

# Feature Article

Application

## Requirement for Service Activity

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HORIBA TECHNO SERVICE Co., Ltd. (hereinafter HTS) became an independent company from HORIBA, Ltd. (hereinafter HOR) in 2000 in order to improve quality of products including service quality for the entire HORIBA group. Nowadays, analytical instruments and customer's requirement are diversified year by year. Under this environment, HTS has been catching up customer's requirement globally, and we have been providing service support in response to such a requirement. On the other hand, HTS has established a service structure that has strong relation with local customers in Japan. In this article, we would like to introduce a total picture of business handled by HTS, then we would like to introduce a service activity of Automotive Test Systems (hereinafter ATS) segment, for example how HTS utilizes ISO/IEC17025 certificate to establish high quality service, how HTS can collect reliable data by using ISO/IEC17025. In addition, we would like to explain how HTS has made countermeasure for various requirements of emission analysis and regulation.

### Introduction

In recent years, the importance of service has been focused in order to improve customer satisfaction in the business field of analytical instruments. Total quality of product can be maintained by high quality service in addition to quality of product itself. In this article, we would like to describe service that is now focused in the market. We can judge a service capability from some numerical data such as response capability, technical capability, structure solidness and delivery speed of parts that are given by MTTR (Mean time to repair), MTBF (Mean time between failures), etc. On the other hand, it must be difficult to make a numerical value for items such as communication level, confidence level and hospitality. We, HTS are targeting to improve total quality of product including such difficult items.

### Service Structure

Firstly, we are starting to explain about a history of HTS. HTS which had been a Service Division (called Customer Service Centre) under HOR organization, became an independent company (invested by HOR 100%) on 21 March 2000. We started business with 253 employees in

total, 130 employees from HOR and 123 employees from Service Department of COS (Currently operated as HORIBA Advanced Techno). The Purpose of establishment of HTS was the following 6 items. We were targeting to be professional team who should be able to give feedback for quality improvement for HOR products. And we believed that we could give feedback with customer's point of view after realizing the following 6 items at HTS.

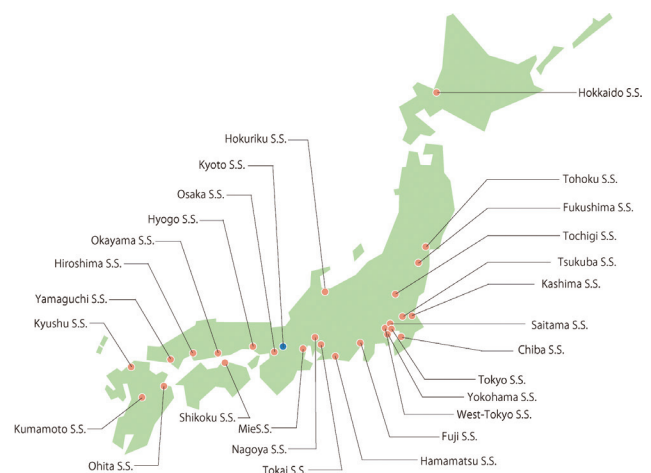


Figure 1 Service Station in Japan

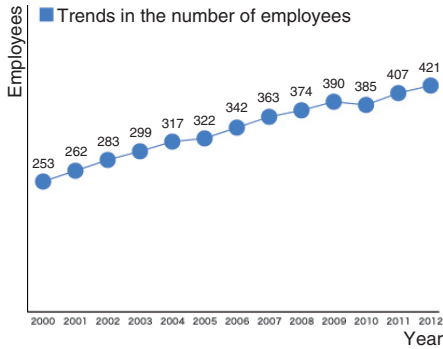


Figure 2 Employee Number Transition

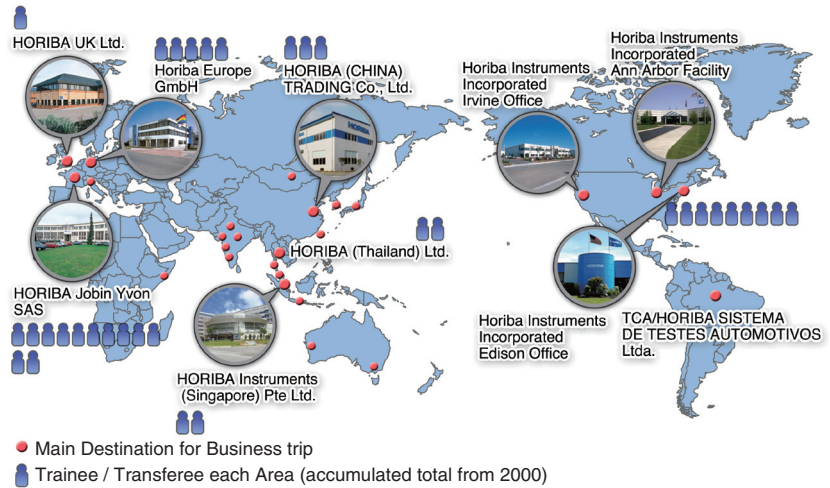


Figure 3 Displacement to oversea

- ① Improve speed of Service
- ② Improve & standardize skill of Service engineer
- ③ Improve efficiency of organization (Elimination overlapping work)
- ④ Clarify profit responsibility (Factory and Service)
- ⑤ Establish service strategy (Price setting / Advanced payment)
- ⑥ Enhancement of Consciousness (Challenging spirit / One team spirit)

### Service Station

When HTS was established, there were 21 service stations in Japan. In order to accelerate close relation with local customers, we have reorganized service stations (some stations were moved, some stations were newly opened). As the result, numbers of station have been increased to 27 stations as of 2013 (Figure 1). On the other hand, when we started HTS operation in 2000, number of employee was 253 only. However, number of employee is now increased to 438 in 2013 (Figure 2). Moreover, HTS

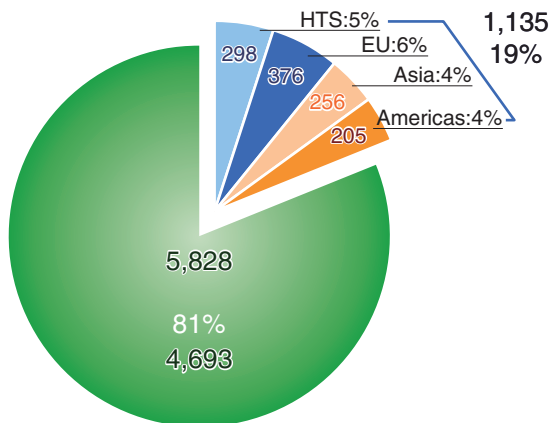


Figure 4 Employee Proportion / Region

has been dispatching service engineers to 9 affiliate companies in the oversea since 2000 (Figure 3).

### Oversea Network

HORIBA Group has totally 5828 employees (as of Nov 2013), 1135 of them are service engineers. Among 1135 engineers, 40% is shared by service engineers who are working for Automotive Testing System Business. One of our targets is to provide the same service quality even our products deliver to wherever in the world. Therefore, it is important to share information within our group companies in order to keep the same service quality. And we have held International Service Meeting (hereinafter ISM) every year to share information within group companies. During ISM, managers from each country have discussed and decided global service strategy and policy. Moreover, HTS has sent trainee and/or transferee to each country, and they are contributing to reduce skill gap among each area and each country. In addition, they are accelerating globalization of HTS. (Figure 3, 4, 5)

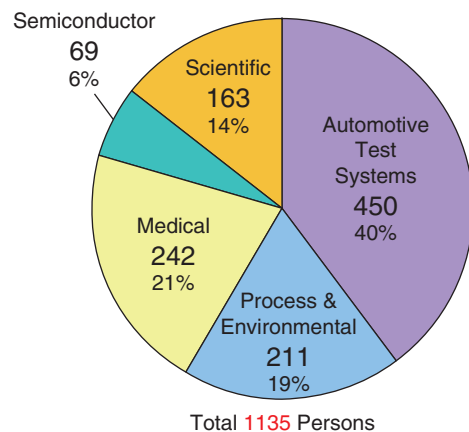


Figure 5 Employee Proportion / Segment

### Service linking with local community and local customers

As we described in the previous Column, HTS is aiming to provide the same quality of service anywhere in the world. At the same time, HTS is thinking our service should closely be in touch with local community and local customers. For instance, local clinic is locating nearby patients, and they are providing primary medical treatment and rehabilitation together with consultation in Japan. And local clinic is using medical instruments that are relatively simple and small. On the other hand, when the situation of patient becomes more serious, then large hospital should take care of such patient by using more sophisticated medical instruments. HTS is thinking our service business is similar to this situation. It is necessary for us to maintain close communication and relation with local community and local customers. This is one of important role of HTS. When HTS can make close communication and relation, customer start to consider repeat order for HORIBA products.

#### Total Cycle Support

One of Service role is to make our products in stable operation at the customer site for a long term. HTS has been providing Start-up engineering service, Maintenance service, Modification work, Repairing work and Sales of spare parts. In these service businesses, if we provide a proper maintenance service, we can find out malfunction in advance due to the deterioration of parts, etc. This can realize longer life-time and shorter down-time caused by any sudden problem. Moreover, this can bring reliable and guaranteed data. HTS has provided the Total Cycle

Support from delivery to replacement. And we have offered maintenance program and maintenance level judging from usage condition on site. Once in a while, we renew Data Acquisition Unit and Operation Unit. Idea of Total Cycle Support brings lower maintenance cost, replacement cost and less down-time. And we believe that Total Cycle Support gives benefit for the customers.

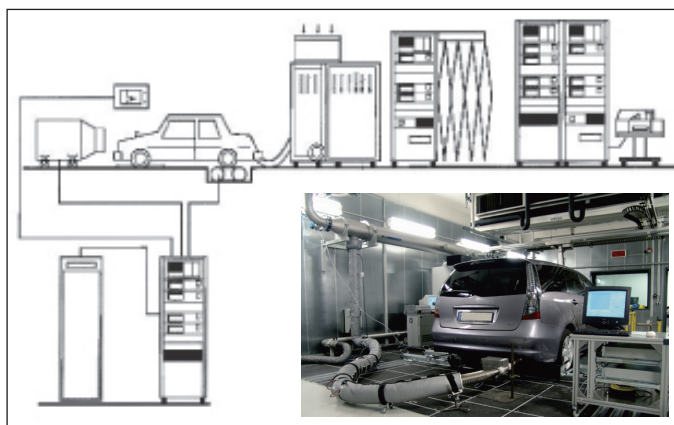
### ISO/IEC17025

#### Background and acquisition

In recent years, Traceability is required to assure the quality of service and product. It is required to use standard material and standard gas that are traceable to the international measurement standard and/or the national measurement standard when maintenance service is made. Even for the export inspection of vehicle, the certificate is required to check vehicle can meet the regulation of country where its vehicle is exported. This is due to the change of circumstances surrounding vehicle industry. And it is the best way to utilize the certificate of ISO/IEC17025 in order to prove if vehicle can meet regulation or not.

It's also required to show evidence which is traceable to the international/national authority for measurement equipment and standard gases. This means that Emission gas analysis system from HORIBA must be traceable to the international/national authority, otherwise test result from system cannot be assured (Figure 6). In response to strong requirement from car manufactures, HTS acquired authorization, ID Number ASNITE 0033 C, of calibration laboratories based on ISO/IEC 17025 to proof the

### Target Equipment based on ISO/IEC 17025 Accreditation



- ①Exhaust Gas Analyzer
  - Calibration Curve
- ②CVS
  - Propane Shot
- ③Chassis Dynamometer
  - Engine Tachometer meter
  - Vacuum Gauge
  - Speed Meter
  - Speed Linkage Cooling Fan
  - Braking and Driving Force Meter
- ④Evaporative Emission Test Facilities
  - Calibration Curve
  - Capacity Check
- ⑤Driver's Aid
  - Linearity
- ⑥Pen Recorder
  - Linearity
  - Paper Feeding Time

Emission Test Facilities General Conceptual Diagram (Not including Evaporative Emission Test Facilities)

Figure 6 Certified Exhaust Gas Analyzer System



Figure 7 Certification

reliability of data from emission gas analysis system. (Figure 7)

## Calibration of Emission Gas Analysis system based on ISO/IEC17025

### Realization of Traceable Calibration and Effect of MRA

ISO/IEC17025 is the International Standard that specifies the general requirements for test laboratory and calibration authority. This International Standard specifies the requirements to be satisfied by test laboratory and calibration authority when they perform test analysis and calibration. Approved test laboratory and calibration authority can use an authorization mark on their certificate. And their certificate shall be reliable documents that can be used internationally<sup>[1]</sup>. In Japan, there is Japan Calibration Service System (hereinafter JCSS) based on the ISO/IEC17025 program. JCSS is based on Article 143 of Measurement Act and JCSS is not applicable for emission gas analysis system. Therefore, we adopted the program of Accreditation System of National Institute of Technology and Evaluation (hereinafter ASNITE). ASNITE is the program which was established by National Institute of Technology and Evaluation (hereinafter NITE)<sup>[2]</sup> And ASNITE is the accreditation program for the category of non-traceable system to the National Standard in Japan. In addition, to satisfy the requirement from export inspection of vehicle,

calibration certificates that we should have are not only ISO/IEC17025 but also certificate that should be applicable internationally. NITE is a member of International Laboratory Accreditation Cooperation (hereinafter ILAC) and they have signed on Mutual Recognition Arrangement (MRA). This is the reason why our calibration certificate can be used internationally. So, we could go further about new style of service business starting from customer's requirement in Japan.

### Providing high reliable data

It is necessary for us to meet management requirements and technical requirements when we acquire an accreditation of ASNITE program based on ISO/IEC17025.

### Technical Requirements

Quality management & assurance standard under ISO9000 series are written regardless of the nature of business, in particularly ISO-9000 series certify quality control system and process. However, reliability of products that is manufactured under ISO9000 system is not certified by ISO9000 system. On the other hand, ISO/IEC17025 is including requirements (please refer to items below) for technical management when test and calibration are made in addition to requirements for quality management that are similarly required by ISO9000 series.

- ① Calibration procedure must be clarified and its appropriateness must be confirmed.
- ② Required ability and training must be clarified and appointed person must be available.
- ③ Periodic calibration must be made on measuring instruments and traceability and uncertainty must be indicated clearly.

### Calculation of uncertainty

It is important to calculate uncertainty and this is particularly different from work in the past. Definition of error was defined as difference from true value. However, due to difficulty to acquire true value, definition of uncertainty is adopted. Therefore, this standard is mentioning the procedure to estimate "uncertainty uncertainty". And this standard requires to follow this procedure. Uncertainty is defined as "parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measured" and uses below procedure to calculate it.

- ① Consider what sorts of factor affect maldistribution of result, then list up factors by using a



Table 1 Uncertainty Budget

Mark	Uncertainty Source	Type	Value ±	Probabikity Distribution	Divisor	Std. Uncertainty	Sensitivity Coefficient	Unit (km/h)
u1								
u2								
u3								
u4								
u5								
u6								
u7								
u8								
uc	Combined Uncertainty			Normal Distribution				
U	Expanded Uncertainty			Normal Distribution (k=2)				

characteristic diagram. The point is to extract a number of factors as possible multiple personnel.

- ②By using Budget Sheet (Table 1), calculate Standard uncertainty and Expanded uncertainty by each extracted factors considering with influence for uncertainty. Result of uncertainty become quality of calibration work.

**Execution of proficiency test**

Proficiency Test is defined as “evaluation of measurement performance or calibration by calibration association against pre-established criteria by means of inter-laboratory comparisons”. This means that HTS has to execute test for calibration comparison between our exhaust gas analysis system and system at other calibration association. Then evaluation should be made by a performance evaluation formula that is stating as “Equation 1”. By following this procedure, quality of calibration result is confirmed.

$$En = \frac{X_{lab} - X_{ref}}{\sqrt{U^2_{lab} + U^2_{ref}}} \dots\dots\dots (1)$$

- X<sub>lab</sub> : Participating laboratory’s result
- X<sub>ref</sub> : Reference laboratory’s result
- U<sub>lab</sub> : Participating laboratory’s expanded uncertainty (k=2)
- U<sub>ref</sub> : Reference laboratory’s expanded uncertainty (k=2)

Judgment standard of En number show below

- | En | ≤ 1: Satisfaction
- | En | > 1: Unsatisfaction

We have been providing reliable data by improving management system and technical skill under requirements of ISO/IEC17025.

**Implementation of Total Support**

**Location of Technical Personnel**

Technical personnel who can execute calibration based on ISO/IEC17025 is limited small number of elite recourses who took education, training. They are certified in the company and located at east, central, and west of Japan. We have established organization that can handle high quality MRA calibration anywhere in Japan.

**Quality Management by MRA calibration with 40 years’ experience**

Inspection facility which is exclusive used for MRA calibration should traceable to national / international standard. In addition to continuous calibration management, reliable result of calibration can be realized by 1) complete organization structure for transportation and storage, 2) exclusive inspection facility and standard material strictly controlled, 3) skillful engineer. HTS has organization structure that has been accumulating know-how of exhaust gas analysis for 40 years as a member of HORIBA group. We have now realized total support structure of exhaust gas analysis system with 40 years’ experience and ISO/IEC17025.

**Expansion of MRA Calibration**

It is necessary for business of exhaust gas analysis to expand items that can adapt to MRA calibration in order to meet requirements for production reliability from vehicle manufacturers. First, calibration curve must be controlled and maintained properly. The reason is that calibration curve is one of the most important factors to maintain accuracy of gas analyser. To make accurate calibration curve, HTS is now scheduling to establish MRA calibration for gas divider. We are targeting to start

this new business within 2014 in order to catch up movement of Japanese vehicle manufacturers who are now intending to utilise their plants in ASEAN countries as the export base. We are planning to use calibrated items by ISO/IEC17024, then planning to issue certificate as much as possible. In addition, we are now considering to establish an organisation structure that is traceable to other countries such as Russia, eastern Europe, China, Brazil, etc.

### Regulatory Requirement

The numbers of vehicles reached 1,071 million in 2011 globally. This means that 154 vehicles are prevailed in 1,000 persons, 1 person in 6.5 persons own a vehicle. If we look at the situation in Japan, 7,500 vehicles are registered. On the other hand, it is said that about 200 million of motorcycle are available in the world (Japan: more than 12 million). Automobile and motorcycle must be necessary for our life<sup>[3]</sup>. However, air pollution caused by exhaust gas is now becoming serious social issues especially for large cities. In order to deal with this issue, we are required to handle certificate business flexibly. Considering this kind of situation, each country has enforced regulation to control emission gas<sup>[4]</sup>. We are now describing action of HTS in response to this trend in the following Colum.

### Difficulties to Meet the Trend

It is important to manage and control testing equipment which can meet regulatory demand but there are 2 difficult points when we catch up this trend. First difficulty is adaptability of product itself (Table 2). Software and hardware of measuring equipment are developed in accordance with the revision of regulation. After installation, modification work for better performance would be required to meet the revised regulation (or new regulation). Second difficulty is in the case that new measured element is added in regulation. We have already been facing two elements, one is PN (Particle number) measurement and the other is N2O (Nitrous Oxide) measurement. PN measurement was started in Europe as a substitution of PM (Particle matters) measurement. N2O is one of greenhouse gases under controlled by GHG regulation. When we face new elements that we did not measure in the past, it is important to have a system to make hearing from customer and offering adequate system to the customer. And we service engineer can execute this kind of task because we are nearby customer. Therefore, it is very important for service engineer to have enough knowledge of regulation trend. HTS is working with HOR and we are trying to collect customer’s voice and making feedback to HOR.

Table 2 of §1065.303-Summary of Required Calibration and Verifications<sup>[5]</sup>

Type of calibration or verification	Minimum frequency
§1065.305: Accuracy, repeatability and noise	Accuracy: Not required, but recommended for initial installation.
	Repeatability: Not required, but recommended for initial installation.
	Noise: Not required, but recommended for initial installation.
§1065.307: Linearity verification	Speed: Upon initial installation, within 370 days before testing and after major maintenance.
	Torque: Upon initial installation, within 370 days before testing and after major maintenance.
	Fuel flow rate: Upon initial installation, within 370 days before testing, and after major maintenance.
	Gas dividers: Upon initial installation, within 370 days before testing, and after major maintenance.
	Gas analyzers (unless otherwise noted): Upon initial installation, within 35 days before testing and after major maintenance.
	GC-ECD: Upon initial installation and after major maintenance.
	PM balance: Upon initial installation, within 370 days before testing and after major maintenance.
§1065.340: Diluted exhaust flow (CVS)	Pressure, temperature, and dew point: Upon initial installation, within 370 days before testing and after major maintenance.
	Upon initial installation and after major maintenance.
	Upon initial installation, within 35 days before testing, and after major maintenance.
§1065.341: CVS and batch sampler verification	For thermal chillers: upon installation and after major maintenance.
§1065.342 Sample dryer verification	For osmotic membranes; upon installation, within 35 days of testing, and after major maintenance.
	Zero, span, and reference sample verifications: within 12 hours of weighing, and after major maintenance.

## Conclusions

HORIBA group have been growing with the customer by catching up their demand. This means that we've gropingly developed our products with the customer. Under this process, service engineer has participated product development and gas analysis at site, then we have always improved our technical level, knowledge and speed of service. We will be continuing to improve our service capability to acquire a real customer's satisfaction.

## References

- [ 1 ] Document No.ASG101 6<sup>th</sup> edition revised 1<sup>st</sup> June 2007 JIS Q 17025 (ISO/IEC 17025(IDT)) General requirements for the competence of testing and calibration laboratories  
[http://www.iajapan.nite.go.jp/jnla/pdf/koukaib\\_f/asg101\\_06.pdf](http://www.iajapan.nite.go.jp/jnla/pdf/koukaib_f/asg101_06.pdf)  
(Referenced in 2013-12-17)
- [ 2 ] New edition Measurement Relationship Regulation works edit by Japan Association for Metrology Promotion Publisher Hideya Tanaka
- [ 3 ] <http://www.jama.or.jp/world/world/index.html> (Referenced in 2013-12-21)
- [ 4 ] 7<sup>th</sup> edition revised New type Vehicle Examination Standard Works Publisher Hideyo Kobayashi p. 1
- [ 5 ] Code of Federal Regulations Title 40: Protection of Environment PART 1065—ENGINE-TESTING PROCEDURES [http://www.ecfr.gov/cgi-bin/text-idx?SID=f6914f946a970eece75b1f3d860b2e4&tpl=/ecfrbrowse/Title40/40cfr1065\\_main\\_02.tpl](http://www.ecfr.gov/cgi-bin/text-idx?SID=f6914f946a970eece75b1f3d860b2e4&tpl=/ecfrbrowse/Title40/40cfr1065_main_02.tpl) (Referenced in 2013-12-21)



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