

HOW TO START MANUFACTURING INDUSTRIES

ROTARY THERMOFORMING OF PLASTOMERS

Rotary thermoforming is a plastomers processing method used to produce hollow objects of a volume ranging from several cm³ to 20 m³, with a wall thickness ranging from 2 to 10 mm and more.

Rotary thermoforming has numerous advantages over other methods of polymers processing, the foremost of which is the very short period needed to make the moulds and dispatch the first sample, usually within 15 to 60 days of the order and even less for simple products. The mould itself is about 10 times cheaper compared to moulds for blow moulding or injection moulding, so that very small series can be made.

A series of 1000 pieces is thought to be optimal if the moulds are made of sheet steel, and of 10,000 pieces if they are cast in aluminium or made of galvanoplastics.

The product walls are free of strain, they are relatively thick in comparison to products made by blow moulding or injection moulding, and the polymers used for rotary thermoforming are generally stable in the temperature range of -40 to 120°. In this temperature range they are highly impact resistant and resistant to aggressive media (acids, alkali) and other chemicals with the exception of aromatic compounds and some petroleum derivatives.

A wide range of products for various applications is produced by this process. The most frequently produced are various containers for chemicals (liquids and powders) and transportation vessels for the chemical, textile, food and other industries. Various objects used in agriculture can also be produced: transportation vessels, storage bins, tanks, etc. Other products include toys, light fittings, furniture and a variety of household objects.

The material to be processed depends on the required properties of the finished product. The materials most frequently used are polyethylene of all densities, cross-linked and linear polyethylene, polystyrene, polyamide, polyvinylchloride and nylon.

PROCESS DESCRIPTION

Mixing

Mixing is needed when the finished product has to be

coloured. The plastomer powder and pigments are mixed in exact proportions in mixers of a standard type until the mixture becomes completely homogenous so that the finished product is coloured evenly.

Dosing

The plastomer, which is in bags or containers, is put into vessels of a certain size, weighed and taken to the rotary thermoformer.

Moulding

Moulding (rotary thermoforming) of plastomers includes the following steps:

- Pouring the plastomer into the mould
- Closing the mould
- Putting the mould into the machine
- Heating the mould and plastomer
- Cooling the mould and the product
- Taking the mould out of the machine
- Taking the mould apart
- Taking the product out of the mould.

The process consists in melting the plastomer powder in a mould which rotates around two mutually perpendicular axes, or rotates around one axis while swinging around the other. The mould is heated most often with an open flame so that the powder melts and the plastic is evenly distributed around the inner walls of the mould. When the melting process is completed (after 2-6 minutes) the heating is cut off and the mould cooled by air circulation while still rotating. When the product has cooled to about 60°C the mould is removed from the machine, opened, and the product is taken out.

Finishing

When the product has been taken out of the mould it often has to be finished by cutting, planing, drilling, milling, etc.

The rotary thermoformer consists of a power generator which rotates the mould, a gas burner for heating the mould and a control panel for operating the machines.

The moulds are relatively simple. They are usually made of steel sheets 1-3 mm thick. Their low cost means that they can be made in small series or even piecemeal.

A batch system of production is used.

PRODUCTION CAPACITY

Approximately 200 t/year

This calculation is based on 16 hours/day (two shifts) and 270 days/year.

REQUIRED MACHINERY AND EQUIPMENT

I t e m	No.
Gas tanks (4 m ³)	2
Mixers	2
Rotary thermoformers	6
Cooling ventilators	12
Finishing equipment and tools	2 sets
Scales	4
Moulds	12
Also: vehicles, firefighting equipment, ventilation, maintenance equipment, and, if required, a 500 kg crane.	

The total FOB price of machines and equipment is estimated at US dollars 92.000.

REQUIRED RAW MATERIALS

High density polyethylene or LHDPE (powder)	100 t/year
Low density polyethylene (powder)	100 t/year
Pigments	0.1 t/year

REQUIRED MANPOWER (for two shifts)

Q u a l i f i c a t i o n	No.
University degree	2
Technicians	1
Skilled workers	4
Unskilled workers	13
TOTAL:	20

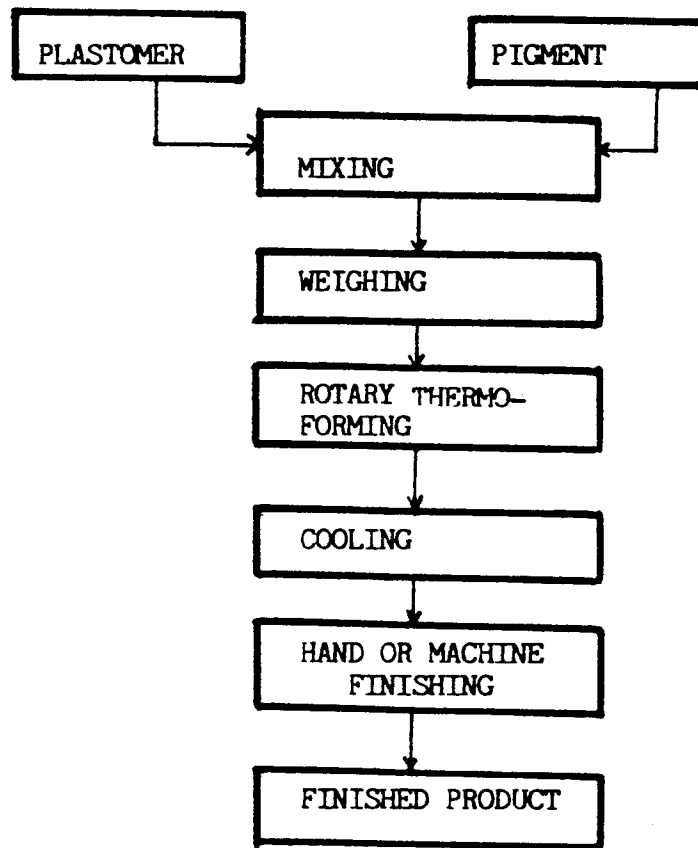
REQUIRED UTILITIES

Electric power	200 kWh/t of product
Gas (liquid)	250 kg/t of product

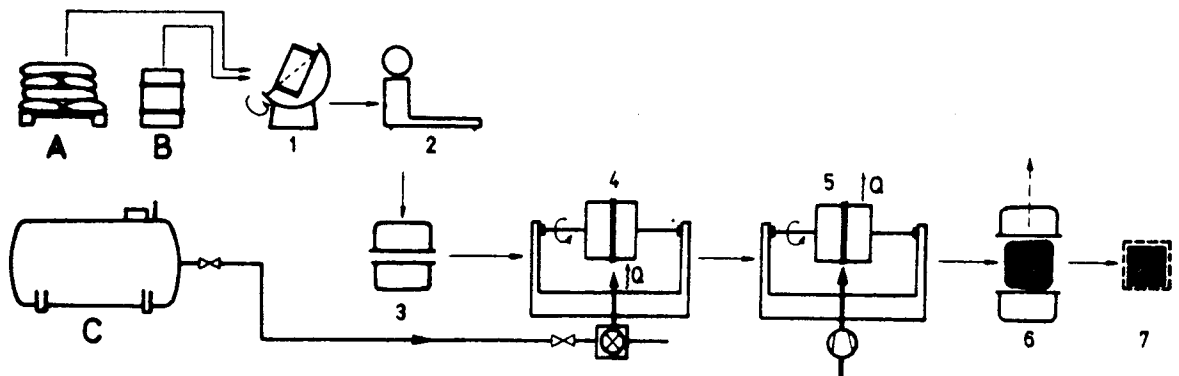
REQUIRED AREA FOR PLANT SITE

The total area occupied by the plant is about 1000 m² including the plant building, warehouse, offices and service facilities.

PROCESS BLOCK DIAGRAM FOR
TERMOFORMING OF PLASTOMERS



PROCESS FLOW SHEET FOR ROTARY THERMOFORMING OF PLASTOMERS



- A Plastomer
- B Pigment
- C Fuel gas

- 1 Mixing
- 2 Weighing
- 3 Filling the moulds
- 4 Rotary thermoforming

- 5 Air cooling
- 6 Opening the mould
- 7 Hand or machine finishing