

HYDRAULIC BOLT TENSIONING

Hydraulic Nuts

A hydraulic nut incorporates its own internal hydraulic jack. This enables large diameter bolts to be tensioned, with ease, to high and accurate pre loads. Hydraulic nuts are widely used in the Oil, Gas, Offshore, Mining, Conventional & Nuclear Power Generation and Heavy

Engineering industries on applications including :-

- Press tie rods
- Marine diesel engines
- Propeller shafts
- Propellers
- Pumps
- Compressors
- Rock crushing machines
- Steel rolling mills



Boltight hydraulic nuts are available in four types and a wide range of sizes, the largest ever made being in excess of 20 inch thread size. Typically they range from M24 to M250. Hydraulic nuts are available in standard and custom designs. All nuts are made to order so manufacturing a nut, custom built, to suit the application is common.

Advantages

- Fast and effortless
- Even and accurate pre load
- Low loss of initial load (shim type)
- No torque or torsion stress
- No flogging hammers or spanners
- Self aligning (shim type)
- Improved fatigue performance
- Simultaneous operation
- Long life of internal jack
- Ideal for confined spaces

Hydraulic nuts are quickly installed. A hydraulic pump activates the internal jacking system, so the effort required to tighten a very large diameter bolt is reduced to the effort needed to operate the pump. If an air driven pump is used the tightening operation really is fast and effortless.

Normally spanners, flogging hammers or torque wrenches are required to tighten large bolts but these are not required when a hydraulic nut is used. They also induce high torsional stresses in the bolt during tightening and can damage the bolt threads. As there is no nut rotation during tightening a hydraulic nut, the operation can be performed in a confined space and torsional stresses or thread damage are eliminated.

The nut develops a load which is directly proportional to the oil pressure. This can be accurately controlled and because it is developed hydraulically, it is evenly applied. Any number of hydraulic nuts can be connected together for simultaneous operation. In this way, all of the bolts in a joint can be evenly loaded to the same high and accurate pre load.

When the oil pressure is applied, the joint is compressed and the bolt stretches. This produces a gap between the body of the nut and the piston. Depending on the type of nut, either shims are inserted into the gap, or a locking collar on the piston is turned. When the hydraulic pressure is released, the load is transferred onto the shims or the locking collar to retain the load.

When tightening bolts it is possible to induce bending stress in the shank of the bolt if the joint faces are not true or flange rotation occurs in a flanged joint. The hydraulic nut is self aligning whilst under pressure and misalignment or flange rotation will produce a variation in the gap between the nut body and the piston. In the case of shim type nuts, tapered shims can be made and fitted to eliminate the effects of misalignment and flange rotation. In the case of collar type nuts, a spherical washer would need to be fitted under the hydraulic nut.



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Achieving a bolt pre-load which is in excess of the working load and eliminating bending and torsional stresses greatly improves the fatigue performance of the bolt.

The internal jacking system is not under pressure when the nut installation is complete and so does not deteriorate when the nut is in service providing it is not exposed to high radiation doses or elevated temperatures.

Three types of hydraulic nut and one mechanical nut are available from Boltight.

SHIM TYPE / LOWER / COLLAR TYPE / UPPER COLLAR TYPE / RUBBER FILLED TYPE (MECHANICAL)

Shim Type

This nut has a flanged piston. A shim gap is created between the body and the piston when the nut is pressurised. The size of the shim gap is a combination of the compression of the bolted joint and gasket, if fitted, plus the elongation of the bolt.

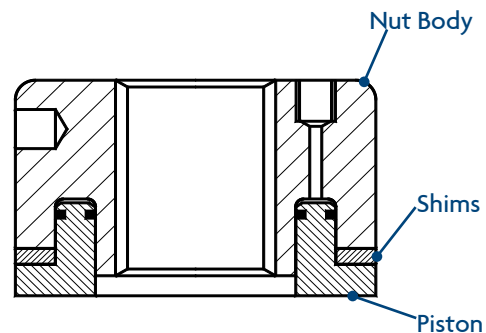
In use the nut is pressurised until the hydraulic jack develops the desired pre-load. The shim gap is measured and shims are made to fit. The pressure is increased slightly to allow the shims to be inserted. The pressure is released and the pre-load is transferred onto the shims. A very high percentage of the load is retained in the bolt. The shim type nut is the most accurate type of hydraulic nut.

Advantages

- One diameter high
- Easy to use
- Quick to remove
- Very accurate
- Lower cost

Disadvantages

- Measuring shim gap
- Making shims
- Temperature limited by seals



Lower Collar Type

This nut has a longer piston which is externally threaded and fitted with a load retaining locking collar. A gap is created between the body and the locking collar when the nut is pressurised. The gap is a combination of the compression of the bolted joint and gasket, if fitted, plus the elongation of the bolt.

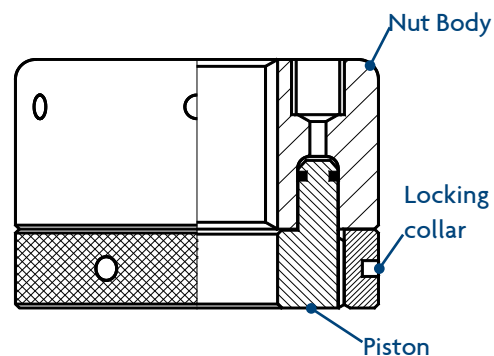
In use the nut is pressurised until the hydraulic jack develops more than the desired pre-load. The locking collar is tightened. The pressure is released and the pre-load is transferred onto the locking collar threads where settling of the threads causes some of the pre-load to be lost. This is more critical in short bolt applications where the bolt elongation may be small. The pre-load loss on transfer to the collar becomes less significant on longer grip length bolts.

Advantages

- Quick to install
- Easy to use
- Quick to remove

Disadvantages

- Greater height
- Less accurate
- Higher cost
- Temperature limited by seals



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Upper Collar Type A

This nut has an internally and externally threaded piston. The external thread of the piston is fitted with a load retaining, locking collar. A gap is created between the nut body and the locking collar when pressure is applied. Again the gap is a combination of the compression of the bolted joint and gasket, if fitted, plus the elongation of the bolt.

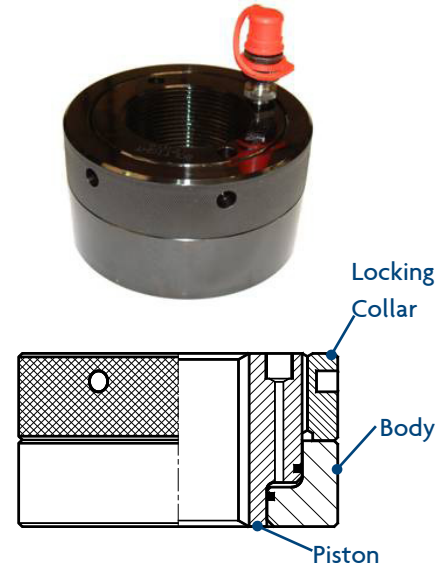
In use the nut is pressurised until the hydraulic jack develops more than the desired pre-load. The locking collar is tightened. The pressure is released and the pre-load is transferred onto the locking collar threads. Due to settling of the collar threads some of the pre-load is lost. This is more critical in short bolt applications where the bolt elongation may be small. The pre-load loss on transfer to the collar becomes less significant on long grip length bolts.

Advantages

- Quick to install
- Easy to use
- Quick to remove
- Top entry for hydraulics

Disadvantages

- Less accurate than shim type
- Higher cost
- Temperature limited by seals



Upper Collar Type B

This nut is in two parts. A plain bore load cell and a collar nut. The collar nut is threaded internally and externally, and is fitted with a load retaining, locking collar. A gap is created between the load cell body and the locking collar when the load cell is pressurised. Again the gap is a combination of the compression of the bolted joint and gasket, if fitted, plus the elongation of the bolt.

In use the load cell is pressurised until the hydraulic jack develops more than the desired pre-load. The locking collar is tightened. The pressure is released and the pre-load is transferred onto the locking collar threads. Due to settling of the collar threads some of the pre-load is lost. This is more critical in short bolt applications where the bolt elongation may be small. The pre-load loss on transfer to the collar becomes less significant on long grip length bolts.

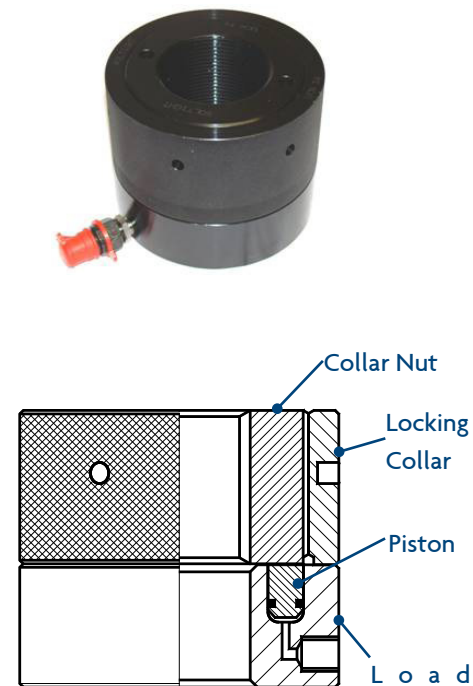
Because the load cell has a plain bore the hydraulic connection can be located in the best position. The load cell can be fastened to the joint face and left in place. Similarly the hoses or rigid steel pipe-work may be permanently connected and left in place.

Advantages

- Quick to install
- Easy to use
- Quick to remove
- Load cell and piping can remain in place
- Hydraulic connection position is fixed
- Only need to remove the collar nut and collar

Disadvantages

- Greater height
- Less accurate
- Higher cost
- Temperature limited by seals



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Rubber Filled Type (Mechanical)

This is a mechanically operated, shim type nut. It is activated by tightening socket head cap screws located in the top of the nut. The nut has a flanged piston. A shim gap is created between the body and the piston when the nut is operated. The size of the shim gap is a combination of the compression of the bolted joint and gasket (if fitted), plus the elongation of the bolt.

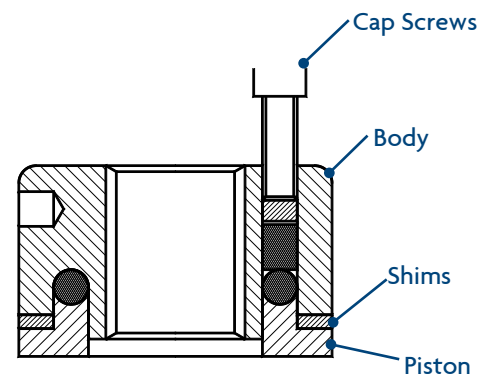
In use the socket head cap screws are tightened until the shim gap is large enough to accept the pre-machined shims. The socket head cap screws are then removed and the pre-load is transferred onto the shims. A very high percentage of the load is retained in the bolt. The mechanical operating system is unloaded during service.

Advantages

- No hydraulic hoses or pump required
- Simple and easy to use

Disadvantages

- Slower to use
- Less accurate than shim type hydraulic nuts
- Temperature limited by seals



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