

## **Design & Fabrication of “Solar Lift”**

**(Solar Operated bucket Conveyor)**

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### **Abstract**

A bucket conveyor for agriculture is a type of material handling equipment used in farming operations to transport crops and other materials from one location to another. The conveyor consists of a series of buckets or containers that are attached to a chain or belt and move along a track or path.

The abstract of a bucket conveyor for agriculture would describe the basic design and operation of the equipment, including the types of materials it can handle and the maximum capacity it can transport. It would also provide an overview of the key features of the equipment, such as the size and shape of the buckets, the speed and direction of the conveyor, and any safety features or controls that are built into the system.

In addition, the abstract might discuss the advantages and disadvantages of using a bucket conveyor for agriculture compared to other types of material handling equipment, such as conveyor belts or augers. It might also describe the potential applications of the equipment in various farming operations, including grain handling, seed processing, and fertilizer distribution.

Overall, the abstract for a bucket conveyor for agriculture would provide a concise and informative summary of the key features and benefits of this important piece of equipment for modern farming operations.

### **Introduction**

A bucket conveyor is a type of material handling equipment that is used to move bulk materials vertically or horizontally. It is often used in industries such as agriculture, mining, and construction, as well as in manufacturing plants and warehouses. The conveyor consists of a series of buckets or containers that are attached to a chain or belt and move along a track or path.

The basic design of a bucket conveyor consists of a series of buckets or containers that are attached to a chain or belt. The chain or belt is driven by a motor, which causes the buckets to move along the track. The buckets are usually made of plastic or metal and are designed to hold a specific amount of material.

Bucket conveyors are available in a variety of sizes and configurations to suit different applications. They can be used to move a wide range of materials, including grains, seeds, powders, and bulk solids. Some bucket conveyors are designed to handle abrasive or corrosive materials, while others are designed for use in environments with high temperatures or high humidity.

One of the main advantages of a bucket conveyor is its ability to move materials vertically, which can save space and reduce the need for multiple pieces of equipment. Bucket conveyors are also efficient and reliable, with a low risk of spillage or contamination. They are easy to maintain and can be customized to suit specific needs and requirements.

In summary, bucket conveyors are an important type of material handling equipment that are used in a wide range of industries. They are designed to move bulk material efficiently and reliably, and can be customized to suit specific applications and environments.





**Components and Specification**

**1) 5MMDCCconnector**



#### 2.1x5.5mmDC Power Jack Socket Panel Mount

2.1x5.5mm DC Power Jack Socket Panel Mount(Female) comes with Metal Nut to mount the jack in your Application. It has Plastic Cover which provides a tight connection with a male pin, Centre pin can be 2.1mm or 2.5mm. In addition, the male plug is 2.5mm/2.1mm x 5.5mm and also provides good environmental protection.

It is widely used in small-scale as well as prototyping projects where 12 to 30 Volt power supply is needed such as household appliances, electric force, telecommunications, machine tool, vessel, textile, printing, Mining machine,

#### Specifications

<i>Supply voltage(V)</i>	<i>upto 30</i>
<i>Type of connector</i>	<i>Female</i>
<i>Supports DC Power Jack</i>	<i>2.1x5.5mm</i>
<i>Diameter(mm)</i>	<i>14</i>
<i>Total Length(mm)</i>	<i>18</i>

## 2) SQUARE CHANNEL



Thickness	1.5mm
Material	MS
SurfaceTreatment	Galvanized
Shape	Rectangle
Size	20mm
PipeSection	Square

### 3) 22WattSolar Panel

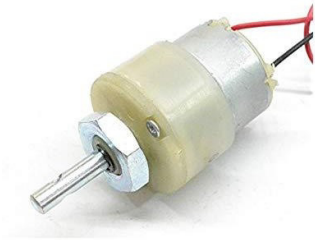


#### TechnicalSpecifications

ModelName	DS10
NoOfCells	36cellsinseries
Pmp(Wp)	10
Voc(V)	21.0
Isc (I)	0.60
Vmp(V)	18.0
Imp(I)	0.56
Dimension(Mm)	300x350x25mm
Weight(Kgs)	1.2

X- Pitch	264
Y-Pitch	175

#### 4) DCMotor



#### 12VDCMotor

##### Features

12V–500RPM –

3.6 KG•CMtorqueDCgearheadm

otor30:1GearRatio

2mmrearencodershaft

Goodcompromisebetweenspeedandtorqueforsmallroboticdesigns.

##### Description

Motor is a 12V DC geared motor with a .25” motor output shaft and a 2mm rear encoder shaft. The 2mm shaft works with our ENC300 quadrature encoder to allow the motor to be used in position control applications. Motor controllers that are rated for 12V @ 2A are ideal for controlling this motor. However, motor controllers with lower current ratings can also be used if they have over-current and overtemperature protection.

##### Specifications

- Operating voltage 4.5-18V
- Startuptorque(kilogram-forcecentimeter)3.6KG•CM
- Startuptorque(inch-pound)3.1Inch•lbf
- Gearratio30:1
- No-LoadCurrent(12V)0.053A
- StallCurrent1.5A
- No-LoadSpeed(12V)500RPM

#### 5) BALLBEARING



- Simple, versatile and robust design
- Low friction
- High-speed capability
- Accommodate radial and axial loads in both directions
- Require little maintenance

Performance

Basicdynamicloadrating	13.5 kN
Basicstaticloadrating	6.55kN
Limitingspeed	20000r/min
Referencespeed	32000r/min
SKFperformanceclass	SKFExplorer

Borediameter	20 mm
Outsidediameter	47 mm
Width	14 mm

Properties

Boretype	Cylindrical
Cage	Sheetmetal
Coating	Without
Fillingslots	Without
Locatingfeature,bearingouterring	None
Lubricant	None
Matchedarrangement	No
Material,bearing	Bearingsteel
Numberofrows	1
Radialinternalclearance	CN
Relubricationfeature	Without
Sealing	Without

6) Roller



- Ga.galvanized steeltube
- 12"between framestosuit12"overallwidthgravityconveyors
- Crimped,oiledbearings;90pounds'loadcapacityperroller
- 40diametersmildsteelaxle,12"long
- Springretainedononeend.

### Motor Calculations

#### Torque

Torque is the tendency of a force to rotate an object about an axis. Torque is made up of two components; a load (constant) component and an acceleration component.

The load torque component is usually due to friction and/or gravity and is always acting on the motor. This component can usually be determined by calculation or by putting a torque wrench on the system and reading the torque value. When it is not able to measure, then we use some equation to calculate the approximate value.

The acceleration torque however, is only acting on the motor when it is accelerating or decelerating. Once the motor is running at a constant speed, this component goes away.

Measuring the acceleration component is difficult not to mention dangerous. If you want the load to be up to speed within 50 milliseconds, it's likely that a torque wrench will fly off. Therefore, we calculate the acceleration component. This component is a function of the inertia of the system and the acceleration rate. So, once we determine these values, we can figure out the acceleration torque.

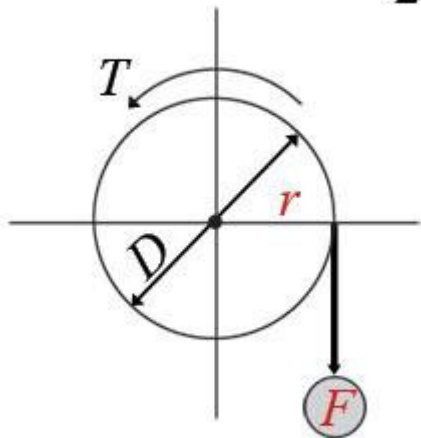
#### Load Torque (T)

Load torque is very simple.

As you see this equation torque is the product of the force and the distance between the force and the center of rotation. For example, if you want to hold the force acting on the end of pulley,  $T = F \times r$ .

So calculating load torque is determining the force in the system and the logical distance between the motor shaft and the where the force is acting. When the mechanics become complicated, we need to convert the  $F$  and  $r$  to fit the mechanics.

$$T = F \times r = F \times \frac{D}{2}$$



$r$  = distance between the center of rotation  
 $F$  = force point

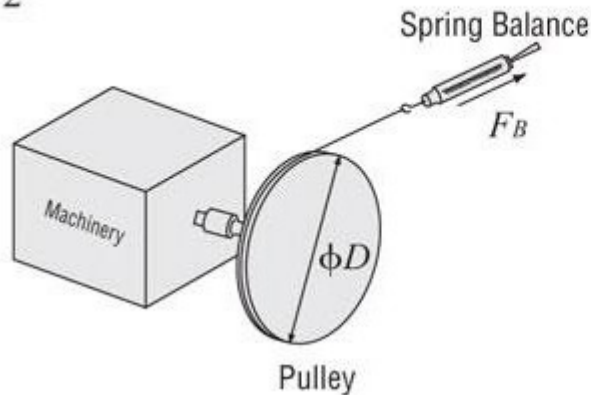
#### Load Torque-Actual Measurement

If you can measure the force, that is the most accurate way to find the force since it takes care of the efficiency and coefficient of friction on the every part.

$F_B$  = Force when the main shaft begins to rotate



$$T_L = \frac{F_B D}{2}$$



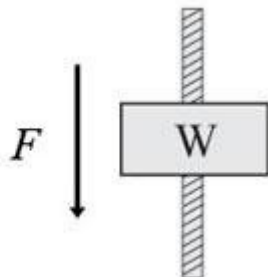
$F_B$  : Force when main shaft begins to rotate  
 ( $F_B = \text{value for spring balance} \times g$ )  
 $D$  : Final pulley diameter  
 $g$  : Gravitational acceleration

### Forces

There are three types of forces; vertical, horizontal and incline. A force varies depending on how it acts.

### Vertical Force Calculation

$$F = W = mg$$



$F$  : Force of moving direction  
 $m$  : Total mass of the table and load  
 $g$  : Gravitational acceleration

### Based on above reference

- 1) Weight of the die ( $m_1$ ) – 550 Gram
- 2) Weight of the guideways ( $m_2$ ) – approximately 100 gram
- 3) Weight of the motor ( $m_3$ ) – 250 gram
- 4) Friction factor – 1.25
- 5) Diameter of leadscrew – 8 mm

$$M = m_1 + m_2 + m_3$$

$$= 550 + 100 + 250$$

$$= 900 \text{ gram}$$

$$F = W = mg = (900 \times 9.81)$$

$$= 8829 = 0.8829 \text{ Kgcm} = 0.9 \text{ Kgcm}$$

$$F_b = F \times \text{Friction factor}$$

$$= 0.9 \times 1.25$$

$$= 1.125 \text{ N}$$

$$\text{Load torque} = \frac{(F_b \times D)^2}{2} \quad \text{KGCM}$$

$$= \frac{(1.125 \times 8)^2}{2} = 45 = 4.5 \text{ Kgcm}$$

## **Construction & Working**

A bucket conveyor is a type of conveyor system that uses a series of buckets to transport materials vertically or horizontally. It is commonly used in industries such as agriculture, mining, and construction.

The construction of a bucket conveyor typically consists of a series of buckets that are attached to a belt or chain. The buckets are typically made of materials such as plastic, metal or rubber and can vary in size and shape depending on the specific application.

The working principle of a bucket conveyor is relatively simple. The buckets are filled with the material to be transported, and as the conveyor belt or chain moves, the buckets are lifted up to a certain height and then tipped over to deposit their contents at the desired location. The buckets are then returned to their starting position to be refilled with more material.

There are two main types of bucket conveyors: continuous and centrifugal. In a continuous bucket conveyor, the buckets are attached to a continuous loop of material, such as a belt or chain, and move continuously through the system. In a centrifugal bucket conveyor, the buckets are attached to a rotating drum or wheel, which lifts and deposits the material at the desired location.

Bucket conveyors are known for their durability, high capacity, and ability to handle a wide range of materials. They are often used in applications where materials need to be transported vertically or over long distances, and where a high degree of reliability and efficiency is required.

## **Conclusion**

Bucket conveyors are an efficient and versatile method of transporting materials in many industrial applications. They can handle a wide variety of materials, including powders, granules, and even delicate or fragile products. Bucket conveyors are commonly used in the food processing, agricultural, and chemical industries.

The main advantages of bucket conveyors include their ability to move materials vertically and horizontally, their gentle handling of delicate or fragile products, and their high capacity and efficiency. They are also easy to maintain and operate, with minimal downtime.

However, bucket conveyors also have some limitations. They are not suitable for handling very fine or dusty materials, as these can escape from the buckets and cause dust hazards. They also require regular cleaning and maintenance to prevent contamination or damage to the product being transported.

In conclusion, bucket conveyors are a reliable and efficient method of transporting materials in various industrial settings. Their versatility and capacity make them a popular choice in many industries, and with proper maintenance and care, they can provide a long service life.

## **Acknowledgement**

An acknowledgement for a bucket conveyor could be

We would like to express our sincere gratitude to the designers, engineers, and manufacturers of the bucket conveyor that we have recently installed in our production line. This advanced piece of machinery has greatly improved our operational efficiency and productivity, allowing us to transport materials more quickly and safely.

We appreciate the attention to detail that has gone into the design of this equipment, which has ensured its reliability and durability. The seamless integration of the bucket conveyor into our existing infrastructure has made our workflow smoother and more streamlined, resulting in cost savings and increased output.

Once again, thank you for providing us with this exceptional piece of equipment, which has significantly contributed to the success of our operations. We look forward to continuing our partnership with your company and exploring future opportunities to enhance our production capabilities.

## Reference

Here are some references for bucket conveyors:

1. "Bucket Conveyors" by Unstreak Corporation Ltd. - This article provides an overview of bucket conveyors, their applications, and design considerations.
2. "Bucket Conveyor Design Guide" by Rison International Inc. - This guide provides information on the design and selection of bucket conveyors, including sizing, capacity, and material handling considerations.
3. "Bucket Elevator and Conveyor Systems" by Gough Econ, Inc. - This website provides information on bucket elevators and conveyors, including product specifications, case studies, and application examples.
4. "Bucket Conveyor Systems" by Frazier & Son - This website provides information on bucket conveyor systems, including product specifications, design options, and case studies.
5. "Bucket Conveyor" by Wikipedia - This article provides a general overview of bucket conveyors, their history, and basic design principles.
6. "Bucket Elevator Design: Centrifugal vs. Continuous" by FEECO International, Inc. - This article discusses the differences between centrifugal and continuous bucket elevator designs and their respective advantages and disadvantages.
7. "Bucket Conveyors and Bucket Elevators" by Spiro flow Ltd. - This website provides information on bucket conveyors and elevators, including product specifications, design options, and case studies.

References section include:

- "Bucket Elevator Book: A Practical Guide to Bucket Elevator Design, Application, and Operation" by Nilesh Patel [1]
- "Bulk Material Handling by Conveyor Belt 7" edited by Mark Alspaugh [2]
- "Experimental study of the dynamic behaviour of a bucket conveyor" by Armando Alférez[3]
- "Design and Analysis of Bucket Conveyor System for Industrial Application" by S. S. Vanamane and V. G. Suryawanshi [4]
- "Bucket conveyor with adjustable bucket spacing" by Marc-Oliver Dreher, et al. [5]
- [www.wikipedia.com](http://www.wikipedia.com) [6]
- [https://en.wikipedia.org/wiki/Bucket\\_elevator](https://en.wikipedia.org/wiki/Bucket_elevator) [7]