The left-hand column provides descriptive text.

NECESSARY INFORMATION

Required product parameters.

Service use.
Material chemical name.
Bulk density – mass/volume – kg/m^3
Maximum duty – kg/hr or m^3/hr
Maximum lump size - dimensions
average size
percentage of lumps in total
Height product is to be raised (meters) and angle of incline if any. Provide enough height at the outlet of the discharge chute so the product is always falling following discharge.
Product characteristics – abrasiveness
flowability – free/cohesive/slug
dampness – % moisture
friability – firm/breaks/powders
particle shape –
length/size/volume
temperature of product
angle of repose
corrosiveness
Operating environment, location and conditions –
corrosive/damp
Service required – continuous/intermittent.
Open or closed boot design.

SELECT BUCKET SIZE AND SPACING

The size and number of buckets is determined from the required throughput using an iteration process.

Select the bucket from the range in the bucket supplier's catalogue. Only 2/3 (67%) of the bucket's design capacity is used in calculations.

Centrifugal discharge conveys usually have a spacing between buckets that is 2 to 3 times the bucket projection, though the spacing can be greater for free-flowing products.

DETERMINE BELT SPEED

The bucket spacing times the number of buckets per second determines the required belt speed. The speed for centrifugal bucket elevators is usually in the range of 1 m/s to 2 m/s to insure the product throws into the chute at the head pulley.

CALCULATE HEAD PULLEY DIAMETER

A simplifying assumption is made that the throw commences at the top of the head pulley. At this point the centrifugal force and gravity force are balanced.

Centrifugal force = $m \cdot v^2 \cdot \dfrac{\cos\beta}{r}$ where

m = mass in kg
v = belt speed in m/s
β = angle from top dead centre
r = pulley radius in m

Gravity force = $m \cdot g$ where

g = gravity constant 9.8 m/sec^2.

Putting both forces equal to each other -
The right-hand column provides an example.

The right-hand column provides an example.

NECESSARY INFORMATION

Product parameters.

Raise crushed product from mill outlet to storage silo.
Aluminium Sulphate.
1700 kg/m^3
5,000 kg/hr
3 mm max
2 mm
Nil
5.5 m including length of discharge chute into 4 m high storage silo.

Sharp edges
Free
Less than 2%
Firm
Consistent
Ambient
30 degrees
Corrosive if damp
Dry and airy

Intermittent – up to 12 hours per day 6 days a week
Open boot bottom, elevator will sit on a concrete floor.

SELECT BUCKET SIZE AND SPACING

5,000 kg/hr throughput.
Select a bucket 150 mm wide x 100 mm projection with a volume of 0.78 litre.
Using 2/3 of the volume give a capacity of 0.5 litre.
0.5 lt. is 0.0005 m^3 and holds 0.85 kg of product. (0.0005 m^3 x 1700 kg/m^3).
To move 5000 kg/hr using 150 x 100 buckets requires 6,000 buckets per hour or 100 buckets per minute.
Select a bucket spacing of 300 mm.

DETERMINE BELT SPEED

100 buckets per minute/60 sec per minute = 1.7 bucket/sec.
1.7 bucket/sec x 0.3 m = 0.5 m/sec. This is too low and will prove to be insufficient for a clearance throw into the discharge chute. The bucket spacing will need to be increased and the calculation repeated.

CALCULATE HEAD PULLEY DIAMETER

$$r(radius) = \frac{v^2}{g} = \frac{(0.5m)^2}{9.8m/\sec^2} = 25mm$$

The head pulley diameter is 50 mm. This size, though accurately calculated, is not practical. It is far too small. The buckets cannot deform sufficiently to go around the pulley without over-stressing both buckets and belt.

The solution is to increase the bucket spacing or to use smaller buckets. This then requires a proportionate speed increase to maintain the throughput. The greater velocity needs a larger head pulley revolving at the same RPM. However as we are using the smallest buckets available it is necessary to increase the bucket spacing.

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