

Assume: Motor A-MAX 22 3.5 Watt
 ☆ $\phi 22\text{mm}$ 12.0V

GP22B 19:1 #110356 GP22A 53:1 #134163
 eff = .81 Lash 1.6° eff = .59 Lash 1.6°

To Lift Batt Vertically the Torque output must be
 $T_o = 0.0509 \text{ N.m}$

∴ The Input Torque = Motor output Torque must be:

$$T_i = \frac{.0509 \text{ N.m}}{(.81)(19)} = .00331 \text{ N.m} \quad T_i = \frac{.0509}{(.59)(53)} = .001628 \text{ N.m}$$

Motor stall Torque = .0157 N.m

Motor will Drive the Batt Vertical thru Both Gear Boxes

Motor Nominal Torque $T_n = 6.3 \text{ mNm} = .0063 \text{ N.m}$

Speed Torque Gradient 428 rpm/mNm

Motor Nominal Speed $n_n = 3950 \text{ rpm}$

$$n_w = n_n + [(T_n - T_i)(428 \text{ rpm/mNm})]$$

$$= 3950 + [(6.3 - 3.31)(428)]$$

$$n_w = 5,230. \text{ rpm}$$

$$= 3950 + [(6.3 - 1.628)(428)]$$

$$n_w = 5,949.$$

Ball screw rpm)₀ = Gear Box rpm)_i / reduction

$$\text{rpm})_0 = \pi_w / 19 = 275.3 \text{ rpm}$$

$$\parallel$$

$$4.59 \text{ rev/sec}$$

$$\parallel$$

$$4.59 \text{ mm/sec}$$

$$\text{rpm})_0 = \pi_w / 53 = 112.3 \text{ rpm}$$

$$\parallel$$

$$1.87 \text{ rev/sec}$$

$$\parallel$$

$$1.87 \text{ mm/sec}$$

Time To Move Battery 25.9 mm

$$\frac{25.9 \text{ mm}}{4.59 \text{ mm/sec}} = 5.6 \text{ sec}$$

$$\frac{25.9}{1.87} = 13.8 \text{ sec}$$

Current Draw To Do the Work.

Motor Nominal Current $A_n = 0.376 \text{ A}$

Torque Constant = 17.1 mN·m/A

$$A_w = [(T_w \text{ mN} \cdot \text{m} - T_n) / T_C] + A_n$$

$$A_w = [(3.31 \text{ mN} \cdot \text{m} - 6.3) / 17.1] + .376$$

$$A_w = 0.201 \text{ A}$$

$$A_w = [(1.628 - 6.3) / 17.1] + .376$$

$$A_w = 0.103 \text{ A}$$

@ 30° pitch the Torque Required is:

$$(.0509 \text{ N}\cdot\text{m}) \sin(30^\circ) = \boxed{.02545 \text{ N}\cdot\text{m}}$$

∴ the Input Torque (Gear Box) = Motor output Torque

Therefore

$$T_i = \frac{.02545}{(.81)(19)} = .001654 \text{ N}\cdot\text{m}$$

$$T_i = \frac{.02545}{(.59)(53)} = .0008139 \text{ N}\cdot\text{m}$$

$$n_w = n_n + [(T_n - T_i)(428 \text{ mN}\cdot\text{m})]$$

$$n_w = 3950 + [(6.3 - 1.654)(428)]$$

$$\boxed{n_w = 5938 \text{ rpm}}$$

$$n_w = 3950 + [(6.3 - .8139)(428)]$$

$$n_w = 6,298 \text{ rpm}$$

Ball screw rpm)_o = Gear Box rpm)_i / reduction

$$\text{rpm})_o = n_w / 19 = 312.55 \text{ rpm}$$

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$$6.21 \text{ rev/sec}$$

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$$5.21 \text{ mm/sec}$$

$$\text{rpm})_o = 6298 / 53 = 118.83 \text{ rpm}$$

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$$1.98 \text{ rev/sec}$$

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$$1.98 \text{ mm/sec}$$

Time To Move the Battery (2)(25.9 mm) = 51.8 mm

$$\frac{2(25.9)}{5.21 \text{ mm/sec}} = \boxed{9.9 \text{ sec}}$$

$$\frac{2(25.9)}{1.98 \text{ mm/sec}} = 26.2 \text{ sec}$$

Current Draw To Do The Work. @ 30° pitch

$$A_w = [(T_w \text{ mN}\cdot\text{m} - T_n) / (17.1 \text{ mN}\cdot\text{m}/\text{A})] + A_n$$

$$= [(1.654 - 6.3) / 17.1] + .376$$

$$A_w = 0.104 \text{ A}$$

$$= [(0.8139 - 6.3) / 17.1] + .376$$

$$A_w = 0.055 \text{ A}$$