PiezoClamping®

Prestress and Charge Meter for Piezoceramics

For the assembly of bolt-clamped ultrasonic transducers and converters with optimal prestress.

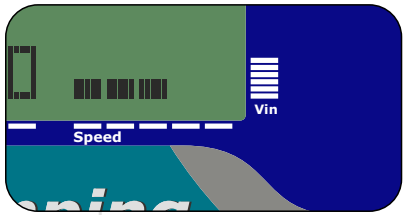
PiezoClamping® is an innovation for direct measurement of prestress in piezoceramics. It is accurate and immune to the variations undermining traditional methods of control via torque and via charge measurement using a voltmeter.

How it works

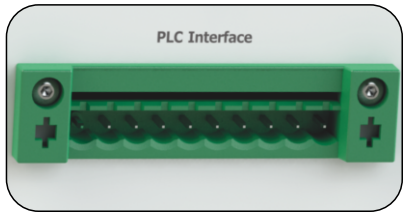
Simply connect the PiezoClamping®, entry the ceramic parameters and tighten the transducer bolt until the desired prestress is achieved. The tightening can be applied slowly and with pauses without affecting the result.

Unlike the tightening torque, prestress is a fixed value that does not depend on the dimensions and quantities of ceramics, type of bolt, thread finishing and lubrication.

Features



Speed control.



Automation interface.

Technical specifications

Prestress:	From 0.1 to 99.9 MPa
Electrical charge:	From 0.1 to 999.9 µC
Precision:	±1%
Number of piezoceramics:	From 1 to 8 units

PiezoClamping®:

- **Prevents damage and standardizes the prestress.**
- **Calibration with traceability to SI.**

WORLD WIDE 2 YEARS WARRANTY

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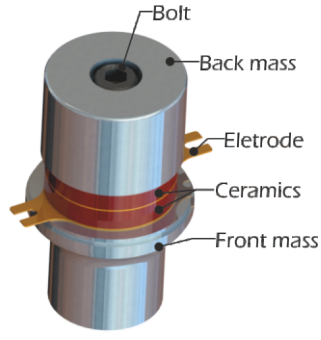
Prestress technology for ultrasonic transducers and converters

Prestress or preload is the bias pressure applied to piezoelectric ceramics of power ultrasonic transducers during assembly. It aims to maximize the operating power and the coupling of the ceramics to the metallic masses simultaneously, besides avoiding displacement during vibration.

The optimum prestress mostly depends on the maximum mechanical stress supported by the piezoelectric material, unlike the tightening torque, which varies according to the area of the ceramic pieces and to the friction coefficient of the bolt with the metallic masses. The typical values are 45 MPa for the PZT-8 material and 35 MPa for the PZT-4.

Prestress is a key factor for the lifespan, maximum operating power and efficiency of transducers. Nevertheless, the excess of prestress changes the properties of the ceramics and may cause crushing; whilst the lack of it causes the lateral displacement of the ceramics in high power, leading to cracks, electric arcs and short circuits.



Ultrasonic welding converter: Typical example of Langevin type power ultrassonic transducer

Optimum prestress control and application

The prestress control is usually limited to the attempt of standardization via the tightening torque control or via the measurement of the electric charge generated by the piezoceramics, with no concern for the absolute value applied.

Although the tightening torque control of the bolt is practical, it is indirect and of low accuracy. That is because the correlation with the prestress depends on several factors and varies drastically with the friction coefficient of the materials and with the lubrication. Additionally, when the bolt stuck, it may lead to the application of a prestress lower than expected, even though the target torque has been reached.

The control by the electric charge generated by the ceramics has the advantage of being a direct measurement, although it is also of low accuracy because the charge is consumed by the voltmeter, which makes the measurement result dependent on the speed of the prestress application. In addition, the measured value is an electric voltage proportional to the force and that demands calculations to determine the prestress.

PiezoClamping® employs a novel technology in which the prestress is measured during the tightening process accurately, steadily and free of the variations that undermine the accuracy of control methods via torque, using a torque wrench, and via charge measurement, using a capacitor and a voltmeter.

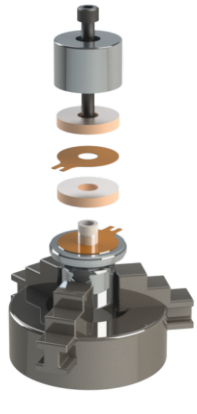
Optimum prestress provides greater power and extends lifespan.

The excess of prestress changes the piezoceramics properties and may cause crushing.

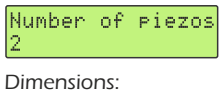
The lack of prestress allows ceramics displacements, resulting in cracks, electric arc and short-circuit.

Optimum prestress application using PiezoClamping®

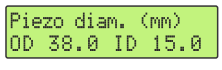
1. Assemble the transducer and configure the PiezoClamping®:



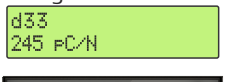
Number of ceramics:



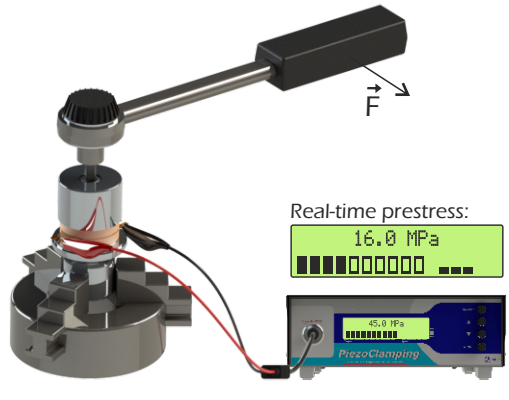
Dimensions:



Charge constant:



2. Tighten until you reach the desired prestress (full bargraph):



Notes: To assemble the transducer, ensure that interfaces, bolt thread and front mass are clean, dry and non-lubricated (only the bolt head seat can be lubricated to reduce the torque required to achieve the desired prestress). PiezoClamping® must be set for the desired prestress, clamping speed and for the number and specific characteristics of the ceramics used. To protect the bolt if it gets stuck, use a torque wrench with the torque set to 120% of the typical torque required to achieve the desired prestress. To increase stability and reduce the loss of prestress over the time and use, ensure to tighten and untighten the transducer a few times before the final tightening. PiezoClamping® can also measure the prestress applied to the transducer by simply loosening it with the PiezoClamping® connected and configured.