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Thread stripping strength calculator

RoyMech Resources Screws & Fastening Index Screw Thread Calculations These pages include several standards. To confirm the status of any standard, identify the replacement standard if it is obsolete and/or buy the standard please use. It is also possible to become a BSI member and obtain copies of the Standards at very reduced prices. Screws Index page... Introduction The critical areas of stress of mating screw wires are the effective cross-sectional area, or drawing area, of the external thread. The shearing area of the external thread that depends on minor diameter of the typed hole The shear area of the internal thread which depends on the large diameter of the external thread The permissible voltage and screw end power and the method of applying the force in the calculation of thetraps are not considered on this page, But is addressed on this website by tables and more importantly referenced links If a screw is threatened confirmation to fail, it is preferable that the screw fails rather than the internal or external thread strips. The length of the screw engagement should therefore be sufficient to carry the full load necessary to break the screw without harvesting the wires. The size of a screwed fasteners is first established by calculating the pull load to be withstanded by the propeller and choosing a suitable screw to withstand the pull load with the appropriate factor of safety or preload. If the joint is fixed using a nut and bolt then assume the nut is selected from the same degree as the bolt there is little need to size the nut. The fasteners manufacture the length of the nut to ensure that the screw will fail in front of the nut. If the screw is stuck in a typed hole then a check of the depth of thread engagement is required. Generally for female and male threads of the same material with, the female thread is stronger than the male thread in shear for the same length of engagement The following rules of thumb are suggested for arrival at reasonable lengths of wire for steel screws used with screwed holes in weaker material. For steel a length of thread engagement of at least 1 x Nominal dia's of the thread For Cast Iron or copper or bronze the thread engagement must be at least 1.5 x Nominal dias of the thread for Aluminum, zinc or plastic the wire engagement should be at least 2 x Nominal dia's of the wire however for a quality safe connection, when the typed material has a significantly lower eventual pull strength than the screw material, - ensuring the screw will fail in tension in front of the female, it is preferable to use suitable rated nuts or design wire inserts. For some notes on thread Add ref. Thread Add Note: Several studies on wire loading have determined that the shearing stress is not evenly distributed across the wires. The first first resisting the burden is the highest stressed and the next one is much less stressed and so on... . If the wire material was very hard and did not produce the first wire, then almost all the load could be withstanded. However, due to material yield, there is some distribution of the load. A study (see link 2 below) determined that for a typical Grade 8 nut the percentage of the load taken by consecutive threads is about 34%, 23%, 16%,11%,9%, 7% .... This effect can be alleged by the use of very accurate threads and by using ductile materials for the components. It has been determined that, for carbon steel, there is no increase in wire shearing power by a wire engagement length more than the screw diameter. It is normal practice to use a typed hole depth of about 1.5 x nominal diameter - this leaves at least 1 diameter of good wire engagement. A very simple rule that can be applied for that vast majority of applications is that a thread length of 80% of the screw diameter (standard nut height) is sufficient to ensure that the screw will fail in tension before the female thread (nut) fails in wire stripping (assuming the screw and nut are similar material). Comparisons below indicate how to make adjustments if the typed metal (nut) power is lower than the screw/bolt. Stress Area formula D = Basic Diameter. p = Screw Thread Pitch Le = Length of Thread Engagement a t = The Screw Thread Pull Stress Area d p = Pitch Circle Diameter of Thread A ss = The Thread Shaving Area The following formula for the Pull stress area of the (male) screw It is based on ISO 898 Part 1. see calculation below.. d p = Pitch circle diameter of thread dp = (D - 0.64952.p) The thread shaving area = Ass When the female and male threads are the same material. Ass = 0.5. π. dp. Le = 0.5 π (D - 0.64952.p). Le Ensuring that the screw fails before the wire syrup it is necessary that the shearing area is at least 2 times the pull area. i.e Le (min) = 2 . A T/[0.5 .π .(D - 0.64952.p)] It assumes that the male and female wire materials have the same strength. If the Female Material force is lower i.e J as calculated below is greater than 1 then the length of engagement should be increased to prevent the female thread stripping If the value of J is greater than 1 then the length of engagement should be increased to at least More detailed Notes The above formulas are sufficient to enable the tension strength to be calculated and to allow the depth of wire for a typed hole are comparisons to provide more accurate evaluation of the shearing strength of wires. These are comparisons derived from FED-STD-H28/2B, 1991 and Machinery Handbook Eighteenth Edition. They are strictly apply to UN wire range, but if the relevent metric screw wire dimensions are used, they will Results. In practice when the values calculate the value for the screw shaving force is similar to the very convenient formula provided above. These equations are only of theoretical value Screw Shaving area calculations K nmax = Maximum minor diameter of internal threading. E smin = Minimum pitch dia of external thread. E nmax = Maximum pitch dia of internal thread. D smin = Minimum large dia of external thread. n = 1/p = threads per unit (mm) Minimum length of thread (assume male and female threads are material of similar force). Shear area for screw shaving area for female wire Ash material in which the female thread is taped is significantly weaker that the screw material then J should be evaluated. If the value of J is greater than 1 then the length of engagement should be increased to at least Stress Area -ISO 898 Note: Short desk of nominal stress area formula of information in BS EN ISO 898.. Some calculate stress areas for ISO Metric Threads.. Medium fit (6H/6g) The purpose of this table is to show the results of the above formula. It is clear from this table that there is no great advantage in using the detailed formula above. The approached formula for the screw wire stress area (A ss) is generally sufficiently accurate and there is no need to use the more detailed formula for Ash. For sizes under M6, the formulas deliver very similar values. For sizes M6 and above the value for Ass provide a slightly more conservative result (20% margin at M36) I have obtained the thread dimensions on tables in Machinery's Handbook 27th ed. If you intend to use this information please check it against a reliable source (ref disclaimer above) All dimensions in mm Size M3 M4 M5 M6 M8 M10 M12 M14 M16 M20 M22 M24 M30 M36 Basic Dia D (mm) 3.00 4.00 5.00 6.00 8.00 10.00 12.00 14.00 16.00 20.00 22.00 24.00 30.00 36.00 Pitch p 0.50 0.70 0.80 1.00 1.25 1.50 1.75 2.00 2.00 2.50 2.50 3.00 3.50 4.00 1/p n 2.0000 1.4286 1.2500 1.0000 0.8000 0.6667 0.5714 0.5000 0.5000 0.4000 0.4000 0.3333 0.2857 0.2500 Stress Dia D s 2.5309 3.3433 4.2494 5.0618 6.8273 8.5927 10.3582 12.1236 14.1236 17.6545 19.6545 21.1854 26.7163 32.2472 Tensile Stress Area A t 5.0308 8.7787 14.1825 20.1234 36.6085 57.9896 84.2665 115.4394 156.6684 244.7944 303.3993 352.5039 560.5872 816.7226 Pitch circle dia. d p 2.6752 3.5453 4.4804 5.3505 7.1881 9.0257 10.8633 12.7010 14.7010 18.3762 20.3762 22.0514 27.7267 33.4019 Approximate Method Shear Area/unit Length Ass/mm 4.2023 5.5690 7.0378 8.4045 11.2910 14.1776 17.0641 19.9506 23.0922 28.8653 32.0069 34.6383 43.5530 52.4676 Shear Area Assm=2. 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