Latest trends in feed milling & Trouble shooting in a Cattle Feed Plant

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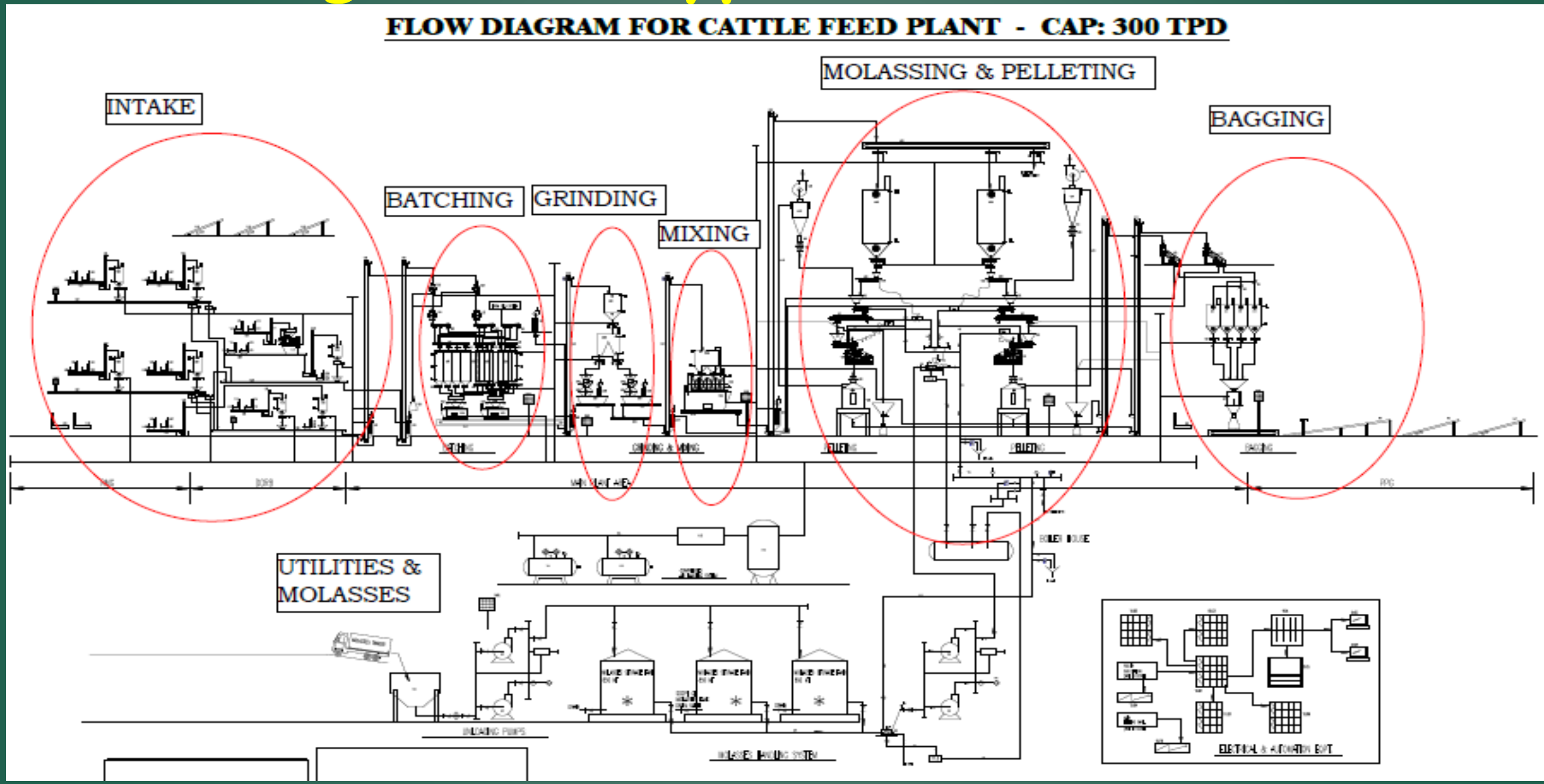
Flow Diagram of Typical Cattle Feed Plant



Intake Section: Concept of Day Bins

Advantages Of Day Bins

- Providing day bins of say 30 cum capacity inside RMG provides buffer stock of Raw Materials.
- By simultaneous buffer storage of various ingredients labour cost & time is saved as material is always kept ready to be conveyed to Pre-Weighing bins (4 to 5 day bins typically provided for 150 MTPD plant).
- Ensures 100% capacity utilization of intake as conveyors are filled to rated capacity
- Can maximize labour utilization and avoid interruptions due to their dependency. Also night shift dumping can be totally eliminated
- Facilitates direct dumping of raw materials from truck to day bins.
- Saves direct labour cost of stacking and later dumping – savings upto Rs 33 lakh/ annum minimum observed.
- Facilitates automation of the dumping operations ensuring continuous availability of raw material at the PW bins

Intake Section: Use of Portable Stackers

Advantages of Portable Stackers

- Use of mechanized system like portable stackers /fixed conveyors to minimize manual labour for stacking of bags in godowns.

- Ensures maximum use of godown vertical space for stacking capacity permissible and achieves even upto 2 ton/sqmt storage

- However, safety aspects to be maintained.

Material stacked in storage godown using portable stackers at CFP, Hassan

Intake-Developments in Premix & Mineral Mix

- Mechanization and automation combined with an efficient dust extraction system in the operation of mineral mixture & pre-mix plant, including vitamin dosing system has been provided for large plants- reduces labour; starting from weighing and mixing to conveying and storage.

- This includes micro dosing and vitamin dosing as well.

- This also reduces handling losses of costly ingredients and improves quality of the feed

Mechanisation of Premix & Mineral Mix Operations

Cattle Feed Plant at Khurda, Odisha

Dust Extraction System in Mineral Mix Plant at CFP, Kaladera,Jaipur

Intake: Use of Galvanized Iron Corrugated (GIC) Silos for Grains & DORB

Advantages of Silo System of RM storage

- ✓ Initial cost 46% costlier than godown storage but no wastage and handling losses. More storage /sqmt.
- ✓ Reduces labour cost of retrieving after stacking.
- ✓ Temperature monitoring & aeration systems ensure upkeep of quality (grains).
- ✓ Auto filling of pre-weighing bins through automation is achieved.
- ✓ Better rodent/pest control especially long storage.
- ✓ Better keeping quality through recirculation (without aid of manual labour) prevents temperature rise of grains.

DORB Silos are provided with hydraulic extractors

Hydraulic Extractor- Morilon, France

Precautions in Using Silos

Moisture of material being stored not to exceed limits defined.

Powdery material or material with lesser bulk density not to be stored in grain silos.

Recirculation to be done regularly (grain).

Temperature monitoring system (grain) to be used effectively for starting blower and recirculation if needed.

Daily recirculation/withdrawal in DORB silos is a must.

Batching Section: Use of Multiple Hoppers

CFP, Katarva
Banaskantha

Advantages of Multiple Batching

- The use of multi batch weigher arrangement ensures parallel batching where hopper discharge can be simultaneous. This doubles the number of batches prepared and sent to the mixed feed bin per hour.

- Better accuracy of minor and major ingredients.

- Flexibility in material loading selection for a a batch formation helps in even loading of hammer mill wherever pre-mixer is absent.

Use of SCADA based Automation for Batching, Grinding, Mixing & pelleting at CFP, Katarva

Advantages of SCADA

- ✓Ensures filling of Pre-weighing bins from day bin automatically.
- ✓Auto cleaning of cascade magnets achieved with ferrous impurities brought straight down to GL.
- ✓Batching, grinding, mixing, pelleting sequencing & interlock with minimum hardwiring and eliminates manual operation which if needed can be done from the SCADA.
- ✓Can Optimises travel time from grinding to mixed feed bin through setting from control room.
- ✓With IMCC there is added advantage of availability of real time electrical parameters which can be stored for diagnostics, scheduling maintenance etc .

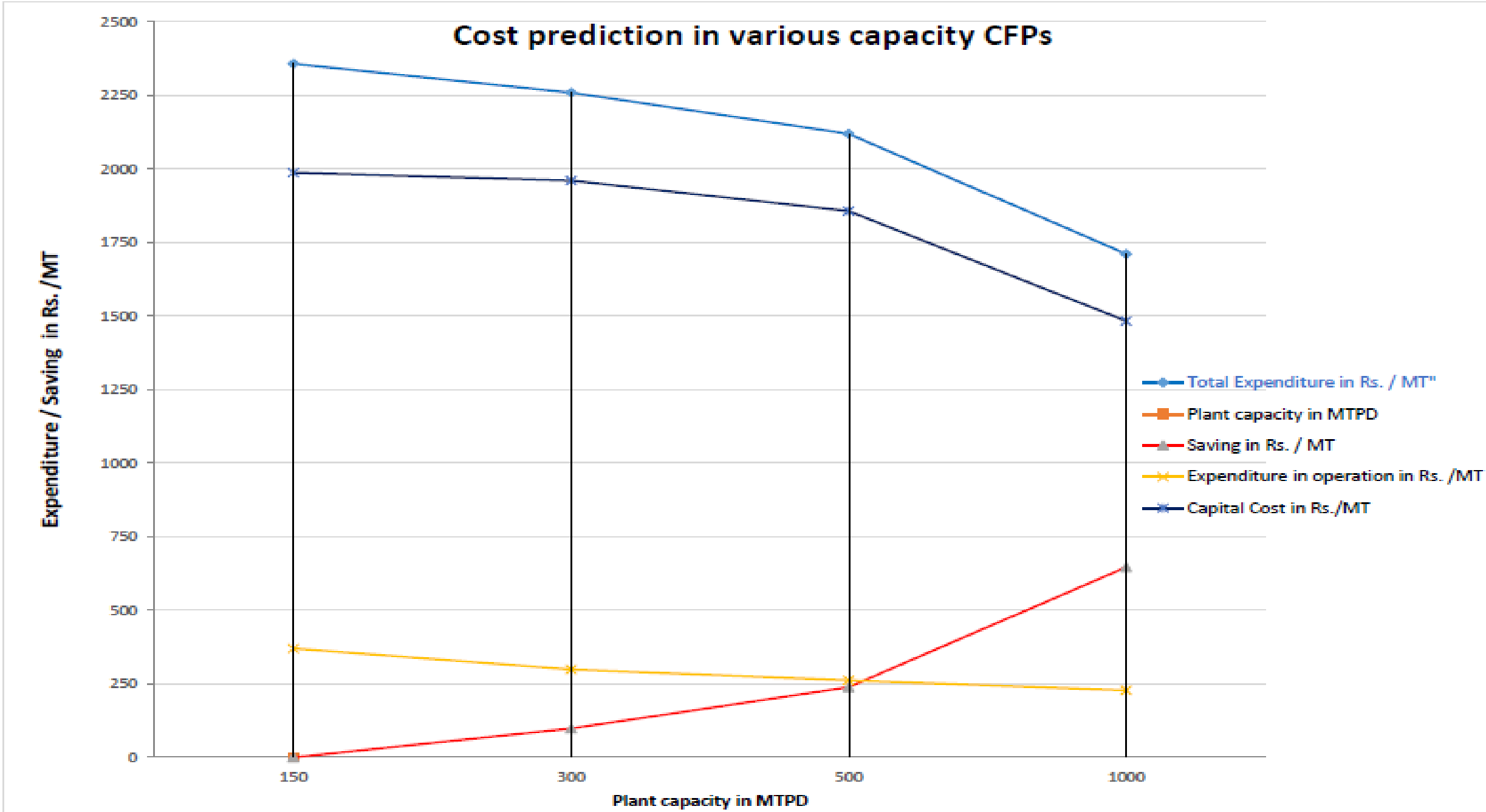
Diamond Shaped Cascade Magnet at Erode

Some Trends on Plant Sizes

- Higher the plant capacity – lower the operating cost/MT (Also higher the pellet mill throughput lesser the KW/ton).

- A plant of say 150 MTPD is designed and constructed with envelope considering future higher capacity (300 MTPD). In future only the 2nd pelleting equipment is added within the same plant area.

- This saves future cost. The cost of higher capacity Hammer Mill & Batch Mixer with other related equipment is minimal compared to the shutdown cost of expansion.

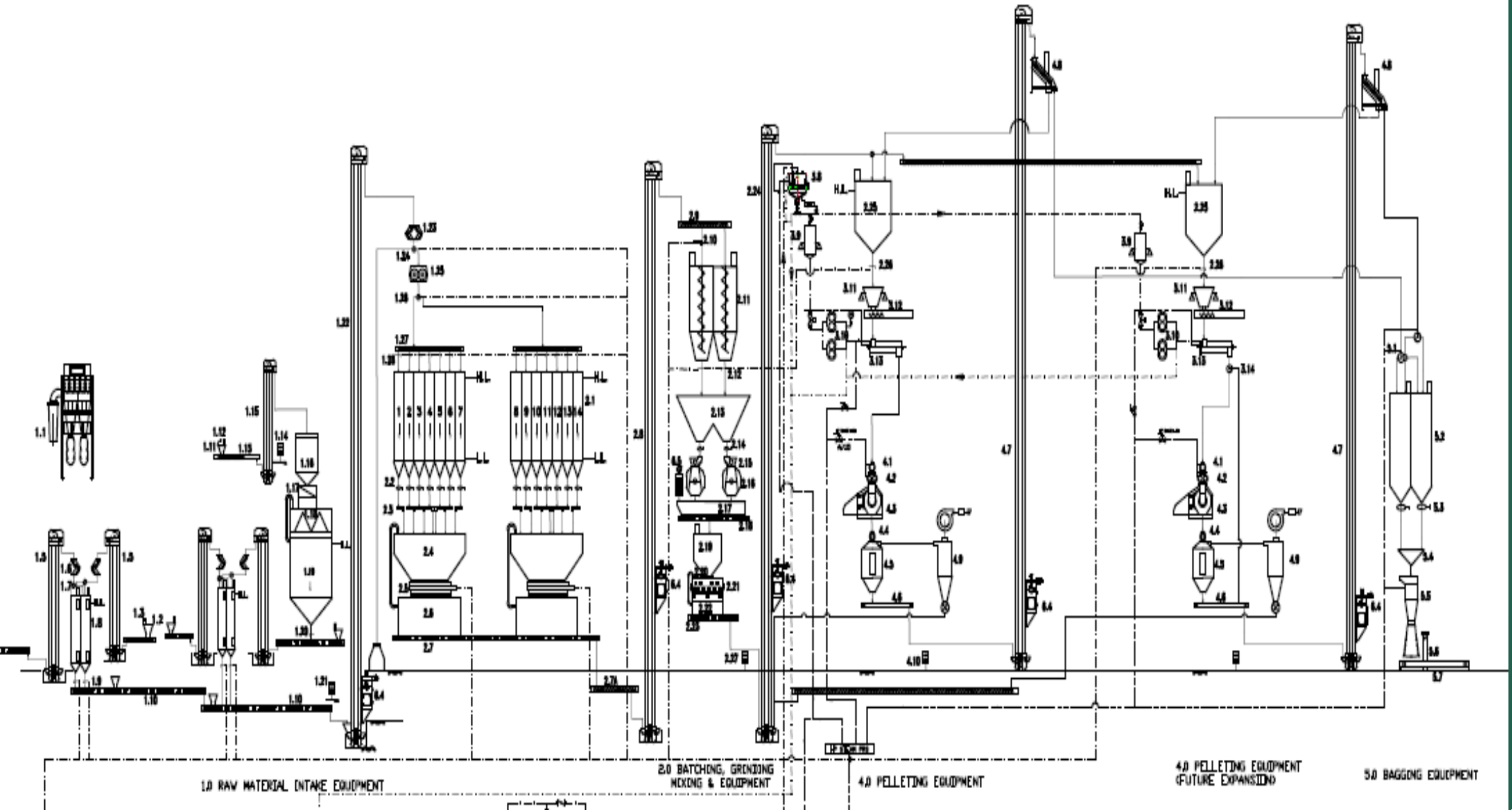

Cost prediction in various capacity CFPs
Expenditure / Saving in Rs. /MT
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
150
300
500
1000
Plant capacity in MTPD
Total Expenditure in Rs. / MT"
Plant capacity in MTPD
Saving in Rs. / MT
Expenditure in operation in Rs. /MT
Capital Cost in Rs./MT

COST COMPARISION OF VARIOUS CAPACITY CFPs.

	Capacity in MTPD	150	300	500	1000
		(Rs. lakh)	(Rs. lakh)	(Rs. lakh)	(Rs. lakh)
1.0	Capital investment including land cost.	4590.00	9028.00	14230.00	22720.00
2.0	Interest on capital investment @ 9%	413.10	812.52	1280.70	2044.80
3.0	Depriciation considered on civil bldg. & steel structure @5% & plants and machineries @15% (ave. @10%) (excluding land value)	675.00	1333.95	2107.50	3367.50
4.0	Total expenditure per year (2 + 3)	1088.10	2146.47	3388.20	5412.30
5.0	**Total capital Expenditure / day / MT (Rs. / MT)**	**1987**	**1960**	**1857**	**1483**
6.0	Expenditure in operation (Rs. /MT)	370	299	262	228
7.0	Total Expenditure /MT of feed production (Rs. / MT) (7=5+6)	2357	2259	2119	1711
8.0	Saving /MT	0.00	98.17	238.68	646.74

Some Trends in Grinding

- Relocating hammer mill wherever possible above batch mixer not only reduces capital and operating cost but also ensures lower power requirement and lesser dust owing to powder transfer as powder elevator is eliminated.
- Use of vertical mixers before grinding ensures uniform loading of the Hammer mill and prevents choking as feeder would be uniformly loading the hammer mill . This also ensures longer life of the machines and beaters.
- Hammer mill doors are made sliding type saving space & ease of maintenance


1.0 RAW MATERIAL INTAKE EQUIPMENT
2.0 BATCHING, GRINDING MIXING & EQUIPMENT
4.0 PELLETING EQUIPMENT
4.0 PELLETING EQUIPMENT (FUTURE EXPANSION)
5.0 BAGGING EQUIPMENT


Vertical mixer - 21 m. level

Hammer Mill with sliding doors

Courtesy: M/s CEASPL, Kerala

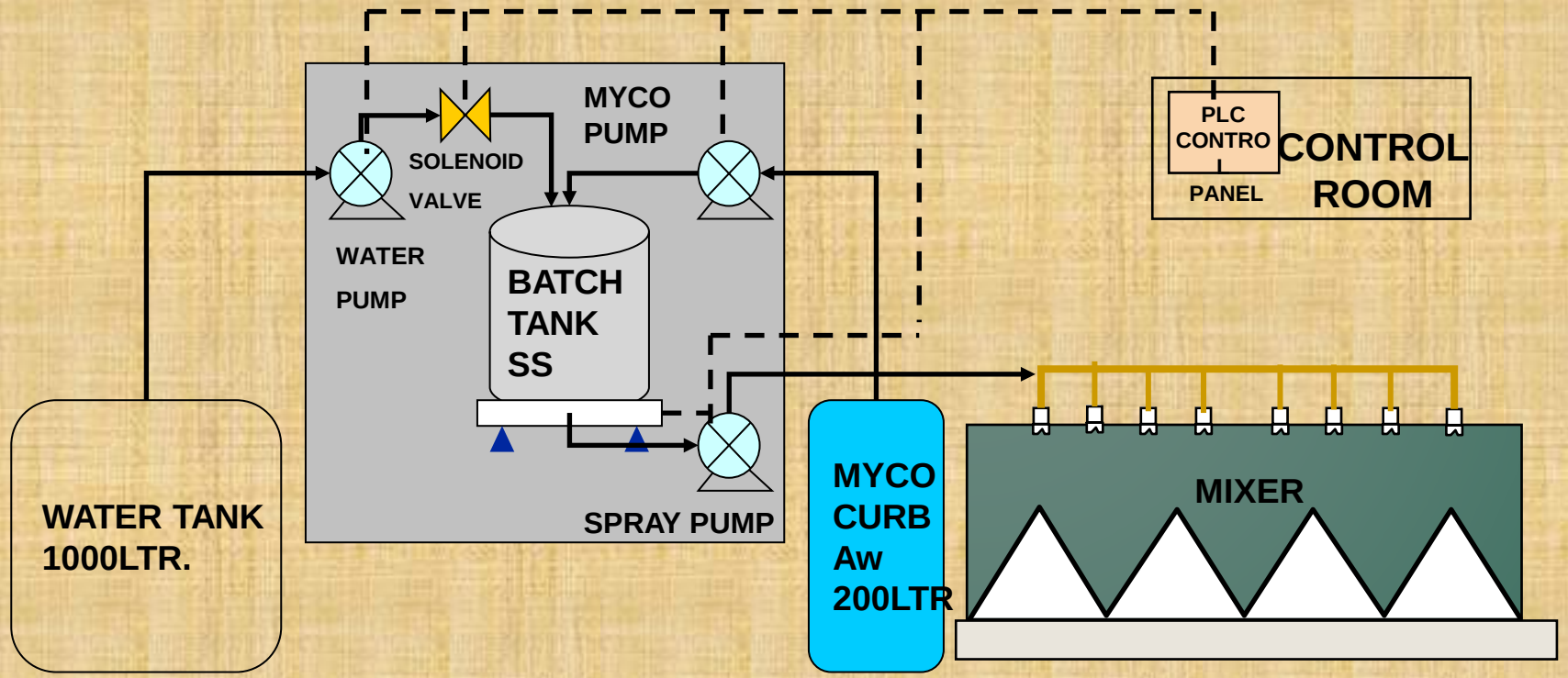
Some Trends in Mixing

- Use of cylindrical design Batch Mixer from tear drop design ensures better mixing efficiency with lesser mixing time < 3 minutes.
- Rotor of Paddle type with direct coupled Geared motor type and with facility to inject molasses upto 3 %.
- Manual sampling arrangement to check the mixing efficiency (coefficient of variation or Cv < 5).
- Provision of moisture addition in Batch Mixer to help prevent moisture loss of end product.

Direct Geared Motor Coupled Cylindrical Batch Mixer

Example of Moisture Control By Addition of Mixture of Organic Acid & Surfactant By M/s. Kemin

Schematic



Molassing & Pelleting Section

- Relocation of the Molasses mixer above the pellet mill ensures lesser breakdowns and operational /choking issues of conveying molassed feed.
- Use of slow speed molasses 144 RPM mixer which reduces power by almost 70%- lesser breakdowns and has an increased life – can mix upto 16% molasses.
- Use of double layer (single/twin rotor) conditioner ensures not only improved hygenization , better absorption of molasses, better cooking of meal but also gives uniform pellet quality and improved life of pellet mill.
- For bigger plants use of CRT (Controlled Retention Time) units with 4 minutes of ripening time before pelletization offers better absorption of molasses and better quality pellets.

Molasses Mixer Above Pellet Mill

Triple Layer (Twin Rotor) Conditioner

CRT long term conditioner - 11 m. level

Molassing & Pelleting Section Automation

- Automation of complete molassing and pellet section upto bagging eliminates the pellet RCP if control room is on pellet mill floor. Automation includes:
  - Steam control to conditioner based on feed temperature setting, generally 68 to 70 deg C.
  - Control of feeder to pellet mill based on feed back loop of pellet mill amps
  - Control of molasses injection based on formula setting using the L-I-W method
  - Auto dump operation on loss of power/high amp setting
  - Feeder cutoff on mash flow stop or Bagging bin full.

Use of L-I-W or loss in weight method for accurate molasses injection. Discharge rate of mash weighed and communicated to PLC for set molasses injection

Some Trends in Pellet Cooling

- From the earlier MS column type design, the pellet cooler has been changed to the counter current design, housed in separate room with ducts carrying cool air from the top of the building for better efficient cooling. (see photo). Also all product contact parts are of GI/SS.

- For higher capacity pellet coolers the Use of twin /multi cyclone at the pellet cooler ensures more efficient cooling and the SPM of exhaust lesser than 30mg/Ncum.

- Wherever possible if the pellet cooler cyclone is located nearer to pellet cooler, it ensures lesser maintenance issues

Fresh Air Ducting at CFP Katarva

Separate Pellet Cooler Room With Fan Duct

Pellet Cooler Cyclone Located Nearer to Pellet Cooler at CFP, Kaladera

Bagging Section Trends……

- Double weigher semi automatic bagging machines fort small plants can bag upto 20TPH (6 to 7 BPM) where bags are clamped manually.
- Bagging details can be made available both locally and at the main plant PLC.
- Use of auto sampler for sampling final feed.
- Use of telescopic conveyors help send filled bag directly to trucks and can save labour cost.

Double Weigher of Bagging Station

Auto Sampler - CFP Katarva

Telescopic Conveyor

Aspiration Improvements

- Improved dust extraction system for dumping operations in raw material godowns and silo unloading docks.
- It is observed that dust levels in the godowns has reduced from 100 to 170 mg/Ncum in earlier plants to < 30mg/Nm3 in the new plants.
- Use of efficient localized aspiration units in dust generating areas in place of centralized aspiration system, including over conveyors like distribution chain conveyors over Pre –weighing bins, and on all elevators to keep the plant dust free as far as possible and to avoid cross contamination.
- Also the use of blowers with silencers to reduce noise level in the plant.

Dust Free Godowns

Dumping Hopper Aspiration Unit- CFP Kaladera

Spot Filters With Silencers on Conveyors

CFP Kaladera

Distribution con.
above proportioning bins - 21 m. level

Utilities and Services

- Use of screw type air compressors (VFD driven) along with refrigerated air drier, instead of reciprocating receiver mounted type, not only reduces noise but leads to energy savings and has lesser maintenance costs.
- Use of IE2 motors reduces overall energy costs by at least 2 % and payback 7 months.
- Use of LED lighting fixtures leads to savings in energy although payback is about 2.7years. However fittings are maintenance free with lumens depreciation of 15% max at end of 15 years.
- Agro based/solid fuel boilers reduces steam cost from Rs 2.5 to 3 per kg to Rs 1.5 per kg.
- Fire fighting system complete with hydrants.

Screw Type Air-Compressors

Agro Waste Boiler/Solid Fuel Boiler

Trouble Shooting

Again Best Understood Section Wise

- Trouble shooting and down time can be largely eliminated by following a systematic Preventive maintenance schedule.
- By ensuring the various sections of the plant are well maintained, the plant can easily achieve the rated capacity and even more depending on the formulations.
- The four variables are machinery performance, Good quality raw material and utilities, following correct processes and most importantly manpower.
- A section wise approach may be adopted.

Intake Section

✓The purpose of this section is to ensure that quality raw materials are always made available at the PW bins. The Key to trouble free performance include:

- Ensuring tip top condition of all conveyors & elevators (chain slack/belt slack/bucket tightness etc.).
- Efficient performance of Magnets & Jute twine removers.
- Product flow ability -No choking owing to material characteristics anywhere in machine or pipes.
- Compressed Air -pressure at 6 bar always available for gates/flaps operation.
- Last but not the least there is no Labour or Raw material shortage.

Batching-grinding-mixing Section

- The purpose of this section is to ensure that the mixed feed bin (pelleting bin) never runs out of mash. Key is:
  - To ensure that sequence of batch formulation dose not choke the down stream hammer mill (in plants that do not have vertical mixers)
  - Maintain the Hammer mill at high level of performance.
  - To ensure no choking of ground material in any hopper till it reaches the Mixed feed bin.
  - To maintain the level switches, flaps and compressed air system in perfect condition along with the computerised batching system since automation is the heart of this section, especially travel time from weigh hopper through the hammer mill to the pelleting bin.

Molassing-Pelleting Section

- This section ensures bagging section is continuously occupied. The key here is continuously monitoring the continuity of pellet production through PM amps and the temperature of feed. In manual plants this is totally dependent on the operator.
- Three factors dictate the smooth operation of this section:
  - 1) Smooth flow of molasses and ensuring that the same is sprayed at the right temperature (around 50 deg C) into the molasses mixer.
  - 2) Saturated Steam at right temperature is added for conditioning the meal since the purpose of steam is both to add heat and moisture. Moisture is easily absorbed by the particles when not ‘wet’. Every 10 deg C rise in meal temp adds about 1% moisture.

Pellet Cooler

- 3) Just as heat and moisture were added in the conditioner, in the pellet cooler, the steam heat (plus heat of friction) is to be removed along with the moisture. Heat picked up by air in the cooler increases its temperature which in turn increase its capacity to pick up moisture.
- Heat in the pellet provides the energy to move the moisture from the core to the surface (just opposite of conditioning) where it is picked up by the cooling air.
- Therefore the pellet cooler functioning especially the blower performance and its cfm output, the velocity of the air etc., is of utmost importance to ensure that the surface moisture from pellets is easily picked by the cooling hot air.

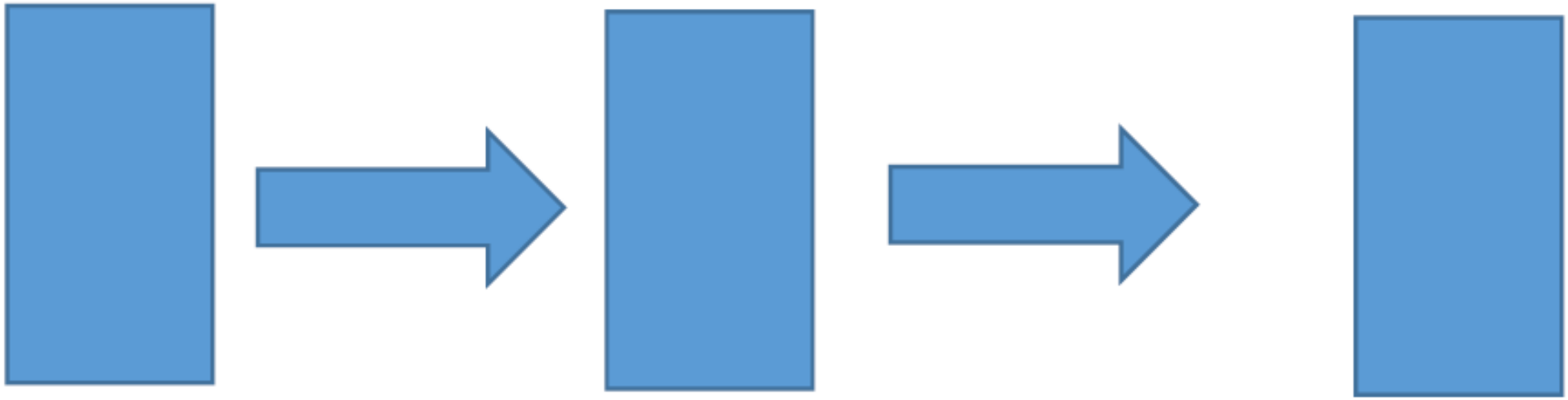
Importance of Conditioning

- **Heat:**
  - Gelatinises the starch
  - Plasticises the protein
  - Destroys pathogens
  - Aids in drying of pellets in the cooler.
- **Moisture:**
  - Softens, forms cohesive bridge & lubricates the mash reducing friction between walls of die and mash and hence reduces wear of the die
  - Overcomes shrinkages
  - Reduces sp. Energy consumption
  - Reduces fines.

Moisture addition in feed

Moisture levels	Percent	Ideal
in RMG feed ingredients (Ave)	10 to 12	11
Loss after grinding max	2	1.5
through Molasses (max)	2.5 to 3	2.5
through saturated steam	2.5 to 3	2.5
after conditioning	14 to 17	14.5
Final expected after cooling during bagging	11.5 to 11.8	11.5 to 11.7
0.5 to 0.7 losses in storage		
through migration to surface		

Effective Trouble Shooting is Finding Where The Link in The Chain is Getting Broken



Thank You