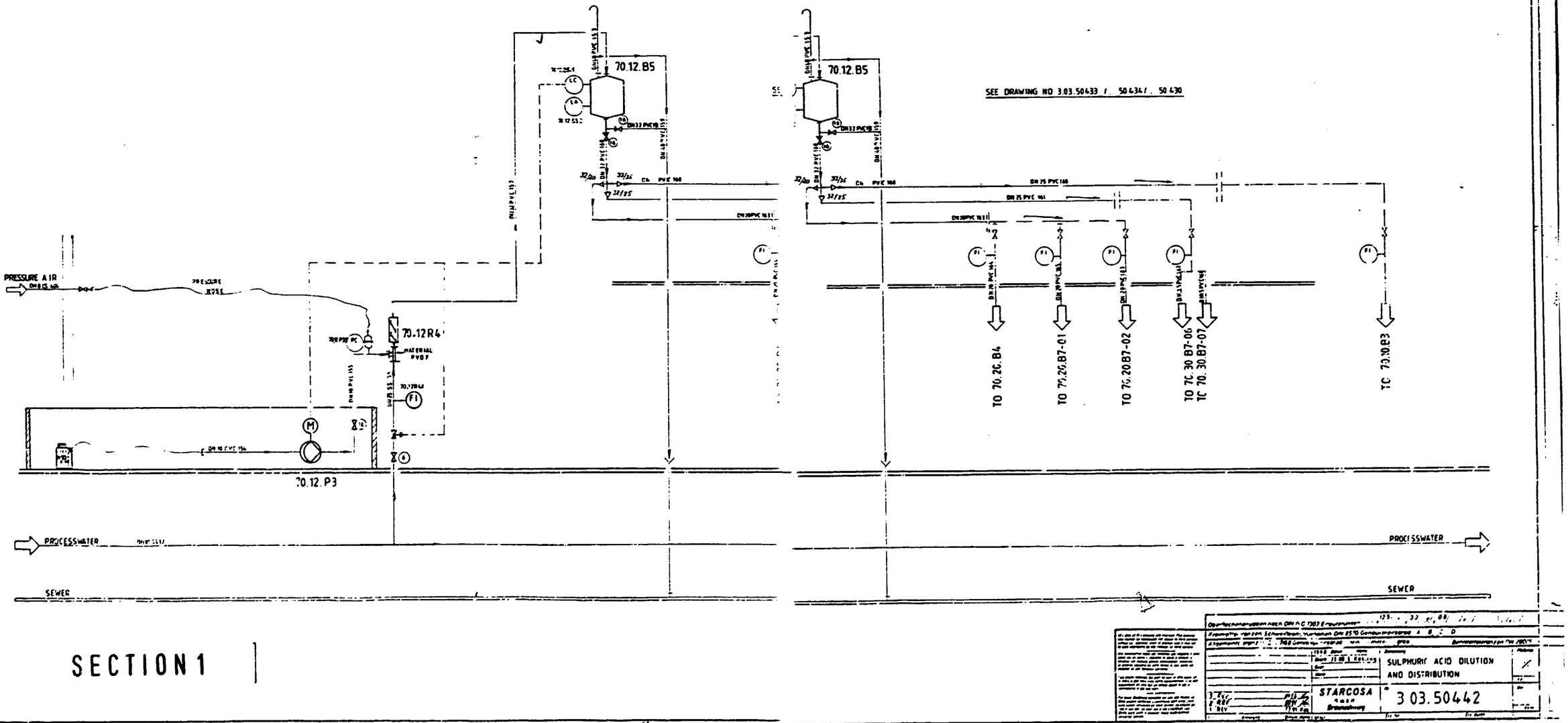
SECTION 4

		Ammonia Water System	
	STARCOSA GmbH Bremerhaven	3.03.50431	

ITEM-NO.		70.12.P3	70.12.R4	70.12.B5
DESIGNATION		DOSING PUMP	STATIC MIXER	TANK FOR H_2SO_4 DILUTED
TECHNICAL DATA		0 - 20 l/h 15 m	5001/h	5001
MATERIAL		SS/Synthetic	MS	PVC
NOTE				

BS
FOR LUTED

SECTION 2



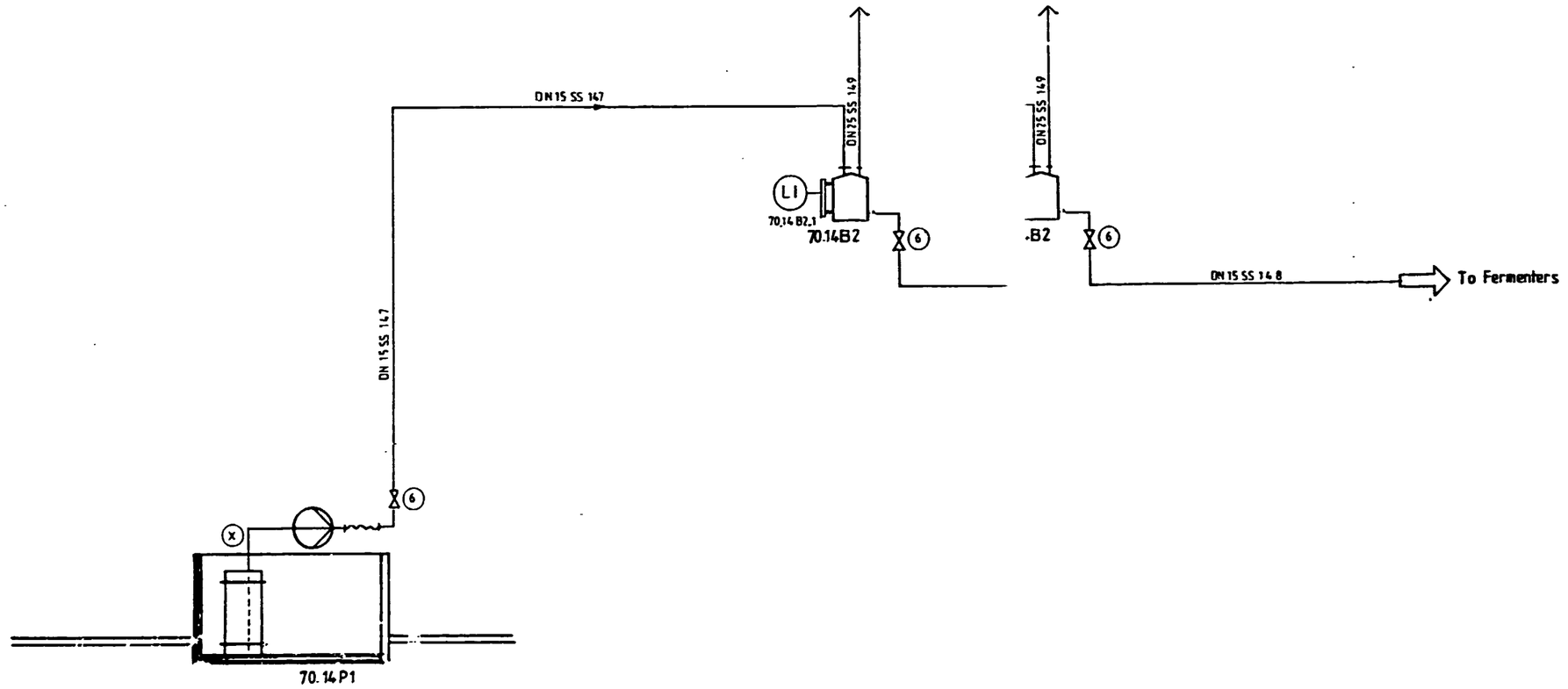
SECTION 1

SULPHURIC ACID DILUTION AND DISTRIBUTION

STARCOSA

3.03.50442

ITEM No.		70.14 P1			70.14 B2
DESIGNATION		BARREL PUMP			OVERHEAD TANK
TECHNICAL DATA		1 m³/h			250 l
		5 m			
MATERIAL		SS			SS
NOTE					
					EXISTING



LEGEND

VALVES:

1. Butterfly valve with lever, disc SS
2. Butterfly valve with gear, disc SS
3. Butterfly valve with gear, disc CS
4. Diaphragm valve (CI)
5. Diaphragm valve, rubber coating
6. Ball valve (SS)
7. Globe valve (CI)
8. Steam trap (CI)
9. Check valve (SS)
10. Sediment separator (SS)
11. Sample cock
12. Cock with hose connection
13. Float valve (SS)
14. Gate valve (CS)
15. Cock (PVC)

(x) Sub supplier

Material of pipes:

CS Carbon Steel
SS Stainless Steel
PVC Poly Venyl Cloride

Material of valves:

CI Cast Iron
SS Stainless Steel
PVC Poly Venyl Cloride

SECTION 2

SECTION 1

Oberflächenangaben nach DIN ISO 1302 Erläuterungen ▽ = 12,5 ▽ = 3,2 ▽ = 0,8 ▽ = ▽ ▽ = ▽

Fremdtoleranzen Schweißkonstruktionen DIN 8570 Genauigkeitsgrad A B C D

Allgemeintoleranzen DIN 7168 Genauigkeitsgrad fein mittel grob

			1989	Datum
			Bearb.	11
			Gepr.	
			Norm	

STARCOSA G.m.b.H. Braunschweig

Antifoam Oil Handling System
P+I DIAGRAM

Nr. 3.03.50411

Ers. für: Ers. durch:

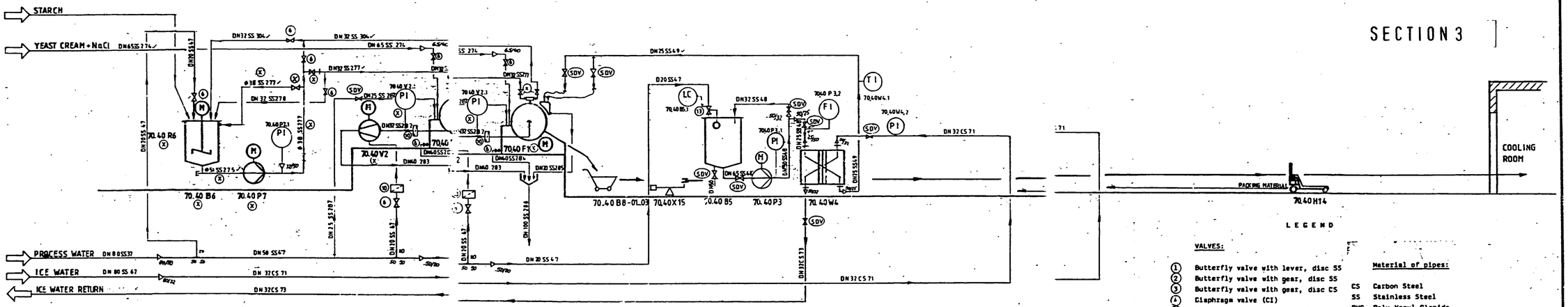

ITEM-No.
DESIGNATION
TECHNICAL DATA
MATERIAL
NOTE
70.20B1
PURE CULTURE FERMENTER
6m³
SS
EXISTING PROPAGATOR B
70.20B2
TANK
50l
SS
70.20F12-03
AIR FILTER
1500m³/h
SS
70.20B4
FERMENTER
19m³
SS
EXISTING FERMENTER C
70.20P5
SPECIAL PUMP
50m³/h 20m
SS
70.20W6
HEAT EXCHANGER
100 000 kcal/h
SS
70.20B7-01
FERMENTER
53m³
SS
EXISTING FERMENTER 01
70.20P8-01
SPECIAL PUMP
165m³/h 20m
SS
70.20W9-01
HEAT EXCHANGER
380 000 kcal/h
SS
EXISTING
70.20B7-02
FERMENTER
53m³
SS
EXISTING FERMENTER 02
70.20P8-02
SPECIAL PUMP
165m³/h 20m
SS
70.20W9-02
HEAT EXCHANGER
380 000 kcal/h
SS
EXISTING
70.20V11-01
BLOWER
1000 Nm³/h 4m WC
CAST IRON STEEL
70.20V11-02
BLOWER
4000 Nm³/h 4m WC
CAST IRON STEEL
70.20V11-03
BLOWER
4000 Nm³/h 4m WC
CAST IRON STEEL
70.20V11-04
BLOWER
2000 Nm³/h 4m WC
CAST IRON STEEL
70.20F12-02
AIR FILTER
13 000 Nm³/h 4m WC
SS
70.20F12-01
AIR FILTER
13 000 Nm³/h 4m WC
SS
70.20B13
TANK
5m³
MS
70.20P14-01
CENTRIFUGAL PUMP
50m³/h 20m
CAST IRON
70.20P14-02
CENTRIFUGAL PUMP
50m³/h 20m
CAST IRON
H2SO4 DILUTED
AMMONIUM WATER TO 70.20 B7-02
AMMONIUM WATER TO 70.20 B7-01
WORT
WORT
WORT
WORT
ANTIFOAM OIL
AMMONIA WATER TO 70.20 B4
TO MOLASSES PREPARATION
MONOAMMONIUMPHOSPHATE, MgSO4 DOSING BY HAND
ICE WATER
TO ICE WATER TANK
STEAM
COOLING WATER FROM COOLING TOWER
PROCESS WATER
WARM WATER
CIP
CIP RETURN
CONDENSATE
SECTION 1
SECTION 2
SECTION 3
SECTION 4
SECTION 5
SECTION 6
TO SEPARATOR 70.30S2 01-02
TO FILTER 70.60F3
COOLING WATER RETURN TO COOLING TOWER
YEAST MILK
SEWER
LEGEND
VALVES:
1 Butterfly valve with lever, disc SS
2 Butterfly valve with gear, disc SS
3 Butterfly valve with gear, disc CS
4 Diaphragm valve (CI)
5 Diaphragm valve, rubber coating
6 Ball valve (SS)
7 Globe valve (CI, SS)
8 Steam trap (CI)
9 Check valve (SS)
10 Sediment separator (SS)
11 Sample cock
12 Cock with hose connection
13 Float valve (SS)
14 Gate valve (CS)
15 Cock (PVC)
16 Ball valve (PVC)
17 Air filter
18 Relief valve
20 Air trap
N Sub supplier
Z Existing
Material of pipes:
CS Carbon Steel
SS Stainless Steel
PVC Poly Vinyl Clorid
Material of valves:
CI Cast Iron
SS Stainless Steel
PVC Poly Vinyl Clorid
SSDV SAUNDERS DIAPHRAGM VALVE
KV KLINGER VALVE
STARCOSA GmbH Braunschweig
FERMENTATION P+I DIAGRAM
3.03.50433
3.0

ITEM No.
DESIGNATION
TECHNICAL DATA
MATERIAL
NOTE
70.30 F1 STRAINER SS
70.30 S2-01 SEPARATOR 25 m³/h SS
70.30 A3 WASHING NOZZLE SS
70.30 S2-02 SEPARATOR 25 m³/h SS
70.30 P5 DEFOAMING PUMP 6 m³/h 30 m SS
70.30 W6 HEAT EXCHANGER 120.000 kcal/h SS EXISTING
70.30 X7-01 CLEANING NOZZLE
70.30 B7-01 TANK 6,5 m³ SS EXISTING
70.30 R7-01 AGITATOR EXISTING
70.30 X7-02 CLEANING NOZZLE
70.30 B7-02 TANK 6,5 m³ SS EXISTING
70.30 R7-02 AGITATOR EXISTING
70.30 X7-03 CLEANING NOZZLE
70.30 B7-03 TANK 2,5 m³ SS EXISTING
70.30 R7-03 AGITATOR EXISTING
70.30 B7-04 TANK 2,5 m³ SS
70.30 R7-04 AGITATOR
70.30 X7-04 CLEANING NOZZLE
70.30 B7-06 TANK 1 m³
70.30 R7-06 AGITATOR
70.30 X7-07 CLEANING NOZZLE
70.30 B7-07 TANK 1,5 m³ SS
70.30 R7-07 AGITATOR
70.30 P9 CENTRIFUGAL PUMP 10 m³/h 10 m SS
70.30 W13-01/02 COOLING UNTIS
70.30 W10 FULLY AUTOMATIC REFRIGERATING UNIT 40.000 kcal/h
70.30 B11 TANK 20 m³ MS
70.30 P11-01/02 CENTRIFUGAL PUMP CAST IRON
SECTION 1
SECTION 2
SECTION 3
SECTION 4
SECTION 5
SECTION 6
ICE WATER RETURN FROM 70.20 B1
CIP
FERMENTED WORT
DEYEASTED WORT
500 kg
70.10 H 16
ICE WATER
STEAM
WARM WATER
COOLING WATER
COOLING WATER RETURN
PROCESS WATER
ICE WATER RETURN
CIP RETURN TO 130
SEWER I
SEWER II
TUBE CONNECTION
TO FERMENTERS
H₂ SO₄ DILUTED
COOLING ROOM
TO THE DRUM FILTER
ICE WATER RETURN FROM 70.40 W4
SDV SAUNDER DIAPHRAGM VALVE
LEGEND
VALVES:
1 Butterfly valve with lever, disc SS
2 Butterfly valve with gear, disc SS
3 Butterfly valve with gear, disc CS
4 Diaphragm valve (CI)
5 Diaphragm valve, rubber coating
6 Ball valve (SS)
7 Globe valve (SS) 7M Globe valve (CI) with metallic seat (CS)
8 Steam trap (CI)
9 Check valve (SS)
10 Sediment separator (SS)
11 Sample cock
12 Cock with hose connection
13 Float valve (SS)
14 Gate valve (CS)
15 Cock (PVC)
16 Ball valve (PVC)
17 Air filter
18 Relief valve
19 Mud filter
X Sub supplier
Material of pipes:
CS Carbon Steel
SS Stainless Steel
PVC Poly Venyl Cloride
Material of valves:
CI Cast Iron
SS Stainless Steel
PVC Poly Venyl Cloride
SEPARATION
P+I DIAGRAM
STARCOSA
Braunschweig
3.03.504.34

ITEM No.		70.40B8-01..03	70.40 B6	70.40R6	70.40P7	70.40 V2	70.40 F1
DESIGNATION		YEAST TROUGH	TANK	AGITATOR	CENTRIFUGAL PUMP	VACUUM PUMP	VACUUM DRUM FILTER
TECHNICAL DATA		200 l	1,0 m³		3m³/h 10 m	100 m³/h 25 TORR	4 m²
MATERIAL		SS	SS		SS	CAST IRON	SS
NOTE		PORTABLE 1 x EXISTING	SUB SUPPLIER	SUB SUPPLIER	SUB SUPPLIER	SUB SUPPLIER	SUB SUPPLIER

70.40 F1		70.40X15	70.40 B5	70.40 P3	70.40 W4						
VACUUM DRUM FILTER		BALANCE	TANK	CENTRIFUGAL PUMP	HEAT EXCHANGER						
4 m²		0 ~ 50 KG	0,4 m³	10m³/h 100 m	2 m²						
SS				CAST IRON							
SUB SUPPLIER			EXISTING	EXISTING	EXISTING						

										70.30H14
										LIFTING CARTS
										1200kg
										EXISTING



LEGEND

VALVES:

1. Butterfly valve with lever, disc SS
2. Butterfly valve with gear, disc SS
3. Butterfly valve with gear, disc CS
4. Diaphragm valve (CI)
5. Diaphragm valve, rubber coating
6. Ball valve (SS)
7. Globe valve (SS)
8. Steam trap (CI)
9. Check valve (SS)
10. Sediment separator (SS)
11. Sample cock
12. Cock with hose connection
13. Float valve (SS)
14. Gate valve (CS)
15. Cock (PVC)

(x) Sub supplier

Material of pipes:

CS Carbon Steel
SS Stainless Steel
PVC Poly Venyl Cloride

Material of valves:

CI Cast Iron
SS Stainless Steel
PVC Poly Venyl Cloride

SDV SAUNDER DIAPHRAGM VALVE

6	REV	08.12.94	Ma				
5	REV	17.11.94	Ma				
4	REV	12.9.94	Ma				
3	REV	29.6.94	Ma				
2	REV	19.5.94	Ma				
1	REV	14.4.94	Ma				
0	REV	24.3.94	Ma				

STARCOSA GmbH Braunschweig

FILTRATION AND PACKING
P+I DIAGRAM

Nr. 3.03.50-435

ITEM No.		70.50 H1			70.50 B2
DESIGNATION		WATER TREATMENT PLANT			TANK
TECHNICAL DATA		2m³/h			5m³
MATERIAL					MS
NOTE					EXISTING

70.50 B2	70.50P3-02	70.50W3	70.50 A8		70.50P3-01		70.50 B6
TANK	CENTRIFUGEL PUMP	STEAM BOILER	CHIMNEY		GEAR PUMP		TANK
5m³		1500kg steam/h 8bar	Ø 700mm height 10000mm				32m³
MS							MS
EXISTING	EXISTING	EXISTING			EXISTING		EXISTING

B6		70.50 P7		70.50 B4		70.50 B9
iK		GEAR PUMP		TANK		PURGING TANK
³		10m³/h 10m		2,8m³		0,6m³
		CAST IRON		MS		MS
ING				EXISTING		EXISTING

LEGEND

VALVES:

1. Butterfly valve with lever, disc SS
2. Butterfly valve with gear, disc SS
3. Butterfly valve with gear, disc CS
4. Diaphragm valve (CI)
5. Diaphragm valve, rubber coating
6. Ball valve (SS)
7. Globe valve (CI)
8. Steam trap (CI)
9. Check valve (SS)
10. Sediment separator (SS)
11. Sample cock
12. Cock with hose connection
13. Float valve (SS)
14. Gate valve (CS)
15. Cock (PVC)

(x) Sub supplier (2) Existing

SDV SAUNDER DIAPHRAGM VALVE

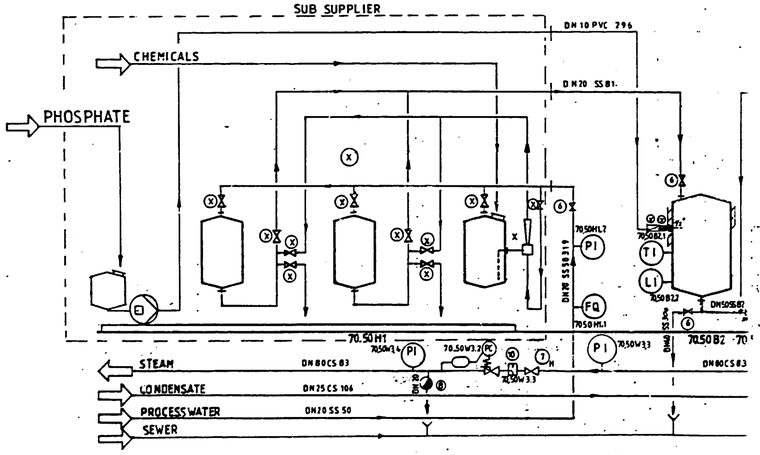
Material of pipes:

CS Carbon Steel
SS Stainless Steel
PVC Poly Venyl Cloride

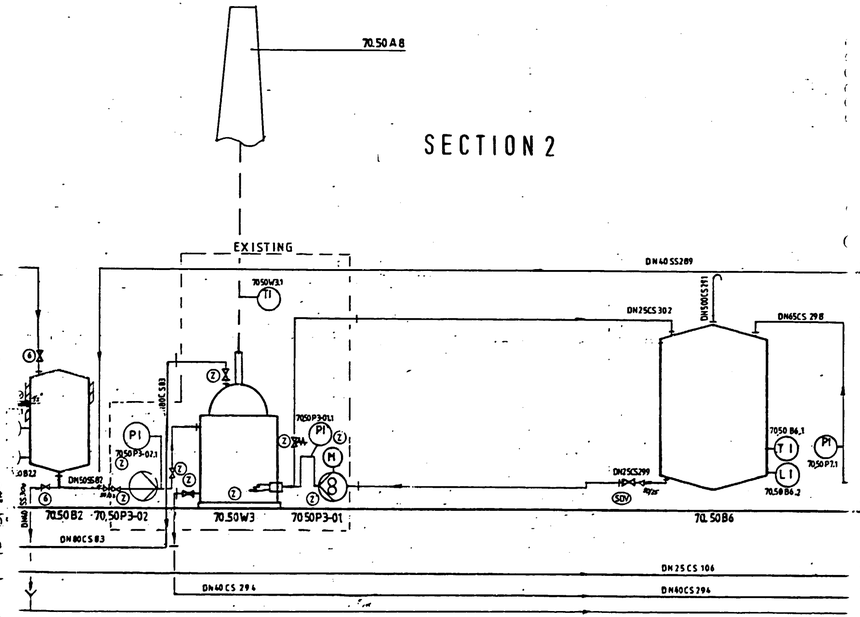
Material of valves:

CI Cast Iron
SS Stainless Steel
PVC Poly Venyl Cloride

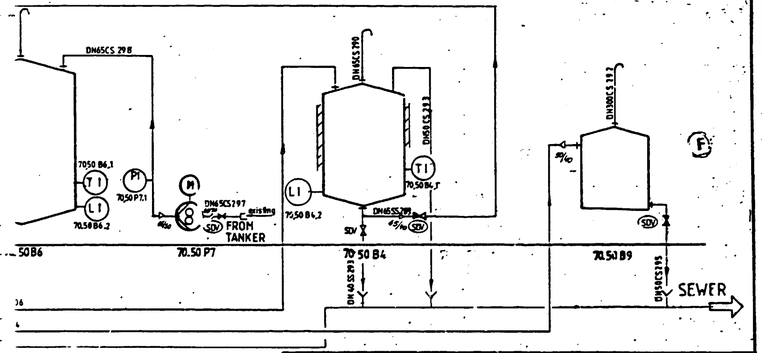
SECTION 1



SECTION 2



SECTION 3



STEAM GENERATION
P+I DIAGRAM

STARCOSA GmbH

3.03.50436

ITEM No.		70.60 B1	70.60 F3	70.60P4			70.60 A 2
DESIGNATION		RECEIVING TANK	FILTER	CENTRIFUGAL PUMP			DOS TANK
TECHNICAL DATA		5,5m³	50m³/h	50m³/h 20m			50l
MATERIAL		MS	MS	CAST IRON			PLASTICS
NOTE		EXISTING					

70.60 A 2	70.60 P 2		70.60 B5-01		70.60 B5-02	70.60P6-01	70.60 P6
DOSING UNIT TANK	PUMP		TANK		TANK	CENTRIFUGAL PUMP	CENTRIFU PUMP
50l	0-8 l/h		150 m³		150 m³	50m³/h 30m	50m³ 30m
PLASTICS	PLASTICS		MS		MS	CAST IRON	CAST IRO
			EXISTING		EXISTING		

SDV SAUNDER DIAPHRAGM VALVE
KV KLINGER VALVE

VA
(1) Bu
(2) Bu
(3) B
(4) Di
(5) Di
(6) Ba
(7) Gl
(8) St
(9) Co
(10) Se
(11) Sa
(12) Co
(13) Ga
(14) Co
(15) BA
(16) BA
(x) Su
(Z) EX

Mat
CS Ca
SS St
PVC Po

AIR FROM 70.20V11-01-03 DN 40 CS 219
TOWN WATER DN100CSS25
TO THE FACTORY
DN 80 SS 37
DN65 SS25
DN65 CS 219
DN65 SS28
DN65 SS27
DN100 SS26
DN40 SS 219
DN125CS325
DN125PVC325
DN15PVC316
DN15PVC317
DN15PVC315
DN100SS31
DN100 SS 30
DN80SS32
DN80SS33
DN80SS34
DN80SS35
DN80SS36
DN80SS37
65/50
70.60 B1
70.60P4
70.60F3
70.60A2
70.20P7
70.60B5-01
70.60B5-02
70.60P6-
70.60F31
70.60F32
70.60F33
70.60F3.3
70.60A2.2
70.60A2.1
70.60B5.1
70.60B5.2
LC
LIC HL
LIAHL
LIAHI
PC
PI
FQ
M
CHLORINE
CHLORINE
PVC
SDV
SDV/NO

SECTION 1

SECTION 2

4. REV.	10.8.91		STARCO
3. REV.	10.8.91		
2. REV.	10.7.91		
1. REV.	10.7.90		

70.60 B5-01	70.60 B5-02	70.60 P6-01	70.60 P6-02
TANK	TANK	CENTRIFUGAL PUMP	CENTRIFUGAL PUMP
150 m³	150 m³	50 m³/h 30 m	50 m³/h 30 m
MS	MS	CAST IRON	CAST IRON
EXISTING	EXISTING		

SECTION 3

SDV SAUNDER DIAPHRAGM VALVE

KV KLINGER VALVE

LEGEND

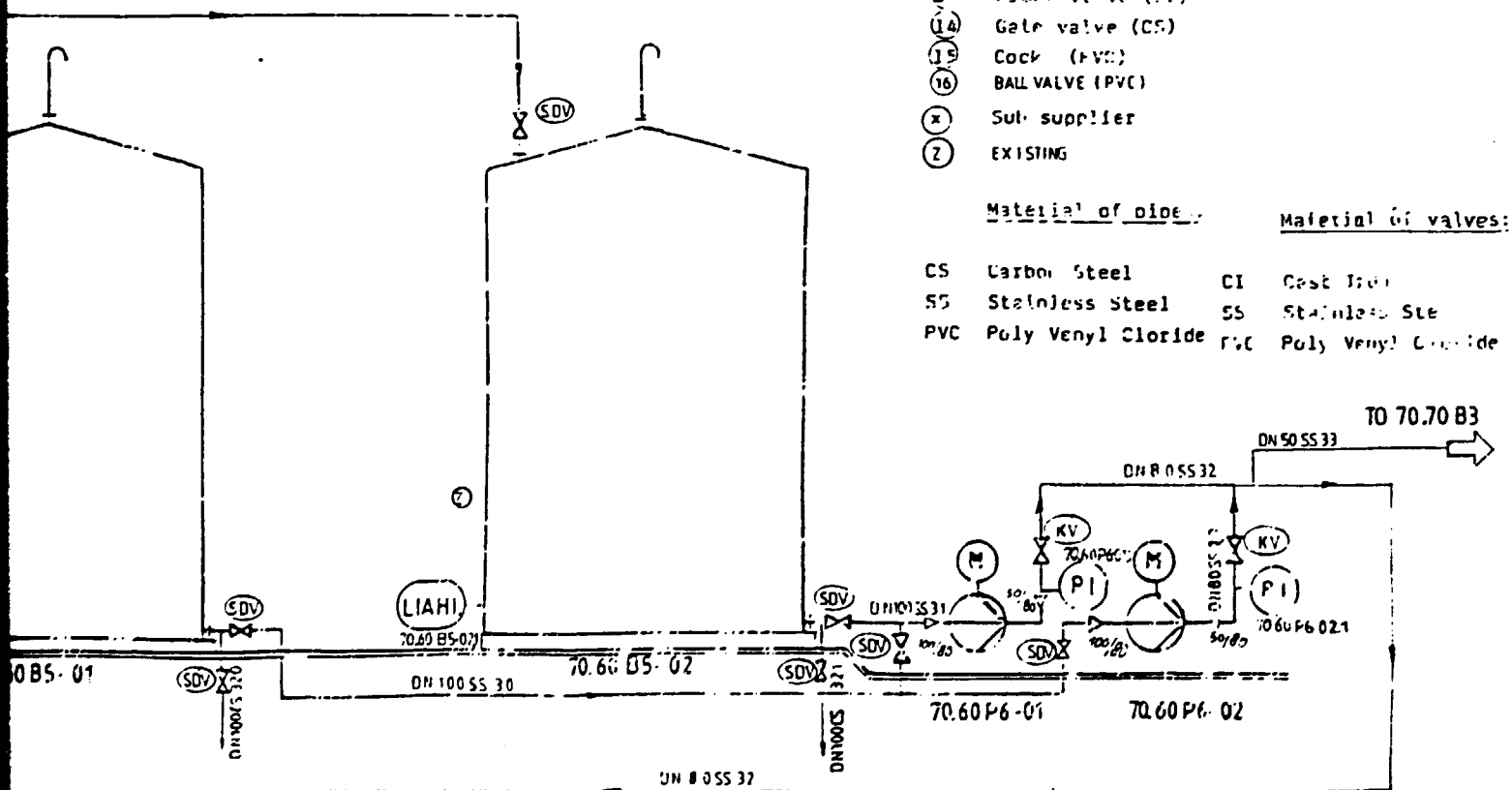
VALVES:

1. Butterfly valve with lever, disc CI
2. Butterfly valve with gear, disc SS
3. Butterfly valve with gear, disc CS
4. Diaphragm valve (PP)
5. Diaphragm valve, [illegible]
6. Ball valve (SS)
7. Globe valve (CI)
8. Steam trap (CI)
9. Check valve (SS)
10. Sediment separator (SS)
11. Sample cock
12. Cock with hose connection
13. Float valve (SS)
14. Gate valve (CS)
15. Cock (PVC)
16. BALL VALVE (PVC)

x Sub supplier

Z EXISTING

Material of pipes:		Material of valves:	
CS	Carbon Steel	CI	Cast Iron
SS	Stainless Steel	SS	Stainless Ste
PVC	Poly Venyl Cloride	PVC	Poly Venyl Chloride



4 : REV	10.8.91	STARCOSA GmbH Processtechnology	PROCESSWATER EQUIPMENT P+I DIAGRAM
3 : REV	10.8.91		
2 : REV	10.7.91		3.03.50416
1 : REV	01.10.90		

ITEM NO.	70.70 W2.01/02	70.70 B3	70.70 F1	70.70 P4.01	70.70 P4.02	70.70 P5
DESIGNATION	COOLING TOWER	WATER BASINS	FILTER	CENTRIFUGAL PUMP	CENTRIFUGAL PUMP	CENTRIFUGAL PUMP
TECHNICAL	400 m³/h 1 200 000 kcal/h	20 m³	400 m³/h	200 m³/h 30 m	200 m³/h 30 m	10 m³/h 30 m
MATERIAL		BETON	SS	CAST IRON	CAST IRON	CAST IRON
NOTE