

Packaging and Labeling Industries

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Abstract

Packaging has great role in attracting customers. Big manufacturing units attract customers on the basis of packaging and labelling. It beautifies the product but at the same time one must know the proper techniques to pack the material depending upon the nature.

Keywords-**Air compressor, Moulding packaging, machinery**

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I. Introduction

Packaging is the science, art and technology of enclosing or protecting products for distribution, storage, sale, and use. Packaging also refers to the process of designing, evaluating, and producing packages. Packaging can be described as a coordinated system of preparing goods for transport, warehousing, logistics, sale, and end use. Packaging contains, protects, preserves, transports, informs, and sells. In many countries it is fully integrated into government, business, institutional, industrial, and personal use.

It also includes manufacturing and selling of bottles, containers, and PET preforms. The companies offers packaging products for dairy products, sauces and condiments, agro chemicals, food products, home and personal care products, pharma products, liquor and spirits, pickles and spices, home care products, and gifts and premiums. It also includes exporting of products.

Major Requirements for running of factory (Production) are:

- Power
- Water
- Air

Other Basic Utilities include:

- DG (Generator): Backup power
- Boiler : Provides Steam

- Refrigeration: (includes)
 - ❖ Chiller
 - ❖ Cooling Tower
 - ❖ Air Compressor
 - ❖ etc..
- Water System (R.O. water): Processed/Filtered water.
- Fire System (Fire Safety Measures)

Operations in Production of goods out of raw material include:

1. Pre Moulding Operations
2. Moulding
3. Post Moulding Operations
4. Packaging and Delivering
5. Maintenance
6. Tool Room

II. PRODUCTION

Pre Moulding Operations:

Includes: Drying of Raw Materials (Removing the moisture present in them) to prevent bubbling and markings on the product and to ensure clarity of the surface of the product.

Moulding:

Different types of Mouldings include:

- ❖ Injection Moulding (IM)
- ❖ Injection Blow Moulding (IBM)
- ❖ Stretch Blow Moulding (SBM) :
 - Manual SBM
 - Automatic SBM
- ❖ Injection Stretch Blow Moulding (ISBM)
- ❖ Extrusion Stretch Blow Moulding (EBM)

Injection Stretch Blow Moulding (ISBM):

Introduction:

Raw Material is warmed, dried, liquefied, Injected, Stretched and then are Blow moulded into the desired goods.

Requirements:

A. Power and Machinery:

- a) Power (440 Volts)
- b) Hydraulic Oil (Grade: 46)
- c) Induction Motors
- d) SMPS: Switch mode power supply.
- e) Rectifier (Input: 220 Volts AC to Output: 24 Volts DC)
- f) Pumps:
 - i) Vane Pump
 - ii) P1 Pump
 - iii) P2 Pump
- g) Hydraulic Valves (for mechanical operations).

B. Water:

- a) Chilled Water (4kg)
- b) Cooling Tower (4kg)

C. Air:

- a) LP (Low Pressure) air supply (pipeline): for Pneumatic Cylinder Operations. (7kg to 9kg)
- b) HP (High Pressure) air supply: for Blowing Operations. (20kg to 28kg)

Procedure: { Product Development }

1. Raw Material is taken and Regularly warmed in the heaters.
2. With the help of "Honeycomb type Machinery" material is run into a continuous cycle of warm air where the "Honeycomb Net" absorbs all its moisture and dries the material completely. The moisture is exhausted through vents. The moisture less material is then moved forward.
3. Movements are regulated with the help of different motors and sensors.

4. The material then goes through a combination of heaters in small quantities. The combination consists of 3 to 4 heaters which liquefies the material. Colors are mixed thoroughly during this time. The temperature of the different heaters varies between 160C to 200C.
5. The liquid is then sent into the mould with help of a piston. This is known as Injection.
6. Within the mould, first the preforms are prepared which are then stretched as per requirements (for 0.15 Seconds) and then blow moulded into the final product which is then ejected from the mould.
7. The product then proceeds for quality check and then packaging and delivering.

Machinery of Moulds and Hydraulic Oil Flow:

1. The hydraulic tank has capacity of 300 litres.
2. Oil is sucked from the tank and sent through junction blocks and sent forward into the machinery.
3. In the injection piston the presence of oil increases pressure so that the piston moves forward for injection whereupon the portal for further flow of oil opens and it escapes or returns throughout the circuit pipelines which releases the pressure so that the piston is pulled back for material insertion.
4. Regulation and flow of oil is maintained with the help of valves and sensors. They also determine the direction of flow.
5. The pistons, the hydraulics and the moulds move as per the pressure generated by the flow of oil.
6. The oil after returning from the machinery is cooled down by chilled water in cooling machinery.
7. The cooled hydraulic oil is then sent back to the oil container tank.

Notes:

- i. Valves are operated in Volt DC. Sensors are also operated in 4 Volt DC.
- ii. Pneumatic Cylinder Operations include working of Hydraulics, Moulds, their movements, etc...
- iii. Within the mould the temperature of the material is maintained as per requirements by regular flow of chilled water through a water supply pipeline from the chillers.
- iv. In small machines 2 motors and pumps are required (1 for oil flow and 1 for running moulds) whereas in larger machines 3 motors and pumps are required (1 for oil flow and 2 for running moulds){hydraulic oil}.

Stretch Blow Moulding (SBM) :

Introduction:

Blow moulding of preforms into the desired final product is manually conducted and operated.

Requirements:

1. Atleast one operating man. (Operator)
2. Blow Mould.
3. Pre-forms.
4. Warmer/Heater to warmup the preforms.

Procedure:

1. Preforms are put on a conveyer belt cycle which takes them through a heater/warmer closely to warm them up.
2. The operator then picks up the preforms (2 at a time).
3. Places them into mould, locks the mould and starts the machine.
4. The machine blow moulds the preforms into the desired shapes (Final Products).

5. The operator removes the formed product from the mould and repeats his task.
6. The cycle continues.

Injection Blow Moulding (IBM):

Introduction:

Raw Material is warmed, dried, liquefied, Injected and then are Blow moulded into the desired goods.

Requirements:

- A. Power and Machinery:
 - a) Power (440 Volts)
 - b) Hydraulic Oil (Grade: 46)
 - c) Induction Motors
 - d) SMPS: Switch mode power supply.
 - e) Rectifier (Input: 220 Volts AC to Output: 24 Volts DC)
 - f) Pumps:
 - i) Vane Pump
 - ii) P1 Pump
 - iii) P2 Pump
 - g) Hydraulic Valves (for mechanical operations).
- B. Water:
 - a) Chilled Water (4kg)
 - b) Cooling Tower (4kg)
- C. Air:
 - a) LP (Low Pressure) air supply (pipeline): for Pneumatic Cylinder Operations. (7kg to 9kg)
 - b) HP (High Pressure) air supply: for Blowing Operations. (20kg to 28kg)

Procedure: {Product Development}

1. Raw Material is taken and Regularly warmed in the heaters.
2. With the help of "Honeycomb type Machinery" material is run into a continuous cycle of warm air where the "Honeycomb Net" absorbs all its moisture and dries the

material completely. The moisture is exhausted through vents. The moisture less material is then moved forward.

3. Movements are regulated with the help of different motors and sensors.
4. The material then goes through a combination of heaters in small quantities. The combination consists of 3 to 4 heaters which liquefies the material. Colors are mixed thoroughly during this time. The temperature of the different heaters varies between 160C to 200C.
5. The liquid is then sent into the mould with help of a piston. This is known as Injection.
6. Within the mould, first the preforms are prepared which are then blow moulded into the final product which is then ejected from the mould.
7. The product then proceeds for quality check and then packaging and delivering.

Machinery of Moulds and Hydraulic Oil Flow:

1. The hydraulic tank has capacity of 300 litres.
2. Oil is sucked from the tank and sent through junction blocks and sent forward into the machinery.
3. In the injection piston the presence of oil increases pressure so that the piston moves forward for injection whereupon the portal for further flow of oil opens and it escapes or returns throughout the circuit pipelines which releases the pressure so that the piston is pulled back for material insertion.
4. Regulation and flow of oil is maintained with the help of valves and sensors. They also determine the direction of flow.
5. The pistons, the hydraulics and the moulds move as per the pressure generated by the flow of oil.

6. The oil after returning from the machinery is cooled down by chilled water in cooling machinery.

7. The cooled hydraulic oil is then sent back to the oil container tank.

Injection Moulding (IM):

Introduction:

Raw Material is warmed, dried, liquefied, and then are Injection moulded into the desired goods.

Requirements:

- A. Power and Machinery:
 - a) Power (440 Volts)
 - b) Hydraulic Oil (Grade: 46)
 - c) Induction Motors
 - d) SMPS: Switch mode power supply.
 - e) Rectifier (Input: 220 Volts AC to Output: 24 Volts DC)
 - f) Pumps:
 - i) Vane Pump
 - ii) P1 Pump
 - iii) P2 Pump
 - g) Hydraulic Valves (for mechanical operations).
- B. Water:
 - a) Chilled Water (4kg)
 - b) Cooling Tower (4kg)
- C. Air:
 - a) LP (Low Pressure) air supply (pipeline): for Pneumatic Cylinder Operations. (7kg to 9kg)

Procedure: {Product Development}

1. Raw Material is taken and Regularly warmed in the heaters.
2. With the help of "Honeycomb type Machinery" material is run into a continuous cycle of warm air where the "Honeycomb Net" absorbs all its moisture and dries the

material completely. The moisture is exhausted through vents. The moisture less material is then moved forward.

3. Movements are regulated with the help of different motors and sensors.
4. The material then goes through a combination of heaters in small quantities. The combination consists of 3 to 4 heaters which liquefies the material. Colors are mixed thoroughly during this time. The temperature of the different heaters varies between 160C to 200C.
5. The liquid is then sent into the mould with help of a piston. This is known as Injection.
6. The Liquid then with the application on the moulds and rapid cooling moulds into the desired product.
7. The product then proceeds for quality check and then packaging and delivering.

III. Utilities:

Water:

For:-

- Cooling tower,
- Chiller water,
- Boilers [Steam (Pharmaceuticals)],
- DG [Power],
- Refrigeration,
- R.O Water,
- Fire systems , etc...

Cooling Tower:

Hot water from above is sprinkled downwards through a column from where cold/chilled air is sent upwards which results in collection of chilled water in the base of the tower and hot air escaping from the top of the cooling tower.

Water for here is used in low pressure Pneumatic Cylinder Operations.

Chiller Water:

Water after taking part in refrigeration cycle and lowering its temperature is used in blowing operations in moulds.

Refrigeration:

Water is used in refrigeration cycle of air to condense them and pressurize them to create high pressure air for different operations like blowing in moulds.

Air:

For:-

- Moulding operations,
- Cooling towers, etc...

Air Compressors:

Using refrigeration cycle, suction, condensation and pressurizing, pressure of air is increased step by step from 4kg/unit to 14kg/unit to 30kg/unit to 42kg/unit, which is then used in blow moulding operations.

IV. Moulds:

Generally made up of Mild Steel.

Different layers include:

- (Injection):
 - Top plate.
 - Liner plate (middle).
 - Stripper plate (for runner (left over liquid raw material turned into solid)).
- (Ejection):
 - Cavity back plate.
 - Cavity plate.
 - Ejector stripper plate.

Note:

- i. Drills used in the production, maintenance, repair and assembling of moulds is made up of Carbide.

V. Quality:

Different equipments used and tests done during quality check of materials include:

- i. Top load testing,
- ii. Cracks,
- iii. Weight,
- iv. Leakages,
- v. Wall thickness,
- vi. Induction sealer,
- vii. Height,
- viii. Torque,
- ix. Box load,
- x. Strength (ESCR),
- xi. Deep freezer.

Top load testing:

In this test load is applied on the product on its top to check its top load capacity, that is that how weight can be put up over the product on its top like filling of cartons in the truck one over another.

Wall thickness:

Magnetic ball and sensors are used to sense whether the thickness of the container is regular and equal at all points or not.

VI. Conclusion:

Choosing packaging machinery includes an account, management and assessment of technical capabilities, labor requirements, worker safety, maintainability, serviceability, reliability, ability to integrate into the packaging line, capital cost, floorspace, flexibility (change-over, materials, multiple products, etc.), energy

requirements, quality of outgoing packages, qualifications (for food, pharmaceuticals, etc.), through output, efficiency, productivity, economics, return on investments, etc.

Packaging machinery can be:

1. purchased as standard, off-the-shelf equipment or off-the-shelf machine.
2. purchased custom-made or custom-tailored or modified to specific operations.
3. manufactured or modified or enhanced by in-house engineers and maintenance staff within the tool room.

Efforts at packaging line automation increasingly use programmable logic controllers, coordination sensors and robotics.

Packaging machines may be of the following general types:

- Accumulating and collating machines
- Blister packs, skin packs and vacuum packaging machines
- Bottle caps equipment, over-capping, lidding, closing, seaming and sealing machines
- Box, case, tray, and carrier forming, packing, unpacking, closing, and sealing machines
- Cartoning and taping machines
- Cleaning, sterilizing, cooling and drying machines
- Coding, printing, marking, stamping, and imprinting machines
- Converting and modifying machines
- Conveyor belts, accumulating and related machines
- Feeding, orienting, placing and related machines
- Filling machines: handling dry, powdered, solid, liquid, gas, or viscous products
- Inspection: visual, sound, metal detecting, etc.
- Label dispenser and printers.

- Orientation, unscrambling machines
- Packaging filling and closing and loading machines
- Palletizing, depalletizing, unit load assembly
- Product identification: labeling, marking, etc.
- Sealing machines: heat sealer or glue units
- Slitting machines
- Weighing machines: check weigher, multihead weigher
- Wrapping machines: stretch wrapping, shrink wrap, banding
- Form, fill and seal machines
- Other specialty machinery: slitters, perforating, laser cutters, parts attachment, etc.