
British Standard Method for evaluation of Performance of rotary pneumatic assembly tools for threaded fasteners

[ISO title: Rotary pneumatic assembly tools for threaded fasteners — Performance test]

Méthodes d'essai des caractéristiques de fonctionnement des outils pneumatiques rotatifs
pour l'assemblage d'éléments de fixation filetés

Verfahren zur Messung der Leistung von drehenden Druckluftwerkzeugen für
Verbindungselemente mit Gewinde

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Compliance with a British Standard does not of itself confer immunity from legal obligations.

National foreword

This British Standard, which has been prepared under the direction of the Mechanical Engineering Standards Committee, is identical with ISO 5393-1981 'Rotary pneumatic assembly tools for threaded fasteners — Performance test' prepared by Technical Committee ISO/TC 118, Compressors, pneumatic tools and pneumatic machines, and published by the International Organization for Standardization (ISO).

Terminology and conventions. The text of the international standard has been approved as suitable for publication as a British Standard without deviation. Some terminology and certain conventions are not identical with those used in British Standards; attention is drawn especially to the following.

Wherever the words 'International Standard' appear, referring to this standard, they should be read as 'British Standard'.

The comma has been used as a decimal marker. In British Standards it is current practice to use a full point on the baseline as the decimal marker.

Cross-references

International standards	Corresponding British Standards
ISO 31	BS 5775 Quantities, units and symbols (Individual Parts are identical)
ISO 1000-1981	BS 5555 : 1976 SI units and recommendations for the use of their multiples and of certain other units (Identical)
ISO 3534-1977	BS 5532 : 1978 Statistics — Vocabulary and symbols (Identical)

The Technical Committee has reviewed the provisions of ISO 2787-1974 and ISO 5941-1979 to which references are made in clause 2, and has decided that they are acceptable for use in conjunction with this standard. The related British Standard to ISO 2787 is BS 5344 : 1976 'Methods for acceptance tests for rotary and percussive pneumatic tools'.

British Standard Method for evaluation of

Performance of rotary pneumatic assembly tools for threaded fasteners

0 Introduction

This International Standard covers the performance test methods for measurement of installation torque of pneumatic assembly tools for tightening of threaded fasteners and how such tests should be evaluated and presented.

Such methods are important for the following purposes

- a) to enable manufacturers of pneumatic assembly tools to offer their products under correlated technical specifications;
- b) to give users standardized technical information on torque output and consistency of pneumatic assembly tools for threaded fasteners.

The test method is designed to measure the capability of assembly tools with the level of accuracy that is needed in assessing type data. The test is not intended as a routine in-plant inspection test.

An example of a test joint is given in annex B.

1 Scope and field of application

This International Standard specifies a performance test method for pneumatic assembly tools for installing threaded fasteners and gives instructions on how measured data should be statistically evaluated and presented.

This International Standard is not applicable to impact wrenches, ratchet wrenches or wrenches with ratcheting clutches, because their applied torque cannot be measured with conventional types of instrumentation.

2 References

- ISO 31, *Quantities, units and symbols*.
- ISO 1000, *SI units and recommendations for the use of their multiples and of certain other units*.
- ISO 2787, *Rotary and percussive pneumatic tools — Acceptance tests*.
- ISO 3534, *Statistics — Vocabulary and symbols*.
- ISO 5941, *Compressors, pneumatic tools and machines — Preferred pressures*.

3 Definitions and symbols

The following definitions and symbols are specific to this International Standard

3.1 Definitions¹⁾

3.1.1 torque control tool : Pneumatic assembly tool for tightening of threaded fasteners, which is provided with torque sensitive control means that limit the magnitude of the output torque or cut it off altogether as a predetermined torque level is reached.

3.1.2 stall type tool : Pneumatic assembly tool for tightening of threaded fasteners, which is not provided with any torque sensitive control means, and which delivers an output torque as long as the trigger or supply valve is actuated.

1) Where reference is made to this International Standard, it is to be understood that indicated values of "torque", "rated torque", "standard deviation" and "mean shift" correspond to measurements made at an effective inlet pressure of 6,3 bar and the tool adjusted in such a way that the "test torque level" equals the rated torque. If for any reason the test pressure is other than 6,3 bar, then the test pressure must be stated and the torque is cited.

3.1.3 mean torque : Arithmetic mean calculated from several torque readings on a specific joint and at stated conditions.

3.1.4 test torque level : Mean torque measured under actual test conditions when the tool is tested on the low torque rate joint (see 4.2.4).

3.1.5 rated torque : Specific term used for mean torque when measured on the low torque rate joint at an effective test pressure of 6,3 bar¹⁾.

For torque control tools, the rated torque value is determined with the highest setting of the torque control means in accordance with the manufacturer's recommendation and 6,3 bar test pressure.

3.1.6 torque range : Comprises all torque values between and including the rated torque and the lowest mean torque recommended by the manufacturer.

NOTE — Provided that the available air pressure is at least 6,3 bar, the mean torque delivered by a tool for tightening threaded fasteners, can normally be adjusted to any desired value within the torque range. Such adjustment is made by regulating the air pressure or manipulating the torque control means.

For some torque control tools, the torque output is adjusted in a limited number of steps within the torque range.

3.1.7 torque rate : The torque rate of a screw joint is a measure of joint stiffness, defined as required torque increase per angular displacement (expressed in newton metres per revolution) as the joint is tightened.

The torque rate varies widely in practical applications and can vary on a specific joint due to variances in component parts which make up that joint. These variances are due to factors such as lubrication, elasticity, quality of threads, compressibility of material, etc.

For this test method, the test joints or the test rig must have controlled constant torque rates to give consistent test results.

The torque rate is measured by simultaneous recording of the applied torque and the angular displacement of the input of the test fixture or threaded fastener, at a speed which is sufficiently low to exclude dynamic effects.

3.1.8 mean shift : The mean torque on the high torque rate joint (see 4.2.4) minus the mean torque on the low torque rate joint, at otherwise identical test conditions, notably same pressure level and same setting of torque control means.

3.1.9 rated mean shift : The mean shift when the test conditions are such that the test torque level equals the rated torque.

3.2 Symbols

3.2.1 Symbols and units are to be according to ISO 31 and ISO 1000 when applicable.

3.2.2 Subscript H is used to denote high and subscript L to denote low torque rate joint conditions.

4 Method for measurement of performance

4.1 General rules for performance tests

4.1.1 All measurements carried out in compliance with this International Standard shall be performed by competent persons and with accurate instrumentation, which is calibrated against existing standard methods.

4.1.2 The performance of pneumatic tools is affected by different ambient conditions such as atmospheric pressure and temperature. For this reason ambient conditions shall be kept within limits stated in ISO 2787.

4.1.3 During the performance tests the air pressure measured at the inlet to the tool must be kept within the following limits :

- free running conditions : between nominal value and -4% of nominal value;
- approaching maximum torque : $\pm 2\%$ of nominal value.

No adjustments are to be made during the course of a given test. An example of a suitable test installation is shown in figure 2.

4.1.4 If torque output is adjusted by other means than variation of pressure, the adjustment shall be constant throughout the test and such that the torque control mechanism operates each time.

4.1.5 It is recommended that torque control tools are subjected to complete tests at the levels of adjustment that correspond to the highest and the lowest torque levels within the torque range of the tool. Performance tests may also be carried out at any test torque level within the torque range.

No test should be performed outside the torque range recommended by the manufacturer.

4.1.6 During the test run of the tool, lubrication consistent with manufacturer's specification shall be provided.

4.2 Torque measurement

4.2.1 The torque increase per revolution, or torque rate, of a threaded joint varies widely from application to application and can vary appreciably on a specific assembly. Any test of torque performance of a tool must be conducted on joints having controlled torque rates. The test shall include a joint where the torque rate is very low and a joint where the torque rate is high as per 4.2.4. The high and low torque rates straddle the range of conditions which affect the torque output of the tool.

1) 1 bar = 100 kPa

On a low torque rate joint, the tightening is usually accomplished with several revolutions of the fastener. In this case the torque delivered to the fastener approximates the stall torque of the tool or its torque setting.

On a high torque rate joint, the tightening is accomplished in a fraction of a revolution. On a high torque rate joint, the kinetic energy of the rotating parts of the tool may cause the torque delivered to the fastener to be higher than on a low torque rate rate.

4.2.2 To satisfy the above conditions, test fixtures for use with this International Standard must comply with the following :

a) In a diagram where the required torque is plotted as a function of the angular displacement of the input drive of the test joint, the resulting curve must essentially be a straight line between 50 % and 100 % of the test torque level. The slope of this straight line is used to calculate the torque rate of the joint. Between the limits of 20 % and 100 % of the test torque level, plotted values shall not deviate from a straight line by an amount of more than 10 % of the test torque level;

b) The torque rate of any test joints shall remain within plus or minus 10 % of the torque rate stated in the test report (see 4.4.2);

c) The moment of inertia of rotating parts in the test joint shall be as small as possible in relationship to the effective moment of inertia of the rotating parts of the tool.

4.2.3 When the torque rate of a test joint is measured, the joint shall be tightened slowly but evenly in order to exclude inertia effects and stick-slip problems.

4.2.4 Each assembly tool shall be tested on both a high (designated H) and a low (designated L) torque rate joint, where

a) the high torque rate joint (H) shall be such that the torque increase from 50 % to 100 % of the test torque level corresponds to an angular displacement of less than 30°, see figure 1;

b) the low torque rate joint (L) shall be such that the torque increase from 50 % to 100 % of the test torque level corresponds to an angular displacement of not less than one full turn (360°), see figure 1.

NOTE — It is a minimum requirement that each tool shall be tested on a high torque rate joint and on a low torque rate joint as defined above, however, the test procedure can be applied to any specified torque rate.

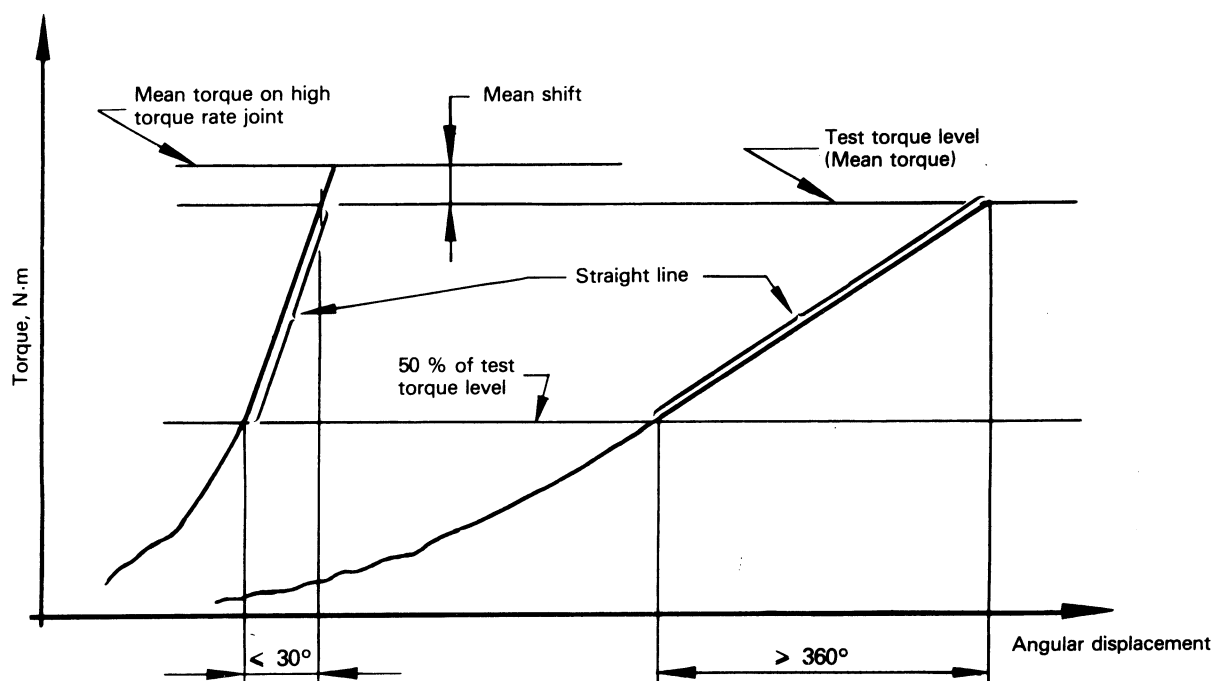


Figure 1 — High and low torque rate joint