

Replacing Mixers and Hot Feed Rubber Extruder with Cold Feed Extruder

Aurangabad Mixed MSME Cluster

Cluster Brief:

Aurangabad (Maharashtra) is a prominent MSME Cluster and houses about 1000 Auto parts Manufacturing MSME Units located in major industrial Areas Waluj – MIDC and some in outskirts of the city in industrial area like Chikalhana etc. The Auto Component Units in Aurangabad Cluster are principally known for rubber, metal and plastic components for auto and non- auto Sectors.

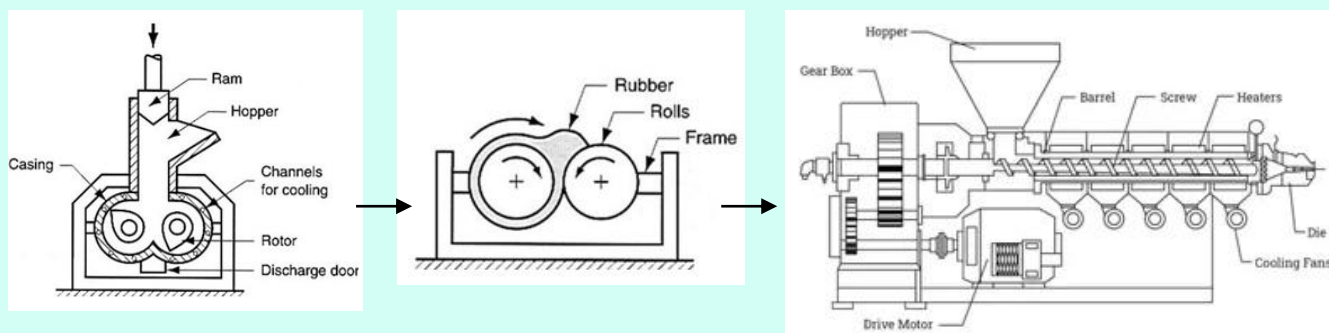
Aurangabad has mainly metal, plastic, rubber component and tyre retread industries which caters to the auto OEM's like Bajaj Auto, Skoda Auto, Audi etc. and Non-auto like Siemens etc.

Deogiri Rubber Cluster Foundation is the local industry association having about 50 members industries from rubber sector. The association has formed one Common Facility Centre (CFC) for rubber mixing, which provides ready pre-mixed rubber as raw material to its member industries. The production capacity of the CFC is around 70 to 100 tons /day.

Pratishtan Forging Cluster Foundation is another local industry association managed by forging industries in Aurangabad with around 150 members. This association has also setup a CFC for Shot blasting, drawing, cutting and forging operations.

Existing Technology:

Presently, the process requires 2 mixers (some time one) and a hot feed extruder machine in order to draw a certain profile of the rubber, for making the rubber components or belts. A typical sketch of the hot rubber extrusion process is shown below:



Mixer – 1

Mixer – 2 (Seizer)

Hot Feed Extruder

The semi-processed rubber is procured from the local suppliers and is feed to the Mixer – 1 for proper mixing and to attain the desired properties of the rubber like hardness, elongation, tensile strength, tear resistance etc. The motor is main driver of the machine. The capacity of the motor and the running time varies from industry to industry and product to product. For the given case, the mixer – 1 runs for around 10 hours a day (1-shift) for 300 days a year. The capacity of the electrical motor employed is 45 kW (60 HP) and if we talk about the actual consumption the machine actually consumes nearly 32 kVA. It takes around 10 – 15 minutes to process a lump of the rubber in Mixer – 1.

After processing the rubber in Mixer – 1, the mixed rubber is further feed to Mixer – 2, which is also called sizer, to further reduce the hardness of the rubber and get the rubber in the desired

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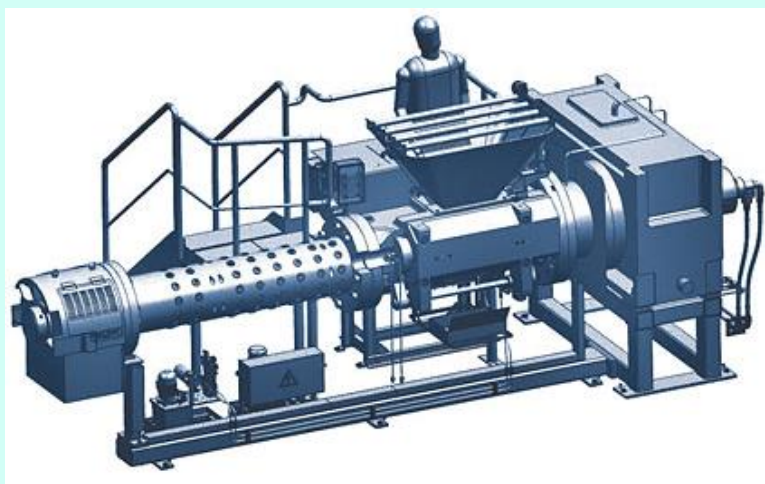
thickness and width as required for the extruder. The machine also runs for about 12 hours a day (1-Shift) for 330 Days a year. The capacity of the motor connected to this machine is 30 KW and consumes around 18 kVA.

After drawing a rubber strip of the desired size generally at the temperature of 60 deg. C, it is feed to the hot feed extruder to get the required rubber profile. The hot feed extruder runs for about 12 hours a day (1-Shift) for 330 days annually. The capacity of the motor connected to the hot feed extruder is 25 kW and consumes around 14 kVA.

Proposed Energy Saving Technology:

The proposed energy saving technology comprises of a single machine called Cold Feed Extruder, wherein the rubber is feed to the extruder at room temperature to produce the required profile of the rubber or rubber product.

The extruder serves to extrude and plastify the material for subsequent processing. Cold rubber compounds are fed to the extruder by a slab feeder. The extruder heats and homogenizes the material and conveys the material into the Pork Chop head by means of a screw. The machine is driven by a 3-Phase Induction Motor with rated capacity 22 kW. The machine noted to be running 12 hours a day for 330 days a year and consumes approximately 14 kVA.



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Justification of technology selection:

The technology presently being employed is more than 20 years old and requires pre-processing of rubber at high temperature before feeding it to the extruder. Also the process setup has 3 machineries with total rated capacity of 97 kW and requires huge space for complete production set-up. The actual consumption of the process is around 53.3 kVA for processing of 175 Kg/ hr.

The energy savings can be achieved by installing a new technology cold feed extruder machine which will employ only single extruding machine resulting in removal of 2 mixing machines from the process. It is expected to consume approximately 18.8 kVA for processing of 175 Kg/ hr. Apart from the energy savings, the removal of mixing machines would also result in better space management and less manpower requirements since the industry is facing labour shortage issues. Talking about the quality of the output, the cold feed extruder produces better and uniform quality product with faster production rate.

Energy & Monetary Saving:

The detailed energy savings calculations for replacing the existing technology system with energy saving cold feed rubber extruder are given in the table below. The present setup

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consumes around 53.3 kVA¹ for a production of 175 Kgs of rubber per hour. The machines reported to run for 8 hours effectively in a single shift. Accordingly, the Specific Energy Consumption (SEC) for the existing setup is calculated to be 0.30 kVAh/kg of rubber.

For the proposed technology cold feed rubber extruder, the electricity consumption is expected to be around 18.8 kVAh with production of 175 Kg/ hour. The operating hours considered for calculating the savings are 12 hours / day for 330 annual days. The Specific Energy Consumption (SEC) for the proposed setup is calculated to be 0.10 kVAh/kg of rubber.

Parameters	Units	Values
Total electrical load of Mixers and Hot feed Extruder	kVAh	53.3
Production output	Kgs/ Hr	175
Operating Hours	Hrs/ Day	12
Specific Energy Consumption – Existing	kVAh/Kg	0.30
Electrical Load of Cold Feed Extruder	kVAh	18.8
Production output	Kgs/ Hr	175
Operating Hours	Hrs/ Day	12
Specific Energy Consumption – New	kVAh/Kg	0.10
Specific Energy Savings	kVAh/kg	0.20
Percentage Savings	%	64.7
Annual Energy Savings	kVAh	136681
Annual Energy Cost Savings (Tariff Rate @ Rs. 9.60 / kVAh)	In Rs.	1312133
Manpower Savings	Nos.	3
Worker Wage Rate	Rs./Day/Man	550
Annual Manpower Cost Savings	Rs.	544500
Total Cost Savings	Rs.	1856633
Investment for Cold Feed Extruder	In Rs.	2800000
Payback in Years	Years	1.5

Based on the calculations, the Specific Energy Savings is noted to be 0.20 kVAh/kg (64.7%). Therefore, the implementation of cold feed rubber extruder would result in 136681 kVAh with monetary savings of Rs. 1312133/ year (Rs. 9.6/ kVAh). The proposed technology will also reduce the demand of manpower from 5 Nos. to 2 Nos. and would result in labor charges of Rs. 544500/ year. Therefore, the total cost savings calculated is Rs. 1856633/ year. Since, the estimated technology installation cost is Rs. 28 Lakhs per installation, the simple payback period for the same would be 1.5 years.

The benefits can be summarized as:

- 60 - 65 % reduction in energy consumption
- Shorter payback within 3 years
- Less dependency on manpower

¹ Electricity billing is done on kVA basis.

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- Increased space utilization with less numbers of machines and operations
- Better product quality

Replication Potential:

Based on the discussion with associations, units, sample survey and energy audits, it is estimated that the technology has a replication potential in 12 units. Based on replication potential, the overall project benefits will be as follows:

Parameters	Units	Values
Annual electrical energy saving (1 unit)	kVAh/year	136681
Annual electrical energy saving (12 units)	kVAh/year	1640172
Annual CO ₂ emission saving (1 unit)	tCO ₂ /yr	112
Annual CO ₂ emission saving (12 Units)	tCO ₂ /yr	1344
Estimated investment in technology (1 unit)	Rs in Lakh	28
Estimated investment in technology (12 units)	Rs in Lakh	336
Total Investment	in million USD	0.44
Life time energy saving	GJ	59046
Life time CO ₂ saving	tCO ₂	13440

Availability of the Technology:

There are good many technology providers available in India and many of them have their base in Maharashtra. The following vendors may be approached for the technology implementation in the cluster.

Name of the Supplier	Complete Address	Email Address and Contact Number
Malik Engineers	Unit No. 1, Shailesh Indl. Est. No. 1, Navghar, Vasai Road, East Mumbai - 401210, Maharashtra, India	Mr. Rajkumar, Ph: 07971384315
J. R. D. Rubber And Plastic Technology Private Limited	K - 49, Model Town, Delhi - 110009	Mr. Rajiv Gugnani, Ph: 8045318834
G. G. Engineering Works	Safed Pool, Kurla- Andheri Road Andheri, East Mumbai - 400072	Mr. HS Kalra, Ph: 8048076026

Effect on the process:

This technology will improve the production process and will reduce the overall production cycle time leading to quick fulfillment of the orders and reduction in energy consumption per unit of production.

Reasons for unpopularity:

This technology has yet not penetrated the cluster because of the following reason:

- Higher capital investment for the technology.
- No one has yet demonstrated the results of the technology to all unit owners in the cluster.

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- Aware of the technology but not sure about the benefits and cost economics for the investment.