Eccentrically loaded bolted joints

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What is an eccentric loaded welded joint. Eccentrically loaded bolted connections examples. Design of eccentrically loaded bolted joints. Eccentrically loaded bolted joints in shear.

13.1.1 The maximum traction failure induced in the bolt is given by, where, dc = bolt core diameter. The cross section at the diameter of the nucleus is the weakest section. In addition to this, bolt wires can also fail in cutting and crushing. To analyze that, it is presumed that each wire spin supports equal load and fault occurs in bolt wires and not in the nut wires. The stress concentration is also neglected in the analysis of bolts. 13.1.2 Load cutting fault The maximum cutting stress developed in threads is given by, where n = no. of turns, b = width of the thread section at the root h = n×b = bolt height 13.1.3 Croshing Loading of threads The maximum crushing stress developed in the wires is given by, where n = no. of turns, d = outer diameter of the bolt 13.1.4 Belt fault In addition to the traction load case, bolts can also be subjected to cutting loads. In this case the maximum stress of the cut is given by, where P, in this case, is the force acting on the joint perpendicular to the bolt axis. Using the above reports, the bolt core diameter can be calculated for a given material and the load type. If standard bolt tables are available, you can select a suitable bolt and other sizes can be taken from the table. If the tables are not available the approximate dc = 0.8 d ratio is generally used to find the nominal diameter of the bolt. (The exact relationship for ISO threads is dc = d – 1,22687 p, where p is the field). 13.2 Pre-stress in Bolts Stress develops in the threaded joint due to the initial tightening couple. The developed stress is compression in members and traction in nature in bolts. The initial voltage value in bolts is calculated using an empirical relationship. Initial voltage, Fi = 2840 d (N) (for fluid seal joints) = 1420 d (N) (for other joints) where, of a nominal diameter of the bolt in mm. The initial stress in the bolt can be calculated by Fi. 13.3 Eccentrically Loaded bolt joints 13.3.1 Eccentric load acting in the bullion plane Figure 13.2 Eccentric load acting in bolt plan Consider the joint shown in Figure 13.2. The P force acts remotely and from the center of gravity. This eccentric force can be considered equivalent to an imaginary force P acting at the centre of gravity and a ‘Pe’ moment on the centre of gravity. The primary cutting force developed in bolts, due to the direct load, the secondary cutting force due to the moment can be determined as follows. It is assumed that the secondary cutting force in any bolt is proportional to its distance from the center of gravity. Consider C as a proportionality constant, so...Similarly P"2, P"3 and P"4 values, and can be calculated. Primary and secondary cutting forces are then added vectorally to obtain the resulting cutting force in each bolt, which can then be used to find stress. 13.3.2 Eccentric load that acts perpendicular to the bolt plane Figure 13.3 Eccentric load that acts perpendicular to the bolt plane Consider a bracket fixed to a structure as shown in Figure 13.3. That an eccentric force P is acting at a distance and from the structure. Two lower bolts are denoted by 2 and two by 1. P acts perpendicular to the bolt axes and leads to a direct cut load, which can be given by, In addition, due to eccentricity, P leads to a Pe moment, which tends to tilt the bracket on the C edge. This leads to resist traction forces in all bolts, which are proportional to their distance from C. If and are the tensile strength developed in bolts respectively in position 1 and 2, Considering C as a proportionality constant, Equating the moments due to P and due to the resistance forces, or and bolts farther from the tilting edge have the maximum value to resist the pulling force. Therefore, the stresses in bolts denoted by 1 will have maximum tensions that can be determined as follows: For a given material you can find maximum main tensions developed in bolts and compared with the permitted values or the size of bolts. 13.3.3 Eccentric load that acts parallel to the bolt plane Consider the bracket fixed to the structure indicated in figure 13.4. Let an eccentric P force be acting at a distance and from the C edge on which it tends to tilt the bracket. There are two bolts at each position, namely 1 & 2. As P, in this case, acts parallel to the bolt axes, leads to a primary traction force and a secondary traction force due to the moment. Primary traction forces are given by, Figure 13.4 Eccentric load acting parallel to the bolt plane As discussed in the previous case, secondary traction forces are given by, the total traction force in each bolt in position 1 & 2 is given by, P1 = P'1 + P"2 and P2 = P'2 + P"2 Since 1 bolts are farther from the edge on which the bracket tends to tilt, the maximum strength is developed in those. The maximum tensile effort in bolts in position 1 is given by, This can be compared to the permissible voltage values. References: Design of machine elements from V Bhandari Analysis and design of machine elements from Vijay Kumar Jadon A textbook of design of the machine from RS Khurmi Important questions, sample paper, design of eccentrically loaded/revetted joints Mechanical engineering notes | EduRev, extra questions, documentspast, ppt, target type questions, semester notes, semester,, fake tests for the examination, the design of bolted / riveted joints covered by eccentricians notes of mechanical engineering | EDUREV, MCQ, video conferences, examination, study material, free, design of bolted / riveted joints covered with eccentric mechanical engineering notes | Edurev, shortcuts and tricks, questions of the previous year with solutions, practice quizzes, questions of living, summary; You are reading a free preview page from 5 to 9 are not shown in this preview. Slideshare uses cookies to improve functionality and performance and to provide relevant advertising. 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