



UNDERSTANDING THE NEW TORQUE WRENCH CALIBRATION STANDARD

COMPARISON BETWEEN THE OLD (2003) AND NEW EDITION(2017) OF THE STANDARD ISO 6789

Written by R.Sadananda Murthy
(Founder & Managing Director
of Sushma Industries Pvt Ltd)



Image Source: Stahlwille

The new standard published in two parts cancels and replaces ISO 6789:2003

ISO 6789-1:2017

“Specifies requirements and methods for design conformance testing and quality conformance testing: minimum requirements for declaration of conformance”

ISO 6789-2:2017

“Specifies the method for calibration of hand torque tools and determination of measurement uncertainty”



[FOR TYPE I: INDICATING TORQUE TOOLS AND TYPE II: SETTING TYPE TORQUE TOOLS]

A. AS PER OLD STANDARD ISO 6789:2003

A.1 No. of operation to be done and no. of readings to be recorded for estimation of uncertainty and measurement deviation of a torque tool is as given below			
Type & Class	Repeatability w_{re}		
	Pre-Load	Readings at (20,60,100) %	Total
All type I	1	3 x 5	16
Type II classes A, B, D, E & G	5	3 x 5	20
Type II classes C & F	5	3 x 10	35



A.2 Rate of Loading
Minimum time period for application of torque values
For Type I: Not specified in the standard
For Type II setting Torque Tools: Force to be applied to the tool up to 80%. From 80% to the final target value, the force shall be applied slowly and uniformly during a period of 0.5 s to 4 s.

A.3 Components for determination of measurement uncertainty of the Torque Tool at 20%, 60% and 100% and measurement deviation		No. of computations
1. Repeatability (Type A)	w_{re}	3
2. Uncertainty due to the variation in the scale, dial or display resolution	w_r	3
3. Uncertainty of the measuring device	w_{md}	3
4. Measurement deviation	A_s	3
Determination of the relative standard measurement uncertainty	$W = \sqrt{\left(\frac{w_{md}}{2}\right)^2 + w_r^2 + w_{re}^2}$	3
Total number of computations =		15

B. As per New Standard ISO 6789-2:2017

B.1 No. of operation to be done and no. of readings to be recorded for estimation of uncertainty of a torque tool is as given below

Type and Class	No. of readings to be taken to evaluate uncertainties due to									
	Repeatability w_{re}		Reproducibility w_{rep}	Output drive of the tool, w_{od}		Interface w_{int}		Force loading point w_i		Total readings
	Pre-Load	Readings	Readings	Pre-Load	Readings	Pre-Load	Readings	Pre-Load	Readings	
All type I, Type II classes A, D & G	3	15	(5 x 5)	5	(10 x 4)	5	(10 x 4)	5	(2 x 10)	153
Type II classes B, C, E, & F	5	10	(4 x 10)	5	(10 x 4)	5	(10 x 4)	5	(2 x 10)	168

B.2 Rate of Loading as per New Standard ISO 6789-1:2017

Applied Torque value	<10 Nm	≥ 10 Nm <100 Nm	≥ 100 Nm <1000 Nm	≥ 1000 Nm
Minimum time to increase the torque from 80% of target value to the target value	0.5s	1s	1.5s	2s
For screw drivers (Type D, E and F) the time to increase the torque from 80% of target value to target value shall be between				0.5s to 1.0s
For indicating tools Type I time intervals between any two subsequent loadings shall be of same duration				
Setting torque tools (type II) Shall be loaded with a slowly and steadily increasing torque until attainment of the target torque is signalled by the torque tool. The target torque shall be reached after a minimum time is defined.				

B.3 Components for determination of measurement uncertainty of the Torque Tool and Relative measurement error At t_{min} , 60% and 100%

	No. of computations
Uncertainty due to the variation in the scale, dial or display resolution	w_r 3
Uncertainty due to reproducibility of torque tools	w_{rep} 3
Uncertainty due to Geometric effects of the output drive of the tool	w_{od} 3
Uncertainty due to Geometric effects of the interface between the output drive of the tool and the calibration system	w_{int} 3

Variation in Force loading point	w_l	3
Repeatability (Type A)	w_{re}	3
Uncertainty of the measuring device	w_{md}	3
Relative measurement error at t_{min} , 60% & 100 %	$\bar{a}_1, \bar{a}_2, \bar{a}_3$	3
Determination of the relative standard measurement uncertainty, W at t_{min} , 60% & 100 %		
For Indicating Torque Tools: $w = \sqrt{\left(\frac{W_{md}}{2}\right)^2 + 2w_r^2 + w_{rep}^2 + w_{od}^2 + w_{int}^2 + w_l^2 + w_{re}^2}$		3
For Setting Torque Tools: $w = \sqrt{\left(\frac{W_{md}}{2}\right)^2 + w_r^2 + w_{rep}^2 + w_{od}^2 + w_{int}^2 + w_l^2 + w_{re}^2}$		
Relative expanded uncertainty of measurement, $W = k \times w$, where $k = 2$ coverage factor		
Determination of the relative measurement uncertainty interval, W' $W' = a_s + W + b_{ep} $, Where, \bar{a}_s is the mean value of relative measurement error and $b_{ep} = \frac{b_{e\ max}}{\bar{X}_r} \times 100$ in % [b_e is stated measurement error of the measurement device]		3
Total number of computations =		30

C. Importance of avoiding parasitic forces

This is the most significant change. The application of load is more clearly defined, and it is emphasized that the calibration device must allow the tool to move to prevent “parasitic” loads or moments. This means the connection between torque measurement system and torque tool shall permit self-alignment so that, the parasitic forces and moments are minimized.

D. Conclusion:

Torque wrench calibration as per new edition demands 153 to 168 operations, recording, controlling the rate of loading within specified time, 30 computations to arrive at uncertainty of measurements and the relative measurement error, and to ensure and to minimize parasitic loads or moments, it may be extremely difficult by manual operation [using manual torque calibrators] and computation of data manually.

Further, most of the present torque loaders (torque calibration devices) may not meet the above requirements and may become obsolete, hence may need to be computer-controlled or opt for a motorised torque calibration system for ease of use and computation.

We wish to inform you that Sushma Industries Pvt. Ltd. is already manufacturing motorised and or computerised Torque wrench calibration systems along with software to load and control the process of calibration, computation of results and preparation of calibration certificate as per ISO 6789-2:2017.

Sushma team will be pleased to assist you for consultancy, training, selection of new calibrators to comply with the new standard.

