4- Flap and Gear Design

March 6, 2021 2:45 PM

Sat. Mar 6/21
START : 2:30 pm
END : 9:45 pm , 30 mn total

8mm Precision Ground Rotary Shaft

ID: TRM4000_0 Product Lifecycle

High carbon steel shaft for rotary power transmission.

$8.23 /Meter

Quantity Available: 298m

Length	Price
5m	$7.90
10m	$7.57

Cut Range	Tolerance	Sold by the	Cut Fee
50 - 2000mm	2mm	Millimeter	$1.27

Number of Pieces: − 1 +

Piece Length in mm

https://www.phidgets.com/?tier=3&catid=83&pcid=74&prodid=730

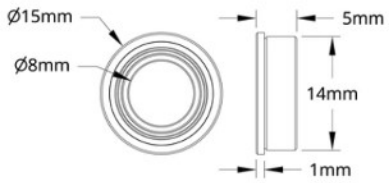
1611 Series Flanged Ball Bearing (8mm ID x 14mm OD, 5mm Thickness) - 2 Pack

SKU: 1611-0514-0008

$3.49 / 2 Pack

1 Add to Cart

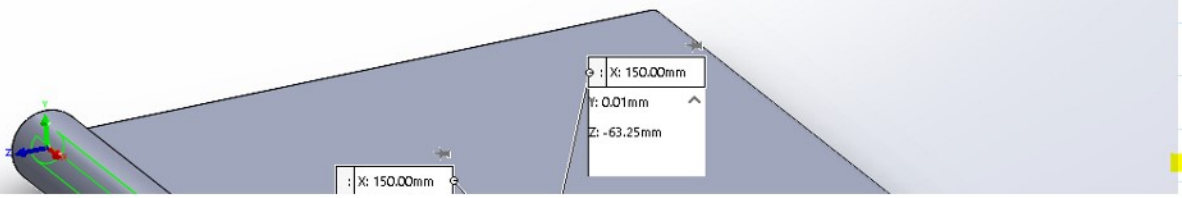
Add to Wish List



https://www.gobilda.com/1611-series-flanged-ball-bearing-8mm-id-x-14mm-od-5mm-thickness-2-pack/

RECALCULATING WORST-CASE SCENARIO TORQUE

- no longer neglecting weight of trap door

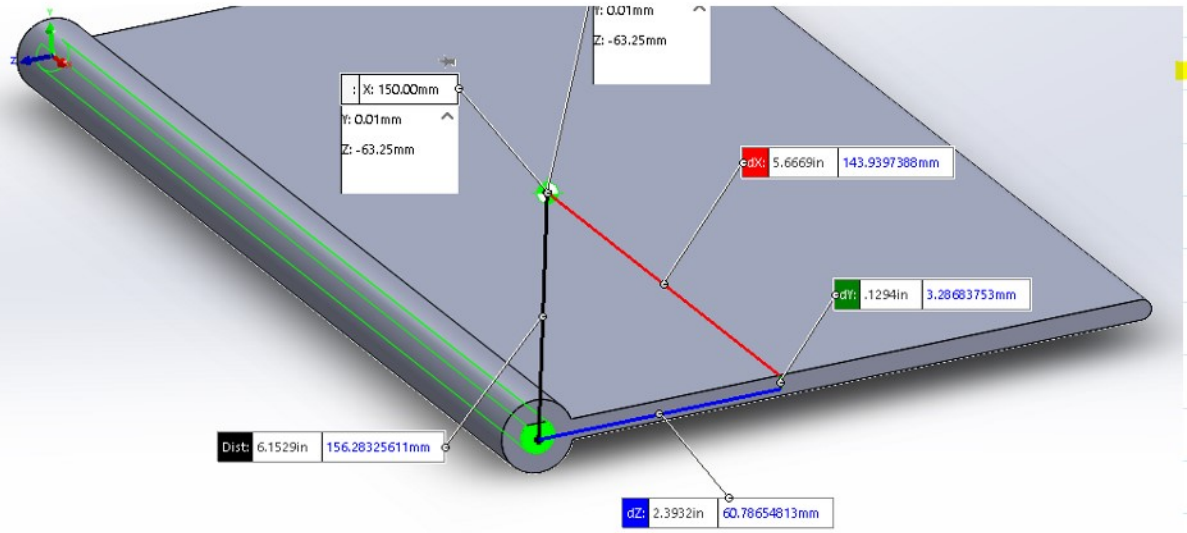


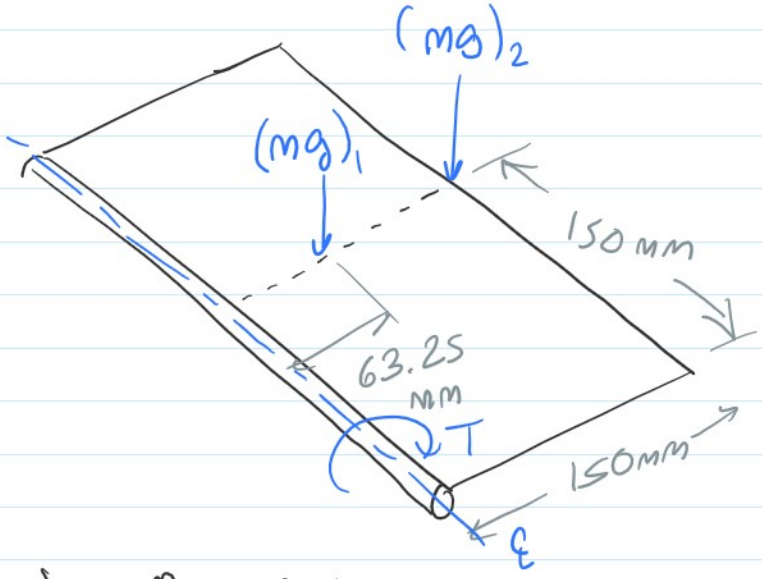
Mass properties of Trap_Door
Configuration: Default
Coordinate system: -- default --

Density = 0.00 grams per cubic millimeter

Mass = 348.45 grams

Volume = 278313.69 cubic millimeters





* neglecting any effect of D-shaft on torque (negligible)

$(mg)_1$ = effect of trap door mass
$(mg)_2$ = effect of glass bottle (worst-case loading scenario)

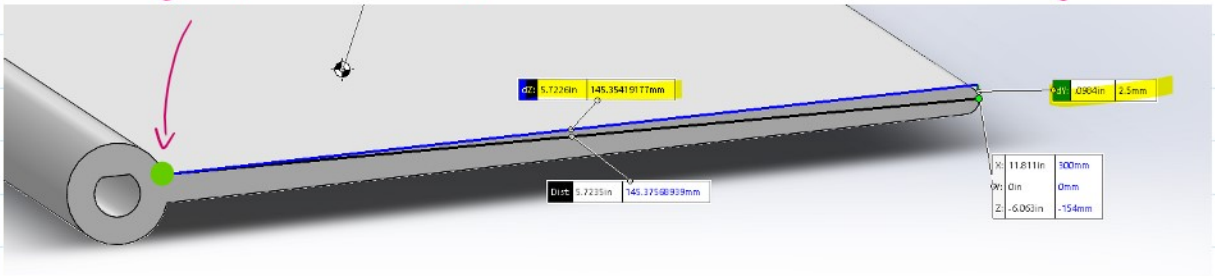
$$T = (mg)_1 (63.25 \times 10^{-3}) + (mg)_2 (150 \times 10^{-3})$$
$$= (348.45 \times 10^{-3})(9.8.1)(63.25 \times 10^{-3}) + (0.275 \times 9.81)(150 \times 10^{-3})$$
$$= 0.62087 \text{ Nm} = 620.87 \text{ mNm}$$

Motor has rated 197 mNm holding torque

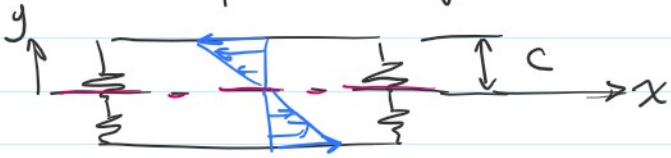
$$n = \frac{620.87 \text{ mNm}}{197 \text{ mNm}} = 3.1516 \longrightarrow \text{bump to } 4 = \text{reduction ratio min}$$

Checking against bending failure where door meets hinge:

Checking against bending failure where door meets hinge:

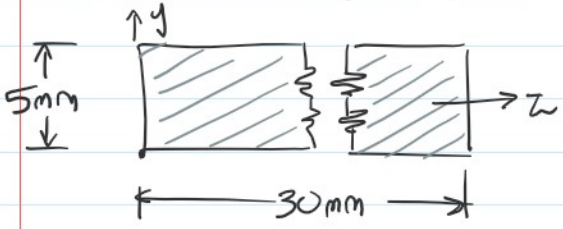


- Distance to $(mg)_2$: 145.3542 mm
- Distance to $(mg)_1$: 63.25 − (150 − 145.3542) mm = 58.6042 mm
- Neutral axis passes through center



$$c = \frac{w}{2} = \frac{5mm}{2} = 2.5\ mm$$

cross-section of beam (door):



$$I_z = \frac{bh^3}{12} = \frac{(30\times10^{-3})\times(5\times10^{-3})}{12} = 1.25\times10^{-5}\ m^4$$

$$\sigma_{max} = \frac{Mc}{I} \quad (0.275\times9.81) \quad (348.45\times10^{-3})(9.81)$$

$$= \frac{[(mg)_2(145.3542\times10^{-3}) + (mg)_1(58.6042\times10^{-3})]\times(2.5\times10^{-3})}{1.25\times10^{-5}\ m^4}$$

$$= 118.49\ Pa \ll \text{tensile strength} = 35.9\ MPa$$

∴ won't fail under bending