

## “Design And Development of Flexible Screw Conveyor System For Granular material”

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**Abstract:** Nowadays, in agriculture field, It is very necessary to use material handling system for to move material from one place to another place continuously to minimize operating time and labor costing also the manpower. Various conventional conveyor systems like belt conveyor, bucket conveyor, bucket elevator, screw conveyor, pneumatic and vibratory conveyors and roller conveyor systems are used in this field.

In our case, the system is used and run on small scale farmers certainly to convey the granular material with precisely. In these report the suitability of flexible spring conveyor system is studied critically and on comparing with other conventional system of the manually material handling. The flexible screw conveyor system consists of electric motor, mild steel spring, hose pipe with suitable hopper. In which the moving part in mild steel spring which is attached perfectly with shaft of electric motor. This equipment can transport granular material from one place to another place.

The advantages of using flexible screw conveyors for moving bulk materials are discussed. A flexible screw conveyor consists of a spring steel or stainless steel flexible screw that is enclosed in a flexible or a rigid plastic tube. The only moving part contacting materials in a flexible screw conveyor is a rugged flexible screw, which is directly driven by an electric motor. The equipment can transport bulk material ranging from large pellets to submicron powders including difficult to handle products that pack, cake, seize, fluidize and plug.

**Keywords:** Flexible Screw, Granular Material, Conveyor

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## 1. INTRODUCTION

Material conveying is a cyclic process that requires lot of human efforts. Conveyor is a mechanical material handling equipment used to transfer different types of material from one place to another with minimum human efforts. Conveyor systems allow quick and efficient transportation for a wide variety of materials, which make them very popular in the material handling and packaging industries. Many kinds of conveying systems are available and are used according to the various needs of different industries. Conveyor systems are used across a range of industries due to the numerous benefits they provide. Conveyors can safely transport materials from one level to another, which when done by human labor would be expensive and time consuming.

### 1.2Types of conveyors:

An “conveyor” is a mechanical device used for transfer of material from one place to another. Many kinds of conveying system are available and are used according to various needs of different industries and can be classified as,

- Aero-mechanical conveyors
- Belt conveyor
- Belt-driven live roller conveyors
- Bucket conveyor
- Chain conveyor
- Drag conveyor
- Dust-proof conveyors
- Electric track vehicle systems
- Flexible conveyors
- Gravity skate wheel conveyor
- Overhead I-beam conveyors
- Overland conveyor
- Pharmaceutical conveyors
- Pneumatic conveyors
- Screw or auger conveyor
- Vertical conveyors
- Vibrating conveyors
- Spiral conveyor
- Line shaft roller conveyor
- Motorized-drive roller conveyor

Amongst all types of conveyor screw conveyor are used to transfer granular and less fragile material. Screw conveyors are also called as auger or helix conveyors, use a helical shaft rotating within a trough or tube. Basic working principle of screw conveyor is similar to Archimedes screw. As the screw rotates, the flights push materials through the pipe or tube. Screw conveyors are commonly used in agriculture for handling grain, in food processing plants to move dry ingredients, and in wastewater treatment plants for handling grit and dewatered sludges. Flexible screw conveyor is the type of screw conveyor in which rigid screw and tube are replaced by flexible shaftless screw and hose pipe respectively.

## 1. Flexible screw conveyor:

In case of flexible screw conveyor, a shaftless helix is used in this design which results in smooth movement of bulk materials without any clogging. The flawless solution for high moisture content material is a shaftless screw conveyor. These are very flexible and can be

shifted according to the plant layout and bear less wear and tear of the material because elimination of internal bearings. Flexible screw conveyor transfers non fragile granular material by shearing and tumbling effect.

### 2.1. Design various components:

The design of a flexible screw conveyor involves several key components including the screw, casing, and motor. The screw is the primary component that transports the material and is typically made from mild steel or other corrosion-resistant materials. The casing is the mainly hose pipe. The motor is used to power the screw.

#### 2.1.1. Shaftless screw (Spring):

Design of shaftless screw is based on parameters to be selected as per specific application requirement. In this paper standard values of different parameters are taken in consideration.

Length of pipe	3050 mm	Material flow rate	1500 kg/hr
Inclination height	1500 mm	Material	Grains
Material density	800kg/m <sup>3</sup>	Pitch angle	45 <sup>0</sup>

By considering above parameters and requirements, determine the bulk density, angle of repose, flowability, and other material properties. These will help determine the size, shape, and configuration of the screw [3]. Based on the material properties and flow rate, calculate the required screw diameter, pitch, and helix angle. The screw diameter should be large enough to accommodate the material flow without causing blockages or excessive wear. The pitch should be designed to move the material efficiently without excessive force or pressure. Determine the length and configuration of the screw based on the distance to be covered, the operating conditions, and any constraints. The screw may be straight or curved, depending on the specific requirements. The length of the screw should be sufficient to ensure proper material flow and avoid any material buildup. Design the support structure

and bearings to ensure that the screw is properly supported and aligned. The bearings should be chosen based on the load capacity, operating conditions, and any other requirements.

### 2.1.2 Selection of motor:

The selection of a motor for a flexible screw conveyor depends on several factors, including the flow rate, the conveyor length, the angle of inclination, the material being conveyed, and the type of screw. Several factors, including the material being conveyed, the required throughput, the length and configuration of the conveyor, and any other relevant operating conditions. It is important to consult with an experienced engineer or supplier when selecting a motor for a flexible screw conveyor to ensure that the motor is properly sized and compatible with the conveyor system

Once these factors have been determined, the appropriate motor selected is, 2 HP induction motor at 1440 rpm, above 15 Nm torque.

## 2. Development of flexible screw conveyor:

The development of a screw conveyor involves a comprehensive design process that takes into account several factors, including the material being conveyed, conveyor geometry, motor selection, and other operating conditions. The following is a general overview of the steps involved in the development of a screw conveyor. Manufactured screw, selected motor, hose pipe, coupling are assembled together in precision to have actual flow rate and power rating approximate similar to theoretical factors.

## 4. Result and Discussion

### 4.1. Testing:

Sr. No.	Height of elevation (cm)	Weight of Material (kg)	Time(sec)	Flow Rate (kg/hr)
1	0	15	45	1200
2	60	15	48	1125
3	120	15	53	1020
4	180	15	58	950

On changing the diameter of spring, the variation in capacity are as follows,

#### 4.2. Results:

Sr. No	Diameter (mm)	Capacity (kg/hr)
1	40	800
2	55	1100
3	62	1200
4	65	1350
5	70	1700
6	80	2200
7	90	2700
8	100	3500
9	110	4500
10	125	6000

#### 4.3. Discussion:

As our flexible screw conveyor system conveying the granular material from one place to another system with the help of our system, we are testing the different granular materials like wheat, bajara, maize and so on related to the farmers which are conveyable, we test flow rate for the wheat material, in which how many materials are transfer in how much time.

Table shows specific capacity with respect to the diameter of hose pipe, with increasing cross section capacity and flow rate increases. Table shows calculations of flow rate for different elevation from ground surface, following cases gives information about testing,

Case I: For zero elevation flexible screw conveyor system gives best result that can transfer 15 Kg wheat in 45 seconds giving total flow rate 1200 Kg/hr.

Case II: For 60 cm elevation achievable flow rate is 1125 Kg/hr i.e., 15 Kg in 48sec which is less than first case.

Case III: For 120 cm elevation achievable flow rate is 1050 Kg/hr i.e., 15 Kg in 53sec which is less than second case.

Case IV: For 180 cm elevation achievable flow rate is 950 Kg/hr i.e., 15 Kg in 58sec which is less than first three cases because height of elevation is very high.

So, by considering all the cases we get the best result of flow rate at surface level and minimum flow rate at 180 cm elevation.

#### 5. Conclusion:

We have successfully designed and developed flexible screw conveyor system in which the Granular materials are successfully transfer by the system.

We developed cost effective system as our aim is to develop a system for small scale farmer and mainly the system is easily purchased by the farmers.

By the tesing and results of the system we get a good results in time for transferring the materials ,in this testing we are able to transfer the different material like wheat, Bajara, Maize and so on related and important to farmers are successfully transfer within a minimum time as wanted to farmers.

In the results we get the very good result for the wheat that the system transfers the 1300 kg

wheat in only 1 hr

## 6.References

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## Appendix

