National Torque Standard

Torque traceability system from the field measurement to the primary standard

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Present status of static torque standard in Japan

"Torque" is just one of physical quantity, expressed by the product of force (Newton) and length (Meter). The unit of torque is "N·m" (middle point dot or space is required between N and m). The torque is also called turning force or torsional force. As examples of torque, you can find rotational torque of engines in automobiles, tightening torque of bolts and nuts used in various fields from assembling small precise mechanical parts to constructing huge buildings and bridges. Loosening caps of bottles for juice is also controlled with torque.

Torque is directly related to not only the industrial field but also all sorts for scenes in the life of the people. Therefore, in order to confirm the reliability of torque measurement, it is greatly demanded the establishment of torque traceability system as well as development of calibration method for torque measuring devices (TMDs).

The research and development of torque standard machines (TSMs) have been started since 1997, in the National Research Laboratory of Metrology (NRLM), the former institute of the National Metrology Institute of Japan (NMIJ). A demand distribution of TMDs（a conceptual diagram）for the rated capacity of them could be obtained as shown in Fig. 1, from a questionnaire survey in the industry conducted before launching the development. The distribution diagram seemed normal distribution, and shows that 50 N·m takes approximately median value and the demand of TMDs widely spreads from 1 mN·m to 1 MN·m.

Then, first, two kinds of deadweight type torque standard machines, rated capacity of which are 1 kN·m and 20 kN·m, have been developed in 2002 (called 1-kN·m-DWTSM and 20-kN·m-DWTSM). Moreover, the third deadweight machine, rated capacity of which is 10 N·m, has been developed in 2012 (called 10-N·m-DWTSM). It could become possible to supply the static torque standard to the industry by satisfying approximately 90 % of the demand, using these three deadweight type torque standard machines.

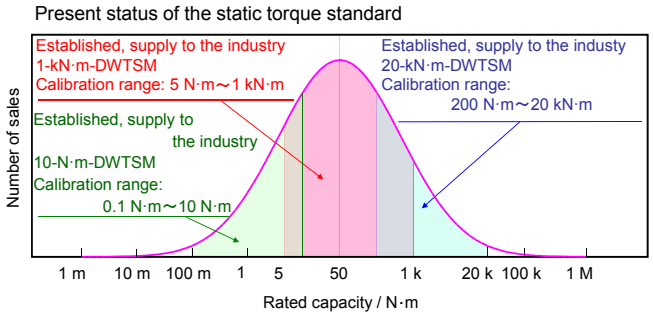


Fig. 1 Demand of torque traceability in the industry

Deadweight Torque Standard Machine - First

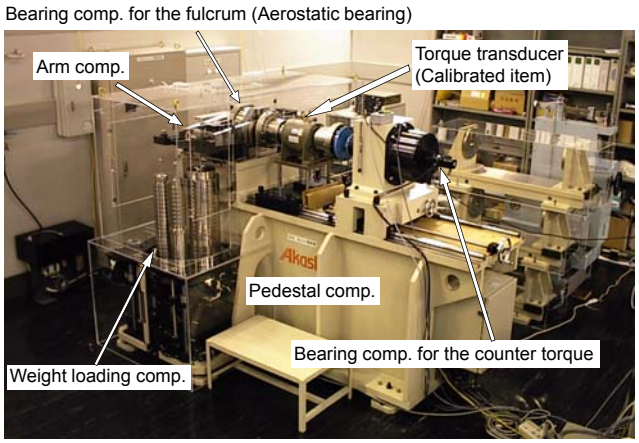


Fig. 2 1-kN·m-DWTSM

Deadweight Torque Standard Machine - Second

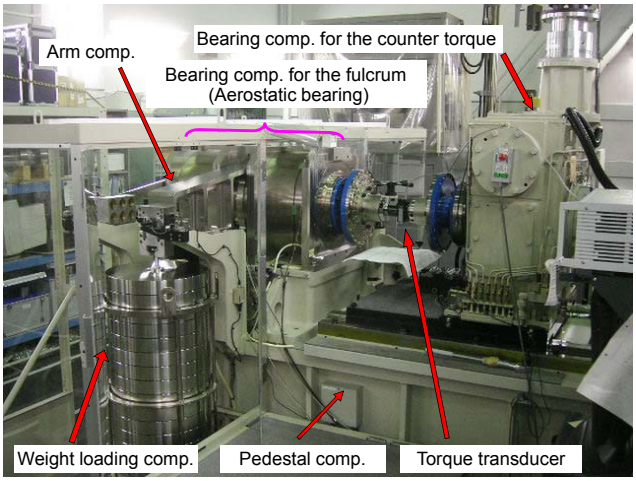


Fig. 3 20-kN·m-DWTSM

Deadweight Torque Standard Machine - Third

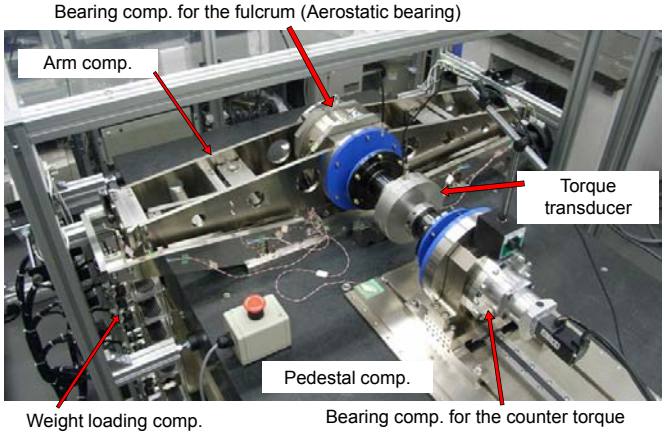
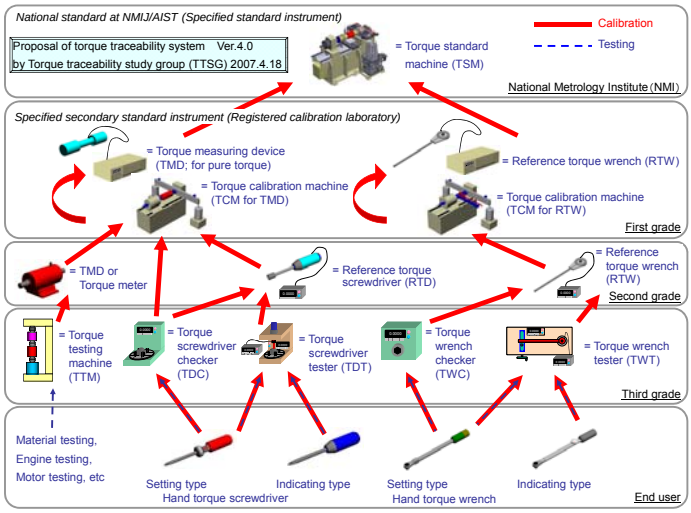


Fig. 4 10-N·m-DWTSM

SI traceability system of Torque proposed by NMIJ



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