Clip nut torque

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A world of crane rail expertise

In most engineering application it is normal to tighten bolts to a torque which will give 85% of the proof load in tension. A lower bolt tension could lead to failure of the bolt in fatigue. A higher tension may lead to bolt or nut damage. The design of Gantrail clips calls for the bolt tension to be carried across the slotted part of the clip via a top part. Thus Gantrail has chosen lower torque values than might be expected with the same sized bolts used in other applications. This in no way affects the strength of the clips all of which have been tested under the surveillance of Lloyd's Register of Shipping surveyors. This note explains the background for bolt choice and tightening in more detail and also gives some explanation on how the correct tightness can be ensured.

BOLT GRADE

The cost of using grade 8.8 bolts in an installation is very little more than using grade 4.6 bolts. However they offer 2.5 times the strength. Thus Gantrail recommends that grade 8.8 bolts should always be chosen in preference to grade 4.6. All torques are given in Newton metres (Nm).

To convert Nm to other figures use the following conversions:-

- Nm to kilogram metres (kgf) multiply by 0.102
- Nm to pounds force feet (lbf.ft) multiply by 0.74

Studs are considered to be equal to grade 4.6 bolts and are torque tightened to the same values as 4.6 bolts.

Clip designation	Torque for grade 4.6 bolts or welded studs Nm	Torque for grade 8.8 bolt Nm
3112/10	35	85
3116/10	75	200
3120/15	160	390
3124/15	275	600
3124/20	275	600
3224/20	275	600
3226/15	275	600
6124/20	275	600
7120/10	160	390
8119/15	Not applicable	250
8219/20	Not applicable	250
9112/08	Not applicable	60
9116/08	Not applicable	125
9116/10	Not applicable	125
9120/15	Not applicable	250
9216/08	Not applicable	125
9220/20	Not applicable	250

Clip nut torque Introduction

TORQUE FOR THIN NUTS

Thin nuts are routinely made and are typically used as lock nuts. When there is a potential clearance problem between the clip and the crane wheel, thin nuts may be specified. These should be specified to be consistent with the bolt strength in use. The torque that can be used is 80% of that for full nuts, however, the margin of safety in the nut thread strength is less than for full nuts. If problems are experienced higher grade nuts or bolts should be used.

TOLERANCE ON TIGHTENING TORQUES

Customers have asked what tolerance there is on the torque tightening figure. Some have requested a specified range of torque for the tightening of clips and not just a single figure as shown in our brochure. This is not normally practical. Gantrail specify a torque based on experience of what the clips will take. To specify a lower figure could risk a clip slipping and to specify a higher figure could result in some damage to the components of the clip.

The torque Gantrail specifies is a proportion of the torque that should give the full proof load in the bolt. The proof load is given in BS 3692. (ISO 272, ISO 4759/1). UK practice is to tighten hexagonal bolts such that their tension when tightened is 85% of the proof load. For grade 4.6 and grade 8.8 bolts this is done using a torque calculated using a simple formula. In practice the tension achieved after torque tightening can be quite inaccurate due to the surface condition of the bolt and nut and the presence of any lubricants or zinc. However, in general engineering it is not considered necessary to do more than torque tighten with a calibrated torque wrench and normally only a proportion of bolts. On the other hand, for high strength friction grip bolts this is not adequate and various alternatives have been tried including, load indicating washers and bolts as well as part torque, part turn method.

For our clips we do not have a full bolt bearing area and we typically suggest a torque which should achieve approximately 70% of bolt proof load, depending on the clip. With the inaccuracy of torque wrenches and the variability of bolts even this will result in a range of actual bolt tensions. If Gantrail were to include a range of torques, this would increase the range of actual bolts tensions achieved on site. It is accepted that customers do not want to tighten all nuts with a torque spanner but there is an accepted and reasonably reliable method of ensuring that the correct bolt tension is achieved. The method is as follows:-

- Fit a sample of the nut and bolt to be used into a calibrated bolt tension meter.
- Tighten the bolt using the means intended; in most cases an electric or pneumatic impact wrench. If the required bolt tension is known the bolt is tightened to that tension. The wrench is then set or operated to achieve the same results on future bolts.
- If the torque is specified in the requirements for the job, this is checked after tightening of the bolt using a direct indicating torque wrench (i.e. not one that clicks or breaks on achieving the required torque). If the torque is not correct, the test is repeated with lower or higher settings of set-able impact wrenches or less or more impacts of non-set-able wrenches. When the procedure for using the wrench achieves a bolt tightening that is consistent with the correct torque spanner reading, this method is used on site.

While this may sound long-winded and expensive (bolt tension) meters may cost 1000s of pounds, it is what is done by structural companies on sites with stringent quality control and quality assurance requirements. Torque wrenches made by reputable firms should conform to the ISO standard and the British Standard BS 6703: 1988. These require an accuracy of 6% at 20% of full scale reading and 3% at 100% of full scale reading with accuracy between these points being pro-rata. If customers have problems on a specific project where our products are going to be used, Gantrail may be able to offer specific advice.

Gantry Railing Ltd
Sudmeadow Road, Hempsted, Gloucester GL2 5HG
www.gantrail.com
Tel: +44 (0) 1452 300688
Fax: +44 (0) 1452 300198
International: +44 (0) 1452 300688
E-mail: info@gantrail.com