Handbook on Verification of NAWI Weighbridges Train the Trainer Course

APEC/APLMF Training Courses in Legal Metrology(CTI 46/2009T)

APEC

Asia-Pacific Economic Cooperation

APLMF

Asia-Pacific Legal Metrology Forum

June 7–10, 2010
Bandung, Indonesia

APEC# 211-CT-04.2 ISBN 978-7-5026-3078-2

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Asia-Pacific
Economic Cooperation

Asia-Pacific
Legal Metrology Forum

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Group photo

Photos taken during the training course

Contents

Foreword

This booklet is one of outcomes of the APEC/APLMF Seminars and Training Courses in Legal Metrology (CTI 46/2009T) titled "Train the Trainer course on Verification of NAWI Weighbridges" which was held on June 7 – 10, 2010 at the Holiday Inn, Bandung, Indonesia.

This training course was organized by APLMF and supported by Directorate of Metrology (DOM), Ministry of Trade, Indonesia, National Metrology Institute Australia (NMIA) and National Institute of Metrology (NIM), China. I would like to extend my sincere gratitude to colleagues of DOM and other staffs for their outstanding preparation and speakers from member economies for their contributions. Also, special thanks should be extended to the Program Director Toni Widhiastono and Program Executive, Ms. Joyce Yong from APEC Secretariat for their tremendous supports.

APLMF secretariat has 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. This course has enhanced the technical capabilities of participants and provided harmonized procedures for testing weighbridges which are aligned OIML Recommendation R 76. Participants observed demonstrations of the verification of a weighbridge. Also, participants have received electronic copies of the training materials which they can use when they train staffs in their economies thus to meet the APEC objective of harmonizing metrology legislation with OIML international recommendations. Participants of this training course included officials in charge of type approvals and/or regulation of NAWI measuring instruments, National Metrology Institutes (NMIs) as well.

During this training course, participants introduced the current control measures pattern approval, verification and calibration and the further development on NAWI measuring instruments. All detailed program could be found in the summary report by Mrs. Marian Haire, one of the trainers.

Due to the great contributions from trainers and active participants as well as the effective collaboration between the DOM and APLMF Secretariat, I would like to say that this training course was 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.

Oct. 5, 2010

Mr. Pu Changcheng

APLMF President

Summary Report

The Training Course Verification of NAWI Weighbridges was held from 7 to 10 June, 2009 at the Holiday Inn, Bandung, Indonesia. It was hosted by Metrological Cooperation Directorate, Metrology Ministry of Trade, Indonesia.

The course was attended by:

- 15 Legal Metrology participants from the following economies: People's Republic of China, Indonesia, Malaysia, Mongolia, Papua New Guinea, Peru, Philippines, Singapore, Thailand and Viet Nam;
- 39 local participants;
- 2 industry representatives from Singapore.

Trainers from the National Measurement Institute, Australia (NMI, A) and National Institute of Metrology, P. R. China provided the training. The APLMF secretariat and nine staff members from the host economy also supported the course. The host economy provided the venue and meals.

Having confidence that goods traded are the correct weight or measure plays an important part in every day commercial transactions. As part of the process of ensuring continued confidence internationally with respect to goods sold by weight using a weighbridge OIML member economies are encouraged to implement OIML R 76. The test procedures for verification outlined in R 76 formed the basis for this course. The Uniform Test Procedures NMI V 1 found on the NMIA website outlines all the procedures demonstrated during the course.

The course provided participants with the knowledge and skills to:

- analyse a weighbridges operating environment to determine how it could impact on its performance;
- verify a weighbridge in accordance with test procedures.

This training will enhance the technical capabilities of participants and provide harmonized procedures for testing weighbridges which are aligned OIML Recommendation R 76. Participants observed demonstrations of the verification of a weighbridge. Participants also received electronic copies of the training materials to fulfil their obligation to train others in their economy.

The course started with welcoming addresses from the secretary-general of West Java Province, the host economy and the APLMF Secretariat. The official group photograph was then

taken. Following the formal opening addresses each economy gave a brief presentation outlining their experience with the verification of weighbridges. Also outlined were any current problems encountered with the verification of weighbridges.

The emphasis of this course was on the practical applications of OIML R 76. The presentations outlined the following:

- Construction of weighbridges;
- Calculating maximum permissible errors;
- Visual inspection;
- Repeatability;
- Eccentricity;
- Accuracy of zero;
- Discrimination;
- Weighing Test;
- Weighing Test using Substitution Material, Calculating the actual weight of the substitution load;
- Tare Test;
- Supplementary Test;
- Conducting a full verification.

Following each demonstration the participants worked in small groups to gain practical experience and to allow time to ask the trainers questions. An in field practical session was held at Metrology Training Center, Bandung using a 10t weighbridge and 3t of reference masses. This practical session allowed participants to understand how to conduct the test.

The host economy also arranged for a visit to a textile manufacturing factory where the participants were able to observe a 60t weighbridge which is used continually during production.

On the last day of the course a group of participants presented the key points of the course to show they understood and were ready to deliver the training in their own economies. Dr. Zhong Ruilin also gave a talk on the type evaluation of weighbridges.

Many of the participants reported they had difficulty verifying weighbridges because they did not have access to an adequate supply of reference masses. This was particularly a problem in economies made up of several islands.

The participants evaluated the course very positively. Some comments include:

- It gave me a deep understanding of R 76;
- I have gained the confidence to calculate MPE, change points, errors and substitution

loads;

- I will review our documentation and ensure it is in line with R 76;
- We will apply the NAWI test procedures at work.

The training was presented by Mr. Adrian Caster, Dr. Zhong Ruilin and Mrs. Marian Haire. Mr. Caster has worked in the weighing industry for over 44 years. Adrian has recently retired from his role as manager of the NMI, A Patter Approval Laboratory. Zhong Ruilin is responsible for type evaluation of weighing instruments at NIM, P. R. China. Mrs. Marian Haire is the manager of the Training and Technology Transfer Section with NMI, A. She is also the Chair of the APLMF Working Group on Training Coordination.

During the closing ceremony, certificates were presented to all the participants.

Mrs. Marian Haire
NMIA, Australia

APEC/APLMF Seminars and Training Courses in Legal Metrology

(CTI 46/2009T)

Train the Trainer course on Verification of NAWI Weighbridges

June 7 – 10, 2010

in Bandung, Indonesia

Program

Organizers:

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

Supporting Organizations:

1. Directorate of Metrology, Ministry of Trade, Indonesia
2. National Metrology Institute Australia (NMIA)
3. National Institute of Metrology (NIM), China

Target audience:

We suggest that the ideal participants include:

- Inspectors or industry representatives who verify weighbridges
- Staffs with a responsibility for training in the verification process

Presenters:

- Adrian Caster: National Measurement Institute, Australia
- Marian Haire: Manager Training Services, National Measurement Institute, Australia
- Zhong Ruilin, Senior Engineer, National Institute of Measurement, Peoples Republic of China

Main Objective of the Training Course:

This course will enhance the technical capabilities of participants and provide harmonized procedures for testing weighbridges which are aligned OIML Recommendation R 76. Participants will observe demonstrations of the verification of a weighbridge. Participants will receive elec-

tronic copies of the training materials which they can use when they train others in their economy.

Venue and Accommodation:

Accommodation for the participants will be prepared in the Holiday Inn hotel, Bandung, Indonesia with a rate of about **70 dollars** for a single room and about **80 ~ 85 US dollars** for a double room, respectively. Please complete the hotel reservation form to make the reservation.

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**, **P. R. China**, **Indonesia**, **Malaysia**, **Mexico**, **Papua New Guinea**, **Philippines**, **Peru**, **Russian Federation and Thailand.**
- **APLMF travel support** would be provided for the following 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 by the APEC/APLMF secretariat. All supported participants are **required to prepare a 10 minute presentation providing an overview of how weighbridges are verified in their economy and an outline of their training plan for dissemination of the information when they return to their economy.** The English proficiency of your selected participant will very much affect the training outcome so we hope you will take this into account when selecting your nominee for this training course.
- The participants who receive **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 will be required to pay their airfare and accommodation themselves but will be reimbursement approximately 6 weeks after they have submitted the required supporting documents directly to APEC Secretariat. Access Information:

Access information:

Bandung is a Capital City of West Java Province. It is about 200 km or takes 2 hours 30 minutes from Soekarno-Hatta International Airport, Jakarta. All international flight will departure

at Soekarno-Hatta International Airport at Jakarta except some budget flight could departure at Husein Sastranegara Airport at Bandung.

There are 3 (three) ways to arrange the transportation to Bandung:

1. By Bus

We recommend use bus "PRIMAJASA". The reservation desk could be found at Gate E Terminal 2 Soekarno-Hatta International Airport at Jakarta. You will be transferred to Bandung Super Mall (BSM) and take taxi to Holiday Inn Hotel, Bandung. The rate (single trip) is Rp 75, 000 or 8 US dollars.

2. By Taxi

We recommend use taxi "CIPAGANTI". The reservation desk could be found at Arrival Hall or around Gate E Terminal 2 Soekarno-Hatta International Airport at Jakarta. You will transfer directly to the hotel. The rate (single trip) is Rp 135, 000 or 15 US dollars.

3. By train

Take bus "DAMRI" to GAMBIR Station at Gate F Terminal 2 Soekarno-Hatta International Airport at Jakarta and stop at GAMBIR Rail Way Station. Then take Train "ARGOGEDE" or train "PARAHYANGAN EXECUTIVE CLASS" to Bandung. Take taxi to the Holiday Inn Hotel, Bandung. The bus "DAMRI" rate (single trip) is Rp 20,000 or 2 US dollars and train rate (single trip) is Rp 55,000 or 6 US dollars.

The Directorate of Metrology will set the help desk at the airport to assist for transfer pick-up to the venue. The host staff will be wearing the official blue shirt and holding the APLMF training sign at the arrival hall. Please inform us for any changes in your flight schedule.

Currency and Credit Cards:

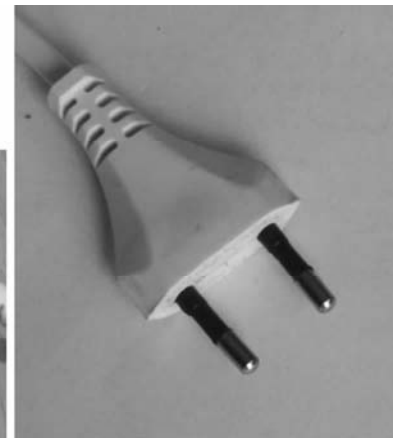
The local curency is Rupiah. The notes includes Rp 100,000, Rp 50,000, Rp 20,000, Rp 10,000, Rp 5,000, Rp 2,000, Rp 1,000, Rp 500, Rp 200 and Rp 100. Major credit cards (VISA, MASTER CARD, etc.) are accepted in hotels, restaurants and big stores.

Climate:

The average temperature at Bandung is about 20℃ ~28℃ in June.

Electricity Supply:

Indonesia Voltage is 220 ~ 240 volts AC. The power plugs used in Indonesia are of 2 pin.



Local Time:

GMT +7

Contact Persons:

- **APLMF Secretariat** (Registration, Travel support)

  Dr. ZHANG Chao & Mr. GUO Su

  APLMF Secretariat

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

- **Host** (Visa application, Hotel reservation)

  Mr. Rifan Ardianto & Mr. Hero Soebroto

  Directorate of Metrology, Ministry of Trade

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  Telp: +62 22 420 3597

  Fax: +62 22 420 7035

  Mobile: +62 817 922 7633 (Mr. Rifan)

  Email: rifan.ardianto@depdag.go.id, subdit.skk@gmail.com

Program

Day 1 June 7, Monday	08:30-09:00	*Registration*
	09:00-09:30	Welcoming address from the host economy Opening ceremony (APLMF Secretariat) Group photo taking
	09:30-10:30	Presentation by each economy
	10:30-11:00	*Coffee break*
	11:00-12:00	Presentation by each economy
	12:00-13:30	*Lunch break*
	13:30-15:00	Construction of weighbridges
	15:00-15:30	*Coffee break*
	15:30-17:00	Calculating maximum permissible errors
	18:30-21:00	*Welcome Dinner*
Day 2 June 8, Tuesday	09:30-10:30	Visual inspection, Repeatability, Eccentricity, Accuracy of zero, Discrimination
	10:30-11:00	*Coffee break*
	11:00-12:00	Weighing Test, Weighing Test using Substitution Material, Calculating the actual weight of the substitution load, Tare Test, Supplementary Test, Conducting a full verification
	12:00-13:30	*Lunch break*
	13:30-15:00	Practical observation of test procedures at MTC Bandung
	15:00-15:30	*Coffee break*
	15:30-17:00	Practical observation of test procedures at MTC Bandung
Day 3 June 9, Wednesday	09:00-17:00	Site visit: Verification of weighbridge at Metrology Training Center
	19:00-21:00	*Farewell Dinner hosted by the APLMF Secretariat*
Day 4 June 10, Thursday	09:30-10:30	Assessment of participants
	10:30-10:45	*Coffee break*
	10:45-12:00	Assessment of participants
	12:00-13:30	*Lunch*
	13:30-15:00	OIML 76 amendments
	15:00-15:20	*Coffee break*
	15:20-16:00	Orthotropic Weigh Bridge Construction and Latest Technology in Weighing Cell by Mettler Toledo, Switzerland
	16:00-17:00	*Concluding ceremony*

Participants List

APEC/APLMF Seminar and Training Courses in Legal Metrology (CTI-46/2009T)

Training Course on Verification of NAWI Weighbridges

No.	Category	Economy	Name	Organization
1	APLMF	P. R. China	Ms. ZHENG Huaxin	APLMF Secretary, Department of Metrology, AQSIQ
2	APLMF	P. R. China	Mr. GUO Su	APLMF Secretary, Department of Metrology, AQSIQ
3	Trainer	Australia	Mr. Adrian Caster	National Measurement Institute
4	Trainer	Australia	Mrs. Marian Haire	National Measurement Institute
5	Trainer	P. R. China	Mr. Zhong Ruilin	National Institute of Metrology, P. R. China
6	Participant	Thailand	Mr. Tapphinyo Koatnon	Central Bureau of Weights and Measure
7	Participant	PNG	Mr. Joe Panga	Papua New Guinea-National Institute of Standards and Industrial Technology
8	Participant	P. R. China	Mr. Fu Yibin	Guangzhou Institute of Measurement and Testing Technology, P. R. China
9	Participant	Philippines	Mr. Gregorio Mendoza	National Metrology Laboratory, Industrial Technology Development Institute (NML-ITDI)
10	Participant	Viet Nam	Mr. Bui Anh Ha	Small and Medium Enterprise Development Support Center 1-Directorate for Standards, Metrology and Quality (STAMEQ)
11	Participant	Malaysia	Ms. Suliana Ghazalli	National Metrology Laboratory, SIRIM Bhd.

12	Participant	Peru	Mr. Aldo QUIROGA	INDECOPI
13	Participant	Mongolia	Mr. Dalaibayar Daramjav	MASM
14	Participant	P. R. China	Dr. Ma Binghu	Zhejiang institute of metrology, P. R. China
15	Participant	Singapore	Mr. Lim Yong Seng	SPRING Singapore
16	Participant	Singapore	Mr. Kriegsman Tan	SPRING Singapore
17	Participant	Singapore	Mr. Fu Yuan Wu	Sartorius Mechatronics Singapore Pte Ltd.
18	Participant	Singapore	Mr. WEE OON SEONG	Matcon-Matic PTE LTD
19	Participant	Malaysia	Dr. Wan Mohamed Wan Abd Malik	National Metrology Laboratory, SIRIM Bhd.
20	Participant	Malaysia	Mr. Peter J. Berinus Agang	
21	Participant	Malaysia	Mr. Khalid Bin Tik	
22	Local participant	Indonesia	Mr. Edy Sungkono, S. E	Balai Pelayanan Kemetrologin-Jambi
23	Local participant	Indonesia	Mr. Syamsul Bahri, SE	UPTD Metrologi Padang
24	Local participant	Indonesia	Mr. Ali Mutakin, ST	Balai Pengelolaan Laboratorium Kemetrologian-Jawa Barat
25	Local participant	Indonesia	Mr. Arbainsyah, ST	UPTD Metrologi Samarinda
26	Local participant	Indonesia	Mr. Tri Daryono	UPT Metrologi Disperindag-NTT

27	Local participant	Indonesia	Mr. Dedi Kusaryadi, SE	Balai Metrologi-Banyumas
28	Local participant	Indonesia	Mr. Ir. Duma Pangaribuan	UPTD Balai Metrologi Sibolga
29	Local participant	Indonesia	Mr. Wihananto	UPTD Metrologi Singkawang
30	Local participant	Indonesia	Mr. H. Edy Subiantoro S. H, S. T, M. M	BSML Banjarmasin
31	Local participant	Indonesia	Gede Santika	
32	Local participant	Indonesia	Budiarto	
33	Local participant	Indonesia	Subagyo. SE	
34	Local participant	Indonesia	Fanny Abast	
35	Local participant	Indonesia	Aen Jueni	
36	Local participant	Indonesia	Rana Ramadi, S. Si	PT Almega
37	Local participant	Indonesia	Mr. Ir. Yosafat Eko Wahyono, M. T	PT Almega
38	Local participant	Indonesia	Mr. Bagus Kardiyono, S. Si	PT Almega
39	Organizer	Indonesia	Mr. Hero Subroto	Directorate of Metrology
40	Organizer	Indonesia	Mr. Rifan Ardianto	Directorate of Metrology

41	Organizer	Indonesia	Mr. Deden Muhammad F. S	Metrology Training Center
42	Organizer	Indonesia	Mr. Permadi	Metrology Training Center
43	Organizer	Indonesia	Mrs. Sri Astuti	Metrology Training Center
44	Organizer	Indonesia	Mr. Moogy Frianto H	Directorate of Metrology
45	Organizer	Indonesia	Mr. Aris Kusnandar	Directorate of Metrology
46	Organizer	Indonesia	Mr. Nalendra	Balai Kemetrologian Bandung
47	Organizer	Indonesia	Ms. Yenni Marlin	Metrology Training Center
48	Organizer	Indonesia	Mr. Adi Chandra	Metrology Training Center
49	Organizer	Indonesia	Mr. Harry Santosa	Directorate of Metrology

Australian Government
National Measurement Institute

NMI V 1
Uniform Test Procedures for the Verification, Certification and In-service Inspection of Non-automatic Weighing Instruments

measurement.gov.au

First edition	—	2000 (NSC V 1)
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PREFACE

This fifth edition of NMI V 1 differs from the fourth edition in the following ways:

- Clause 4.1: MPEs for in-service inspection have been amended.
- Clauses 4.2 (supplementary weighing), 5.3.3 (zero setting of digital indicating instruments), 5.7 (accuracy of tare setting) and 5.8 (price computation): a new paragraph has been added requiring these tests only to be completed at: initial verification/certification, when any changes affecting the function occur, or at the discretion of the trade measurement authority.
- Clause 5.1.1.2 (equal arm instruments): steps 6 to 7 have been replaced and step 8 has been corrected to repeat steps 4 to 7 once more.
- Clause 5.2 (eccentricity): high capacity instruments have been replaced with instruments with a capacity greater than 100 kg.
- Clause 5.2.1: step 2 has been amended.
- Clause 5.2.2.2: a method to test eccentricity using substitution material has been added for instruments with a load receptor with more than four points of support.
- Figures 1 and 2: the central position has been removed from the eccentricity figures.
- Clause 5.2.3: step 1 had been amended.
- Clause 5.4 (weighing performance): the criteria for selecting decreasing loads has been reduced to three loads when weighing Max to Min.
- Clause 5.5.2 (discrimination): steps 6 and 7 have been amended.
- Clause 5.7 (accuracy of tare): step 1 has been added to test the capacity of the tare facility
- The test report has been modified to include eccentricity using the substitution method.

ABBREVIATIONS

d	actual scale interval
e	verification scale interval
E	error
G	gross value
I	indication
I_{sub}	indication of the substituted load
L	load
L_{sub}	actual calculated value of the substituted load
ΔL	additional load to next changeover point
Max	maximum capacity
Min	minimum capacity
MPE	maximum permissible error
n	number of points of support
N	net value
P	actual position
T	tare value
T_{Max}	maximum tare capacity
U	unit price
$\hat{=}$	international symbol of correspondence
$\lvert \pm 2 \rvert$	denotes absolute value

CONTENTS

EXPLANATION OF TERMS

For explanations of other terms see *NMI V 0. Uniform Test Procedures: General Information.*

Adjustment

Alteration of the measurement parameters to bring the instrument within the allowable MPEs for an instrument in use.

Calibration

The set of operations that (under specified conditions) establishes the relationship between the indicated or nominal value of an instrument and the corresponding known value of the measured quantity.

Certification

The examination of an instrument by a **certifier** (the holder, or an employee of the holder, of a servicing licence) in order to mark the instrument indicating that it conforms with the relevant test procedures.

- **Initial certification** is the certification of a new instrument by a certifier which does not bear a verification or certification mark and has never been verified or certified before.
- **Subsequent certification** is any certification of an instrument by a certifier because the mark is no longer valid due to such reasons as:
  - repairs or adjustments have been made that affect metrological performance; or
  - the mark has been defaced or removed.

In-service Inspection

The examination of an instrument by an **inspector or certifier** to check that:

- the verification or certification mark is valid; and
- the errors do not exceed the MPEs permitted for in-service inspection.

In-service inspection does not permit the instrument to be marked with a verification or certification mark.

Verification

The examination of an instrument by an **inspector** in order to mark the instrument indicating that it conforms with the relevant test procedures.

- **Initial verification** is the verification of a new instrument by an inspector which does not bear a verification or certification mark and has never been verified or certified before.
- **Subsequent verification** is any verification of an instrument by an inspector because the mark is no longer valid due to such reasons as:
  - repairs or adjustments have been made that affect metrological performance; or
  - the mark has been defaced or removed.
- **Re-verification** is the examination of an instrument by an inspector to check that:
  - the verification or certification mark is valid; and
  - the instrument has not been modified in any way since verification or certification;

  in order to mark the instrument indicating that it conforms with the relevant test procedures.

1. SCOPE

NMI V 1 describes the test procedures for the verification, certification and in-service inspection of non-automatic weighing instruments to ensure that they measure to within the maximum permissible errors specified in the National Measurement Regulations and that they comply with the certificate of approval.

These test procedures supersede those found in *Inspectors Handbook Number 2*.

Certificates of approval are based on *NMI R 76-1. Non-automatic Weighing Instruments. Part 1: Metrological and Technical Requirements — Tests*. Refer to NMI R 76-1 for all metrological and technical requirements. However the specifications for unclassified non-automatic weighing instruments are given in Appendix C. Unclassified non-automatic weighing instruments are instruments without a class mark, which comply with *General Specifications for Measuring Instruments to be used for Trade, Part 9* (superseded in May 1976) and the certificate/s of approval relating to that instrument.

All instruments must comply with the relevant Trade Measurement Act and Regulations.

2. EQUIPMENT

1. Certificate/s of approval.
2. Appropriate reference standards of measurement as described in Table 1.

   Notes:

   The reference standards of measurement are referred to as Inspectors' class 1, class 2 and class 3 standards, and they are often simply referred to as weights or standard weights. The permissible uncertainties associated with these standards are described in Schedule 9 of the *National Measurement Regulations 1999*.

   Inspectors' classes 1 and 2 standards are not constructed of iron; Inspectors' class 3 standards are constructed of iron.

   A set of reference standards of measurement of any class from 10 mg to 5 kg consists of the following: 1 × 10 mg, 2 × 20 mg, 1 × 50 mg, 1 × 100 mg, 2 × 200 mg, 1 × 500 mg, 1 × 1g, 2 × 2 g, 1 × 5g, 1 × 10 g, 2 × 20g, 1 × 50 g, 1 × 100g, 2 × 200 g, 1 × 500g, 1 × 1kg, 2 × 2kg and 1 × 5kg.
3. Suitable substitution load materials.

Table 1. Appropriate reference standards of measurement

Instrument class	Reference standards of measurement required
Classes 1 and 2	Inspectors' class 1 standards of appropriate denominations or masses with the appropriate uncertainties and variations i.e. not greater than one-third of the MPE for the load applied to the instrument being tested
Classes 3 and 4 with 30 kg capacity or less	One set of reference standards of measurement containing: • 50mg to 5kg – Inspectors' class 2; and • 10kg and 20kg – Inspectors' class 3
Classes 3 and 4 exceeding 30 kg capacity but not exceeding 3t	One set of reference standards of measurement containing: • 1g to 5kg – Inspectors' class 2; • 1t Inspectors' class 3; and • access to a further 2t of Inspectors' class 3 standards
Classes 3 and 4 exceeding 3t	One set of reference standards of measurement containing: • 100g to 5kg – Inspectors' class 2; • 3t Inspectors' class 3; and • access to further Inspectors' class 3 standards sufficient to test to 20% of the largest capacity weighing instrument certified

4. Current Regulation 13 certificates for all reference standards of measurement. Uncertainties and variations must be in accordance with the National Measurement Regulations. The combined uncertainties and variations must not be greater than one-third of the MPE for the load applied to the instrument being tested. Consult the licensing authority for more information.
5. Test report (see Appendix A).

3. VISUAL INSPECTION

Visually inspect the instrument and record details of the required data and characteristics of the instrument on the test report.

3.1 Required Data

1. Test report reference number.
2. Date of test.
3. Type of test: verification, certification or in-service inspection (for in-service inspection ensure that the verification/ certification mark is in place).
4. Name of owner/user.
5. Address of owner/user.
6. Name of contact on premises.
7. Address where instrument located, if applicable.
8. Description of instrument.
9. Manufacturer/s.
10. Model.
11. Instrument serial number.
12. Certificate/s of approval number.
13. The non-metrological characteristics including: Max, Min, verification scale interval (e) and accuracy class.

3.2 Characteristics of the Instrument

1. Does the instrument comply with its certificate/s of approval?
2. Is the instrument being used in an appropriate manner?
3. Are all mandatory descriptive markings clearly and permanently marked on a data plate?
4. Is the data plate fixed on the instrument?
5. Is the instrument complete?
6. Is the instrument broken?
7. Is the instrument clean?
8. Is the instrument operational?
9. Is the level-indicating device (if fitted) secured and functional?
10. Is the instrument level?
11. Are there any apparent obstructions to the operation of the instrument?
12. Is the instrument mounted on a firm base?
13. Does the operator (and where applicable, the customer) have a clear and unobstructed view of the indicating device and the whole weighing operation?
14. Is the instrument adequately protected against abnormal dust, air movement, vibrations, atmospheric conditions and any other influence likely to affect its performance?
15. If applicable, does the steelyard, tare bar or proportional weight comply with the mandatory requirements in respect to design and marking?
16. For overhead track weighing instruments: is the weigh rail of an acceptable form and correctly aligned?
17. For suspended weighing instruments: does it hang freely from the point of support, and are all transparent covers in good repair?
18. For weighbridges: does it comply with the relevant Trade Measurement (Weighbridge) Regulations?
19. For additional indicating devices: do they exactly repeat the information on the primary indication and does any device for price computation and/or ticket/label printing comply with the requirements of General Supplementary Certificate S1/0/A (or General Supplementary Certificates S1/0 and S2/0 for devices initially verified or certified prior to March 1992)?

4. STANDARD PROCEDURES

This section contains two standard procedures which are used a number of times. Whenever one of these procedures is referred to, an appropriate reference is made to them.

4.1 Maximum Permissible Error

The error limits for verification, certification and in-service inspection are shown in Table 2.

To determine whether or not the indication is within the MPE for a particular load the following procedure is conducted.

1. Determine the MPE for the load applied using Table 2.
2. Apply the load to the load receptor.
3. If the load and the indication are the same no further testing is required, as the indication is within the MPE in all cases. This is a: PASS
4. If the load and the indication are **not** the same then for:

(a) MPE of ±0.5*e* FAIL

(b) MPE of ±1*e*

(i) For a stable indication +1*e* from the load value apply an additional 0.5*e*. If the indication:

- **remains unchanged** the instrument is within MPE: PASS
- **changes up and stabilises** at +2*e* the instrument is outside MPE: FAIL

(ii) For a stable indication of –1*e* from the load value apply an additional 0.5*e*. If the indication:

- **changes up and stabilises** at the load value, the instrument is within MPE: PASS
- **remains unchanged** the instrument is outside MPE: FAIL

(iii) If the indication is greater than ±1*e* from the load value: FAIL

(c) MPE of ±1.5*e*

(i) for a stable indication of ±1*e* from the load value: PASS

(ii) for a stable indication that is more than ±1*e* from the load value: FAIL

4.2 Supplementary Weighing

This test is only required at:

- initial verification/certification;
- when any changes affect the initial zero setting function; or
- at the discretion of the trade measurement authority.

For instruments with an initial zero-setting device with a range greater than 20% of Max, a supplementary weighing test shall be performed using the upper limit of the range as zero point (NMI R 76-1, clause A.4.4.2).

Table 2. MPEs for verification, certification and in-service inspection

MPEs	For loads, m, expressed in verification scale intervals, e			
	Class 1	Class 2	Class 3	Class 4
±0.5*e*	$0 < m \leqslant 50\,000$	$0 < m \leqslant 5\,000$	$0 < m \leqslant 500$	$0 < m \leqslant 50$
±1*e*	$50\,000 < m \leqslant 200\,000$	$5\,000 < m \leqslant 20\,000$	$500 < m \leqslant 2\,000$	$50 < m \leqslant 200$
±1.5*e*	$200\,000 < m$	$20\,000 < m \leqslant 100\,000$	$2\,000 < m \leqslant 10\,000$	$200 < m \leqslant 1\,000$

When the certificate of approval states that the instrument has an initial zero-setting range greater than 20% the performance procedure for repeatability, eccentricity, weighing performance and the discrimination tests are repeated at the positive limit of the initial zero-setting range. Steps 1 and 2 are completed once only. Steps 3 to 5 are carried out for all additional tests.

1. Find the positive limit of the initial zero-setting range as follows:
   (a) Set the instrument to zero with the load receptor empty.
   (b) Apply a load equal to approximately 10% of Max on the load receptor and switch the main power supply to the instrument off and then back on.
   (c) If the instrument returns to zero:
      (i) increase the load by a small amount and switch the main power supply to the instrument off and then back on;
      (ii) continue this process increasing the load by a small amount each time until it does not re-zero.
   (d) If the instrument does not display zero:
      (i) reduce the load by a small amount and switch the main power supply off and then back on again;
      (ii) continue this process reducing the load by a small amount each time until the instrument displays zero.
   (e) Continue step (c) or (d) until the addition or removal of 10e resets the instrument to zero. This is the positive portion of the initial zero-setting range.
2. Record this load on the test report.
3. Apply a load equal to the positive limit of the initial zero-setting range.
4. Switch the main power supply to the instrument off and then on.
5. Repeat the appropriate test procedure and record the results on the test report.

5. TEST PROCEDURES

The following series of test procedures determine if the performance of a non-automatic weighing instrument meets requirements and whether the instrument requires adjustment or service.

Each test procedure is explained as a discrete test. However tests can be combined to expedite the testing procedure. A suggested sequence for testing is shown in clause 6.

If an instrument is going to be used in a different geographical location, correct the gravity setting for the intended location. The effects of gravity can be up to 0.3% depending on the variation in latitude and altitude between the location of calibration and the location of use. Refer to the manufacturer's instruction manual. Before certifying such an instrument it is advisable to check with the relevant trade measurement authority where the instrument will be used to ensure you meet their requirements.

5.1 Repeatability

The difference between the results of several weighings of the same load shall not be greater than the absolute value of the MPE of the instrument for that load (NMI R 76-1, clause 3.6.1).

This test procedure has been designed to check if the instrument will give a consistent result for the same load when it is applied a number of times in approximately the same position on the load receptor. For the result to be considered consistent the difference between the largest and smallest readings for the same load must be no greater than the absolute value of the MPE for that load. For example, if the MPE for the load is equal to $\pm 1e$, the absolute value of this error is $|\pm 1| e = 1e$. See Appendix B.1 for a worked example.

Use a load which is just less than the second MPE change point. If the instrument has more or less than 2 MPE change points use a load, which is approximately two-thirds maximum capacity.

Check the certificate/s of approval to determine if the instrument has an initial zero-setting range >20%. If it has, a supplementary test is required (see clause 4.2).

Determine whether the instrument is:

- non-self-indicating;
- analogue indicating; or
- digital indicating.

Select and conduct the appropriate test as documented below.

5.1.1 Non-self-indicating Instrument

5.1.1.1 Platform Instrument

1. Set the instrument to zero.
2. Apply the load to the load receptor.
3. Bring the indicating element to the equilibrium position using the proportional weights and/or steelyard poises and record the indication.
4. Remove the load from the load receptor.
5. Reset instrument to zero if the indication is not zero.
6. Apply the load to the load receptor.
7. Bring the indicating element to the equilibrium position using the proportional weights and/or steelyard poises and record the indication.
8. Repeat steps 4 to 7 **once** more.
9. Determine whether the instrument has passed or failed.
10. Record the results on the test report.

5.1.1.2 Equal Arm Instrument

1. Set the instrument to zero.
2. Apply the load to the goods receptor.
3. Apply standard weights to the load receptor until the indicating element is in the equilibrium position and record the mass.
4. Remove the load(s) from both load receptors.
5. Reset instrument to zero if the indication is not zero.
6. Repeat steps 2 to 4.
7. Check that the difference between the loads applied for each application does not exceed the absolute value of the MPE for the load applied.
8. Repeat steps 4 to 7 **once** more.
9. Determine whether the instrument has passed or failed.
10. Record the results on the test report.

5.1.2 Analogue Indicating Instrument

1. Set the instrument to zero.
2. Apply the load and record the indication.
3. Remove the load.
4. Reset instrument to zero if the indication is not showing zero.
5. Repeat steps 2 to 4 **two** more times.
6. Determine whether the instrument has passed or failed.
7. Record results on the test report.

5.1.3 Digital Indicating Instrument

1. Set the instrument to zero.
2. Apply the load and set the displayed reading to centre e in the following way:
   (a) apply 0.5e to the load receptor;
   (b) apply additional standard weights of 0.1e with the load until the indication changes up and stabilises; then
   (c) remove 0.5e leaving the additional standard weights with the load.
3. Record the indication.
4. Remove the load and the additional standard weights together as one load.
5. Reset instrument to zero if the indication is not showing zero.

6. Apply the load and the additional standard weights together as one load.
7. Record the indication and determine whether the instrument has passed or failed in accordance with the following requirements:
   (a) If the indication is the same as the previous test then simply repeat steps 4 to 6 with the same load. If all three loads show the same indication then this is a PASS.
   (b) If the indication for the second or third load changes and stabilises at $\pm 1e$ from the original indication then it will be necessary to find each load's actual position to determine whether the instrument has passed or failed. Appendix B.1 provides an example of how to find the actual position of a load.
   (c) If the indication for the second or third load changes and stabilises at a value greater than $\pm 1e$, then this is a FAIL.
8. Record results on the test report.

5.2 Eccentricity

The indications for different positions of a load shall meet the MPEs, when the instrument is tested according to NMI R 76-1, clauses 3.6.2.1 to 3.6.2.4.

Determine whether the load receptor on the instrument has:

- four or less points of support;
- more than four points of support;
- is subject to minimal off-centre loading;
- is subject to rolling loads.

Select and conduct the appropriate test/s outlined in clauses 5.2.1 to 5.2.4. This test is not applicable for instruments with scoop receptors where the product measured gathers at the centre.

Note: If an instrument is designed in such a way that loads may be applied in different manners, it may be appropriate to apply more than one of the tests.

It is suggested that large standard weights be used in preference to several small standard weights. Smaller weights shall be placed on top of larger weights, but unnecessary stacking should be avoided within the segment to be tested. Apply the load centrally in the segment if a single weight is used, and uniformly over the segment if several small weights are used.

When an instrument with a capacity greater than 100 kg shows good zero return during the repeatability test, i.e. it has not been necessary to re-zero the instrument before returning the load to the load receptor, then it is not necessary to completely unload the instrument before returning the load to the load receptor.

Check the certificate/s of approval to determine if the instrument has an initial zero-setting range >20%. If it has, a supplementary test is required (see clause 4.2).

5.2.1 Instrument with a Load Receptor with Four or Less Points of Support

On an instrument with a load receptor with four or less points of support, a load corresponding to one-third of the sum of the maximum capacity and the corresponding maximum additive tare effect shall be applied (NMI R 76-1, clause 3.6.2.1).

1. Determine the number of support points.
2. Divide the load receptor into n approximately equal segments, where n is the number of points of support. Note each point of support and assign numbers to the segments with position 1 to the left closest to the viewing position and then label the other segments in a clockwise direction as shown in Figure 1.
3. Zero the instrument.
4. Apply one-third Max plus maximum additive tare (if applicable) at position 1.
5. Record the load and the indication.
6. Determine if the indication is within the MPE for the load applied. Refer to clause 4.1 for MPE check.

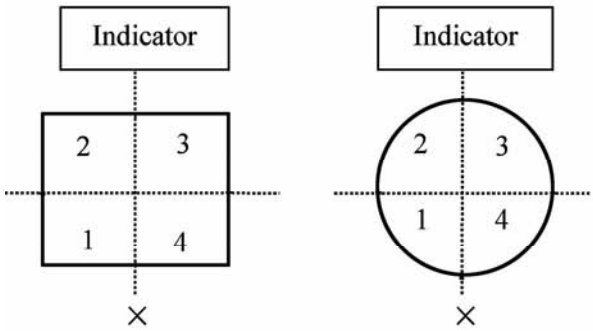


Figure 1. Position of each load
(× indicates the viewing position)

7. Remove the load.
8. Repeat steps 3 to 7 for all points of support.
9. Determine whether the instrument has passed or failed.
10. Record results on the test report.

5.2.2 Instrument with a Load Receptor with more than Four Points of Support (e.g. Road Weighbridge)

Eccentricity may be tested using **either**:

- standard weights in the non-substitution method (see clause 5.2.2.1); **or**
- a vehicle of known weight in the substitution method (see clause 5.2.2.2).

5.2.2.1 Non-substitution Method

1. Determine the number of support points.
2. Divide the load receptor into n approximately equal segments, where n is the number of points of support. Note each point of support and assign numbers to the segments with position 1 to the left closest to the viewing position and then label the other segments in a clockwise direction as shown in Figure 2.

   Note: For rail weighbridges, if two points of support are too close together for the load to be distributed as indicated above, double the load and distribute over twice the area on both sides of the axis connecting the two points of support.
3. Zero the instrument.
4. Apply $1/(n-1)$ Max plus Max additive tare (if applicable) at location 1.
5. Record the load and the indication.
6. Determine if the indication is within the MPE for the load applied. Refer to clause 4.1 for MPE check.
7. Remove the load.
8. Repeat steps 3 to 7 at all the other locations in turn for all points of support.
9. Determine whether the instrument has passed or failed.
10. Record results on the test report.

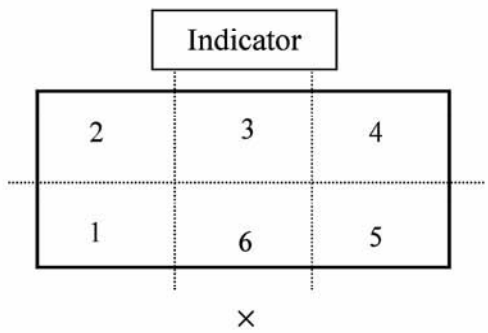


Figure 2. Position of each load
(× indicates the viewing position)

5.2.2.2 Substitution Method

Use a suitable vehicle (e.g. a fork lift) to move the loads. Ensure that its:

- wheel track width does not exceed 0.5 the width of the load receptor;
- wheel base length does not exceed $1/n$ the length of the load receptor; and
- gross weight is greater than 0.5 times and less than the nominated weight required in clause 5.2.2.1.

1. Determine the number of support points.
2. Divide the load receptor into n approximately equal segments, where n is the number of points of support. Note each point of support and assign numbers to the segments with position 1 to the left closest to the viewing position and then label the other segments in a clockwise direction as shown in Figure 2.

Note: For rail weighbridges, if two points of support are too close together for the load to be distributed as indicated, double the load and distribute over twice the area on both sides of the axis connecting the two points of support.

3. Determine $1/(n-1)$ Max plus Max additive tare (if applicable). If this value is:
   - **greater than** 5 tonne go to step 4;
   - **less than or equal to** 5 tonne, use the non-substitution method in clause 5.2.2.1.
4. Determine the mass required for testing. The substitution load shall be:
   (a) at least 0.5 of the weight determined in step 3; and
   (b) no more than the weight determined in step 3.
5. Zero the instrument.
6. Place standard weights onto the load receptor in the required position, equal to the weight of the vehicle or less, provided that it is within 0.3 tonne of the vehicle weight.
   Note: Ensure that the placement of the weights does not exceed the wheel track or base dimensions of the vehicle.
7. Apply additional standard weights of $0.1e$ to the load until the indication changes up and stabilises.
8. Record the additional load to the next change point (ΔL) and the indication (I).
9. Calculate the error in the weighbridge (E) for the load applied (L) using $E = I + 0.5e - \Delta L - L$.
10. Remove the standard weights and ΔL. Ensure that $10e$ is left on the load receptor for digital instruments to avoid zero tracking.
11. Drive the vehicle as close as possible to the footprint of the weights in step 6. Remove the $10e$ placed on the load receptor in step 9.
12. Record the indication for the substitution load (I_{sub}).
13. Add additional standard weights of $0.1e$ until the indication changes up and stabilises. Leave these additional standard weights (ΔL) with the substitution load.
14. Calculate the actual load (L_{sub}) of the substitution load using $L_{sub} = I_{sub} + 0.5e - \Delta L - E$.
15. Round the true value of L_{sub} to a whole scale interval $L_{sub(rounded)}$ by applying additional standard weights.
16. Reposition the vehicle to each point of support and record the indication.
17. Determine if the instrument passes or fails. To pass each indication for all point of support must are within $0.5e$ of the applied load L_{sub}.
    Note: If the instrument fails use the non-substitution method described in clause 5.2.2.1.
18. Record results on the test report.

5.2.3 Instrument with Special Load Receptors

On an instrument with a load receptor subject to minimal off-centre loading (e.g. tank or hopper) a load corresponding to one-tenth of the sum of the maximum capacity and the maximum additive tare effect shall be applied to each point of support (NMI R 76-1, clause 3.6.2.3).

1. Divide the load receptor into n approximately equal segments, where n is the number of points of support. Note each point of support and assign numbers to the segments with position 1 to the left closest to the viewing position and then label the other segments in a clockwise direction.
2. Zero the instrument.
3. Apply one-tenth Max plus Max additive tare (if applicable) at location 1.

4. Record the load and the indication.
5. Determine if the indication is within the MPE for the load applied. Refer to clause 4.1 for MPE check.
6. Remove the load.
7. Repeat steps 2 to 6 at all the other locations in turn.
8. Determine whether the instrument has passed or failed.
9. Record results on the test report.

5.2.4 Instrument Used for Weighing Rolling Loads

On an instrument used for weighing rolling loads (e.g. rail weighbridge, overhead track scale or rail suspension instrument) a rolling load corresponding to the usual rolling load, the heaviest and the most concentrated one which may be weighed, but not exceeding 0.8 times the sum of the maximum capacity and the maximum additive tare effect, shall be applied at different points on the load receptor (NMI R 76-1, clause 3.6.2.4).

For the following procedure it is recommended that rolling loads be used. However if these are not available then it is appropriate to use the equivalent static load.

1. Determine the positions 1, 2 and 3 at the beginning, middle and end of the load receptor respectively in the normal driving direction as shown in Figure 3. Indicate the location of each load by assigning a number to each position where the load will be placed. Position 1 is located furthest to your left when you view the indicator from a normal operating position. Positions 2 and 3 are numbered sequentially from position 1.

1	2	3	→ driving direction

Figure 3. Load positions

2. Zero the instrument.
3. Apply a rolling load no greater than 0.8 Max plus maximum additive tare (if applicable) at location 1. The load selected should be representative of the way the instrument is normally used. It is recommended that the load is no smaller than 0.5 Max and no greater than 0.8 Max.
4. Record the load and the indication.
5. Determine if the indication is within the MPE for the load applied. Refer to clause 4.1 for MPE check.
6. Remove the load.
7. Repeat steps 2 to 6 at positions 2 and 3 and then in the reverse direction 3, 2 and 1 in turn.
8. Determine whether the instrument has passed or failed.
9. Record results on the test report.

5.3 Zero Setting

After zero setting the effect of zero deviation on the result of the weighing shall not be more than 0.25*e*; however, on an instrument with auxiliary indicating devices this effect shall be not more than 0.5*d* (NMI R 76-1, clause 4.5.2).

Most instruments used for trade are either class 3 or 4 and are unlikely to have an auxiliary indicating device. However, if the instrument being tested has an auxiliary indicating device, then activate the zero-setting device as shown below. If the indication is reading anything other than zero, the instrument is outside the requirements of ±0.5*d* and has failed.

Determine whether the instrument is:
- non-self-indicating;
- analogue indicating; or
- digital indicating.

Select and conduct the appropriate test as documented below.

5.3.1 Non-self-indicating Instrument

The accuracy of the zero-setting device of a non-self-indicating instrument can be checked at any stage of testing the instrument, as it is essential to ensure that an instrument is set on zero before commencing any procedure.

At the completion of one of the test sequences when the entire load has been removed check visually that the instrument has returned to within ±0.25*e* of its equilibrium position. If it has not returned to its equilibrium position, apply 0.25*e* on the **appropriate** load receptor. Then:

- if the indicator has moved through the equilibrium point the instrument has passed; or
- if the indicator has not moved through the equilibrium point the instrument has failed.
- Record results on the test report.

5.3.2 Analogue Indicating Instrument

The accuracy of the zero-setting device of an instrument with analogue indication can be checked at any stage during the testing of the instrument, as it is essential to ensure that an instrument is set on zero before commencing any procedure. At the completion of one of the test sequences check visually that the instrument has returned to within ±0.25*e* of zero.

Record results on the test report.

5.3.3 Digital Indicating Instrument

The procedure used to determine the accuracy of zero setting is only required at:

- initial verification/certification;
- when any system changes affecting zero setting occur; or
- at the discretion of the trade measurement authority.

The procedure for accuracy of zero setting will depend on the instrument to be tested. If the instrument has:

- non-automatic or semi-automatic zero setting, follow the procedure in clause 5.3.3.1;
- automatic zero setting, follow the procedure in clause 5.3.3.2.

The majority of instruments currently being used have non-automatic or semi-automatic zero setting so in most cases follow the procedure in clause 5.3.3.1.

These tests are all conducted at 10*e* to take the instrument out of its zero-tracking range on the assumption that an electronic instrument will have zero tracking and it will be in operation.

At the completion of one of the test sequences check visually that the instrument has returned to within ±0.25*e* of zero.

5.3.3.1 Non-automatic and Semi-automatic Zero Setting

1. Activate the zero-setting device.
   (a) Load the instrument using a standard weight that is within the zero-setting range (this range varies between 0 to 4% of Max, in most cases this is ±2% around zero).
   (b) Add additional standard weights to take the total load just **below** the next changeover point.
2. Re-set the indication to zero using the zero-setting device.
3. Apply 10*e* to the load receptor.
4. Apply an additional 0.25*e*. If the indication:
   - **remains unchanged** go to step 5;
   - **changes and stabilises** at +1*e* from the original indication: FAIL
5. If the indication remains unchanged in step 4, apply an additional 0.5*e*. If the indication:
   - **changes and stabilises** at +1*e* from the original indication: PASS
   - **remains unchanged**: FAIL
6. Record results on the test report.

5.3.3.2 Automatic Zero Setting

1. Activate the automatic zero-setting device in the following way:
   (a) Apply a load of approximately 5*e*.
   (b) Zero the instrument and then remove the load.
   (c) Wait for the automatic zero setting to occur and the indication displays zero, this should take a minimum of 5 seconds.

   Note: If the display does not return to zero after 15 seconds, the

instrument does not have automatic zero setting, and you should carry out the procedure in clause 5.3.3.1.

2. Quickly apply 10*e* to the load receptor.
3. Apply an additional 0.25*e*. If the indication:
   - **remains unchanged** go to step 4;
   - **changes and stabilises** at +1*e* from the original indication: FAIL
4. If the indication remains unchanged in Step 3, apply an additional 0.5*e*. If the indication:
   - **changes and stabilises** at +1*e* from the original indication: PASS
   - **remains unchanged**: FAIL
5. Record results on the test report.

5.4 Weighing Performance

This test procedure is used to establish the weighing performance of the instrument at several loads. When loading and unloading weights, the load shall be progressively increased and decreased. The loads shall be applied evenly distributed over the platform.

When loading and unloading the instrument it must not be allowed to zero track. This is achieved by maintaining a suitable load on the instrument when loading and unloading. When the instruments normal mode of operation is weighing Max to Min, consider using five decreasing loads and three increasing loads. The MPEs for increasing and decreasing loads are shown in clause 4.1.

Criteria for selecting **increasing** loads:

- Use at least five different loads.
- The loads must span from minimum to maximum capacity for the instrument in approximately equal steps.
- Include the load at the MPE change points. When selecting the loads for a multi-interval instrument, which has partial weighing ranges, include all the MPE change points.
- Include any load where a unit weight or balance weight is used to engage another range.
- Do not select the load at the point where the scale interval changes. It is recommended that a load 5*e* less than this point be used.
- Do not select maximum capacity if over-range blanking occurs at that point. It is recommended that a load of 5*e* less than maximum be used.

Criteria for selecting **decreasing** loads:

- Use at least three different loads from maximum to minimum capacity for the instrument in approximately equal steps.

When testing instruments with a maximum capacity greater than 3 tonne, instead of standard weights any other constant load made up of substitution material may be used, provided that for instruments with maximum capacity:

- 3 t < Max ⩽ 15 t, standard weights to at least 3 tonne, or the maximum capacity which ever is the lesser, plus any additive tare are used; and
- >15 t, standard weights to at least 20% maximum capacity plus any additive tare are used.

It is essential that this test be carried out after the repeatability and eccentricity tests, particularly if substitution materials are used.

Check the certificate/s of approval to determine if the instrument has an initial zero-setting range >20%. If it has, a supplementary test is required (see clause 4.2).

5.4.1 Weighing Performance Not Using Substitution Load Material

1. Use the criteria in clause 5.4 to determine the loads to be used in this test.
2. Record these loads on the test report.
3. Zero the instrument.
4. Apply each load increasing from minimum to maximum.

5. Determine if the indication is within the MPE for each load applied (refer to clause 4.1 for MPE check).
6. After applying maximum capacity apply a load up to 10e to ensure over-range blanking is correctly set.
7. Remove the loads in a descending order until the minimum load has been removed.
8. Determine if the indication is within the MPE for each load applied (refer to clause 4.1 for MPE check).
9. Check that the instrument has returned to within ±0.25e of zero.
10. Determine whether the instrument has passed or failed.
11. Record results on the test report.

5.4.2 Weighing Performance Using Substitution Load Material

This test should only be conducted if the instrument has satisfied the requirements for both repeatability and eccentricity. It can be difficult to obtain substitution material of the same value as the standard weights. This procedure contains instructions for two methods:

- use **method A** when the substitution material is within −10% of standard weights used or −1 tonne, whichever is the smaller; and
- use **method B** when the substitution material is exactly equal to the standard weights.

The decision on which method to use will depend on the availability and suitability of the substitution material.

1. Use the criteria in clause 5.4 to determine the loads (minimum of 5) to be used in this test.
2. Record these loads on the test report.
3. Determine the number of substitutions required.
4. Zero the instrument.
5. Apply each load increasing from minimum up to maximum until a substitution load is required.
6. At each increasing and decreasing load determine if the indication is within the MPE for the load applied (refer to clause 4.1 for MPE check).
7. When the maximum available standard weights have been applied then apply additional standard weights of 0.1e until the indication changes up and stabilises.
8. Calculate the actual error using the formula $E = I + \frac{1}{2}e - \Delta L - L$, where:
   - E is the error in the weighbridge for the load applied;
   - I is the indication of the weighbridge;
   - L is the load applied; and
   - ΔL is the total of the additional standard weights required for the indication to change up and stabilise.
9. Use either method A or method B depending on the availability of substitution materials.

Method A

(a) Remove the standard weights and ΔL. For electronic instruments make sure that 10e is left on the load receptor to avoid zero tracking.

(b) Add substitution material until the indication, I_{sub}, is within −10% or −1 tonne, whichever is smaller, of the standard weights. The substitution material should be placed as close as possible to the same position on the load receptor.

(c) Record the indication for the substitution load (I_{sub}).

(d) Add additional standard weights of 0.1e until the indication changes up and stabilises. Leave these additional standard weights (ΔL) with the substitution load.

(e) Calculate the actual mass (L_{sub}) of the substitution load using the formula $L_{sub} = I_{sub} + \frac{1}{2}e - E$.
Note the error may be positive or negative.

(f) Use L_{sub} plus standard weights to make the next load required for this test.

See Appendix B.2 for a worked example of method A.

Method B

(a) Remove the standard weights. For electronic instruments make sure that $10e$ is left on the load receptor to avoid zero tracking.

(b) Leave ΔL on the load receptor.

(c) Replace the standard weights with substitution material. The substitution material should be placed as close as possible to the same position on the load receptor. Continue to add substitution material to the substitution load until the indication changes up and stabilises at the same indicated value determined previously.

(d) Remove ΔL. The substitution material (L_{sub}) will then be equal to the standard weights (L) it is replacing, i.e. $L_{sub} = L$.

(e) Use L_{sub} plus standard weights to make the next load required for this test.

10. Continue to apply loads using the standard weights and further substitution material using the same procedure as before.

11. After applying maximum capacity apply a load up to $10e$ to ensure over-range blanking is correctly set.

12. Remove the loads in a **convenient** descending order until the minimum load has been removed.

13. Check that the instrument has returned to within $\pm 0.25e$ of zero.

14. Determine whether the instrument has passed or failed.

15. Record results on the test report.

5.5 Discrimination

The actual scale interval for a class 1 or 2 digital instrument may be d and not e. As the majority of instruments to be verified will be class 3 or 4 where $e = d$, the procedures below have been simplified to refer only to e. If the instrument to be tested has $d \neq e$ then e becomes d in this instance for the whole procedure.

Check the certificate/s of approval to determine if the instrument has an initial zero-setting range >20%. If it has, a supplementary test is required (see clause 4.2).

Determine whether the instrument is:

- non-self-indicating;
- analogue indicating; or
- digital indicating.

Select and conduct the appropriate test as documented below.

5.5.1 Non-self-indicating Instrument

An extra load equivalent to 0.4 times the absolute value of the MPE for the applied load when gently placed on or withdrawn from the instrument at equilibrium shall produce a visible movement of the indicating element (NMI R 76-1, clause 3.8.1).

1. Zero the instrument.
2. Apply the load to the load receptor.
3. Bring the instrument to its equilibrium position.
4. Gently apply an extra load of 0.4 times the absolute value of the MPE for the applied load on the load receptor.
5. Observe if there is a visible amount of movement of the indicator.
6. Remove the load.
7. Determine whether the instrument has passed or failed.
8. Record results on the test report.

5.5.2 Analogue Indicating Instrument

An extra load equivalent to the absolute value of the MPE 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 the extra load (NMI R 76-1, clause 3.8.2.1).

1. Zero the instrument.
2. Apply a load to the load receptor and, bring the indication to a mark by applying a small amount of extra material to the load receptor.
3. Record the initial indication as I_1.
4. Gently apply an extra load equal to the absolute value of the MPE for the applied load on the load receptor.
5. Record the new indication as I_2.
6. Calculate the difference in the two indications; $I_2 - I_1$.
7. Ensure that the change in indication determined in step 6 is greater than or equal to 0.7 times the extra load added in step 4.
8. Determine whether the instrument has passed or failed.
9. Record results on the test report.

5.5.3 Digital Indicating Instrument

An additional load equal to 1.4 times the verification scale interval, when gently placed on or withdrawn from the instrument at equilibrium shall change the initial indication by one actual scale interval (NMI R 76-1, clause 3.8.2.2).

1. Zero the instrument.
2. Apply a load to the load receptor.
3. Apply additional standards weights of $0.1e$ until the indication changes up and stabilises.
4. Record this indication.
5. Gently apply a load of $1.4e$. The indication should increase by $1e$ to the next scale interval.
6. Determine whether the instrument has passed or failed.
7. Record results on the test report.

5.6 Sensitivity

The sensitivity test is only performed on non-self-indicating instruments.

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$\leqslant$30 kg; and
- 5 mm for an instrument of class 3 or 4 with Max >30 kg.

The sensitivity tests shall be carried out by placing extra loads with a slight impact, in order to eliminate the effects of discrimination threshold (NMI R 76-1, clause 4.1).

1. Zero the instrument.
2. Apply a load to the load receptor.
3. Bring the instrument to its equilibrium position.
4. Apply an extra load equal to the absolute value of the MPE for the applied load.
5. Measure and record the linear distance between the middle points of this reading and the reading without the extra load as the permanent displacement of the indication.
6. Determine whether the instrument has passed or failed.
7. Record results on the test report.

5.7 Accuracy of Tare Setting

This test is only required at:

- initial verification/certification;
- when any changes affecting the tare function occur; or
- at the discretion of the trade measurement authority.

A tare device shall permit setting the indication to zero with an accuracy better than:

- $\pm 0.25e$ for electronic instruments and any instrument with analogue indication;
- $\pm 0.5d$ for mechanical instruments with digital indication and instruments with auxiliary indicating devices.

On a multi-interval instrument e shall be replaced by e_1 (NMI R 76-1, clause 4.6.3).

For any tare load applied, the MPE for the remaining weighing capacity is the same as if no tare was being used (NMI R 76-1, clause 3.5.3.4).

1. Load the instrument using a weight that exceeds the tare capacity and ensure the tare facility is not functional.
2. Activate the tare-setting device in the following way:
   (a) Load the instrument using a weight that is within the tare-setting range.
   (b) Add additional weights to take the total load just **below** the next changeover point.
3. Re-set the indication to zero using the tare-setting device.
4. Check the accuracy of tare-setting in the following way:
   (a) Apply $10e$ to the load receptor.
   (b) Apply an additional $0.25e$. If the indication:
      - **remains unchanged** go to step 4(c);
      - **changes up and stabilises** $+1e$ from the original indication: FAIL
   (c) If the indication remains unchanged in step 4(b), apply an additional $0.5e$. If the indication:
      - **changes up and stabilises** $+1e$ from the original indication: PASS
      - **remains unchanged**: FAIL
   (d) Record results on the test report.
   (e) Remove $10e$, $0.25e$ and $0.5e$ to bring the indication back to zero.
5. Check the tare weighing device in the following way:
   (a) Ascertain whether the instrument has additive or subtractive tare.
   (b) Determine the instruments remaining capacity.
   (c) Add a load equal to full remaining capacity.
   (d) Determine if the indication is within the MPE. Refer to clause 4.1 for MPE check.
6. Record results on the test report.

5.8 Price Computation

This test is only required at:

- initial verification/certification;
- when any changes affecting the price function occur; or
- at the discretion of the trade measurement authority.

On a price-indicating instrument the supplementary primary indications are unit price and total price and, if applicable, number, unit price and total price for non-weighed articles, prices for non-weighed articles and price totals. Price charts, such as fan charts, are not subject to the requirements of these test procedures (NMI R 76-1, clause 4.15.1).

The total price shall be calculated by multiplication of weight and unit price, both as indicated by the instrument and shall be within ± 0.5 cents of the instrument's indicated total price. The device which performs the calculation is in any case considered a part of the instrument. The value of digital price scale intervals shall be 1 cent. All calculations shall be rounded to the nearest cent (NMI R 76-1, clause 4.15.3).

The price computation check is performed to check that the price calculating function is able to compute the total price. Conduct the check over a range of loads, and preferably during the weighing test.

1. Apply a load to the load receptor and input an appropriate unit price. See Appendix B.3 for a worked example of appropriate loads and unit prices.
2. Calculate the total price from the unit price and indicated weight.
3. Compare the calculated total price with the indicated price.
4. Repeat the test at least **four** more times.
5. Determine whether the instrument has passed or failed.
6. Record results on the test report.

6. SUGGESTED SEQUENCE FOR TESTING

1. Make sure any electronic instrument has been allowed to warm up for about half an hour.
2. Check the certificate/s of approval for supplementary tests (clause 4.2) and any additional tests required. Make provision for including these tests in the testing sequence.
3. Visually inspect the instrument and make a record of its metrological characteristics.
4. Conduct a repeatability test (clause 5.1).
5. Conduct an eccentricity test (clause 5.2).
6. Check accuracy of zero setting (clause 5.3) if applicable.
7. For non-self-indicating instruments, check zero setting (clause 5.3) and sensitivity (clause 5.6) during the repeatability test.
8. Determine the loads and conduct a weighing performance test (clause 5.4).
9. Conduct a discrimination test (clause 5.5) during the weighing performance test.
10. For digital indicating instruments conduct an accuracy of tare setting test (clause 5.7) if applicable.
11. Conduct a price computation check (clause 5.8) if applicable.
12. Determine whether the instrument has passed or failed.
13. Complete the test report.
14. Carry out anything else you need to do to complete the procedure. This may include:
    - obliterating verification, certification and control marks from the instrument; and
    - stamping the instrument (for more information on stamping see *NMI V 0. Uniform Test Procedures: General Information*).

APPENDIX A. TEST REPORT

Although the format of the test report may vary according to the individual needs and requirements of trade measurement authorities and licensees, the following test report contains the minimum amount of information that must be recorded.

If the certificate of approval requires additional tests, attach pages that record the results of these tests.

Number each page of the test report in the style shown at the top of each page.

Test Report for Non-automatic Weighing Instruments

Test report reference number ..... Date of test.....

Type of test (tick one) ☐ Verification ☐ Certification ☐ In-service inspection

For in-service inspection record the verification/certification mark.....

Name of owner/user .....

Address of owner/user .....

Name of contact on premises .....

Address where instrument located, if applicable .....

Description of instrument .....

Manufacturer/s .....Model .....

Serial number .....Certificate/s of approval number .....

Max .....Min.....

Verification scale interval (*e*).....Accuracy class .....

Does the instrument comply with its certificate/s of approval?	yes/no
Is the instrument being used in an appropriate manner?	yes/no
Are all mandatory descriptive markings clearly and permanently marked on the data plate?	yes/no
Is the data plate fixed on the instrument?	yes/no
Is the instrument complete?	yes/no
Is the instrument broken?	yes/no
Is the instrument clean?	yes/no
Is the instrument operational?	yes/no
Is the level-indicating device (if fitted) secured and functional?	yes/no/na
Is the instrument level?	yes/no
Are there any apparent obstructions to the operation of the instrument?	yes/no
Is the instrument mounted on a firm base?	yes/no
Does the operator (and where applicable, the customer) have a clear and unobstructed view of the indicating device and the whole weighing operation?	yes/no
Is the instrument adequately protected against abnormal dust, air movement, vibrations, atmospheric conditions and any other influence likely to affect its performance?	yes/no
If applicable, does the steelyard, tare bar or proportional weight comply with the mandatory requirements in respect to design and marking?	yes/no/na
For overhead track weighing instruments: is the weigh rail of acceptable form and correctly aligned?	yes/no/na
For suspended weighing instruments: does it hang freely and are all transparent covers in good repair?	yes/no/na
For weighbridges: does it comply with the relevant Trade Measurement (Weighbridge) Regulations?	yes/no/na
For additional indicating devices: do they exactly repeat the information on the primary indication and does any device for price computation and/or ticket/label printing comply with the requirements of the General Supplementary Certificates (see clause 3.2.19)?	yes/no/na

Test Results

Repeatability (clause 5.1)	Load	
	First reading	
	Second reading	
	Third reading	
	Difference	
	☐ Pass ☐ Fail	
Eccentricity (clause 5.2.2) using either:	☐ Pass ☐ Fail	

• **non-substitution** method (clause 5.2.2.1); **or**	Number of supports:			
	Load used:			
	Position 1		Position 7	
	Position 2		Position 8	
	Position 3		Position 9	
	Position 4		Position 10	
	Position 5		Position 11	
	Position 6		Position 12	

• **substitution** method (clause 5.2.2.2)	*MPE* change points:								
	Available standard weights:								
	L	Makeup of load	MPE	$\frac{1}{2}e$	I	ΔL	E	L_{sub}	L_{sub} (rounded)

Zero setting (clause 5.3)	☐ Pass ☐ Fail
Discrimination (clause 5.5)	☐ Pass ☐ Fail
Sensitivity (clause 5.6)	☐ Pass ☐ Fail ☐ na
Accuracy of tare setting (clause 5.7)	☐ Pass ☐ Fail ☐ na
Price computation (clause 5.8)	☐ Pass ☐ Fail ☐ na

Weighing performance (clause 5.4) using either:	☐ Pass ☐ Fail									
• **non-substitution** method (clause 5.4.1); **or**	Loads applied (minimum 5)						Indication up		Indication down	
	Over-range blanking ☐ Pass ☐ Fail									
• **substitution** method (clause 5.4.2)	Method used ☐ Method A ☐ Method B									
	MPE change points:									
	Available standard weights:									
	Substitution load			First:			Second:			Third:
	Up	L	Makeup of load	MPE	I	$\frac{1}{2}e$	ΔL	E	L_{sub}	L_{sub} (rounded)	Pass/fail /na
	Over-range blanking ☐ Pass ☐ Fail									
	Down	L		Makeup of load	MPE		I		Pass/fail	
Overall result	☐ **Pass** ☐ **Fail**									

Inspector's/certifier's name..... Identification number.....

Signature .....

Comments .....

.....

APPENDIX B. WORKED EXAMPLES

B.1 Repeatability Test — How to Find the Actual Position of a Load (see clause 5.1.3)

1. In the case where the indication for the second and/or third load changes and stabilises at $\pm 1e$ from the original indication the maximum difference may still be less than or equal to the absolute value of the *MPE*. In this case the actual value for each load must be found in order to determine if the instrument has passed or failed the test. You can calculate these actual values as shown in Figure B.1. As the first load was set at centre e the actual position P_1 is equal to the actual true value of the scale interval.
2. To find the actual value P_2 for the second position of the load, you first record the indication I_2. Then add additional weights of $0.1e$ until you reach the next changeover point. The total mass of the additional weights you add is ΔL_2. Substitute the values you have recorded in the formula $P_2 = I_2 + \frac{1}{2}e - \Delta L_2$.
3. Repeat using the values for the third position of the load to find $P_3 = I_3 + \frac{1}{2}e - \Delta L_3$.
4. To find the difference take the smallest value (in the example above this is P_1) from the largest value (in the example above this is P_3). If this value is:
   (a) less then the absolute value of the *MPE*, the instrument has: PASSED
   (b) greater then the absolute value of the *MPE*, the instrument has: FAILED

B.2 Weighing Performance using Substitution Load Material used (see clause 5.4.2)

In this example method A is used.

The instrument is a Class 3 non-automatic weighbridge with a maximum capacity of 60 t and an e value of 0.02 t (20 kg).

There are 16 t of standard weights including suitable standard weights to achieve minimum capacity and indication changeover points. Also available is a test rig and forklift (Sub 1) with a gross mass of approximately 16 t and a truck loaded with gravel (Sub 2) with a gross mass of approximately 32 t.

In selecting the loads you are required to use at least 5 loads, to include Min, first *MPE* change point, second *MPE* change, Max and appropriate substitution loads. The loads for the example shown below are: 0.4 t, 10 t, 16 t, 32 t, 40 t, 44 t and near Max.

This example demonstrates both a graphical and mathematical solutions for the substitution loads only. The graphical representation shows where the load actually is and how the errors associated with that load can be determined. The mathematical solution simply confirms the findings of the graphical solution by inserting the values into the appropriate formula.

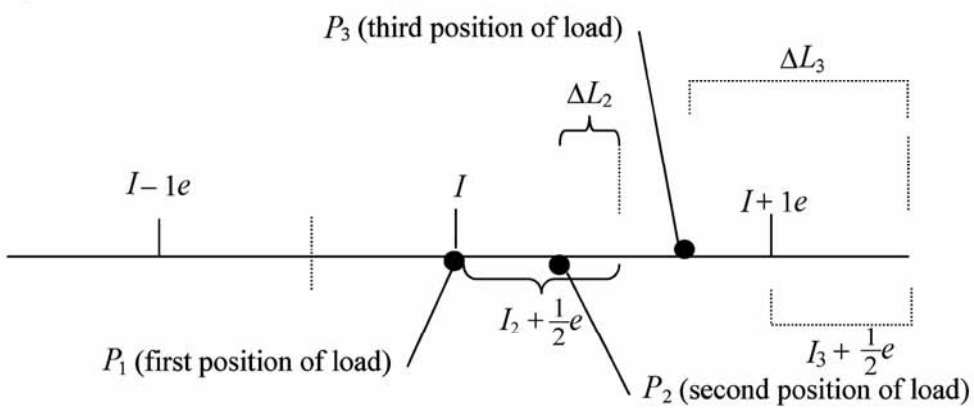


Figure B.1. Finding the actual position of the load

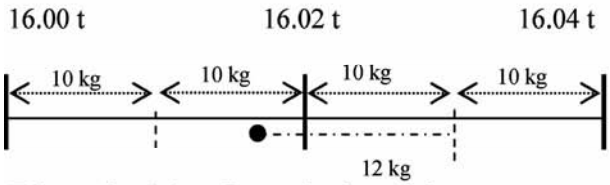
The results have been recorded on a sample test report at the end of this example.

The first test load applied is equal to the minimum capacity of the instrument. This load is made up of standard weights and equals 0.4 t.

The second test load applied is equal to the first *MPE* change point. The load is made up of standard weights and equals 10 t.

The third test load applied is made up of standard weights and equals 16 t.

Because this is the point at which the first substitution is required you need to determine the error of the weighbridge using the 16 t of standard weights. This is represented graphically as follows:



When the 16 t of standard weights were placed on the weighbridge the indication displays 16.02 t (*I*). A further 12 kg of standard weights (ΔL) was required to take it to the next indication changeover point and stabilise.

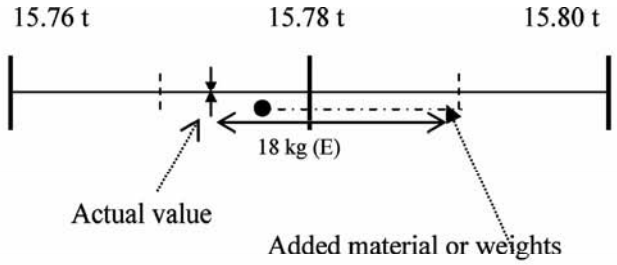
Using the diagram you can see it is 10 kg plus another 8 kg more than 16 t. Graphically we can see the error is +0.018 t or 18 kg.

Mathematically using the formula

$E = I + \frac{1}{2}e - \Delta L - L$ we can calculate E as

$= 16.02\text{ t} + 0.01\text{ t} - 0.012\text{ t} - 16.00\text{ t}$
$= +0.018\text{ t}$ or $+18$ kg.

Next determine the true value of the first substitution load (Sub 1). Do this by placing the substitution load on the weighbridge. At this point the indication displays 15.78 t. This is represented graphically as follows:



Take the weighbridge to the next indication changeover point, which is 15.79 t. Do this by adding more substitution material or weights. This additional material or weights becomes part of the substitution load. The actual value of the substitution load is the indication changeover point less the error.

The calculated error in the weighbridge at this point is +18 kg. Taking this into account the point labelled actual is the true position for the substitution load. Graphically we can see the value of the substitution load is:

15.79 t – 0.018 t (error) = 15.772 t

Mathematically using the formula

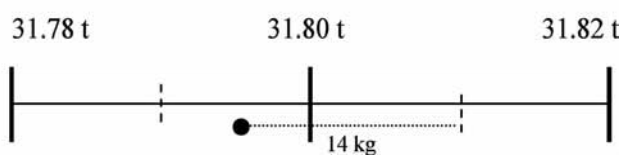
$L_{sub} = I_{sub} + \frac{1}{2}e - E$ (at 16 t) we can calculate

$L_{sub} = 15.78\text{ t} + 0.01\text{ t} - 0.018\text{ t} = 15.772\text{ t}.$

Bring the substitution load to a round figure by adding an additional 8 kg of standard weights. The substitution load now becomes 15.78 t (true value of the substitution load).

The fourth test load applied is made up of Sub 1 plus 16 t of standard weights. This load equals 31.78 t.

Calculate the error for the weighbridge when using this new known load of 31.78 t. When the load is placed on the weighbridge the indication reads 31.80 t (*I*). This is represented graphically as follows:



A further 14 kg of standard weights (ΔL) was required to take it to the next indication changeover point and stabilise. Using the diagram you can see it is 16 kg more than 31.78 t. Graphically we can see the error is +0.016 t or 16 kg.

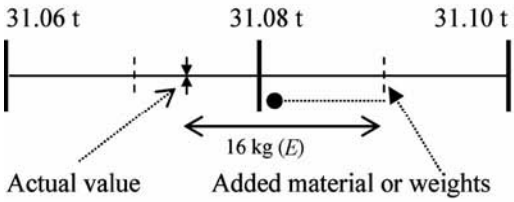
Mathematically using the formula $E = I + \frac{1}{2}e - \Delta L - L$ we can calculate E as

$= 31.80\text{ t} + 0.010\text{ t} - 0.014\text{ t} - 31.78\text{ t}$

$= +0.016\text{ t}$ or 16 kg.

Now you know the error at this point of the weighbridge you can apply the second substitution load (Sub 2).

Next determine the true value of the second substitution load (Sub 2). Do this by placing the substitution load on the weighbridge. At this point the indication displays 31.08 t. This is represented graphically as follows:



Take the weighbridge to the next indication changeover point which is 31.09 t. Do this by adding more substitution material or standard weights. This additional material or standard weights becomes part of the substitution load. The actual value of the substitution load is the indication changeover point less the error.

The calculated error in the weighbridge at this point is 16 kg. Taking this into account the point labelled actual is the true position for the substitution load. Graphically we can see the value of the substitution load is 31.09 t – 0.016 t (error) = 31.074 t.

Mathematically using the formula

$L_{sub} = I_{sub} + \frac{1}{2}e - E$ (at 31.78 t)

$= 31.08\text{ t} + 0.01\text{ t} - 0.016\text{ t} = 31.074\text{ t}.$

Bring the substitution load to a round figure by adding an additional 6 kg of standard weights. The substitution load now becomes 31.08 t (true value of the substitution load).

The fifth test load applied is close to second *MPE* change point. It is made up of Sub 2 plus 8 t of standard weights. This load equals 39.08 t.

The sixth test load applied is made up of Sub 2 plus 16 t of standard weights. This load equals 47.08 t.

Remove standard weights and add the test rig and forklift that was used for Sub 1. This becomes Sub 3. Determine true value of L_{sub} through method previously used.

The final test load applied is made up of Sub 3 plus 13 t of standard weights. This load equals 59.86 t.

After you have carried out the test at 59.86 t apply a load up to 10e above max. in order to check that the over-range blanking is correctly set.

Remove all the loads in a convenient manner applying the appropriate MPEs for the load and ensuring zero returns to within ±0.25e.

B.3 Appropriate Loads and Unit Prices for Price Computing (see clause 5.8)

The instrument shall be tested from the minimum to maximum capacities, as well as the smallest up to the largest unit price. Table B.1 provides an example of appropriate loads and unit prices.

Table B.1. Calculation of the total price from the unit price and indicated weight

Indicated weight (kg)	Unit price ($/kg)	Total price ($)
0.40	0.01	0.00
0.50	0.01	0.01
1.00	123.45	123.45
1.00	678.90	678.90
Test up to Max capacity	Test up to Max unit price	Calculated result

Results of Weighing Performance Using Substitution Load

Instrument description: Class 3 static weighbridge

Max: 60 t

Verification scale interval (e): 0.02 t

Method used	Method A
MPE change points	10 t, 40 t
Available standard weights	16 t
First substitution load (Sub 1)	Test rig + forklift (approximate mass16 t)
Second substitution load (Sub 2)	Gravel truck (approximate mass 32 t)
Third substitution load	Test rig + forklift + gravel truck (approx 48 t)

L	Makeup of load	*MPE*	I	$\frac{1}{2}e$	ΔL	E	L_{sub}	L_{sub} (rounded)	Pass/fail/ na
0.4 t	weights	±0.01 t	0.4 t	—	—	—	—	—	pass
10 t	weights	±0.01 t	10 t	—	—	—	—	—	pass
16 t	weights	±0.02 t	16.02 t	0.01 t	0.012 t	+0.018 t	—	—	pass
Sub 1	Test rig + forklift	—	15.78 t	0.01 t	—	+0.018 t	15.772 t	**15.78 t**	na
31.78 t	Sub 1 + 16 t	±0.02 t	31.80 t	0.01 t	0.014 t	+0.016 t	—	—	pass
Sub 2	Gravel truck	—	31.08 t	0.01 t	—	+0.016 t	31.074 t	**31.08 t**	na
39.08 t	Sub 2 + 8 t	±0.02 t	39.10 t	0.01 t	0.016 t	+0.014 t	—	—	pass
47.08 t	Sub 2 + 16 t	±0.03 t	47.10 t	0.01 t	0.016 t	+0.014	—	—	pass
Sub 3	Sub 1 + Sub 2	—	46.86 t	0.01 t	—	+0.014	46.856 t	46.86 t	na
59.86 t	Sub 3 + 13 t	±0.03 t	59.88 t	0.01 t	0.018 t	+0.012 t	—	—	pass
Over-range blanking									pass

L	Makeup of load	*MPE*	I	
59.86 t	Sub 3 + 13 t	±0.03 t	59.86 t	pass
28.78 t	59.86 t – Sub 2	±0.02 t	28.78 t	pass
13 t	28.78 t – Sub 1	±0.02 t	13.00 t	pass
10 t	13 t – 3 t	±0.01 t	10.00 t	pass
0 t	—	±0.25e	0	pass

APPENDIX C. SPECIFICATIONS FOR UNCLASSIFIED NON-AUTOMATIC WEIGHING INSTRUMENTS

Appendix C gives the specifications for unclassified non-automatic weighing instruments. These are instruments without a class mark, which comply with *General Specifications for Measuring Instruments to be used for Trade, Part 9* (superseded in May 1976) and the certificate/s of approval relating to that instrument.

C.1 General

Every instrument shall:

(a) be clearly and permanently marked with the capacity and scale interval, on or in the vicinity of any mass-indicating device;

(b) be clearly and permanently marked with the manufacturer's name or mark and serial number;

(c) have a lead cap (stamp plug) located in one of the following positions:
  (i) on the beam of a beam-scale vertically under or over the fulcrum knife edge;
  (ii) on the beam of a counter scale;
  (iii) on the steelyard, dial or housing of other weighing instruments; and

(d) have every steelyard, lever or beam fitted so as to prevent excessive lateral play, the instrument being correct if the knife edges and bearings are moved within their limits of movement.

C.2 Removal or Inter-changeability of Parts

Instruments shall not have parts, the removal of which would affect their accuracy, if they can be used without such parts; or have parts the interchange or reversal of which would affect their accuracy.

C.3 Scale Marks

The scale marks (including the price scale marks) on an indicating device shall be straight lines of uniform thickness, uniformly spaced and with an aspect ratio of not less than two. The principal lines shall be numbered clearly and legibly and marked by longer lines; and, unless every scale mark is numbered progressively from zero, there shall not be more than four consecutive marks of the same length.

This applies provided that on fan-shaped dials a uniform variation in scale spacing shall be permitted such that the mean width of the 5 largest consecutive divisions shall not be more than 20% larger than the mean width of the 5 smallest consecutive divisions.

The scale marks on any steelyard shall be parallel and, if there are notches, shall be correctly placed with reference to such notches; notches shall be uniformly spaced in one plane at right angles to the shank and be protected by a notch-protection bar.

C.4 Form of Digits on Indicators

Indications shall permit readings by simple juxtaposition of the digits and all digits comprising mass, unit price and price indications shall be oriented in the normal viewing position, apart from instruments with fan-shaped dials.

The height, or apparent height, of digits comprising the mass and price indications on analogue indicators shall not be less than three times the minimum reading distance in millimetres, without being less than 2 mm.

The height, or apparent height, of digits comprising the mass and price indications on digital indicators (other than ticket printers) and semi-digital indicators shall not be less than three times the minimum reading distance in millimetres, without being less than 5 mm.

C.5 Printing Requirements

Printed data shall be clear and indelible. If the mass or quantity and price are printed, the unit price or price per item shall also be printed. The decimal marker shall be printed by the printer and shall not be pre-printed on the ticket.

Where statements (numerical value and designation) of mass or quantity, unit price or price per item and price are on one horizontal line there shall be a space of at least one digit between each statement.

Numbers and their designations shall be horizontally aligned. The designations of mass or quantity, unit price or price per item and price shall follow the same horizontal alignment as the numerals or shall all be located immediately above or below them.

When printing a number with a value less than one, the decimal marker shall be preceded by at least one zero digit (one preferred).

C.6 Value of Scale Interval

The value of the scale interval shall be in the form 1, 2 or 5×10^k milligrams, grams, kilograms or tonnes, where k is a positive or negative whole number or zero.

C.7 Scale Spacing

The minimum scale spacing shall be:

(a) 1.25 mm for dial-indicating devices;

(b) 1.75 mm for optical-projection indicating devices;

(c) 5 mm for numerical-analogue indicating devices with or without optical projection;

(d) 2 mm for tare bars and steelyards; and

(e) 2.5 mm for spring balances of a capacity exceeding 15 kg and crane weighers on which the dial is an integral part of the mechanism suspended from the hook.

C.8 Reading Aperture for Analogue Indicators

When an analogue indicator is viewed through an aperture, the width of the aperture, measured along the line of travel of the indicator, shall be such as to allow the numbers of at least two numbered scale marks to be visible at all times.

C.9 Reading Index

C.9.1 Length

The tip of the index shall reach the shortest scale marks, but shall not extend beyond the middle of the marks. However this clause shall not apply to:

(a) an index consisting of a fine wire or thread stretched over the scale marks, including a hairline on a ground glass screen;

(b) an instrument in which the index moves over two concentric sets of scale marks; and

(c) an instrument in which the index is in the same plane as the scale marks and is not more than 1 mm from any scale mark.

C.9.2 Width

The width of the index shall not be greater than the thickness of the scale marks.

C.9.3 Index Stops

Stops shall limit the travel of the index but shall permit the index to move at least four scale intervals below zero and above maximum self-indicating capacity. On fan-shaped dials and single-revolution dials, there shall be no scale marks below zero and above maximum dial capacity.

C.9.4 Parallax

The distance between the dial and the index shall not exceed the width of a scale interval, without exceeding 2 mm.

C.10 Lowest Permitted Maximum Capacity

The lowest permitted maximum capacity, in relation to the scale interval, for a self-indicating instrument or a graduated non-self-indicating instrument is given in Table C.1, provided that:

(a) on a spring balance of 50 kg capacity or over, the scale interval shall not be more than 1/200 of the capacity;

(b) for instruments used only for the weighing of persons, freight, coal,

solid fuel, or animals, or for pit-bank weighing instruments, the lowest permitted maximum capacity shall be half that specified in Table C.1; and

(c) scale intervals of 1 kg are permitted to be used on instruments for determining the weight of excess baggage at airports.

Table C.1. Lowest permitted Max

Scale interval	Lowest permitted maximum capacity	Minimum number of scale intervals[a,b]
5 g	250 g	50
10 g	500 g	50
20 g	2 kg	100
50 g	10 kg	200
100 g	25 kg	250
200 g	100 kg	500
500 g	250 kg	500
1 kg	500 kg	500
2 kg	1 t	500
5 kg	2.5 t	500
10 kg	10 t	1 000
20 kg	20 t	1 000
50 kg	50 t	1 000
100 kg	100 t	1 000

[a] Number of scale intervals = capacity/scale interval

[b] Not applicable to centre-zero instruments

C.11 Zero Setting

A zero-setting device, if fitted, shall comply with the following rules:

(a) the range shall not be greater than 4% of the maximum capacity of the instrument and it shall be possible to adjust zero to the middle of the range;

(b) it shall be possible to adjust zero to within 0.25*e*; and

(c) where zero setting is effected by means of loose material in a balancing chamber, the loose material shall be secured (sealed) and totally enclosed and shall be prevented from shifting position in such a way as to affect the accuracy of the instrument.

C.12 Taring Device

Where an instrument is fitted with a taring device:

(a) a single taring device, if graduated, shall have the mass value of the scale interval corresponding with that of the mass indicator provided that it may be ungraduated except for a zero scale mark and a scale mark at its capacity; and

(b) a major taring device shall be graduated in multiples of the capacity of the minor taring device.

C.13 Counterpoise Masses

A counterpoise mass shall be clearly and permanently marked with the international symbol of correspondence (≙) and the equivalent mass denomination, e.g. ≙5 kg, and also with the serial number of the instrument.

C.14 Centre-zero Dials

Instruments fitted with a centre-zero dial shall have at least one scale mark on each side of the zero scale mark, the mass value of which shall be marked on the dial.

C.15 Maximum Permissible Error

Every instrument under test shall retain its equilibrium, give constant mass indications on the repeated application of any given load, be correct for increasing or decreasing loads, and indicate zero within ±0.25*e* when the load is removed.

The MPEs for self-indicating instruments and graduated non-self-indicating instruments, with the instrument adjusted to zero within ±0.25*e* at no load, shall be:

(a) 0.5*e* for the first 500*e*;

(b) 1*e* over 500 and up to 2 000*e*; and

(c) 1.5*e* over 2 000*e*.

The MPEs for balances, beam scales and counter scales are as shown in Table C.2. The MPE for even-arm scales shall be half the amount specified in Table C.2 for loads up to

half capacity and the whole amount specified for loads from half to maximum capacity.

C.16 Additional Requirements for Particular Types of Instruments

C.16.1 Balances and Beam Scales

Every beam scale shall:

(a) be clearly and permanently marked class B or class C;
(b) be correct when a load of one-third the capacity of the instrument is in the middle or near the edge of the pan; and
(c) have a pointer for indicating the position of equilibrium.

C.16.2 Counter Scales

Where the beam of a counter scale has two side-members they shall be connected by at least two crossbars.

A counter scale shall be correct when a load of one-third the capacity of the instrument is placed successively against the mid-point of each edge of the load receptor.

Where the goods pan is in the form of a scoop, the scale shall be correct when half-full load is placed against the middle of the back of the scoop and the other half-full load in any position on the scoop, the weights being entirely on the mass pan but in any position on it.

C.16.3 Spring Balances

Every spring balance of a capacity of less than 50 kg shall be provided with a double-sided dial which is covered by transparent material, provided that this paragraph shall not apply to spring balances which are permanently marked 'for use by itinerant vendors only' or 'hawker's scale only'.

If the pan of a spring balance is below the spring, the instrument shall be correct wherever the load is placed on the pan.

If the pan of a spring balance is above the spring, the instrument shall be correct when a load of one-third the capacity of the instrument is placed successively against the mid-point of each edge of the load receptor.

A spring balance with a multi-revolution index shall have a vertical slide with denominated scale marks indicating mass values representing complete revolutions of the reading index.

Table C.2. MPEs for balances, beam scales and counter scales

Capacity	*MPE*			
	Balances	Beam scales		Counter scales
		Class B	Class C	
5 g	±4 mg	±10 mg	—	—
25 g	±6 mg	±15 mg	±60 mg	—
50 g	—	±20 mg	—	—
100 g	—	±30 mg	—	—
250 g	—	±60 mg	±240 mg	—
500 g	±12 mg	±100 mg	±400 mg	±1.5 g
1 kg	—	±150 mg	±600 mg	±2.5 g
2 kg	—	±250 mg	±1 g	±3.5 g
5 kg	±70 mg	±500 mg	±2 g	±6 g
10 kg	—	±1 g	±4 g	±8 g
15 kg	—	±1.5 g	±6 g	±10 g
25 kg	±120 mg	±2.5 g	±10 g	±15 g
50 kg	—	±4.5 g	±20 g	±25 g

C.16.4 Self-indicating Counter Machines

Every analogue self-indicating machine for retail counter use shall be provided with mass indications on the purchaser's and the vendor's side of the instrument, covered by transparent material, provided that this paragraph shall not apply to machines used only for ascertaining freight charges and permanently marked 'not for trading direct with the public' or similar wording.

An instrument with analogue indication shall not have a taring device unless the words 'not for retail counter use' are permanently marked on the instrument.

The value of analogue price scale intervals shall be 1, 2, 5 or 10 cents, provided that:

- 2 cent scale intervals are not permitted for unit prices less than 60 cents per kilogram;
- 5 cent scale intervals are not permitted for unit prices less than 150 cents per kilogram; and
- 10 cent scale intervals are not permitted for unit prices less than 300 cents per kilogram;

No price shall be repeated in any column or row, provided that this paragraph shall not apply to any floating column up to 10 cents per kilogram.

An instrument with analogue indication may only be used for prices which can be read directly from the chart and for prices obtained by adding or subtracting the values from two unit-price columns or rows, or by doubling or halving the values from one unit-price column or row.

A self-indicating counter machine shall be correct when a load of one-third the capacity of the instrument is placed successively against the mid-point of each edge of the load receptor.

On a self-indicating counter machine where the goods pan is in the form of a scoop, the scale shall be correct when half-full load is placed against the middle of the back of the scoop and half-full load in any position on the scoop, the weights being entirely on the mass pan but in any position on it.

Construction of Weighbridge

Name: *Zhong Ruilin*

Org. : *National Institute of Metrology, China*

June 7,2010

Construction of Weighbridge
Construction Requirements in OIML R76

OIML R76 2006(E) 4.1

Suitability
- •Suitability for application
- •Suitability for use
- •Suitability for verification

Security
- •Fraudulent use
- •Accidental breakdown and maladjustment
- •Controls
- •Securing of components and pre-set controls
- •Adjustment
- •Gravity compensation

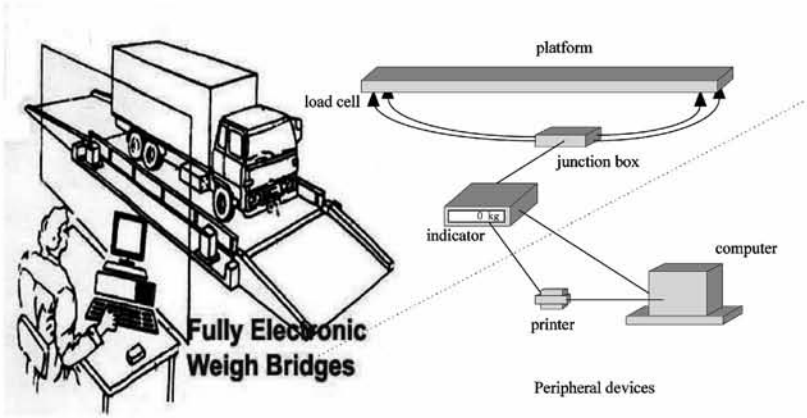
Construction of Weighbridge
Construction Requirements in OIML R76

- An instrument shall be designed to suit its intended purpose of use
- OIML R76 are intended to specify the performance, not the design of an instrument, so that technical progress is not impeded

Construction of weighbridge
some examples



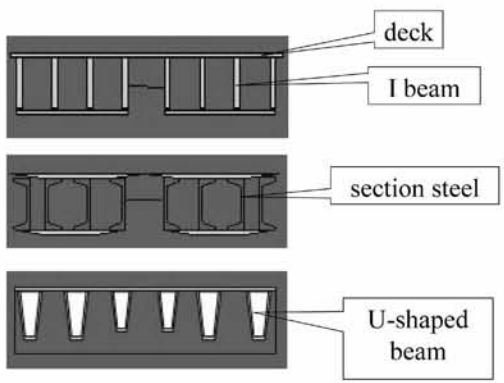

Construction of weighbridge
typical components



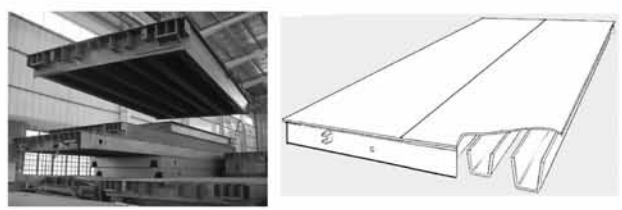
Construction of weighbridge
platform

- support vehicle
- made by steel, concrete, and other material with same strength
- skid resistant surface

Construction of weighbridge
platform (*made by steel*)



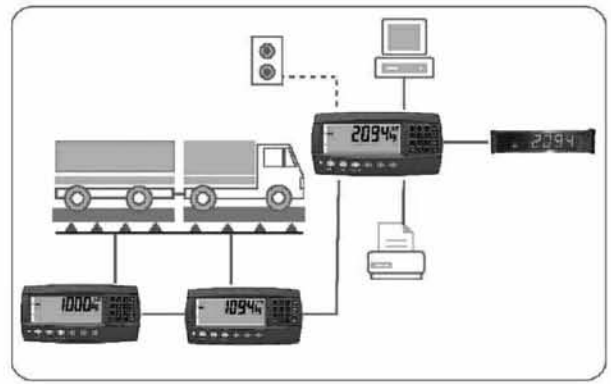
Construction of weighbridge
platform (*made by steel*)



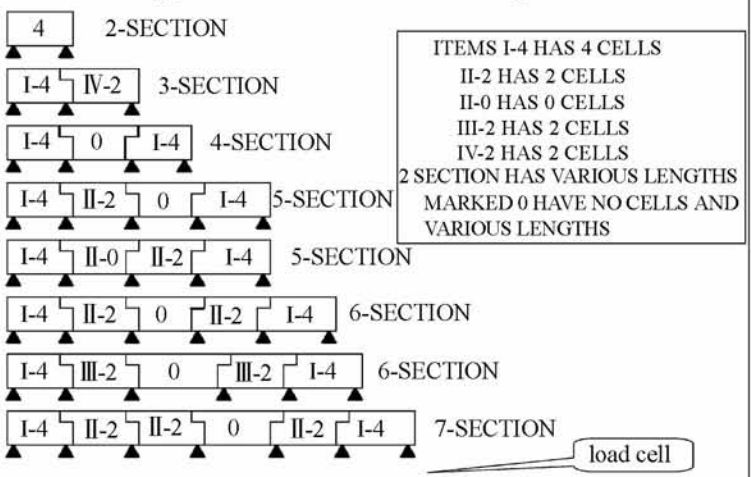
U-shaped beam

Construction of weighbridge
platform (*made by concrete*)

Construction of weighbridge
multi platforms combination



Construction of weighbridge
Typical combination examples



Construction of weighbridge
load cell

Force transducer which, after taking into account the effects of the acceleration of gravity and air buoyancy at the location of its use, measures mass by converting the measured quantity (mass) into another measured quantity (output) .

Construction of weighbridge
load cell

Meet requirements of OIML R60

Construction of weighbridge
Indicator

Electronic device of an instrument that may perform the analog-to-digital conversion of the output signal of the load cell, and which further processes the data, and displays the weighing result in units of mass.

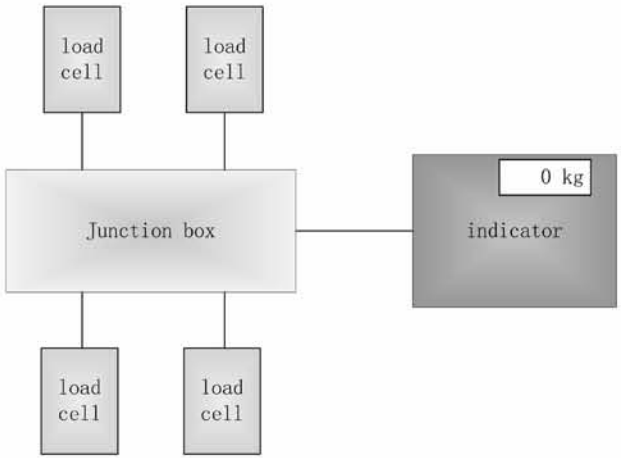
Construction of weighbridge
Indicator

Meet requirements of OIML R76

Construction of weighbridge
Junction box

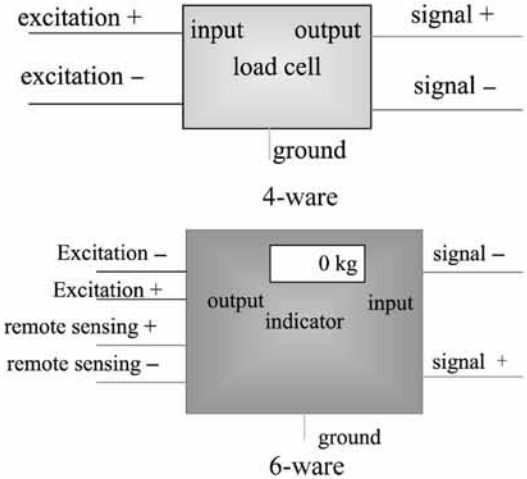
Construction of weighbridge

Typical connection



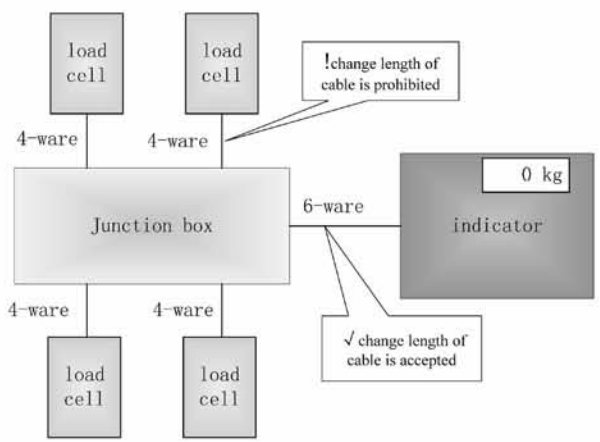
Construction of weighbridge

Typical connection



Construction of weighbridge

Typical connection



Construction of weighbridge

Peripheral devices (no mandatory)

—— Printer

—— Computer

—— Other devices (such as Data storage device)

Installation of weighbridge
pit type and pit-less type

pit type

pit-less type

Thank you!

Type Evaluation of Weighbridge based on OIML R76 2006(E)

Name: *Zhong Ruilin*

Org. : *National Institute of Metrology, China*

June 10,2010

Contents

- Terminology
- Metrological Requirements
- Type Evaluation

Terminology
Type (pattern) Evaluation

Defined in International Vocabulary of Terms in Legal Metrology, edition 2000

systematic examination and testing of the performance of one or more specimens of an identified type (pattern) of measuring instruments against documented requirements, the results of which are contained in the evaluation report, in order to determine whether the type may be approved.

Terminology
Definition of NAWI

Defined in T.1.2

Instrument that requires the intervention of an operator during the weighing process to decide that the weighing result is acceptable.

Terminology
Definition of NAWI

Non-automatic weighing instrument

Intelligent actions by the operator that affect the result are:

——Taking an action when an indication is stable

——adjusting the mass of the weighed load

——make a decision regarding the acceptance of each weighing result

——observing the indication or releasing a print out

Terminology
Definition of NAWI

- OIML R50 Continuous totalizing automatic weighing instruments (belt weighers)
- OIML R51 Automatic catchweighing instruments
- OIML R61 Automatic gravimetric filling instruments
- OIML R106 Automatic rail-weighbridges
- OIML R107 Discontinuous totalizing automatic weighing instruments (totalizing hopper weighers)
- OIML R134 Automatic instruments for weighing road vehicles in motion and measuring axle loads

In cases of doubt: Definitions for automatic weighing instruments in OIML R 50, R 51, R 61, R 106, R 107 and R 134 have higher priority!

Terminology
Family

Defined in T.3.5

Identifiable group of weighing instruments or modules belonging to the same manufactured type that have the same design features and metrological principles for measurement (for example the same type of indicator, the same type of design of load cell and load transmitting device) but which may differ in some metrological and technical performance characteristics (e.g. Max, Min, *e*, *d*, accuracy class, etc.).

Terminology
family

Identifiable group of weighing instruments or modules with:

——the same manufactured type

——the same design features

——the same metrological principles for measurement

——some different metrological and technical performance characteristics

reduced testing required at type examination

Terminology
select EUTs of a family

——highest number of verification scale intervals (n)

——smallest verification scale interval (e)

——ratio between the tested capacities (Max) shall not exceed 10

——$Max \leqslant 5 \times Max_{test} \times (n_{test} / n)$

——Highest accuracy class (perhaps additional tests necessary for lower accuracy classes)

——…

Summary of characteristics see OIML R76 3.10.4.6

Terminology
EUT selection example

A family of weighbridge:

	Variant	Max	*e*	*d*	*n*
Accuracy class III Temperature range: –10℃ / +40 ℃	1	30 000 kg	20 kg	20 kg	1 500
	2	40 000 kg	20 kg	20 kg	2 000
	3	60 000 kg	20 kg	20 kg	3 000
	4	100 000 kg	50 kg	50 kg	2 000

Metrology Requirements
Metrological characteristics of NAWIs

- Accuracy class
- Maximum capacity, Max
- Minimum capacity, Min
- Verification scale intervals, *e*
- Number of verification scale intervals, *n*
  n = Max/*e*
- Actual scale intervals, *d*
- Maximum tare effect, *T*
- temperature limits
- …

Metrological Requirements
Accuracy class

Special accuracy	(I)
High accuracy	(II)
Medium accuracy	(III)
Ordinary accuracy	(IIII)

Metrological Requirements
classification

Accuracy class	Verification scale interval, *e*	Number of verification scale intervals, *n* = Max/*e*		Minimum capacity, Min (Lower limit)
		minimum	maximum	
Special (I)	0.001 g ≤ *e*	50 000	—	100 *e*
High (II)	0.001 g ≤ *e* ≤ 0.05 g 0.1 g ≤ *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 (IIII)	5 g ≤ *e*	100	1 000	10 *e*

Metrological Requirements
Verification scale interval

Type of instrument	Verification scale interval
Graduated, without auxiliary indicating device	*e* = *d*
Graduated, with auxiliary indicating device	*e* is chosen by the manufacturer according to the requirements in 3.2 and 3.4.2
Non-graduated	*e* is chosen by the manufacturer according to the requirements in 3.2

Metrological Requirements
Verification scale interval

Only class I and class II weighing instruments may be fitted with an auxiliary indicating device

For weighing instruments with auxiliary indicating device

$$d < e \leqslant 10\,d$$
$$e = 10^k \text{ kg}$$

Metrological Requirements
MPE

Maximum permissible errors on initial verification	For loads, m, expressed in verification scale intervals, e			
	Class I	Class II	Class III	Class IIII
± 0.5 e	$0 \leqslant m \leqslant 50\,000$	$0 \leqslant m \leqslant 5\,000$	$0 \leqslant m \leqslant 500$	$0 \leqslant m \leqslant 50$
± 1.0 e	$50\,000 < m \leqslant 200\,000$	$5\,000 < m \leqslant 20\,000$	$500 < m \leqslant 2\,000$	$50 < m \leqslant 200$
± 1.5 e	$200\,000 < m$	$20\,000 < m \leqslant 100\,000$	$2\,000 < m \leqslant 10\,000$	$200 < m \leqslant 1\,000$

MPE apply to gross loads and when a tare device is in operation they apply to the net loads. The maximum permissible errors do not apply to calculated net values when a preset tare device is in operation.

Metrological Requirements
Test Standards

- Weights
- Auxiliary verification device
- Substitution of standard weights at verification

Metrological Requirements
Test Standards

- Substitution of standard weights at verification

  When testing instruments at the place of use (application), instead of standard weights any other constant load may be used, provided that standard weights of at least 1/2 Max are used.

  If the repeatability error is not greater than 0.3 e, the portion of standard weights may be reduced to 1/3 Max.

  If the repeatability error is not greater than 0.2 e, this portion may be reduced to 1/5 Max.

  The repeatability error has to be determined with a load (weights or any other load) of about the value where the substitution is made, by placing it 3 times on the load receptor.

Metrological requirements
Temperature limits

Not stated in descriptive mark

−10 ℃/ +40 ℃

Special temperature limits

The range within these limits shall be at least equal to

5 ℃ for instruments of class I

15 ℃ for instruments of class II

30 ℃ for instruments of classes III and IIII

Metrological requirements
Typical tests in Type Evaluation

	Tests		Report page	PASSED	FAILED	Remarks
1	Weighing performance	Initial				
2	Temperature effect on no-load indication					
3.1	Eccentricity using weights					
3.2	Eccentricity using a rolling load					
4.1	Discrimination					
4.2	Sensitivity					
5	Repeatability					
6.1	Zero return					
6.2	Creep					
7	Stability of equilibrium	Printing, storage				
		Zero-setting, tare balancing				
8	Tilting					
9	Tare					
10	Warm-up time					
11	Voltage variations					
12.1	AC mains voltage dips and short interruptions					
12.2	Electrical bursts	a) Mains power supply lines				
		b) I/O circuits and communication lines				
12.3	Surges	a) AC mains power supply				
		b) Any other kind of power supply lines				
12.4	Electrostatic discharges	a) Direct application				
		b) Indirect application (contact discharges only)				
12.5	Immunity to radiated electromagnetic fields					
12.6	Immunity to conducted radio-frequency fields					
12.7	Electrical transients on instruments powered from a road vehicle power supply	a) Conduction along supply lines of external 12 V and 24 V batteries				
		b) Capacitive and inductive coupling via lines other than supply lines				
13	Damp heat, steady state	a) Initial test (at reference temperature)				
		b) Test at high temperature and 85 % relative humidity				
		c) Final test (at reference temperature)				
14	Span stability					
15	Endurance	a) Initial test				
		c) Final test				
	EXAMINATIONS					
16	Examination of the construction					
17	Checklist					

OIML R76-2 2007(E) page 9

Type Evaluation of Weighbridge
Difficulties

- Too large dimension to put into climate chamber!
- Can not do weighing test in climate chamber!

How to do type evaluation of a weighbridge?

Type Evaluation Test
Module approach

Testing of modules instead of a complete instrument possible where

——testing the instrument as a whole is difficult or impossible

——modules are manufactured and/or placed on the market as separate units to be incorporated in a complete instrument

——the applicant wants to have a variety of modules included in the approved type

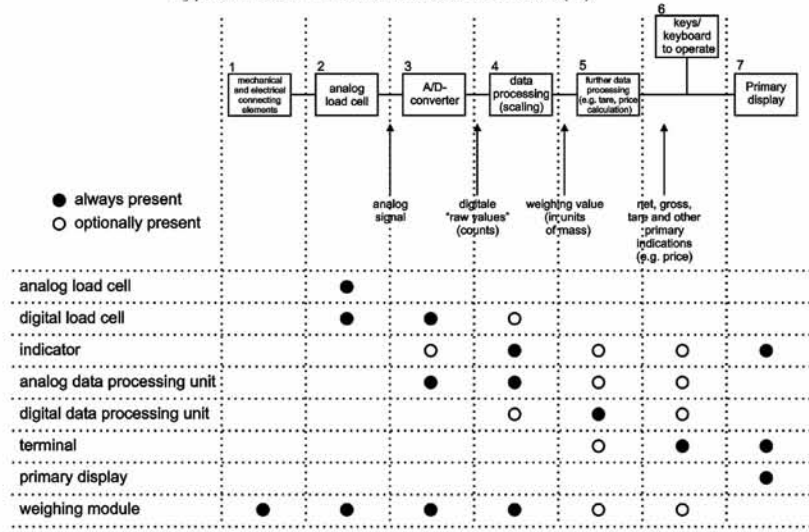
Type Evaluation Test
Module

- *Defined in T.2.2*

  Identifiable part of an instrument that performs a specific function or functions, and that can be separately evaluated according to specific metrological and technical performance requirements in the relevant Recommendation. The modules of a weighing instrument are subject to specified partial error limits.

Type Evaluation Test
Module

Typical module in OIML R76 edition 2006(E)



Metrological characteristics
module

- Analog load cell
- Digital load cell } OIML R60
- Indicator
- Analog data processing unit } Annex C
- Digital data processing unit
- Terminal
- Primary display } Annex D
- Weighing module — Annex E

Type Evaluation Test
Module Approach

typical modules in weighbridge:

——indicator

——load cell

typical apportioning of errors:

——indicator $p_{ind} = 0.7$

——load cell $p_{LC} = 0.5$

——mechanical and electrical connecting elements $p_{con} = 0.5$

Type Evaluation Test
Modular Approach

modules are tested separately, and respective OIML Certificate exists

- load cell
  OIML R60 2000 edition 2000(E)
- indicator
  OIML R76 edition 2006(E)

OIML certificate of load cell or indicator can be used in type evaluation without repeated testing .

Type Evaluation
Modular Approach

Procedure:

——Check OIML certificates of load cell and indicator

——Prepare data of

- weighbridge
- load cell (NH type load cell not allowed)
- Indicator

——Compatibility check (Annex F)

Type Evaluation of Weighbridge
Test on Complete Weighbridge

- Tests
  - ——**Weighing performance**
  - ——**Eccentricity**
  - ——Discrimination
  - ——**Repeatability**
  - ——Zero return
  - ——Creep
  - ——Stability of equilibrium
  - ——**Tare**
  - ——Warm-up
- Examination of the construction
- Checklist

Type Evaluation of Weighbridge
Evaluation of Error

- For instruments with a device for displaying the indication with a smaller scale interval

  $E = I - L$
- For instruments without a device for displaying the indication with a smaller scale interval

  $P = I + \frac{1}{2}e - \Delta L$

  $E = P - L = I + \frac{1}{2}e - \Delta L - L$

The corrected error prior to rounding is:

$E_c = E - E_0$

Type Evaluation of Weighbridge

Weighing Performance

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

Number of loads:
Determining the initial intrinsic error : at least 10
Others: at least 5

Loads include:

0,Min, Max, at of near Values at which *MPE* changes

If the instrument has zero-tracking, use a small load (typically, $10e$) to determine E_0.

Type Evaluation of Weighbridge

Eccentricity

- Determine E_0
- Use test load [about Max /$(n-1)$] to test on each segment
- Calculate each corrected error

Type Evaluation of Weighbridge

Repeatability

- 2 series, one with a load about 50% Max, the other Max
- Max <1 000 kg, each series 10 weighings
  otherwise, at least 3 weighings

Type Evaluation of Weighbridge

Tare

weighing tests should be performed on instruments with

subtractive tare: with one tare value between 1/3 and 2/3 of maximum tare

additive tare: with two tare values of about 1/3 and 3/3 of maximum tare effect

Type Evaluation of weighbridge

- Documents examination
- Each module (load cells, indicator) has OIML certificate
- Compatibility check
- Test on complete weighbridge

→ Type evaluation

Thank you!

Presentation of Verification of NAWI Weighbridges

Yibin Fu
Guangzhou Institute of Measurement and Testing Technology, China
June, 2010

- How weighbridges are verified in China?
- Reference documents for the verification :
  《National Verification Regulation of Digital Indicating Weighing Instrument》(JJG 539—1997),
  《General Verification Regulation for Nonautomatic Weighing Instrument》(JJG 555—1996),which is equivalent to OIML R76.

Verification Items (Example):

e=*d*: 20 kg
Max: 50 t

1. Testing of Zero Device accuracy

Measured Error of indication	*MPE*
0.0*e*	0.25*e*

2. Discrimination test: An additional load equal to 1.4*d*,when gently placed on the instrument at equilibrium at the point of Min , 1/2Max and Max capacity shall change the indication.

3. Eccentricity test (testing load=1/3Max) :

(Position)

(Obverse)

Measured Error of indication	*MPE*
① +0.1*e* ② −0.2*e*	±1.0*e*
③ +0.3*e* ④ +0.3*e*	

4. Weighing test

(span verified)	Measured Error of indication	*MPE*
0≤*m*≤500*e*	+0.2*e*	±0.5*e*
500*e*<*m*≤2 000*e*	+0.5*e*	±1.0*e*
2 000*e*<*m*≤Max	+1.0*e*	±1.5*e*

5. Tare Weighing test

(span verified)	Measured Error of indication	*MPE*
0≤*m*≤500*e*	+0.2*e*	±0.5*e*
500*e*<*m*≤2 000*e*	+0.5*e*	±1.0*e*
2 000*e*<*m*≤Max	+1.0*e*	±1.5*e*

6. Repeatability test

Result	*MPE*
0.5*e*	1.0*e*

Ways of Verification:

1. *Weighbridge test car*

2. *Lifting Weights of 20kg all by human-hand*

3. *Cranes and other machines*

Skills from experiences

1. Use a test car to finish repeatability test ?

2. Finish Eccentricity test before weighing test ?

   As we all know, most causes for the disqualification of weighbridges come from the eccentricity. So we may finish eccentricity test before weighing test to avoid doing unnecessary test.

3. Attach importance to the metrology supervision managements of weighbridges.

   Sealing of the weighbridges to avoiding fraudulent use.

Weighbridge is a measuring instrument subject to compulsory verification in China. In Guangdong province, there are about 6 000 weighbridges being in use. Administration of Quality and Technology Supervision of Guangdong Province will carry out a supervision inspection periodically besides routine verification of the weighbridges. Anyone who cheat in using weighbridge or refuses to have the weighbridge verified on time will be punished according to the METROLOGY LAW OF THE PEOPLE'S REPUBLIC OF CHINA.

- And also, in order to enhance the metrological management level and the consciousness of metrology law, the Administration will help those who use the weighbridge set up metrological management system and provide training courses about the metrology . Besides that, Administration will guide the manufacturers of weighbridges to set up the enterprise metrology assurence system.

My training plan for dissemination of the information when I return to China?

1. Review the electronic copies of the training materials and the notes. Then integrate and translate them to the Chinese version.

2. Set up the training programme in my institute with the corresponding inspectors or industry representatives who verify weighbridges in my economy.

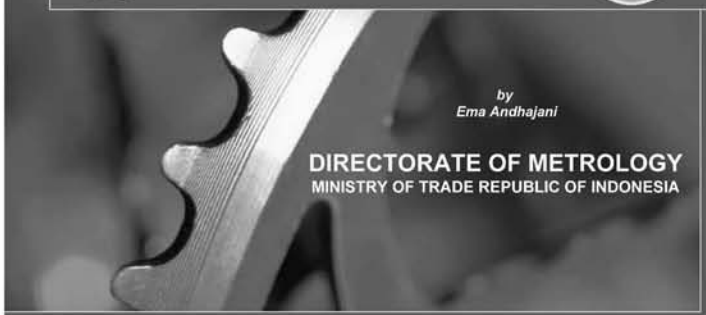
3. Share what I've learned during the training course in Bandung and the experiences of participants from other economies.

4. Integrate the situation of weighbridges and the verification regulation in my economy with OIML Recommendation R76 , try the best to enhance the technical capabilities/skills of the inspectors in my institute and improve the metrology management level of weighbridges in my area.

End of the Presentation

Thank you!

Overview of NAWI Weighbridges in Indonesia



by
Ema Andhajani

DIRECTORATE OF METROLOGY
MINISTRY OF TRADE REPUBLIC OF INDONESIA

Indonesia

Land areas	**: 1,922,570 km²**	**DOM Location**	**: Bandung (BDG)**
Populations	**: 228 million**	**Approx. 200 km from Jakarta**	
Capital City	**: Jakarta (JKT)**		

Self Introduction

Directorate of Metrology (DOM)

DOM belongs to Directorate General of Domestic Trade, the Ministry of Trade Republic of Indonesia.

Kementrian Perdagangan Republik Indonesia

Direktorat Metrologi

Self Introduction

My position is staff in metrological technique and my responsible are planning and designing standard of procedure, technical regulations and research for legally measuring instrument.

Organization of Directorate of Metrology (DOM)

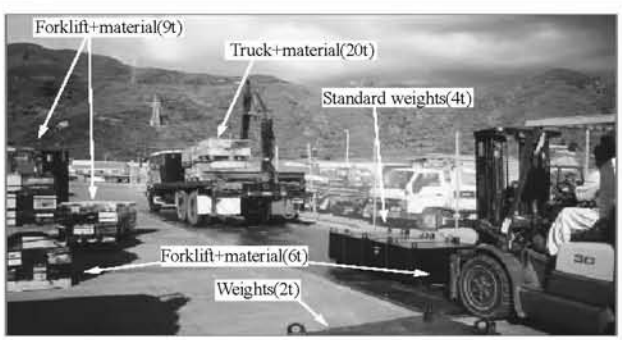
- Planning and Policy making for legal metrology;
- Technical service for issuing certificate of type approval;
- Enforcement of the measurement law;
- Administration and Supervision of legal metrology system;
- Dissemination of legal metrology system;
- International cooperation

Usage weighbridges in Indonesia

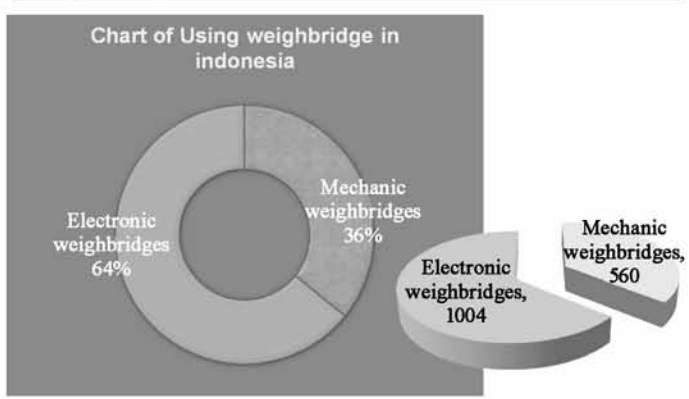
Weighbridge is a set tool to deliberate goods vehicle or truck that can be attached in fixed or tool that moved pin-cushion moves (portable) that used by to know vehicle weight and payload that used by for street observation or to measure level of payload at industry, port, mining or agriculture.

Truckscale = weighbridge

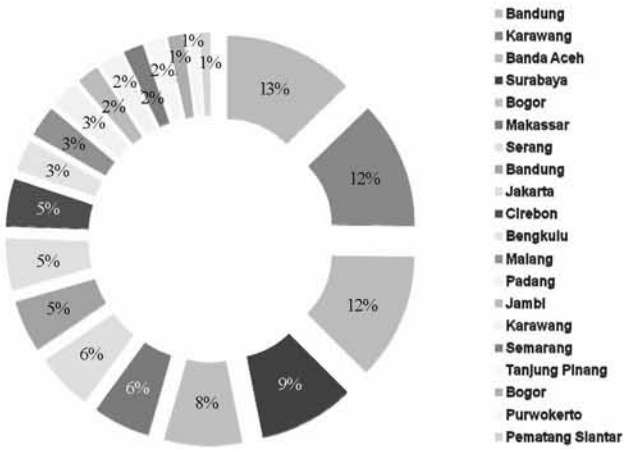
weighbridges



Source: OIML BULLETIN VOLUME X L I I I • NUMBER 2 • A P R I L 2002



20 biggest cities that re-verification weighbridge



Spreading the usage of weighbridge in Indonesia

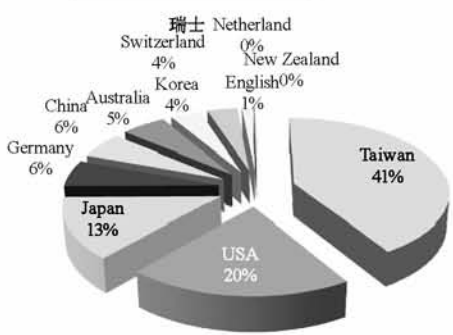
Legal Metrology System for weighbridge

Legal Metrology Sytems

Type Approval	Legal Metrology Bodies (DOM → Metrological Technique) Issuing Type Approval Certificate Issuing Authorities (DOM →Examination unit of Measuring Instrument) Perform Type test & Issuing test report
Initial Verification	Designated verification bodies are in charge initial verification of weighbridges
Re-Verification	——Each provincial government (Regional Verification Offices) are in charge of weighbridges of periodical verification & Inspection of weighbridges ——Duration of re-verification weighbridges : 1 year

Type Approval of Weighbridge

Type Approval of electronic indicator



VERIFICATION ITEM

1. Repeatability
2. Eccentricity
3. Discrimination
4. Zero Accuracy
   ——Automatic Zero Setting
   ——Non-Automatic Zero Setting
5. Weighing Test

The compliance to the international standars/ recommendations for weighbridges

To implement the recommendations OIML have been adopted into technical requirements and adjusted to the conditions of the weighbridge in indonesia

—— R76-1 (2006) NAWI
part 1 Metrological and Technical Requirement
—— R76-2 (2007) NAWI
part 2 Test Report Format

Problem

Very lack of amount of standard weights when execute verification and re-verification so load of standard weights substitution to test weighbridge is changed with standar substitution of weights/ ballast that has not yet fulfilled international standard.

THANK YOU

Terima Kasih

Overview of the Legal Metrology System on Non-Automatic Weighing Instruments (NAWI) in Malaysia

07- 10 June 2010 Bandung, Indonesia

Ms. Suliana Ghazalli
Metrologist
National Metrology Lab
SIRIM Berhad, MALAYSIA

SIRIM

Organizational Structure Of SIRIM Berhad

Introduction

Your Solution T

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.

National Metrology Lab

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 SERVICES & METROLOGY ADVISORY 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

LEGAL METROLOGY IN MALAYSIA

In Malaysia legal metrology for different fields is administered by different authorities under different enforcement Acts.

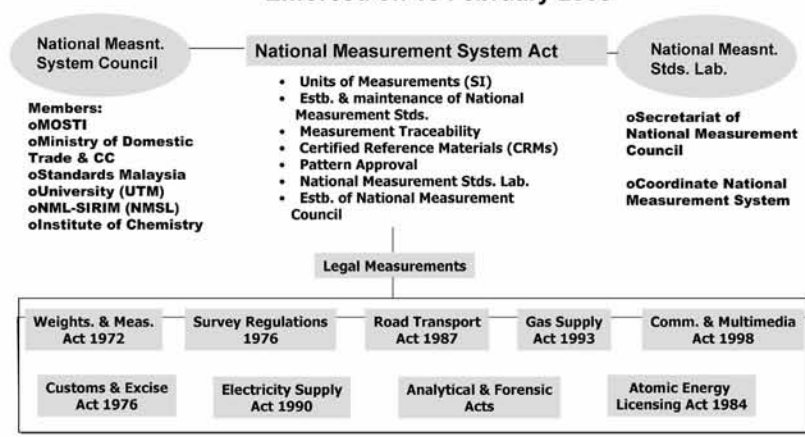
Legal Metrology authorities in Malaysia

- Enforcement Division, Ministry of Domestic Trade, Co-operatives and Consumerism—Weights and Measures Act 1972
- Road Transport Dept., & Royal Malaysian Police—Road Transport Act 1987
- Dept. of Environment & Road Transport Dept.—Environment Act
- Energy Commission—Electricity Supply Act 1990 & Gas Supply Act 1993
- Communications and Multimedia Commission—Communications and Multimedia Act 1998

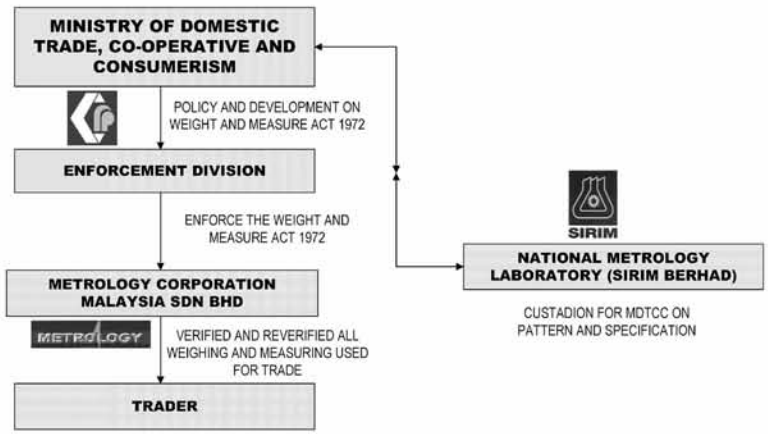
National Measurement System Act 2007

- Passed by Parliament in July 2007
- Publication in the Gazette on 30 August 2007
- Came into operation on 15 February 2008
- Enforced under the Ministry of Science, Technology and Innovation (MOSTI), Malaysia
- An umbrella Act for all legislation

The National Measurement System Act 2007 Enforced on 15 February 2008



METADOLOGY OF METROLOGY SYSTEM IN MALAYSIA – WMA 1972



OVERVIEW OF WEIGHTS AND MEASURES ACT 1972

- Enforced by the Ministry of Domestic Trade, Cooperative and Consumerism
- Prescribes the SI units as the only legal unit in Malaysia
- Regulates weighing and measuring instruments for trade use

CUSTODIAN WEIGHTS AND MEASURES

The National Measurement Standards Laboratory has been appointed as the Custodian of Weights and Measures under the Weights and Measures (Amendment) Act 2007.

Note: Under the NMS Act 2007 NML-SIRIM was appointed as the National Measurement Standards Laboratory

Verification of Measuring Instruments for Trade Use

Privatization of technical verification services

Dec. 2002——Weights and Measures Act 1972 was amended. Minister given the power to issue a license to a private company to carry out the technical verification services

1 April, 2005——Appointed company takes over the technical verification services

OVERVIEW OF WEIGHTS AND MEASURES ACT 1972

Scope of the act :

- To establish uniform units of measurement and standards of mass and measure based on the International System of Units.
- To establish and maintained the primary, secondary and tertiary standard.
- To govern the weight, measure and weighing and measuring instruments.

Legal Metrology System in Malaysia

OVERVIEW OF WEIGHTS AND MEASURES ACT 1972

- To ensure all weighing and measuring instruments used for trade complies with the specifications standard, being verified and re-verified.
- To govern the license company to Conducting the Calibration and Verification of Weighing and Measuring Instruments.

Legal Metrology System in Malaysia

OVERVIEW OF WEIGHTS AND MEASURES ACT 1972

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.

Legal Metrology System in Malaysia

OVERVIEW OF WEIGHTS AND MEASURES ACT 1972

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

The Way Forward

- 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 !

Overview of NAWI Weighbridges in Papua New Guinea

Strengthening Legal Metrology Infrastructure for
Train the Trainer Course on Verification of NAWI Weighbridges

7–10 June, 2010
Bandung, Indonesia

PNG NISIT

- Established by an Act of Parliament, NISIT Act, 1993
- The national agency responsible for spearheading Standards and Conformance in PNG
- Operates four (4) Technical Divisions (at present)
  - ——Technical Standards
  - ——Laboratory Accreditation
  - ——Certification
  - ——Metrology

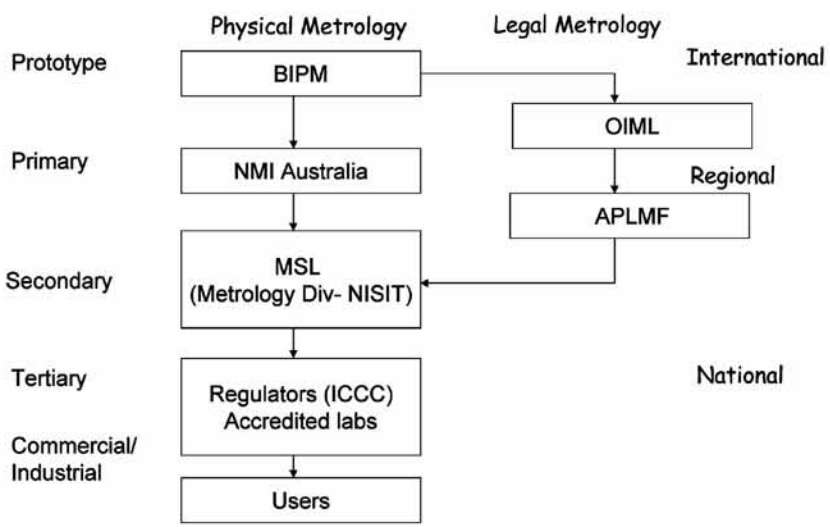
Metrology Division

- Is in charge of Physical and Legal Metrology Programs in PNG
- Operates the accredited Measurement Standards Laboratory (MSL)
- Provides Calibration & Verification Services

Measurement Standards Laboratory (MSL)

- Maintains the National Measurement System
- Disseminates the National Measurement Standards
- The only accredited Calibration & Measurement Laboratory in PNG (accredited by NATA, Australia)
- Participates in Proficiency Testing
- Custodian of the National Primary Standards (PNG Measurement Standards)

Measurement Traceability maintained by MSL



General Overview of the Legal Metrology System on NAWI in Papua New Guinea

DCI

Custodian of Trade Measurement Act

ICCC

Organization that enforces all Trade Measurement regulations

NISIT (MSL)

Administers Metrology Functions

Others

Companies providing maintenance services and initial installation

NISIT and Verification of NAWI Weighbridges In PNG

- MSL is not providing this service to date
- Possibility to look into providing calibration and verification services for these instruments

Way Forward

- This Training/Seminar to provide a starting point to NISIT to support this activities back in PNG

Thank you for your Attention

APEC/APLMF Seminars and Training Courses in Legal Metrology

"Overview of NAWI Weighbridges in Peru"

Licenciado Aldo Martín Quiroga Rojas
7–10 June, 2010
Bandung, Indonesia

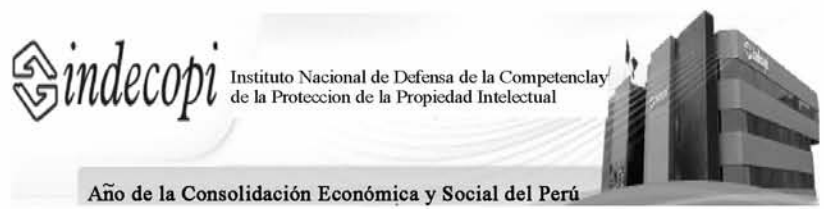
INDECOPI suma esfuerzos al servicio del mercado

PERU

PERU

Country: PERU
Official religion: Catholic
Regions: 25
Capital: Lima
Official language: Spanish
Area: 1 285 216 km²
Population: 29 132 013

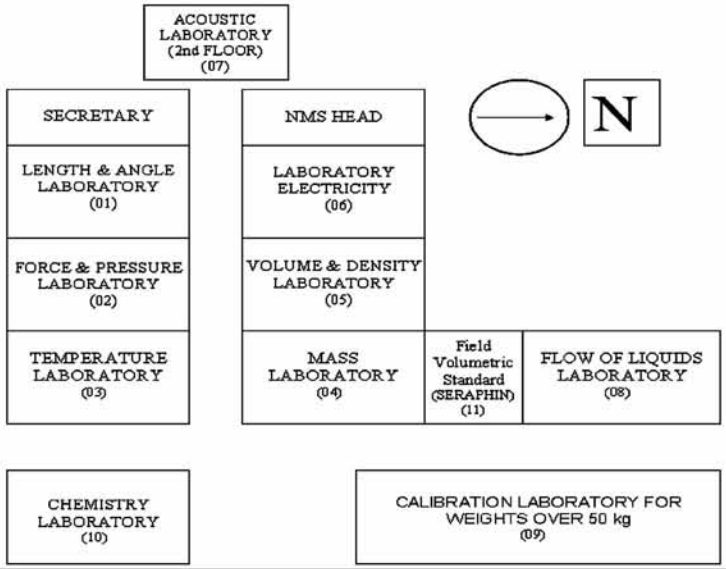
INDECOPI



Indecopi is a institution of the goverment . It was create in 1982.
Indecopi is in Lima and has 19 branches in Peru.
The National Metrology Services is an Indecopi area.
The NAWI weighbridges are calibrated by the National Metrology Services.

The National Metrology Services

LAYOUT OF NATIONAL METROLOGY SERVICE LABORATORIES



The National Metrology Services

The National Metrology Services

The National Metrology Services

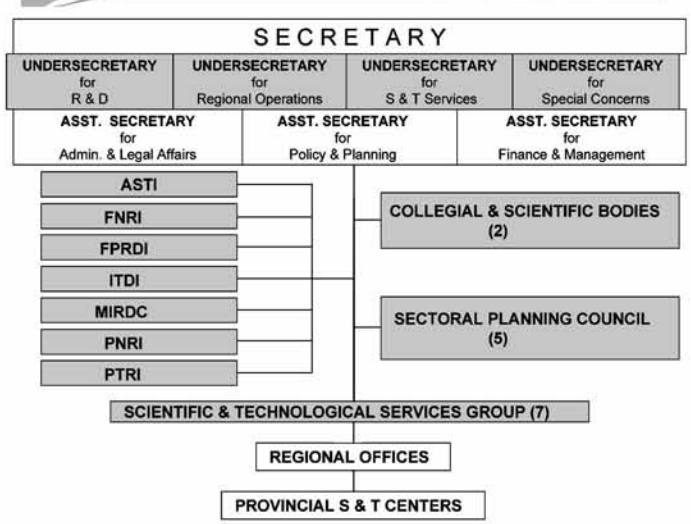
Overview of NAWI Weighbridges in Philippines

Bandung, Indonesia
7–10 June, 2010
Philippines Country Report

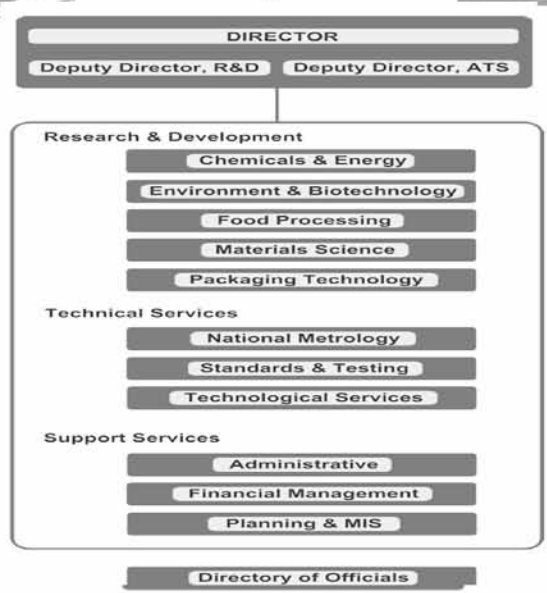
Self Introduction

I am Mr.Gregorio Mendoza, Science Research Specialist I working at the Mass Standards Section of the National Metrology Laboratory of the Industrial Technology Development Institute (ITDI) an agency of Department of Science and Technology (DOST) and already 26 years in service.

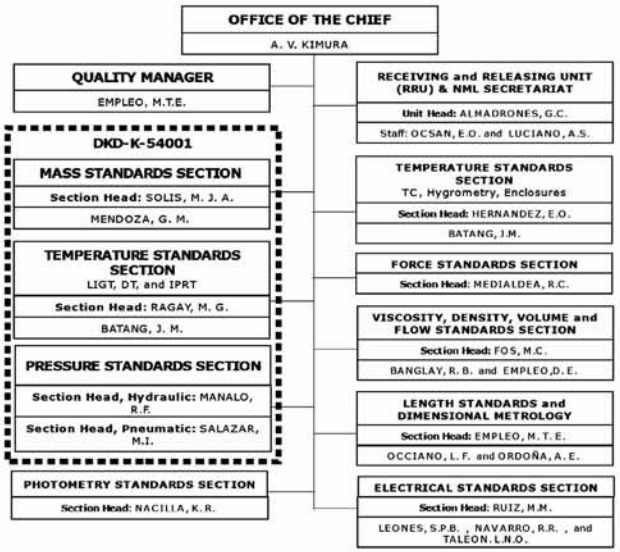
The ORGANIZATION of DOST



The New ITDI Organisational Chart



Organisational Chart of the National Metrology Laboratory



Brief History:

The Industrial Technology Development Institute (ITDI), a government organization under the Department of Science and Technology (DOST), is a multi-disciplinary research and technical service institute. It is mandated by virtue of Executive Order No.128 to render various of services to local industries.

The National Metrology Laboratory (NML) is tasked to establish, develop and maintained the national standards of measurement (scientific metrology). In addition to this task, the NML leads together with other regulatory agencies in the implementation of the legal metrology services and provides industrial metrology services to manufacturing industries.

The ITDI is mandated by Batas Pambansa Bilang 8 section 6 to establish and maintain the national standards for the SI units of quantities such as mass, length, temperature, voltage and pressure; and the Science Act of 1958, pertaining to the test and analyses of products and materials and the calibration of weights and measures.

National Metrology Laboratory

MISSION——To establish and disseminate national standards of units and measurements to calibration laboratories and other sectors to provide international traceability to measurements done in the country by reliably conducting calibration and measurements at accuracy levels appropriate to the needs of the clients.

Description of Specific Activity

My major task/activity on Mass Laboratory are the following:

1. Calibration/Verification of standard weights (class F1 to M series)
2. Verification of weighing machines, from analytical/ precision balances, industrial and high capacity weighing machines (Accuracy class I, II, III, IIII).
3. Verification of different types of weighbridges:
   a. Beam type
   b. Dial type (pendulum)
   c. Electromechanical (hybrid) 'S' type load cell
   d. fully load cell

Weighbridges

Basically all weighbridges are calibrated on-site. We verify weighbridges (Range: 20 t to 100 t). using OIML Recommendation R 76-1 as our reference standard document. We have modified and simplified the OIML test procedures in this manner:

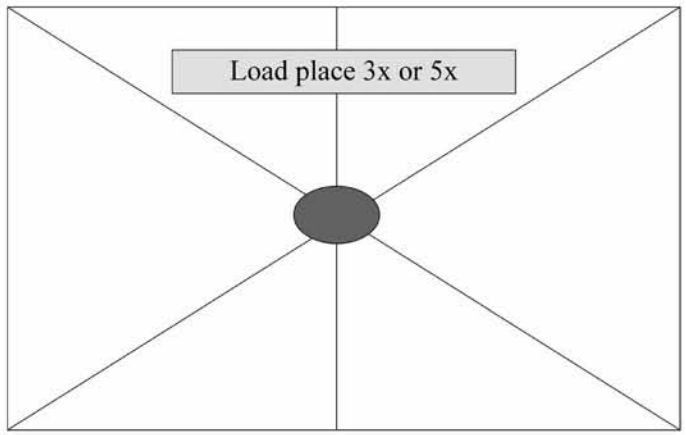
1. Repeatability test,
2. Eccentricity /shift test,
3. Increasing/decreasing load test (Departure from Nominal Value)

Weighbridges

1. **Repeatability test:** The scale indication should be consistent and should not exceed the maximum permissible error (mpe) (for the applied load) when a load of at least 1/4 of scale capacity is placed at the center of the platform three (3) to five (5) times. If the error exceeds the mpe stop using the scale and have it repaired before proceeding to next test.

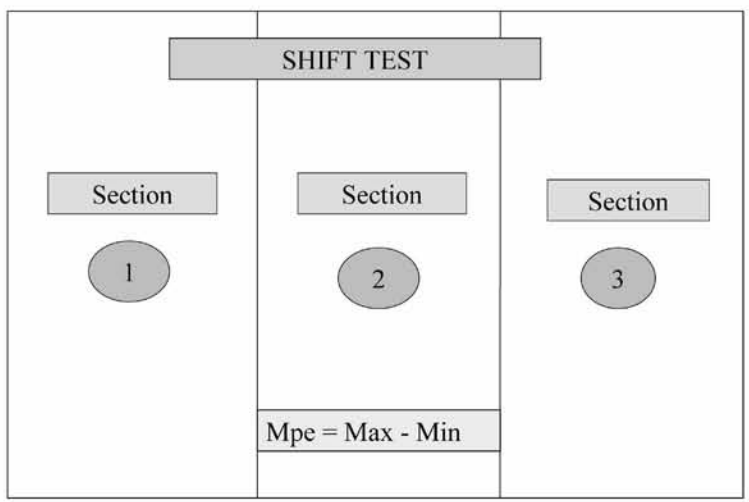
Weighbridges

Repeatability: (min of 1/4 Cap and/or up to Full Cap)



Weighbridges

2. **Eccentricity/shift test.** This test determined whether the scale indication is consistent and does not exceed the maximum permissible error (mpe), for the applied load at least 1/4 scale capacity, when load is placed at different parts of the platform (center and at each end of platform) using a vehicle/truck. If error exceeds mpe stop using scale and have it repaired before proceeding to next test.



Weighbridges

3. **Increasing/decreasing load test:** This is to determine the accuracy of the indication of the scale. In this test, we encounter problems with the availability of standards weights to be used. At NML we have 500kg × 50 pcs of roller type weights for a total of (25t). With the difficulty in hauling these weights sometimes we used only at least 10% of the capacity. We do build-up method using dummy loads defending on the materials available at the site.

Weighbridges

❖There are many types of weighbridges that are being used by the industry:

a) beam type (few exist)
b) dial/pendulum type
c) electromechanical or hybrid type
d) electronic , fully load cell type (pit less or pit type) which is commonly used now in the market.

Weighbridges

Nowadays, there are many metrology services (local distributors) that supply new weighbridges with imported parts of different brands.
They follow all the necessary requirements to install new weighbridges. (e.g. civil works for the foundation and platform, installation of load cells and indicators of the equipment).

Weighbridges

After the completion of the scale installation, one of the requirements for turn over to the owner of the unit is a Verification or Test Certificate from the regulatory body or from an accredited third party laboratory. The NML of ITDI is one of the institutions that conducts verification/or testing and issue the corresponding test certificates.

Weighbridges

❖There are some metrology services that provides all the necessary verification data, including instruction manuals.

❖Others don't give the necessary data , instead they issue a password on the software of the instrument so that no one can adjust the instrument except them.

Weighbridges

- After the verification of the weighbridge, we put stickers on the indicator showing that it is already verified by the proper authority.
- The verification interval for weighbridges is one year.

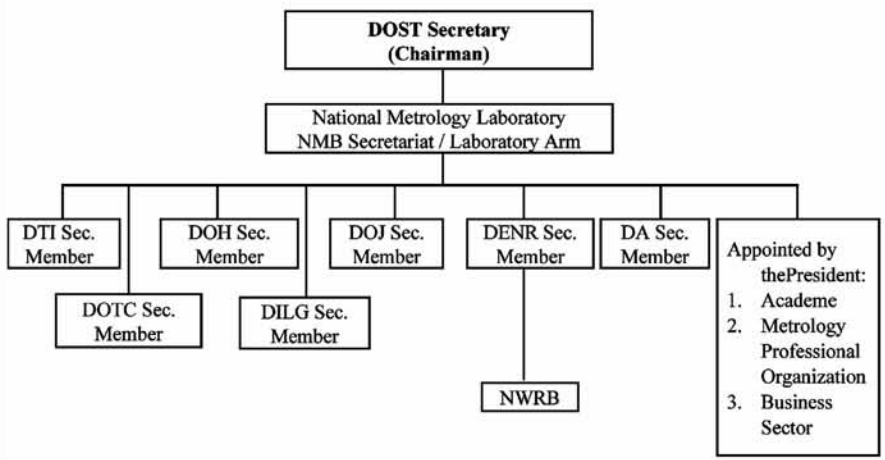
ACTION PLAN

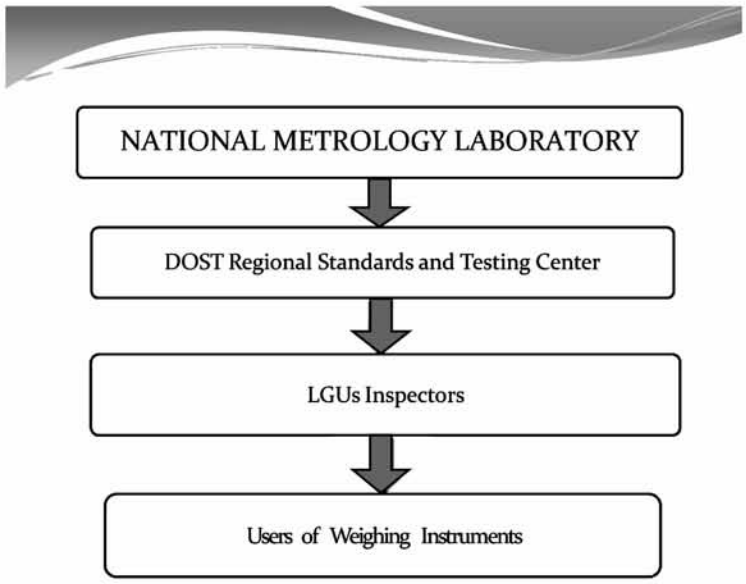
- Under the National Metrology Act of 2003, the National Metrology Board which is composed of different departments will oversee the implementation of legal metrology based on each department mandated tasks.

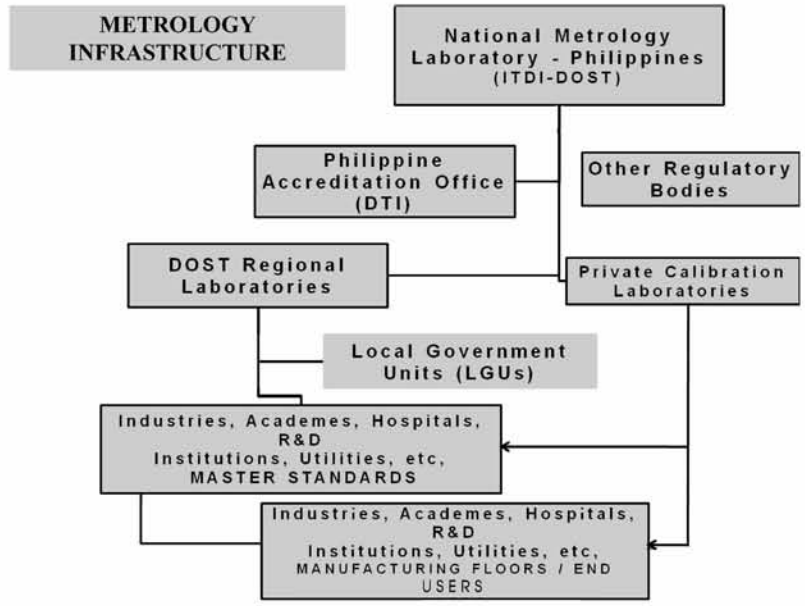
ACTION PLAN

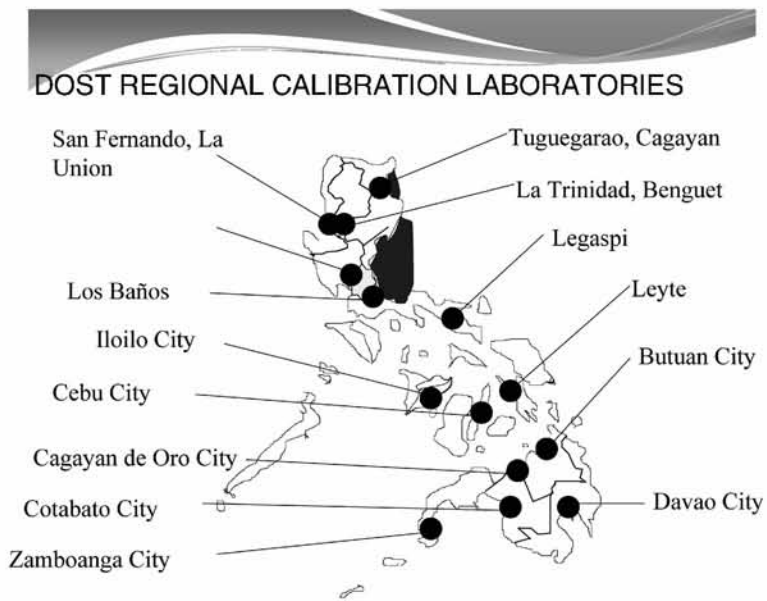
- For industrial and commercial weighing machines, the NML is still doing the verification while at the same time giving training to DOST Regional Staff and local government unit Inspectors. The thrust of the NML is to train them first before the verification activities will be turned over to them. **Please refer to Chart.**

National Metrology Board









Being the Philippine NMI, the NML, ITDI has to keep abreast of advances/developments in Science and Technology to continually provide highly accurate and reliable metrology and calibration services to industry and for the benefit of all concerned.

Furthermore, technical expertise of NML staffs are gained through trainings provided by foreign NMIs abroad and this expertise are shared with other laboratories or companies in need of metrology trainings after they return.

MARAMING SALAMAT PO

THANK YOU
very much for listening

APEC/APLMF Train the Trainer Course on Verification of Non-automatic Weighing Instruments (NAWI)——Weighbridges

Presented by
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Inspector, Weights and Measures Office (WMO)
SPRING Singapore
7 June，2010

SPRiNG singapore

Outline

1. Singapore Weights and Measures Programme
2. Activities of WMO, SPRING Singapore
3. Legal Metrology Requirements for NAWI
4. Next Steps

The Weights and Measures Programme

- Governed by the Weights and Measures Act & Regulations
  ——regulates weighing and measuring instruments for trade use and net contents of pre-packaged goods
  ——penalises suppliers on short weights and measures.
- Ensures a uniform and accurate system of weights and measures so that buyers get what they paid for.
- Ensures fair trade and correct excise tax computation.

Activities of WMO

Manages Authorised Verifier (AV) Scheme

- Weights and Measures Act and Regulations were amended in Dec 2005, allowing SPRING Singapore to designate AVs.
- AV Scheme took effect from 1 Jan 2006. From 1 Jan 2009, 100% verification work is undertaken by AVs.
- To date, 22 AVs have been designated.
- The AV Scheme increases the pool of verifiers resulting in lower cost and reduced turnaround time for businesses.

Activities of WMO

Registers patterns of new instruments for trade use

- All patterns of new weighing and measuring instruments for trade use have to be tested and certified to meet the applicable OIML Recommendation. (ie. NAWI to OIML R76)
- This is to ensure that they are designed to be robust and can maintain their accuracy under different climatic and operating conditions.
- To date, over 250 patterns of weighing and measuring instruments have been registered with SPRING Singapore for trade use.

Activities of WMO

Administers the Accuracy Label

- To further boost the confidence of consumers and businesses alike, Accuracy Labels (above) are affixed on all verified weighing and measuring instruments for trade use.
- Contain AV's identification code, eg, "01", "02" and date of verification.
- All 40,000 weighing and measuring instruments for trade use are affixed with the Accuracy Label.

Activities of WMO

Post-market Surveillance and Audit Inspections

- Inspects weighing and measuring instruments for inaccuracies & tampering.
- Conducts audit reviews on Authorised Verifiers.
- Investigates complaints on short weights & measures.

Legal Metrology Requirements for NAWI

Metrology Control

- NAWI should be pattern evaluated to the relevant international standard (ie. OIML R76) and is subject to SPRING's approval and registration prior to trade use.
- All NAWI meant for trade use are required to be verified and stamped with the weights and measures seal. Verification by SPRING's designated AVs is conducted based on OIML R76.
- The re-verification period of one year is recommended to prevent any short-weight.
- NAWI with accuracy class III and IIII are most commonly used in Singapore. Typical class III weighing instrument includes the electronic price computing scales and weighbridges. Class IIII weighing instruments include mechanical spring balances.

Next Steps

1. Expand the scope of the Authorised Verifiers to include new areas like verification of CNG dispensers, working standards, etc.
2. Develop verification capabilities in emerging areas including Flowmeters, Gas Meters and Hydrogen Dispensers.
3. Equip WMO Inspectors/Authorised Verifiers with latest updates of relevant OIML Recommendations.

Thank You

SPRING singapore
Enabling Enterprise

Overview of the Legal Metrology System on NAWI in Thailand

By Mr.Thapphinyo Koatnon
Bureau of Weights and Measures, Department of Internal Trade,
Ministry of Commerce

Verification of Truck scale

1. verifying quality and general feature

1.1 All truck scales must show any details, which shall be clear, read easily and hardly erased, on the scale. The following shall be shown as details. (Ministerial regulation section 10)

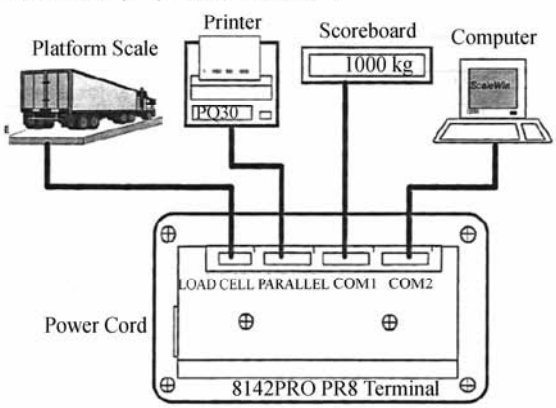
1. Name or Private mark of manufacturer, importer or seller
2. Model name indicated type of scale
3. Identity Number of scale

1.2 Capacity range of truck scale and weighing range of load cell shall be clearly shown and hardly erased. (Ministerial regulation section 11)

1.3 Truck scale and load cell produced for traditional rate shall be shown capacity range and weighing range in unit of metric system such as kg(Ministerial regulation section 12)

1.4 For initial verification and the re-verification, it is important to fix each of compensation rates to equal. For used scale, it is important to fix the compensation rate as twice as for initial verification.(Ministerial regulation section 13)

1.5 Indicator located outside weighing room shall be clearly shown data for relevant people in weighing operation. For example, while weighing person is weighing truck on platform, weighing person in weighing room must clearly see any habitat of people or living things on platform. [Ministerial regulation section 19 (11),section 21]



1.6 For digital indicator, if scale has display data on multiple indicators, every indicator shall be shown correct data, and all data shall be the same. For example, data shown by load-measuring device, remote display, weighing result ticket shall be the same. [Ministerial regulation section 15 (2)]

1.7 Control keys, indicator, and other equipments including switch shall be read easily, clear and hardly erased. (Ministerial regulation section 16)

1.8 Truck scale shall be sealed to avoid any modification method after verified. Any person can modify or repair scale only when the competent officer damage that seal.(Ministerial regulation section 17)

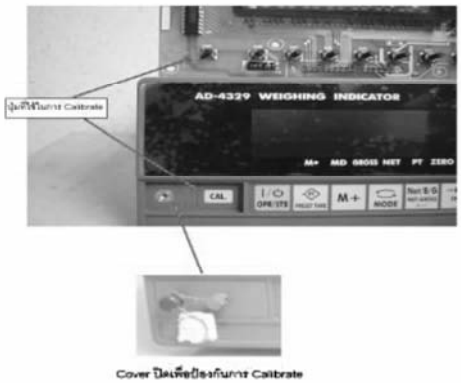
1.9 Printing part shall print correctly data. Height of letters and digits shall not less than two millimeters. Printing part shall print only in stable mode. For example, while weighing in stable mode, data shall be sent to printing part automatically. Then weighing person can press key to print data which be the same as data shown on indicator. [Ministerial regulation section 19 (6)]

1.10 Saving part shall save data when display is in stable mode, such as while truck in weighing mode is moving, any person cannot input any data from keyboard or load-measuring device into computer. [Ministerial regulation section 19 (7)]

1.11 In case of testing motion of truck scale on platform while truck is moving, when press ZERO or other keys, system shall not input any data from load-measuring device into computer. For example,while weighing truck on platform in motion mode, weighing person press key to input data. If system can input data while truck is in moving mode, the scale shall be repaired. (Ministerial regulation section 9)

1.12 In case of scale has locking device, scale must clearly show locking device and weighing area. Weighing person can weigh only in weighing area. For example, pattern approval document sent from central bureau of weights and measures may contain content about some model of load-measuring device which program can lock calibration. [Ministerial regulation section 19 (10)]

Protecl Calitxate

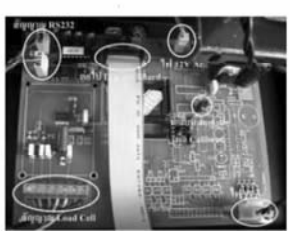


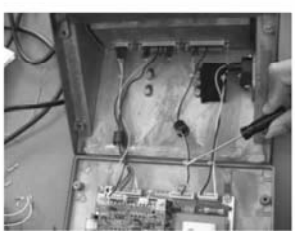
Cover

1.13 For the Electro-magnetic interference test , by using a radio that has 5 watt-power and has AM and FM frequency within 50 cms, the scale need to be not affect to a display, a data , and a printer. [Ministerial regulation section 19 (14) (g)]

1.14 For computer system or other equipment connected, only one weighing program in computer system connected to load-measuring device shall be installed. [Ministerial regulation section 19 (14) (h) and Ministerial act B.E. 2001]

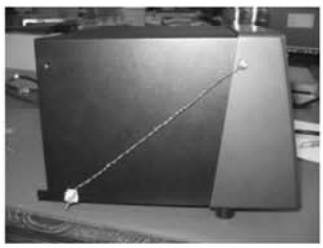
1.15 The connection of signal wires shall send signal only one way. For RS232, it shall use just Tx and Gnd for connecting with other equipments such as a computer, a Remote Display and a printer. To observe the wire from Main Board to Port,the connection of computer and Remote display shall have just two wires (Tx and Gnd). For RS 485 and RS 422 , it is prohibited. (Ministerial act B.E. 2001)





1.16 Indicator both inside and outside weighing room must show data as the same as real weighing data. Remote display, load-measuring device and computer system must show the same data. For example, when weighing people or truck on platform of truck scale, weighing person shall observe remote display, load-measuring device and computer system. All of these must show the same data.[Ministerial regulation section 15 (2) (b) and section 34]

1.17 In case of initial verification, load-measuring device shall be verified for sealing to indicate initial verification avoidance at central bureau of weights and measures, center of weights and measures and branch bureau of weights and measures by verifying using pattern approval document sent from company to central bureau of weights and measures. (Departmental act Feb 21, 2005)



2. Accuracy class verification

2.1 Accuracy class III by using the classified accuracy of the scale (n=Max/e)
n = the number shall between 500 to 10000. For certification, the n number shall be 20 kgs. For fixing the number d, it shall be appropriate with the Load cell and the d number shall be 10 kgs. **(**Ministerial regulation section 24 and section 25**)**

2.2 For initial verification and the re-verification, it is important to fix each of compensation rates to equal. For used scale, it is important to fix the compensation rate as twice as for initial verification. (Ministerial regulation section 13)

3.Accurancy Test

3.1 The response rate of the scale for testing discrimination is 1.4d. The scale shall display the changing weight. To test discrimination, it is important to put the weight on the scale firstly and put new weight on the scale. The result of a display shall be changed 1 d.
[Ministerial regulation section 31(2)]

3.2 Testing weight by increasing and decreasing weight. Place weight in weighing range on various positions in accordance with verification table. For example, place weight from five hundred kilograms to ten thousand kilograms or any weight up to weighing person. Especially, placing weight shall depend on load cell.**(** Ministerial regulation section 29**)**

3.3 Testing repeatability on middle area of platform in accordance with verification table, such as re-placing by using crane for lifting up and down on middle area of platform about three times. (Ministerial regulation section 32)

3.4 Place weight on various positions in accordance with verification table.**(** Ministerial regulation section 33**)**

3.5 The changing weight to zero and the range of the set of adjust auto zero of the scale. The changing to zero shall not over 4 percent of the capacity.**(** Ministerial regulation section 9**)**

4. Stamping verification mark

4.1 Truck scale shall be sealed to avoid any modification method after verified. Any person can modify or repair scale only when the competent officer damage that seal. The following shall be sealed.(Ministerial regulation section 17)

1. Connector LC
2. Remote Display
3. Signal combination box
4. Other position related to weigh modification

4.2 The number plate of the scale and the specific mark shall be put on the scale and the signal box tightly.

company				
	Capacity 50 000 kg		*e* 20 kg	*d* 10 kg
Private mark			No. Truck Scale	
Manufacturer /	importer	repairer	001-2010	
	initial verification		Re-verification(1)	Re-verification(2)
Verification – date	16-5-2010			
expiry date	16-5-2012			

5. The expiry date of such verification(Term of license)

Non automatic weighing instruments installed in a fixed position which capacity range greater than twenty metric tons shall be two years term of license. **(**Ministerial regulation section 89**)**

6. Verification fee

Initial verification fee is two thousand baht, and the re-verification fee is one thousand baht. (Ministerial regulation section B.E. 2001**)**

7. Issuing licenses and permits for instruments

The certification of the scale shall be following byNo.105.(Ministerial regulation section 87**)**

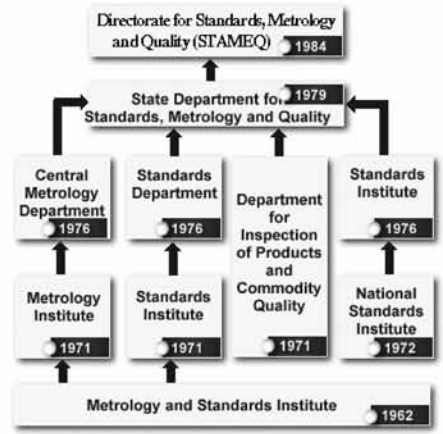
8. Table for recording result of verification.

As attaching form.

Mr.Bui Anh Ha
Viet Nam

NATIONAL INFRASTRUCTURE FOR LEGAL METROLOGY

A. Legal Metrology Infrastructure Overview



STAMEQ Activities

- **1.** To set up policies, strategies, schemes, measures on development in the fields of standardization, metrology, products and commodities quality and submit them to the Ministry of Science and Technology.

STAMEQ Activities

- **2.** To prepare legal documents on standardization, metrology,products and commodities quality management.

STAMEQ Activities

- 3. Standardization
- 4. Measurement
- 5. Products quality
- 6. To organize, conduct scientific research, training, improving technical professional skills, testing, technology transfer; propagate information and advise on standardization, metrology, quality, productivity, code numbering and bar code.

National Infrasture for Legal Metrology

STAMEQ Activities

- 7. To carry out international relations on standardization, metrology, quality, productivity, code numbering and bar code in accordance with law;representative of Viet Nam to participate in international and regional organizations according to decision of the relevant state bodies.

National Infrasture for Legal Metrology

STAMEQ Activities

- 8. Inspect, control and treat violations on standardization, metrology, code numbering and bar code under the competence.

National Infrasture for Legal Metrology

STAMEQ Activities

- 9. To manage fee collection, charges and other expenses on the fields of standardization, metrology, quality and other related fields in accordance with law.

National Infrasture for Legal Metrology

STAMEQ Activities

- 10. To guide and check professional skills to bodies on standardization, metrology and quality under ministries, branches, locals.

STAMEQ Activities

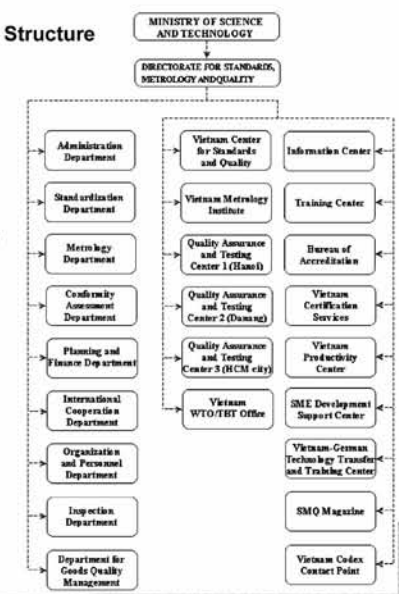
- 11. To guide, inspect activities of bodies on standards, metrology and quality services.
- 12. To set up and implement administrative reform program of STAMEQ according to objectives and contents of the administrative reform program of the Ministry of Science and Technology.

STAMEQ Activities

- 13. To manage organization structure of STAMEQ according to decentralized administration of the Ministry of Science and Technology and stipulated by the State.
- 14. To administer finance,assets of STAMEQ in accordance with law.

STAMEQ'sOrganization Structure

- STAMEQ consists of 16 independent units with total staffs of 700.
- STAMEQ also directs activities of the 64 provincial, city departments of standardization, metrology and quality control with staff up 1,000



Membership of STAMEQ

- ***1. International Organizations***

Order	Organization	Since	Kind of Member
1	ISO——International Standardization Organization	1977	Full member
2	IEC——International Electronical Commission	2002	Associate
3	OIML——Organisation Internatinale de Metrologie Legale	2003	Full member
4	ILAC——International Laboratory Accreditation Cooperation	1992	Full member
5	CAC——Codex Alimentarius Committee	1989	Full member
6	EAN——European Article Numbering-International	1995	Full member

National Infrasture for Legal Metrology

Membership of STAMEQ

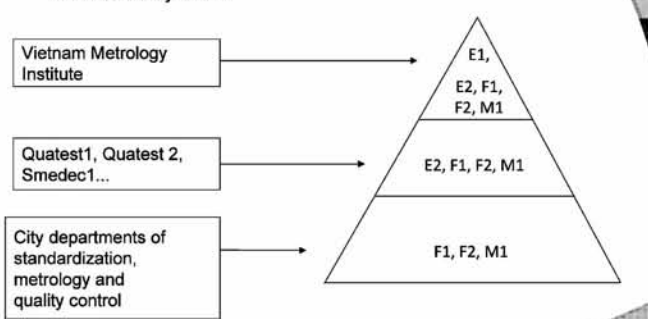
- ***2. Regional Organizations***

Order	Organization	Since	Kind of Member
1	PASC - Pacific Area Standards Congress	1992	Full member
2	APLAC Asia Pacific Laboratory Accreditation Cooperation	1995	Full member
3	APMP Asian Pacific Metrology Program	1995	Full member
4	APQO Asian Pacific Quality Organization	1994	Full member
5	ACCSQ Asean Consultative Committee for Standards and Quality	1995	Full member
6	APEC -SCSC Asian Pacific Economy Cooperation - Sub Committee for Standards Conformance	1998	Full member
7	TA Technonet Asia	1993	Full member
8	APO Asian Productivity Organization	1996	Full member
9	APLMF Asian Pacific Legal Metrology Forum	1996	Full member
10	CGPM The General Conference on Weights and Measures of Meter Convention		
11	ASEM/TFAP/SCA Asia-Europe Meeting / Trade Facilitation Action Plan / Standards and Conformity Assessment		

National Infrasture for Legal Metrology

B. Legal Metrology

The Traceability Chain



National Infrasture for Legal Metrology

Techniques Capacity and Services

Viet Nam Metrology Institute:
——Standard Weights of E1 class: 1kg
——Standard Weights of E2 class: 1mg-10kg
——Standard Weights of F1 class: 1mg-10kg
——Standard Weights of F2 class: 1mg-20kg
——Standard Weights of M1 class: 1mg-500kg
——Non Automatic Weight Instrument: 1g-150t

SMEDEC 1:
——Standard Weights of E2 class: 1mg-500g
——Standard Weights of F1 class: 1mg-10kg
——Comparator, max=30 kg/d=0.5g
——Calibration of M1 class Weights 20kg
——Calibration Balances, class 1,2,3,4

City departments of standardization, metrology and quality control:
——Standard Weights of F1 class: 1mg-10kg
——Calibration of M2 class Weights
——Calibration of Balances, class 1,2,3,4

National Infrasture for Legal Metrology

C. The trend of international integration of measurement in the future

- *1. For scientific and industrial measurement*
- *2. For legal measurement*

National Infrasture for Legal Metrology

D. Concerns and problems faced

- Technical and legal infrastructure are still very week and backward Expensive and time consuming with APEC policies
- Lack of funds to participate in international standardization activities
- Lack of knowledge and experience of personnel

National Infrasture for Legal Metrology

D. STAMEQ website

- For further information, please visit our website at:http://www.tcvn.gov.vn

National Infrasture for Legal Metrology

Mr Bui Anh Ha
SMEDEC 1- STAMEQ
Viet Nam

HOW ARE WEIGHBRIDGES VERIFIED IN VIET NAM

Legislation Documents

- In Viet Nam, when verify weighbrigdes, we use “ĐLVN 13:2009: Weighbridges-Methods and means of verification”. It was published to replace for the “ĐLVN13:1998”
- Decree 54/2009/NĐ-CP Provisions on sanctions against administrative violations in the Field of Standards, Metrology and Quality Products, Goods

Before verify a weighbridge

- Check that it bears a name tag
- Check that it bears a certification mark
- Check the completeness of parts
- Ensure the platform and the sourrounds are free of debris that could cause errors in the reading. The weighbrigde pit should not contain water.
- Make sure the indicator is zero
- Check the Environmental Conditions

Technical testing

- For Mechanical Weighbridge
  - ——Check the load receptor and load-transmitting device
  - ——Check the indicator
  - ——Steelyard is truly balanced
- For Electronic Weighbridge
  - ——Check the load receptor
  - ——Check the joint box and cable
  - ——Check the indicator
  - ——Check the flatform, foundation

Measurement testing

- mpe testing (maximum permissible error)
- Sensitivity testing
- Movability testing
- Repeatable testing
- Eccentricity loading testing

Certification

- The certificate will be issued to the weighbridges, which have pass the test.
- If not, the verifier will calibrate and verify again.

Licensing Authority

- Testing Center:

Ex: Small and Medium Enteprise Development Support Center 1, 2 (SMEDEC1, 2)
Quality Assurance and Testing Center 1 (QUATEST 1)in North of Viet Nam;
Quality Assurance and Testing Center 2 (QUATEST 2)in Middle of Viet Nam
Quality Assurance and Testing Center 3 (QUATEST 3)in South of Viet Nam

- City departments of standardization, metrology and quality control :

in 64 provincial of Viet Nam

- Private Company, which have to be accredited by Accreditation Organization

Test weighs M1 20kg

Test weighs M1 500kg

A weighbrigde in Viet Nam

Thank you!

Asia-Pacific Legal Metrology Forum (APLMF)

Overview of NAWI Weighbridges in Mongolia

June 7–10, 2010. Bandung, Indonesia

MONGOLIAN AGENCY FOR STANDARDIZATION AND METROLOGY

Dalaibayar Daramjav

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MAP OF MONGOLIA

Capital: Ulaanbaatar

Location: Northern Asia, between China and Russia

Quick facts about Mongolia

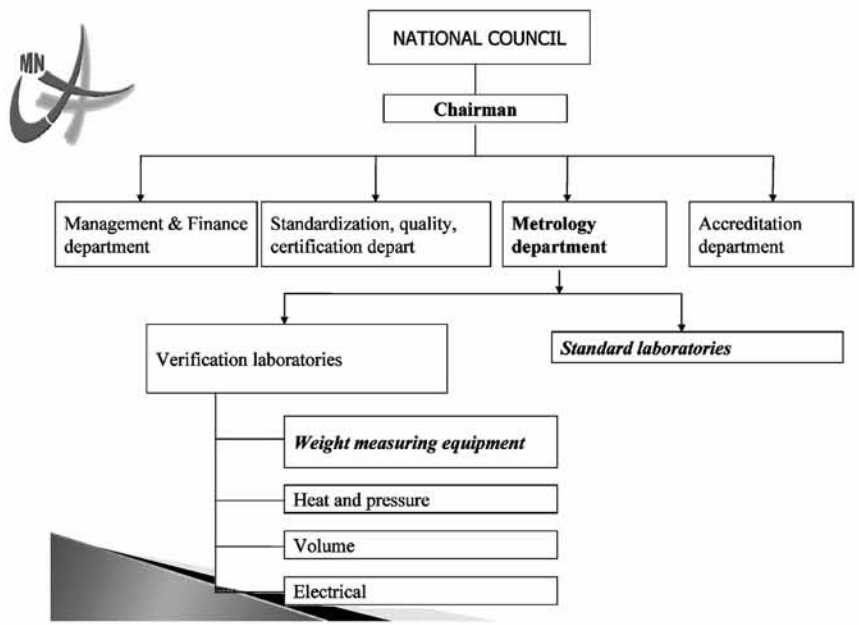
- Population: 2,8 mil.(with low density of 1,5 persons per sq.km)
- More than 10 ethnic groups, (75%-Khalkha, 7%-Kazakhs and others)
- Language: Mongolian
- Religion: More than 90%-Tibetan Buddhist Lamaism, 6%-Muslim
- Climate: Extreme continental, 4 distinct seasons (-45C in January; +25C in July)

MONGOLIAN AGENCY FOR STANDARDIZATION AND METROLOGY

Mongolian Agency for Standardization and Metrology is State Central Standards and Metrology body responsible for coordinating and managing sector of Mongolia.

Under the "Law on Traceability of Measurement Uniformity", the MASM manages the legal metrology system in Mongolia, and coordinates the national calibration system for measuring instruments. MASM also establishes, maintains and disseminates national measurement standards. Responsibility for the local metrology activities rests with the 22 Aimag's (province) Metrology Centers. MASM provides professional and management guidance for the local metrology authorities.

- The main functions are:
  - Standardization
  - Conformity assessment
  - Establishment of national measurement standards
  - Legal metrology
  - Accreditation
  - Training and consulting
  - International cooperation



Metrology Department

The Metrology Department of MASM performs to establish national measurement standard system and regulation on metrology and supervision of their implementation.

Main activities

- Development of national measurement standards system
- Maintenance and improvement of measurement standards
- Dissemination national measurement standards
- Development of certified reference materials
- Calibration of measurement standards and measuring instruments with high accuracy
- Verification of instruments as required by law
- Pattern approval of measuring instruments
- Licenses for metrological service and sale

Weight measuring equipment verification laboratory

- This laboratory has not only suggested that testing and verification high capacity weighing instruments of Mongolian, type approval and to grant license of weighbridge testing on arranging, building, purchasing but also organizing to training for law, statutes, standards on it.
- There is structure of that laboratory has consisted from 6 state-supervisors of Ulaanbaatar city, and 21 state-supervisors of 21 aimags.

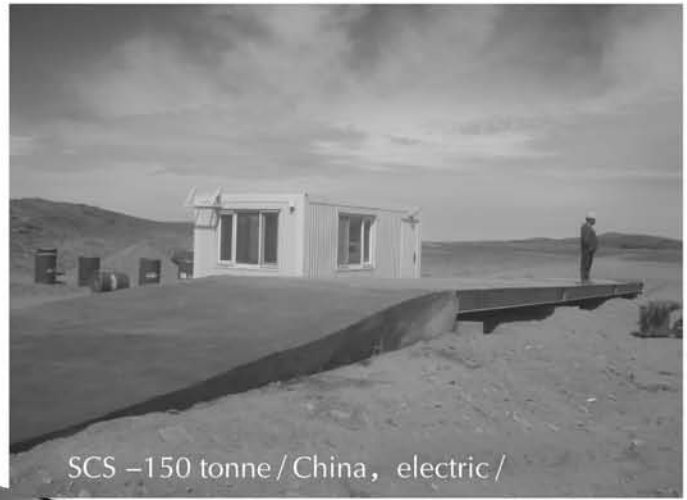
Legal standards on verification and re-verification of a weighbridge:

- Verification of mechanical mass measurement . MNS: 5311—2003
- Verification of electrical mass measurement. MNS: 3144—1998
- Verification of non-automatic mass measurement. OIML R76

There are following weighbridges approved to be used in Mongolia after having tested.

- RTs 30–40 tonne /Russian, mechanic/
- SCS–150 tonne /China, electric/
- Load Cell 20-30 tonne /China,/
- Indicator /China, XK3190-D20, XK3190-A9/

- Chinese Weighbridge is marked SCS-150 that is verified by Mongolian type approval and pervasive usage in Mongolia.



Verifying

Verifying

weighing

Quantity of etalon weigh instruments are used verification and re-verification

- 50 kg weigh instruments——100 amounts
- 20 kg weigh instruments——120 amounts

Total 2.4 tonne

Problems on weighbridge verification and re-verification:

1. Weigh instruments are not enough.
2. There is not enough knowledge on workers of weighbridge building company.
3. There is too much time spending to copy weigh instruments for requirement of OIML R-76.
4. There is no common system for testing, calibration and re-verification of weighbridges in Mongolia.

Summary

The participation in the Train-The-Trainer course will benefit to understand current legislation and procedures on type approval and verification of weighbridges.

Thank you for your attention