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INDUSTRIAL TRAINING REPORT
for
Work Term-I

carried out at :

PUNJAB MAIZE PRODUCTS LIMITED
(PMPL)

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31/8/87

Submitted by

VARINDER DHAWAN

Department of Mechanical and Industrial Engineering
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To

Mr S.K. Satsangi,
Head, Placement and Coordination,
Thapar Institute of Engineering & Technology,
Patiala-147001.

Dear Sir,

This report entitled, "Work Term-I Report" was prepared as my work report for the Punjab Maize Products Limited. This is my first work term report.

Punjab Maize Products Limited are the manufacturers of liquid glucose, dextrose, oil cakes and gluten etc.

My training was under Mr R.S. Maur. This report has been written by me and has not received any previous academic credit at this or any other institution. I am very grateful to Mr R.S. Maur, for his help and guidance during my work and my stay in the organisation. I would like to thank the other members of the industry.

My heartly thanks are for Mr S.K. Satsangi, without his encouraging help, this training was not possible. I would also like to thank my department for providing me with all type of help whenever desired.

Yours sincerely,

Varinder Dhawan.

(VARINDER DHAWAN)
Roll No.193/84

INDEX

SR.NO.	TOPICS		PAGE NO
1.	ABSTRACT	...	1
2.	2.1. INTRODUCTION	...	4
	2.2. Working set-up	...	5
3.	PRODUCT AND USES:		
	3.1. Nature of products manufactured	...	6
	3.2. Maize starch	...	7
	3.3. Modified starches	...	9
	3.4. Production of liquid glucose	...	17
	3.5. Production of desctrase monohydrate	...	18
4.	4.1. Boiler House	...	21
	4.2. Specification of mulitherm boiler	...	22
	4.3. Specification of ISGEC-JOHN THOMPSON boiler	...	23
	4.4. Boiler precautions.	...	26
	4.5.Check of boiler for IBR specifications	...	27
	4.6. Cost accounting of multitherm boiler	...	31
	4.7. Husk feeding system(improvements)	...	40
	4.8. Water softening plant	...	42
	4.9. Technical details	...	44
5.	VALVE CONTROLS:		
	5.1. Definition	...	47
	5.2. Instructions	...	50
	5.3. Installation of valves	...	52
	5.4. Operation of valves	...	54
	5.5. Maintenance of valves	...	56
	5.6. Various types of valves used in industry	...	60
	5.7. Details of butterfly,parallel side blow off valve	....	62
	5.8. Steam traps	...	65
	5.9. Assembly of geared motor	...	67
	5.10.Assembly of reduction gear	...	69
6.	E.T.P. AND STARCH PLANT:		
	6.1. Cost accounting of starch slurry	...	70
	6.2. Trials on rice starch	...	73
	6.3. Effluent treatment plant	...	74
7.	PULVERISING SECTION:		
	7.1. Fabrication of supporting structure for cyclone and dust collector of pulveriser	...	76
	7.2. Design,errection and commissioning of grinding mills driving arrangement	...	79

8. PRODUCTION, PLANNING AND CONTROL:

8.1. Introduction ... 87
8.2. Importance and objectives ... 87
8.3. Organisation set-up of PPC ... 90
8.4. Production planning ... 90
8.5. Production control ... 93
8.6. Weekly/monthly production control ... 99
8.7. Conclusion ... 100
8.8. Correlation chart of performance ... 101

9. CONCLUSION AND RECOMMENDATIONS ... 104

10. FORMS AND FIGURES ...

...

ABSTRACT

ABSTRACT

INTRODUCTION

Punjab Maize Products Ltd.(PMPL), was a joint venture of Indian Drugs and Pharmaceuticals Ltd.(IDPL) and Punjab State Industrial Development Corporation (PSIDC). But, now it is a private undertaking. This report was written for the Industrial Training i.e. work term I during my stay in PMPL from 2nd February 1987 to 31 July 1987. It is an agro-based plant set-up in Sangrur (Punjab).

PRODUCT AND USES

Glucose and dextrose are the main finished products which are manufactured here from maize (trials are on from rice also) which is used in pharmaceuticals. Ready made foods, gums, chewing tobacco etc. Modified starches are used in textile, foundary, paper industry. The products as corn steep liquor is used for cattle feed, corn steep liquor, gluten, oil cakes, fibre, hydrol are the other products used in different purposes.

BOILER HOUSE

The steam which is produced from two boilers ISGEC-JOHN THOMPSON and Multitherm boilers is used for conversion of starch slurry to glucose. The cost accounting for multitherm boiler was done and the cost of producing 1 ton of steam under standard conditions was found to be Rs. 20. The multitherm boiler run with

the husk feeding system was facing many problems. The use of venturi in husk feeding system made it more efficient and long lasting.

VALVE CONTROLS

Many different types of valve controls are used in industries. Every valve has got certain specific task to perform and hence, has got specific errecting, maintaining and overhauling instructions. The importance of safety valves, relief valves, non-return valves etc. has been highlighted.

STARCH AND E.T.P.

The cost accounting of the starch plant was done to know the amount of expenditure being done on producing 1 ton of starch, by calculating the man power, raw material and electricity costs. The repair of sumergical pump and after that there replacement with centrifugal pumps in effluent treatment plant has been shown.

PULVERISING SECTION

In the pulverising section, the stand for the cyclone and dust collector of the pulveriser were made from channels in fabrication shop. Seven new grinding mills were installed after designing their belts pulleys, shafts etc. The output of grounded rice was raised to required amount as the earlier pulveriser was not working well. The proper placement of raw material and grounded rice is suggested by material movement study.

PRODUCTION, PLANNING AND CONTROL

The study of the production, planning and control department was taken to known about the design of PPC and to organise production control round the clock. Without having control over production, no planning can be successful and without proper planning, no control is useful. So efficient PP needs efficient control too. The production plan has to be worked out annually, monthly and daily. The production control reviews the performance of production, materials, management marketing function periodically. The performance of liquid glucose are attached similar approach can be followed for other products also.

INTRODUCTION

INTRODUCTION

Punjab Maize Products Limited (PMPL) was a joint venture of State owned IDPL - Indian Drugs and Pharmaceuticals Ltd. and PSIDC - Punjab State Industrial Development Corporation, is a highly sophisticated plant (Agro based), was set up at the cost of Rs eight crores in an industrially backward district of Sangrur in Punjab.

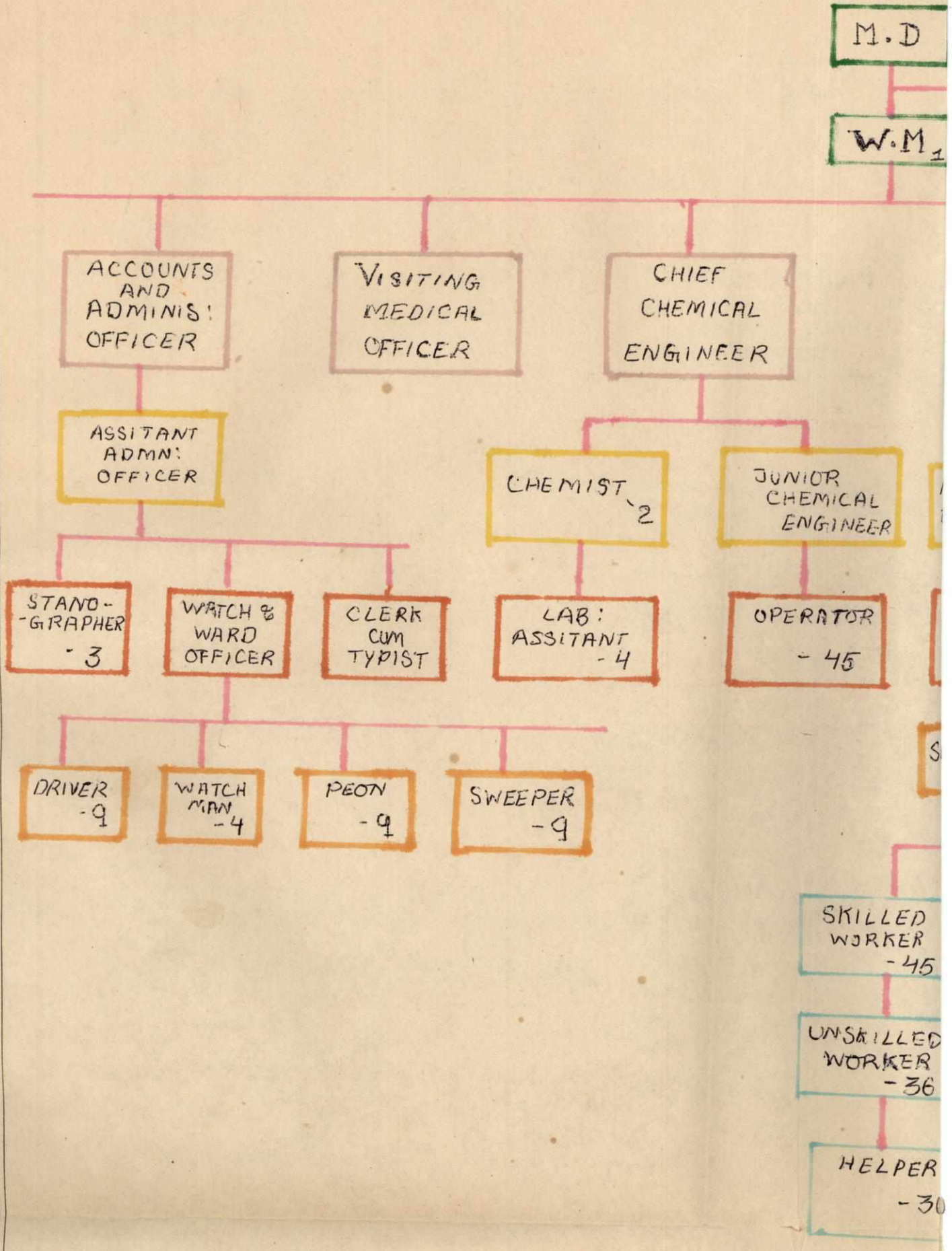
Now this plant is owned by a private person, Mr S.T.S. Rai, an industrialist from Kenya. The total assets of the industry at present amount to approximately fifteen crore rupees. This plant helps the former to sell their products directly to the industry.

The various types of products which can be manufactured here are shown subsequently. The dextrose plant is the first of its kind in India using the most modern technology of enzyme-enzyme process obtained from M/S D.D.S. Kroyer of Denmark.

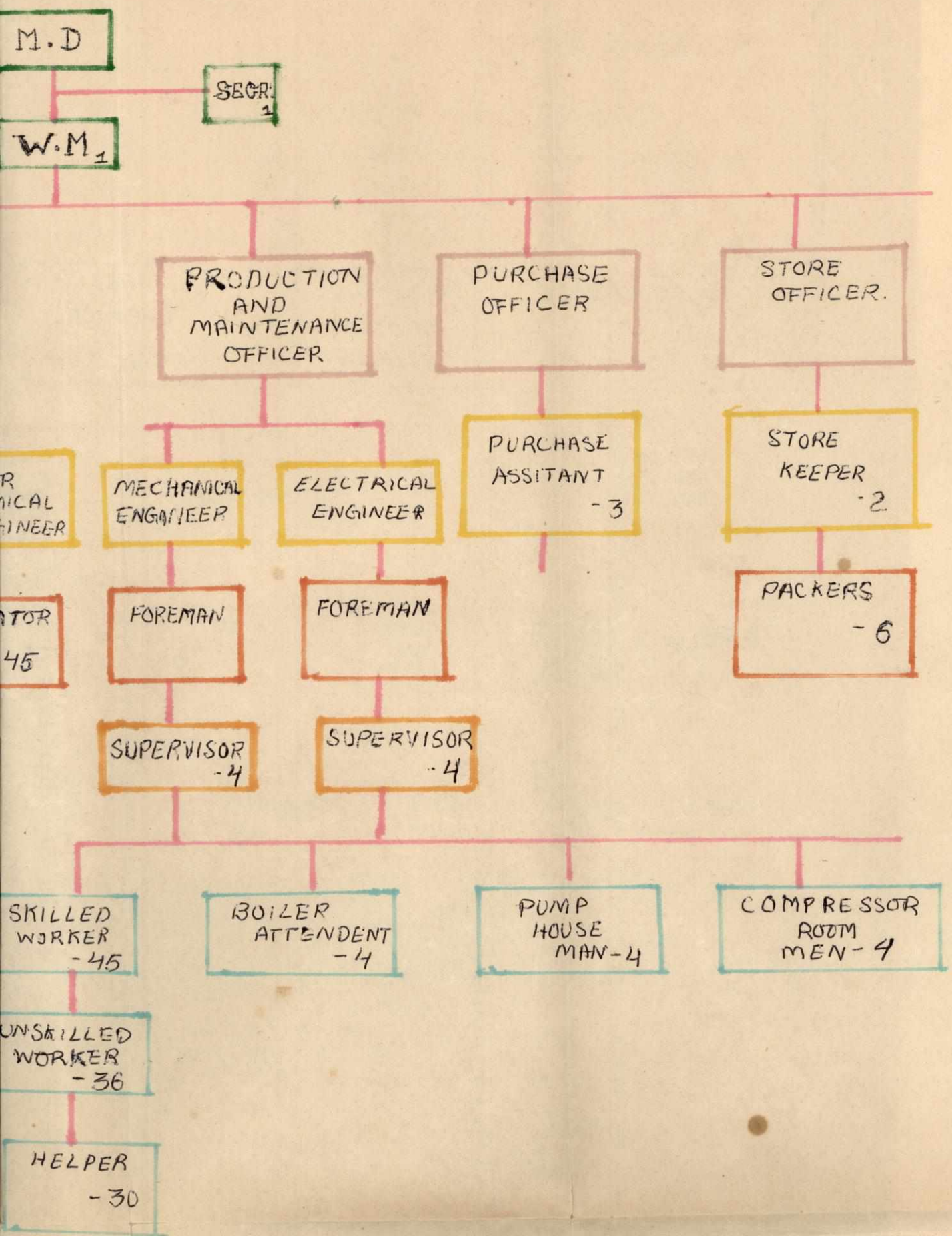
The second phase of PMPL complex includes the production of Vitamin C, various food products and chemicals like furfur-aldehyde from maize which is a waste. This would raise the capital investment to thirty crores.

Now-a-days, the maize is being replaced by rice which has less by-products and easy availability.

ORGANISA


M.D
W.M 1
ACCOUNTS AND ADMINIS: OFFICER
VISITING MEDICAL OFFICER
CHIEF CHEMICAL ENGINEER
ASSITANT ADMN: OFFICER
CHEMIST - 2
JUNIOR CHEMICAL ENGINEER
STANO-GRAPHER - 3
WATCH & WARD OFFICER
CLERK CUM TYPIST
LAB: ASSITANT - 4
OPERATOR - 45
DRIVER - 9
WATCH MAN - 4
PEON - 9
SWEEPER - 9
SKILLED WORKER - 45
UNSKILLED WORKER - 36
HELPER - 30

NISATIONAL SET UP



WORKING SET-UP

The PMPL unit at present is being headed by Chairman, Mr T.S. Rai. The next authority is his son who acts as M.D. M.D. is being assisted by a Secretary. The Company has got one Works Manager who reports the upto-date of the factory to the Managing Director.

The whole man power is divided into six main departments headed by Accounts and Administration, Chief Chemical Engineer, visiting Medical Officer, Production & Maintenance Superintendent, Store Officer and Purchase Officer.

Under Administration officer comes the Assistant Administration officer, stenographer, watch and ward officer, Clerk, typist, driver, peon, watchman and sweeper. Except the last four, all other work in general shift.

Chief Chemical Engineer heads the chemist, junior chemical engineer, lab. assistant and operator of glucose plant. Except him, all others come in shifts like A, B, C, which are from 6a.m. to 2 p.m. 2.p.m. to 10 p.m. and 10 p.m. to 6 a.m. respectively.

Purchase officer is being assisted by three purchase assistants and store officer by store-keeper and packers.

Production and maintenance superintendent heads mechanical and electrical section, including their engineers, foreman, supervisor, boiler attendant, worker etc. All this set-up is shown in manpower chart.

PRODUCT AND USES

Nature of products manufactured and the process of manufacturing it

The various types of products that can be manufactured in PMPL, Sangrur to their designed capacity are as follows, alongwith their field of use:

Products	Annual production in Tonnes	Uses
Maize starch	4,500	Pharmaceuticals, detergents, paper, textiles.
Dextrose monohydrate	3,000	Pharmaceuticals, canned and ready made foods, bakery, products, ice creams etc.
Liquid glucose	3,500	Pharmaceuticals, confectionary, jams, ice creams, bakery, shoe pollish, tannery, chewing tobacco.
Modified starches	6,000	Food products, detergents, adherine textile, cigarettes, tobacco, paper, foundry.
Corn steep liquor	2,400	Pharmaceuticals, vegetables, cattle feed.
Maize oil	750	Pharmaceuticals, vegetables, oils, soap.
Gluten	3,000	Pharmaceuticals, cattle and poultry feed.
Maize oil cake	1,050	Cattle feed.
Fibre	2,000	Cattle feed.
Hydrol	175	Pharmaceuticals.

Maize starch

It is made from maize of good quality, which is generally brought from Bihar. The biology of maize is as

starch + gulten

germ

The maize is first cleaned on the vibrating sieves in the godowns itself. Then they are added with caustic water in the pit and are pumped to the cells tanks where the process of steeping takes place.

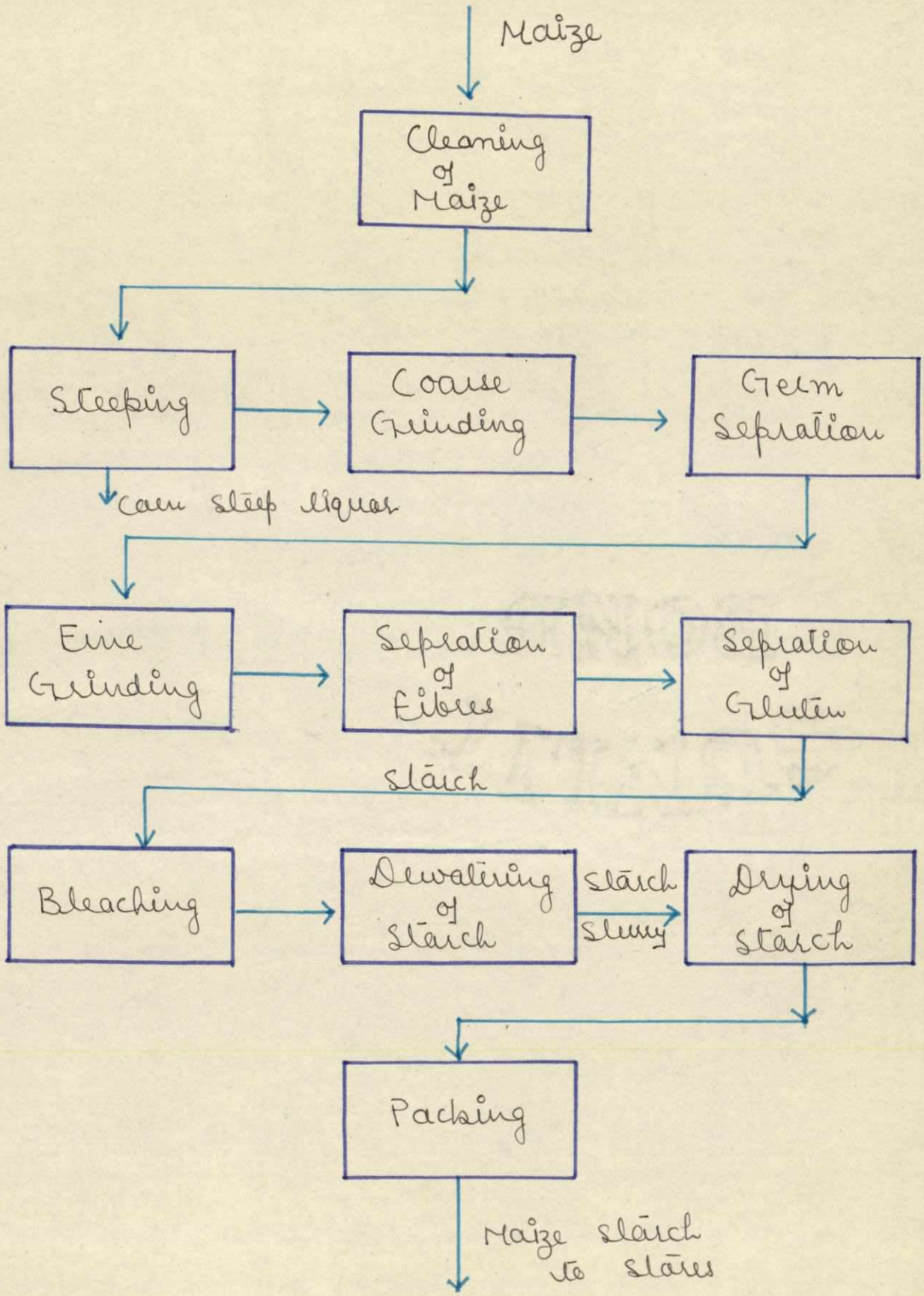
The process of steeping is the mixing the maize slurry with sulphur water (from SO_2 plant). The water is of 0.25-0.3% strength and then settling it for 24 hours. The second product got over here is corn steep liquor.

Now the rest of the slurry is sent for coarse grinding in vertical grinding mills driven by 60 HP motor. The pipes used for the flow of material are of H.D.P. The germ separation takes place and the germs are taken out and the slurry is again sent to the grinding mill for fine grinding by adjusting the gap between the grinding stones.

After fine grinding, the separation of fibres takes place in the fibre separation unit and after that from the slurry starch and gluten are separated in the separators which rotate

at very high speed and slurry goes out of fine nozzles. When the starch and gluten are separated, the bleaching process on the starch is done with the help of any suitable bleaching agent. After this, the starch is dewatered and then dried in the centrifugal section with horizontal centrifuge. Then the dry starch is packed and sent to stores.

Material Flow Diagram For Maize Starch



Modified starches

Starch is used as such also. But further modifications are:

- pregelatinised starches - oxidised starches,
- acid modified starches - cationic starches,
- organic ethers - organic esters
- Halogenated derivatives

Pregelatinised starches

These starches are soluble in cold water. Partes made from these starches are less viscous, less transparent, have less swelling power and are not as smooth as parts from the original starch. These are made by cooking on steam heated roller drum or by prolonged grinding in fall mill.

Oxidised starches

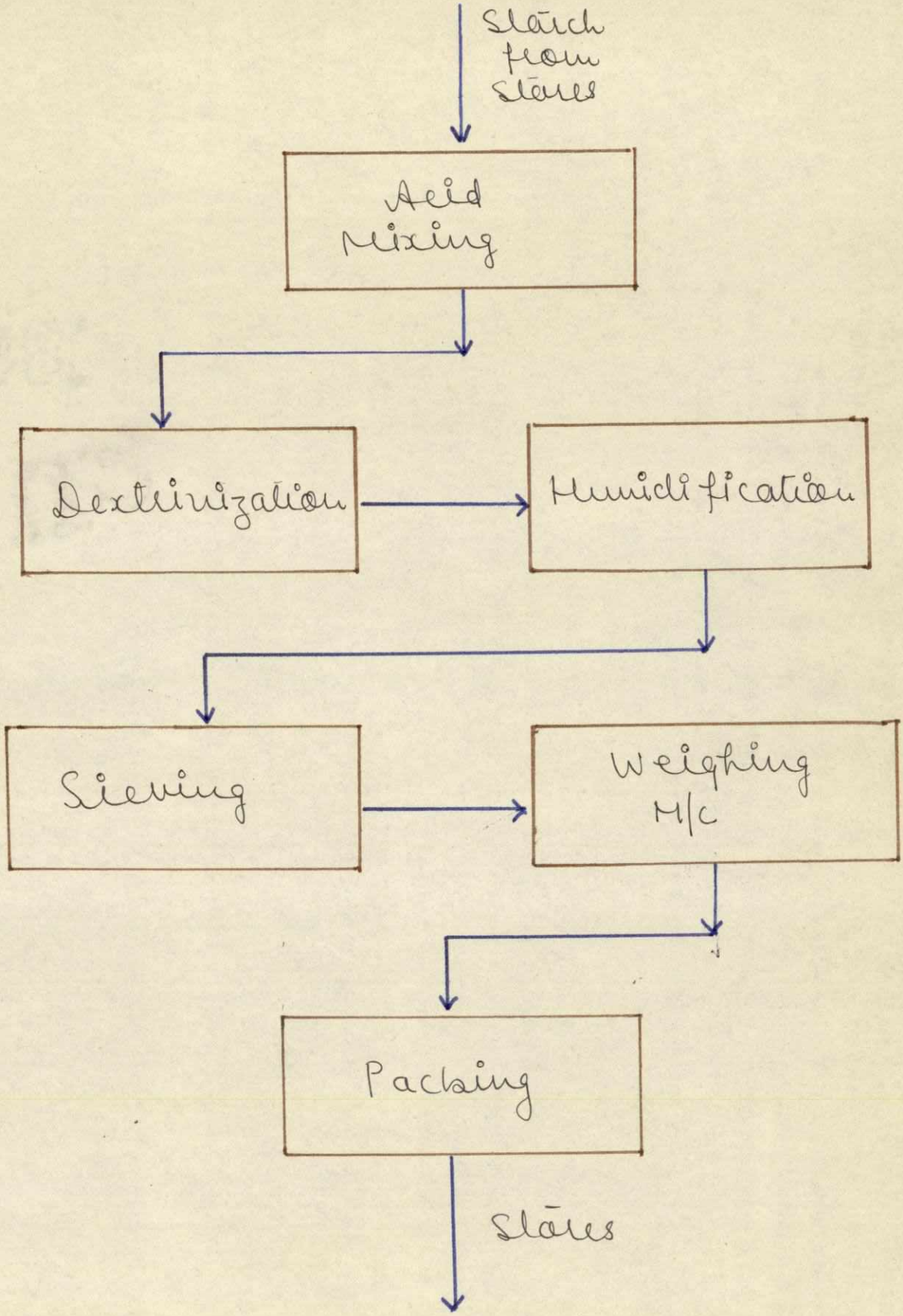
They are of similar look as untreated starches. It has has lesser tendency to set back and is more translucent than the parent starch. Viscosity of part is also lower.

Sodium hypochlorite is normally used as oxidising agent. Composition of oxidised compounds mainly depends upon pH at which oxidation is carried out. $KMnO_4$ under alkaline conditions, peracetic acid can also be used as oxidising agent.

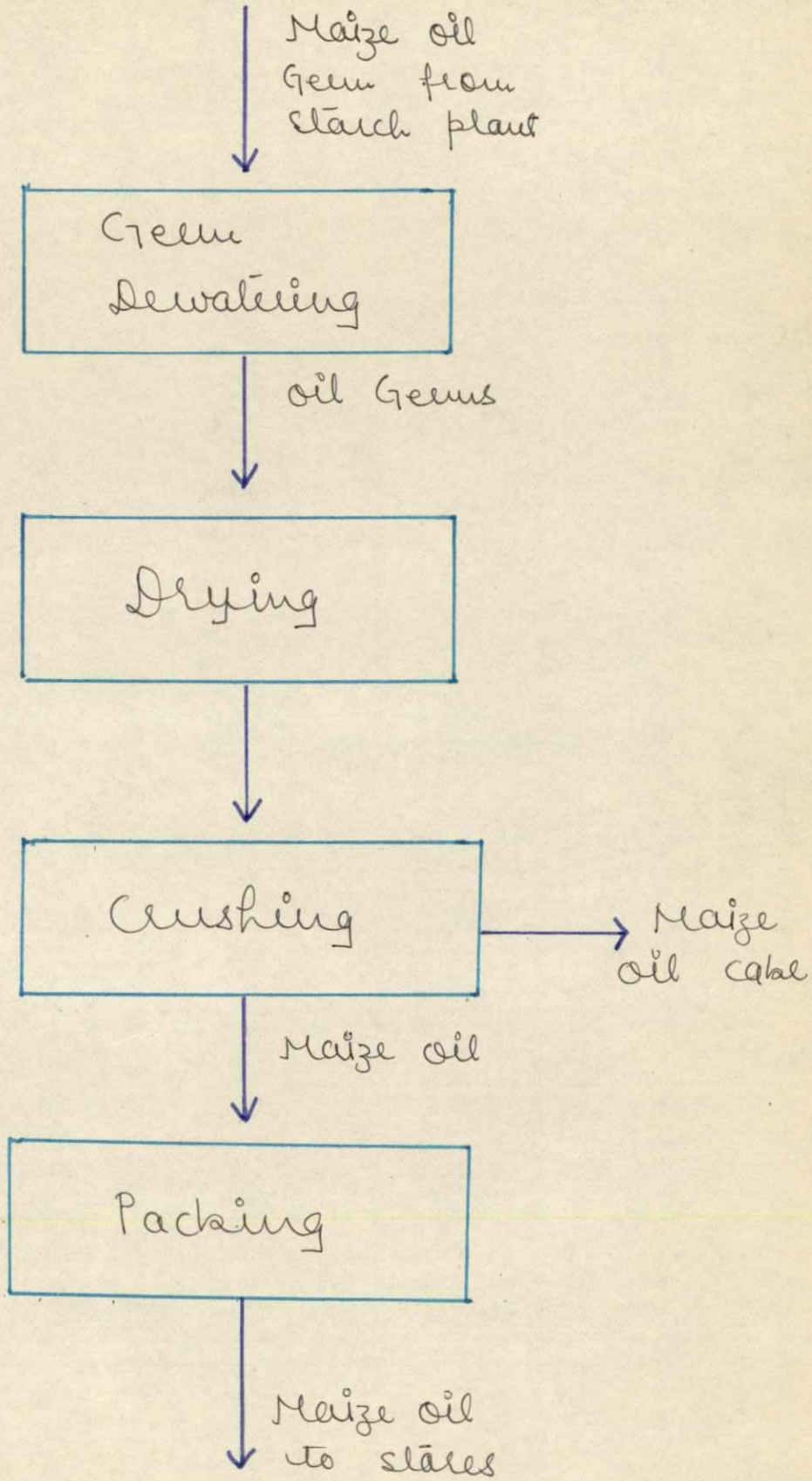
Acid modified starches

They are 'thin boiling' starches. It has low viscosity and not much change with temperature. There is reduction in

Material Flow Diagram For Modified Starhes



Material Flow Diagram For Maize Oil



organic solvents to obtain highly substituted starch.

Dextrin or Roasted starch

Starch itself is not soluble in water but its derivatives, dextrin or roasted starch dissolve readily to give various commercial adhesives, partes and gums.

Dextrins are normally prepared by roasting starch in the presence of acid which changes the properties of starch. The severity of heat and acid treatment determines the degree of solubility, which is the basis for classifying or grading dextrins. Finished dextrins are very fine powders, varying in colour from pure white to yellow light.

Dextrins don't easily react with chemicals and are therefore specially suitable for application in textile field. In textile printing, they are used for thickening. Free of grits and other impurities, which usually accompany lower grade of starch, they ensure thatthe copper rolls (used in printing) do not suffer from abrasion. In sizing they are used for starch for increased adhesion. In finishing, they give the fabric a superior feel. Dextrins are also used as multi-purpose adhesives. The stickiness of dextrin can be increased by adding caustic soda or borax.

In adhesive industry itself, dextrins are preferred to glue which has an unpleasant odour and is subjected to rapid factorial decomposition. They are also preferred to starch as they need no cooking and require considerably less water for

forming the parte. This reduces drying time and little likelihood of mould infection in warm climate. As adhesives dextrins are thus used in book binding, cartoon realing cigarette,parting lable, parting of all kinds, paper box making etc.

The role of dextrin in foundry is to give green strength to the moulds and to prevent deformation of core, which is considerably handled before being fired into the oven. It does not make the core too dense so that there are not trapped gases which causes blow holes. It is a good core finding material.

Dextrin is largely used in dry distemper. 2-3% dextrin mixed with chalk and pigment act as carries and impart good adhesion to colour to the wall.

Liquid glucose

This is prepared by heating starch at high temperature in the presence of acid. Normally, liquid glucose is a mixture of dextrose, maltose, and dextrins in the ratio 35%:32%:33%.

The principle method of grading liquid glucose is by reference to its density which is measured on Baume scale. When density drops below 38° Be, syrup is liable to ferment. In cold climate, it is liable to held it at 43° Be material.

Liquid glucose contains dextrin, which retards the process of crystallisation. This is an advantageous factor in a

number of applications in manufacture of food products like jams, jellies, chewing gums, caned fruits etc. Moreover, glucose prevents the spoilage of product without increasing its sweetness.

Liquid glucose being a non-crystallising substance with less sweetness produces a homogenous and palatable confectionary. Hard candy is often made entirely out of glucose syrup without adding cane sugar.

In ice cream, it prevents crystallisation and imparts smoother texture. Can sugar can be replaced upto 25% without materially changing the properties of the ice cream. It is also used in bakeries. Its non-crystallizing and hygroscopic qualities help to keep the finished product in a soft condition. It is also used for making chewing tobacco to impart flavour, and to promote desirable texture. It is used for dressing tobacco for cigarettes.

It is available in low, medium and high conversion grade.

Dextrose

It is commercially prepared by the hydrolysis of starch, employing acid or enzymes. Dextrose being less sweeting than sugar, it can be used in ice creams, soft drinks etc. to increase the solid substance without increasing the sweetness unduly. Moreover, the solution of dextrose has a lower freezing

point than cane sugar resulting in ice cream with a smoother creamier texture.

It is far preferred to cane sugar for use of a substrate, an ingradient in making dough for bread or other non-sweet items like meat products, dairy products, carbonated beverages etc. The main advantage of dextrose over sugar is that its moderate sweetness does not obliterate the finer flavour, yet dextrose is as powerful a preservative as sugar.

As dextrose is a monosachride, it does not require inversion like cane sugar before assimilation into the system. Being assimilated it acts as a quicker energy giving agent than sugar. Doctors generally recommend dextrose for infant feeding, for counteracting insulin shocks in diabetes, in treatment of obesity, and for keeping the blood sugar level when work or play of exertion. Because of these properties, dextrose monohydrate may be formulated with vitamins and minerals, and can be sold for periods of physical stress.

Dextrose is extensively used in chemical and fermentation industries. When dextrose is processed by electrolytic or fermentation method, calcium gluconate is obtained. Hydrogenation of dextrose leads to sorbitol a base for vitamin C. In manufacturing antibiotic, dextrose is used as an important ingredient of the media.

In the pharmaceutical industry, dextrose is used for intravenous injections and as a binder in compounding of tablets. It is available in two forms: dextrose, dextrose monohydrate.

Hydrol

This is obtained as a by-product by traditional hydrolysis of starch to dextrose. From the dextrose plant, the final mother liquor called 'hydrol' is sold as such to various users in tanning, caramel colour and rayon industires.

Production of liquid glucose

Firstly, the starch slurry is taken in a tank.

Acidification

The starch slurry from the starch plant is acidified with certain acids like HCl, and its pH is maintained at 2.

Conversion

The acidified slurry is then taken to the convertor. The conversion of starch to glucose takes place here with steam at 12 kg/cm^2 and 160°C. The conversion is started with iodine. Then the temperature of steam vapours are lowered.

Bleaching and refining

The refining is done with the basic solution and the material is sent to presses to filter carbon. The bleaching in the tanks is done with decalite. Then the material is again refined through fine presses.

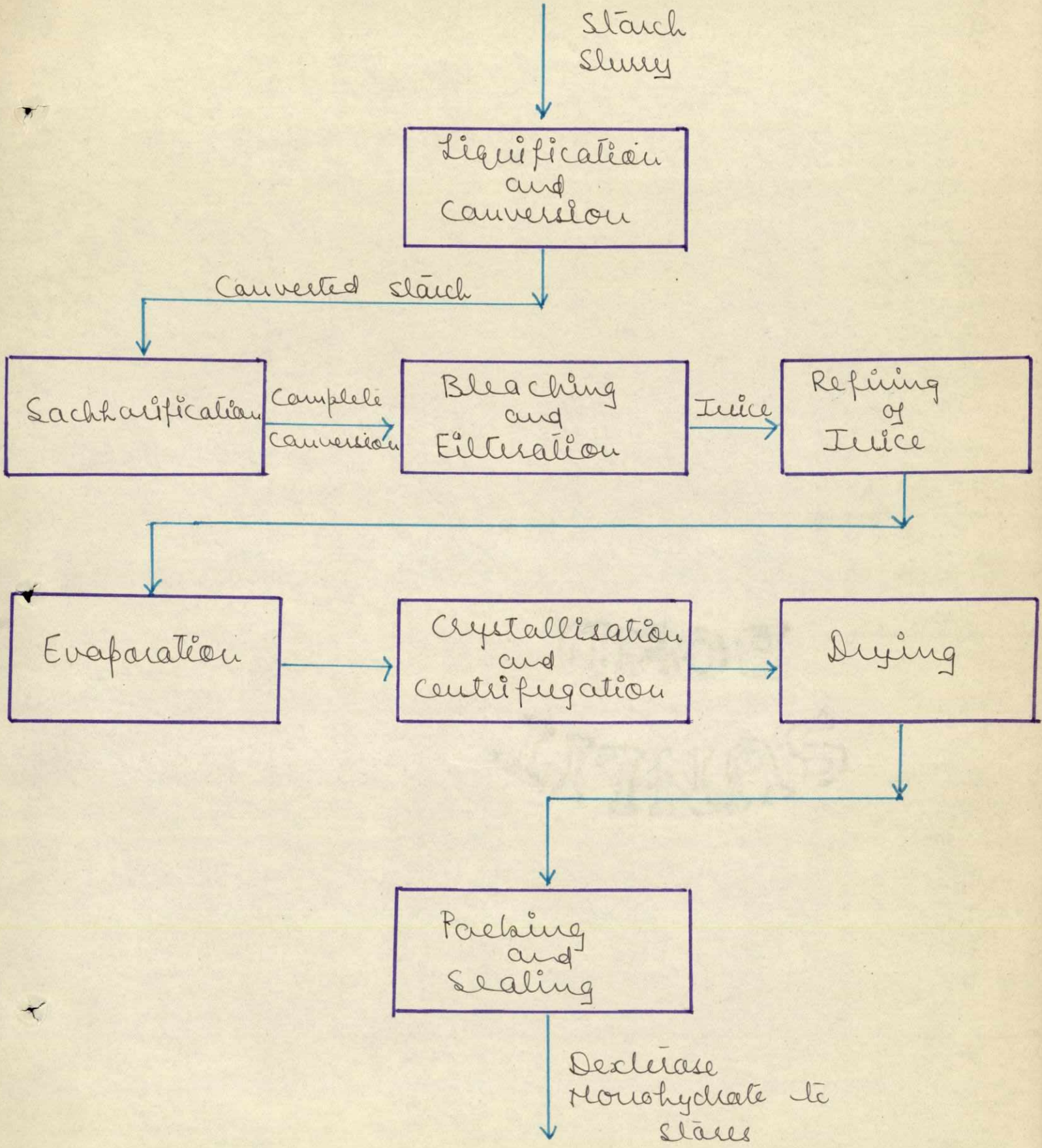
Purification

It is done in the ion exchange unit where it is purified in rubber lined drums. The cooling takes place in heat exchangers. If even now some impurities are left, they are carbonized in carbon and decalite tanks.

Evaporation

These evaporators are operated under vacuum and the water is evaporated here and 87% solution is obtained. The final stage is packing. It is done directly under the evaporators in the drums of 300 kg each.

Material Flow Diagram For Dextrose Monohydrate



Production of Dextrose monohydrate

Chemistry of process: Starch is hydrolysed to dextrose in the presence of an acid catalyst or an enzyme like amylogluc-oridase.

$$C_6H_{10}O_5 + H_2O \longrightarrow C_6H_{12}O_6$$

Continuous enzymatic hydrolysis is applied for product-ion from dry starch. The various stages are given follow along with the description:

Liquification

The dry starch is liquified to 17 BC. The pH of starch slurry is adjusted to 6.5 by addition of 10% solution of sodium carbonate. Calcium chloride is also added to the desired amount. Enzyme alpha-amylase is added 1 kg/1050 kg of dry starch. The water is pumped to the converter which consists of a number of heat exchangers and one spiril pipe coil. Firstly, the heat to the first heat exchanger is opened to heat water to 85°C and 1 kg/cm^2. Condition in second heat exchanger are of 140°C 3.5 kg/cm^2. The starch flow is maintained at 1.613 m^3/hr and enzyme supply is started.

The gelatnation and hydrolysis starts in the first heat exchanger. The retention time in converter is 6-8 minutes. The hydrolysate is discharged into expansion cyclene where water is evaporated due to sudden expansion and is condensed and drained. Now the liquified mass is at 63°C, 10 BE, 4.5 pH.

Saccharification

The product obtained from the above process is stirred in the drums and correct enzyme dosage is kept.

Filteration and Refining

After this, the sacchirified product is fed to filteration. The addition of carbon slurry to the tanks is continuous. After filteration through filter presses, the filterate is taken to tanks and the carbon fat and protein are obtained as filter cakes. Hydrolysate received is pumped into ion exchanger, containing ion exchange and cation exchanger. This helps in removing dissolved impurities like salts, chloride etc. Hydrolysate is received in stirring tank. Then the hydrolysate is passed through filter presses of varying fineness to remove carbon.

Evaporation

This station consists of a double effect falling film vacuum evaporator and accessories. Here hydrolysate (from above) 30% dry substance (D.S.) is concentrated to 70% D.S. The evaporated water is condensed.

Crystallisation

The above solution is taken to crystaliser. The temperature of inside material is maintained at 46°C with circulating cool water. The material flows from one crystalliser to another with gravity.

Boiler House

Steam consumption in the PMPL is only in the glucose plant and that too in the convertor and evaporator. The steam is produced in the boiler house and then is supplied to the glucose plant through perfectly insulated pipes which have steam traps at constant distance to ensure quality steam. The boiler house has the following equipments:

1. Multi-therm boiler.
2. ISGEC-John Thompson Boiler.
3. Coal pulverizing and conveying system.
4. Husk feeding system.

The multitherm as well as ISGEC boiler are now being run with husk as the husk from the sheller is bought alongwith the rice and thus saves money, as coal has to be bought from Madhya Pradesh and husk is available locally.

In the steam production cycle, steam after its usage in plant comes back to condensing tank where it mixes with soft water. Then this hot water at 85°C is fed to the boilers. This pre-heated water reduces the fuel consumption. The air for the burning comes from forced draught (FD) fan and induced draught (ID) as well as secondary draught (SD). Flue gases are taken out with the help of induced draught and natural draught through chimney.

Specifications of Multi-therm boiler

Type of boiler - water tube
Design pressure range - 16.87 kgf/cm^2
Working pressure range- 15.00 kgf/cm^2
Hydraulic pressure- 22.26 kgf/cm^2
Evaporation capacity - 5800 kg/hr
Fuel - Husk or coal.

Main parts of Multitherm

1. Water level indicator: There are two water level indicators in this boiler. If one does not work properly, other show the true level. There are three cock in each indicator. They are used to clean and check the water level indicator. Frequency of check is 4 hours.

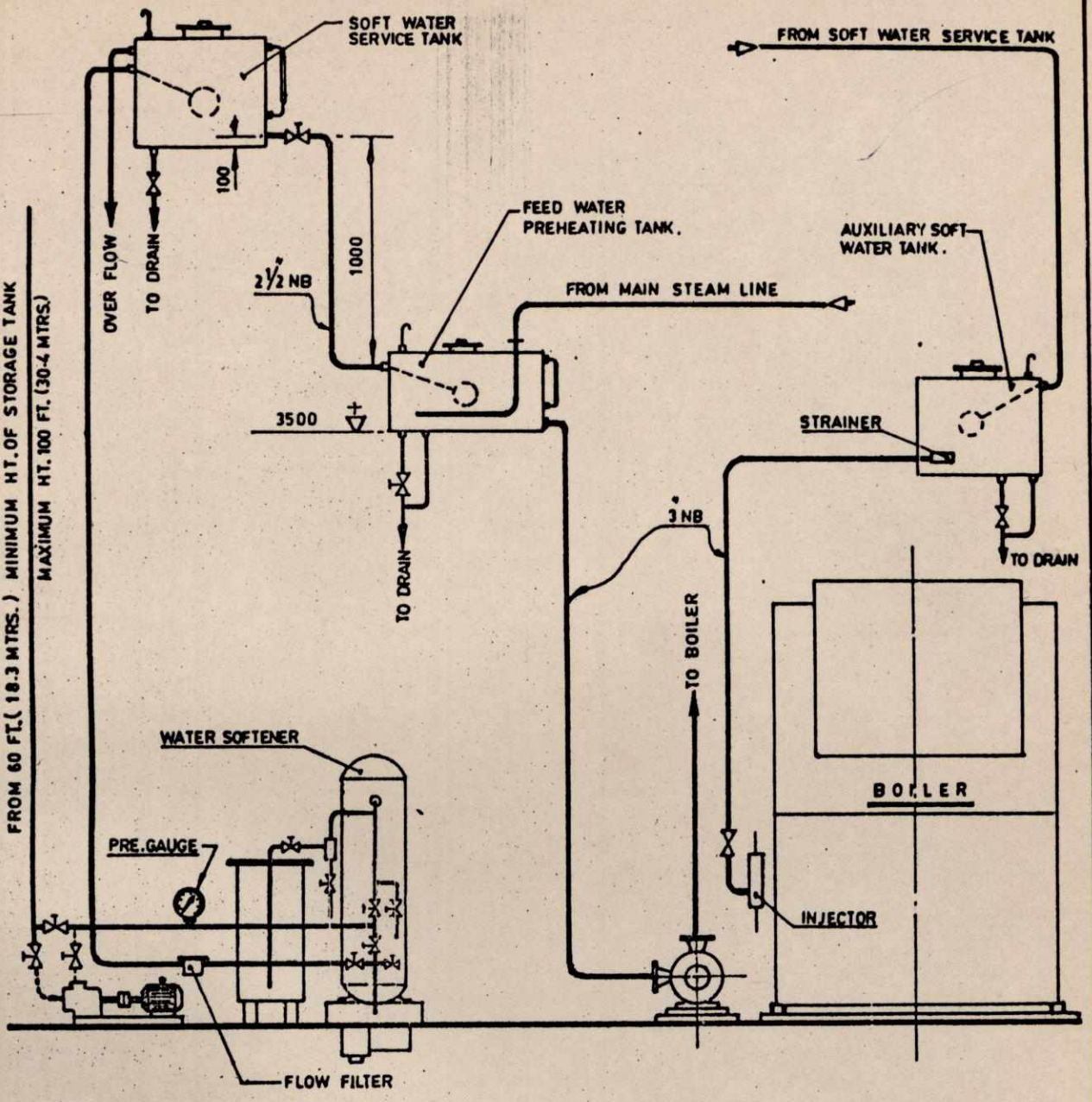
2. Blow down: There is one blow down in this boiler and is used ro remove scale formed on the tubes. This is done by flowing hot water with steam at high pressure through tubes.

3. Soot blower: It also act as a cleaner and is used to remove the carbon particles which remain unburnt and are settled down on the outer surface of water tube. A parous cylinder is fitted at the end of steam tube and named soot blower. When it removes carblon particles, I.D. and FD fan are on.

4. Steam injector: This is used to supply water to the boiler when the feed pump does not work. There are three openings in steam injector, one for water inlet, second for steam inlet and third for water outlet.

5. Air removal valve: It is used to remove air from boiler when it starts running.

FEED WATER SUPPLY ARRANGEMENT



NOTE :

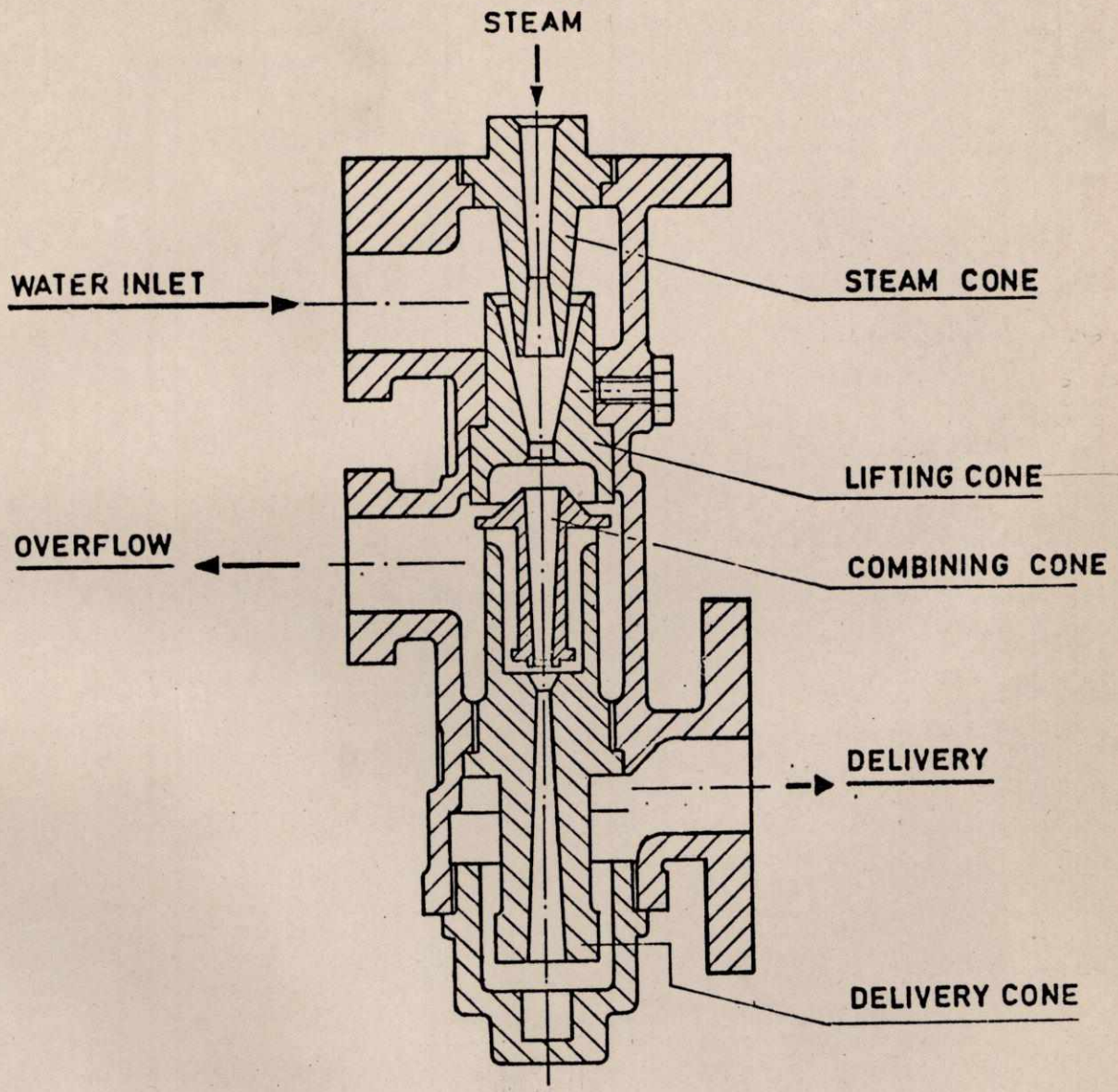
1. TANK SHOULD BE LOCATED AS NEAR AS POSSIBLE TO AVOID FRICTIONAL LOSSES IN LONG PIPE LINES.
2. THE CLIENT MUST CHECK AND ENSURE AFTER INSTALLATION THAT THE MINIMUM FLOW OF WATER TO PREHEATING TANK IS ABOUT 20% MORE THAN THE REQUIREMENT OF THE BOILER.
3. DO NOT INSTALL THE SERVICE TANK RIGHT ABOVE THE FEED WATER PREHEATING TANK.
4. FEED WATER PREHEATING TANK, OIL SERVICE TANK AND AUXILIARY SOFT WATER TANK CAN BE INSTALLED ON THE SAME PLATFORM.
5. IF SERVICE TANK IS INSTALLED ABOVE THE PREHEATING TANK, IT IS NOT NECESSARY TO HAVE A SEPARATE TANK FOR INJECTOR. THE STEAM INJECTOR CAN BE DIRECTLY CONNECTED FROM THE SOFT WATER SERVICE TANK.

DRN	Loyed	2-9-77
CHK	K. Sully	2-9-77

THERMAX (INDIA) PVT. LTD. POONA-19

IM/2000801

STEAM INJECTOR
(GRESHAM)



ISGEC JOHN THOMPSON BOILER

It is a two drum natural circulation integral type boiler.

Specifications

a) Working conditions:

MCR - evaporation 13.4 ton/hr
Steam pr. at boiler out 15 kg/cm^2
Steam temp. " " saturated
Feed water temperature at economiser inlet - 105°C
Ambient temperature = 26.7°C

b) Coal analysis: No need as it is with husk.

c) Pressure schedule:

Boiler outlet pressure	15 kg/cm^2
Operating margin	1.17 "
Ist drum safety valve set pr.	16.17 "
2nd drum safety valve set pr.	16.87 "
Drum design pressure	16.87"
Economiser design pressure	17.93"
Feed pump discharge pressure	20.74"

Combusion Chamber Dimensions:

Width - 2683 mm
Depth - 3353 "
Volume 49.2 m^3

Heat release rate - 143870 KCal/m^3/hr

Heating surfaces:

Combustion chamber	- 147 m^2
Convection	- 274 "
Economiser	- 145 "

Boiler bank

Outside	- 80.8 mm
Thickness	- 105 wg
Material	- B.S. 3059/306 equa

Economisers

Type: ISGEC John Thompson Bore cotinous loop type

Tube outside dia. - 38.1 mm
Tube thickness - 9/10
Material - BS 3059/305 Equal

Furnace

Location: Front, rear and side walls outside dia-219 mm,
Material specification- SA 106 Gr B or equal.

Economiser

Outside dia. - 168 mm
Material - SA 106 Gr.B or Equal

Forced drought fan

Make - Andrew Yule or SF

Type - Centrifugal,backward, Bladed
Volume-design - 15,250 m^3/hr
Static pressure design = 110 mm
Temperature design = 48.9°C
Speed design = 1400 rpm
Power required design = 10.2 hp.
Motor rating design = 15 hp
Type of control = Damper
Bearing = Heavy duty,double row/ball roller bearing
Material = MS
Type of coupling - Wellman-Biby flexible coupling.

Induced drought fan

Type - Centrifugal star type
vol. design - 26,100 m^3/hr
Static pressure - 180 mm wg
Temperature - 193.4°C
Speed - 980 rpm
Power required at fan shaft - 28.6 hp
Motor rating - 40 hp
Type of control - Damper
Bearing - Heavy duty
Material - M.S.

Secondary air fan

Type - Centrifugal backward blades

Volume - 39038 m^3/hr

Static pressure - 381 mm

Temperature - 23.4°C

Speed - 2900 rpm

Power required at fan shaft - 9.8 hp

Motor rating - 12.5 hp

Control - same, bearing run

Flexible coupling.

Boiler Precautions

1. All water fuel and steam piping should be thoroughly flushed or blown out before being connected to the boiler. This will prevent foreign matter blocking or damping the boiler water system.

2. See that the feed water pressure available at the inlet of water softner is never less than what is required as laid down in manual.

3. Never reduce the height at which the feed water preheating tank is kept from floor level as this will cause cavitation.

4. Long the feed water, preheating tank to prevent heat losses.

5. Provide expansion joints on the suction and delivery sides during the ID fan.

6. Only gate valves are used in the water and fuel oil lines and not globe valves.

7. Use steam traps whereas water logging of the system is possible.

8. Make the discharge of the auxilary and blow down connection in such a way that they are visible to the boiler operator.

9. Provide adequate space around the boiler for easy involvement and servicing.

Check the boiler for IBR specifications
(Registration of multitherm boiler under IBR)

Licenty of registration

Multitherm boiler are required to be registered under section 9 of the Indian Boiler regulation and in accordance with Chapter 7 of the Indian Boiler Act.

Boiler inspection

The boiler inspection shall generally involve:

1. Open inspection
2. Hydraulic test
3. Steam test

1. Open inspection: This is to verify the actual details of the boiler consumption to the one specified by suppliers. The boiler inspector verify during this inspection:

i) Approval stamping made on header.

ii) Serial number and inspecting authority's seal on various valves and mountings.

iii) Measurement of the spring, body, valve, and valve seats of the steam safety valves.

Note: The following preparatory action should be taken prior to the inspection:

i) Safety valve should be opened out completely so that spring,body and valve seats are available for measurements of various dimensions.

ii) It should be assured that serial No. and inspecting authority's seal on IBR valves is clearly visible so that the inspector can immediately relate the valve to corresponding certificate.

iii) The side and manhole panels be removed to facilitate the best possible inspection.

Hydraulic Test

Under Regulation 377 of IBR, important provision of which as applicable to Multitherm boiler are:

Every boiler shall be hydrallically tested, in the presence of boiler inspector and at pressure 1.25 timer the working pressure plus 50 pounds per sq.inch. Boiler shall withstand this pressure without leakage or deformation of any part for atleast 10minutes. After this test, the inspector should carefully examine the boiler inside and outside and satisfy himself that the boiler has withstood pressure.

Preparing boiler for hydraulic test

Safety valves should be removed and opening blank flanged pressure switch connection removed and opening plugged. Following valves to be kept close during the test:

a) Main steam stop valve
b) Feed check valve
c) Feed water stop-cum-non-return valve
d) Auxilary valve
e) Gauge glass cocks:
   i) Steam cocks
   ii) Water cocks
   iii) Drain cocks
f) Mobreg blow down valve
g) Boiler blow down valve
h) Steam inlet valve for OPH tank
i) Soot blower inlet valve

The injector unit and the connecting pipe lines between the injector check valve and non-return valve be removed during the test.

The header shall be completely filled with clean water and pressure being applied gradually with a test pump having a pump capacity higher than the hydraulic pressure.

A convenient inlet for the pressure test be taken (preferably from the opening of injector check valves) and necessary test pump connections made.

Care is to be taken to avoid air pockets in order to allow the water to come in contact with the pressure parts.

Raise the hydraulic test pressure to specified limits and ensure that no appreciable leakage is observed from joints. A pressure drop of 0.5 kgf/cm^2 from maximum pressure may be considered acceptable in about 30 minutes duration test.

Steam test

Every newly installed boiler before the issue of the certificate of registration, to be tested under steam to the satisfaction of Inspector. At the time of test, safety valves should be set free.

After adjustment of safety valves to the actual pressure, the boiler shall be tried under full steam and firing with the top valve closed, during which time, the inspector shall not allow the accumulation of pressure and other details as well as the loading of adjustment of safety valves.

The Inspector shall, if he is satisfied with the conditions of boiler accepts the particulars and approved working pressure entered in form I by inspecting authority

insure a provision order to enable the boiler to be worked.

Note: Apart from boiler, the steam lines are to be hydraulically tested.

The steam traps are to be tested and their frequency to ensure quality steam.

Cost Accounting of Multitherm Boiler

When we produce a particular thing, we must know, how much it is costing us i.e. what is per unit cost of the product in order to apply any economics to it. Same is the case with steam. The cost per ton of steam produced has to be worked out. During the production of steam, three types of cost is incurred:

i) Man power cost
ii) Raw material cost
iii) Power cost

In order to work out cost per unit production, we have to take certain assumptions which are as follows:

1. Though the boiler capacity is 5.8 T/hr, we will assume it to be 5 T/hr, as the actual capacity is always less than the rated capacity.

2. Firing time/starting time is assumed to be approximately 2 hrs.

3. The ID Fan, FD fan as well as blower (husk feeder) runs only for 2/3 time during the full day working of the boiler i.e. for 16 hr approximately. As they switch on and off according to the requirements.

4. The stream is taken at an average pressure of 12 kgf/cm^2 and at 150°C.

5. Husk consumption is 1/3rd of the total amount of steam produced.

6. The cost of removing ash from boiler is not taken into consideration.

7. Lubrication of some parts of the boiler is also not accountable.

8. Minor losses of any type are neglected.

Production

If the boiler is run for 24 hrs regularly, the total amount of steam produced is 110 ton i.e. water consumed is 110 m^3 in one day, i.e. various pumps will have to pump 110 ton of water.

1. Man power cost:

Total number of man power involved in the operation of boiler is as follows:

	No./day
i) Sr. Engineers	- 1
ii) Fire man	- 3
iii) Helper	- 9(15)
iv) Boiler attendant	- 3

Their respective monthly and daily pay is as follows:

	Pay monthly/person	Daily cost
Sr. Engineer (1)	Rs. 3000	Rs. 100
Boiler attendant(3)	Rs. 1000	Rs. 100
Fire man (3)	Rs. 600	Rs. 60
Helpers (15)	Rs. 480	Rs. 240
Total	Rs. 5,080	Rs. 500

Man power cost (daily) = Rs. 500/-

2. Electric power cost

In order to work out the power cost, we will see the various types of motors attached with pumps and any other type of electric appliance used, which are as follows:

Feed pump motor:

Type - Siemens
Power- 40 hp/30 kw (50 Hz)
Rpm - 2950

F.D. fan motor:

Type- Siemens
Power- 3.7 kw (50 Hz)
rpm - 1420

I.D. fan motor:

Type - Kirloskar
Power- 7.5 kw
rpm - 1480

Soft water storage tank:pump motor(1 stand by)

type - Kirloskar
Power- 5.5 kw
rpm - 2850

Hot water storage tank: pump motor(1 stand by)

Make- Kirloskar
Power- 3.7 kw (50 Hz)
rpm - 2850

Husk feeder motor:

Make- Siemens
Power- 15 kw
rpm - 2910

All other accessories like fan, tubes, bulbs etc. consume approximately 1 kw/hr.

Now in order to calculate the time of working of various motors attached with the pump, we have to find out the time

needed by the pumps to pump that amount of water. The discharge rates of various pumps are as follows:

Feed pump - 15 m^3/hr

Soft water pump - 20 m^3/hr

Hot water pump - 20 m^3/hr

New volume of 1 ton of water is 1 m^3 i.e. the pump capacities are:

Feed pump - 15 ton/hr

Soft water pump - 20 ton /hr

Hot water pump - 20 ton/hr

So in order to pump 110 ton of H_2O, in one day, these pumps will have to work for following number of hours:

Feed pump - 110/15 = 22/3 hrs

Soft water pump - 110/20 = 5.5 hrs

Hot water pump - 5.5 hrs

Thus taking the collective of all the above stated data and the power cost is taken as:

1 kw hr = 1 unit = 70 ps.

Equipment (motors)	Power (kw)	Working (hrs)	Units	Cost (Rs)
i) Feed pump	30	7.33	219.9	153.93
ii) F.D. fan	3.7	16	59.2	41.44
iii) I.D. fan	7.5	16	120	84.00
iv) Soft water pump	5.5	5.5	30.25	21.18
v) Hot water pump	3.7	5.5	20.35	14.25
vi) Husk feeder	15	16	240	168.00
vii) Accessories	1	12	12	8.40
				491.00

Thus the total electric power cost is= Rs. 491/.

Raw Material Cost

The raw material used in the production of steam is water and husk and little quantity of lubricants. In order to find the cost of 1 ton of water, we will have to find out the cost of running the vertical turbine pump. The cost of softening the water in water softening plant (as discussed earlier), is also taken into consideration i.e. the cost of various chemicals and resins used in it.

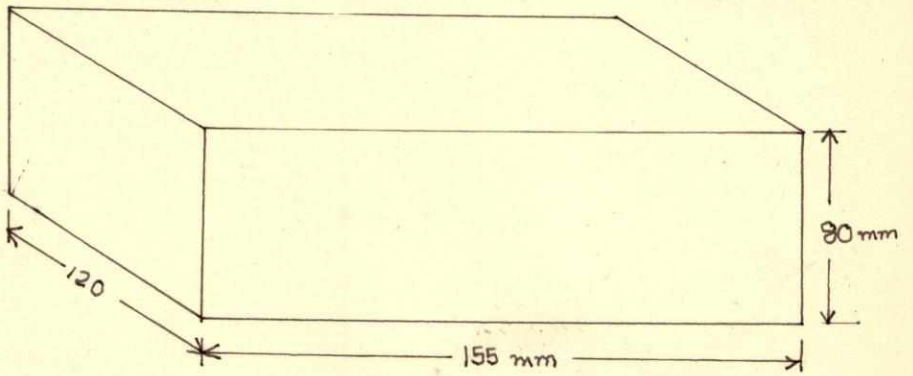
Now in order to work out the cost of getting 1 ton of water out of earth, we will study V-T pump which is as follows:

V.T. Pump

This plant is the heart of whole, the industry. The only source of supply of water. It is a multiimpeller pump. The V-T pump (vertical-turbine pump) is run with the help of a 85 H.P. motor, and one is stand by. It rotates in anti-clockwise direction. The maximum allowable current is 49A, above this the motor gets tripped of automatically.

The water is sucked from one impeller to the other and to the subsequent impellers with this thing, sufficient amount of head is created but the discharge is same as of the first impeller. All the impellers are mounted on the same shaft in vertical direction. The V-T pump need continuous lubrication with mobile oil and is done with the help of an oil cup which should be always full.

OIL CUP



The delivery pipe is connected with two types of valves: (1) non-return valve, (2) gate-valve. The first one is to prevent the delivered water from coming back into the pump and the second one controls the amount of discharge required. The whole water is stored in a concrete water tank of 20m dia. and 30m height.

Specifications

Pump size = 250 mm x 250 mm

Capacity in LPH = 1,50,000

Total head = 45 m

Number of stages =6

Bowl H.P. (recommended) = 30.52 H.P.

Motor " = 35 H.P.

Speed = 1460 rpm

Bowl efficiency = 82%

Outside dia. of bowl = 238 mm

Shaft size = 30.1 mm

Tube size = 50 mm

Column size = 200 mm

Length of column assembly = 18 m

Impeller material = Bronze

Shaft material = As per ISI

Lubrication = Oil

Motor:

Make = Kirloskar

Motor= 35 H.P.

Type = 8 P.D.P. 400/440 V

Phase = 3

Frequency = 50 cycles

Supply = A.C.

From the above data for pumping 110T i.e. 110 m^3 or 110,000 of water will have to be worked for:

discharge = 40,000 lt/hr for 110 m^3 = 11/4 hrs

Power consumption = Motor capacity x working time =

$$= 35 \times \frac{3}{4} \times \frac{11}{4} \text{ kw hr} =$$

Cost of motor running = power x cast per unit =

$$= 35 \times \frac{3}{4} \times \frac{11}{4} \times 0.7 = 50.55 \text{ Rs}$$

Thus it is Rs. 50.55.

<u>Oil consumption</u>

The initial level in the oil cup was noted, it was 81 mm at 9.15 a.m. and after 4 hrs, it was 78 mm i.e. 3 mm drop. So the volume of oil consumed was known. It worked out to be 5/72 lt./hr.

Working time = 11/4 hrs

Oil consumption = 5/72 lts/hr

Oil cost = Rs.17/lt.

Total cost for the full working time = $\frac{11}{4} \times \frac{5}{72} \times 17$

Hence oil cost is Rs. 3.25.

Husk consumption

The amount of steam produced = 110 T. As per assumption, the husk consumed during whole operation = 1/3rd = $\frac{110}{3}$ T

Cost of IT of husk = Rs. 28

Cost of $\frac{110}{3}$ T of husk = $28 \times \frac{110}{3}$ = Rs. 1027.

Husk cost = Rs. 1027.

NaCl cost

It is used for softening the water in water softening plant:

Consumption = 280 m^3/100 kg- NaCl

For 110 $m3^3$ = $\frac{11}{28} \times 100$ kg

Cost of NaCl = Rs 1/2 per kg

Total cost = $\frac{11}{28} \times 100 \times \frac{1}{2}$

NaCl cost = Rs. 19.65.

Resins cost

Once the resins are put in the water softening plant, they work there for about 5 years. The amount of resin cost per day comes out to be Rs 25/- as collected from data available.

Thus, total raw material cost is:

Water	= Rs. 50.55
Oil	= Rs. 3.25
Husk	= Rs.1026.70
NaCl	= Rs. 19.50
Resins	= Rs. 25.00
Total	= Rs.1125/-

Thus the total cost of running the boiler for one day is as:

Man power cost =	Rs. 500.00
Electric power cost =	Rs. 491.00
Raw material cost =	Rs.1125.00
Total cost=	Rs.2116.00

Thus the cost of 110T of steam is Rs. 2116.

Hence the cost of 1T of steam is Rs. 19.24.

Cost/tonne of steam = Rs. 19.24.

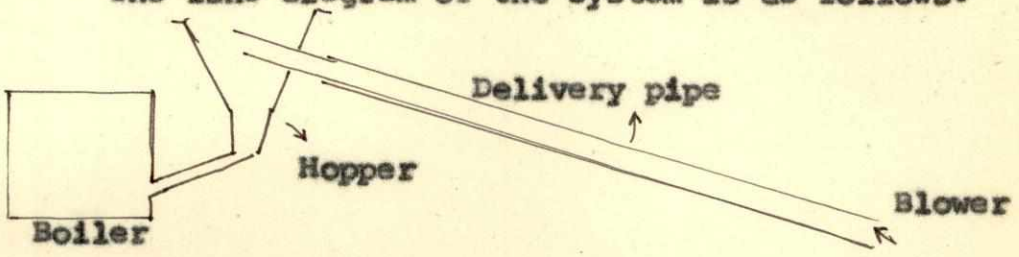
Husk Feeding System

Problems and Solutions

The husk feeding system for the Multi-therm boiler include the following things:

i) Main centrifugal fan.
ii) Driving motor.
iii) Delivery pipe.

The line diagram of the system is as follows:

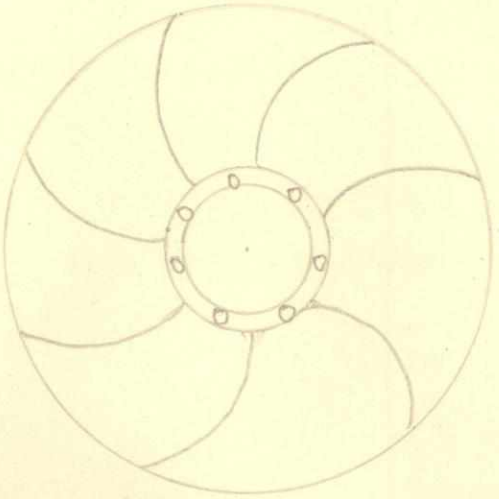


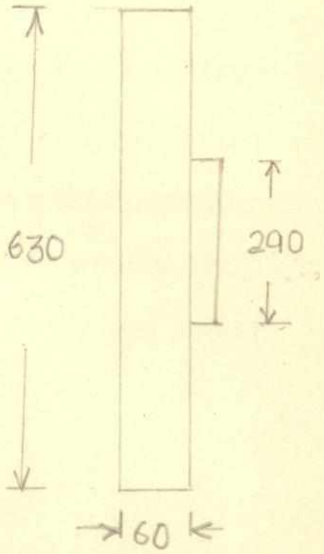
Now the first fan design of the Blower was as shown in Fig.1. With its curved blades. Now the problem with this particular fan was not with design, but its wearing out. As the husk in the fast moving fan acts as a grinding element. The blades are of no use after about a working of 72 hrs and then we have to replace it with new fan. This process was not at all economical and the fabrication of the fan in the fabrication shop was not so accurate as the balancing machine was not available and the unbalanced fan on the shaft end causes the breaking of bearing and the bearing housing.

Now in order to overcome the above stated problem the whole fan design was changed. The new fan was more wide and less in number of blades and material was stainless steel. Now the delivery pipe was directly connected into the boiler furnance

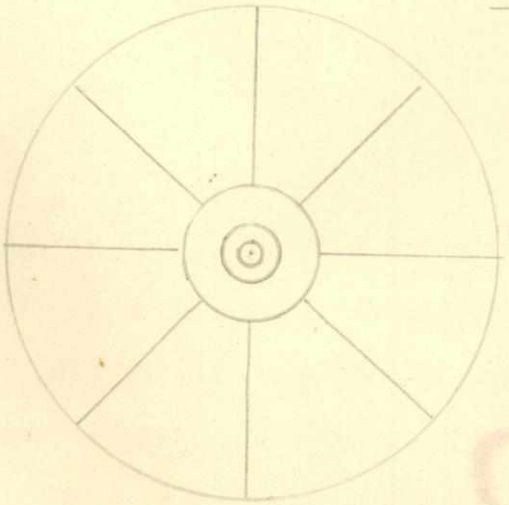
FAIN DESIGNS

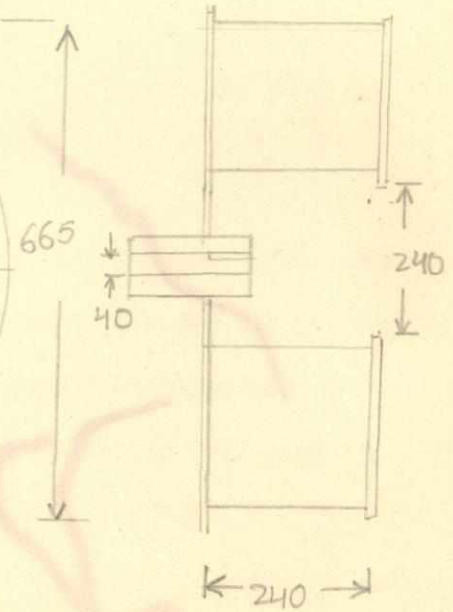
I



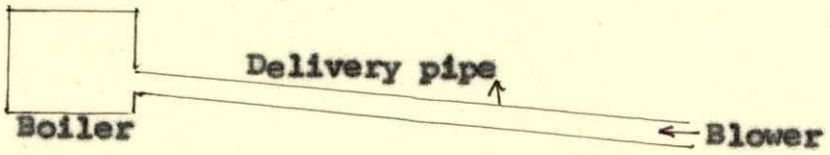


II





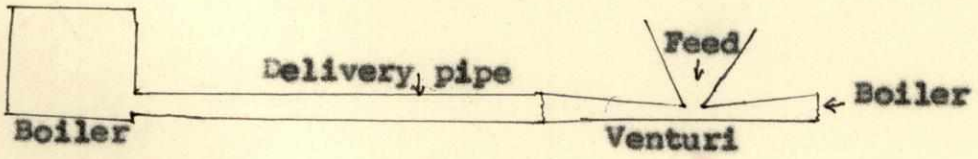
through blower ash shown below:



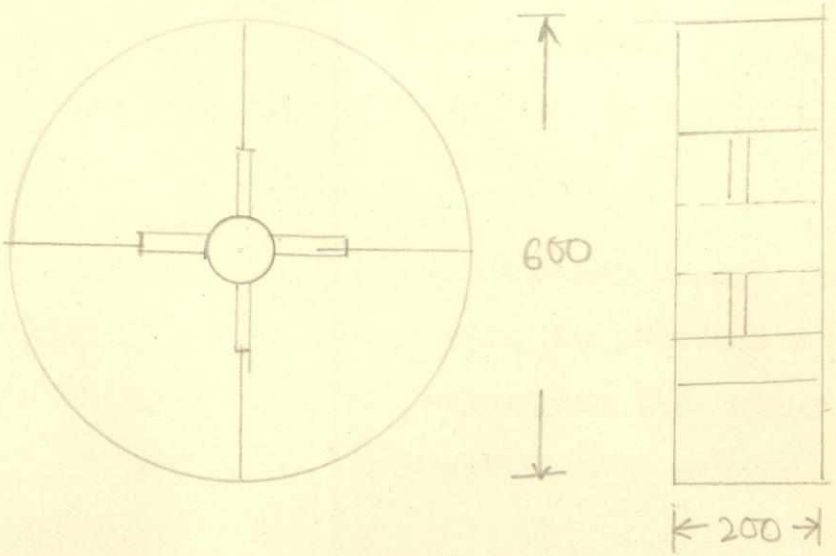
The early system was suffering from vibrations as the structure was very heavy. So an economical way of using vibrational pads was suggested. The damaged rubber diaphragms were used as pads. Even this very blade design was not successful as blades weared out after about 15 days of service. The new motor was also erected.

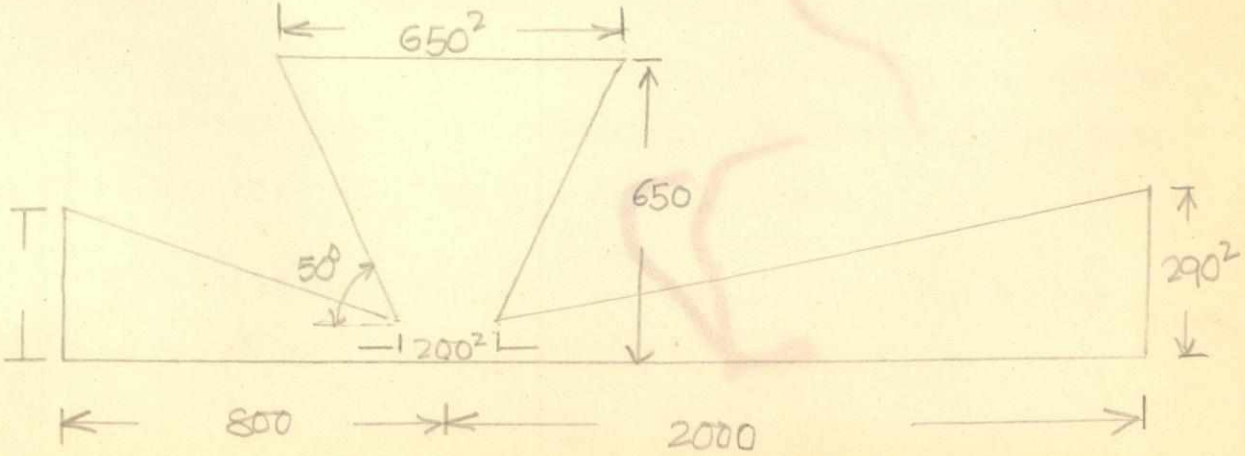
Incoming of Venturi

As we saw that the major problem was that the blades of the fan don't last long, so in order to have efficient and continuous feeding to the boiler a new concept was developed. The line diagram shows the new arrangement as:



The venturi as shown in the figure attached was introduced just in the beginning of the delivery pipe. Here the velocity increases at the hopper bottom and the high velocity cause vacuum and due to this vacuum, the husk put in the hopper is sucked and blown to the boiler. The new fan design as shown in the diagram was introduced to propell greater amountof air. This system is know working efficiently without any trouble from design and material selection point of view.


600
200


650²
650
58°
290²
200²
800
2000

WATER SOFTENING PLANT

It is used to soften hard water, stored in vertical tank. Itis passed through water treatment plant. In this plant there are two types of Resins:(i) cation resin, (ii) anion resin.

Hard water is firstly passed through cation resins where its positive ions are removed i.e. the positive ion of the salt which are present in hard water,then this water passes through anion exchanger where the negative ions are removed, thus the water gets softened.

The soft water is then taken to tank of 80 m^3 capacity from which it is taken to condensing tanks where it is mixed with condensate steam. Then this preheated H_2O is used in boiler to produce steam. The softening of H_2O is done to avoid scale formation in boiler. To clean the resin we pass NaCl solution through the softening tank. This purifies the resins. Various parts of water softening plant are:

i) Vertical pressure vessel: This is only one and is of welded mild steel construction, complete with manhole with cover, nozzle to suit process condition leg support, and lifting legs. The vessle is painted internally with titumetric compound and externally with one shop coat of lead oxide.

ii) Collection system: This is one in number header and lateral, stainer and plate.

iii) Inlet distribution: one in number.

iv) Charge of resin: one in number.

v) Set of frontal pipe work and valves.

vi) Salt mixing tank.

vii) Testing kit: It is used to test hardness of water.

Technical details

General: Water softening plant: Manufacturer: BST Engineering Service

No.of units = 1

Average flow rate through softner= 20 m^3/hr

Regeneration interval = -24 hr.

Total quantity of water treated per regeneration =480 m^3

Inlet water supply per minut: = 1.4 kg/cm^3
3.0 kg/cm^2

Pressure drop: Normal = 0.4 kg/cm^2
Maximum=0.7 kg/cm^2

Inlet water total hardness = 164 ppm as $CaCO_3$

Na/Te ratio assumed = less than 20%

Treated water hardness= zero degree comercial

Vessel

Type of vessel = vertical

Material = MS-IS-226

Type of ends = spherical dished end

Diameter = 1180 mm

Height = 2200 mm

Distribution system= Bell mouth/3 arm.spreader

Resin Strongly acidic cation exchange resin sodium cycle.
Bed depth = 1250 mm approx.

Regeneration

Salt required for regeneration = 182 kg

Method of regeneration by ejector

Concentration of solution during ejection =5%

Solution preparation tank = 1 number

Material = MS

Accessories

Sampling cock = 2 No., one each at inlet and outlet.
Pressure gauge = 1
Water testing kit = 1

Soda ash doser

Soda ash doser is dosed for pH correction. This is done by means of our standard displacement doser. A pr. drop is created in the pipeline coming the raw water by means of an orifice plate inserted in the line. Thus part of the water is diverted through the closer. The doser consists of a pr. vessel with a rubber bag (filled with soda ash solution) bolted to the neck.

Action of water on the outside of the rubber bag forces the solution into the pipeline, flow being regulated by means of needle valve. Thus the pt. of water can be raised to the required level. The rubber bag can be recharged with soda ash solution one initial charge is exhausted.

Analysis of output water

Colour = Clear
Hardness = 0.00 ppm as $CaCO_3$
pH =8.5
O_2 = 0.002 ppm max.
Turbidity = 0.0 ppm
Silica = Not exceeding 1.00 ppm.

Total disolved solid (TDS) Not exceeding = 60 ppm

Detergent = 0.00 ppm
Oil = 0.0 ppm
Copper = nil
Free CO_2 = nil

Analysis of input water:

Source of supply= V.I. pump
Colour = colourless
Odour = No
Turbidity = clear
pH = 7.3

Chemical

Total solids = 3.30 ppm
Total hardness = 164 ppm as $CaCO_3$
Calcium (Ca)= 52 ppm
Mg = 8.26 ppm
Cl = 45.0 ppm
F = 0.04 ppm
Ammonical nitrogen= 0.04 ppm
Nitrite nitrogen = 0.002
Sulphate (SO_4) = -
Nitrate nitrogen = present
Iron (Fe) = 0.2 ppm
Cu = nil
Toxic substance (lead, chromium) = nil

Temperature of water in condensing tank should not exceed 85°C, otherwise it may damage gland in feed pump.

VALVE CONTROLS

Definitions

Safety valve: An automatic pressure relieving device actuated by the static pressure upstream of the valve and characterised by rapid full opening or pop action. It is used for steam, gas or vapour service.

Relief valve: An automatic pressure relieving device actuated by the static pressure upstream of the valve, which opens in proportion to the increase in pressure over the opening pressure. It is used primarily for liquid services.

Safety relief valve: An automatic pressure actuated relieving device suitable for use as either a safety or relief valve depending upon application.

Pressure relief valve: A pressure relief valve is a pressure relief device which is designed to reclose and prevent the further flow of fluid after normal conditions have been restored.

Set pressure

It is that inlet pressure at which the pressure relief valve is adjusted to open under service conditions. In a safety or safety-relief valve in gas, vapour or steam, the set pressure is the inlet pressure at which the valve pops under service conditions. In a relief or safety relief valve in liquid service, the set pressure is the inlet pressure at which the valve start to discharge under service conditions.

Operating pressure

The operating pressure of a vessel is the pressure to which the vessel is usually designed for a maximum allowable working pressure, which will provide a suitable margin above the operating pressure in order to prevent any undesirable operation of relief device (it should be as great as possible).

Maximum allowable working pressure

It is the maximum gauge pressure permissible at the top of completed vessel in its operating position for a designated temperature. The pressure is based on calculations for each element in a vessel using nominal thickness, exclusive of allowances for corrosion and thickness required for loadings, other than pressure . It is the basis of pressure setting of pressure relieving devices protecting the vessel. The design pressure may be used in place of maximum allowable working pressure.

Over-pressure

It is a pressure increase over the set pressure of a pressure relief valve, usually expressed as a percentage of set pressure.

Accumulation:

It is the pressure increase over the maximum allowable working pressure of the vessel during discharge through the pressure relief valve.

Blown down

It is the difference between the actual popping pressure of a pressure relief valve and actual reseating pressure expressed as a percentage of set pressure.

Lift

It is the actual travel of the disk away from closed position when a valve is relieving.

Back pressure

It is the static pressure existing at the outlet of a pressure relief device due to pressure in discharge system.

Instructions for the storage, installation operation and maintenance of valves

A properly designed and applied valve will give years of trouble free performance, provided it is installed properly, used properly and receives regular preventive maintenance.

If pipes are considered to be the arteries of a piping system then valves are supposed to be the heart of the system.

General principles

1. Storage of valves: Valves should be handled with utmost care, while transporting, maintaining or installation. Use hangers etc. to lift heavy valves to avoid sudden fall:

a) Stored in a dirt free and non-corresive atmosphere,

b) should not be kept in open,

c) they should be in closed partition when kept in store,

d) while storing the gate valves (other than those for oxygen), the seats should be coated with the film lubricating oil to prevent galling. Before putting it into service, it should be cleaned,

e) valves with screws or welding ends shall have the ends protected with metal, wood or plastic plugs,

f) flanges of flanged valves shall be protected over the entire garket surface with metal hardboard or solid wooden flange protectors securely attached to valves. The closing of end shall avoid the possibility of entrance of any foreign material inside the valve,

g) valves must be protected against contact with acidic or caustic substances,

h) valves controls for O_2 etc. should be avoided in contact with grease etc.,

i) pneumatically operated diaphragm type control valves, diaphragm valves or any other type of valve with resilient/rubber components should be stored in a relatively cold atmosphere away from oil and grease,

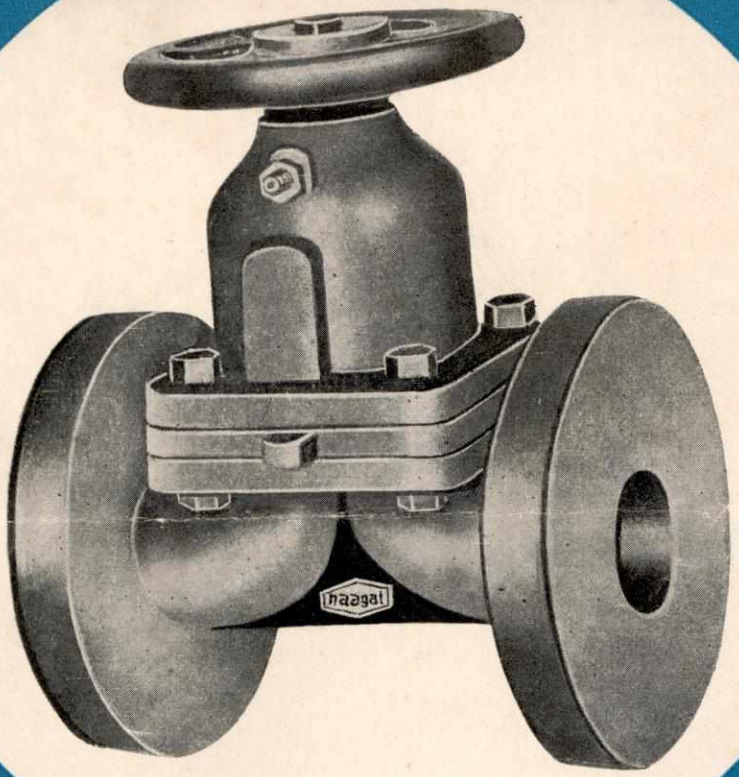
they should be stored in racks and not on floor to avoid dampness of rubber components,

j) proper maintenance should be done even while storage,

k) all ferrous valves (other than stainless steel valves) should be kept in store after painting the exposed surface with rust preventives or rapping it in No-rust paper,

l) valves should not be dumped in heap,

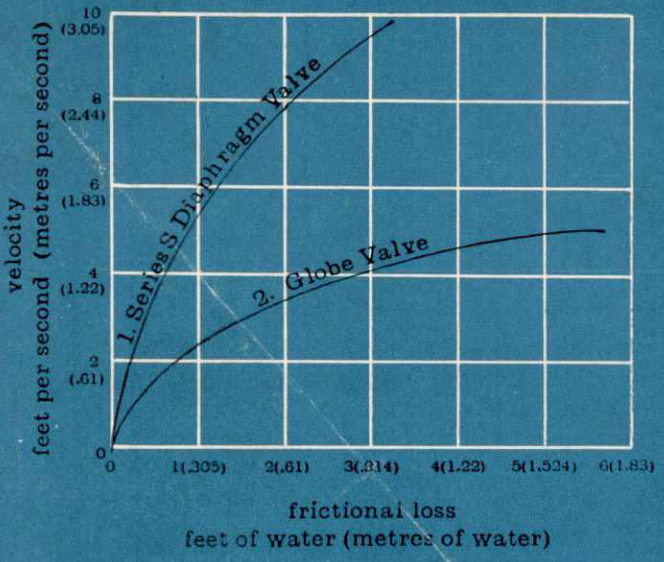
m) check the specification of valves.



naagal

Diaphragm Valves

PROTECTIVE COATED FOR HANDLING OF CORROSIVE CHEMICALS



Nominal size-mm	Operating Pressure Kg./cm²
25	14.00
40 to 50	12.25
65, to 125	10.50
150	8.75

Hydrostatic Tests	
Shell test	1½ times nominal pressure rating
Seat Test	Same nominal pressure rating

Note: The curve indicates frictional resistance for the Diaphragm Valve handling water at 40°C.

Note:
1. Flanges are offered drilled or undrilled as required.
2. Body lining & diaphragm can be supplied as required.
3. Tolerance in the face to face dimension

   0-200 mm ±1

   201-400 mm ±2

   401-600 mm ±3
4. All dimensions are in mm
5. Manufacturing standard B S 5156 : 1974
6. Technical alteration reserved

In addition to the Protective Coated Diaphragm Valves we also manufacture in Lead, Globe, "Y" Type and Gate Valves. NAAGAL Lead Valves are made from a special alloy of Antimony and Lead. The presence of controlled quantities of Antimony considerably improves the mechanical properties of Lead such as high creep strength, better resistance to vibration and higher tensile strength without changing the corrosion resistance of the metal. Lead Valves are of particular interest in handling of Sulphuric Acid, Rayon Solution, Super Phosphates, Aluminium Sulphate, Acetone, Alcohol, Chromic Acid, Phosphoric Acid and various other chemicals.

naagal

k.k.nag (pvt) ltd. Fluid Control Division
Regd. Office : 23/5-A, Bund Garden Road, Poona 411 001. Cable : 'KALNAG'. Tel. 26436
FACTORY : SHEMBEKAR IND. COMPOUND, BOMBAY-POONA ROAD CHINCHWAD, POONA 411 019 TEL. 82036

Installation of valves in pipe lines

1. Pipeline should be inspectec carefully before installation alongwith the valve to notice any injurious defect in the both which might cause hindrance.

2. The valves should be cleaned with pressurised kerosene oil (except O_2 valves) or with air flart.

3. Welding splasher, rust etc. should be removed from pipe line.

4. For large diameter valves and pipes step should be taken to support the pipe near the valve.

5. The valve should be easily accessible.

6. The impingment of high velocity fluids carrying abrasive solids can effect the life time of seats and discs. In such cases, strainers should be used.

7. Where necessary, the float of a level control valve should be fitted in a separate chamber, to avoid wave motion which might cause hunting and vibrations thus reducing the sensitivity of valves.

8. During welding the valve directly in pipe line, the weld spatter should not damage the body as well as the gate face.

9. Arrow-head direction should be taken care of.

10. The flanges should be centralized and have parallel faces.

11. When valves are meant for not media, the threads of flanges fasteners are to be given a coat of graphite suspended oil.

12. The gaskets used should be cut properly to avoid obstruction in the flow of fluid.

13. The weld ream must be perfect and there must not be excess material at the root of seat to avoid obstruction in flow.

14. Valves should be assembled in a manner that there is minimum axial load imposed on the body of valve. The entire layout should be so arranged such that the thermal expansion of the pipes on the valves is kept minimum.

15. Safety valve should be mounted with spindle in vertical partition. Sufficient clearance should be left.

16. Air release valves should be fitted in well made pits by heavily perforated surface boxes.

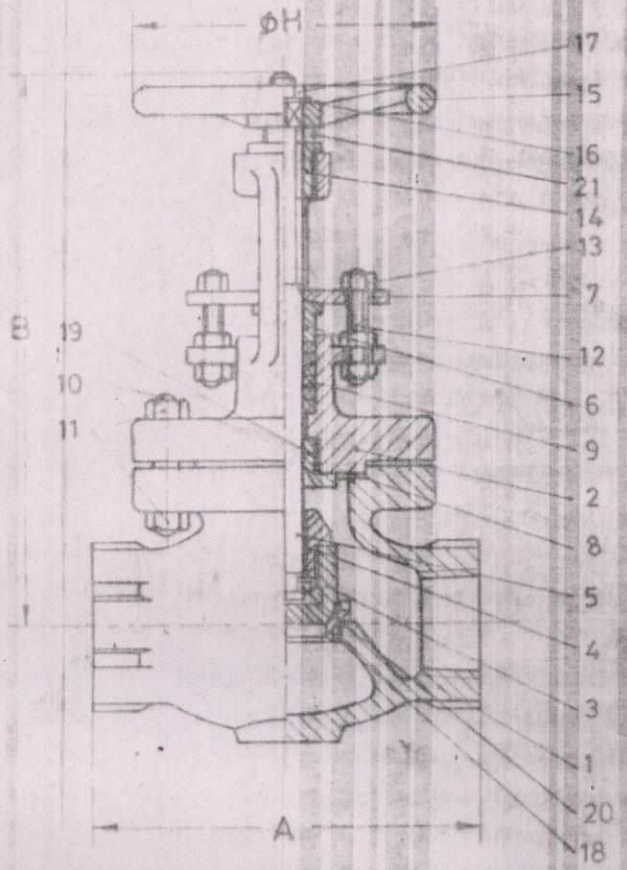
17. For maximum efficiency, the pressure reducing valves, should be correctly set up with by pass to have free maintenance.

Globe Valve
Screwed Ends

akay industries

Sup. Date 1 Jan 1976 | Date 1 Jul 1977 | Ref. GL-[illegible]/111

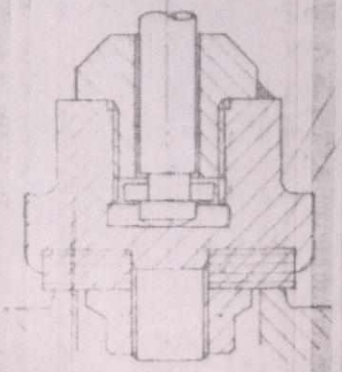
Handwheel Operated



Part No.	Part Name	Material
1	Body	CS
2	Bonnet	CS
3	Disc	410
4	Disc Nut	410
5	Stem	410
6	Gland	410
7	Gland Flange	CS
8	Gasket	CAF
9	Gland Packing	PIBA
10	Bonnet Stud	ASTM A 193 Gr B7
11	Bonnet Stud Nut	ASTM A 194 Gr 2H
12	Gland Stud	STEEL
13	Gland Stud Nut	STEEL
14	Yoke Bush	BS
15	Handwheel	STEEL
16	Washer	STEEL
17	Handwheel Nut	STEEL
18	Seat Ring	410
19	Bonnet Bush	410
20	Split Ring	410
21	Lock Pin	STEEL

Standard Screwed ends
BS taper threads (Rc)
unless otherwise offered

* Other materials available on request



Alternative Disc Arrangement

Dimensions in mm

Nominal Size	15	20	25	40	50
A	95	108	127	165	190
B Open	185	240	260	315	335
ØH	105	105	180	180	180
Approx Wt-kgs	4.5	5.2	7.2	12.0	16.5

Dimensions B are approximate

Max. Working Pressure 50.5 kgf/cm^2

chemflo

Operation of Valves

1. Before operating the valve for the first time, the bolts on the connecting flanges and on the bonnet flange must be checked and re-tightened if necessary, soft gaskets have a tendency to settle down during the initial period of service.

2. The valve should be operated by movement of hand-wheel in direction of arrows marked on it. It is opened normally by turning the handwheel in counter clockwise direction and vice-versa.

3. When valves are provided with built in by-pass valve should be opened gradually before opening the main valve. This will enable the pipe line to warm up and pressures on either side of main valve will equalise.

4. When valves are not provided with by-pass they must be slowly opened in sequence so that the valves and the pipe line get warmed up on the steam line.

5. When the pipe line is under pressure a de external visual inspection of the valve should be carried out and any gland leaking must be tightened uniformly.

6. It is recommended that all important valves be opened out and thoroughly inspected after trial operation. This should be done to ensure that there is no damage caused to the valve components during trial run.

7. All the work connected with the assembly of valves should be carried out by fully qualified technicians who are well conversent with valves and pipe lines.

Care of the seat

The seat should be considered the heart of a valve and if heart is dead, the very purpose of the valve will be lost. So the best way to preserve the seat is to have a completely clean pipe system. It should be clearly born in mind that valves are not dirt-traps. It is not uncommon for dirt, scale, rust and pieces of weld metal to be found in valves after their removal from a system. It is technically impossible to expect such valves to provide shut off under these conditions and particularly when they are subjected to high pressure and temperature during operation. In a new plant and later when making repairs, the piping must be thoroughly cleaned before use.

Care of gland (stuffing) box

1. Prolonged storage may spoil the gland packings, so before operating the valve for a first packing should be checked and if the need be, stuffing box should be filled with a fresh package.

2. It is important that the stuffing box be inspected before and during operation, the gland must be tightened before and during operation. Because the packing generally tends to settle down on the early stage of use.

3. When it is required to change the gland packing when the valve is under pressure, the valve should be fully opened with its back seat in position so that there is no danger of fluid leaking to the stuffing box by the operator is doing the refilling operation of gland box.

Maintenance of Valves

Valve maintenance begins with the selection of a valve, because correct choice of type and materials will minimise the need for maintenance. Valves however need regular inspection during operation and prompt attention when troubles arise. Preventive maintenance may be defined as "carrying out inspection by competent personnel and overhaul at regular intervals to ensure continued efficient working of mechanism used". Valves are mechanisms. As a general rule, they should be subjected to schedule maintenance in the manner normal to all running machinary but in every instance, it is recommended that the procedure followed is that given in instructions. Here are few tips:

1. Whenever the operating conditions of a system are altered, check the valves to ensure that they are suitable for new working conditions.

2. Safety and relief valves of all types are ought to be periodically tested by caring gear to maintain freedom from sticking.

3. Isolation and emergency valves not work occasionally but when they are needed they need urgently. So they should be tested regularly.

4. Don't allow valve packing to leak. This reduces the efficiency of the packing and may make a new valve stem necessary. The leaking also waste the material. A leaking valve often means a chattering valve. The chatter initiate others troubles e.g. accidental closing.

5. When screwed bonnets are hard to remove, use a short wrench and tap it a few times with a hammer. This is more effective than a sustained pull and reduce the risk of distortion.

6. If a valve leaks slightly when shut off,open it little to flush particles that may be hindering seats. Trying to shut it with a crew bar is likely to ruin the seat.

7. Regular checks should be made on air release valves on water mains to ensure that the balls are free. Any type of leakage should be watched immediately. A leaking valve would attract vegetable roots, flies to such an extent that valve will stop functioning.

8. When check valves are fitted with springs, the spring should be removed as soon as they become fatigued. As check valves are automatic, they should be inspected regularly to ensure proper seating.

9. Severe damage can result to stems,gates, nuts and faces of gate valves by use of larger hand wheels, tee-keys etc. than those originally supplied.

Maintenance of all assemblies

1. Valves those are not operated frequently and which may remain open or closed for long periods should be worked even partially (monthly say).

2. Greaving of spindles and gearings, and other working components as appropriate, should be performed after every six

months. Valves meant for oxygen service and some other service, where use of lubricants is not recommended should not be greased or oiled.

3. When faulty gaskets are the cause of leakage, care should be taken to ensure that replacements are of correct material.

4. To loosen renewable face or seat rings a good rust solvent is recommended where it is necessary to or split a ring to remove it, damage to the body specifically in case of screed rings, must be carefully avoided. When inserting a screwed ring replacement, graphite compound on the thread will not facilitate tightening but removal later. When inserting a shouldered rings it must be made tight against the ring.

5. After a lengthy period of operation connecting bolts should be checked for tightness.

6. When it is necessary to keep a valve close in cold weather, precaution should be taken to prevent it from freezing up.

7. It is recommended to inspect all valves in a system during overhauling and every time the pipe line is put out of operation such that every valve is inspected atleast twice a year. This must be done in case of all valves irrespective of their period of operation.

8. The valves should be dismantled for such inspection and components thoroughly cleaned and inspected to ensure:

a) that there is no indication of corrosion or cavitation under the seats or any where else.

b) That there is no pitting or any indication of seizing noticed on the surface of removing components.

9. After every dismantling, the seating surface should be ground or lapped with suitable grinding or lapping parts.

10. After reassembly, they should be tested for proper functioning.

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Various types of valves used in industry are:

1. Gum metal gate valve as per IS 778:1971.
2. Gun metal globe valve as per IS 778:1971.
3. Gun metal vertical check valve as per IS 778, Class I.
4. Ball valve, diapragm type as BS 1212 part-2.
5. Gun metal globe wheel valves.
6. Bronze union bonnet globe valve.
7. Gun metal non-return (check) valve.
8. Gun metal ball float valve.
9. Gun metal lever gate valve.
10. Gun metal flush cocks.
11. Cart iron, gate valve, clip pattern.
12. Spring plug cocks.
13. Cast iron sluice valve.
14. Cast iron wedge gate valve.
15. Cast iron outside screw yoke type gate valves.
16. Cast iron globe stop valve.
17. Cast iron globe stop and check valve.
18. Cast iron swing check (reflux) valves.
19. Cast iron lift check valve as BS:5133
20. Cast iron taper plug pressure lubricated cocks.
21. Bar stock needle valve.
22. Cast iron air release and vacuum breaker valve.
23. Cast iron butterfly valves.
24. Cast iron diapragm valve.
25. Bronze globe steam stop valve.
26. Cast iron/cast steel spring loaded safety valve.

27. Bronze pressure reducing valves.

28. Bronze accessible feed check valve.

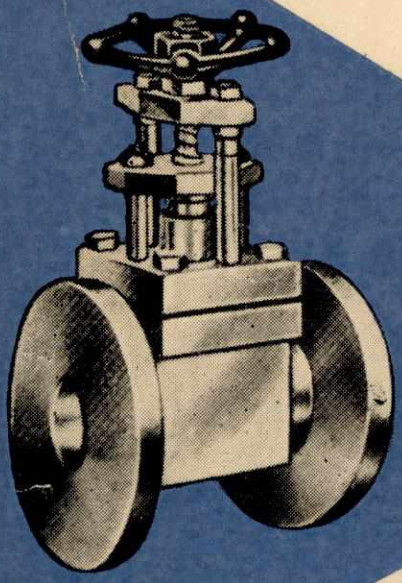
29. Parallel slide blow off valve.

30. Forged steel globe/gate valve.

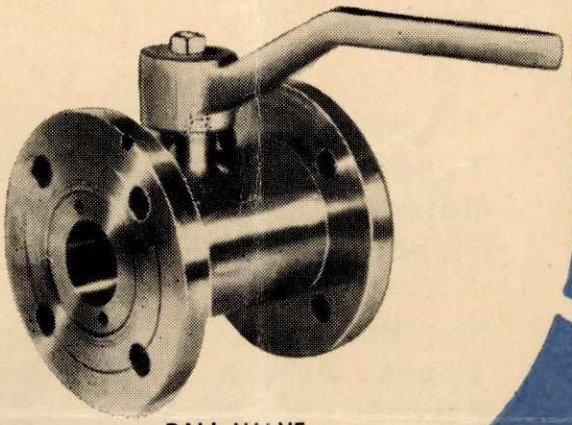
There are various other types of valves in usage also.

JAY JAY Enterprises

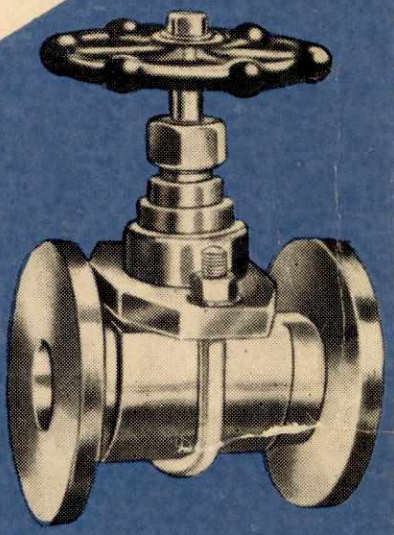
INDUSTRIAL VALVES



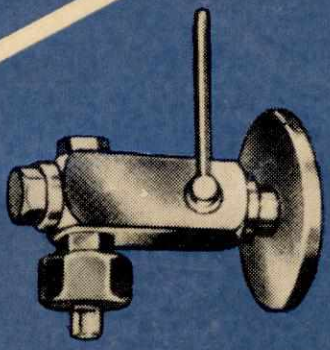
FABRICATED GATE VALVE

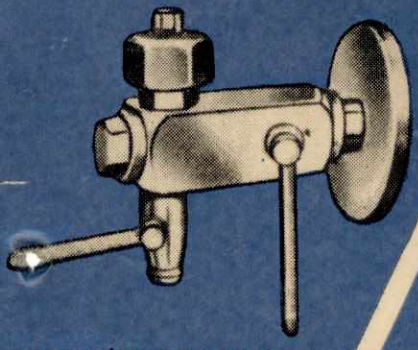


BALL VALVE
ONE PIECE



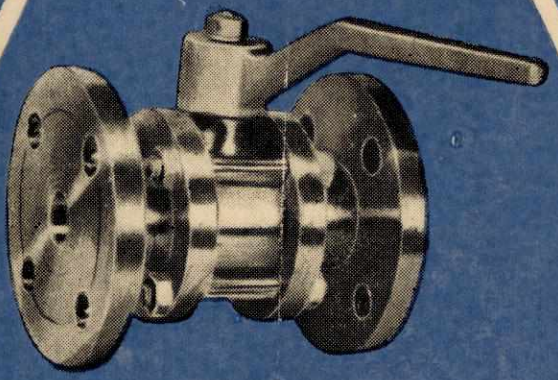
'U' CLAMP PATENT
GATE VALVE

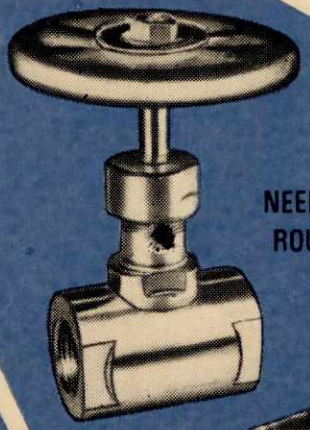




GUAGE GLASS COCKS

BALL VALVE THREE PIECE





NEEDLE VALVE
ROUND BODY

GLOBE VALVE
SQUARE BODY

Wide range of services in Oil Refineries, Fertiliser Plants, Chemical Plants, Power Stations, Petro Chemical Industries, Water Works, Sugar Industries etc. We can offer various types of **INDUSTRIAL VALVES** in following different standards and material of constructions.

* **TYPES OF VALVES** : Ball, Gate, Globe, Needle, Check, "Y" Type Globe Valve, Flush bottom, Steam Jacketed Valve, Diaphram . . . . . etc.
* **MATERIAL** : Stainless Steel 304, 316, Bar Stock, Cast St. Steel, Cast Carbon Steel, Mild Steel, Cast Iron, Rubber line .. .. ..etc.
* **STANDARD** : Manufacturer's ASA-150, ASA-125, DIN .. .. ..etc.
* **SIZES** : From $\frac{1}{4}$" to 16" depends on Design of the Valve and Material of Construction.
* **TEST PRESSURE** : Up to 1500 PSI. We can give Needle Valve up to 10,000 PSI Pressure.

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* All ypes of Flanges
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  Material : Mild Steel, St. Steel, Forged Steel etc.
  Standard : ASA, BS, DIN etc.

* Pipe Fittings
  Types : Stubends, Elbows, Tees, Reducers, Nipples etc.
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Valve repaired

Type: Cost steel swing check valve as per B.S. 1868.

Application: These valves are designed for high pressure and temperature pipe line in oil refineries, petrochemical and other industrial plants. These are used to prevent reversal flow in horizontal or vertical direction, or/and angle line. These are designed of different sizes and for different pressure and temperature range.

General: Body and cover are made of ample wall section to provide maximum safety and long life. The stream line design of valve give minimum of turbulence and pressure loss.

End flanges: Flanges conform to B.S. 1560 or ASA B16.5-1961. In classes 150 and 300 1/16" raised face is provided on the flange facing and height of raised face is included in minimum flange thickness. In class 600 it is 1/4". They are of serrated finish and are also back faced or spot faced for proper fixing of bolts.

By-pass arrangement: Valves can be provided with by-pass arrangement if wanted.

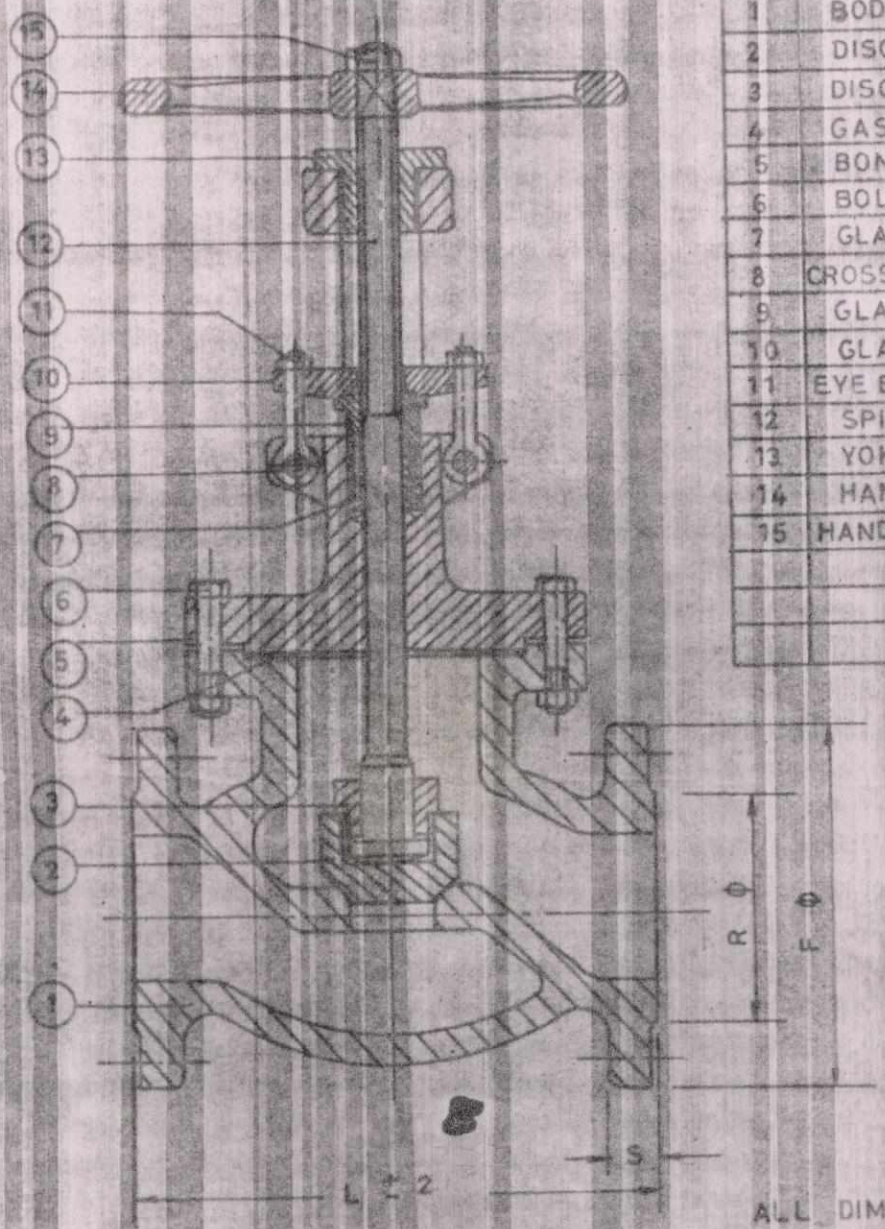
Drilling: Unless ordered, the flanges are faced, drilled and spot faced according to B16.5-1961 or BS:IS60.

SIZE →	½" / 15	¾" / 20	1" / 25	1¼" / 32	1½" / 38	2" / 51	3" / 76	4" / 102	5" / 127	6" / 152	8" / 203	10" / 254	12" / 305
L →	108	118	127	140	165	203	241	292	356	406	495	622	698
R ϕ →	88	98	108	118	127	152	190	229	264	279	343	406	483
S →	12	12	12	13	14	16	19	24	24	25	29	30	32
R' ϕ →	35	43	51	64	73	92	127	157	186	216	270	324	381

NOTE: 1. 'L' AS PER ASA-B-16-10.
2. END FLANGE DETAILS AS PER USAS-B-16-5

IF IN DOUBT ASK

S.NO	PART NAME	MATERIAL
1	BODY	CF8 / CF8M
2	DISC	AISI 304 / 316
3	DISC NUT	AISI 304 / 316
4	GASKET	TFE
5	BONNET	CF8 /
6	BOLT & NUT	
7	GLAND PACKING	T.F.E.
8	CROSS BOLT & NUT	C.S.
9	GLAND	AISI 304 / 316
10	GLAND FLANGE	AISI 304 / 316
11	EYE BOLT & NUT	C.S.
12	SPINDLE	AISI 304 / 316
13	YOKE NUT	~~AISI~~ 304 Bl. br
14	HAND WHEEL	C.I. 1
15	HAND WHEEL NUT	C.S.



ALL DIMENSIONS ARE IN MM

NITON INDUSTRIES

C-138, GHATKOPAR INDUSTRIAL ESTATE, L.B.S. MARG, BBAY-86

DRN. BY	STAINLESS STEEL
CHD. BY	GLOBE VALVE ASSEMBLY
APD. BY	A.S.A. -150 CLASS
SCALE: N.T.S.	

Butter-fly valves

Rapidly advancing industries are using for their compactness and consistent droplight performance. Rouress-Boving butterfly valves are available in many types, classes, constructions and operating arrangements. These are designed for fresh water, salt water service. Low pressure butterfly valves are available for a variety of applications such as air and low temperature gases. Their standards are as follows:

AWWA -C 504, BS-3952 etc.

These are available in flanged or flangeless constructions. These valves have patented resilent real having a long service, like

i) round nosed solid rubber real
ii) inflatable hare real
iii) music note solid section real

The material for construction according to the standards is as follows:

Body- C.I.	= IS:210 Gr:20/28
Clamping ring Disc-CI.	= IS:210 Gr:20/28
Seat ring, shaft - SS	= ASTM A-479
Seal	= nitrite rubber
Internal hardware	= 5.5 ASTM-A-193B8

These butterfly valves are available in variety of operating arrangements, manual power, worm gear, pneumatic, electric hydraulic operator. For ordering this type of valve, one must mention: size, pressure, temperature, fluid, flow rate service, operator, type like high shut off or low leakage/control.

Parallel slide Blow off valve

This rack and pinion operated parallel slide blow off valves are available in cart steel and bronze, suitable for following boiler operating pressures:

1. Cart steel : for boiler operating pressure upto 350 PSI with B.S.10/IBR table J flanges.
2. Bronze: for boiler operating pressure upto 17:57 kg/cm^2 with B.S. 10/IBR table H flanges. For boiler operating pressure upto 16.54 kg/cm^2 with B.S.10/IBR F flanges.

The outstanding feature of this valve is that it maintains fluid tightness and ease of operation without the aid of any wedging action. A spring between the discs keep them in a close contact with the seat when the valve is not under pressure and slide valve remove any dirt and any foreign matter from the faces, operation by means of rack/pinion is so arranged as to give full opening with half turn of the box key. The gland forms a locking guard which prevents the removal of box key unless the valve is closed. When ordering state for:

1. Size of valve,
2. Figure number boiler operating pressure,
3. If flanges required, drilled, if nothing specified they will be undrilled,
4. Whether box key required,
5. End connection required type.

Steam Trap

Type: Vertical inverted bucket type-
Thermodynamic type

The first one are available with C.I. body with brass bucket and stainless steel seat. The second one are available with stainless steel body with or without strainer. The types of end connections are of:

a) Screwed female and flanged end,
b) Screwed female and socket welding end.

The maximum service pressure and temperature according to the material of body are as follows:

C.I. - 10.54 kg/cm^2 204.4°C

Stainless steel -40 kg/cm^2 426°C

Working

a) Inverted bucket type:

1. Condensate enters under the inverted bucket and passes freely to the wide open valve at the top.

2. Steam following the condensate is trapped in the bucket, the bucket rises lifting the valve onto seat. The vale remain water sealed.

3. Condensate enters the trap as the steam condenses, reducing the boyancy of the bucket. The bucket sinks untill the hook pulls on the valve lever.

4. Condensate continues to replace steam in the bucket untill the bucket buoyancy is reduced to the point that the valve is pulled off the seat and full bore discharge takes place. Air

trapped in the bucket passes through the bucket vent, collects underneath the cover and is discharged ahead of condensate. Any steam passes through the vent is condensed and offset radiation losses from trap body.

b) Thermodynamic type:

1. Disc is raised from seat ring by incoming pressure, allowing instant discharge of air and condensate.

2. High velocity of following flash steam creates a low pressure area under disc which drews it towards the seat and at the same time builds pressure in chamber.

3. Steam pressure in chamber acting on full top area of disc, forces it down against the pressure of incoming steam until it seats on inner ring closing the inlet. At the same time, disc also seats on outer ring, trapping pressure in chamber.

4. Condensate in chamber decreases the pressure, the disc is raised by incoming pressure, and cycles begins again.

Positive back pressure is to be deduced.

Negative back pressure is to be added.

Testing They are tested hydrostatically for double pressure than working pressure. Test certificate form III-C of IBR is required.

Note: Steam traps operate most efficiently when condensate load ranges between 5% and 50% of trap capacity.

Assembly of Geared Motor

The geared motor was not working. It was facing the following problems:

a) The gear teeths were worn out.

b) The bearing was tight and unrepairable.

c) The oil seals were leaking.

d) The locking unit of bearing was missing.

e) The motor pinion was damaged.

f) The gasket to prevent leakage was torned off.

g) The motor specifications are as follows:

Make *Kirloskar

Weight = 28 kg
Material = MS

RPM = 1440
Phase = 3
Power = 7.5 hp
Input rpm = 1440
Output rpm = 1440 x 1/25.2 = 57.5

The whole system was dismentled. The various types of gears used are shown on the drawing.

The reduction factor for this geared motor can be calculated as follows:

No.of teeths on motor pinion(Helical pinion)= 14
First driven (idle gear) = 115
No.of teeth on the second driving gear (which is fitted on final driven shaft) = 15 (helical pinion)
No.of teeth on the final gear on driven shaft (helical gear) = 46

$\therefore$ reduction factor is $R = R_1 \times R_1$

R_1 is first reduction factor = = 14/115

R_2 is second reduction factor = 15/46

Resultant R = 14/115 x 15/46 = 21/529 = 1/25.2

Bearing (Roller) = 30213
Ball bearing (1) = 6309
Ball bearing (2) = 6307
Body = C.S.

The geared motor is used in case of agitator for mixing starch and for other type of processes like separating gluton out of it or making the solution homogenous.

The main advantage is because of less splashing (as number of rpm is less) and more power.

These motors come in different sizes and under different trade names.

The following repairs were done:

1. The teeths which were damaged slightly were repaired.
2. The bearings were replaced alongwith new oil seals up.
3. New gasket was cut according to the sizes.

Assembly of Reduction Gear

This speed reducer are of substantial construction combining rigidity with strength. All worm gears are to B.S. 721:1863, a specification based largely on David Brown patents of 1915 and 1927.

The work is of high quality case-hardening steel, accurately generated grounded and super finished. The worm wheel comprises a David Brown Taurus phosphor bronze centrifigually cast rim of substantial section welded to a rigid centre, which is pressed and keyed to the shaft.

Shafts are located on dual purpose bearings of ample capacity and having a substantial margin on output shafts for accommodating overhung loads.

Lubrication is constant at all speeds in either direction of rotation and apart from an occasional oil check, no attention is necessary in service.

E.T.P. AND STARCH PLANT

Cost Accounting of Starch Slurry

The cost accounting of the starch plant was done in order to know the cost of producing the one ton of starch involving all the processes. In order to get to the above result, we will have to work out the three different types of costs involved during processing of rice to rice starch. They are:

1. Man power cost.
2. Raw material cost.
3. Electric/power cost.

The various assumptions which have been made for working out the cost are as:

i) Average rice processed per day in the starch plant is 2.5 MT.

ii) Loss of 5% is assumed during the cleaning and grinding of rice.

iii) Caustic soda consumed per ton of rice is roughly taken as 20 kg.

iv) The whole process takes exactly four days and therefore the power cost is divided over the whole production of 4 days that is 10 MT.

Man power cost

As data obtained from the personnal department shows that the total salary delivered monthly to the starch plant is Rs. 12058, i.e. for regular employees.

Therefore salary for one days is - Rs. 402.00
Salary daily to casual workers - Rs. 858.16
Total salary per day is - Rs. 1260.16

Since 2.5 MT of rice is processed daily,
Therefore, man power cost per ton of rice = $\frac{1260.16}{2.5}$

Man power cost= Rs.504/ton of rice. = Rs.504/-

Raw material cost

During the whole process, the raw materials used are:

Rice - 1780 Rs/M.T.
Caustic soda- 3 Rs/kg

Now if we deduct 5% loses from the above value of broken rice, the pulverized rice costs us Rs. 1869/M.T. Amount of caustic soda used per ton of rice is 20 kg. Therefor, cost of caustic soda= Rs. 60/ton of rice. Thus total raw material cost in processing one ton of rise is 1869+60 = Rs. 1929. Hence, raw material cost = Rs. 1929/ton of rice.

Power cost

The total power cost includes the electricity consumed in running various types of motors attached to the grinding mills, agitators pumps etc. The power consumed in running the fan, bulbs etc. is neglected. The various types of power consuming equipment alongwith their working capacity and working time is as follows:

Name of Equipment	No.	Working time (hrs)	Capacity (kw)	Total units
1. Grinding mill	1	48	22	1056
2. Filling pump	1	4	7.5	30
3. Agitator of filling pit	1	4	0.75	3
4. Agitator of silo	1	24	15	360
5. Pump of silo	1	8	5.5	44
6. DSM pump	6	8	15	720
7. Separator-I	3	8	30	720
8. Separator-II	1	8	40	320
9. Agitator of feed tank	3	8	5.5	132
10. Pumps of separator -I feeding	2	8	5.5	88
11. Pumps of separator-II feeding	1	8	1.5	120

12. Pumps of tanks	2	8	5.5	88
13. SO_2 pump	1	8	5.5	44
14. Pump for final output	1	8	0.75	6
			Total=	3731

Thus the total number of unit of electricity consumed during the processing of 10 MT of rice is 3731.

Rate of power- 70 Ps/unit.

Hence, total power cost is 3731x0.7 = Rs. 2612.

Therefore, power cost per M.T. of rice = 2612/10 = Rs.261.2.

Total cost

Man power cost	- Rs. 504
Raw material cost	- Rs.1929
Power cost	- Rs. 261
	Rs.2694

Thus cost of 1 ton of starch slurry = Rs. 2694.

Trials for rice starch

The idea for the production of rice starch was originated because 90% of the rice is produced in Asia pacific countries. Rice is separated from the rice husk in the shellers where from the rice is supplied to the grinding mills and husk can be used for following processes:

- sand blarting because of its high silica content,
- soaps (hand washing etc),
- ammoniation for cattle feed and fertilizers,
- crude oil of low free fatty acids,
- it is bleached to give high quality edible oil.

The composition of rice on dry starch basis is:

Ash - 0.48%
Protein - 8%
Lipids- 0.54%
Starch- 90.2%

In the rice grains, the starch granuals (which are very small and polygonal and of the size -3-5 u) are found in a rigid structure by protein, the major component of which is an alkali soluble fraction or glutein. Therefore, all processes are based on alkali treatment.

Effluent Treatment Plant

It is drainage system used to neutralise the effect of water coming from all the plants after process. This water is full of chemicals and other organic compounds that it cannot be directly disposed off for this purpose. The water is treated here and is removed from all type of hazadorous impurities, and then it is allowed for agricultural purposes.

Specifications

Total CVL flow = 230 m^3/day
AV BOP = 4000 mg/1 ppm
av:BOP as per tender = 7000 mg/1
Treated effluent should conform to = IS 2490

Working

The raw effluent will be received in a sump of 6Mx6Mx 1.2M SWD and pumped at a constant rate to a hopper bottom, primary settling tank of 4.3Mx4.3x0.9 m SWD and 3.3 m hopper depth. The settled effluent will flow by gravity to first stage aeration tank of 11x11x34 m SWD where 25 Hp arration will be installed. The aerceted effluent will be settled in a hopper bottom settling tank of 3.7x3.7x0.9 SWD and 29.5 hopper depth.

The settled sludge from this tank will be recirculated into first stage aeration tank and the excess sludge will be dried on sludge drying beds. The overflow from the first stage settling tank will be gravitated into stage II aeration tank 8x8x3.2 m SWD where 10 Hp agitator will be installed.

The effluent will be finally settled in a hopper bottom setting tank of 3.7x3.7x0.9 SWD and 2.95 hopper depth before

discharging into inland surface waters. Stage II sludge will be recirculated into stage II aeration tank and excess will be dried.

Specification of mechanical equipment

Vertical pumps - 10 m^3/hr capacity

Ist stage agitator - 25 Hp in RCC tank

IInd stage agitator- 10 Hp in RCC tank

Sludge pump (3) - centrifugal horizontal 10 m^3/hr 6 m head suitable TEFC squirrel cage motor.

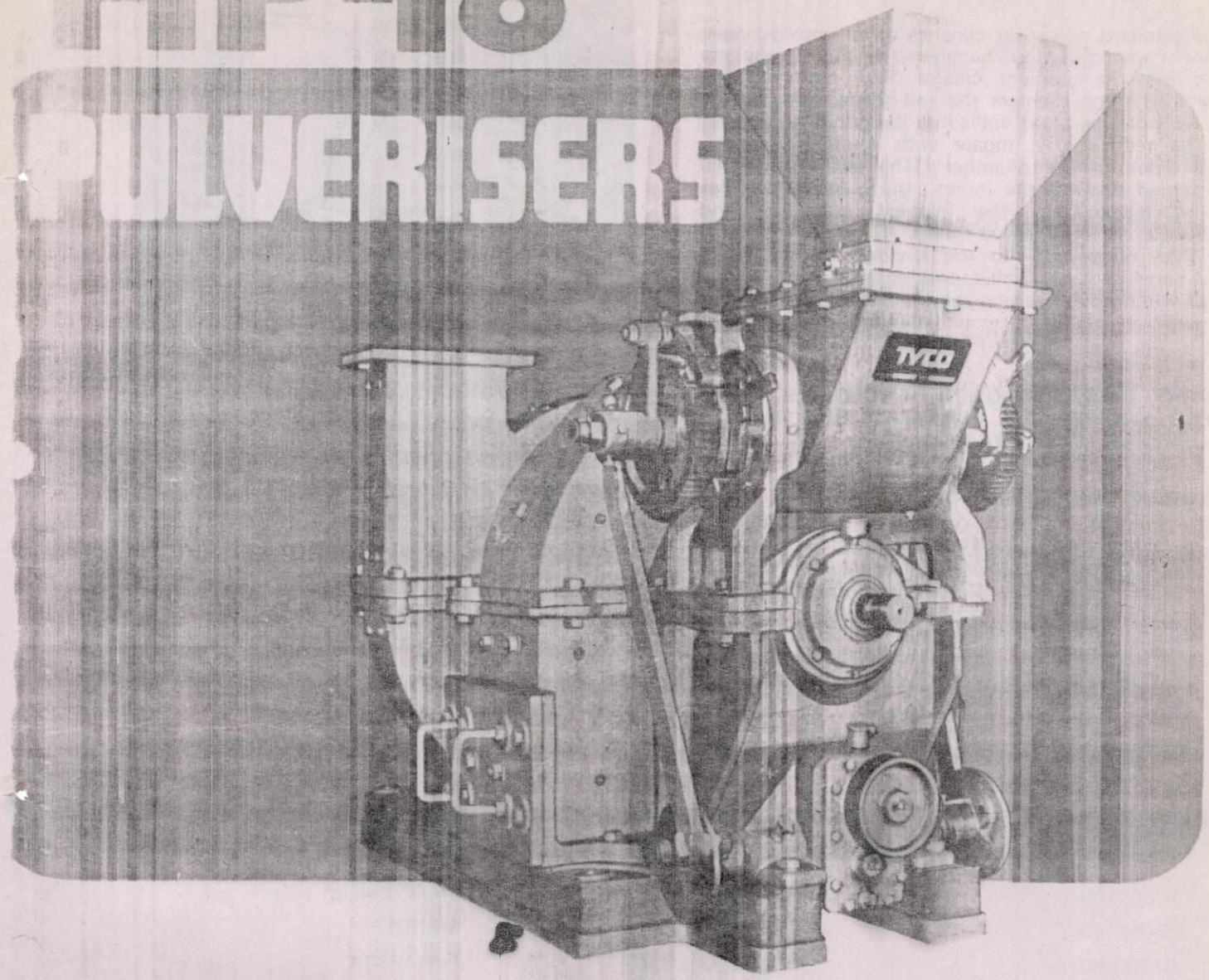
Piping - HDPE and CI valves.

Flash mixer: Sump for neutralisation.

PULVERISING SECTION

TY PUBLICATION NUMBER
THP 503

HP-18 PULVERISERS



SIZES : HP-18 Pulveriser

Type : High speed hammer mills

The TYCO PULVERISER is a versatile grinding unit of heavy and rugged construction, and built for continuous operation day after day. The unit is especially designed for the medium-fine and fine grinding of relatively soft non-abrasive minerals and many manufactured products.

The TYCO PULVERISER has proved applicable to a very wide range of grinding operations throughout the world.

OUTSTANDING FEATURES

Combines ruggedness, dependability, high efficiency and automatic operation.

Dust free, completely integrated system for grinding and classifying.

Assures low cost operation with consistent uniform product.

Operates at peak efficiency and highest tonnage per horse power.

Flexible control over product fineness.

Requires minimum attention other than ordinary maintenance.

VERSATILE IN APPLICATION

The TYCO PULVERISERS meet most capacity requirements and lend themselves to a wide degree of adjustment with fineness of the finished products ranging from about 60 mesh to bulk passing through 300 mesh depending to a considerable extent on the particular material being handled.

Unlike an ordinary hammer mill it has no screens to break, wear out of clog. TYCO PULVERISERS combine grinding, classifying, and conveying all in one single unit.

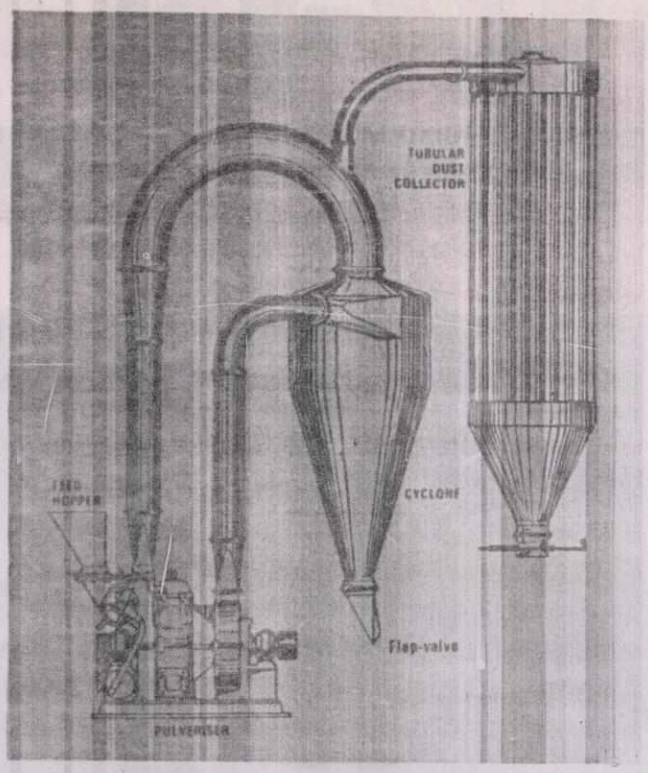
PRINCIPLES OF OPERATION

The standard pulveriser consists of an encased main rotor carrying swing hammers, fineness regulator and pressure gradient creator. Raw material from the feed hopper enters the roll feeder and, as the feeder pockets rotate, spills into the grinding chamber to be reduced by impact with rotating hammers and sides of the chamber. The ground material is carried towards the outlet ; the oversize particles being rejected by the fineness regulators and returned for further grinding. Classified material is then conveyed into the cyclone for collection and bagging. A dust collector is included in the system for ensuring dustless operation and no loss of ground powder.

EVERY INSTALLATION IS ENCLOSED FROM FEED HOPPER TO PRODUCT BIN AND IS DUSTLESS IN OPERATION

SERVICE FACILITIES

Every TYCO PULVERISER is backed up by comprehensive service facilities of which our customers can avail against specific service contract. Supervision of erection and commissioning, periodic inspection service, overhauling of mills, general trouble shooting, are some of the wide range of service facilities we offer from our fully staffed and equipped service department.



Space requirement for standard plant layouts :

Model HP-18 PULVERISER : 3980 mm 2900 mm 5070 mm height.

ELECTRICALS REQUIRED: ONE 30 HP, 1440 RPM, TEFC SLIPRING MOTOR WITH STATOR/ROTOR STARTER.

SOME APPLICATIONS

ASBESTOS	DIATOMACEOUS EARTH	MAGNESIUM OXIDE
BARYTES	GYPSUM	MARBLE
BENTONITE	HYDRATED LIME	PIGMENTS
CHEMICALS	JUTE STICKS	PRUSSIAN BLUE
CALCITE	KAOLIN	PESTICIDE FORMULATIONS
CHINA CLAY	LIMESTONE	ROASTED TAMARIND SEEDS
COAL	LEADOXIDE	SOAPSTONE
CHALK	LAPIZ LAZULI	SYNTHETIC GRAPHITE
CARBON BLACK	(ULTRAMARINE BLUE)	TALC

TYCO (India) Pvt. Limited
4F, Neelambar Bldg., 28B, Shakespeare Sarani, Calcutta-700 017
■ NEW DELHI ■ MADRAS ■ NAGPUR

Fabrication of supporting structure for cyclone and dust collector of Pulveriser

Pulveriser is a versatile grinding unit of heavy and rugged construction and built for cotinuous operation day after day. The various specifications of the pulveriser are as follows:

Make- TYCO(I) Pvt. Ltd.
Model - HP-18
Size - 3980 mm x 2900 mm x 5070 mm
Power- 30 Hp
RPM - 1440
Motor - L & T
Type- High speed hammer mill

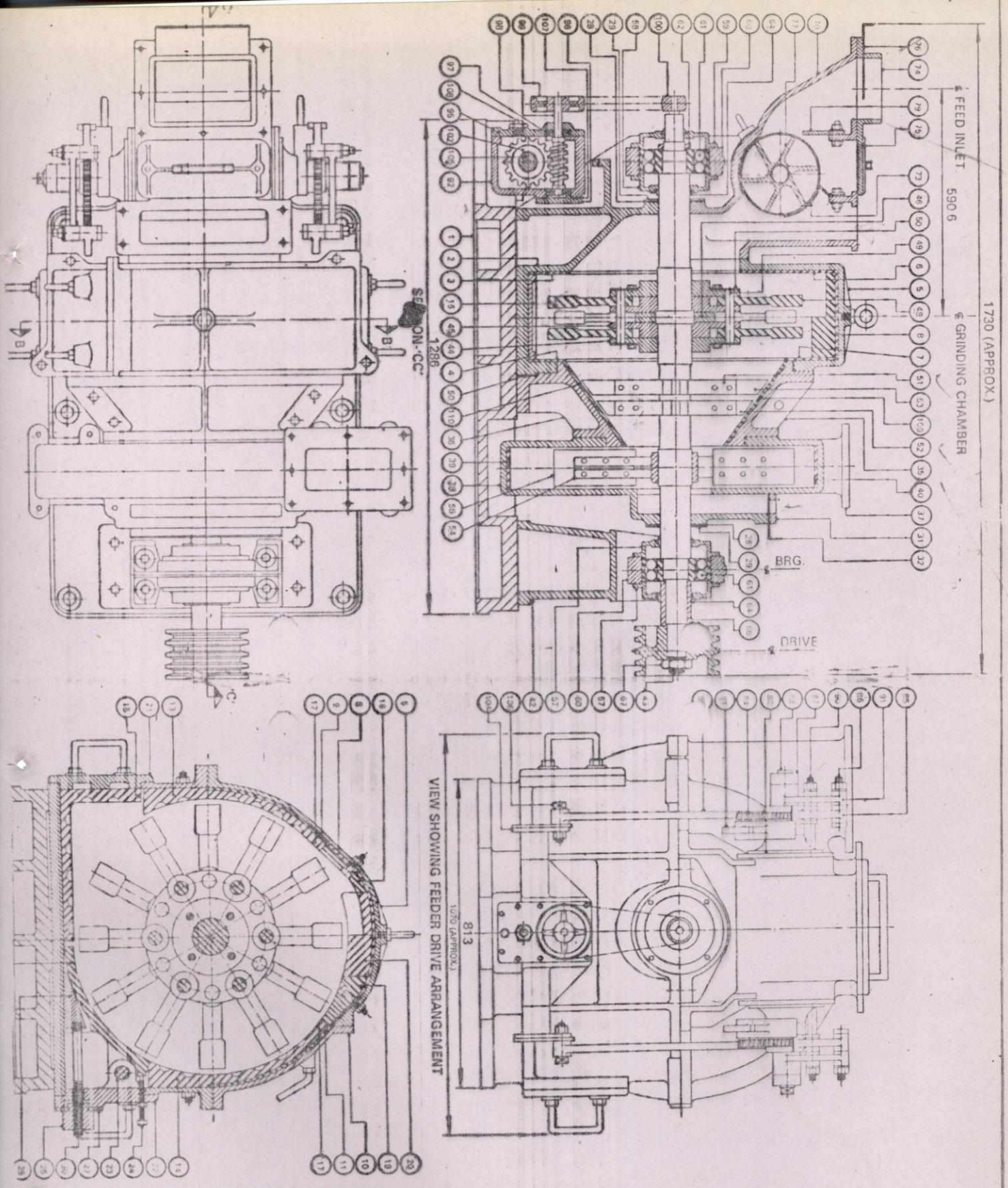
This pulveriser is capable of medium fine and fine grinding of relatively soft and non-abrassive minerals, and many manufactured products. Here in the PMPL it is used to pulverise rise to 250 shieve level and which is further processed to make starch in starch plant.

Outstanding features

- combine suggedness dependability, high efficiency automatic operation,
- dust free, completely integrated system for grinding and classifying,
- low cost operation,
- highest tonnage per Hp
- flexible control over product fineness,
- low maintenance.

Principles of operation

It consists of an encased main solar carrying swing hammer, fineness regulator and pressure gradient creator. Raw material from feed hopper enters the roll feeder and as the



TYCO (India) Pvt. Limited

NERAL ARRANGEMENT OF MODEL HP–18 PULVERISER

AWING NO.		REV.
A/HP 18/2		

ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED

feeder pockets rotates, spills into the grinding chamber to be reduced by impact with rotating hammers and sides of chamber. The ground material is carried towards the outlet, the oversize particles being rejected by the fineness regulators and returned for further grinding. Classified material is then conveyed into the cyclone for collection and bagging. A dust collector is included in the system to ensure dustless operation and loss of ground powder.

Applications

Pulveriser can be used to ground material to different fineness as 60 mesh to 300 mesh or so on. The various types of materials that can be grounded are:

Arbertor	Barytes	Entonite
Chemicals	Calcite	China clay
Coal	Chalk	Carbon black
Diantomaceous earth	Gypsum	Hydrated lime
Jute sticks	Kaolin	Limestone
Lead oxide	Magnesium oxide	Talc etc.

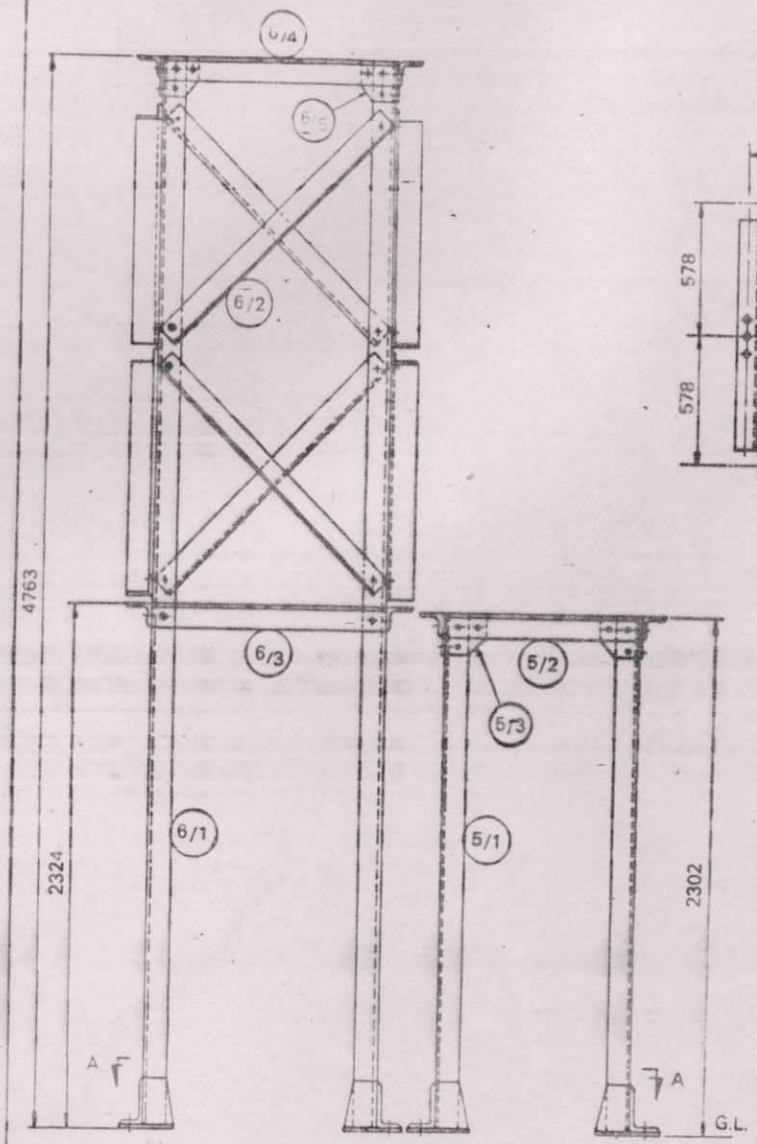
Structure

The various dimensions of the structure are shown in the diagram attached. Little bit of alteration were made during the actual fabrication. The various types of material used are were:

Channels : Size 75 mm, Material - MS

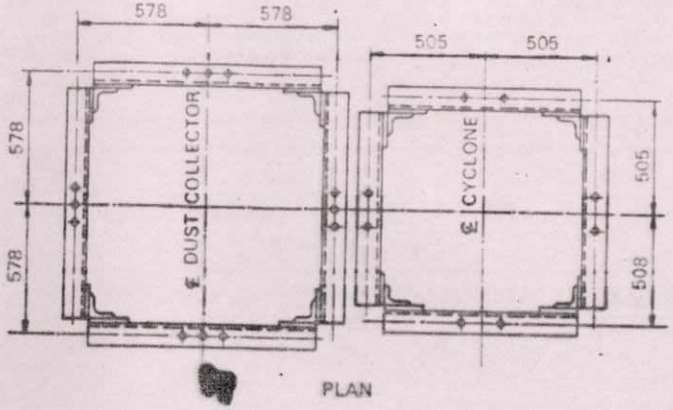
Reinforced plates: Size - 175 mm x 200 mm
Thickness- 5 mm
Material - M.S.

Fartening bolts - 1" x 5/8"
Material - M.S.

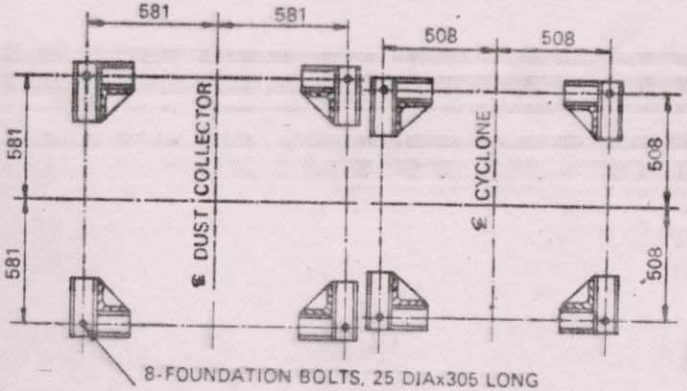


DUST COLLECTOR SUPPORTING STRUCTURE

CYCLONE SUPPORTING STRUCTURE



PLAN



8-FOUNDATION BOLTS, 25 DIAx305 LONG

SECTION ON 'A-A'

TYCO (India) Pvt. Limited

SUPPORTING STRUCTURE FOR CYCLONE AND DUST COLLECTOR—MODEL HP. 18 PULVERISER

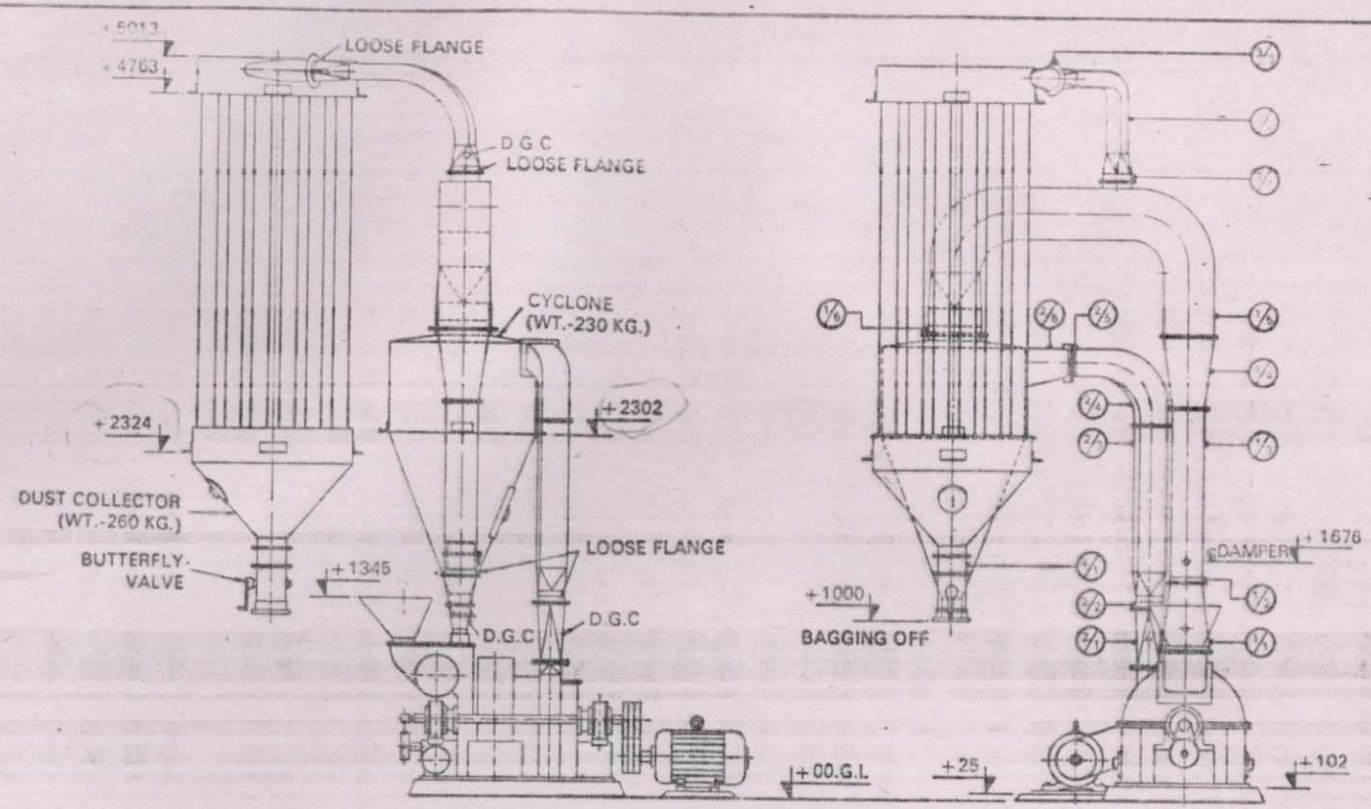
DRAWING NO.		REV.
5GA/HP. 18/5		

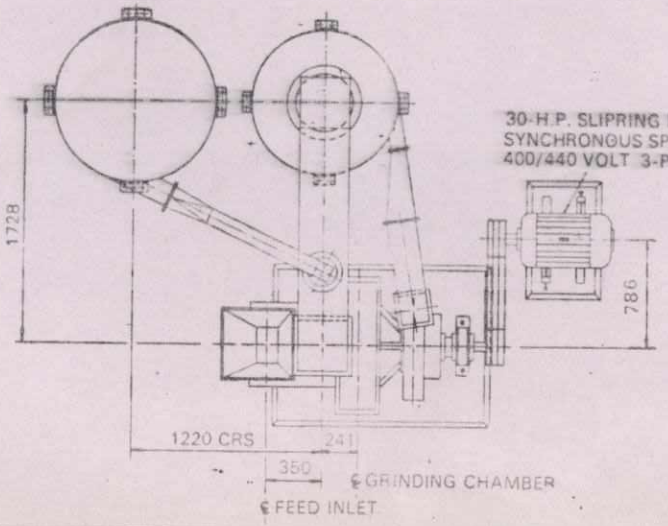
NOTE—ALL DIMENSIONS ARE IN MM. UNLESS OTHERWISE SPECIFIED

Foundation plates: Size- 200 mm x 200 mm
Thickness- 15 mm
Material- MS

Foundation bolts - size 1" x 1"
Material- MS

The whole fabrication was done with one fitter and three helpers in three days time working one shift daily and was successfully errected.





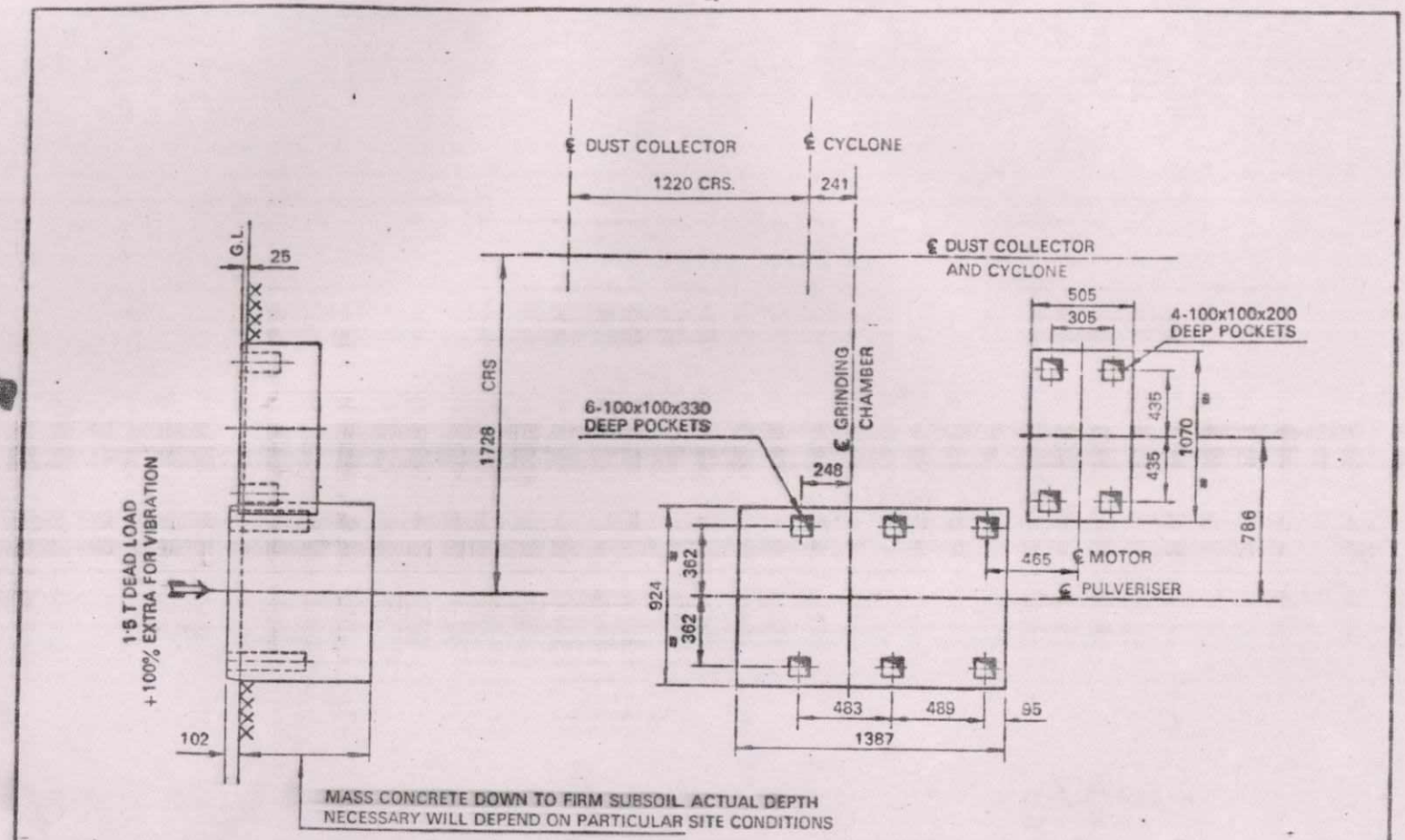
DGC—DRAUGHT GAUGE CONNECTION

TYCO (India) Pvt. Limited

PLANT ARRANGEMENT OF MODEL HP. 18 PULVERISER

DRAWING NO.		REV.
6GA/HP. 18/4		J

NOTE—ALL DIMENSIONS ARE IN MM. UNLESS OTHERWISE SPECIFIED

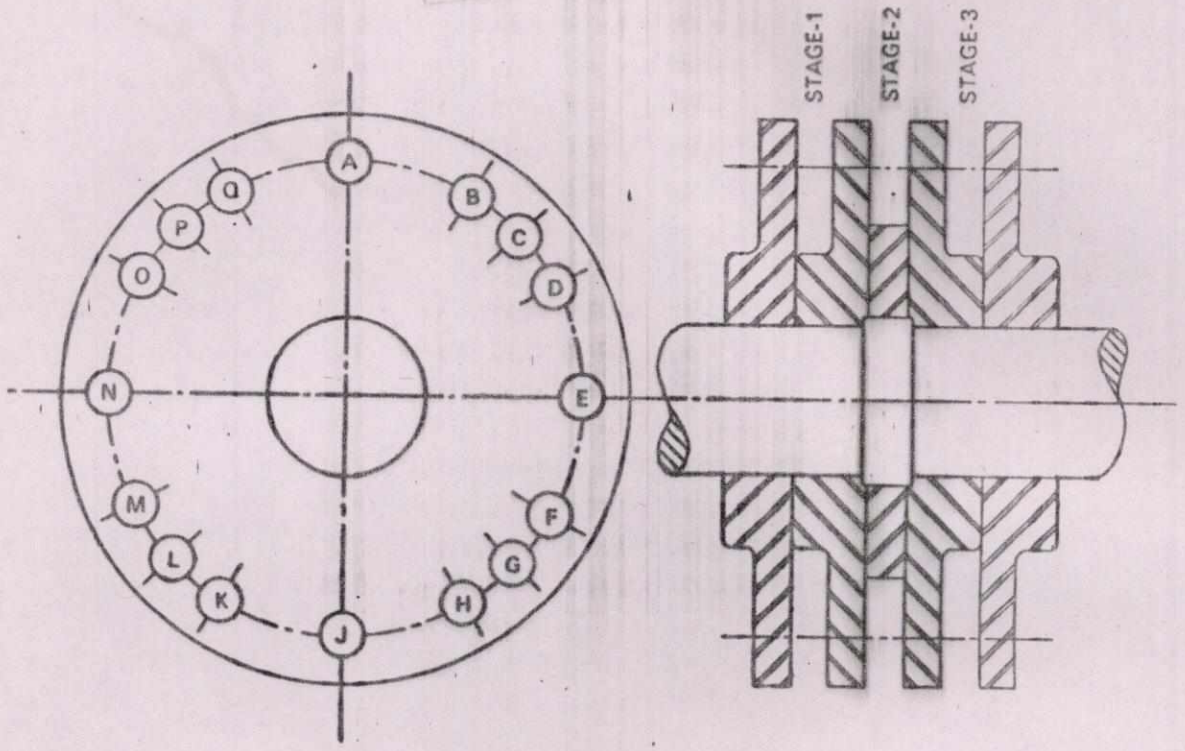


TYCO (India) Pvt. Limited

FOUNDATION DETAILS FOR
MODEL HP. 18 PULVERISER

DRAWING NO.		REV.
5GA/HP. 18/9		

NOTE :-ALL DIMENSIONS ARE IN MM. UNLESS OTHERWISE SPECIFIED



NO. OF HAMMER	6		9			12				18					
STAGE	PIVOT HOLES														
1	A	J	A	F	M	A	E	J	N	A	D	F	J	M	O
2	E	N	D	J	O	C	G	L	P	B	E	H	K	N	Q
3	A	J	A	F	M	A	E	J	N	A	D	F	J	M	O

NOTES :

THE HAMMER & ARRGT. OF HAMMERS ARE

DETERMINED BY EXPERIMENT FOR EACH INDIVIDUAL CONTRACT.

DESIGN, ERRECTION AND COMMISSIONING OF GRINDING MILLS DRIVING ARRANGEMENT

The pulveriser which was errected in order to ground rice at the capacity stated as 1000 kg/hr. But this rated capacity was nowhere near the actual capacity which was from 200-250 kg/hr. If we use the normal stated 35 Hp motor, each time we increase the feed the motor trips.

Now in order to get the required amount of pulverised rice, the errection of small wheel grinding mills was prepared which was accepted. This small grinding mill includes two stone wheels which are fitted on a shaft and a pulley is also fixed on it. The drive is given to the pulley and the stone (lower one) rotates and the rice feed given from the top is crushed and the output is got from the second terminal.

This one grinding machine requires 15 Hp at about 500 rpm.

The plant requirement = 1.6 Ton/hr
Capacity of 1 m/c = 200 kg/hr
No.of m/cs required = 8
Capacity of pulveriser = 200 kg/hr
New grinding machines required = 7

The machines will be errected on two different shafts as shown in Figure. Two parts are done on one shaft four mills are fitted and on other three mills are fitted. Now the design section involves three parts which are interdependent:

1. Design of belts.
2. Design of pulleys.
3. Design of shaft.

The motor used in both the sections i.e.

Section I- Mill No. 1,2,3,4
Section II- Mill No. 5,6,7

is of 60 Hp each and 1470 rpm. So the pulleys which are recommended are as follows:

V-belt pulleys on motor shaft	- 200 mm
V-belt pulleys on shaft ends	- 400 mm
Driver pulleys on shaft	- 250 mm
Driver pulleys of the mills	- 350 mm

Thus rpm of shaft = $1470 \times \frac{200}{400} = 735$

RPM of mills = $735 \times \frac{250}{350} = 525$

Design of Belts

Flat belt for Section I: The belt material - Canvas
Type- Quarter turned

Horse power transmitted by each pulley - 60/4 = 15 Hp

Torque acting on driven belt = $\frac{71,620 \times 15}{525} = 2047$ kg/cm

Note: We will neglect the loss of friction or any slip in the belt:

$\therefore \quad T_1 - T_2 = \frac{2047 \times 2}{35} = 117$ kg

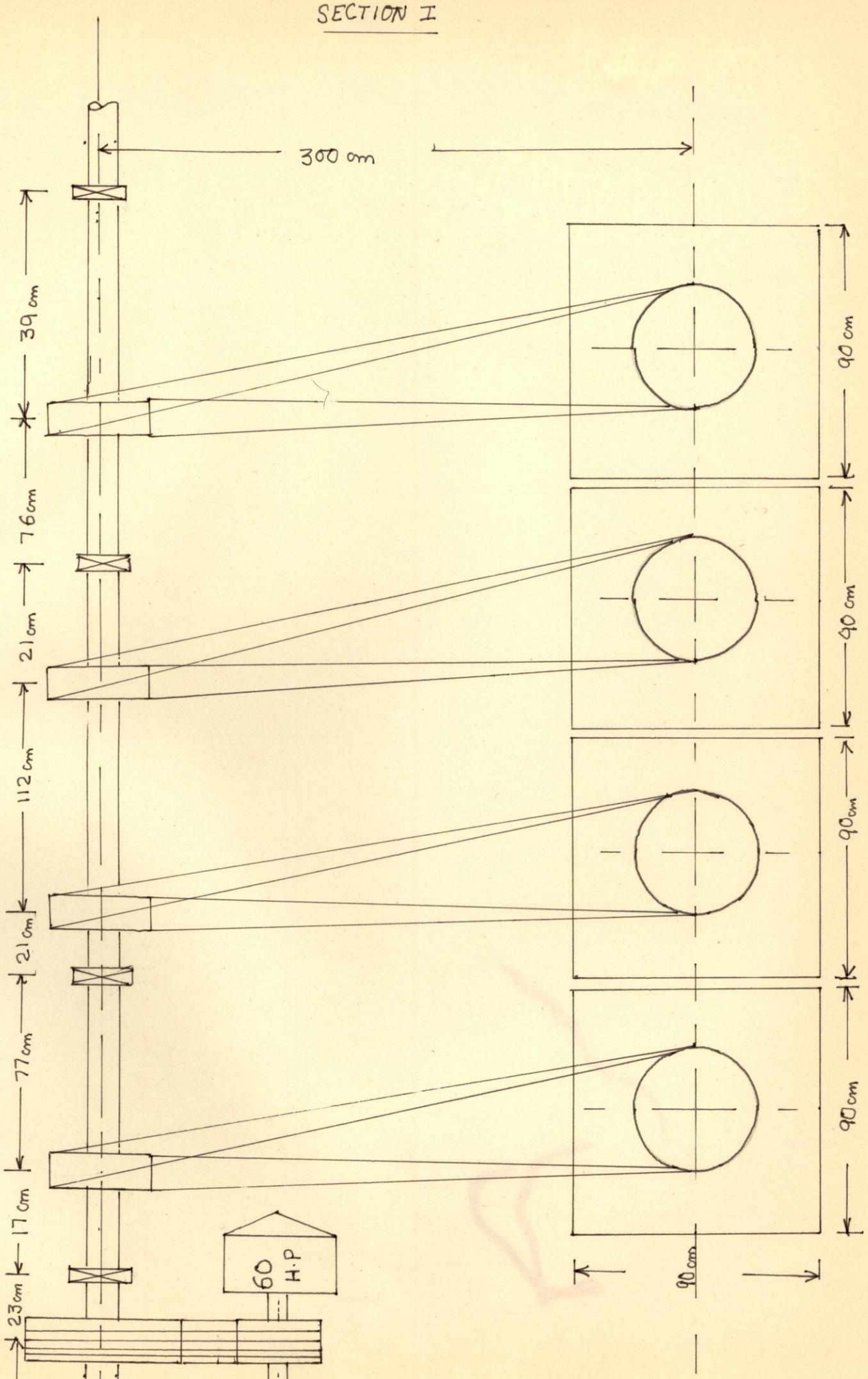
Angle of contact on smaller pulley: $\theta = \frac{D_2 - D_1}{C} \times 60°$

C= centre distance between shaft and the centre of driven pulley = 3 meters = 300 cm

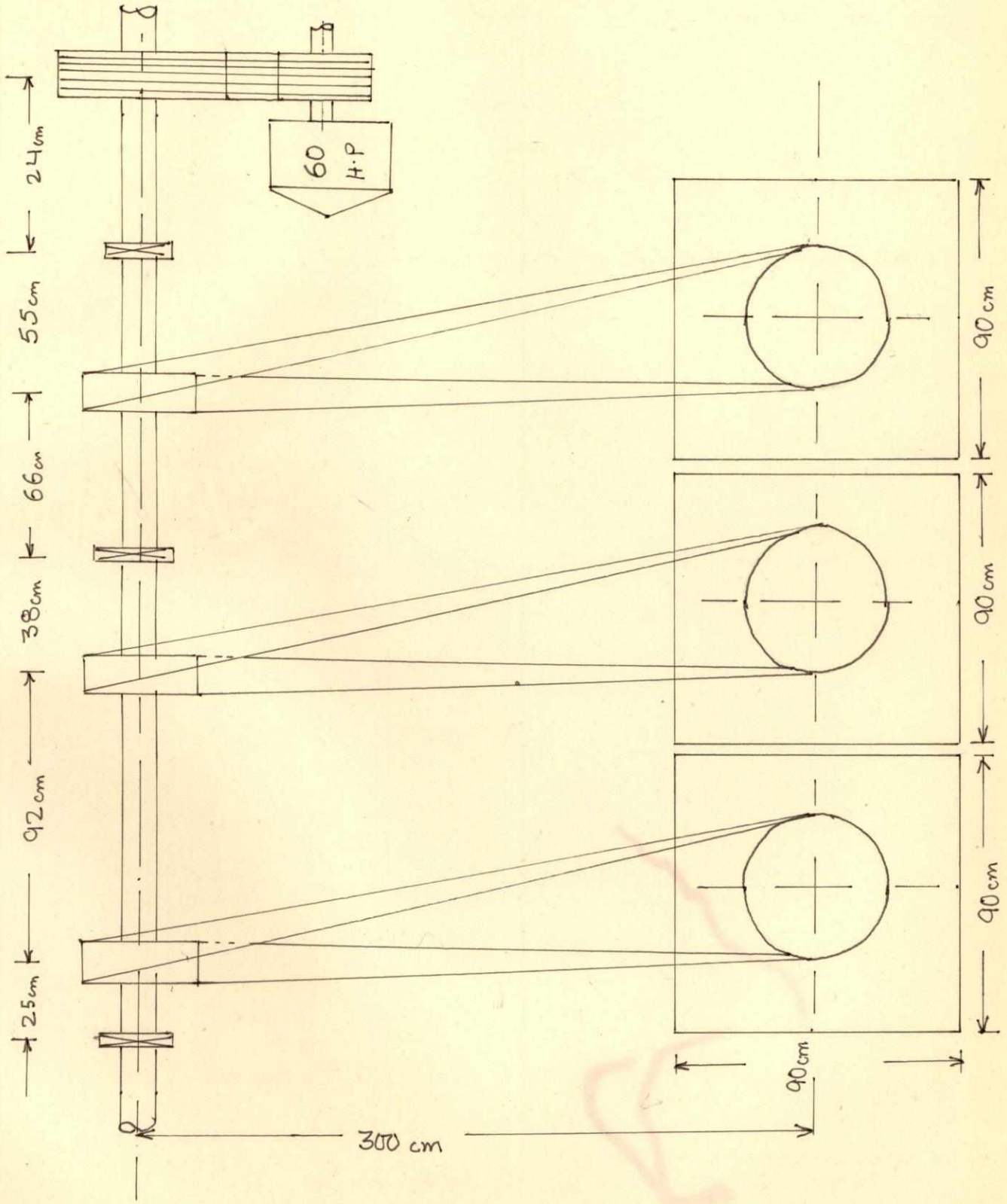
$\theta = 180° - \frac{35-25}{300} \times 60 = 178° = 3.11$ radians

$V = \frac{DN}{60}$ 9.62 m/s

SECTION I


300 cm
39 cm
76 cm
21 cm
112 cm
21 cm
77 cm
17 cm
23 cm
60 H.P
90 cm
90 cm
90 cm
90 cm
90 cm

SECTION II



Note : It is less than 10 m/s, so we neglect centrifugal tension.

$$\frac{T_1}{T_2} = e \qquad \text{where } u = 0.2 \text{ (from tables)},\ \theta = 3.11$$

Hence $\frac{T_1}{T_2} = 1.86$

Solving them we get, $T_1 = 253$ kg, $T_2 = 136$ kg

From tables safe stress of belt is = 25 kg/cm^2. Thus, area of belt = $253/25 = 10.12$ cm^2.

We use 4 ply belt of thickness 1.5 cm. Therefore,

width = $\frac{10.12}{1.5} = 6.75$ cm

Thus, t = 1.15 cm, W= 6.75 cm

Flat belt for Section II: Here 60 Hp is divided into three pulleys, thus each pulley is contributing 20 hp.

Thus torque acting = $\frac{71620 \times 20}{525} = 2729$ kg

$T_1 - T_2 = \frac{2729 \times 2}{35} = 156$ kg

$\frac{T_1}{T_2} = 1.86$ (same),

Hence, $T_1 = 337$ kg

$T_2 = 181$ kg

Area of belt = $\frac{337}{25} = 13.48$ cm^2

Thus, t = 1.5 cm, w = 9 cm.

Length of the quarter turned belt:

$$L = \frac{}{2}(D_1+D_2) + \sqrt{D_1^2 + C^2} + \sqrt{D_2^2 + C^2}$$

$$= \frac{}{2}(35+25) + \sqrt{35^2+300^2} + \sqrt{25^2 + 300^2}$$

= 697 cm.

To provide initial tension, the belt length is decreased by =1%. Original belt length = 690 cm.

Design of V-belt

The pulley sizes are 200 mm and 400 mm. From tables, for speed ratio = 2. $C/D^2 = 1.2$, C= 1.2 x 400 = 48 cm

The belt used is C-type:

C min. = $0.55\ (D_2+D_1) + t$

C max. = $2\ (D_2+D_1)$

Now for sectionC,

Width = 22 mm Thickness = 14 mm
Area = 230 mm^2 Power= 50-100 Hp

Weight per meter length = 0.343 kg

Hence, C min = 0.55(20+40)+1.4 = 34.4 cm
C max. =2(20+40) = 120 cm

Thus the centre distance is between limits.

Arc of contact = $2 \cos^{-1} \left(\frac{D_2 - D_1}{2C} \right)$

$= 2 \cos^{-1} \left(\frac{40-20}{2x48} \right) = 156°$

Belt speed V= $\frac{DN}{60} = \frac{\pi \times 0.2 \times 1470}{60} = 15.4$ m/s

Rated horse power for section C is:

$(1.47\ V^{-0.09} - \frac{142.7}{De} - 2.34 \times 10^{-4}\ V^2)\ V$

De = D x kd

From Tables kd= 1.13, for speed ratio 2

De = 200 x 1.13 = 226 mm.

Thus, solving the empirical formula, the capacity of one C-section belt comes to be 7.12 kw.

From tables rated power is 5.9 kw.

Design power = 60 Hp = 44.76 kw.

Thus, number of belts required = $\frac{44.76}{7.12}$ = 6.29

So 7 belts are to be used.

Length of belt :

$$L = 2C + \frac{}{2}(D_2 + D_1) + \left(\frac{D_2 - D_1}{4C}\right)^2 = 192.33 \text{ cm.}$$

From tables nominal inside length = 1905 mm. In that case, centre distance is changed slightly. Provide adjusting centre distance of ±3%.

Design of Pulleys

Material is cast iron. The other dimensions like diameter is already designed. The maximum speed for split-type pulleys is limited to 1000 m/min. and ours is 577 m/min. much safe. We will use split-type pulleys as their assembly is easy on such a long shaft, and we don't have to provide key ways in shaft and pulleys which are stress raiser.

Flat pulley design

The belt recommended is 10 cm wide.

Hence width of pulley = 1.25 x width W= 12.5 cm

From data book, the number of arms for the pulleys are four.

Length of hubl = $\frac{}{2}$ x dia of shaft =

= $\frac{}{2}$ 75 = 118 mm

Outside diameter of hub d_1 = 1.5 x shaft dia. + 25 mm

= 1.5x75+25 = 138 mm

Hub thickness = $\frac{138-75}{2}$ = 63/2 mm = 32 mm

Thickness of pulley rim t = D/200 + 3 mm for single belt

= 250/200 = 15.5 mm

Section of arm: If we use elliptical section arm with major and minor axis as a and b, then from data book a= 2b.

and thickness at hub = a= 2.94 $\frac{WD}{4N}$ for single belt,

= 2.94 $\frac{125x250}{4x4}$ = 37 mm

Hence b = 18.5 mm

V-belt pulleys

This is 200 mm and 400 mm in diameter. Section C and number of grooves equal to 7.

Flat pulley on mills:

Given dia. of mill shaft = 50 mm

W = 125 mm N= 4 l= $\frac{\quad}{2}$ x 50 =78.6 mm

Outside dia of hub= d_1 = 1.5x50+25 = 100 mm

Hub thickness = 100-50 = 50 mm

Thickness of rim t = $\frac{350}{200}$ + 3 = 20.5 mm

a = 2.94 $\frac{125x350}{4x4}$ = 42 mm

b = 21 mm

Shaft design

For Section I, the belt tensions on each of the flat pulleys is 400 kg and that on the V-belt pulley, is 1875 which is a sum of all the five belts. Now the resultant loads on bearings was calculated and was found that the maximum bending moment acts near the motor and the maximum torque on the V-belt pulley side. Then from the formula:

$$d^3 = \frac{16}{} \qquad (C_m M)^2 + (C_t T)^2 \qquad ^{1/2}$$

The dia of the shaft was calculated which comes out to be 54.7 mm. The value of Cm and C_t is 1.5 for minor shock loads.

For Section II, the belt tension on the flat pulleys is 525 kg each and on the V-belt pulley, it is 1875 kg. Thus after finding the resultant load on each bearing, it was found thatthe maximum bending moment acts in the centre and the maximum torque is due to V-belt pulley. Using the above stated formula. The diameter of the shaft was found to be 49.3 mm. Thus taking safety factor into account, the shaft dia. is choosen as 75 mm.

Note: The shaft material is C-60 and the calculation part is not shown because of it's length and multiplication.

Key design for V-belt pulleys:

We choose rectangular key of mild steel: U= D+B = 88 mm

Width = U/4 = 22 mm
Thickness= U/6 = 14.75 mm
Length = 1.5 U = 132 mm

Errection and Commissioning

For the erection, the list of materials was sent to purchase department with following particulars:

Flat belt - 4 inch, 4 ply, 56 meter
V-belts - C-93 - 14 number
Flat pulleys, split type: 7 numbers
Diameter = 250 mm
Hub length = 118 mm
Outside dia of hub = 138 mm
Hub thickness = 32 mm
Rim thickness = 16 mm
No.of arms = 4

V-groove pulley= C-section
Diameter - 200 mm - 2 No
Diameter - 400 mm - 2 No

Shafts - C-60 mild steel
Diameter - 75 mm
Lengths - 340 cm
- 415 cm

Bearings with brackets:

Double row, self-aligning ball bearings.

Foundation bolts - 1 inch x 1 feet - 50 No.

The whole project was successfully errected and commissioned. The motors of the section I and section II were placed side by side. The shaft was about 75 cm high from floor area and the motors were bolted on the ground.

STUDY OF PRODUCTION PLANNING AND CONTROL

Study the Functioning of production,
Planning and Control Department

Introduction

Industrial Engineering department of IDPL organised the production planning and control department when it was a public sector undertaking to streamline the procedure for reporting the plant performance, consumption coefficients etc. at Punjab Maize Products Ltd., Sangrur. It was desired that production control cell had to be organised round the clock to coordinate all agencies to overcome the troubles and report to the top management about the performance of plant on day-to-day basis.

Importance of production planning and control system

Samuel Eilon, Management expert defined the production planning and control as below:

> "The highest efficiency in production is obtained by manufacturing the required quantity of product of the required quality, at the required time, by the best and cheapest method. To attain this target, management employs production planning and control, the tool that coordinates all the manufacturing activities".

In recent years, it is increasingly becoming apparent that planning and control systems are the basic activities that determine the effectiveness of an enterprise. In fact, it is the nerve centre of an organisation whose effort is mostly to maximise the output and profits, subject to capacity of the plant and marketing constraints. While planning is done to design a particular production system, it is necessary that we

should have control over it, as production planning and control have to go simultaneously. Without having control over production, no planning can be successful and without proper planning no control is useful. So efficient production planning needs efficient production control system too. The problem of getting Material Managers, the Engineers, the Finance Managers and the Production Personnel, working together as a coordinated team to produce a product economically continually faces the management of the organisations. In fact, unless the activities of these departments are closely coordinated, manufacturing will not be achieved with effectiveness. Coordinating these men, materials and machines and equipment are the task of production control.

Production control supervises the flow of work through a plant, so that work progresses from section to section or department to department without delay and with minimum interruptions. Thus through the actions of production control, a customer's order is translated into a manufactured product. The contributions of the production control to the efficient operation of plant is evidenced in many ways:

a) It provides management with the information necessary to plan and schedule work in the plant so that minimum expenses and optimum efficiency can be achieved, both of which make for greater profits.

b) In terms of manufacturing customer's orders, production control assures a more positive and accurate completion.

c) Good production control system also maintains working inventories at a minimum making possible a real saving in both labour and material investment.

d) In these and other ways production helps a company to operate and produce more efficiently and achieve lowest possible costs.

Production control procedures and documents depends upon the type of manufacturing system. In case of continuous manufacturing system the product is manufactured in a continuous uninterrupted fashion as it flows down theline. In continuous manufacturing, the main purpose of production control is to see that sufficient quantity of raw materials is available for use in accordance with the manufacturing schedule and to see that the material flows smoothly through the various manufacturing stages.

Objectives of Planning and Control

The main objectives of production planning and control are:

1. To plan the production based on the sales forecast and plant constraints.
2. To schedule the production with appropriate resources.
3. To coordinate the various functions like production, engineering, purchases and stores, finance, marketing, quality control etc. to see that the production targets are met, thereby meeting the customer's demand.
4. To utilise or mobilise all the resources to optimise the production function.
5. To review the progress of production periodically and take the remedial action to correct the deviations, if any.
6. To provide the status of the production to the top management with appropriate reporting system, and to execute the decisions of top management.

Organisational set-up of production planning and control

For the existing organisational set-up, there are four levels of Managers other than the level of Executive Director/ Managing Director. It is suggested that a department namely Management Services may be created directly under the control of Executive Director/Managing Director, headed by a Manager(Management Services), who could be drawn from the Industrial engineering field. The Manager will be responsible for the function of production planning and control and industrial engineering and safety etc.

The Manager will be assisted by four Assistant Managers to work in the production control round the clock and one more Assistant Manager to work for production planning. These Assistant Managers may be drawn from production department. The existing junior industrial Engineer will be with the Manager(Management Services) to assist the functioning of production planning and control and other industrial engineering functions.

Production planning

The production planning is done at various levels and at various periods. The following procedure is suggested:

1. Annual production plan: The Manager (Marketing) will provide the annual sales forecast in physical units against each product by middle of the January to the Production planning and control department/Manager Management and Services for the period of April to March. The production planning and control will

finalise the production plan within the constraints of marketing and plant capacity and resources available or to the extent resources are made available like men, materials and machines or equipment etc. The final annual plan after the approval by Executive Direction/Managing Director will be communicated to the production, purchase and stores, finance, engineering and other concerned agencies by middle of February. Based on the annual production plan, the requirement of raw materials will be calculated by production planning and control and a purchase indent/requisition will be given to the purchase department by March to take up the procurement action.

Similarly, the engineering department and other departments should arrive at the annual requirement of materials and the purchase indents will be sent to the purchase department. However, in future, a calender indenting may be adopted so that the purchase department can effectively mobilise their resources by proper planning.For example: (i) all indents of raw materials may be placed by March. (ii) All indents of engineering items may be placed by May. (ii) All indents of lab. chemicals and equipments may be placed by July.

2. Monthly production plan: Every month by 18th, the Manager will furnish the details of sales forecast productwise to the PPC for the succeeding month. Based on this sales forecast, and constraints of plant and raw materials like maize etc., the monthly production targets will be finalised in consultation with production, engineering, purchase, finance etc.

and after the approval by the Executive Director/Managing Director, the PPC will communicate the approved target to all the concerned within 7 days. Based on this approved target the PPC will calculate the requirement of raw materials and communicate to the purchase department within 3 days so that the supply of materials will be regulated as per the requirement. Similarly, a copy should be sent to the stores so that the issue of raw materials will not exceed the stipulated quantum as per the target. In case the production department needs the material over and above the allotted quantum, the stores must issue only after the approval by the E.D/Manager PPC. A similar approach may be followed in case of engineering items of consumable nature.

3. Daily production plan: Based on the approved monthly production plan given by PPC, the production blocks will convert the monthly targets into daily targets within the constraints of availability of equipments and time. The day-wise plan with number of batches and output based on reglament output per batch multiplied by planned number of batches should be prepared by the production block for each product and the copy of the day-wise plan for the entire month should be sent to the production planning and control within 5 days from the receipt of the approved monthly plan.

4. Monthly PPR schedules: The engineering department should prepare the planned preventive repair schedules and send the copy to the production planning and control for the follow up. For the effective planning of maintenance, few performa are suggested here to be maintained by the engineering department:

Form No. Engg.1 Equipment History card.

Form No. Engg.2 Equipment Data sheet.

Form No. Engg.3 Lubrication chart.

If these proformae are maintained well regularly, they will enable the engineering department for the effective planning and maintenance in near future. These are the pre-requisites which must be thoroughly implemented. Based on the data provided through these proformae, a detailed study can be carried out for the systematic planning and maintenance of equipment and machines.

Production Control

The production control will have to coordinate the various agencies and review the progress, take the corrective action, put up the status of the affairs to the top level management for the decision/directives. Various documents have been suggested here to compile the information regarding the

a) percentage fulfillment of targets of sales,

b) percentage fulfillment of targets of production,

c) percentage of fullment of maintenance schedules,

d) percentage of loss of production on account of down time of equipment, services.

e) The performance of materials management,

f) Material usage/efficiency.

Further the data collection and processing the information is envisaged at different periodicities. Since the planning is in the descending order from annual plan to daily plan, the progress is

reviewed in the ascending order i.e. from daily to annually. Thus the production is reviewed:

a) daily, b) weekly, c) monthly, d) quarterly, and d) yearly.

The details of reviewing the progress with above mentioned periodicities are given below:

1. Daily production control: In order to review the performance daily, the production control will have to work round the clock and collect the data since there is no primary document in the production department with respect to the process, a basic document called the batch sheet has been desinged under the Form No.Prod-I. Now since liquid glucose is in ful swing, the batch sheet has been designed for the same. In case of Dextrose, the plant is under initial run of production and starch plant and other are still under erection stage and as such for these products the batch sheets are not designed. In due course, the batch sheets for these can also be designed in a similar way.

2. The salient features of the batch sheet of liquid glucose: The liquid glucose plant is a batch made continuous plant unlike a continuous plant. There are no intermediates which can be stocked. The capacity of the plant is 12 m tonne/day with 6 lots per day. Each lot starting from one end to the other end of the plant passes through different stages and finally comes out as liquid glucose. The entire process has been classified into 8 distinguished stages to exercise the control on the process and materials. Once a lot number is given to

continue the same lot number till the final completion of the batch. Here are three hurdles in the process:

a) There is only one holding tank i.e. LG-15 of 6000 litres capacity before the mass is sent to ion exchange equipment LG-18 (i) and (ii). Due to this, in case the LG-15 is occupied partly by previous lot, the next lot coming from filter press LG-14 (i) and (ii) will have to be received in the same tank LG-15 and gets mixed up with the previous lot loosing its identity.

b) Similarly there is only one holding tank LG-22 of 6000 litres capacity, before the material is fed to the vacuum evaporator and causing to loose the identity of the lots.

c) The vacuum evaporator LG-23 (i) and (ii). The capacity being of bigger one, at a time it has to be operated with three lots. Since by the time final desired concentration of liquid glucose is attained, the minimum level of about 4000 litres has to be maintained in the evaporator. This necesstiates to evaporate the three lots at a time and the identity of the lot number is lost.

In order to overcome these troubles, one more holding tank of 6000 litres capacity at LG-15 is required. Since there is one buffer tank near LG-22 of capacity about 2000 litres, till the material reaches last but one stage, the identity of the lot can be retained. At this stage, for each lot the volume and concentration have to be asscertained, before the material is transferred to the evaporator. For each three lots together, one batch number can be given so that summation of all the inputs

of three lots can be related to the one batch of the evaporator. Therefore, in the beginning itself, when a lot is started, the number can be given as:

0001-1
0001-2
0001-3

The last digit represents the lot number and the first four digits represent the batch number. But this type of numbering will pose the difficulty whenever one of the three lots has to be reprocessed, resulting in mixing the lot of other batches.

Therefore, in order to avoid all these difficulties, it is suggested to give lot numbers separately and for every three lots fed to the evaporator, one batch number can be given and finally in the last lot of the three lots, the batch number composed of three lot numbers should be given alongwith output in the batch sheet. This batch sheet consists the columns for writing the materials charged for the lot and the process parameters maintained against each equipment/process/stage etc. This sheet should be filled up by the operator at each stage and hand over to the operator who looks after the next stage. Finally, when the lot/batch is completed, the shift incharge should sign the sheet and the same batch sheet should be sent to the PPC. The PPC will maintain a register against each product and record the raw materials fed to each batch, output of the batch and consumption coefficients against each material as shown in Form No. PPC-5.

2. Equipment occupation sheet: The equipment occupation sheet form No.PPC-I has been designed for liquid glucose. This form has to be filled up by the production control round the clock. The production shift incharge will inform on phone about the movement of batches equipment-wise once in a shift before one hour ending of the shift. This will help the production control to ascertain whether the material is flowing without any delay and if so on account of what reason, so as to take an immediate corrective action. At tne end of each shift the number of batches completed sampled to QCD will be given by the production. QCD will inform the number of batches passed, rejected reasonwise on phone to PPC, which will be recorded in the equipment occupation sheet.

3. Position of services: There are various services used in the plant:

1. Electricity, 2. Steam, 3. Water, 4. D.M. water, 5. Cooling water, 6. Compressed air, 7. Effluent treatment.

The services must be ensured with specified level of quality for the effective production. To ensure this, a proforma No.PPC-2 has been designed. The shift incharge of services will report to the production control twice in a shift about the position of the services which will be recorded in proforma No.2. Based on this production control will regulate the production incase of any difficulty in the services.

4. Breakdown of equipments and services: A proforma No. PPC-3 for collecting the information of breakdown of the equipments

and services has been designed. The shift incharge of production will inform to production control shift-wise about the breakdown, loss of time and loss of production, due to down time of equipment and services. This will be filled in this proforma by production control. In case the production suffers because of breakdown of the equipment and services, the production control will immediately intimate the concerned engineer and all efforts must be made by the concerned engineer to rectify the equipment on the spot immediately. Daily, the same statement should be sent to the PPC duly signed by the production and maintenance incharge by 10 a.m. for the previous day.

5. Stock and receipt of raw materials: Daily the stores will send a statement to PPC giving the details about the daily stock position of the raw materials in the proforma form No. Stores-I by 10 a.m. for the previous day. The PPC will find out the criticality of the raw material as well as excess stock of the raw material compared to the norms and intimate to the purchase department to take corrective action and put up to the top management for information and necessary action. Further a list of criticial material will be sent by the stores to PPC in the form No.Stores-2.

6. Daily stock statement of finished products: Daily the statement of the finished products should be sent to the PPC by 10 a.m. for the previous day in the proforma No.Marketing-I by finished products stores.

7. Daily production statement: Production department will send the daily production statement to PPC in the proforma No. Prod. 2 by 10 a.m. for the previous day. The proforma No. Prod.2 is the same that of proforma PPC-4.

8. Daily quality control report: The quality control will send the information in proforma No. CCL-1 to PPC daily by 10 am for the previous day.

After obtaining all these reports from various departments, the PPC will fill up the proforma No. PPC-6 and report to E.D. by 12.00 a.m so that E.D will be able to review the progress for the previous day with all the departmental Heads by 12.30 p.m. Daily by the end of the night shift i.e. at about 5.30 a.m. the incharge of production control will report the production performance in Form No.PPC-4 alongwith other salient features. In the PPC-4, for starting of batches also similar proforma can be extended if required.

Weekly production control

For the weekly coordination meeting which is already in practice, the same proforma No.PPC-6 can be used with additional information of sales, realisation and outstandings which would be furnished by Manager/Deputy Manager Marketing to PPC weekly.

Monthly production control

1. Monthly report to top management: Every month as on last date of the month, the proforma No.PPC-7 will be filled by PPC and put up to the E.D. so that monthly review can be done

with all the departmental Heads.

2. Monthly fulfillment report: Further, a monthly production fulfillment report will be prepared by the PPC by 15th of every month for the previous month and submitted to E.D. with a copy to production department, engineering department, Finance department and the contents of the report are given below:

1. Record performance.
2. Fulfillment of production and yield.
3. Reasons for the short fall productwise.
4. Raw material consumption productwise and consumption coefficients.
5. Stock position of finished products.
6. Stock position of raw materials, and other materials.
7. Performance of quality control.
8. Production of services.
9. Fulfillment of PPR.
10. Sales realisation, oustandings.

Conclusion

For liquid glucose, all details are given in the proforma. Similar approach may be followed for other products. Further, the norms of stock of material have to be fixed and detailed study w.r.t. mate ials management would be required.

CORRELATION CHART OF PROFORMAE

Sr. No.	Form No.	Description	To be prepared by	To be collected from Form No.	Remarks
1.	Prod-1.	Batch sheet	Production operation and signed by shift incharge and should be sent to PPC.	-	-
2.	PPC-1	Equipment occupation sheet	Shift incharge of Prod. control, shift incharge of production will inform on phone by shift end and before an hour.	-	-
3.	PPC-2	Position of services	Shift incharge of services will inform to the Prod. control on phone and shift incharge of production control will prepare.	-	-
4.	PPC-3	Breakdown of equipment & services	Shift incharge of production will inform Production control by shift end before one hour to be filled by Production control shift incharge.	-	-
5.	Engg.-4	Breakdown of equipment & services	The same proforma PPC-3 has to be filled and duly signed by incharge of production and Enggg. should reach by PPC by 10a.m. for the previous day position.	-	-
6.	PPC-4	Daily Prod. fulfilment report	To be prepared by C-shift incharge of Production control from form No. PPC-1 and by 5.30 a.m. to be reported to ED/MD/Dy.CE/M(P) on phone.	-	-
7.	Prod.-2	Daily Prod. fulfilment report	Same proforma of PPC-4 should be filled by Production incharge and sent to PPC by 10 am. for the previous day.	-	-
8.	PPC-5	Batch-wise consumption coefficients and consumption of raw materials productwise.	To be prepared in a Register for each product from Form No. Prod-1, by PPC month-wise.	This information to be sent by PPC to finance dept. for cost of production.	

9. PPC-6	Daily report to top management	To be prepared by PPC and put upto MD/ED for review with departmental Heads by 12.00 for the previous day.	Production from form No.PPC-4 and Prod.-2. Loss of production from Form No.PPC-3, Engg.-4. Despatches from form No.Mktg.-1, Sales, realisation, etc. from Form No. Mktg.2 (weekly). Inventory of maize and other raw materials from Form No.Stores-1. Finished goods from Form No.Mktg.-1. Critical Materials from Form No. Stores-2. Quality control from Form No. QCL-1.	-
10. PPC-7	Monthly report to top management.	To be prepared by PPC and put upto ED/MD.	Consolidated from daily reports as mentioned in Form No.PPC-6.	
11. Engg.-1	Equipment history card.	Tobe prepared and retained by Engg.dept.	-	This will will help in the planning of maintenance systematically.
12. Engg.-2	Equipment data sheet	To be prepared and maintained by Engg. department.	-	
13. Engg.-3	Lubrication chart	-do-		
14. QCL-1	Daily quality control report	To be sent to PPC by 10 am for the previous day by QCL.	-	
15. Mktg.-1	Daily stock statement of of finished products	To be prepared by marketing manage and sent to PPC by 10 am. for previous day.	-	

16.	Mktg.-2	Sales, Realisation, report	To be prepared by Mktg. Manager on Monday by 10 am. for the previous week and sent to PPC.	-	-
17.	Stores-1	Daily position of raw materials.	To be prepared by stores and sent to PPC by 10 am for previous day.	-	-
18.	Stores-2	Critical material position	-do-		
19.	-	Monthly fulfillment report	To be prepared by PPC and sent to ED/ MD and other departmental Heads	-	-

CONCLUSIONS AND RECOMMENDATIONS

During my training at PMPL, Sangrur, the following conclusions were made:

1. Hopper size of the grinding mills were very small. Its overall capacity is too low, that it is consumed in about 10-15 minutes, thus requiring more frequent filling.

2. Most of the machines installed (smaller ones like motors, fans etc.) are without proper vibration controls, thus decreasing the life of the equipment and stress failure of nuts and bolts.

3. Thousands of nuts and bolts of damaged equipment are only rusted.

4. The material placement (raw as well as grounded) is very improper, thus causing hindrance to free movement of workers and therefore manpower wastage.

5. There is no provision to know about the suggestions or comments of the workers.

Now the recommendations for the above stated conclusions are respectively as follows:

1. The Hopper size i.e. itss capacity is to be doubled so that by the time the first hopper gets vacant, all others are filled by the worker, thus, this way we can save one worker.

2. In order to make the foundation free from the vibration, the use of vibrational pads is suggested. There is no need to buy vibration pads as the damaged diaphragms of diaphragm valves can be used.

3. Rust can be removed with petrol and tap and die work can be performed by one worker thus providing thousands of usable nuts and bolts.

4. At present, there is no material utilization engineer to tackle these problems. So a material utilization responsibility should be established to control and use the material (raw as well as finished) properly.

5. Every where in the plant suggestion boxes should be installed to know about the suggestions and comments of the workers. These comments should be analysed weekly or fortnightly, and the best suggestions should be rewarded.

FORMS AND FIGURES

PUNJAB MAIZE PRODUCTS LIMITED
SANGRUR

Form Engg.-I.

EQUIPMENT HISTORY — This Card No.

Date	Details of Work Done	Down Time	Parts Replaced	Next Replacement Date

Equipment's Name & Description

Reference

Instruction Manual No.
Equipment Record Card No.
Drawing No.

Identification No.	Location

SSK*

PUNJAB MAIZE PRODUCTS LIMITED

SANGRUR

FORM-ENGG-2.

EQUIPMENT DATA SHEET

Equipment's Name					Card No.:		
Maker's Address					Deptt.:		
Agent's Address					Unit:		
					Co. Serial No.		
					Maker's Name:		
Established Life	P.O.No.	Date Received			Dated Installed		
Purchase Cost Rs.	Installation Cost Rs.	Total Cost Rs.			Weight	Height	
Transfer Details					Length	Width	
Installed in Department.	Date	To Deptt.	Date	To Deptt.	Service Needed		

Contd--P/2.

SSK*

FORM-ENGG-2.

Operating Instructions:

Sr.No.	Spares Required & Specification	Company Code No.	Manufacturers Code No.	Number/ Equipt.	Average Life	Kept in Stock/ not in Stock.

Equipment History Card No.
Lubrication Check No.
Inspection Check No.

Remarks:

NOTE:

SSK*

PUNJAB MAIZE PRODUCTS LIMITED

SANGRUR

LUBRICATION CHART

FORM - ENGG-3.

Name of the Equipment	Position No.	No. of Points	Frequency	Type of Lubricant	Consumption	Method of Lubrication	Check Symbol	Remarks

ency Symbol

- ○
- □
- ly △

Method of Lubrication

Grease Gun	GG
Hand Grease	HG
Hand Oil	HO

Check Symbol

Checked & found correct	R
Lubricated Done	L
Adjustment Done	M
Repairs Needed	N

6. Critical Materials (Daily):

Sr. No.	Name of Material	Stock as on today		Norm	Remarks
		Qty. in M.T.	No.of days consumption		

7. Quality Control (Daily):

Sr. No.	Name of Product	No. of samples to be analysed		Samples/Batch analysed		Remarks
		Previous Balance	Received on date	Passed	Rejected	

SIGNATURE----------

P.P.C.(INCHARGE)

/khokhar/

PUNJAB MAIZE PRODUCTS LIMITED
SANGRUR

FORM NO.PPC-6

DATE :-------

DAILY REPORT TO TOP MANAGEMENT

1. Production: (Till date means during the month)

Sr. No.	Product	Tonnage		Fulfilment		Value		% capacity utilisation	
		for the day	Till date	for the day	Till date	For the day	Till date	For the day	Till Date

2. Loss of Production due to time lost etc.

Sr. No.	Product	Loss in Qty.	% Loss	Reasons (B.S. M & O)

B = Due to Breakdowns.

S = For want of Services.

M = For want of Material.

O = Other reasons.

E.D. : For kind information

PUNJAB MAIZE PRODUCTS LTD

SANGRUR

PLANT PERFORMANCE AS ON _____

I. DESCRIPTION	PRODUCTION	DESPATCHES	BALANCE
Dextrose Monohydrate			
Liquid Glucose			

II. CONSTRAINTS

III MATERIAL RECEIPT

1. Raw Material

2. Equipments

IV FINANCE

V. ERECTION

VI GENERAL INFORMATION

MANAGING DIRECTOR,
PUNJAB MAIZE PRODUCTS LTD.,
KOTHI NO.1003, SECTOR 36-C,
CHANDIGARH-160 036

SR.MANAGER(TECHNICAL)

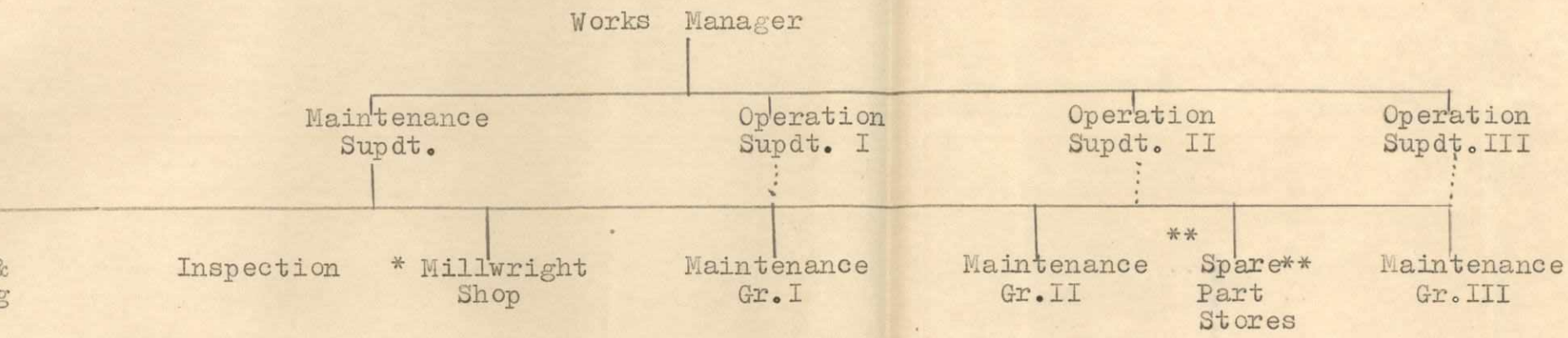
Report format for quarterly reports from P S E S to Administrative Ministries in respect of breakdown of equipments.

of public Sector Enterprise and name of reporting unit
tion of reporting Unit.

Quarter & Year

or ion	Total Plant hours during the quarter	Machine hrs lost due to scheduled Breakdown shutdown	Machine hrs. of scheduled shutdown (as planned)	Target for breakdown hrs. expessed as percentage of available plant hrs.	Actual incidence of breakdown (4b) expressed as % of plant hrs. available	Remarks for variation between (i) 6&7 (ii)4(a)&5
	3	4(a) 4(b)	5	6	7	8

Organisational set-up for Maintenance
(Small size compact factories)



* Including services like air, water, steam, gas etc.

** The type of stores to be kept in these works stores vis-a-vis those to be kept in the Central Stores under the Material Manager will have to be worked out for each plant keeping in view the requirements and organisational set up.

\- - - Shows line of direct control ..... Shows functional responsibility.

QUARTERLY
REPORT NO. 0-05
Quarter ending---------

INDUSTRIAL RELATIONS
(Submission Date-By 15th of the following month)

it:

em	During the quarter	Cummulative to the end of the quarter		Remarks (Reasons, Action)
		Last Year	This Year	
	3.	4.	5.	6.
tal mandays lost				
senteeism				
1 Due to striks, work stoppages etc.(Nos.)				
2 As %age of total mandays available				
ertime payment as %age of salaries and wages of the rkers eligible for over time payment.				
. of disputes				
1 settled				
2 pending				
hers(to be specified)				

RCULATION:

ent - 3 copies(DS/US of the Division concerned, M & E cell, F.A.)

g Commission - 2 copies (I & M Division , M & I Division)

- 2 copies (Production and Finance Divisions).

QUARTERLY
REPORT NO.0-03
QUARTER ENDING_____.

ANALYSIS OF PLANT SHUTDOWN
(For Major Plants only)

*****

?.S.U._____
omitted by 15th of the following month

ars	Plants		
	I	II	III
od of Shutdown for plant maintenance(No.of days)			
lanned			
ctual			
anical Breakdowns			
ature and cause of breakdown			
me taken to rectify the breakdown			
eriod and number of days when the production d to be suspended			
stimated loss of production.			
Problems			
ature of power problem			
eriod of extent of power,cut, if any			
eriod and number of days when production had be suspended.			
stimated loss of production			
aterial Shortage-during the quarter			

Inputs	Quantity required	Qt.received	Shortfall	Stocks at the end of quarter

p/2.

Period when plant had to be shutdown

Estimated loss of production

Labour Problems

i) Nature of labour problem

i) Period during which production had to be suspended

i) Present status of labour situation

v) Estimated loss of production.

x)

Other problems

i) Nature of problem

i) Period during which the production had to be suspended.

i) Present status

v) Estimated loss of production

LOSS OF PRODUCTION (A+B+C+D)*.

1- Loss of production should be assessed independent of target fixed for the period: in other words loss of production should approximately equal to the production if the plant otherwise would have been in production.

2- Information may please be given for each plant separately in the order(I) Ammonia Plant,(II) Urea-Plant (III) S.A.Plant (IV) Phosphoric Acid Plant (V) NPK Plant etc.

*Double counting should be avoided.

PROFORMA FOR WEEKLY REPORT

Report for the period ending_____

f the Plant: M/s. PUNJAB MAIZE PRODUCTS LTD.,
UPPLI ROAD SANGRUR (PB.).

Plan pacity)	Budget for the year 1981-82	Plan for the Month	Cumulative Production till date during the month	Cumulative despatch till date during the month	Cumulative reasons for shortfall in Production
2.	3.	4.	5.	6.	7.

NOTE:- Products name should be mentioned alphabetically.

PRODUCTION STATEMEN
(Submission date - by 10th of th

****

Name of the Unit:

S. No.	Production Name.	Units	Annual rated capacity	Production for the month		Cum.Prodn. upto the end of month	
				Target	Actual	Target	A
1-	2-	3-	4-	5-	6	7-	8-

*Target and Actual to be given in net figures after rejection. The t
targets were fixed.

@ This is generally applicable for drugs. Rejections should include

&The figures in this column are to be calculated on the basis of the

MINIMUM CIRCULATION.

1. Department - 3 Copies (DS/US of the Division concerned, M&S Cell,
2- Planning Commission - 2 copies (I&M) Division and M&I Division).
3- B.P.S. - 2 copies (Production and Finance Divisions).

MONTHLY
REPORT NO. 0-01
MONTH_____.

following month)

end	Prodn.for the year		Loss of prodn. @ during the month due to.							Remarks
ctual	Tar-get	Now anti-cipa-ted.	Power prob-lems	Equip-ment break-down.	Short-age of raw ma-terials	Lab-our trou-ble.	Rejet-ions& in exa-ess of norms.	Other (tobe spec-fied	To-tal loss	Acti-on taken re-quired
9-	10-	11-	12-	13-	14-	15-	16-		17-	18-

argot should be the same figure as approved by Government when

only final rejections.

monthly target.

F.A.).