Measurement Standards at Production Sites: Automobiles

Tomohiro MOCHIZUKI,
Measurement Engineering Department, Nissan Motor Co., Ltd.

Measurement Standards Indispensable for Automobile Inspections

To retain a satisfied customer base, we, automobile manufacturers, must guarantee the quality of the vehicles we sell, and reduce production costs by reducing defects through quality control. For both of these tasks, measurement standards and measurement management occupy a position of vital importance.

Quality control in the automobile manufacturing process proceeds in a step-by-step manner. First, inspection occurs at the level of individual parts. Manufacturers must strictly guarantee that parts pass national regulations concerning the basic functions of parts (running, turning, stopping, etc.). Important security parts such as brakes and chassis are subjected to particularly stringent checks.

Finally, when the car is fully assembled and ready to be shipped to market, a final inspection of the vehicle's performance and various other factors is conducted. The list of items tested in this inspection is daunting, yet all items must be identical to the test items used by the Land Transportation Bureau. Once the vehicle is passed on to the inspection line, each inspection item is tested and adjusted in order.

The measurement standards used in production processes such as these are traceable to national standards. A collection of 93 in-house standard devices is used in common by all companies for precision management. At the level of secondary standard devices, about 400 such devices, which are calibrated using the at-house standard devices, are in use at all worksites. Because the items produced at each plant vary from auto bodies to engines and many other components, some 50–60 secondary standards are required to manage the instruments used in inspection.

The Increasing Importance of Traceability

As multifaceted and complex as the inspection of completed vehicles is, for all of the basic items inspected — brakes, wheel alignment, speedometer, exhaust and much more — traceability must be assured. No variance can be tolerated, even though the same engines may be produced at different plants or the same type of cars may be built in different countries.

Moreover, unlike the conventional practice in the industry, parts and device suppliers anywhere around the world can actually provide their products even if they are not part of our corporate group. For that reason too, the importance of traceability in measurement is rapidly rising to manage the quality of the parts and devices we use. For example, Nissan and Renault require their suppliers to conform to common quality requirements, including ISO/TS 16949 — a set of quality system requirements that applies to the automobile industry.

Under these exacting conditions, manufacturers need to maintain highly precise in-house measurement standards and conduct continuous training of calibration technicians, expecting them to improve their skills to sophisticated levels. Toward this end, we are working proactively to secure certifications in various measurement categories from the Japan Calibration Service System (JCSS), which is considered to be the Japanese version of ISO/IEC 17025. For instance, Nissan is already fully certified in two categories: length (end measures) and electricity (DC voltage).

The advance of economic globalization is driving a steady increase in the import and export of automobiles. Each importing country has its own set of laws governing these products. In many countries, the traceability requirements are stricter than those in Japan.

Ultimately, we would like to establish a one-stop testing process — a system in which, meeting common requirements, countries would accept one another's measurements based on mutual trust in the measurement standards of each country. Because no such system yet exists, the international trade of automobiles still involves complicated and time-consuming processes. We must write test reports that follow the legal requirements of each country. These requirements can be broadly divided between the North American and European type, with many countries outside these two regions choosing to adopt one or the other.

Responding to Advances in Technology

Today's automobiles are becoming more technologically sophisticated with each passing year. The rate of this advance is accelerating. Not surprisingly, the measurement standards required to build these products are changing in number and variety at a blistering pace. For example, as more automobiles are

Photo 1 Welding process on a production line
A battery of robots carries out the work with high precision. (Photo courtesy of Nissan Motor Co. Ltd.)

Photo 2 Installing an engine unit
Human skills and measurement standards play a vital role in ensuring the safety and trustworthiness of automobiles. (Photo courtesy of Nissan Motor Co. Ltd.)

Photo 3 Final inspection of a product fresh off the production line
A wide variety of measuring instruments are used. (Photo courtesy of Nissan Motor Co. Ltd.)

installed with fuel cells, standards for electrical power, hydrogen and chemical reactions must be devised and adopted. These new needs may arise full-blown within the space of a year, but responding as quickly with the standards they require is no easy matter.

At the same pace as the technology furnished to customers, we must rush to calibrate our products according to newly mandated standards. For all automakers, this process presents a formidable challenge in the coming years.

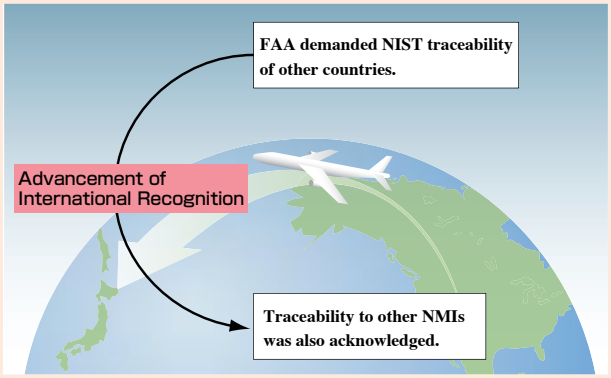
Measurement Standards in Aircraft Maintenance

Toshirou ITOU,
Quality Assurance Department, Japan Airlines

For airline companies, nothing is more decisive for the safety of passengers than aircraft maintenance. Following a tragic airplane crash in 1996, the United States Federal Aviation Administration (FAA) handed down a requirement that all instruments used in the maintenance of US-registered aircraft provide National Institute of Standards and Technology (NIST) traceability, whether the maintenance provider is based in the United States, Japan, or any other country.

Aircraft maintenance requires a dizzying variety of instruments micrometers, calipers, torque wrenches, thermometers, thermocouples, voltage meters, ammeters and others. Ensuring NIST traceability for each and every one of these instruments was grievously time-consuming and incurred enormous costs. Unable to square this circle alone, Japan's airlines turned to the then Agency of Industrial Science and Technology (AIST) for advice. This consultation produced an arrangement between AIST and NIST for cooperation in the field of measurement standards. In addition, the two agencies used the results of comparisons of individual measurement standards mutually to persuade the FAA that these measurement standards were equivalent.

In this way, Japan's airlines were able to win exemptions from the FAA's traceability requirements, allowing them to deploy instruments traceable to Japanese standards in the maintenance of US-registered aircraft and their parts. At about the same time, in 1999, a global Mutual Recognition Arrangement (MRA) was concluded with respect to the field of measurement standards. This framework lent impetus to the development of an organized system of international comparison and mutual recognition for measurement standards on a global scale.



As a result of these developments, in July 2003, the requirements contained in the FAA Advisory Circular, a notice of FAA inspection operation, were changed, clearly permitting the application of NIST or other national measurement institutes' traceability provisions.