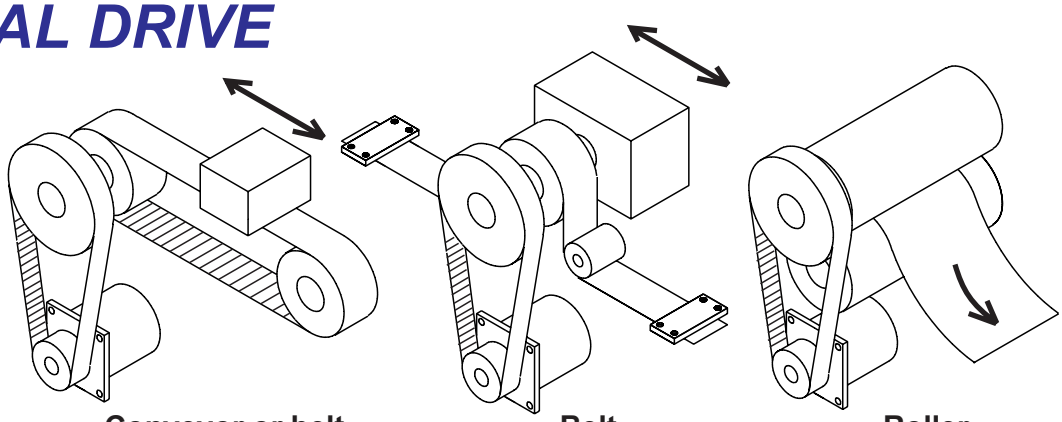
TANGENTIAL DRIVE

MAIN ADVANTAGES

Low cost
High efficiency
High speed motion
Simple construction

MAIN DISADVANTAGES

Low precision
Belt elasticity
Toothed belt slippage
Load may backdrive motor



Conveyor or belt (Fixed motor) | **Belt (Moving motor)** | **Roller**

Fill in the boxes and return to us. We will size a suitable stepper motor and drive for you!

Pulley Diameter
For a roller drive, this is roller diameter. For belt drives, whether a fixed or moving motor, this is the diameter of the driving pulley. For rack and pinion drives, it is the diameter of the pinion. Where possible, the PCD should be given for the pulley diameters. The maths is the same for belt, roller or pinion drives. Load inertia is proportional to 4th power of pulley diameter.($J \alpha d^4$).

Pulley inertia
Pulleys, pinions or rollers have inertia which must be driven by the motor. What is inertia of these? If inertia is not known, advise dimensions and material of pulleys or pinions and we can calculate it. On roller systems, inertia can be very high and may be reduced by using hollow rollers rather than solid or by making rollers in aluminium instead of steel.

Load Mass
This is the mass that the belt must move. Belt drives are limited when driving very large loads. The belt may jump teeth or stretch under large loads. Inertia seen by the motor is directly proportional to load mass.

Drive Method
The drawings above show common tangential drives. If using a roller system, use a 'dancing arm' mechanism so the stepper does not have to unwind a large roll of material, causing possible material slippage. If using a belt system there are two styles, stationary motor and moving motor. The moving motor uses less belt, saving cost but requires power cables to be dragged with the motor. If moving a wide load in a fixed motor belt system (eg. XY tables) it is suggested that two belt drives are used, connected by a shaft.

Gear Reduction
Sometimes it is necessary to use gearing with pulleys, rollers or pinions to reduce inertia or amplify torque. This may be done using low cost timing belts and pulleys or a precision gearhead that mounts onto the motor. High ratio reduction will help torque but will limit speed. Gearing reduces load inertia by the square of the ratio of the reducer ($J \alpha 1/n^2$). Planetary gearheads and pulleys have high efficiency but worm drive gearboxes have very poor efficiency.

External Load
External forces on the load must be taken into consideration. These may be fiction, gravity (if motion is vertical) or cutting forces on a cutting machine. Sometimes these can be measured on an existing machine. On a new machine, you will just have to estimate these forces or try to calculate them.

Resolution
Resolution is the smallest amount of linear movement that corresponds to one motor step. It will depend on driving pulley diameter and gearing. What is the minimum accuracy increment of motion your machine needs to do? This is not necessarily the same as accuracy which is also affected by backlash and quality of your screw and gearing.

Top Speed
What is the maximum linear top speed required? Be careful as specifying a very high top speed will result in a costly system. On many machines, the top speed occurs during rapid traverse when there are no cutting forces involved.

Ramp Time
This is stepper motor terminology for acceleration and deceleration time. These are usually linear although some controllers can provide "S" profile ramping to reduce shock on components. Very fast acceleration times will require large and expensive motors and drives. Motor torque is directly proportional to acceleration rate.

Duty Cycle
Duty cycle (expressed as %) is the proportion of time the motor is running compared to total time. In most machines, the motor will run for a short period and rest for a while before starting the next cycle. The duty cycle is (run time)/(run time + rest time).

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