Asia-Pacific
Economic Cooperation

Asia-Pacific
Legal Metrology Forum

Handbook on the Verification of Mechanical Weighing Scales

APEC/APLMF Training Courses in Legal Metrology (CTI 12/2008T)

May 13-16, 2008
Cholchan Pattaya Resort, Pattaya, Thailand

APEC Secretariat

35 Heng Mui Keng Terrace
Singapore 119616
Tel: +65-6775-6012, Fax: +65-6775-6013
E-mail: info@apec.org
Website: www.apec.org

APLMF Secretariat

Department of Metrology, AQSIQ
No.9 Madiandonglu, Haidian District, Beijing, 100088, P. R. China
Tel: +86-10-8226-0335
Fax: +86-10-8226-0131
E-mail: sec@aplmf.org aplmf@aqsiq.gov.cn
Website: www.aplmf.org

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July 2008

Train the Trainer Course on the Verification of Mechanical Weighing Scales
May 13 – 16, 2008

Photos taken at the training course in Pattaya,Thailand

Contents

Foreword

This booklet is one of outcomes of the APEC Seminars and Training Courses in Legal Metrology titled "Train the Trainer Course on the Verification of Mechanical Weighing Scales" which was held on May 13-16, 2008 at the Cholchan Pattaya Resort, Pattaya, Thailand.

This course was organized by APLMF and arranged as one of the APEC TILF projects, CTI-12/2008T. Also, it was supported by Weights and Measures Bureau of Department of Internal Trade, Ministry of Commerce (CBWM) of Thailand and National Metrology Institute of Japan (NMIJ). Having this result, I would like to extend my sincere gratitude to all the staffs of CBWM and two speakers from NMIJ. Also, special thanks should be extended to the APEC Secretariat for their great contributions.

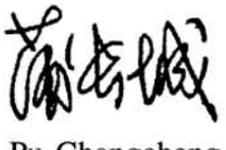
We have conducted the survey among the APEC member economies concerning seminar and training programs in legal metrology to find their needs as well as possible resources available in the region. The survey showed that there is still a strong need for repeating training course on Non-Automatic Weighing Instruments, especially emphasized on the practical training on verification on mechanical weighing scales which are widely used in the member economies.

The target of this training course was the experts in charge of verification of mechanical weighing scales in the APEC/APLMF member economies. The main objective was to experience and learn the actual operation of verification on the scales by hands-on exercise. The contents of the training course comply with the international standard recommended by OIML. Also, the training provided an opportunity to share information on the method and current status of verification in participated economies. Regardless of its heavy use, the legal metrology on verification of mechanical scales has not been well established in developing economies. We looked at this point and determined to serve for the members' demand for long.

In this view, this training course not only meet the highly demand in the APEC/APLMF member economies, but also enhance the verification capability of the Non-Automatic Weighing Instruments by experts. I would like to say that this training course is certainly a fruitful activity!

Finally, I would like to express my deeply appreciate again to the APEC Secretariat's generosity in contributing to the development in legal metrology among the APLMF member economies.

July 14, 2008



Mr. Pu Changcheng
APLMF President

Summary Report

According with the rapid growth of the globalization of international trade, the compliance to the international recommendation OIML R76 has become a major issue for the APLMF member economies in the field of non-automatic weighing scales, which is one of the most important categories of instruments in legal metrology. In order to accommodate such trend, the APLMF Working Group on Training Coordination chaired by Mrs. Marian Haire of Australia has given much effort in organizing a number of training courses in the last few years.

However, the R76 as well as the past training programs put much focus on electrical weighing instruments and did not give much consideration to the mechanical weighing scales regardless of its heavy use in the member economies. This area is in which our members are interested for the training course. To respond to such demand, the Working Group determined to organize the second training course designed only for mechanical scales. From the area of specialty, Mr. Kazuo Neda and Mr. Tsutomu Horikoshi of the National Metrology Institute of Japan (NMIJ) determined to serve as trainers for this training course.

Based on such background, the Train the Trainer Course on the Verification of Mechanical Weighing Scales was held from September 13th to 16th, 2008 at the Cholchan Pattaya Resort, Pattaya, Thailand. As you can see in the title, the course put emphasis on verification procedure and aimed to train the future trainers who would lead in training programs in their home economies. This training course was jointly organized by APEC and APLMF with supported by the Weights and Measures Bureau, Department of Internal Trade, Ministry of Commerce (CBWM), Thailand, and National Metrology Institute of Japan (NMIJ), AIST.

A total of 28 trainees including 20 local trainees attended this course from the following 7 economies: PR China, Indonesia, Malaysia, Peru, Singapore, Viet Nam and Thailand. In addition, many staff from the CBWM in Pattaya contributed to the course. From the Secretariat, Mr. Li Jinsi and Ms. Zheng Huaxin from AQSIQ in PR China attended the course.

On Tuesday the 13th, the training course started off with the opening ceremony. Mr. Veerasak Vissutthatham, Director General of CBWM welcomed all participants with his opening address and send them words of encouragement. After his speech, Mr. Li Jinsi as the APLMF Executive Secretary gave an address. After the opening ceremony, each economy delivered a short presentation about the current situation on the verification of NAWI including mechanical scales in their economy. Then, Mr. Neda gave the lectures starting with the basic understandings of mechanical weighing scales. In the evening, the host provided a welcome dinner at Tungkae Restaurant in Pattaya.

On Wednesday the 14th, Mr. Neda continued his lectures on technical requirements for mechanical weighing scales based on the OIML R76. In the afternoon, practical training on each verification test item was conducted in groups of eight using brand new mechanical scales provided by the host economy accompanied with set weights. All trainees worked very

hard on each activity under the instruction by Mr. Neda and Mr. Horikoshi and enthusiastically threw many questions.

On Thursday the 15th, all participants continued the practical training in the morning. After the practice, Mr. Neda gave a lecture on test methods for verification practiced in Japan as an example. In the afternoon, all participants left the hotel by bus prepared by the host and visited the Eastern Verification Center located in Cholburi. At the testing center, they were impressed by the advanced facilities for verification and calibration in several fields of metrology. In the evening, APLMF provided a farewell dinner at the Ruen Thai Restaurant. The delegates and assistant staffs from the host economy were also present the dinner.

On Friday the 16th, each of the eight groups demonstrated what they leaned by using a scale and an overhead projector in reply to the several assignments given by the trainers. After the demonstrations, the closing ceremony was held. Certificates of completion were granted to all 28 trainees from Mr. Veerasak Vissutthatham, Director General of CBWM who represented the host economy. The ceremony was closed with remarks from Mr. Veerasak and Mr. Li Jinsi.

On departure of the trainees for home, they were granted a CD-ROM that contains text books, reports from the trainees and photos taken during the course. These materials are also available on the APLMF member's website.

Finally, the Secretariat would like to give our sincere and deepest gratitude to the hard work and dedication by the staffs of the CBWM represented by Mr. Veerasak Vissutthatham, Director General of CBWM. In addition, we greatly appreciate the dedicated efforts by the two trainers, Mr. Neda and Mr. Horikoshi who provided well prepared lectures and materials with kind care for all trainees. Also, we can never forget the tremendous support from the Secretariat of Asia-Pacific Economic Cooperation (APEC) although their representatives could not attend this training course.

APLMF Secretariat

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APEC / APLMF Seminars and Training Courses in Legal Metrology
(CTI-12 / 2008T)
Train the Trainer Course on the Verification of Mechanical Weighing Scales

May 13-16, 2008

at the Cholchan Pattaya Resort, Pattaya, Thailand

Program

Organizers:

- Asia-Pacific Economic Cooperation (APEC)
- Asia-Pacific Legal Metrology Forum (APLMF)

Supporting Organizations:

- Weights and Measures Bureau,
  Department of Internal Trade, Ministry of Commerce (CBWM), Thailand
- General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China (AQSIQ)
- National Metrology Institute of Japan (NMIJ),
  National Institute of Advanced Industrial Science and Technology (AIST)

Trainers:

- Mr. Kazuo Neda
  Director, Legal Metrology Division, National Metrology Institute of Japan (NMIJ)
- Mr. Tsutomu Horikoshi
  Legal Metrology Division, National Metrology Institute of Japan (NMIJ)

Registration:

- Fill the attached **Registration Form** and send it to the APLMF secretariat by **April 15**. Please also reply the **type of mechanical scales** commonly used in your economy using this form. This information will be very important to organize the training course effectively.

Venue and Accommodation:

- **Venue**
- Cholchan Resort Pattaya, Thailand, Please Contact:
  1. Mr. Sakchai Hasamin, hasakchai@ hotmail. com, Tel: 662-5474-348 Fax: 662-547-4342

2. Mr. Chartree Areewong, chartreea@ cbwmthai. org, Tel: 662-5474-345 Fax: 662-547-4342

- **Accommodations**

  The accommodation will be prepared at the Cholchan Resort Pattaya with the rates below. If you hope to reserve the accommodation, please fill and send the separated **Hotel Reservation Form** to the host by **April 21.**

  Superior: USD75. 00 / single / double / Day

- **Access Information**: The Cholchan Resort Pattaya is located one hour distance by TAXI from the Suvarnabhumi International airport, our host will arrange the pick up for the international trainees from the Suvarnabhumi International airport to our Hotel.

Travel Support:

- **APEC travel support**, composed of a roundtrip airfare in a discount economy class and per diem including accommodation, would be prepared for the participants from **Chile**, **China**, **Indonesia**, **Malaysia**, **Mexico**, **Papua New Guinea**, **Philippines**, **Peru**, **the Russian Federation**, **and Viet Nam**.
- **APLMF travel support** would be complementary prepared for the non-APEC and full-APLMF member economies; **Cambodia**, **DPR Korea and Mongolia**.
- The maximum number of supported participants is limited to **one** for each economy. The final eligible participants will be decided after an approval by the APEC / APLMF secretariat. All supported participants are required to prepare a presentation with a document during the course. The English proficiency of your selected participant will very much affect the training accomplishments, so we hope you can recommend the right participant for the right training course.
- The candidates of the **APEC support** will be requested to submit an airfare quotation and itinerary in advance and have to wait to buy air ticket until it is approved by the APEC secretariat. Basically, all payment will be reimbursed directly from APEC after the **travel is finished. The supported participants have to pay their airfare and accommodation temporarily by themselves until the reimbursement**.

Visa Assistance:

- If you need visa to enter Thailand, fill the **bottom part** of the **Registration Form** and send it to the secretariat. This information will be forwarded to the host in Thailand and they will provide an invitation letter.

Presentation from each economy:

- At least **one trainee** from each economy will be requested to provide a **brief presentation** about the legal metrology system on non-automatic weighing instruments including mechanical scales in his / her economy. The **recommended topics** of the presentation are given below.

  1 Self introduction

  1. 1 Explain about your organization and department.

  1. 2 Explain your professional experience in your organization.

2 Non Automatic Weighing Instruments (NAWI) in your economy

2.1 What are the major purposes or targets to use NAWI?

2.2 How many manufacturers of NAWI are there in your economy?

2.3 If you know, please mention approximate total number of production of NAWI.

2.4 If you know, please mention approximate ratio (%) of numbers in use for the (a) electronic weighing scales, (b) mechanical scales using a spring, and (c) mechanical balances using a weigh beam and weights.

2.5 What are the accuracy class and the maximum capacity, which are most commonly used?

3 Legal metrology system in your economy

3.1 Who implements the measurement law (government, metrology institute, verification body, testing laboratory, etc.)?

3.2 Describe briefly the types of weighing instruments and its measuring range, which are covered by the measurement law.

3.3 Are initial verification and re-verification required? If yes, which organization performs the verification? How long is the re-verification period? How much verification is performed in a year? Are they increasing or decreasing?

3.4 Are type approvals required? If yes, which organization performs the type approvals? How many type approval tests are performed in a year?

4 Explain current situation in your economy about the compliance to the international standards / recommendations, such as OIML R76?

5 Are there any other requirements from your economy? Do you have any problems in order to implement the legal metrology system (budget, human resources, etc.)?

Contact Persons about the Training Course:

- **APLMF Secretariat** (lecture, registration and travel support)

  Mr. Li Jinsi or Mr. Guo Su No. 9 Madiandong Lu, Haidian District, Beijing 100088 P. R. China

  Fax: +86 10 8226 0131, Tel: +86 10 8226 0335

  E-mail: aplmf@ aqsiq. gov. cn; sec@ aplmf. org

- **Host in Vietnam** (visa assistance, accommodation, venue and access information)

  Mr. Sakchai Hasamin, hasakchai@ hotmail. com, Tel: 662-547-4348 Fax: 662-547-4342

  Mr. Chartree Areewong, chartreea@ cbwmthai. org, Tel: 662-5474-345 Fax: 662-547-4342

Program

Day 1 May. 13 Tuesday	9 : 00 - 9 : 30	**Opening ceremony:** • Roll-call By: Mr. Li Jinsi, APLMF Secretary • Welcome address by Director General of Department of Internal Trade, Ministry of Commerce • Opening address by Mr. Li Jinsi, APLMF Secretary • Take a group photo
	9 : 30 - 10 : 00	*Coffee Break*
	10 : 00 - 12 : 30	**Presentation from the economies:** • Each participant provides a brief presentation of the legal metrology system on non-automatic weighing instruments including mechanical scales
	12 : 30 - 14 : 00	*Lunch Break*
	14 : 00 - 15 : 40	**Basic understandings of mechanical weighing scales presented by Mr. Neda:** • Legal metrology system for weighing scales in Japan Understandings of principle, structure and influence factors
	15 : 40 - 16 : 10	*Coffee Break*
	16 : 10 - 17 : 00	• Outline of the practical training
	19 : 00 - 20 : 30	• *Welcome dinner hosted by* Department of Internal Trade, Ministry of Commerce *At The Cholchan Pattaya Resort*
Day 2 May. 14 Wednesday	9 : 00 - 10 : 30	**Technical requirements for mechanical weighing scales based on the OIML R76 presented by Mr. Neda & Mr. Horikoshi:** • Calculation of Maximum Permissible Error (**MPE**)
	10 : 30 - 11 : 00	*Coffee Break*
	11 : 00 - 12 : 30	Continue the lecture
	12 : 30 - 14 : 00	*Lunch Break*
	14 : 00 - 15 : 15	**Practical training participated by the trainees instructed by Mr. Neda & Mr. Horikoshi:** • Training on verification test items for **Spring** type: • Evaluation of instrumental error • Repeatability • Discrimination • Eccentricity error • Zero-setting accuracy
	15 : 15 - 15 : 45	*Coffee break*
	15 : 45 - 17 : 00	Continue the practical training

Day 3 May. 15 Thursday	9 : 00 - 10 : 30	**Practical training participated by the trainees instructed by Mr. Neda & Mr. Horikoshi (cont.):** • Training on verification test items for **Lever** type: • Evaluation of instrumental error • Repeatability • Discrimination • Eccentricity error • Zero-setting accuracy
	10 : 30 - 11 : 00	*Coffee Break*
	11 : 00 - 12 : 30	**Continue the practical training by Mr. Neda& Mr. Horikoshi (cont.)**
	12 : 30 - 14 : 00	*Lunch Break*
	14 : 00	**Leave the hotel by bus**
	14 : 30 - 16 : 45	**Technical tour guided by the host to visit the Eastern Verification Center, Cholburi.**
	17 : 00	**Back to the Cholchan Resort Pattaya by bus**
	18 : 30	**Leave the hotel by bus**
	19 : 30 - 21 : 30	**Farewell dinner hosted by APLMF at the Ruen Thai Restaurant**
Day 4 May. 16 Friday	9 : 00 - 10 : 30	**Presentation with demonstration of test methods by the trainees instructed by Mr. Neda & Mr. Horikoshi** • Prepare for the presentation in separated group
	10 : 30 - 11 : 00	*Coffee break*
	11 : 00 - 12 : 30	• Presentation with demonstration in separated groups
	12 : 30 - 14 : 00	*Lunch Break*
	14 : 00 - 16 : 00	• Presentation with demonstration in separated groups (cont.)
	16 : 00 - 16 : 15	*Coffee break*
	16 : 15 - 16 : 50	**Closing ceremony:** • Presentation of certificates to all trainees • Closing address by Mr. Veerasak Visutthatham Director of CBWM • Closing address by Mr. Li Jinsi, APLMF Secretary

Participants List

APEC / APLMF Seminar and Training Courses in Legal Metrology (CTI-12 / 2008T)

Training Course on the Verification of Mechanical Weighing Scales (NAWI)

No.	Category	Economy	Name	Organization
1	Trainee	China PR	Mr. Zhang Guangxin	Yunnan Institute of Metrology and Testing Technology
2	APLMF	China PR	Mr. Li Jinsi	APLMF Secretary, Department of Metrology, AQSIQ
3	APLMF	China PR	Ms. Zheng Huaxin	APLMF Secretary, Department of Metrology, AQSIQ
4	Trainee	Indonesia	Ms. Sri Astuti	Directorate of Metrology
5	Trainee	Indonesia	Mr. Adi Candra Purnama	Metrology Training Centre Indonesia
6	Trainer	Japan	Mr. Kazuo Neda	Ministry of Trade
7	Trainer	Japan	Mr. Tsutomu Horikoshi	National Metrology Institute of Japan (NMIJ)
8	Trainee	Malaysia	Ms. Hairani Nordin	Mechanical Metrology Section, National Metrology Laboratory, SIRIM Berhad
9	Trainee	Peru	Mr. Nikko Meza Valencia	National Institute for the Defense of Competition and the Protection of Intellectual Property (INDECOPI)
10	Trainee	Singapore	Ms. Koh Swee Moi	Weights & Measures Office, SPRING Singapore
11	Trainee	Singapore	Ms. Lena Soh Mei Lin	Weights Measures Office, SPRING Singapore
12	Trainee	Viet Nam	Ms. TRAN THI THUY HA	Directorate for Standards and Quality, STAMEQ
13	Host	Thailand	Mr. Veerasak Vissutthatham	Weights and Measures Bureau, Department of Internal Trade, Ministry of Commerce
14	Host	Thailand	Mr. Somsak Panpaisan	Weights and Measures Bureau, Department of Internal Trade, Ministry of Commerce
15	Host	Thailand	Mr. Sakchai Hasamin	Weights and Measures Bureau, Department of Internal Trade, Ministry of Commerce
16	Host	Thailand	Mr. Chartree Arreewong	Weights and Measures Bureau, Department of Internal Trade, Ministry of Commerce
17	Host	Thailand	Ms. Khemsai Rahannok	Weights and Measures Bureau, Department of Internal Trade, Ministry of Commerce
18	Host	Thailand	Ms. Pattaraporn Surasit	Weights and Measures Bureau, Department of Internal Trade, Ministry of Commerce
19	Local Trainee	Thailand	Mr. Surachat Suwanaraw	Central Bureau of Weights & Measures Department of Internal Trade, Ministry of Commerce

20	Local Trainee	Thailand	Mr. Nirun Tamprasith	Central Bureau of Weights & Measures Department of Internal Trade, Ministry of Commerce
21	Local Trainee	Thailand	Mr. Phitsanurach Yoopum	Northern Weights and Measures Center (Chiang Mai)
22	Local Trainee	Thailand	Mr. Poramain Watthananup-rasit	Central Bureau of Weights & Measures Department of Internal Trade, Ministry of Commerce
23	Local Trainee	Thailand	Ms. Hathairat Kasun	Central Bureau of Weights & Measures Department of Internal Trade, Ministry of Commerce
24	Local Trainee	Thailand	Mr. Phongchai Kwunkum	Central Bureau of Weights & Measures Department of Internal Trade, Ministry of Commerce
25	Local Trainee	Thailand	Mr. Nattapoj Kuthong	Central Bureau of Weights & Measures Department of Internal Trade, Ministry of Commerce
26	Local Trainee	Thailand	Ms. Prapussorn Moungmee	Central Bureau of Weights & Measures Department of Internal Trade, Ministry of Commerce
27	Local Trainee	Thailand	Mr. Thanakorn Ngernrueng-chai	Central Bureau of Weights & Measures Department of Internal Trade, Ministry of Commerce
28	Local Trainee	Thailand	Mr. Supachai Jaengjad	Central Bureau of Weights & Measures Department of Internal Trade, Ministry of Commerce
29	Local Trainee	Thailand	Ms. Supaporn Promsuk	Central Bureau of Weights & Measures Department of Internal Trade, Ministry of Commerce
30	Local Trainee	Thailand	Mr. Nopporn Shoopol	Central Bureau of Weights & Measures Department of Internal Trade, Ministry of Commerce
31	Local Trainee	Thailand	Mr. Wichain Sukjit	Weights and Measures Branch Offices (Nakorn Ratchasrima)
32	Local Trainee	Thailand	Ms. Pisakorn Pisankul	Central Bureau of Weights & Measures Department of Internal Trade, Ministry of Commerce
33	Local Trainee	Thailand	Mr. Phanomwase Phukerd-pim	Central Bureau of Weights & Measures Department of Internal Trade, Ministry of Commerce
34	Local Trainee	Thailand	Ms. Jintana Pengyai	Central Bureau of Weights & Measures Department of Internal Trade, Ministry of Commerce

35	Local Trainee	Thailand	Ms. Panawan Khumlor	Central Bureau of Weights & Measures Department of Internal Trade, Ministry of Commerce
36	Local Trainee	Thailand	Mr. Saard Joyrung	Central Bureau of Weights & Measures Department of Internal Trade, Ministry of Commerce
37	Local Trainee	Thailand	Mr. Sayomporn Rongneam	Central Bureau of Weights & Measures Department of Internal Trade, Ministry of Commerce
38	Local Trainee	Thailand	Mr. Warachai Triarun	Central Bureau of Weights & Measures Department of Internal Trade, Ministry of Commerce

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Understandings of principle, structure and influence factors

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Weighing instrument

Measuring instrument that serves to determine the mass of a body by using the action of gravity on this body.

The instrument may also be used to determine other quantities, magnitudes, parameters or characteristic related to mass.

According to its method of operation, a weighing instrument is classified as an automatic or non-automatic instrument.

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Automatic weighing instrument

An instrument that weighs without the intervention of an operator and follows a predetermined program of automatic processes characteristic of the instrument.

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Non-automatic weighing instrument

Instrument that requires the intervention of an operator during the weighing process, for example to deposit on or remove from the receptor the load to be measured and also to obtain the result.

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What's Mechanical Weighing Scale ?

Mechanical weighing scales use mechanical principle such as spring and lever when weighing is measured.

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Various Mechanical Weighing Scale

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Measurement principle

Lever

Elasticity

Spring

Load cell (electronically)

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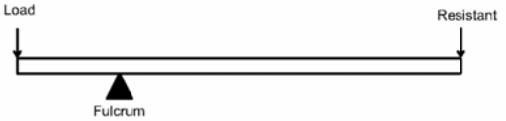
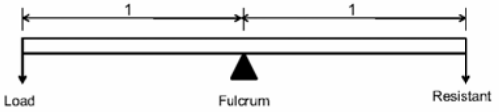
Levers in Mechanical Weighing Instruments

First order levers

The fulcrum is between the Load and Resistant. The resistant is usually either to the load or is less. In the case the lever has a mechanical advantage.



Simple beam (equal arm) Leverage 1 to 1



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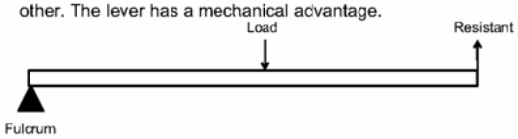
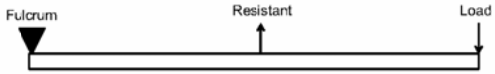
Second order levers

The fulcrum is at one end of the lever and the resistant is at the other. The lever has a mechanical advantage.



Third order levers

The fulcrum is at one end of the lever and the resistant is between the fulcrum and load. The lever has a mechanical advantage.



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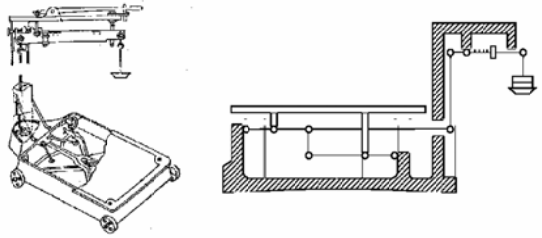
Combination of levers



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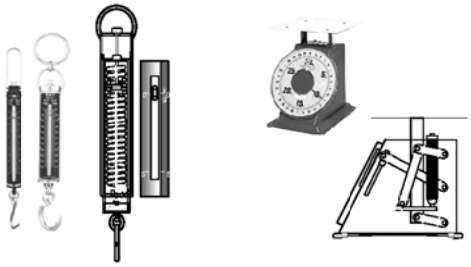
Spring type



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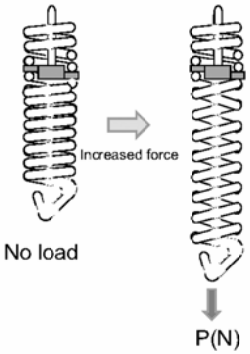
Elasticity : Spring



Hooke's law

Growth of the spring is in proportion to increased force

$$F = -kx$$

$$k = \frac{P}{\delta} = \frac{Gd^4}{8nd^3}$$

F : *Restoring force exerted by the spring*
k : *Spring constant* (N/mm)
x : *The distance by which the spring is elongated*
P : *Load* (N)
δ : *Displacement* (mm)
G : *Rigidity of spring materials* (N/mm²)
d : *Diameter of spring* (mm)
n : *Reel number*
D : *Diameter of the coil*

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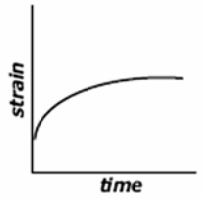
Spring -Creep and Hysteric's-

Creep



The strain by the outside power changes with the passage of time when the outside power is left while added.

Hystericis

The difference is caused in the relation between the stress and the strain in the increase and decrease of the stress.

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Spring -Temperature compensating-

The elastic coefficient changes with the temperature. The strain to constant outside power is different depending on the temperature.

Temperature compensating device

Bimetal

Compensated spring

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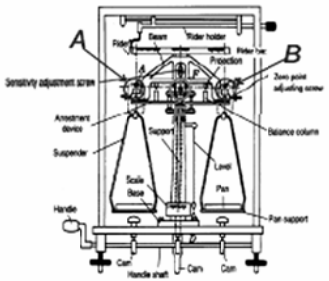
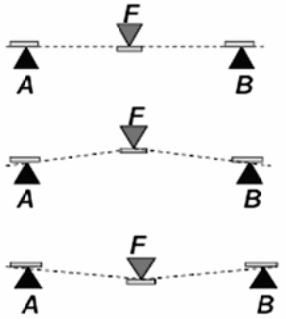
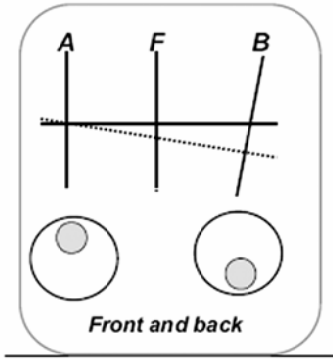
Equal arm balance - Sensitivity -

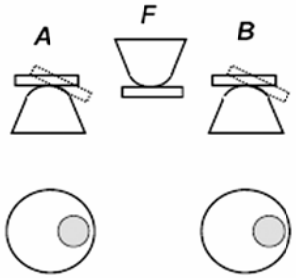




AIST

Equal arm balance - Eccentricity -





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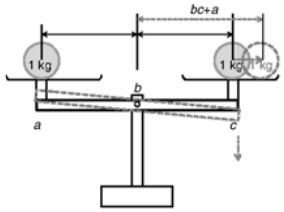
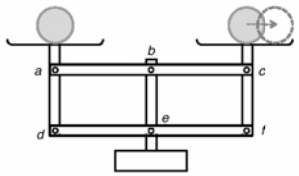
Roberval mechanism

Simple lever



Roberval mechanism



Same mass and same ratio of "*ab*" and "*bc*" ⇨ ***Equilibrium***

Same mass and difference ratio of "*ab*" and "*bc*" ⇨ ***Not Equilibrium***

It's form two parallelogram "*abde*", "*bcef*" which connected the joint of length and breadth with a pin, and move freely.
"*abc*" becomes level when it's put the same mass on a plate in the extension of "*ad*","*ef*".
"*abc*" becomes always level even if it's move a position of the mass then on a plate.

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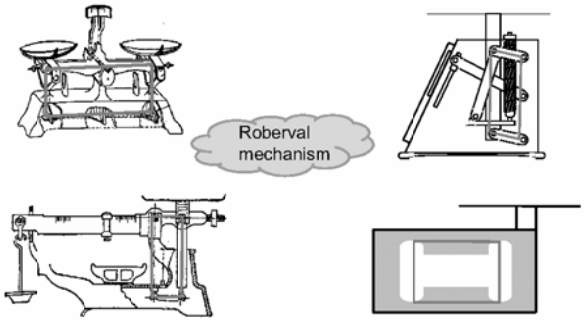
Use example of the Roberval mechanism



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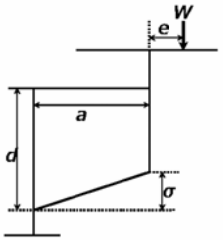
Robarval Eccentricity



Example:

a = 60 mm

d = 180 mm

σ = 1 mm

***W* = 2.5** kg

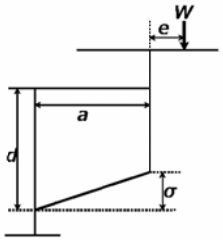
e = 50 mm

$$E = \frac{We\sigma}{ad}$$

E = ?

AIST

Robarval Eccentricity



Answer :

$$E = \frac{2\,500 \times 50 \times 1}{60 \times 180} = 11.6\ \mathrm{g}$$

$$E = \frac{We\sigma}{ad}$$

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Gravity compensation

All objects on the earth are subject to Earth's gravity all the time.
No measurements of force and mass can be free from the gravity effects, as the force and mass are measured by balancing the object's weight on a lever, or by converting it into modification of elastic body.
Gravity compensation is required because the gravity depends on the location on the earth (ex. latitude, longitude, altitude). 9.80665m/s^2 is used as the standard gravitational acceleration.
If a measuring instrument equipped with elastic bodies is calibrated at a place different from a place of use, the value of gravity compensation E_g is obtained in the following equation:

$$E_g = \frac{g_1 - g_2}{9.8} \cdot W$$

Where:
g_1: gravitational acceleration at the calibration site
g_2: gravitational acceleration at the place of use
W: mass, corresponding to inspection weight

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Gravity compensation

A range of the gravity in Japan

9.806 m/s^2 ~ 9.791 m/s^2

Hokkaido:9.806 m/s^2 ・・・ (g_2)

Tsukuba 9.800 m/s^2 ・・・ (g_1)

Okinawa 9.791 m/s^2

EX)
$I_1 \propto W$・(g_1=9.800 m/s^2)
$I_2 \propto W$・(g_2=9.800 m/s^2)
$I_1/I_2 = g_1/g_2$
$I_1 = I_1 \cdot g_2/g_1$
$= 5.000 \cdot 9.806/9.800 = 5.003_1 = 5.003$ (kg)

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Verification procedure for NAWIs

【 OIML R76 Edition 1992 】

AIST

Contents of OIML R76 1992

AIST

The related term of the mechanical weighing scale

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T.1.2 Non automatic weighing instrument

Instrument that requires the intervention of an operator during the weighing process, for example to deposit on or remove from the receptor the load to be measured and also to obtain the result.

The instrument permits direct observation of the weighing results either displayed or printed; both possibilities are covered by the word "indication".

Note: Terms such as "indicate", "indicating component" and their derivatives do not include printing.

A non automatic weighing instrument may be:

-graduated or non-graduated,

- self-indicating, semi-self indicating or non-self-indicating.

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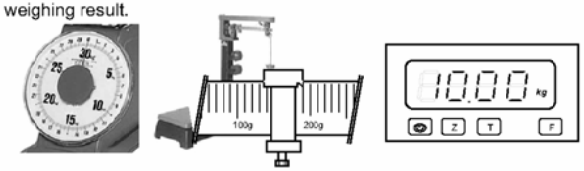
T.1.2.1 Graduated instrument

Instrument allowing the direct reading of the complete or partial weighing result.



T.1.2.2 Non graduated instrument

Instrument not fitted with a scale numbered in units of mass.

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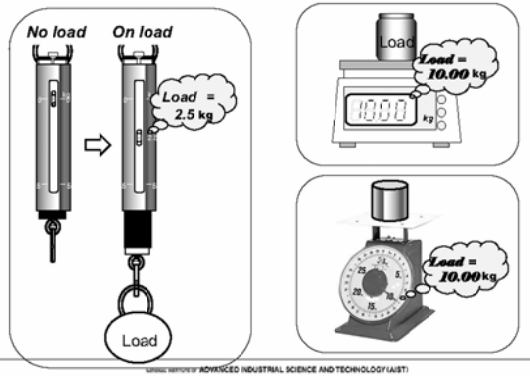
T.1.2.3 Self indicating instrument

Instrument in which the position of equilibrium is obtained without the interventes of an operator.



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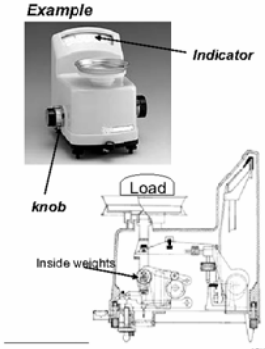
T.1.2.4 Semi self indicating instrument

Instrument with a self indication weighting range, in which the operator intervenes to alter the limits of this range.

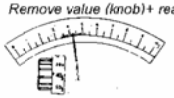
Example



Measurement procedure

1. *Load applies to load receptor*
2. *Remove inside weights by a knob*

3. *Repeat 2 till it is balanced in a weighing range*
4. *Load =*
   Remove value (knob)+ reading for indicator



Knob = 40g
Indicator = 4.3g
Load = 44.3g

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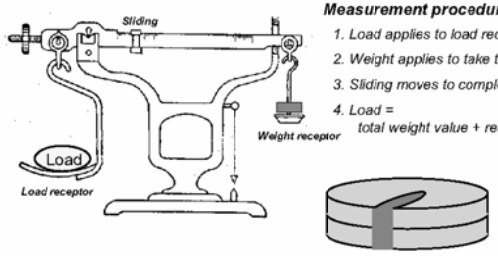
T.1.2.5 Non self indicating instrument

Instrument in which the position of equilibrium is obtained entirely by operator.

Example



Measurement procedure

1. *Load applies to load receptor*
2. *Weight applies to take the rough equilibrium.*
3. *Sliding moves to complete equilibrium*
4. *Load =*
   total weight value + reading of the sliding

AIST

T.2.1 Main device

T.2.1.1 Load receptor

Part of the instrument intended to receive the load.

T.2.1.2 Load-transmitting device

Part of the instrument for transmitting the force produced by the load acting on the load receptor, to the load measuring device.

T.2.1.3 Load measuring device

Part of the instrument for measuring the mass of the load by means of an equilibrium device for balancing the force coming from the load transmitting device, and an indicating or printing device.

T.2.4 Indicating device (of a weighing instrument)

Part of the load measuring device on which the direct reading of the result is obtained.

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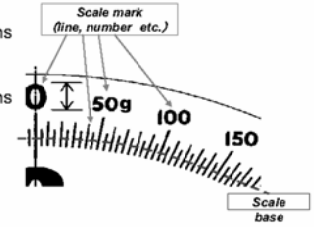
T.2.4.1 Indicating component

Component indicating the equilibrium and /or the result.
On an instrument with several positions of equilibrium it indicates only the equilibrium (so-called zero).
On an instrument with several positions of equilibrium it indicates both the equilibrium and the result. On an electronic instrument, this is the display.



T.2.4.2 Scale mark

A line or other mark on an indicating component corresponding to a specified value of mass.

T.2.4.3 Scale base

An imaginary line through the centers of all the shortest scale marks.

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T.2.7.2 Zero setting device

Device for setting the indication to zero when there is no load on the load receptor.

T.2.7.2.1 Non automatic zero setting device

Device for setting the indication to zero by an operator.

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T.2.7.4 Tare device

Device for setting the indication to zero when a load is on the load receptor:
Without altering the weighing range for net loads (additive tare device),
or
Reducing the weighing range for net loads (subtractive tare device).

It may function as;
- A non automatic device (load balanced by an operator),
- A semi automatic device (load balanced automatically following a single manual command),
- An automatic device (load balanced automatically without the intervention of an operator).

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T.3.2 Scale divisions

T.3.2.1 Scale spacing *(instrument with analogue indication)*

Distance between any two consecutive scale marks, measured along the scale base.

T.3.2.2 Actual scale interval (d)

Value expressed in units of mass of:

The difference between the values corresponding to two consecutive scale marks, for analogue indication, or

The difference between two consecutive indication values, for digital indication.

T.3.2.3 Verification scale interval (e)

Value, expressed in units of mass, used for the classification and verification of an instrument.

T.3.2.4 Scale interval of numbering

Value of the difference between two consecutive numbered scale marks.

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T.3.2.5 Number of verification scale intervals
(single-interval instrument)

Quotient of the maximum capacity and the verification scale interval:

$$n = Max / e$$

T.4 Metrological properties of an instrument

T.4.1 Sensitivity
(k)

For given value of the measured mass, the quotient of the change of the observed variable *l* and the corresponding change of the measured ***M***

$$k = \Delta l / \Delta M$$

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Verification procedure for NAWIs

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Verification Item
(8.3 initial verification)

- ☐ ***Visual inspection (8.3.2)***
- ☐ ***Tests (8.3.3)***
  - ***Error of indication*** **【 Weighing test】**
    - ◇ *Value of maximum permissible error*
    - ◇ *Maximum permissible errors for net values*
    - ◇ *Tare weighing device*
  - ***Accuracy of zero setting and tare devices***
  - ***Repeatability***
  - ***Eccentricity***
  - ***Discrimination***
  - ***Sensitivity of non self indication instruments***

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Visual inspection (8.3.2)

Before testing, the instrument shall be visual inspected

- ***Confirmation of markings:***
  Accuracy class, Max, Min, e, d
- ***Confirmation of condition of instrument***
- ***Confirmation of level of instrument***

**Results of the visual inspection should be recorded in the test report. including test date and observer, etc.*

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Tests (8.3.3)

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Value of maximum permissible error

Maximum permissible error for verification

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Accuracy classes for NAWI's (3.2)

Class 1 Special accuracy Ⓘ
ultra micro-, micro-, semi micro, macro-

Class 2 High accuracy Ⓘⓘ
precision balances

Class 3 Medium accuracy Ⓘⓘⓘ
NAWI's for trade use

Class 4 Ordinary accuracy Ⓘⓥ
NAWI's for lower accuracy

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Accuracy classes for NAWI's (3.2)

Accuracy class	Verification scale interval	Number of verification scale interval		Minimum capacity
		Minimum	Maximum	
Special (I)	0.001g≤ *e*	50 000	-	100 *e*
High (II)	0.001 g≤ *e* ≤0.05 g 0.1g≤ *e*	100 5 000	100 000 100 000	20 *e* 50 *e*
Medium (III)	0.1 g≤ *e* ≤2 g 5 g≤ *e*	100 500	10 000 10 000	20 *e* 20 *e*
Ordinary (IV)	5 g≤ *e*	100	1 000	10 *e*

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Verification scale interval (e)

Value, expressed in unit of mass, used for the classification and verification of an instrument.

Number of verification scale interval (n)

Quotient of the maximum capacity and the verification scale interval.

$$n = Max / e$$

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Maximum permissible error (3.5.1)

Verification

Maximum permissible errors	For loads, m expressed in verification scale intervals, e			
	Class 1	Class 2	Class 3	Class 4
±0.5 *e*	0≤ *m* ≤50 000	0≤ *m* ≤ 5 000	0≤ *m* ≤500	0≤ *m* ≤50
±1.0 *e*	50 000 < *m* ≤200 000	5 000 < *m* ≤20 000	500 < *m* ≤2 000	50 < *m* ≤200
±1.5 *e*	200 000≤ *m*	20 000 <*m*≤100 000	2 000 <*m*≤10 000	200 < *m* ≤1 000

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Exercise

Determine MPE and MPE change points.

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Exercise 1

Determine MPE and MPE change points for verification

Specification of NAWI is

Max : 3 kg,
Verification scale Interval (e): 1 g,
Accuracy class 3

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Maximum permissible errors	For loads, m expressed in verification scale intervals, e			
	Class 1	Class 2	Class 3	Class 4
±0.5 e	0 ⩽ m ⩽ 50 000	0 ⩽ m ⩽ 5 000	0 ⩽ m ⩽ 500	0 ⩽ m ⩽ 50
±1.0 e	50 000 < m ⩽ 200 000	5 000 < m ⩽ 20 000	500 < m ⩽ 2 000	50 < m ⩽ 200
±1.5 e	200 000 ⩽ m	20 000 < m ⩽ 100 000	2 000 < m ⩽ 10 000	200 < m ⩽ 1 000

MPE (e)	Class 3 For loads, m expressed in verification scale intervals, e	MPE (g)	Class 3 (mass)
±0.5 e	0 ⩽ m ⩽ 500	±0.5 × 1g = ±0.5 g	0 ⩽ m ⩽ 500 × 1 g (e) 0 g ⩽ m ⩽ 500 g
±1.0 e	500 < m ⩽ 2 000	±1.0 × 1g = ±1 g	500 × 1g(e) < m ⩽ 2 000 × 1 g(e) 500 g < m ⩽ 2 000 g
±1.5 e	2 000 < m ⩽ 10 000	±1.5 × 1g = ±1.5 g	2 000 × 1g(e) < m ⩽ 10000 × 1 g (e) 2 000 g < m ⩽ 10 000 g

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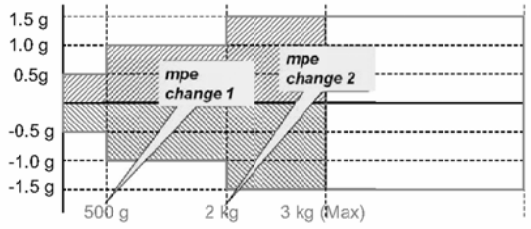
Answer

Max : 3 kg, Verification scale Interval (e): 1 g, Accuracy class 3

MPE (g)	Class 3 (mass)	Mpe change points
±0.5 g	0 g ⩽ m ⩽ 500 g	500 g (change point 1)
±1.0 g	500 g < m ⩽ 2 kg	2 kg (change point 2)
±1.5 g	2 kg < m ⩽ 3 kg (Max)	-



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Exercise 2

Determine MPE and MPE change points for verification

Specification of NAWI is

Max : 6 kg,
Verification scale Interval (e): 2 g,
Accuracy class 3

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Maximum permissible errors	For loads, m expressed in verification scale intervals, e			
	Class 1	Class 2	Class 3	Class 4
±0.5 *e*	0 ⩽ *m* ⩽ 50 000	0 ⩽ *m* ⩽ 5 000	0 ⩽ *m* ⩽ 500	0 ⩽ *m* ⩽ 50
±1.0 *e*	50 000 < *m* ⩽ 200 000	5 000 < *m* ⩽ 20 000	500 < *m* ⩽ 2 000	50 < *m* ⩽ 200
±1.5 *e*	200 000 ⩽ *m*	20 000 < *m* ⩽ 100 000	2 000 < *m* ⩽ 10 000	200 < *m* ⩽ 1 000

MPE (e)	Class 3 For loads, m expressed in verification scale intervals, e	MPE (g)	Class 3 (mass)
±0.5 *e*	0 ⩽ *m* ⩽ 500	±0.5×2g = ±1.0 g	0 ⩽ *m* ⩽ 500×2 g *(e)* 0 g ⩽ *m* ⩽ 1 000 g
±1.0 *e*	500 < *m* ⩽ 2 000	±1.0×2g = ±2.0 g	500×2g *(e)* < *m* ⩽ 2 000×2 g *(e)* 1 000 g < *m* ⩽ 4 000 g
±1.5 *e*	2 000 < *m* ⩽ 10 000	±1.5×2g = ±3.0 g	2 000×2g *(e)* < *m* ⩽ 10 000×2g *(e)* 4 000 g < *m* ⩽ 20 000 g

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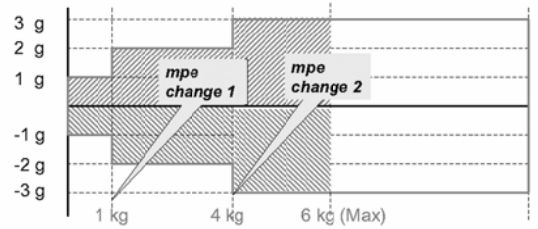
Answer

Max : 6 kg, Verification scale Interval (e): 2 g, Accuracy class 3

MPE (g)	Class 3 (mass)	Mpe change points
±1.0 g	0 g ⩽ *m* ⩽ 1 kg	1 kg (change point 1)
±2.0 g	1 kg < *m* ⩽ 4 kg	4 kg (change point 2)
±3.0 g	4 kg < *m* ⩽ 6 kg (Max)	-



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Exercise 3

Determine MPE and MPE change points for verification

Specification of NAWI is

Max : 5 kg,
Verification scale Interval (e): 10 g,
Accuracy class 3 or class 4

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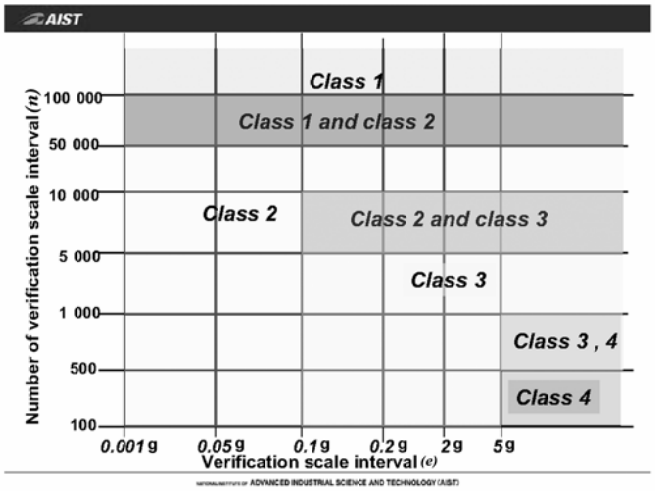
Accuracy classes for NAWI's (3.2)

Accuracy class	Verification scale interval	Number of verification scale interval		Minimum capacity
		Minimum	Maximum	
Special (I)	0.001g ⩽ *e*	50 000	-	100 *e*
High (II)	0.001 g ⩽ *e* ⩽ 0.05 g	100	100 000	20 *e*
	0.1g ⩽ *e*	5 000	100 000	50 *e*
Medium (III)	0.1 g ⩽ *e* ⩽ 2 g	100	10 000	20 *e*
	5 g ⩽ *e*	500	10 000	20 *e*
Ordinary (IV)	5 g ⩽ *e*	100	1 000	10 *e*


AIST
Class 1
Class 1 and class 2
Class 2
Class 2 and class 3
Class 3
Class 3 , 4
Class 4
Number of verification scale interval (n)
100 000
50 000
10 000
5 000
1 000
500
100
0.001 g
0.05 g
0.1 g
0.2 g
2 g
5 g
Verification scale interval (e)
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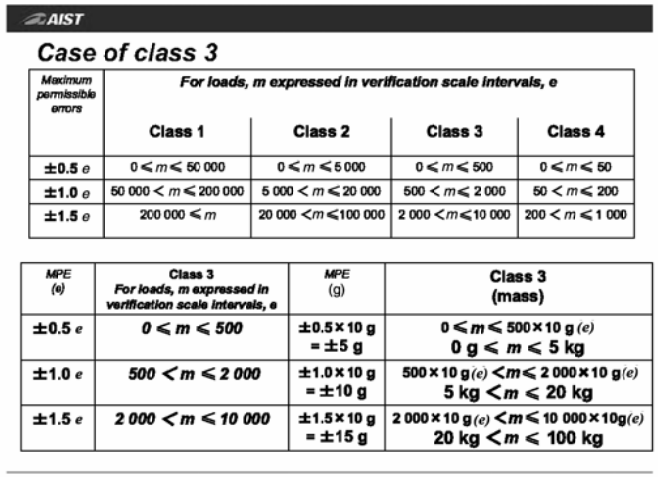
AIST
Case of class 3
Maximum permissible errors
For loads, m expressed in verification scale intervals, e
Class 1
Class 2
Class 3
Class 4
±0.5 e
0 ⩽ m ⩽ 50 000
0 ⩽ m ⩽ 5 000
0 ⩽ m ⩽ 500
0 ⩽ m ⩽ 50
±1.0 e
50 000 < m ⩽ 200 000
5 000 < m ⩽ 20 000
500 < m ⩽ 2 000
50 < m ⩽ 200
±1.5 e
200 000 ⩽ m
20 000 < m ⩽ 100 000
2 000 < m ⩽ 10 000
200 < m ⩽ 1 000
MPE (e)
Class 3 For loads, m expressed in verification scale intervals, e
MPE (g)
Class 3 (mass)
±0.5 e
0 ⩽ m ⩽ 500
±0.5 × 10 g = ±5 g
0 ⩽ m ⩽ 500 × 10 g (e)
0 g ⩽ m ⩽ 5 kg
±1.0 e
500 < m ⩽ 2 000
±1.0 × 10 g = ±10 g
500 × 10 g (e) < m ⩽ 2 000 × 10 g (e)
5 kg < m ⩽ 20 kg
±1.5 e
2 000 < m ⩽ 10 000
±1.5 × 10 g = ±15 g
2 000 × 10 g (e) < m ⩽ 10 000 × 10g (e)
20 kg < m ⩽ 100 kg
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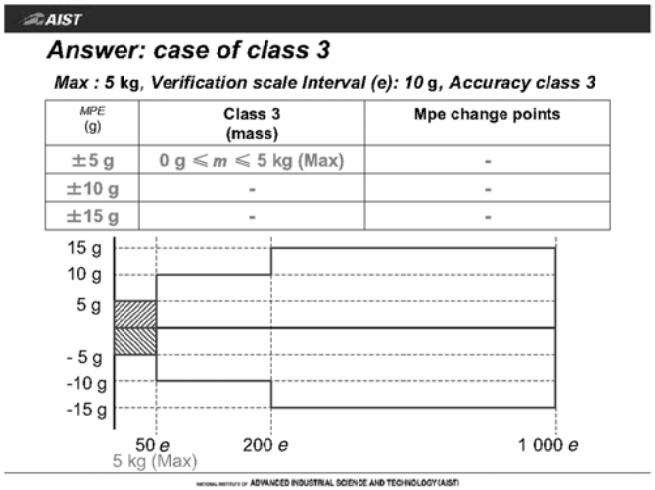
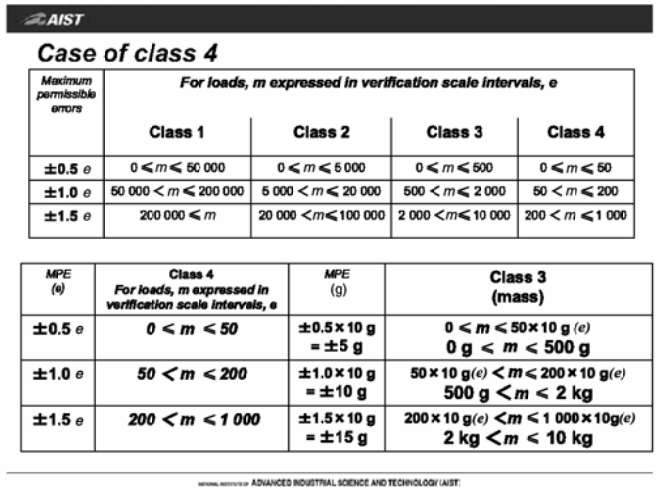

AIST
Answer: case of class 3
Max : 5 kg, Verification scale Interval (e): 10 g, Accuracy class 3
MPE (g)
Class 3 (mass)
Mpe change points
±5 g
0 g ⩽ m ⩽ 5 kg (Max)
-
±10 g
-
-
±15 g
-
-
15 g
10 g
5 g
- 5 g
-10 g
-15 g
50 e
5 kg (Max)
200 e
1 000 e
ADVANCED INDUSTRIAL SCIENCE AND TECHNOLOGY (AIST)


AIST
Case of class 4
Maximum permissible errors
For loads, m expressed in verification scale intervals, e
Class 1
Class 2
Class 3
Class 4
±0.5 e
0 ⩽ m ⩽ 50 000
0 ⩽ m ⩽ 5 000
0 ⩽ m ⩽ 500
0 ⩽ m ⩽ 50
±1.0 e
50 000 < m ⩽ 200 000
5 000 < m ⩽ 20 000
500 < m ⩽ 2 000
50 < m ⩽ 200
±1.5 e
200 000 ⩽ m
20 000 < m ⩽ 100 000
2 000 < m ⩽ 10 000
200 < m ⩽ 1 000
MPE (e)
Class 4 For loads, m expressed in verification scale intervals, e
MPE (g)
Class 3 (mass)
±0.5 e
0 < m < 50
±0.5 × 10 g = ±5 g
0 < m < 50 × 10 g (e)
0 g < m < 500 g
±1.0 e
50 < m < 200
±1.0 × 10 g = ±10 g
50 × 10 g (e) < m < 200 × 10 g (e)
500 g < m < 2 kg
±1.5 e
200 < m < 1 000
±1.5 × 10 g = ±15 g
200 × 10 g (e) < m < 1 000 × 10g (e)
2 kg < m < 10 kg
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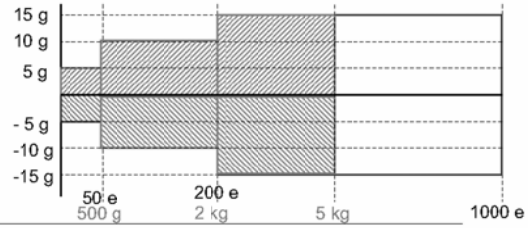
Answer: case of class 4

Max : 5 kg, Verification scale Interval (e): 10 g, Accuracy class 4

MPE (g)	Class 4 (mass)	Mpe change points
±5 g	0 g ⩽ *m* ⩽ 500 g	500 g
±10 g	500 g < *m* ⩽ 2 kg	2 kg
±15 g	2 kg < *m* ⩽ 5 kg (Max)	-



AIST

Exercise 4

Determine MPE and MPE change points for verification

Specification of NAWI is
Max : 6 kg,
e_1 : 1 g (0 – 3 kg)
e_2 : 2 g (3 – 6 kg)
Class 3
**** Multi interval instrument***

AIST

Max : 6 kg (e_1: 0 - 3 kg , e_2: 3 – 6 kg)

$n_1 = Max_1 / e_1$ = 3 kg / 1g = ***3 000***
$n_2 = Max / e_2$ = 6 kg / 2g = ***3 000***

Accuracy class	Verification scale interval	Number of verification scale interval		Minimum capacity
		Minimum	Maximum	
Special Class 1	**0.001g⩽*e***	**50 000**	**-**	**100 *e***
High Class 2	**0.001 g⩽ *e* ⩽0.05 g** **0.1g⩽*e***	**100** **5 000**	**100 000** **100 000**	**20 *e*** **50 *e***
Medium Class 3	0.1 g⩽ *e* ⩽2 g **5 g⩽ *e***	100 **500**	10 000 **10 000**	**20 *e*** **20 *e***
Ordinary Class 4	**5 g⩽ *e***	**100**	**1 000**	**10 *e***

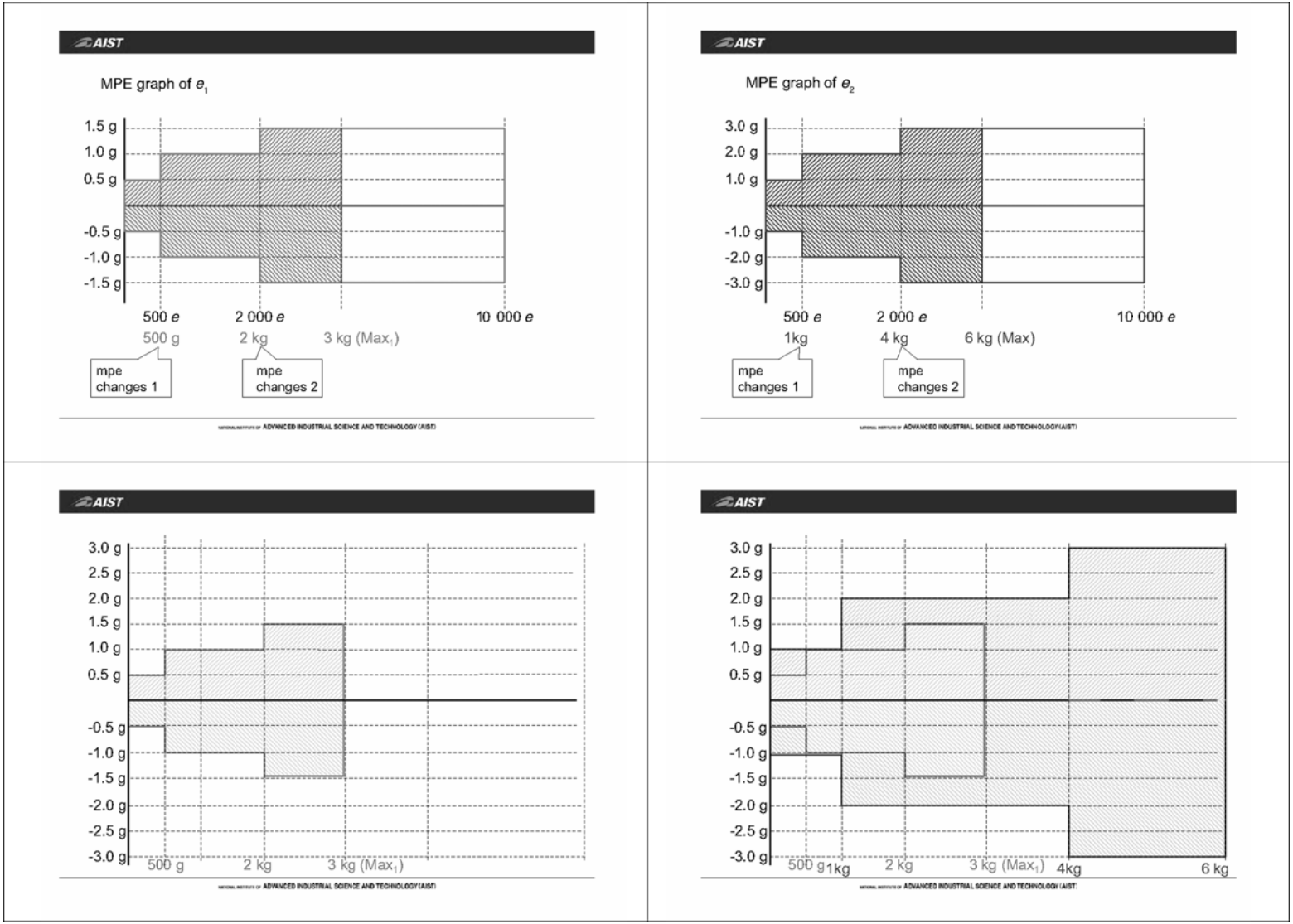
AIST

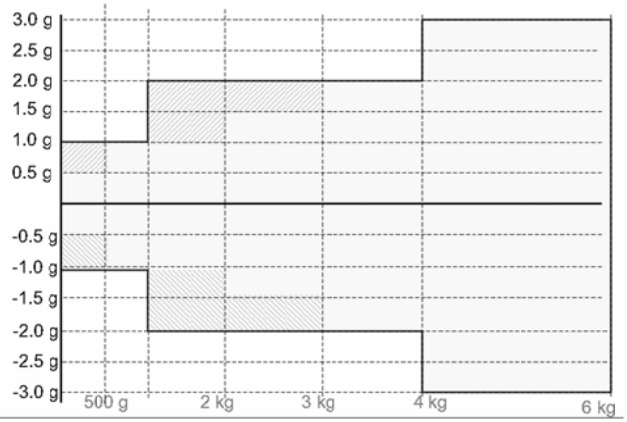
Applied e_1 (1 g)

MPE (e_1)	Class 3 *For loads, m expressed in verification scale intervals, e*	MPE (g)	Class 3 (mass)
±0.5 e_1	***0 ⩽ m ⩽500***	±0.5×1g = ±0.5 g	**0⩽m⩽500×1 g (e_1)** 0 g ⩽ m ⩽ 500 g
±1.0 e_1	***500 < m ⩽2 000***	±1.0×1g = ±1 g	**500×1 g (e_1) <m⩽2 000×1 g (e_1)** 500 g <m⩽ 2 000 g
±1.5 e_1	***2 000 < m <10 000***	±1.5×1g = ±1.5 g	**2 000×1 g (e_1) <m⩽10 000×1g(e_1)** 2 000 g <m ⩽10 000 g

Applied e_2 (2 g)

MPE (e_2)	Class 3 *For loads, m expressed in verification scale intervals, e*	MPE (g)	Class 3 (mass)
±0.5 e_2	***0 ⩽ m ⩽ 500***	±0.5×2g = ±1.0 g	**0⩽m⩽500×2g (e_2)** 0 g ⩽ m ⩽ 1 000 g
±1.0 e_2	***500 < m ⩽ 2 000***	±1.0×2g = ±2.0 g	**500×2 g (e_2) <m⩽2 000×2g(e_2)** 1 000 g <m ⩽ 4 000 g
±1.5 e_2	***2 000 < m <10 000***	±1.5×2g = ±3.0 g	**2 000×2 g (e_2) <m⩽10 000×2g(e_2)** 4 000 g <m ⩽ 20 000 g


AIST
MPE graph of e_1
1.5 g
1.0 g
0.5 g
-0.5 g
-1.0 g
-1.5 g
500 e
2 000 e
10 000 e
500 g
2 kg
3 kg (Max.)
mpe changes 1
mpe changes 2
ADVANCED INDUSTRIAL SCIENCE AND TECHNOLOGY (AIST)
AIST
MPE graph of e_2
3.0 g
2.0 g
1.0 g
-1.0 g
-2.0 g
-3.0 g
500 e
2 000 e
10 000 e
1kg
4 kg
6 kg (Max)
mpe changes 1
mpe changes 2
ADVANCED INDUSTRIAL SCIENCE AND TECHNOLOGY (AIST)
AIST
3.0 g
2.5 g
2.0 g
1.5 g
1.0 g
0.5 g
-0.5 g
-1.0 g
-1.5 g
-2.0 g
-2.5 g
-3.0 g
500 g
2 kg
3 kg (Max$_1$)
ADVANCED INDUSTRIAL SCIENCE AND TECHNOLOGY (AIST)
AIST
3.0 g
2.5 g
2.0 g
1.5 g
1.0 g
0.5 g
-0.5 g
-1.0 g
-1.5 g
-2.0 g
-2.5 g
-3.0 g
500 g
1kg
2 kg
3 kg (Max$_1$)
4kg
6 kg
ADVANCED INDUSTRIAL SCIENCE AND TECHNOLOGY (AIST)



Answer

Specification of NAWI is

***Max : 6* kg, e_1 : *1* g *(0 – 3* kg) e_2 : *2* g *(3 – 6* kg)**

**** Multi interval instrument***

MPE (g)	Class 3 (Gram)	Mpe change points
±0.5 g	0 g ⩽ *m* ⩽ 500 g	500 g
±1.0 g	500 g < *m* ⩽ 2 kg	2 kg
±1.5 g	2 kg < *m* ⩽ 3 kg	3 kg
±2.0 g	3 kg < *m* ⩽ 4 kg	4 kg
±3.0 g	4 kg < *m* ⩽ 6 kg	

Exercise 5

Specification of NAWI is
***Max : 150* kg**
***e : 100* g**
Class 3

Exercise 6

Specification of NAWI is
***Max : 60* kg**
***e : 20* g**
Class 3

Exercise 7

Specification of NAWI is
***Max : 500* g**
***e : 5* g**
Class 4

Exercise 8

Specification of NAWI is
***Max : 3* kg**
***e : 0.1* g**
Class 2

AIST

Exercise 9

Specification of NAWI is

***Max : 1* kg**
***e : 0.2* g**
class 3

Exercise 10

Specification of NAWI is

***Max : 15* kg**
e_1 : 2 g (0 ~ 6 kg)
e_2 : 5 g (6 ~ 15 kg)
**** Multi interval instrument***

AIST

Verification Standards (3.7)

Weights 3.7.1

The standard weights or standard masses used for the verification of an instrument shall not have an error greater than 1/3 of the maximum permissible error of the instrument for the applied.

Max : 3 kg, Verification scale interval (*e*) : 1 g, Min : 20 g ,Class 3

Test points	Test load	MPE (*e*)	MPE(g)	MPE/3	Weights
Zero	0	0.5 *e*	0.5 g	0.17 g	-
Min	20 g	0.5 *e*	0.5 g	0.17 g	***M2 (3mg)***
500 *e*	500 g	0.5 *e*	0.5 g	0.17 g	***M2 (75mg)***
Any	1 000 g	1 *e*	1.0 g	0.33 g	***M2 (150mg)***
2 000 *e*	2 000 g	1 *e*	1.0 g	0.33 g	***M2 (300mg)***
Max	3 000 g	1.5 *e*	1.5 g	0.5 g	***M2 (450mg)***

AIST

OIML R 111 **Weights of classes E1, E2, F1, F2, M1, M1–2, M2, M2–3 and M3**

Minimum accuracy class of weights

The accuracy class for weights used as standards for the verification of weights or weighing instruments should be
in accordance with the requirements of the relevant OIML Recommendations.

The OIML weight classes are defined as follows:

Class E1: Weights intended to ensure traceability between national mass standards (with values derived from the International Prototype of the kilogram) and weights of class E2 and lower. Class E1 weights or weight sets shall be accompanied by a calibration certificate (see 15.2.2.1).

Class E2: Weights intended for use in the verification or calibration of class F1 weights and for use with weighing instruments of special accuracy class I. Class E2 weights or weight sets shall be accompanied by a calibration certificate (see 15.2.2.2). They may be used as class E1 weights if they comply with the requirements for surface roughness, magnetic susceptibility and magnetization for class E1 weights, and if their calibration certificate gives the appropriate data as specified in 15.2.2.1.

Class F1: Weights intended for use in the verification or calibration of class F2 weights and for use with weighing instruments of special accuracy class I and high accuracy class Ⅱ.

AIST

Class F2: Weights intended for use in the verification or calibration of class M1 and possibly class M2 weights. Also intended for use in important commercial transactions (e.g. precious metals and stones) on weighing instruments of high accuracy class Ⅱ.

Class M1: Weights intended for use in the verification or calibration of class M2 weights, and for use with weighing instruments of medium accuracy class Ⅲ.

Class M2: Weights intended for use in the verification or calibration of class M3 weights and for use in general commercial transactions and with weighing instruments of medium accuracy class Ⅲ.

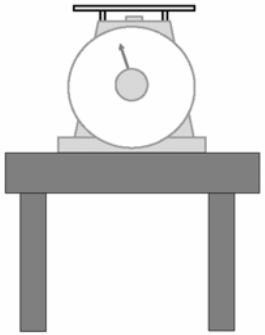
Class M3: Weights intended for use with weighing instruments of medium accuracy class Ⅲ and ordinary accuracy class Ⅳ.

Classes M1–2 and M2–3 : Weights from 50 kg to 5 000 kg of lower accuracy intended for use with weighing instruments of medium accuracy class Ⅲ.

Note: The error in a weight used for the verification of a weighing instrument shall not exceed 1/3 of the maximum permissible error for an instrument. These values are listed in section 3.7.1 of OIML R *76 Non-automatic Weighing Instruments (1992).*

AIST

Test set up



Inspection environment

Set up to solid table

Vibration

Influence by the wind

Preparations for ;

Weights

Report sheet

AIST

Test producer

Part 1: Self indicating instrument (analog indication)
Spring type

Part 2: Non-self indicating instrument
Lever type

AIST

Test producer - part 1

Self indicating instrument (analog indication)

Spring type

AIST

Value of maximum permissible error
【Weighing performance test】

Test loads (A4.4.1 and 8.3.3)

Apply test loads from zero up to and including Max, and similarly remove the test loads back to zero.

Determining the verification for weighing tests at least 5 shall be selected. The test loads selected shall include Max, and Min, and values at or near those at which the mpe changes.

AIST

Weighing Performance Test

Determine the test loads and mpe

Example : Max : 3 kg, *e : 10* g, *Min : 100* g, *class 4*

Test load		mpe
zero		
Min		
Mpe change 1		
Mpe change 2		
Max		
*Any load		

AIST

Weighing Performance Test

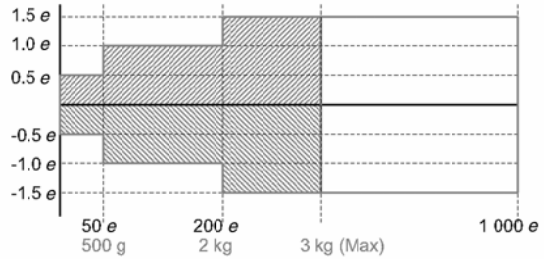
Determine the test loads and mpe

Example : Max : 3 kg, *e : 10* g, *Min : 100* g, *classes 4*

Test load		mpe
zero	0 g	????
Min	100 g	????
Mpe change 1	????	????
Mpe change 2	????	????
Max	3 kg	????
Any load	????	????

AIST

mpe	Class 4 *For loads, m expressed in verification scale intervals, e*	Class 4 (Gram)
±0.5 *e*	$0 \leqslant m \leqslant 50$	$0g \leqslant m \leqslant 500g$
±1.0 *e*	$50 < m \leqslant 200$	$500g < m \leqslant 2\,000g$
±1.5 *e*	$200 < m < 1\,000$	$2\,000g < m < 10\,000g$



AIST

Weighing Performance Test

Determine the test loads and mpe

Example : Max : 3 kg, *e : 10* g, *Min : 100* g, *class 4*

Test load		mpe
zero	0 g	5 g
Min	100 g	5 g
Mpe change 1	500 g	5 g
Mpe change 2	2 kg	10 g
Max	3 kg	15 g
Any load	????	????

Weighing Performance Test

Determine the test loads and mpe

Example : Max : 3 kg, e : 10 g, Min : 100 g, class 4

Test load		mpe
zero	0 g	5 g
Min	100 g	5 g
Mpe change 1	500 g	5 g
Any load	1 kg	10 g
Mpe change 2	2 kg	10 g
Max	3 kg	15 g

Weighing Performance Test

Test loads and MPE are recorded in the test report.

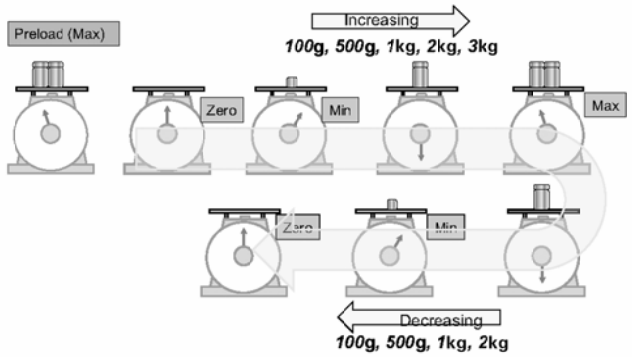
Example : Max : 3 kg, e : 10 g, Min : 100 g, class 4

Load	Indication		Error		Corrected error		Mpe
0							5 g
100 g							5 g
500 g							5 g
1 kg							10 g
2 kg							10 g
3 kg							15 g

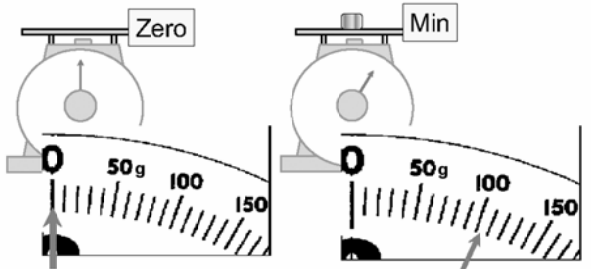
Initial zero error

Weighing Performance Test

Self indication instruments



Weighing Performance Test



Test load (L) = 0 g
Indication (I) = 0 g

Test load (L) = 100 g
Indication (I) = 101 g

If it's possible, read of 0.1e

AIST

Record these the indication value of the instrument when put on the test load

Load	Indication		Error		Corrected error		Mpe
0	0	1					5 g
100 g	101	101					5 g
500 g	503	503					5 g
1 kg	1 005	1 003					10 g
2 kg	2 005	2 010					10 g
3 kg	3 010						15 g

Initial zero error

AIST

Weighing Performance Test

Calculate of Error

$$Error\ (E) = I - L$$

I = Indication L = Load

$$Corrected\ error\ (Ec) = E - E_0$$

E = Error of each test load

E_0 = initial zero error

** If initial zero error is not zero, this formula shall be applied.*

AIST

Record these the indication value of the instrument when put on the test load

Load	Indication		Error		Corrected error		Mpe
0	0	1					5 g
100 g	101	101					5 g
500 g	503	503					5 g
1 kg	1 005	1 003					10 g
2 kg	2 005	2 010					10 g
3 kg	3 010						15 g

Initial zero error

Pass or Fail

AIST

Record these the indication value of the instrument when put on the test load

Load	Indication		Error		Corrected error		Mpe
0	0	1	0	1	0	1	5 g
100 g	101	101	1	1	1	1	5 g
500 g	503	503	3	3	3	3	5 g
1 kg	1 005	1 003	5	3	5	3	10 g
2 kg	2 005	2 010	5	10	5	10	10 g
3 kg	3 010		10		10		15 g

Initial zero error

Pass

AIST

Example

Corrected error shall be applied in the case of the following results

Load	Indication		Error		Corrected error		mpe
0	*5*	*5*					*5* g
100 g	*105*	*105*					*5* g
500 g	*505*	*505*					*5* g
1 kg	*1 010*	*1 010*					*10* g
2 kg	*2 015*	*2 015*					*10* g
3 kg	*3 015*						*15* g

Pass or Fail Initial zero error

AIST

Example

Corrected error shall be applied in the case of the following results

Load	Indication		Error		Corrected error		mpe
0	*5*	*5*	*5*	*5*	*0*	*0*	*5* g
100 g	*105*	*105*	*5*	*5*	*0*	*0*	*5* g
500 g	*505*	*505*	*5*	*5*	*0*	*0*	*5* g
1 kg	*1 010*	*1 010*	*10*	*10*	*5*	*5*	*10* g
2 kg	*2 015*	*2 015*	*15*	*15*	*10*	*10*	*10* g
3 kg	*3 015*		*15*		*10*		*15* g

Pass Initial zero error

AIST

Repeatability (A.4.10)

The difference between the results of several weighings of the same load shall not be greater than the absolute value of the maximum permissible error of the instruments.

Two series of weighings shall be performed ,one with a load of about 50% and one with a load close to 100% of Max. Normally no more than 3 weighings on class 3 and 4 or 6 weighings on classes 1 and 2 are necessary.

AIST

Repeatability test

Self indication instruments : analogue indication

Example : ***Max : 3 kg, e : 10 g, Min : 100 g, class 4***

➢Determining test load and mpe:

1/2 Max = 1.5 kg, mpe is ☐ g
Max = 3 kg, mpe is ☐ g

➢Record in test report

No.	Load	Indication	Load	Indication
1	1.5 kg		3 kg	
2	1.5 kg		3 kg	
3	1.5 kg		3 kg	
	Max-Min		Max−Min	

AIST

Repeatability test

Self indication instruments : analogue indication

Example : ***Max : 3 kg, e : 10 g, Min : 100 g, class 4***

➢Determining test load and mpe:

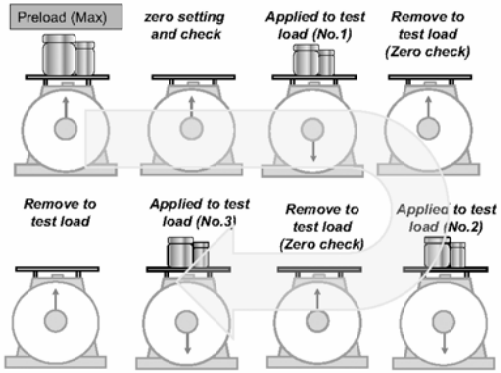
1/2 Max = 1.5 kg, mpe is 10 g
Max = 3 kg, mpe is 15 g

➢Record in test report

No.	Load	Indication	Load	Indication
1	1.5 kg		3 kg	
2	1.5 kg		3 kg	
3	1.5 kg		3 kg	
	Max-Min		Max-Min	

AIST

Repeatability test



AIST

Repeatability test

No.	Load	Indication	Load	Indication
1	**1.5 kg**	1500 g	**3 kg**	2990
2	**1.5 kg**	1505 g	**3 kg**	2990
3	**1.5 kg**	1500 g	**3 kg**	3000
	Max-Min		**Max-Min**	

Pass or Fail

AIST

Repeatability test

No.	Load	Indication	Load	Indication
1	**1.5 kg**	1500 g	**3 kg**	2990
2	**1.5 kg**	1505 g	**3 kg**	2990
3	**1.5 kg**	1500 g	**3 kg**	3000
	Max-Min	*5 g*	**Max-Min**	*10 g*

Pass

AIST

Discrimination test (A3.8)

Self indication instruments : analogue indication

An extra load equivalent to the absolute value of the maximum permissible error for the applied load when gently placed on or withdrawn from the instrument at equilibrium shall cause a permanent displacement of the indicating element corresponding to not less than 0.7 times extra load.

This test shall be performed with three different loads.

Min, 1/2Max, Max

AIST

Discrimination test

Self indication instruments : analogue indication

Example : ***Max : 3 kg, e : 10 g, Min : 100 g, class 4***

➢Determine test load and extra load :

Min = 100 g extra load: ☐ g
1/2Max = 1.5 kg extra load: ☐ g
Max = 3 kg extra load: ☐ g

➢Record in test report

Load	Indication I1	Extra load = mpe	Indication I2	I2-I1
100 g				
1.5 kg				
3 kg				

AIST

Discrimination test

Self indication instruments : analogue indication

Example : ***Max : 3 kg, e : 10 g, Min : 100 g, class 4***

➢Determine test load and extra load :

Min = 100 g ; extra load: 5 g
1/2Max = 1.5 kg ; extra load: 10 g
Max = 3 kg ; extra load: 15 g

➢Record in test report

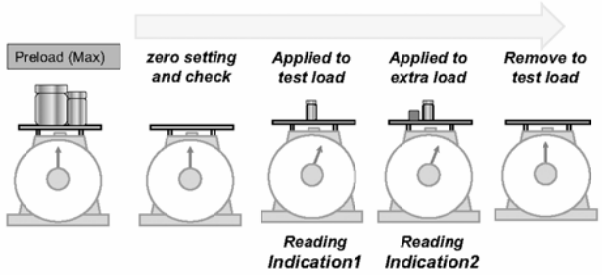
Load	Indication I1	Extra load = mpe	Indication I2	I2-I1
100 g		5 g		
1.5 kg		10 g		
3 kg		15 g		

AIST

Discrimination test

Self indication instruments : analogue indication

Example : ***Max : 3 kg, e : 10 g, Min : 100 g, class 4***

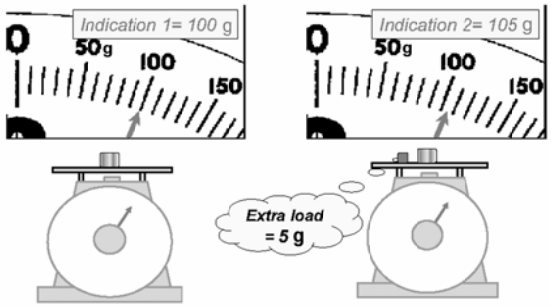


AIST

Discrimination test

Self indication instruments : analogue indication

Example : ***Max : 3*** **kg**, ***e : 10*** **g**, ***Min : 100*** **g**, ***class 4***



AIST

Discrimination test

Self indication instruments : analogue indication

Example : ***Max : 3*** **kg**, ***e : 10*** **g**, ***Min : 100*** **g**, ***class 4***

Load	Indication I1	Extra load = mpe	Indication I2	I2-I1
100 g	100 g	5 g	105 g	5 g
1.5 kg	1500 g	10 g	1510 g	10 g
3 kg	3000 g	15 g	3012 g	12 g

Check if I2-I1 ⩾0.7 mpe

Pass or Fail

AIST

Discrimination test

Self indication instruments : analogue indication

Example : ***Max : 3*** **kg**, ***e : 10*** **g**, ***Min : 100*** **g**, ***class 4***

Load	Indication I1	Extra load = mpe	Indication I2	I2-I1
100 g	100 g	5 g	105 g	5 g
1.5 kg	1500 g	10 g	1510 g	10 g
3 kg	3000 g	15 g	3012 g	12 g

Check if I2-I1 ⩾0.7 mpe

Pass

AIST

Eccentricity tests (A4.7)

The Indications for different positions of a load shall meet the maximum permissible errors, when the is tested according to following.

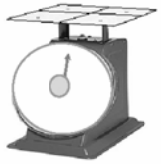
- Instrument with a load receptor having ***n*** points of support, with ***n ⩽ 4***
  Test load : (Max + Additive tare effect) / 3
- Instrument with a load receptor having ***n*** points of support, with ***n > 4***
  Test load : (Max + Additive tare effect) / (*n*-1)
- Instrument with a load receptor subject to minimal off-center loading
  Test load : 0.1Max + Additive tare effect
- Instrument used for weighing rolling loads
  Test load : usual rolling load, the heaviest and the most concentrated one which may be weighed, but not exceeding 0.8 times the sum of the Max and Additive tare effect

AIST

Eccentricity test

Self indication instruments : analogue indication

Example : ***Max : 3*** kg, ***e : 10*** g,
Min : 100 g, ***class 4***



➢***Determine type of load receptor , test load and mpe***

This instrument has 2 points of support

n points of support with ***n ⩽ 4***

Test load = *(Max + Additive tare effect) / 3 =* ? kg

mpe = ? g

AIST

Eccentricity test

Self indication instruments : analogue indication

Example : ***Max : 3*** kg, ***e : 10*** g,
Min : 100 g, ***class 4***

➢***Determine type of load receptor , test load and mpe***

This Instrument has 2 points of support

n points of support with ***n ⩽ 4***

Test load = *(Max + Additive tare effect) / 3 =3* kg */ 3 = 1* kg

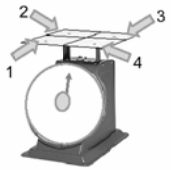
mpe = 10 g

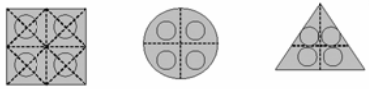
AIST

Eccentricity test

➢***Determine of different position***

Surface of the loading receptor is evenly divided into four





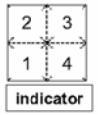
○ Load positions

AIST

Eccentricity test

➢***Record in test report***

Location	L	I	E	Ec	mpe
1	0				
1	1 kg				10 g
2	0				
2	1 kg				10 g
3	0				
3	1 kg				10 g
4	0				
4	1 kg				10 g

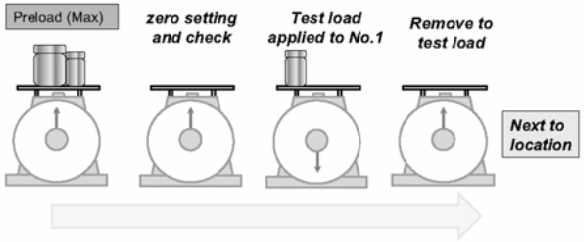


AIST

Eccentricity test

Self indication instruments : analogue indication

Example : ***Max : 3*** kg, ***e : 10*** g, ***Min : 100*** g, ***class 4***



AIST

Eccentricity test

Self indication instruments : analogue indication

Spring type: Example : ***Max : 3*** kg, ***e : 10*** g, ***Min : 100*** g, ***class 4***

Location	L	I	E	Ec	mpe
1	0	0 g			
1	1 kg	1000 g			10 g
2	0	0 g			
2	1 kg	1005 g			10 g
3	0	0 g			
3	1 kg	1005 g			10 g
4	0	5 g			
4	1 kg	1010 g			10 g

Pass or Fail

AIST

Eccentricity test

Self indication instruments : analogue indication

Spring type: Example : ***Max : 3*** kg, ***e : 10*** g, ***Min : 100*** g, ***class 4***

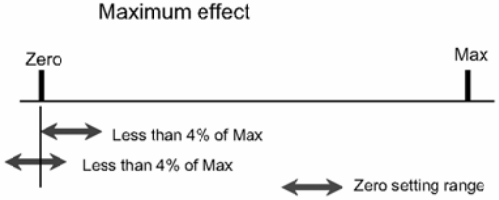
Location	L	I	E	Ec	mpe
1	0	0 g	0 g		
1	1 kg	1000 g	0 g	0 g	10 g
2	0	0 g	0 g		
2	1 kg	1005 g	5 g	5 g	10 g
3	0	0 g	0 g		
3	1 kg	1005 g	5 g	5 g	10 g
4	0	5 g	5 g		
4	1 kg	1010 g	10 g	5 g	10 g

Pass

AIST

Zero-setting device

- The effect does not alter Max
- The accuracy is 0.25 *e* or 0.5 *d* on a auxiliary indicating device
- The range is 4 % of Max for zero-setting



AIST

Zero setting accuracy

After zero setting the effect of zero deviation on the result of the weighing shall not be more than 0.25e; however, on an instrument with auxiliary indicating devices this effect shall be not more than 0.5d

AIST

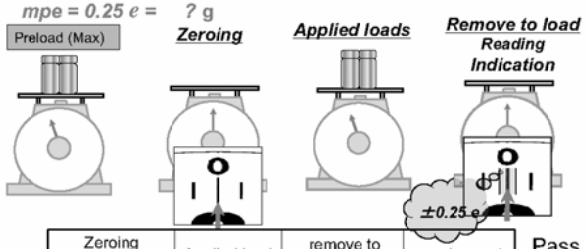
Self indicating instruments : analogue indication

Spring type: Example : ***Max : 3 kg, e : 10 g, Min : 100 g, class 4***

➢***Determine of mpe***

e = 10 g

mpe = 0.25 e = ***?*** g



Zeroing indication	Applied load	remove to load indication	requirement
0 g	150 kg	2 g	

Pass or Fail

AIST

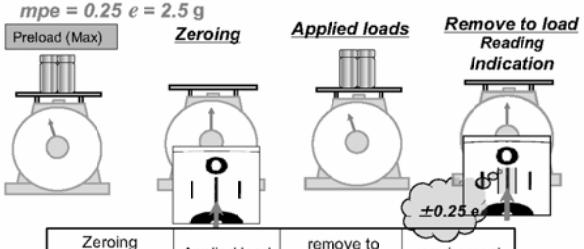
Self indicating instruments : analogue indication

Spring type: Example : ***Max : 3 kg, e : 10 g, Min : 100 g, class 4***

➢***Determine of mpe***

e = 10 g

mpe = 0.25 e = 2.5 g



Zeroing indication	Applied load	remove to load indication	requirement
0 g	150 kg	2 g	2.5 g

Pass

AIST

Test producer - part 2

Non-self indicating instrument

Platform instrument
Lever type

AIST

Value of maximum permissible error
【Weighing performance test】

Test loads

Apply test loads from zero up to and including Max, and similarly remove the test loads back to zero.

Determining the verification for weighing tests at least 5 shall be selected. The test loads selected shall include Max, and Min, and values at or near those at which the mpe changes.

AIST

Weighing Performance Test

Determine the test loads and mpe

Example : Max : 150 kg, e : 50 g, Min : 1 kg, class 3

Test load		mpe
zero		
Min		
Mpe change 1		
Mpe change 2		
Max		
*Any load		

AIST

Weighing Performance Test

Determine the test loads and mpe

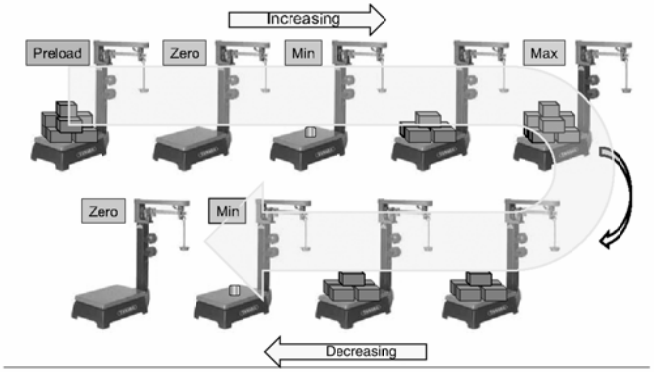
Example : Max : 150 kg, e : 50 g, Min : 1 kg, class 3

Test load		mpe
zero	0	25 g
Min	1 kg	25 g
Mpe change 1	25 kg	25 g
Mpe change 2	100 kg	50 g
Max	150 kg	75 g
*Any load	50 kg	50 g

AIST

Weighing Performance Test

Non self indication instruments Platform instrument



AIST

Weighing Performance Test

Test loads and MPE are recorded in the test report.

Example : Max : 150 kg, e : 50 g, Min : 1 kg, classes 3

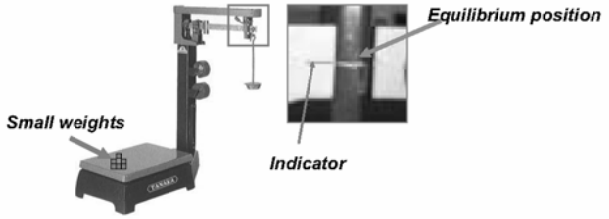
Load	Indication		Small weights		Error		Mpe
0							*25 g*
1 kg							*25 g*
25 kg							*25 g*
50 kg							*50 g*
100 kg							*50 g*
150 kg							*75 g*

AIST

Weighing Performance Test

Zeroing

1. *Small Weights put on the load receptor of no-load after preload.*
2. *Zero setting device to equilibrium position.*



AIST

Weighing Performance Test

Test loads and MPE are recorded in the test report.

Example : Max : 150 kg, e : 50 g, Min : 1 kg, classes 3

Load	Indication		Small weights		Error		Mpe
0	*0*				*0*		*25 g*
1 kg							*25 g*
25 kg							*25 g*
50 kg							*50 g*
100 kg							*50 g*
150 kg							*75 g*

AIST

Weighing Performance Test

Test load (Min)

1. *Min weight put on load receptor.*
2. *Confirm to position of indicator.*
   - *If indicator is an accord with equilibrium position, the error is 0.*
   - *If indicator balanced above equilibrium position,*

     Small weights shall be removed until equilibrium position comes to the indicator. (-)
   - *If indicator balanced below equilibrium position,*

     Small weights shall be put on until equilibrium position comes to the indicator. (+)

AIST

Weighing Performance Test

Test loads and MPE are recorded in the test report.

Example : Max : 150 kg, e : 50 g, Min : 1 kg, classes 3

Load	Indication		Small weights		Error		Mpe
0	*0*	*0*	*0*	*-10 g*			*25 g*
1 kg	*1 000*	*1 000*	*+15 g*	*-10 g*			*25 g*
25 kg	*25 000*	*25 000*	*+15 g*	*-10 g*			*25 g*
50 kg	*50 000*	*50 000*	*+5 g*	*-10 g*			*50 g*
100 kg	*100 000*	*100 000*	*-25 g*	*-40 g*			*50 g*
150 kg	*150 000*		*-50 g*				*75 g*

AIST

Weighing Performance Test

Calculate of Error

Non self indicating instruments

$$Error\ (E) = I - L + SI$$

I = Indication L = Load SI= small load

AIST

Weighing Performance Test

Test loads and MPE are recorded in the test report.

Example : Max : 150 kg, e : 50 g, Min : 1 kg, classes 3

Load	Indication		Small weights		Error		Mpe
0	*0*	*0*	*0*	*-10 g*			*25 g*
1 kg	*1000*	*1000*	*+15 g*	*-10 g*			*25 g*
25 kg	*25000*	*25000*	*+15 g*	*-10 g*			*25 g*
50 kg	*50000*	*50000*	*+5 g*	*-10 g*			*50 g*
100 kg	*100000*	*100000*	*-25 g*	*-40 g*			*50 g*
150 kg	*150000*		*-50 g*				*75 g*

Pass or Fail

AIST

Weighing Performance Test

Test loads and MPE are recorded in the test report.

Example : Max : 150 kg, e : 50 g, Min : 1 kg, classes 3

Load	Indication		Small weights		Error		Mpe
0	*0*	*0*	*0*	*-10 g*	*0*	*-10 g*	*25 g*
1 kg	*1000*	*1000*	*+15 g*	*-10 g*	*15 g*	*-10 g*	*25 g*
25 kg	*25000*	*25000*	*+15 g*	*-10 g*	*15 g*	*-10 g*	*25 g*
50 kg	*50000*	*50000*	*+5 g*	*-10 g*	*5 g*	*-10 g*	*50 g*
100 kg	*100000*	*100000*	*-25 g*	*-40 g*	*-25 g*	*-40 g*	*50 g*
150 kg	*150000*		*-50 g*		*-50 g*		*75 g*

Pass

AIST

Weighing Performance Test

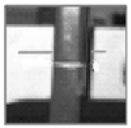
Simple method

Evaluation method; error cannot be determined

Non self indicating instruments

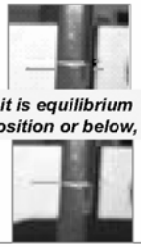
◆ *If indicator balanced above equilibrium position,*

Applied load



Indicator

Remove weights of the value mpe



If it is equilibrium position or below, PASS

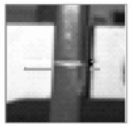
AIST

Weighing Performance Test

Simple method

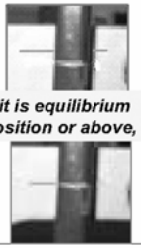
◆ *If indicator balanced below equilibrium position,*

Applied load



Indicator

Apply weights of the value of mpe



If it is equilibrium position or above, PASS

AIST

Repeatability

The difference between the results several weighings of the same load shall not be greater than the absolute value of the maximum permissible error of the instruments.

Two series of weighings shall be performed ,one with a load of about 50% and one with a load close to 100% of Max. Normally no more than 3 weighings on class 3 and 4 or 6 weighings on classes 1 and 2 are necessary.

AIST

Repeatability Test

Non self indication instruments

Example : ***Max : 150*** **kg,** ***e : 50*** **g,** ***Min : 1*** **kg,** ***class 3***

➢Determining test load and mpe:

1/2 Max = 75 kg, mpe : ? g
Max = 150 kg, mpe : ? g

➢Record in test report

No	Load	Indication	Small weights	Load	Indication	Small weights
1	75 kg			150 kg		
2	75 kg			150 kg		
3	75 kg			150 kg		
	Max-Min			Max-Min		

AIST

Repeatability Test

Non self indication instruments

Example : ***Max : 150*** **kg,** ***e : 50*** **g,** ***Min : 1*** **kg,** ***class 3***

➢Determining test load and mpe:

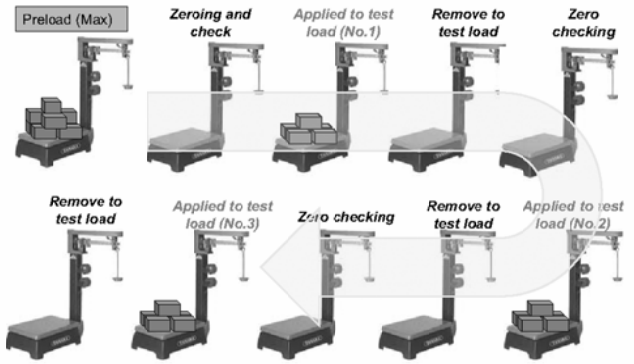
1/2 Max : 75 kg, mpe : 50 g
Max : 150 kg, mpe : 75 g

➢Record in test report

No	Load	Indication	Small weights	Load	Indication	Small weights
1	75 kg			150 kg		
2	75 kg			150 kg		
3	75 kg			150 kg		
	Max-Min			Max-Min		

AIST

Repeatability test



AIST

Repeatability test

No	Load	Indication	Small weights	Load	Indication	Small weights
1	75 kg	75.000 kg	+10 g	150 kg	150.000 kg	-50 g
2	75 kg	75.000 kg	+ 50 g	150 kg	150.000 kg	-50 g
3	75 kg	75.000 kg	+ 50 g	150 kg	150.000 kg	-40 g
	Max-Min			Max-Min		

Pass or Fail

AIST

Repeatability test

No	Load	Indication	Small weights	Load	Indication	Small weights
1	75 kg	75.000 kg	+10 g	150 kg	150.000 kg	-50 g
2	75 kg	75.000 kg	+ 50 g	150 kg	150.000 kg	-50 g
3	75 kg	75.000 kg	+ 50 g	150 kg	150.000 kg	-40 g
	Max-Min		40 g	Max-Min		*10* g

Pass

AIST

Discrimination test

Non self indicating instruments

An extra load equivalent to 0.4 times the absolute value of the maximum permissible error for the appiied load when gently placed cn or withdrawn from the instrument at equilibrium shall produce a visible cause a permanent displacement of the indicating element movement element .

This test shall be performed with three different loads.

Min, 1/2Max, Max

AIST

Discrimination test

Non self indication instruments

Example : ***Max : 150*** **kg,** ***e : 50*** **g,** ***Min : 1*** **kg,** ***class 3***

➢Determine test load and extra load :

Min = 1 kg : Extra load = ? g
1/2Max = 75 kg : Extra load = ? g
Max = 150 kg : Extra load = ? g

➢**Record in test report**

Load	Indication I	Extra load =0.4 mpe	Movement
1 kg			
75 kg			
150 kg			

AIST

Discrimination test

Non self indication instruments

Example : ***Max : 150*** **kg,** ***e : 50*** **g,** ***Min : 1*** **kg,** ***class 3***

➢Determine test load and extra load :

Min = 1 kg : Extra load 25 g ×0.4 = 10 g
1/2Max = 75 kg : Extra load 50 g ×0.4 = 20 g
Max = 150 kg : Extra load 75 g ×0.4 = 30 g

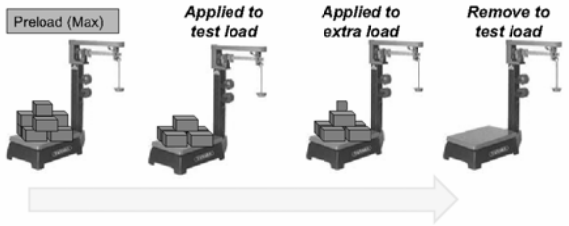
➢**Record in test report**

Load	Indication I	Extra load =0.4 mpe	Movement
1 kg		10 g	
75 kg		20 g	
150 kg		30 g	

AIST

Discrimination test

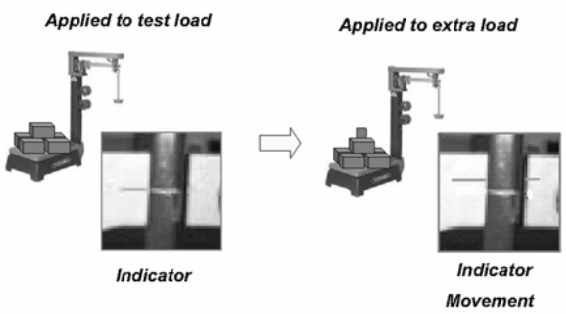
Non self indication instruments



AIST

Discrimination test

Non self indication instruments



AIST

Discrimination test

Non self indication instruments

Example : ***Max : 150*** **kg**, ***e : 50*** **g**, ***Min : 1*** **kg**, ***class 3***

Load	Indication I	Extra load =0.4 mpe	Movement (*)
1 kg	1.000 kg	10 g	+
75 kg	75.000 kg	20 g	+
150 kg	150.000 kg	30 g	+

(*) Mark visible movement by "+"

Pass or Fail

AIST

Discrimination test

Non self indication instruments

Example : ***Max : 150*** **kg**, ***e : 50*** **g**, ***Min : 1*** **kg**, ***class 3***

Load	Indication I	Extra load =0.4 mpe	Movement (*)
1 kg	1.000 kg	10 g	+
75 kg	75.000 kg	20 g	+
150 kg	150.000 kg	30 g	+

(*) Mark visible movement by "+"

Pass

AIST

Eccentricity

The Indications for different positions of a load shall meet the maximum permissible errors, when the is tested according to following.

- Instrument with a load receptor having ***n*** points of support, with ***n ⩽ 4***
  Test load : (Max + Additive tare effect) / 3
- Instrument with a load receptor having ***n*** points of support, with ***n > 4***
  Test load : (Max + Additive tare effect) / (n-1)
- Instrument with a load receptor subject to minimal off-center loading
  Test load : 0.1Max + Additive tare effect
- Instrument used for weighing rolling loads
  Test load : usual rolling load, the heaviest and the most concentrated one which may be weighed, but not exceeding 0.8 times the sum of the Max and Additive tare effect

AIST

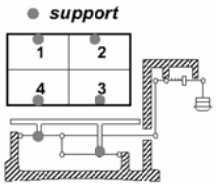
Eccentricity

Non self indication instruments :

Example : ***Max : 150*** kg, ***e : 50*** g ,
Min : 1 kg, ***class 3***

➢***Determine type of load receptor , test load and mpe***

This Instrument has 4 points of support



n points of support with ***n ⩽ 4***

Test load = (Max + Additive tare effect) / 3

= ☐ kg

mpe = ☐ g

AIST

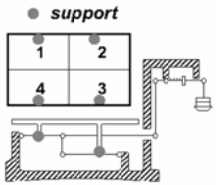
Eccentricity

Non self indication instruments :

Example : ***Max : 150*** kg, ***e : 50*** g,
Min : 1 kg, ***class 3***

➢***Determine type of load receptor , test load and mpe***

This Instrument has 4 points of support



n points of support with ***n ⩽ 4***

Test load = (Max + Additive tare effect) / 3

=150 kg / *3 = 50* kg

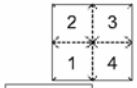
mpe = 50 g

AIST

Eccentricity

➢***Record in test report***

Location	L	I	SI	E	mpe
1	0				
1	50 kg				50 g
2	0				
2	50 kg				50 g
3	0				
3	50 kg				50 g
4	0				
4	50 kg				50 g



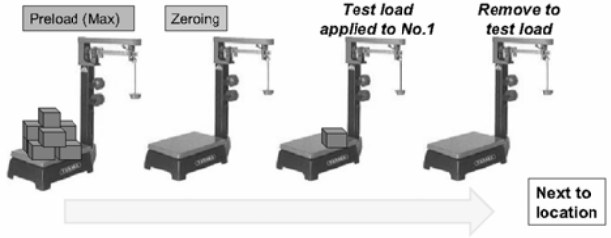
indicator

AIST

Eccentricity

Non self indication instruments

Example : ***Max : 150*** kg, ***e : 50*** g, ***Min : 1*** kg, ***class 3***



AIST

Eccentricity

Non self indication instruments :

Location	L	I	SI	E	mpe
1	0	0	0		
1	50 kg	50.000 kg	0		50 g
2	0	0	0		
2	50 kg	50.000 kg	+5 g		50 g
3	0	0	0		
3	50 kg	50.000 kg	+10 g		50 g
4	0	0	0		
4	50 kg	50.000 kg	-10 g		50 g

Pass or Fail

AIST

Eccentricity

Non self indication instruments :

Location	L	I	SI	E	mpe
1	0	0	0		
1	50 kg	50.000 kg	0	0	50 g
2	0	0	0		
2	50 kg	50.000 kg	+5 g	5 g	50 g
3	0	0	0		
3	50 kg	50.000 kg	+10 g	10 g	50 g
4	0	0	0		
4	50 kg	50.000 kg	-10 g	-10 g	50 g

Pass

AIST

Sensitivity

Only applied on non self indicating instrument

An extra load equivalent to the absolute value of the MPE for the applied load, shall be placed on the instrument at equilibrium and shall cause a permanent displacement of the indicating element of at least:

- 1 mm for an instrument of class 1 or 2;
- 2 mm for an instrument of class 3 or 4 with Max≤30 kg;
- 5mm for an instrument of class 3 or 4 with Max >30 kg.

The test shall be performed with a minimum of two difference loads (e.g. zero and Max)

AIST

Sensitivity

Non self indication instruments

Example : ***Max : 150*** kg, ***e : 50*** g, ***Min : 1*** kg, ***class 3***

- Determine test load and extra load :

  Zero = 0 kg : Extra load ? g

  Max = 150 kg : Extra load ? g

- Record in test report

Load	Extra load mpe	Displacement of indicating element	Requirement
0			
150 kg			

AIST

Sensitivity

Non self indication instruments

Example : ***Max : 150*** kg, ***e : 50*** g, ***Min : 1*** kg, ***class 3***

➢Determine test load and extra load :

Zero = 0 kg : Extra load 25 g

Max = 150 kg : Extra load 75 g

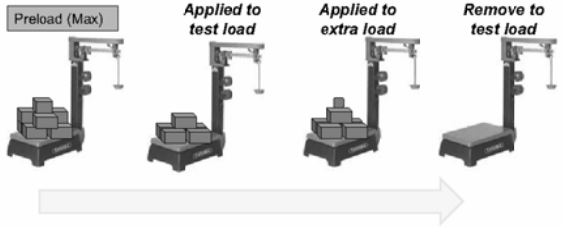
➢Record in test report

Load	Extra load mpe	Displacement of indicating element	Requirement
0	25 g		5 mm
150 kg	75 g		5 mm

AIST

Sensitivity

Non self indication instruments

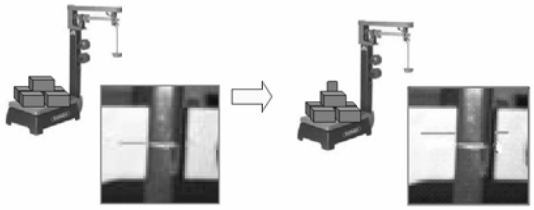


AIST

Sensitivity

Non self indication instruments

Applied to test load ***Applied to extra load***



Indicator ***Indicator***

Distance between the equilibrium positions shall be measured before and after loading of extra load

AIST

Sensitivity

Non self indication instruments

Example : ***Max : 150*** kg, ***e : 50*** g, ***Min : 1*** kg, ***class 3***

Load	Extra load mpe	Displacement of indicating element	Requirement
0	25 g	10 mm	5 mm
150 kg	75 g	9 mm	5 mm

Pass

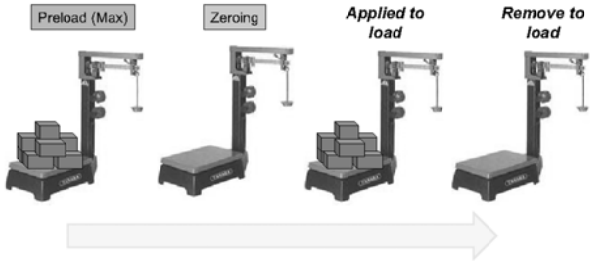
AIST

Zero setting accuracy

After zero setting the effect of zero deviation on the result of the weighing shall not be more than 0.25e; however, on an instrument with auxiliary indicating devices this effect shall be not more than 0.5d

AIST

Zero setting accuracy

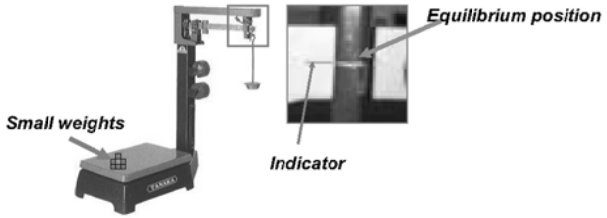


AIST

Zero setting accuracy

Zeroing

1. ***Small Weights put on the load receptor of no-load after preload.***
2. ***Zero setting device to equilibrium position.***



AIST

Zero setting accuracy

After the load is remove, Zero indicator shall be confirmed.

Confirm to position of indicator.

- ***If indicator is an accord with equilibrium position, the error is 0.***
- ***If indicator balanced above equilibrium position,***

  Small weights shall be removed until equilibrium position comes to the indicator. (-)

- ***If indicator balanced below equilibrium position,***

  Small weights shall be put on until equilibrium position comes to the indicator. (+)

AIST

Zero setting accuracy

Example : Max : 150 kg, ***e : 50*** g, ***Min : 1*** kg, ***classes 3***

zeroing	load	Indication	SI	Error	Mpe
0	***150*** kg	***0***	***-10*** g		***12.5***g

Pass or Fail

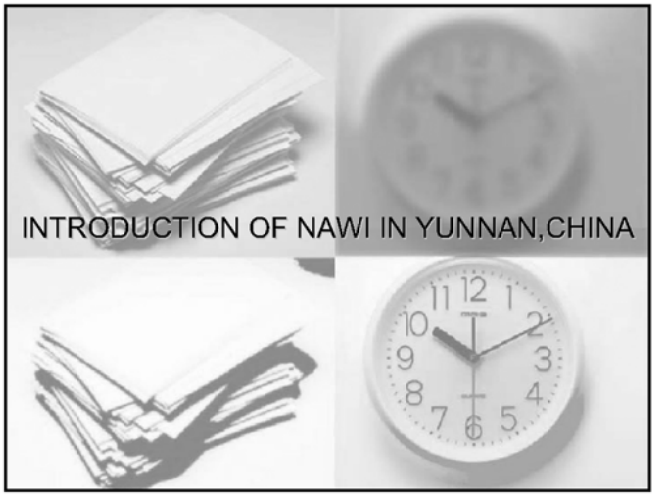
AIST

Zero setting accuracy

Example : Max : 150 kg, ***e : 50*** g, ***Min : 1*** kg, ***classes 3***

zeroing	load	Indication	SI	Error	Mpe
0	***150***kg	***0***	***-10*** g	***-10*** g	***12.5***g

Pass



- My name is Zhang Guangxin.
- I am from China and work for the Yunnan Institute of Metrology and Testing Technology.
- Yunnan Institute of Metrology and Testing Technology is a provincial legal measuring and verifying institute of China.
- Major functions include measuring (calibrating), inspecting, development of testing technology, dissemination of the value of quantity.

- There are over 160 employees working in Yunnan Institute of Metrology and Testing Technology, over 70 of them are senior and secondary technicians.
- The Institute has 7 professional measuring research departments and 7 integrative measuring service departments. With a constant temperature lab over 3 000 square meters, the total area of all labs is over 9 000 square meters. The Institute had set up 119 grade measuring standards which were certificated by the China National Accreditation Service for Conformity Assessment (CNAS).
- Since 1985, I have begun my career in metrology and testing technology.
- At first, I worked in the length department, and then worked in the weighing department.

- NAWI is mainly used for trade settlement.
- There are about ten manufacturers of NAWI in Yunnan, and the total production is several thousands a year.
- Among all the NAWI products, 35% are electronic weighing scales, 15% are mechanical scales using a spring, and another 50% are mechanical balances using a weigh beam and weights.

- The accuracy classes are divided into middle accuracy class and general accuracy class.
- The maximum capacity of the weighing instrument is about 100t in Yunnan province. The middle accuracy class is the most commonly used, and the common capacities of the weighing instruments are from 10kg to 80t.
- The governmental metrology department implements the measurement law.

- NAWI includes digital indicating weighing instrument, non-self-indicating weighing instrument and analog indicating weighing instrument.
- The error of the standard weights should be less than 1/3 MPE of the capacity measured.
- Initial verification and re-verification are required. Both will be performed by the Institute of Metrology and Testing Technology once a year. The number of all the verifications is about 10,000 a year, and increasing.

- Type approvals are required, the metrology institute performs the type approvals. There are about 10 type approval tests per year.
- The general verification regulation for NAWI is OIML R76.

- We hope to have more professional training courses and exchanges with other institutes in this field.

TRAIN THE TRAINER COURSE ON
THE VERIFICATION OF MECHANICAL WEIGHING SCALE
may 13th - 16th,2008
in Thailand

Presented by
Sri Astuti

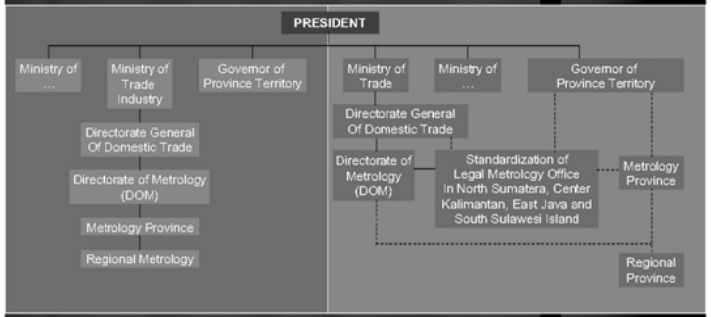
DIRECTORATE OF METROLOGY
DIRECTORATE GENERAL OF DOMESTIC TRADE
THE MINISTRY OF TRADE OF THE REPUBLIC INDONESIA

1. Self Introduction

- ***My name is Mrs .SRI ASTUTI***
- I have been working for the directory of metrology under the ministry of trade since 1997, I am a graduate of the padjadjaran university, majoring physic and working as a staf of standart national unit measuring. My responsibility is verify the standart of weighing instrument.

Government Organization Structure

Centralization System (Before 1997)

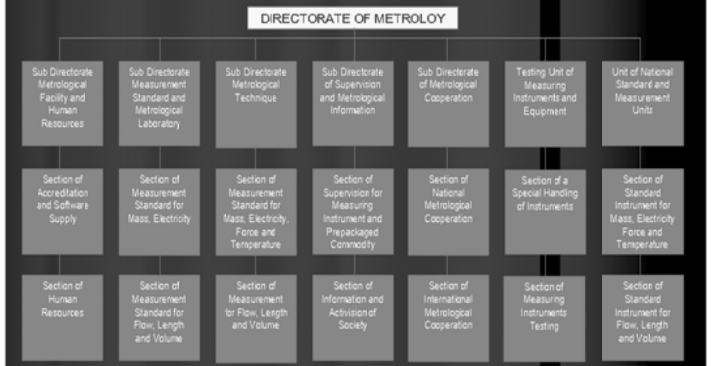


DOM and Metrology Province or regional were connected directly

De-Centralization System (After 1997)

DOM and Metrology Province or regional are not connect directly

The Organization Chart of Directorate of Metrology



Experience in my organization

- To carry out legal metrology control.
- To carry out law act to user which the law of legal metrology.
- To verification and re-verification of legal measuring instrument for mass, volume, length and balance.
- To calibrate the technical metrology instrument.
- To follow in house seminar.

2. NAWI in my economy

- User can use NAWI easier.
- NAWI unit is cheap.
- NAWI belongs to legal metrology instrument.
- The most of NAWI from domestic production and there are many choices of maximum capacity.
- Most of them are for measuring weight of things, goods commodities at the traditional market with lower accuracy.
- It's a simple technology, so it's easy to use for maintenance and get it in land trade.
- Until now there are 96 local corporations of NAWI.

- The total number of the production since 1993 until 2007 approxymately 1653 types.
- The mention ratio for :

  a.electronic weighing scales is 35 %

  b.mechanical scales using a spring is 0.52 %

  c.mechanical balance using a weigh beam and weights is 64.48%
- The most commonly used :

  a) Accuracy class II and III

  b) The maximum capacity : 500 kg

3. Legal Metrology System in my Economy

- The organizations applying measuring law are the directorate of metrology under the ministry of trade ,the regional verification office under the directorate metrology and testing laboratory using ISO 17025.
- The Technical/Science Metrology Service have been implement by Metrology Institute (under the Indonesian Institute of Sciences).
- The Nuclear Radiation Metrology Service have been implement by government body (under the National Atomic Energy Board).
- The Calibration/testing services have been implement by calibration/testing laboratory which has been getting an accreditation certificate from the national accreditation committee.

- The types of weighing instruments are :
  a.mechanical weighing instrument
  - spring
  - beranger
  - centisimal
  - gandar equals weighing instrument which have sliding poises

  b.semi digital weighing
  c.electronic weighing

- In my country we apply initial verification and reverification, the organization perform the verification is regional verification office. The verification period is once a year. Number of the verification is performed in a year about 300 instruments, they are decreasing each year.
- the type approvals are required and the organization which perform the type approvals is the directorate of metrology.
- Every year the type approvals perform approximately 560 types.

- The units of measure used for mechanical weighing instrument are international system units, for example : kg, g.
- Each new product types neither imported or domestic product of the weighing instruments before selling and or using for commodity transaction are required the type approvals first.
- The type approval of legal metrology instruments are only issued by Directorate of Metrology.
- Initial verification and re-verification are required.

- Verification of weighing instruments have been carry out by inspectors of regional metrology offices.
- Re-verifications can be performed neither at the regional metrology office nor the other place of services.

4. Current Situation in my Economy

- Since year 2001 stamp ordinance has been change to be a special technical requirements of non-automatic weighing instruments which was adopted from OIML R-76.
- After this regulation holds for all of non automatic weighing instruments, there are some problems among other things;
  - How way to determine the verification scale interval of weighing instruments which are not equipped a scale interval ?
  - What is our wisdom if the minimum number of verification scale interval of weighing instruments are not comply with OIML R-76?
- All of the weighing instruments are subject to OIML R-76.

- In applying the OIML R 76 , we are confronted with difficult test of deciding the class because the deciding class at OIML R 76 if applied on mechanical weighing instrument in Indonesia there is will experient decreasing of the class from the III class be come the IV class.
- **Example :**
- *centisimal bascule with beam and using sliding poises capacity maximum 500* kg
- *e= minimum scale return in sliding poises = 200* g
  n = 500.000 /200 = 2500 in the class III (NAWI ' s for trade use)
- *if use in steelyard sliding poise capacity maximum 50* kg
  e =minimum scale =200 g
- *n = 50.000/200 = 250 in the class* IV *(NAWI's for lower accuracy)*

In Indonesia regulation law (SK dirjen no 29/DJPDN/kp/XII/98) steelyard sliding poises can be trade because technique ability is good . If using OIML R 76 steelyard sliding poises in NAWI's for lower accuracy (can't trade) but a lot of people in Indonesia still use steelyard sliding poises for trade in the traditional market .

5. Problem to implement the legal metrology system in my economy

- The main problem in the type approval test are budget, capability of human resources.
- We have a lot of finance-related problem especially in equipments levying for the examination of voltage , temperature and magnetic.

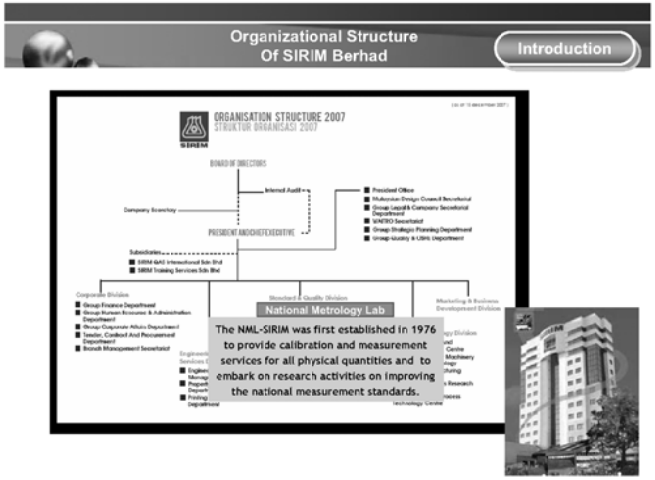
The Other Requirements in my Economy

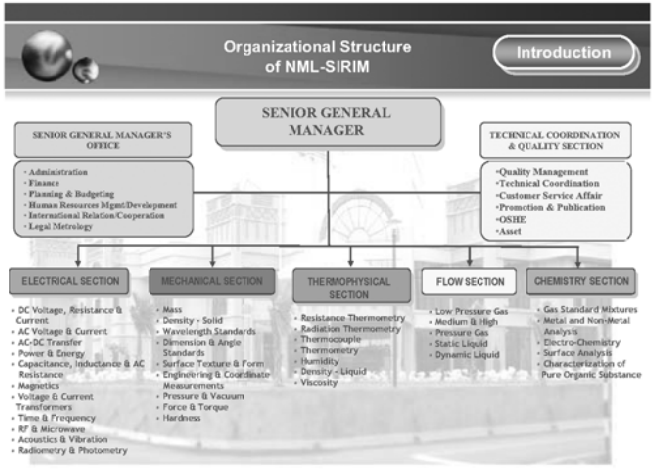
- Measure Law : No. 2 1981 Regarding Legal Metrology
- Regulations :
  1. No. 2, 1985 concerning Measuring Instrument subject to verification.
  2. No. 10, 1987 concerning Legal Units of Measurement.
  3. No. 7, 1989 concerning the National Standardization Council.
  4. No. 2, 1989 concerning the National Standards for Measurement Units.
  5. No.2.1998 concerning special technical conditions measuring the weighing instrument.

and so on.


Thank You
for
Your Attention


Overview of the Legal Metrology System on Non-Automatic Weighing Instruments (NAWI) in Malaysia
13 - 16 May 2008 Pattaya, Thailand
Ms. Hairani Nordin
Metrologist
National Metrology Lab
SIRIM Berhad, MALAYSIA
SIRIM


Organizational Structure
Of SIRIM Berhad
Introduction
ORGANISATION STRUCTURE 2007
National Metrology Lab
The NML-SIRIM was first established in 1976 to provide calibration and measurement services for all physical quantities and to embark on research activities on improving the national measurement standards.


Organizational Structure
of NML-SIRIM
Introduction
SENIOR GENERAL MANAGER
SENIOR GENERAL MANAGER'S OFFICE
• Administration
• Finance
• Planning & Budgeting
• Human Resources Mgmt/Development
• International Relation/Cooperation
• Legal Metrology
TECHNICAL COORDINATION & QUALITY SECTION
•Quality Management
•Technical Coordination
•Customer Service Affair
•Promotion & Publication
•OSHE
•Asset
ELECTRICAL SECTION
• DC Voltage, Resistance & Current
• AC Voltage & Current
• AC-DC Transfer
• Power & Energy
• Capacitance, Inductance & AC Resistance
• Magnetics
• Voltage & Current Transformers
• Time & Frequency
• RF & Microwave
• Acoustics & Vibration
• Radiometry & Photometry
MECHANICAL SECTION
• Mass
• Density - Solid
• Wavelength Standards
• Dimension & Angle Standards
• Surface Texture & Form
• Engineering & Coordinate Measurements
• Pressure & Vacuum
• Force & Torque
• Hardness
THERMOPHYSICAL SECTION
• Resistance Thermometry
• Radiation Thermometry
• Thermocouple
• Thermometry
• Humidity
• Density - Liquid
• Viscosity
FLOW SECTION
• Low Pressure Gas
• Medium & High Pressure Gas
• Static Liquid
• Dynamic Liquid
CHEMISTRY SECTION
• Gas Standard Mixtures
• Metal and Non-Metal Analysis
• Electro-Chemistry
• Surface Analysis
• Characterization of Pure Organic Substance

NML's Core Activities

Introduction

TO ESTABLISH, MAINTAIN AND UPGRADE THE NATIONAL PHYSICAL STANDARDS

TO DISSEMINATE AND PROMOTE MEASUREMENT PARAMETERS AND TECHNOLOGIES TO INDUSTRIES

TO PURSUE TECHNICAL COOPERATIONS WITH INTERNATIONAL STANDARD BODIES

TO CONDUCT RESEARCH & DEVELOPMENT IN PRECISION MEASUREMENT TECHNOLOGY AND STANDARDS

TO PROVIDE LEGAL METROLOGY SERVICES AS REQUIRED BY THE LAWS

NAWI in Malaysia

Q 2.1 : Major Purposes or Targets to use NAWI?

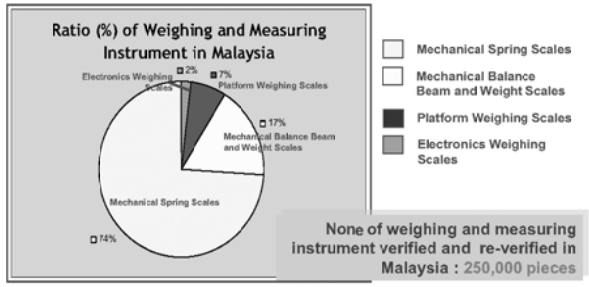
- For accurate weighing and measurement for sale & purchase in retail outlets.
- To protect the consumer from short-weight and measurement

Q 2.2 & 2.3 : No of manufacturer(s) & production of NAWI in Malaysia?

- Only one (1) NAWI manufacturer in Malaysia, with a total of 5000 pieces of production per year.

NAWI in Malaysia

Q 2.4 : Approximate ratio (%) of numbers in use for various scales



None of weighing and measuring instrument verified and re-verified in Malaysia : 250,000 pieces

NAWI in Malaysia

Q 2.5 : The Accuracy Classes and Max Capacity

- Accuracy based on the Pattern or Specification for Weights and Measures or Instruments for Weight or Measuring Order 1981.
- Accuracy class based on the prescribed by the Order:
  - (i) Class 'B' for precious metal, pharmaceutical products
  - (ii) Class 'C' for other retail product
- Range : 30 g to above 100 kg
- Commonly used : Class B

Q 3.1 : Who implements the measurement law ?

WEIGHTS AND MEASURES ACT, 1972 (WMA 72)

- Regulated and governed by Enforcement Division under the Ministry of Domestic Trade and Consumers Affairs (MTDCA).
- Section 14 of WMA72 requires mandatory verification and re-verification for all weighing and measuring instruments used for trade.
- Enforcement of the Act were initially been carried out by Weights and Measures Inspector under the Enforcement Division.
- From April 2005, the service were privatized and done by a company, namely Metrology Corporation Malaysia (MCM). Weights and Measures Inspector only enforces the WMA and oversee the company performance.
- Each standard used to perform the verification is traceable to national standards maintained by NML-SIRIM.

Q 3.2 : Types of weighing instruments and its range, which covered by the measurement law ?

Section 14 (5A) WMA72 requires all weighing and measuring instruments to be approved by the Custodian before they can be used for trade.

a) Linear measures,
b) Liquid capacity measures,
c) Weights,
d) Beam-scales,
e) Balances,
f) Counter machines,
g) Spring balance and scales,
h) Dead-weight machine,
i) Platform weighing machines,
j) Weighbridges,
k) Crane weighing machines,
l) Automatic weighing machines,
m) Instrument for measurement of liquid fuel lubrication,
n) Liquefied petroleum gas dispenser,
o) Parking meters and time recorders,
p) Instrument for the measurement of alcohol liquor,
q) Any other instrument for weighing or measuring approved by Custodian, from time to time.

Q 3.3 : Are initial verification & re-verification required?

- Yes. All weighing and Measuring instruments require initial verification and re-verification.
- It will conducted by the Verification Officer of MCM after being serviced by licenced repairer.
- Verification interval : Once a year.

Q 3.4 : Are type approvals required ?

- Yes. They are required under the WMA72. The NML-SIRIM is conferred the responsibility to perform the type approval as the Custodian of WMA72.
- For the past few years, no new instruments have been submitted to NML for approval.

Q 4 : Explain current situation in Malaysia about the compliance of the international standards, such as OIML R76?

All new weighing instruments (NAWI) are required to comply to the requirements of OIML R76. Verification of such standards are also generally in accordance with the recommendation.

Legal Metrology System in Malaysia

Q 5 : Are there any other requirements from your economy? Do you have problem to implement the legal metrology system?

- Malaysia looks forward to more training opportunities to upgrade the technical competence and knowledge of legal metrology personnel.
- Funding support from donor countries and funding agencies is very much appreciated.

APLMF
Asia-Pacific Legal Metrology Forum

Thank You Very Much For Your Attention !

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Trainer Course on the Verification of Mechanical Weighing Scales
PATTAYA-THAILAND
May 13th-16th, 2008

ECONOMY: PERU

ORGANIZATION: INDECOPI - NATIONAL METROLOGY SERVICE

TRAINEE: Nikko Meza

APLMF
Asia-Pacific Legal Metrology Forum

Asia-Pacific Economic Cooperation

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indecopi

LOCATION

PERU IS PART OF LATIN AMERICA.

IT IS LOCATED IN THE OCCIDENTAL PART OF SOUTH AMERICA.

indecopi

Peru is the land of the INCAS Empire

indecopi

INFORMATION

- Country (long form) Republic of Peru
- Capital Lima
- Total Area 1 285 215 square kilometers
- Population 27 483 864
- Languages Spanish (official), Quechua (official), Aymara
- Religions Christians (Catholic and anothers) 99 %
- Government Type Constitutional Republic
- Currency 1 Nuevo Sol (S/.) = 0,36 US$
- Industry mining of metals, petroleum, fishing, textiles, clothing, food processing, cement, steel, metal fabrication
- Agriculture coffee, cotton, sugarcane, rice, wheat, potatoes, coca; poultry, beef, dairy products
- Peru has the biggest biodiversity of the world
- Natural Resources copper, silver, gold, petroleum, wood, fish and others

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INTRODUCTION

INDECOPI

- Explain about your organization and department.

National Institute for the Defense of Competition and the Protection of Intellectual Property -INDECOPI was created by Law N° 25868 in November 1992, to promote a culture of loyalty and fair competition in the Peruvian Economy and to protect all forms of intellectual property: from copyrights to patents and biotechnology.

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The NATIONAL METROLOGY SERVICE was created in 1983 to promote the development of metrology in Peru and to contribute to the spreading of the units of the SI. Currently it is the only entity in Peru capable of offering a reliable service of metrological assurance, which is necessary for institutions looking for a quality system, and subsequently getting recognition through the ISO 9 000 certification.

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INTRODUCTION

- Explain your professional experience in your organization.

I am technical metrologist of Mass and Volume and Density laboratories in National Metrology Service – INDECOPI. I am in charge of the calibration service of weights, scales and Volumetric Standard.

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Non Automatic Weighing Instruments (NAWI) in your economy

- What are the major purposes or targets to use NAWI?

Using these scales in industry and commerce.

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. How many manufacturers of NAWI are there in your economy?

There are approximatly:

03 manufactures of Mechanical Scales
06 manufactures of Electronic Scales

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If you know, please mention approximate total number of production of NAWI.

Production approximate of NAWI in my economy :
150 scales between mechanicals and electronics for month

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If you know, please mention approximate ratio (%) of numbers in use for the (a) electronic weighing scales, (b) mechanical scales using a spring, and (c) mechanical balances using a weigh beam and weights.

Electronics Weighing Scales: 65 %
Mechanical Scales: 35 %
(spring; weigh beam and weights)

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What are the accuracy class and the maximum capacity, which are most commonly used?

The more common are the weighing scales class III and IV
The capacity is: 10 kg until 50 000 kg

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- Describe briefly the types of weighing instruments and its measuring range, which are covered by the measurement law.

There are no laws. However the scales for commercial transactions must comply with the Peruvian Metrological Standard, which is an adaptation of the OIML R 76.

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Are initial verification and re-verification required? If yes, which organization performs the verification? How long is the re-verification period? How much verification is performed in a year? Are they increasing or decreasing?

In my economy this not is required, but the enterprises request the service of calibration and re-calibration will according to their need.
The recalibration is required for custom scales and road scales, for other scales the recalibration is not required .

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Are type approvals required? If yes, which organization performs the type approvals? How many type approval tests are performed in a year?

In my economy this not required.

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Explain current situation in your economy about the compliance to the international standards / recommendations, such as OIML R76?

Although there is no control by government, there are rules established for customs scales (rules of Customs National Superintendent's Office) and for road scales (rules of Ministry of Transport) which demand that these instruments must have a calibration certificate every 6 months and the calibration must be based on the Peruvian Metrological standard, which is an adaptation of the OIML R 76.

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Are there any other requirements from your economy? Do you have any problems in order to implement the legal metrology system (budget, human resources, etc..)?

To implement system of legal metrology need increased budget and human resources, etc..

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Thank you!

Nikko Meza Valencia
INDECOPI - PERU
nmeza@indecopi.gob.pe

APLMF
Asia Pacific
Legal Metrology Forum

APEC
Asia-Pacific
Economic Cooperation

The Singapore Weights and Measures Programme

Jessie Koh
Weights and Measures Office

13 May 2008

SPRING singapore
Enabling Enterprise

Weights and Measures Programme

Background

- **The Weights and Measures (W&M) Programme aims to protect consumers and traders by regulating the use of weighing and measuring instruments for trade use by weight or measure and pre-packaged goods.**
- **Governed by the Weights and Measures Act and Regulations.**
- **SPRING Singapore administers the W&M Programme since 1 April 2000.**
- **There are about 40 000 weighing and measuring instruments in Singapore.**

5 Categories of Weighing and Measuring Instruments

The following weighing and measuring instruments are regulated in Singapore

(a) (b) (c) (d) (e)

(a) **Instrument for measurement of liquor**
(b) **Flow meters**
(c) **Oil dispensing pumps**
(d) **Linear measures**
(e) **Non-automatic weighing instruments**

Roles of WMO

Pre-market Activities

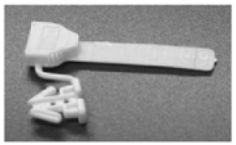
- Designate Authorised Verifiers to perform verification on weighing and measuring instruments for trade use.
- Register approved weighing & measuring instruments.
- Verify and stamp/seal all new or repaired weighing and measuring instruments for trade use.

Post-market Activities

- Inspect weighing and measuring instruments used for trade purposes for inaccuracies and to ensure that they have not been tampered with. To inspect pre-packaged goods or goods sold to ensure that they are not short weight or short measure.
- Investigate complaints pertaining to weight and measure matters from consumers and traders.

Verification Seals

Tamper proof paper adhesive seal



Plastic Seal

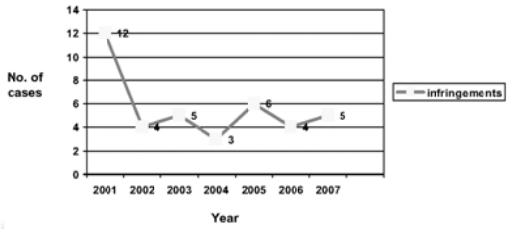
Accuracy Label

Introduced on 1 April 2004, the Accuracy Label is affixed on all verified weighing and measuring instruments for trade use to further boost the confidence of consumers and businesses alike.

WMO Outreach Programme

Achievements

Since 2001, the number of infringements has gone down significantly.



Thank you!

SPRING singapore

กรมการค้าภายใน
Department of Internal Trade

COUNTRY REPORT ON LEGAL METROLOGY IN THAILAND

TRAIN THE TRAINER COURSE ON THE VERIFICATION OF MECHANICAL WEIGHING SCALES

IN THAILAND

สำนักชั่งตวงวัด
Bureau of Weights & Measures

PRESENT BY
PISAKORN PISANKUL

สำนักชั่งตวงวัด
Bureau of Weights & Measures

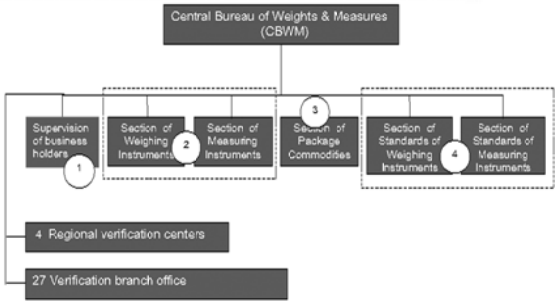
Organization

สำนักชั่งตวงวัด
Bureau of Weights & Measures

Organization (continued...)

- The Northern Verification Center (Chaing Mai)
- The North-eastern Verification Center (Khon Kaen)
- The Eastern Verification Center (Chonburi)
- The Southern Verification Center (Surat Thani)

Organization (continued...)



DUTIES AND SERVICES

1. Supervision of business holders

DUTIES AND SERVICES (continued...)

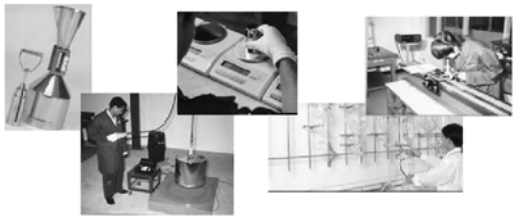
2. Control of Weighing and Measuring instruments

DUTIES AND SERVICES (continued...)

3. Control of packaged goods

DUTIES AND SERVICES (continued...)

4. Governance of legal weighing and measuring standards and services



LAW AND REGULATIONS

- The law of Weights & Measures B.E.2466 (1923)
- The law of Weights & Measures B.E.2542 (1999)

LAW AND REGULATIONS (continued...)

The WMI under the Regulations are as follow:

- Non-Automatic Weighing Instruments
- Automatic Weighing Instruments
- Weights
- Length-measuring Instruments
- Automatic Level Gauges
- Liquid-measuring Instruments
- Water Meters
- Gas Volume Meters
- Direct Mass Flow Meters
- Package commodities
- Rice Moisture Meter
- Etc.,

SELF VERIFICATION

As a following :

- Water Meter since 2006 (5 companies)
- Length Measurement since 2007 (1 company)
- Spring Scale since February 2008
- And the next instruments which now is in process : fuel dispenser and truck scale

SELF INTRODUCTION

I am responsible for verification of scale and weights which are manufactured, repaired and imported and supervision of uses of scale to ensure that no taking advantage of abuse of such instruments takes place.

I will go to inspect and examine the conditions, properties and accuracy of scale used at markets, stores and purchasing places and make public understanding regarding a correct means on the use of scale.

2. NAWI in Thailand

2.1 The major purposes or target to use NAWI

- To weigh products/goods for transaction.
- To weigh the products for recheck the weights.
- To weigh objects for analysis.(In Laboratory).
- To weigh the raw material for industrial work.
- To weigh the vehicle (limiting the vehicle weight of Department of Land Transport).
- etc.,

2. NAWI in Thailand

- Number of NAWI manufacturers: ~ 70 manufacturers.
- Number of production of NAWI is about 570 000 / year.
- Its consist of following:

560,000 spring scale ⇒ around 98%
1,000 electronic weighing
9,000 mechanical balance using a weigh beam and weights ⇒ around 2%

2. NAWI in Thailand

2.5 The accuracy class and the maximum capacity which are most commonly used in Thailand.

- The electronic weighing scales with accuracy class III is the most commonly used.
- The mechanical weighing scale which are used in Thailand almost are accuracy class IV .
- Spring Scale with capacity of 7kg is the most commonly used in Thailand. The Maximum capacity of spring scale is 60 kg.

3. Legal metrology system in Thailand

3.1 Who implements the measurement law ?

- The organization which implements the measurement law is Central Bureau of Weights and Measures. Department of Internal Trade. Ministry of Commerce.

3. Legal metrology system in Thailand

3.2 The types of weighing instruments and its measuring range, which are covered by measurement law.

Weighing instruments are divided into 3 types as follows:

- Non-automatic weighing instruments.
- Automatic weighing instruments.
- Weights.

3. Legal metrology system in Thailand

The measuring range that cover by law:

In Thailand, the measurement law concerning non-automatic weighing instruments is followed by OIML R76 and there are no limit the measuring range in the measurement law except for the spring scales and weights. it is limited the range as follows:

- Weights: the measuring range is 1g～50 kg. (Verification)
- The spring scales: the measuring range as follows:

1 kg	20 kg
3 kg	35 kg
7 kg	60 kg
15 kg	

3. Legal metrology system in Thailand

3.3 Initial verification and re-verification is done by CBWM.

Initial verification	re-verification
The weighing instruments which use for trade	Truck scale (2 years)

3. Legal metrology system in Thailand

3.4 Type Approval:

No Type Approval.

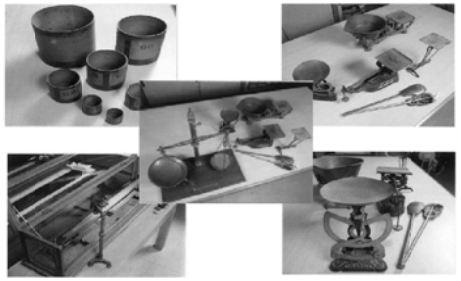
4. Current situation in Thailand about the compliance to the international standards/recommendation?

- Non-automatic Weighing Instruments are based on **OIML R76**
- Automatic Weighing Instruments are principally based on **OIML R50, R51, and R107**.
- Length-measuring Instruments are based on **OIML R35.**
- Automatic Level Gauges are based on **OIML R85.**
- Liquid-measuring Devices Gauges are based on **OIML R117.**
- Gas Volume Meters are based on **OIML R6, R31 and R32.**
- Direct Mass Flow Meters are based on **OIML R105.**
- Weighs are based on **OIML R111.**
- Pre Packaged goods are based on **OIML R79 and R87.**

5. Are there any requirements from your economy? Do you have any problems in order to implement the legal metrology system?

Human resources: According to the downsizing policy of the government 10 years ago, nowaday there are a lot of tasks under the legal metrology while number of officers who supervise that tasks is not enough.

THANK YOU



COUNTRY REPORT

Training course on the Verification of Mechanical Weighing Scales

May 13th-16th, 2008

Pattaya, Thailand

Tran Thi Thuy Ha
Directorate for Standards and Quality
(STAMEQ)

1

Vietnam Country

- Area: 331 690 km²
- Location: Vietnam situated in South - East Asia. It borders China in the North, Lao and Cambodia in the West and look out the East sea (Pacific) in the east and the south.
- Population: 87 millions
- Capital: Hanoi

2

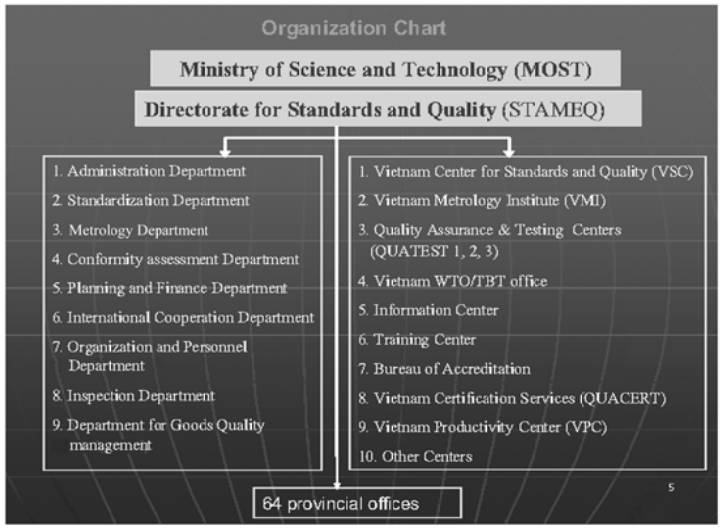
Map and flag of Vietnam

3

Directorate for Standards and Quality

- National Authority for legal metrology is The Directorate for Standards and Quality (STAMEQ).
- STAMEQ is the Governmental Agency under the Ministry of Science and Technology which, according to legal provisions, undertakes the function of the State management on standardization, metrology and quality of products and goods as well as to represent Vietnam in international and regional organizations under decisions of competence State agencies.

4



Metrology Department

1. To assist the General Director of STAMEQ in performing the uniform State management over the system of measurement standards, including:

- *To submit to the General Director of STAMEQ the plan on development of the national system of measurement standards; to assign agencies to keep and preserve national measurement standards;*

6

Metrology Department

- *To submit to the General Director of STAMEQ for promulgation the regulations on measurements and measuring methods, and the regulations requesting the measurement organizations and individuals to create favorable conditions for measuring device-users to inspect measurements and measuring methods.*

7

Metrology Department

2. Metrology Department will perform the following tasks:

- To build and manage the system of national measurement standards; to guide ministries, braches and localities in building the system of measurement standards;

8

Metrology Department

- To organize and manage the expertise and standardization of measuring devices, recognize the capability to expertise measuring devices;
- To certify standard samples, approve measuring-device samples before the production or import thereof according to law provisions;
- To grant and withdraw measurement verifier's cards.

9

Non-Automatic Weighing Instruments (NAWI) in Vietnam

- Non-Automatic weighing instruments belong to "list of measuring instruments are subjected to compulsory verification".
- The major purposes or targets to use NAWI are to create fair in trade, protect legal benefits of users.
- Up to now, there are more ten manufacturers of NAWI in Vietnam.

10

Non-Automatic Weighing Instruments (NAWI) in Vietnam

- Total number of production of NAWI in Vietnam about 2.5 million including 50% of mechanical scales, 45% of electronic weighing scales and 5% other (mechanical balances using a weigh beam and weights).
- NAWI of accuracy class Ⅳ, the maximum capacity is 1 kg, 2 kg, 4 kg, 5 kg, 8 kg, 10 kg, 12 kg, 15 kg, 20 kg, 30 kg, 60 kg, 100 kg, 120 kg, 150 kg which are most commonly used in Vietnam.

11

Legal metrology system in Vietnam

- Government, Metrology State management Agency, Metrology Institute, verification body, testing laboratory, etc., implement the measurement law.
- All types of weighing instrument above mentioned are covered by measurement law.

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Legal metrology system in Vietnam

- All types of weighing instrument are subjected to compulsory verification including initial verification and re-verification.
- Bodies will perform the verification: Vietnam Metrology Institute (VMI), Quality Assurance and Testing Center 1, 2, 3, Department for Standard, metrology and quality in province and Verification authorized Units.
- However, mechanical verification is mostly performed by 64 provincial verification offices and verification authorized Unit (NhonHoa spring dial scale Manufacturer).

Legal metrology system in Vietnam

- The re-verification period is one year.
- There are 2.5 million verification is performed in a year and they are increasing annually.
- All types of weighing instrument must be approved before the production or import.
- STAMEQ is measurement State management Agency to perform the type approvals.

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Legal metrology system in Vietnam

- Verification is performed for non-automatic weighing instruments according to verification procedure (Method and Means of verification) issued by STAMEQ. It complies with OIML R76.

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Thank you for your attention !

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