Ball screw calculation torque

When designing equipment that uses lead screws, it is a common task to try to figure out the size of the engine needed to drive a given force with a lead propeller. This calculator will calculate the torque based on the lead screw parameters and the required strength. There are two torque torques to lift the load and torque to reduce the load. After calculating the torque, you can choose the right stepper. Common Stepper Motor Typical Torque Ranges and Dimensions Motor Torque in N*cm Dimensions Shaft Diameter NEMA 8 4 20mm sq 4mm,5mm NEMA 11 11-13 27mmx sq 5mm NEMA 14 9-15 35mmx sq 5mm NEMA 17 44-54 42mmx sq 5mm NEMA 23 180-300 57mmx sq 0.25 in NEMA 34 200-1100 86mmx sq 14mm Coefficient of Friction for Leadscrew Threads Screw Material Nut material Steel Bronze Brass Cast iron Steel, dry 0.15 - 0.25 0.15 - 0.23 0.15 - 0.19 0.15 - 0.25 Steel, machine oil 0.11 - 0.17 0.10 - 0.16 0.10 - 0.15 0.11 - 0.17 Bronze 0.08 - 0.12 0.04 - 0.06 - 0.06 - 0.09 Equations: These equations come from the Wiki article on force. Torque (raise) - F'Dm/2 (L'u'PI-DM)/(PI-Dm-u'L) Torque (bottom) - F'Dm/2 (L-u'PI-DM)/ (PI-Dm'u'L) Back to the beginning Conversion between linear force and torque Ballscrew Force - Torque x 2 x PI x Gear Reduction Factor / (Lead x %eff) Torque - Power x Lead / (2 x PI x Gear Reduction x %eff) Conclusion: If you know the torque, applied to the ball, you can calculate the linear force produced by the balls. If you know the required linear strength of the ball crew, then you can calculate the torque that needs to be applied. If you know the linear force applied to ballscrew, then you can calculate the torque produced by backdriving ballscrew. The calculation is based on the conversion of the torque used into force, acting on the bearing of the ball, and then on the calculation of the linear vector component as a result of force. Torque and Force x Distance (Rotating Force Acting on the Ball bearing) x (radius of the ball crew) So you can calculate the rotational-vector component of the force based on the torque and radius of the ball crew. T - F1 x D/2, where: F1 is a vector component (tangent to the ball crew) force, set by a screw on a ball bearing. D is the diameter of ballscrew so, F1 and 2T/D Linear force is made from the corner of the ball carving. The angle is indicated by lead, distance per turn (distance in circumference). F1 is a vector component in the direction of ball rotation. It is proportional to the lead of the ball crew. Linear force is a vector component in the able direction of the ball crew, and it is proportional to the circumference of the ball crew. Thus, F2 / F1 - PI x D/L, where: F2 is the linear vector of the L force component is lead, For the turnover solution for F2, we have F2 and F1 x PI x D/L t x x 2 x PI x D / (L x D) F2 and T x x 2 x PI/L units may be in SI or English: language: pounds, and inches, or n-m, n, and meters. See an attached diagram showing the vector components of force. The Ballscrew torque strength chart.png With engine size, one of the most important factors is the required torque. In general, the engine torque curves outline two main areas of acceptable torque: continuous and intermittent. Intermittent engine torque is allowed only for a short time (indicated by the manufacturer) and in most cases is the torque necessary during acceleration. Continuous engine torque is determined by calculating the root middle square of all the torque-skinny moments that occur throughout the application, which usually includes torque during acceleration, torque at constant speed and torque during braking. The constant torque of the torque the engine torque required at constant speed is the amount of torque required to drive the load, the pre-installed torque of the screw assembly, and the torque due to the friction of the support bearings and seals. Tc - torque at constant speed (Nm) Td - torque for load drive (Nm) Tp - torque due to preload (provided by manufacturer) (Nm) Tf - torque due to friction of support bearings and seals (provided by the manufacturer) (Nm) Torque Drive primarily depends on the load on the screw and lead. Fa - total axial force (N) P - lead (mm) η - the efficiency of the Axial load ball propeller is not only a force of process (drilling, stamping, etc.), but also includes the force needed to move the load. Since most ball screw aggregates use profiled rails guide to support load, this is simply an effort that the load exerts radially (down) times the friction factor guide. F - the force of the flowing process (N) m - the mass moves (kg) g - acceleration due to gravity (m/s2) μ - the friction factor of the linear guide point Note that pre-loadable torque fluctuates due to production tolerances and variation of lead, thus, manufacturers will either provide a range of acceptable values (e.g. 0.04 to 0.17 Nm) or they will specify the allowable percentage of the change from the pre-load torque nominal (e.g. 0.10 Nm, ±40%). Ta - total torque during acceleration (Nm) Tacc - torque due to acceleration (Nm) J - System (kgm2) - angular acceleration (rad/s2) N - angular speed (rpm) t - acceleration time (s) Jm - motor inertia (provided by manufacturer) (kgm2) Js - inertia of the screw shaft (provided by the manufacturer) (kgm2) Jl inertia load (kgm2) Slowing the torque of the torque For vertical applications, the torque is a moment to cause back driving is important for determining whether the load will fall on its own, or if the propeller assembly provides enough resistance to keep the load in place when no brake is applied. This article explains how to calculate the rear torque. In addition to having to move the load or perform the process at will, the required engine torque also determines the amount of current required from the servo amplifier. When the current is applied to the engine, it faces resistance and, as a result, heat is generated. This heat is commonly referred to as I2R losses (I - current and R - resistance). Since heat is exponentially associated with the current, the required engine current, and therefore the required engine torque, becomes a critical option for engine selection. Feature image credit: Bishop-Wisecarver Corporation - Please respond the result of technical calculation derived from this computation service as reference value. Please use semi-width symbols. Pre-loading 0% 2% 5% Driving Torque Nm Back Driving Torque Nm Holding Torque Note: When determining all the torque required, Consideration should be done for additional engine load such as windshield wipers or resistance seals, linear resistance guidance, proper compliance inertia, etc. Support: 1-800-468-3982 Sale: 1-800-448-6935 Free shipping for online orders. Conditions apply. Below is the estimated cost of the claims. Please contact 1-800-468-3982 (from overseas 1-847-871-5931) for help or questions. To print the calculation report, click The Full Report to see the engine selection tips Click Tips × Call 1-800-GO-VEXTA (468-3982) or 1-847-871-5931 Print - End Report - Table Friction Factor (Help) Materials Dry Oiled Aluminum 1.0 0.3 Aluminum Steel 0.3 Aluminum Steel 0.3 Aluminum Steel 0.3 Aluminum Steel 0.3 Aluminum Steel 0.6 Brass Steel 0.5 Graphic Steel 0.1 0.1 Polyethylene Steel 0.2 0.2 Polystyrene Steel 0.3 0.3 Rubber Steel 0.4 Steel Steel 0.8 0.2 Teflon Steel 0.. 04 0.04 Wood Wood 0.5 0.2 Positioning Operation Step 1: Leave the Jo Rotor inertia and gear ratio I'm empty if you haven't picked any engine (or directional engine) yet. Then fill out the rest of the form. The software will temporarily calculate the torque of acceleration with a load/rotor inertia factor of 5:1. Step 2 : Choose a product based on the torque you want and the speed you want. Then confirm the inertia factor that will be within the recommendation. (See the tips on choosing the engine that will appear in the result box for detail) Step 3 : Back to form and enter the inertia of the rotor Jo and the ratio gears I product you to calculate torque, the requirement is using this particular product. If you choose a round shaft type engine (without a gearhead), leave me blank or enter one. Roter Inertia Jo : This value is in the specification table for the activation of motor products. Transmission ratio i : This value is the transmission ratio oriented motor product that you have chosen. These values are only used to calculate more accurate acceleration torque. Torque.

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