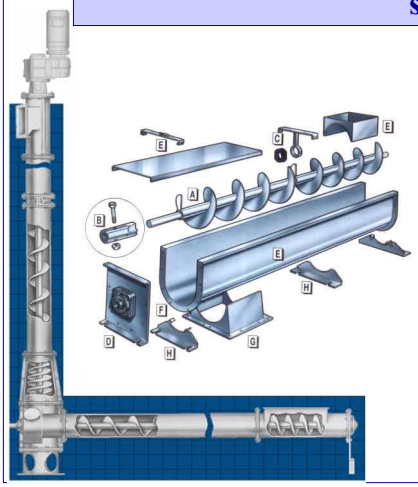
Mechanical Engineering Department
Carlos III University

SCREW CONVEYOR.

TRANSPORTATION

SCREW CONVEYOR

Transport of material along a tube by means of a screw

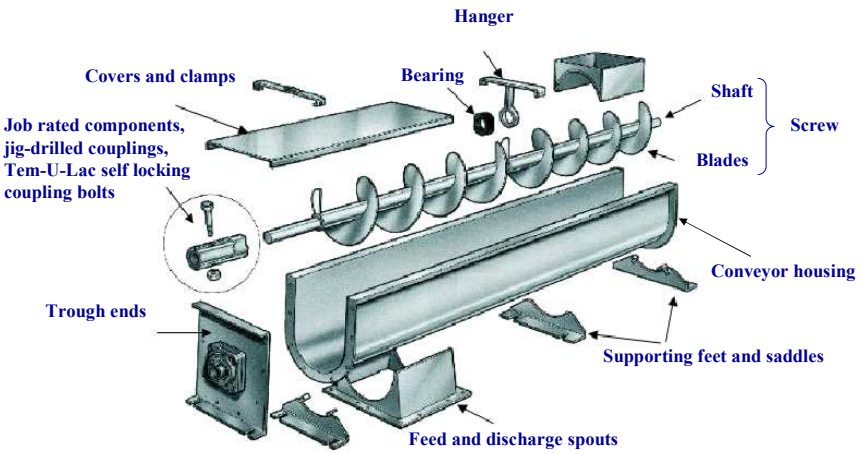


- **Advantages:**
  - They are compact
  - Modular design: easy installation
  - Simple supports
  - High temperatures
  - Easily hermetic
  - Extremely versatile:
    - "Dose"
    - Mixer
  - Distance up to 50 m
  - Several loading and unloading points

SCREW CONVEYOR

- **Drawbacks:**
  - **No big sizes**
  - **No fragile or delicate materials**
  - **Non abrasive materials**
  - **Bigger power requirements**
  - **Material pollution**
  - **Low material volume**

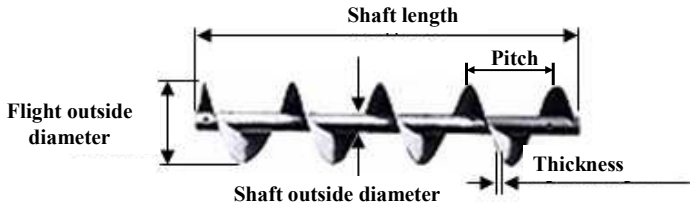
COMPONENTS



SCREW

It consists of a several of blades of helix shape welded to a pipe or shaft. It moves the material.

- **Flight outside diameter, type of blades, spacing between the blades, thickness of the external diameter and interior shaft and rotation direction.**



SCREW

- **Classification:**
  - **Spiral screw conveyor (or flight).**
  - **Sectional screw conveyor.**
  - **Single cut flight.**
  - **Ribbon flight.**
  - **Standard pitch with paddles.**
  - **Screw cut and folded flight.**
  - **Single flight short pitch.**
  - **Van paddle conveyor.**
  - **Single tapered flight standard pitch.**
  - **Step flight.**
  - **Single flight variable pitch.**
  - **Single flight large pitch.**
  - **Double flight standard pitch.**

MATERIAL FLUX CALCULATION

Conveyor housing filled area (m^2)

$$s = \lambda \frac{\pi D^2}{4}$$

Fill coefficient of the section (lower than unity)

Type of load	λ
Heavy and abrasive	0,125
Heavy and a little abrasive	0,25
Light and a little abrasive	0,32
Light not abrasive	0,4

Screw pitch (m)

Screw rotating speed (rpm)

Travelling speed (m/s)

$$v = \frac{t \cdot n}{60}$$

MATERIAL FLUX CALCULATION

Screw pitch:

- Between 0,5 and 1 times its diameter
- Bigger for a lighter load

Screw diameter:

- 12 times bigger than the diameter of the material particles being transported (homogeneous material)
- 4 times bigger than the bigger diameter of the material particles being transported (heterogeneous material)

Screw speed:

$$Heavy\ \ materials \Rightarrow n \approx 50\ \ rpm$$
$$Lighter\ \ materials \Rightarrow n < 150\ \ rpm$$

- Inversely proportional to:
  - Weight of the bulk material
  - Abrasive materials
  - Screw diameter

MATERIAL FLUX CALCULATION

Material density (t/m³)

Flux material decrement coefficient

Transported material flux (t/h)

$$Q = 3600 \cdot s \cdot v \cdot \gamma \cdot k$$

$$s = \lambda \frac{\pi D^2}{4} \qquad v = \frac{t \cdot n}{60}$$

$$Q = 3600 \cdot \lambda \frac{\pi D^2}{4} \cdot \frac{t \cdot n}{60} \cdot \gamma \cdot k$$

Conveyor housing inclination	0º	5º	10º	15º	20º
k	1	0,9	0,8	0,7	0,6

POWER

$$P = P_H + P_N + P_{St}$$

- P_H is the required power to move the material horizontally
- P_N is the required power to operate an unloaded screw
- P_{St} is the required power for an inclined screw conveyor

POWER

Material travelling

Installation length

$$P_H(kW) = c_0 \frac{QLg}{3600} = c_0 \frac{QL}{367}$$

Material resistance coefficient

Material	c_0 Empiric
Flour, sawdust, granular	1,2
Peat fibre, soda, coal dust	1,6
Anthracite, coal, rock salt	2,5
Gypsum, dry clay, fine soil, cement, lime, sand	4

POWER

Unloaded operated screw

$$P_N(kW) = \frac{DL}{20}$$

- It is much lower than the power required to move the material

POWER

Inclined screw conveyor

$$P_{St}(kW) = \frac{QH}{367}$$

Installation height

Required power

$$P = \frac{Q(c_0 L + H)}{367} + \frac{DL}{20}$$