www.tsfftsh.com

patent pending

guaranteed
preload systems

TSH - SH

Minimum guaranteed preload
80% of bolt yield stress

if fastened as specified by the manufacturer

TSF®

TSF®

patent pending

guaranteed **preload systems**

- Reduced number of fixation elements with respect to torque control.
- Quick reaching of preload.
- Low dispersion.
- High stability of the preload.
- Low load distribution factor for the fixation element. Lower fatigue range.
- Achieving preload by the use of pressure tables.
- Insensitivity to bending moments.
- No twisting of the fixation element.
- Ease of assembly and disassembly.
- Simultaneous Assembly of fixation elements. Elimination of elastic interaction of close elements.
- Same assembly protocol for all metric sizes.
- Benefits of elongation, without the disadvantages of friction.
- Ease of verification of preload sustention. It enables maintenance actions, if necessary, based on accurate preload readings.
- Multiple reuse of the element. Ease preload reset by assembly process repetition.
- Insensitive to the type of fixation thread or its lead due to lack of friction in the tightening process. Potential increment of the preload capacity.

Systems to ensure the preload SH and TSH

Bolted joints are essential for engineering applications as diverse as wind turbines, oil rigs, combustion engines, automobiles, cranes, aerospace, nuclear, marine, rail, etc., that must endure the most severe working conditions during its effective lifetime.

These conditions vary constantly, the efforts are not uniform, nor are the temperatures, weather conditions, marine or on land, etc., So that bolts and nuts are designed to withstand the maximum loads that may occur in the application, whether continuous or occasional, regular or extreme situations, during the lifetime of the product in which they are mounted.

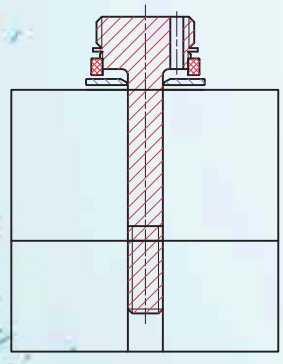
These joints are calculated with the load conditions in sophisticated software programs. Components are also tested in laboratories or in testing to failure.

The most commonly used screws are hex heads that are preloaded by applying a torque via pneumatic, hydraulic, electric or manual tools.

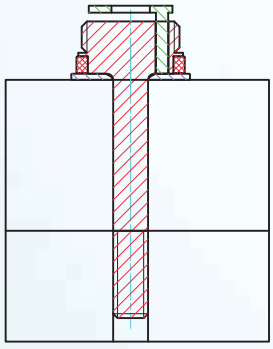
During this process, the bolt preloads and stretches, causing it to act like a spring that presses the pieces together, so the torque applied is of vital importance. This torque will cause the preload applied to the screw to be equal to that calculated for the binding, otherwise the joint will not work properly and end up deteriorating or breaking.

In the application of torque causes the friction to be involved, this friction between parts of the joint generates dispersions in the transformation of the torque to preload. This dispersion can be minimized by the lubrication of the joint components: bolts, screws, nuts, washers, etc., but still and under normal conditions, the dispersion can be up to 25% of the nominal preload calculated.

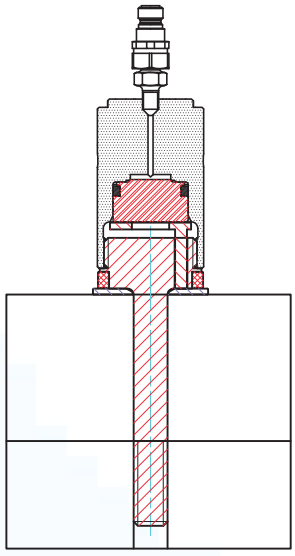
NUTS - LOCK BUSHING



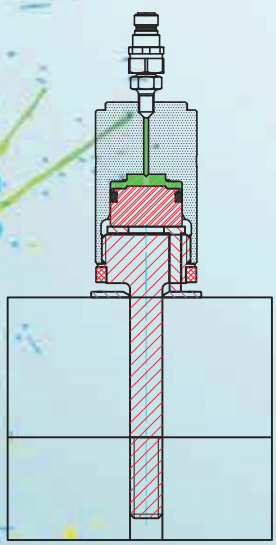
1 The base washer, lock bushing and TSH4 are introduced in the assembly.



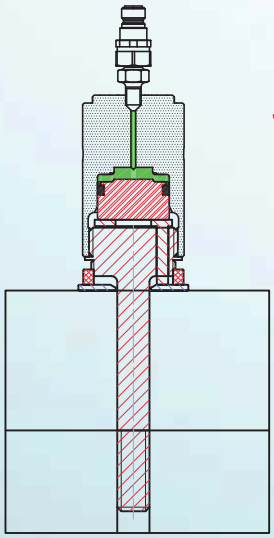
2 Strength transmitters are introduced through the TSH4 head



3 Assemble the puller on the TSH4 head



4 Preload is applied through the hydraulic puller and the TSH4 elongates



5 Adjust the lock bushing between the TSH4 head and the base washer to lock the elongation obtained and maintain the preload

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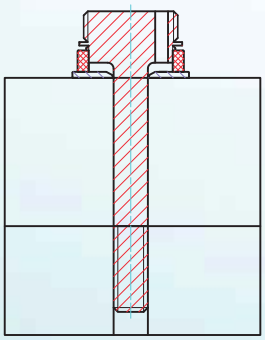


6 Disassemble the puller and strength transmitters from the TSH4

We can deduce that if we are able to control the dispersion of the preload, we will increase the security and integrity of the bolted joints.

TSF has patented a solution to ensure the preloads and control the dispersion in the joints obtaining preload variations below 5%. These systems to ensure the preloads are called SH and TSH in its different variants.
Systems to ensure preloads SH and TSH distinguish for their simplicity and ease of use, improving preload application performance by torque or through puller already existing in the market.

In our patented systems to ensure the preload SH and TSH, it is generated in a hydraulic puller designed specifically, defragmented and delivered to the joint by strength transmitters across the parts involved in such joint.
The preload is controlled by the pressure applied to the puller 95%, 90%, 85%, etc., of the elastic limit for each screw and supported by shims or locking bush, according to the variant used of SH and TSH. As the friction is not involved in obtaining the preload, only the relaxation will affect between the components of the joint.

Due to the design of our SH and TSH we can, doing the correspondent protocol, know the absolute elongation of the joint, that is, the total elongation minus the loss due to relaxation of the components of such joint. Through standard metrology systems (caliper, palmer, etc.,) we can obtain the absolute elongation value and therefore, know the preload of each of the bolts, also at the same time; we have unitary traceability of all the bolts constituting the joint. As we have explained, to know the bolt preload is not necessary to use current sophisticated systems such as ultrasound, etc., although, due to the geometrical characteristics of our SH and TSH, those can also be used.

Once assembled the joint and with traditional metrology media, we can in time, check again the elongation to control and verify the sustainability of the preload, allowing us to take maintenance actions if needed, based on precise measurements of the elongation.

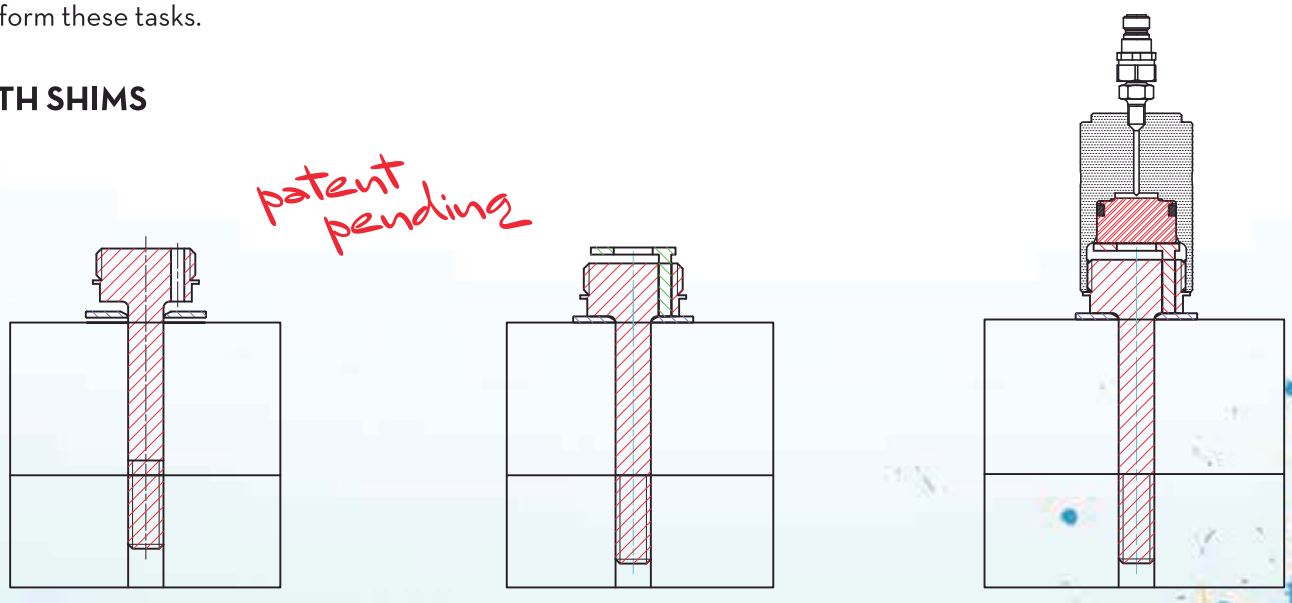
When pulling with our systems to ensure the preload SH and TSH, we eliminate the twist in the tying up element and we achieve insensitivity to bending moments, so as pitch and type of thread of the bolt by not intervening friction in tightening the union.

Is noted in the SH and TSH systems to ensure the preload, the ease of assembly and disassembly of the system and the quick achievement of preload and its reset using the same protocol, which at the same time is the same one for all types of bolts in their different metric sizes; this ease of use allows multiple reuses of the parts that constitute the joint. The preload is defined in pressure-preload tables specifically for each metric size and quality of materials.

By not intervening in the SH and TSH systems the friction, we get a potential increase in preload, high stability and low dispersion, which allows us to place fewer tying up elements than in joints assembled by torque control, or we can also use the same number of tying up elements, reducing the metric size of the bolts to use, obtaining the corresponding savings in machining, assembly time, maintenance, etc.

The field maintenance is drastically reduced due to the security of preload achieved, but whenever needed to do it, it is very easy because no special hardware is required for it, a manual hydraulic pump and a puller are enough to perform these tasks.

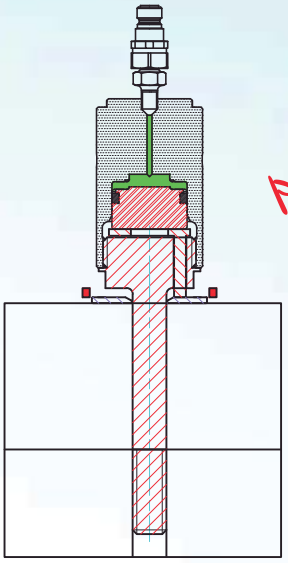
WITH SHIMS



1 The base washer and TSH4 are introduced in the assembly

2 Strength transmitters are introduced through the TSH4 head

3 Assemble the puller on the TSH4 head



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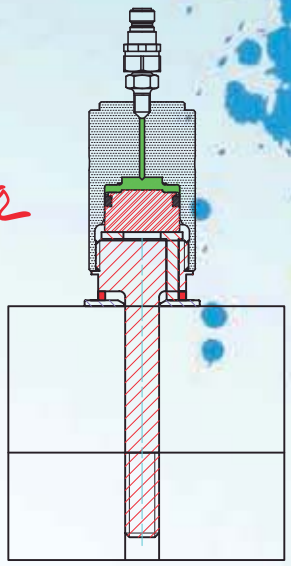

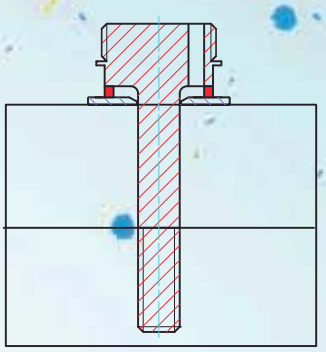

4 Preload is applied through the hydraulic puller and the TSH4 elongates. The shims approximate to the assembly.

5 Adjust the shims between the TSH4 head and the base washer to lock the elongation obtained and maintain the preload.

6 Disassemble the puller and strength transmitters from the TSH4.

RENEWABLE WIND / SOLAR

We supply fasteners from M2 to M100 on cold, hot forging or machined, as well as all kinds of fasteners according to customer requirements.
All these items are manufactured to DIN, ISO, etc. According with ISO 898-1 and ISO 898-2 in addition to the specifications agreed with the customer.
All products are validated in internal laboratories certified A2LA or accredited external laboratories.
We have large stocks of hardware of different standards in grades 8.8, 10.9 and 12.9 that are provided in any type of surface coating.

CAPITAL GOODS

Petrochemical, nuclear, civil engineering, rail, naval...

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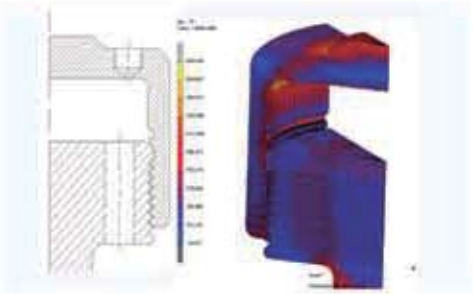

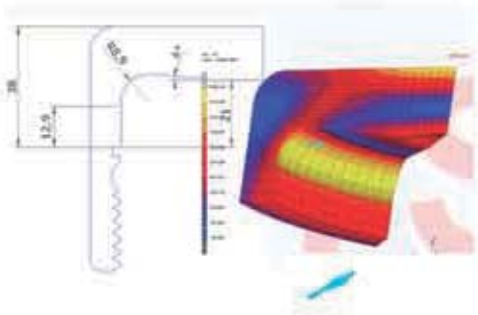

ENGINEERING

CALCULATION AND DEVELOPMENT

Calculation and development of bolted joints for automotive, aeolian, construction, equipment, etc. For the calculation of the unions, the engineering of TSF has a powerful simulation tool using finite elements. The program used is the prestigious MSC.MARC.
The customer is offered the solution with our design and geometry and the certification of such unions in government agencies.

PATENTS AND INNOVATIONS

TSF has among its field of engineering a series of patents of its own:

- **TSH and SH**. Solution to ensure high preloads with high accuracy.
- Screw and nut TSF. Tamper-proof screw and nut also has the feature of removable and indestructible.
- Shear pin. Combined variable diameter bolt cap for applications that must withstand shear.
- System for wind turbine blades separated into sectors. The solution is to divide the blade into two parts and unite them by introducing a special fasteners. In this way, facilitates the manufacture, transport, assembly and disassembly.
- Looseproof fastener. System of screw, nut and washers specially design to avoid unfastening with vibrations.