Asia-Pacific
Economic Cooperation

Asia-Pacific
Legal Metrology Forum

Handbook on Training Course on Electricity Meters

APEC/APLMF Training Courses in Legal Metrology (CTI 09/2009T)

August 10 – 13, 2009
Shah Alam, Malaysia

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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-09/2009T) titled "Training Course on Electricity Meters" which was held on August 10-13 at the Concorde Hotel, Sham Alam, Malaysia.

This course was organized by APLMF secretariat and arranged as one of the APEC TILF projects, CTI-09/2009T. Also, it was supported by National Metrology Laboratory (NML), SIRIM Berhad Malaysia, Japan Electric Meters Inspection Corporation (JEMIC), TNB Metering Sdn. Bhd., Malaysia and Krizik Sdn. Bhd., Malaysia. I would like to extend my sincere gratitude to colleagues of NML - SIRIM for their outstanding preparation and two trainers, Mr. Shuichi Tanabe and Mr. Kazunari Shiraishi from JEMIC as well as two speakers, Ms. Saraswathy Sinniah, TNB Metering Sdn. Bhd., Malaysia and Mr. Jumary Jaapar, Krizik Sdn. Bhd., Malaysia. Also, special thanks should be extended to the Program Director Toni Widhiastono and Program Executive, Ms. Joyce Yong form APEC Secretariat for their tremendous supports.

Since there remain some problems due to unconformity in the regulations and systems on electricity meters employed in each economy or APEC region, main target of this training course was to assist APEC and APLMF member economies to develop common understanding about the current standards and regulations on electricity meters, thus meet the APEC objective to establish a harmonization in legal metrology with OIML international recommendations. The training course covered contents of both legislation and verification of electricity meters.

During this training many main issues including understanding of basic knowledge on electricity metering, overview and construction of electricity meters, current situation about the international standards and regulations related to the electricity meters had been addressed. The training course offered the important platform for participants to sharing knowledge and information in the legal metrology field of electricity meters.

Due to the great contributions from the trainers and speaker as well as the effective collaboration between the host economy and APLMF Secretariat, I would like to say that this training course is certainly a fruitful activity!

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

November 5, 2009

Mr. Pu Changcheng

APLMF President

Summary Report

This is a report of the APLMF training course on electricity meters held on August 10 – 13, 2009 at the Concorde Hotel in Shah Alam, Malaysia.

The seminar provided a presentation session by participated economies about the legal metrology system on electricity meters on the first day.

I took charge of two sessions as follows.

1. Outline of Electricity Meters

(1) The need for electricity meters

(2) Electricity transmission and distribution methods

(3) Power and Energy

(4) Types of electricity meters and precision classification

(5) Electromechanical induction meters

2. IEC, OIML, MID

(1) Overview of International Standards relating to Electricity Meters (TC13)

(2) Current situation of OIML Recommendation's revision (R46 Electricity meters)

(3) Measuring Instruments Directives (Annex MI – 003 Electricity meters)

A review and question session was also provided on the last day. Many participants threw additional questions in that session. All of economies also had a presentation about the method of using information which provided in this training course.

All of participants were very enthusiastic and seriousness. I felt that many participants wanted to know the type approval system and the verification system of other economies.

I believe that this training course's experience will help participants to improve their type approval system and verification system. It was certainly a great opportunity for all of us.

Finally, I would like to extend my sincere gratitude for giving me a valuable opportunity to speak at the seminar.

Japan Electric Meters Inspection Corporation

Kazunari Shiraishi

This is a report of the APLMF training course on electricity meters held on August 10 – 13, 2009 at the Concorde Hotel in Shah Alam, Malaysia.

I took charge of two sessions as follows.

A. Legislation of Electricity Meters

1. Measurement Law
2. Government Ordinance
3. Ministerial Ordinance
4. Verification and Inspection for WHM
5. Inspection of Legal Standards
6. Legal standard Watt – Hour Meters
7. National Standard for power and energy
8. JEMIC
9. Traceability system

B. Verification of Electricity Meters

1. Verification and Inspection body
2. Type Approval
3. Verification procedure
4. Automatic Testing System
5. Verification for various other meters
6. Inspection of Instrument Transformers
7. Maximum Permissible Errors

Our JEMIC has been sending speakers since 2004, and I might think the time has come to revise more advanced level of the contents for the lecture and to change the style.

My request to the seminar style is the method of solving the problem type.

The half of the seminar as usual is no problem but the other is as follows:

1. Request the point that present problem or seems to become a problem.
2. Share the problem to each economy before seminar.
3. Prepare the answer how to solve the problem compared with internal law or regulation of your economy. If it has already been solved already of your case or known, explain the process how to solve.

Half of the economy has already adopted standard of IEC for WHM, I felt that it would reached at some level. I think that the problem that would arise in the near future is the mutual certification for verification and stories of relations with the domestic law with each economy of the smart meter. Finally, I would like to express my sincere gratitude for giving me a great opportunity to attend the seminar.

Japan Electric Meters Inspection Corporation
Shuichi Tanabe

APEC/APLMF Seminars and Training Courses in Legal Metrology
(CTI-09/2009T)

Training Course on Electricity Meters

August 10 – 13, 2009
at Concorde Hotel, Shah Alam, Malaysia

Program

Organizers:

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

Supporting Organizations:

1. National Metrology Laboratory, SIRIM Berhad, Malaysia
2. Japan Electric Meters Inspection Corporation (JEMIC)
3. TNB Metering sdn. Bhd.
4. Krizik Sdn. Bhd., Malaysia.

Trainers:

1. Mr. Shuichi Tanabe, Japan Electric Meters Inspection Corporation (JEMIC)
2. Mr. Kazunari Shiraishi, Japan Electric Meters Inspection Corporation (JEMIC)
3. Ms. Saraswathy Sinniah, TNB Metering Sdn. Bhd., Malaysia.
4. Mr. Jumary Jaapar, Krizik Sdn. Bhd., Malaysia.

Main Objective of the Training Course:

Electricity metering is one of the essential technical infrastructures, which will ensure safety and welfare for the citizens in all economies. In addition, according to the enhanced international free trade, it is getting more important to remove technical or legislative barrier to trade electricity and/or electricity meters (watt-hour meters). However, there remain some problems due to unconformity in the regulations and systems on electricity meters employed in each economy or region.

Main target of this training course is to assist APEC and APLMF member economies to develop common understanding about the current standards and regulations on electricity meters and thus meet the APEC objective to establish a harmonization in legal metrology with OIML international recommendations. This seminar also put importance on the international communication and exchange of information between the participating economies.

Actual contents of the training course would be focused on the understanding of basic knowledge on electricity metering, overview and construction of electricity meters, and current situation about the international standards and regulations related to the electricity meters.

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

Presentation from each economy:

- At least one trainee from each economy will be requested to provide a brief presentation about the legal metrology system on electricity meters in his/her economy. The recommended topics of the presentation are given below.

1 Self introduction

1.1 Explain about your organization and department.

1.2 Explain your professional experience in your organization.

2 Electric meter in your economy

2.1 What organization (s) regulate the measurement of electricity in your economy?

2.2 What are the legal units of measure for the sale of electricity?

2.3 Do electricity meters require approval of type?

2.4 What organization performs approval of type testing?

2.5 Is meter verification testing required?

2.6 What organization performs the meter verification tests?

2.7 Are tests performed on meters in service?

2.8 Are meters given a reverification interval? (8 years? 12 years?)

2.9 Is there as measurement complaint/dispute resolution process?

3 Legal metrology system in your economy

4 Explain current situation in your economy about the compliance to the international standards/recommendations for electricity meter.

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

Registration:

Fill the "**Registration Form**" and send it to the APLMF secretariat by **July 18, 2009.**

Venue and Accommodation:

- **Venue**

Concorde Hotel, Shah Alam

3, Jalan Tengku Ampuan Zabedah C9/C, 40100 Shah Alam, Malaysia

Tel: 603-55122200 Fax: 603-55122210

http: //www. concorde. net/shah/

- **Accommodations**

The accommodation will be prepared at the Concorde Hotel with the rates below. If you hope to reserve the accommodation, please fill and send the separated **Hotel Reservation Form** to the host by **July 18, 2009**

Single: RM 181.70 nett (approx. USD 52)/night/room inclusive of 1 breakfast.

Twin-sharing: RM 193.20 nett (approx. USD 55)/night/room inclusive of 2 breakfasts.

* Above rates include VAT and service charge.

* 1 USD≈3.52 RM

- **Access Information:**

The Concorde Hotel, Shah Alam is situated in the commercial centre of the city of Shah Alam which is located about 55km from the Kuala Lumpur International Airport (KLIA). Participants are advised to arrive at the hotel directly by airport limousine taxi service (about 50 minutes ride). **The taxi ticketing counter is located just before you exit the arrival hall after going through customs check point**. Please note that there are two types of taxis available, the budget taxi costing RM 58.10 (approx. 17 USD) from KLIA to Concorde Hotel and premier taxi costing RM 77.10 (approx. 22 USD). An additional surcharge of 30% is levied on the fare from midnight till 6.00am. It is recommended that participants take the budget taxi as it is comfortable and much cheaper.

Visa assistance:

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

Contact Persons for the Training Course:

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

Dr. ZHANG Chao & Mr. GUO Su

APLMF Secretariat

AQSIQ No.9, Madiandonglu, Haidian District, Beijing 100088, P. R. China

Tel: +86-10-8226-0335

Fax: +86-10-8226-0131

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

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

Mr. Nazri Marzuki, Metrologist/Ms. Puteri Nor Rasidah, Executive,

National Metrology Laboratory, SIRIM Berhad

Lot PT 4803, Bandar Baru Salak Tinggi 43900, Sepang, Selangor Darul Ehsan, Malaysia

Tel: +60-3-8778-1648, +60-3-8778-1608 Fax: +60-3-8778-1661, +60-3-8778-1616

E-mail: nazri_ marzuki@sirim.my nrasidah@sirim.my

Program

Day 1 Aug. 10 Monday	09：30-10：00	**Opening Ceremony**： • Welcome Address by Senior General Manager, National Metrology Laboratory (NML-SIRIM) • Opening Address by the APLMF Secretary • Introductions by the Trainers • Roll Call • Group photo session
	10：00-10：30	*Coffee Break*
	10：30-12：00	Overview of the Measurement System and Current Situation about Electricity Meters in each Economy presented by the Trainees (10 minutes for each economy)
	12：00-14：00	*Lunch*
	14：00-15：30	Outline of Electricity Meters (JEMIC)
	15：30-16：00	*Coffee Break*
	16：00-17：00	Legislation (JEMIC)
	19：00	*Leave the Hotel for Welcome Dinner*
	19：30-21：30	*Welcome Dinner-Hosted by APLMF*
Day 2 Aug. 11 Tuesday	09：00-10：30	IEC OIML MID (JEMIC)
	10：30-11：00	*Coffee Break*
	11：00-12：00	Presentation by an Electricity Meter manufacturer/supplier (Krizik Sdn. Bhd.)
	12：00-14：00	*Lunch*
	14：00-15：00	Presentation on Type Approval and Electricity Meter Testing by TNB Metering Sdn. Bhd., a subsidiary of the national electricity power supply and distribution company in Malaysia
	15：00-15：30	*Coffee Break*
	15：30-16：30	Verification (JEMIC)
Day 3 Aug. 12 Wednesday	09：00-10：00	Travel from Hotel to Krizik (M) Sdn. Bhd., Balakong, Selangor
	10：00-12：00	Technical tour at Krizik (M) Sdn. Bhd.
	12. 00-13：00	*Lunch*
	13：00-14：00	Travel from Krizik (M) Sdn. Bhd. to TNB Metering Sdn. Bhd., PJ, Selangor
	14：00-16：00	Technical tour at TNB Metering Sdn. Bhd., PJ, Selangor
	16：00-17：00	*Return journey to hotel*

Day 4 Aug. 13 Thursday	09：00-10：30	• Review/Questions/Answers for All Presentations • 2009 TC 13 meeting update on Current Status of the revision of OIML Recommendations • Open discussions on Measurement System and Current Situation about Electricity Meters in economies-problems, difficulties and the way forward
	10：30-11：00	*Coffee Break*
	11：00-12：00	**Closing Ceremony**： • Presentation of Certificates to Trainees • Closing Address by the APLMF Secretary • Closing Address by NML-SIRIM
	12：00-13. 00	*Lunch*
	13：00	*Leave hotel for NML-SIRIM*
	14：00-15：30	Visit to NML-SIRIM, Sepang
	16：00-18：00	Visit to Putrajaya (Federal Government Administrative Centre)
	18：00-19：00	*Return journey to Hotel*
	20：00-22：00	*Farewell Dinner hosted by NML-SIRIM*

Participants List

APEC/APLMF Seminar and Training Courses in Legal Metrology (CTI-09/2009T)

Training Coures on Electricity Meters

No.	Category	Economy	Name	Organization
1	APLMF	P. R. China	Dr. ZHANG Chao	APLMF Secretary, Department of Metrology, AQSIQ
2	APLMF	P. R. China	Mr. GUO Su	APLMF Secretary, Department of Metrology, AQSIQ
3	Trainer	Japan	Mr. SHUICHI TANABE	Measurement and Product Safety ServiceJapan Electric Meters Inspection Corporation (JEMIC)
4	Trainer	Japan	Mr. KAZUNARI SHIRAISHI	Measurement and Product Safety ServiceJapan Electric Meters Inspection Corporation (JEMIC)
5	Trainer	Malaysia	Ms. SARASWATHY SINNIAH	TNB Metering Sdn. Bhd.
6	Trainer	Malaysia	Mr. JUMARY JAAPAR	Krizik Sdn. Bhd.
7	Participant	Indonesia	Mr. Iyus Ruslan	Directorate of Metrology
8	Participant	Thailand	Mr. Nopporn Choopol	Phuket Weights and Measures Branch office, Bureau of Weights & Measures, Department of Internal Trade, Ministry of Commerce
9	Participant	PNG	Mr. Roland Tagis	Papua New Guinea-National Institute of Standards and Industrial Technology
10	Participant	P. R. China	Mr. Li lin	National Quality Inspection Center for Electricity Meters (Jiangsu) P. R. China
11	Participant	Viet Nam	Mr. Nguyen Ngoc Hue	Directorate for Standards, Metrology and Quality (STAMEQ)

12	Participant	Cambodia	Mr. YIN Vanndeth	Department of Metrology, Ministry of Industry, Mines and Energy
13	Participant	Mongolia	Ms. ENKHBAATAR TSOMOOGOMBO	Mongolian Agency for Standardization and Metrology
14	Participant	Chinese Taipei	Mr. Kuo Chiung-Ting	Bureau of Standards, Metrology & Inspection
15	Participant	Chinese Taipei	Mr. Huang Chen-sheng	Bureau of Standards, Metrology & Inspection
16	Participant	P. R. China	Mr. Li Ming	Zhejiang Province Institute of Metrology, National Center of Electrical Energy Meter for Quality supervision and Testing
17	Participant	Indonesia	Mr. Eko Karsomo	Metrological Training Centre
18	Participant	Indonesia	Mr. Jaja Sujatma	Regional Industry and Trade Office, Division of Metrology
19	Participant	Indonesia	Mr. Mohammad Ridwan	Metrological Training Centre
20	Participant	Viet Nam	Mr. Nguyen Quang Anh	Hanoi power company
21	Participant	Viet Nam	Mr. Pham Van Dac	Hanoi power company
22	Participant	Malaysia	Mr. Nazri Marzuki	National Metrology Laboratory, SIRIM Berhad
23	Host	Malaysia	Mr. Abdul Rashid Zainal Abidin	National Metrology Laboratory, SIRIM Berhad
24	Host	Malaysia	Mr. Chen Soo Fatt	National Metrology Laboratory, SIRIM Berhad

25	Host	Malaysia	Dr. Mohd Nasir Zainal Abidin	National Metrology Laboratory, SIRIM Berhad
26	Host	Malaysia	Ms. Puteri Nor Rasida	National Metrology Laboratory, SIRIM Berhad
27	Host	Malaysia	Ms. Anita Yusof	National Metrology Laboratory, SIRIM Berhad
28	Local participant	Malaysia	Mr. Ang Chin Han	Metertek Sdn. Bhd.
29	Local participant	Malaysia	Mr. Sang Yu Ging	Sarawak Energy Berhad
30	Local participant	Malaysia	Mr. ELNA AK AKAM	Sarawak Energy Berhad
31	Local participant	Malaysia	Mr. Mohd Supian Mohd Yusof	Stabil Meter Sdn. Bhd.
32	Local participant	Malaysia	Mr. Roshadlisham Ramli	Krizik Sdn Bhd.
33	Local participant	Malaysia	Mr. PETER J. BERINUS AGANG	Ministry of Domestic Trade, Co-operatives & Consumerism
34	Local participant	Malaysia	Mr. ROSLEY ABDULLAH	Ministry of Domestic Trade, Co-operatives & Consumerism
35	Local participant	Malaysia	Mr. ZAWAWI HUSSIN	Ministry of Domestic Trade, Co-operatives & Consumerism
36	Local participant	Malaysia	Mr. MOHD AZNAN IBRAHIM	Ministry of Domestic Trade, Co-operatives & Consumerism
37	Local participant	Malaysia	Mr. DURAI RETNAM ARUCHANDRAN	TNB Metering Sdn. Bhd.

38	Local participant	Malaysia	Mr. THEVARAJAN G. SHANMUGAM	TNB Metering Sdn. Bhd.
39	Local participant	Malaysia	Mr. NOR JAFRI MOKHTAR	TNB Metering Sdn. Bhd.
40	Local participant	Malaysia	Mr. KONG SHYANG YAU	TNB Metering Sdn. Bhd.
41	Local participant	Malaysia	Mr. NORSHAMIZA-TUL SHIMA SHAM-SUDDIN	TNB Metering Sdn. Bhd.

Asia–Pacific
Economic Cooperation

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Forum

Outline of Electricity Meters

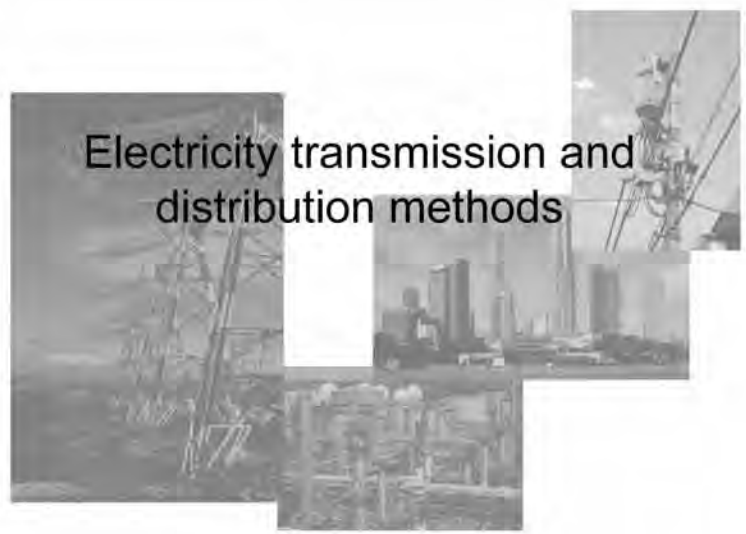
by Mr.Shuichi Tanabe

JEMIC

Contents

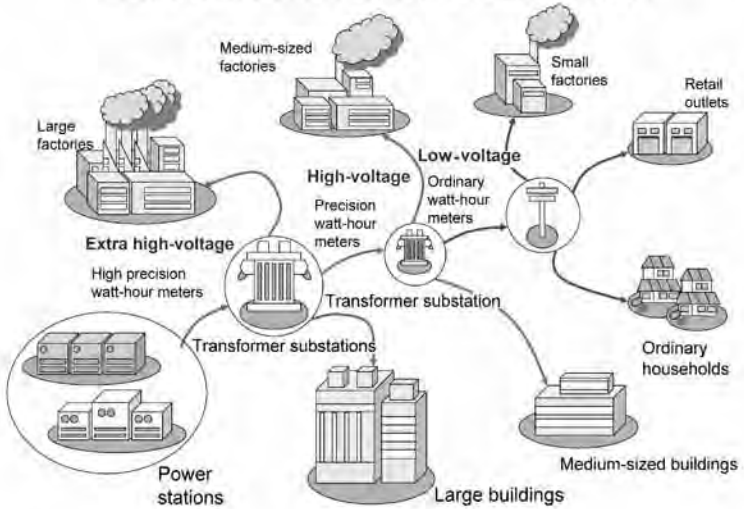
- The need for electricity meters
- Electricity transmission and distribution methods
- Power and Energy
- Types of electricity meters and precision classification
- Electromechanical induction meters

The need for electricity meters



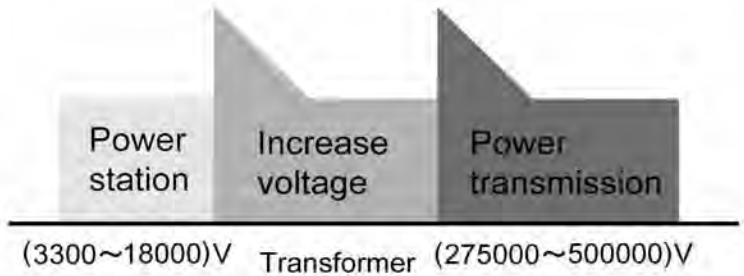
Electricity transmission and distribution methods

Transmission and Distribution



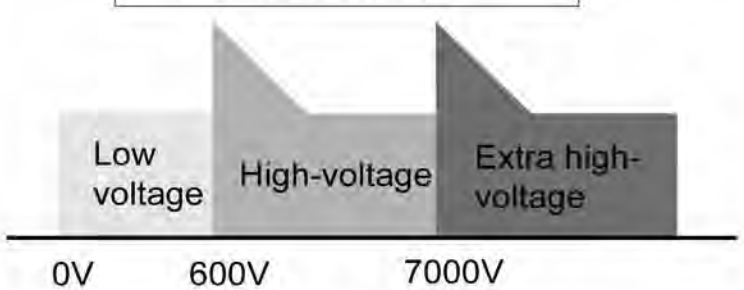
Transmission voltage

Alternating-current voltage in transmission system

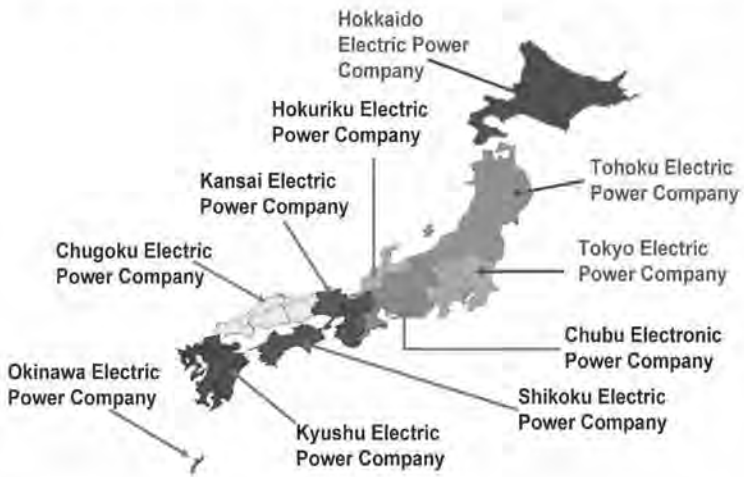


Distribution voltage

Alternating-current voltage in distribution system



Electric Power Companies in Japan



Power supply Frequency in Japan

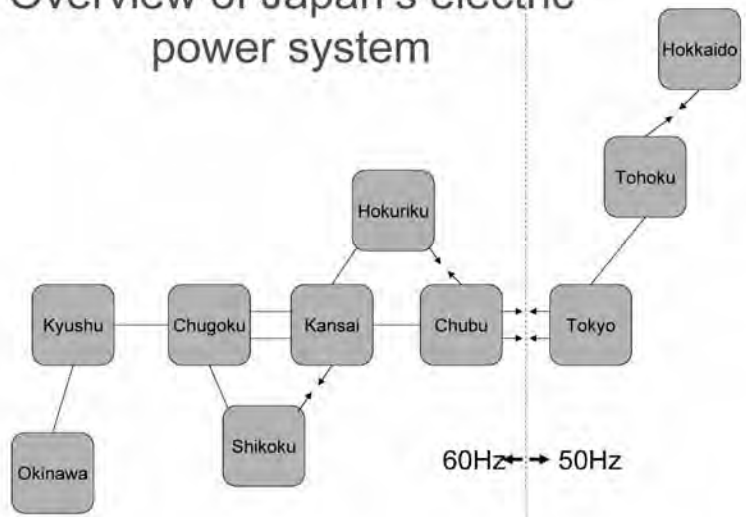
50Hz

Hokkaido Electric Power Company
Tohoku Electric Power Company
Tokyo Electric Power Company

60Hz

Chubu Electric Power Company
Kansai Electric Power Company
Hokuriku Electric Power Company
Chugoku Electric Power Company
Shikoku Electric Power Company
Kyushu Electric Power Company
Okinawa Electric Power Company

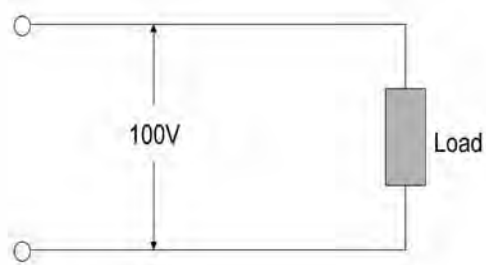
Overview of Japan's electric power system



Distribution methods

Electricity distribution systems (1)

Single-phase two-wire system
Distribution of electricity at low supply capacity of 100V



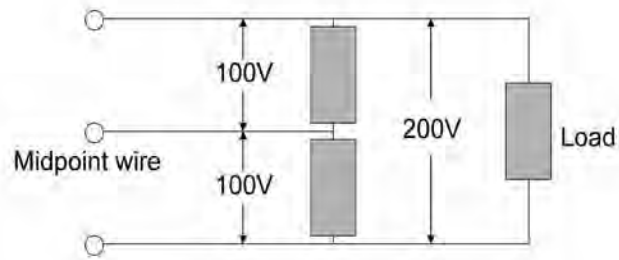
Electricity distribution systems (2)

Single-phase three-wire system

This is a "100 volts + 100 volts = 200 volts" power distribution system whereby power cables originate from the midpoint of the single phase 200 volt power transformer and three wires are used to create two 100 volt circuits and one 200 volt circuit.
If the midpoint wire is earthed, then the earth voltage of the other two wires becomes 100 volts, reducing their potential danger for accidents.

This system is used in ordinary households where a 200V supply is required, such as where the load is high and a 100V supply is not sufficient.

Electricity distribution systems (2)



Electricity distribution systems (3)

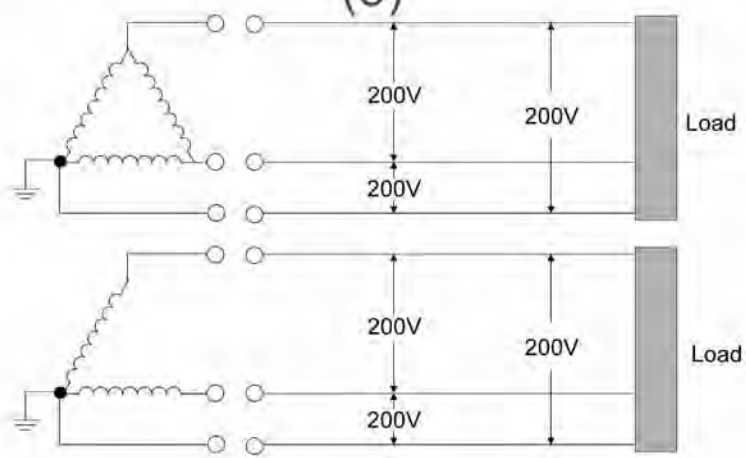
Three-phase three-wire system

These systems are widely used by a range of parties from small factories to major customers. The majority of Japan's power transmission systems are three-phase three-wire systems. (Single-phase power distribution systems use two of these wires.)

Motors are powered with three-phase systems since they produce smoother revolution than single phrase systems.

In high-voltage three-phase three wire distribution systems, meters may be combined with transformers.

Electricity distribution systems (3)



Electricity distribution systems (4)

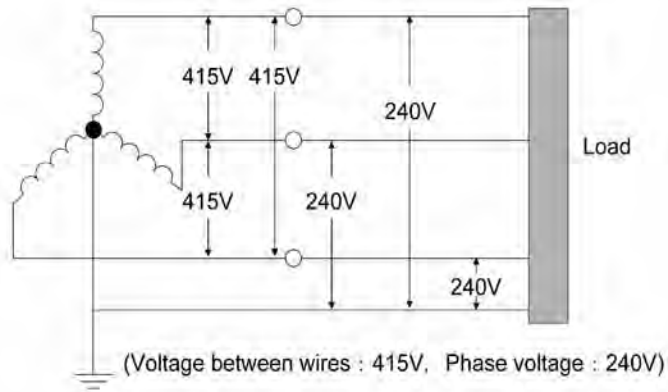
Three phase four wire system

These systems are used to distribute electricity to factories and other customers with a Large-lot load, and therefore are not used for ordinary Japanese households.

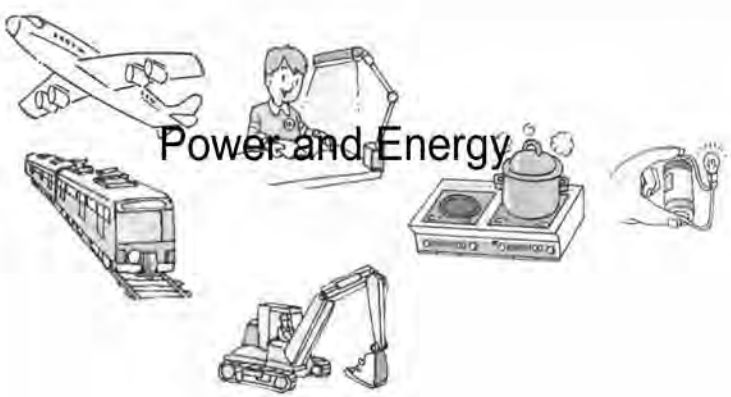
Electricity is input through a three-phase three-wire system, and when the voltage is transformed, a neutral point is connected creating a four wire system.

This system can deal with an increase in the number of customers while remaining economic.

Electricity distribution systems (4)

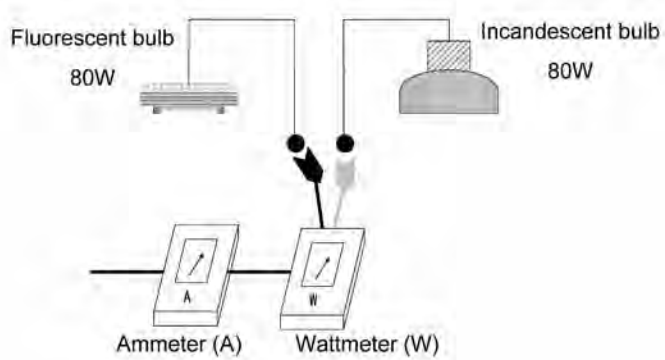


(Voltage between wires : 415V, Phase voltage : 240V)



Power and Energy

Example of household electricity consumption and electricity usage (1)



Example of household electricity consumption and electricity usage (2)

- Measure electricity consumption with wattmeter
- Measure current with ammeter electricity consumption is the same but current differs.

	Current	Power
Incandescent bulb	0.8A	80W
Fluorescent bulb	1.25A	80W

Example of household electricity consumption and electricity usage (3)

Since the household voltage is 100V

Incandescent bulb Power=100V × 0.8A = 80W

Fluorescent bulb Power=100V × 1.25A=125W

The reading for the fluorescent bulb differs from the measured reading.

This is because it has a low power factor.

Example of household electricity consumption and electricity usage (4)

For alternating-current,

The basic formula is

$$\text{Power} = \text{Voltage} \times \text{Current} \times \text{Power factor}$$

Example of household electricity consumption and electricity usage (5)

Therefore power factor is:

Incandescent bulb

$$PF = \frac{\text{Power}}{\text{voltage} \times \text{current}}$$

$$PF = \frac{80W}{100V \times 0.8A} = 1$$

Fluorescent bulb

$$PF = \frac{\text{Power}}{\text{voltage} \times \text{current}}$$

$$PF = \frac{80W}{100V \times 1.25A} = 0.64$$

Example of household electricity consumption and electricity usage (6)

Power factor

	Power factor
Incandescent bulb	1
Fluorescent bulb	0.64

From these results we can see that we can see that "the fluorescent bulb won't achieve a brightness of 80 watts unless it has a current of 1.25 amps".

In other words, the fluorescent bulb has a lower power factor.

Example of household electricity consumption and electricity usage (7)

The power factor is the proportion of the current that flows to the load (bulb) that performs active work (is emitted as light).

The proportion of the power effective work is

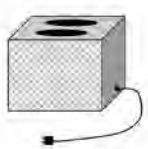
Incandescent bulb	100%
Fluorescent bulb	80%

Example of household electricity consumption and electricity usage (8)

Power factor of household electric appliances

Another example

Toaster
100W
PF 1



Refrigerator
100W
PF 0.8

Example of household electricity consumption and electricity usage (9)

Both appliances use the same power but have a different power factor.

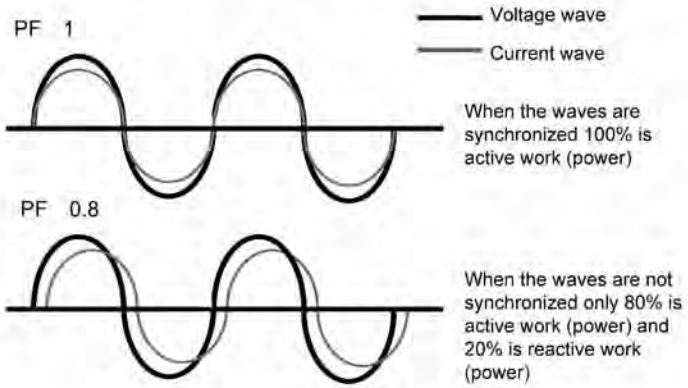
We can find the current from the basic formula.

$$\text{Toaster current} = \frac{100\text{W}}{100\text{V} \times \text{PF } 1} = 1\text{A}$$

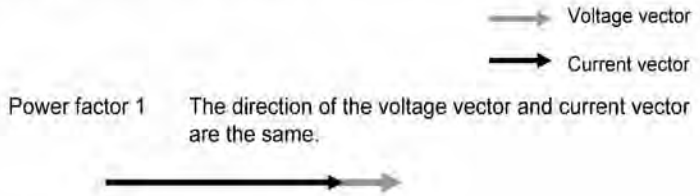
$$\text{Refrigerator current} = \frac{100\text{W}}{100\text{V} \times \text{PF } 0.8} = 1.25\text{A}$$

The volume of the currents are different.

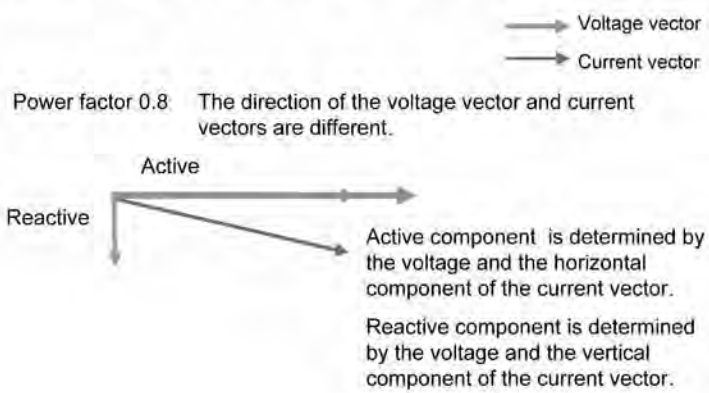
Example of household electricity consumption and electricity usage (10)



Example of household electricity consumption and electricity usage (11)



Example of household electricity consumption and electricity usage (12)



Example of household electricity consumption and electricity usage (13)

Active and Reactive components of power

- Active power = Voltage × Active current component
  $= V \times I \cos\theta$
- Reactive power = Voltage × Reactive current component
  $= V \times I \sin\theta$

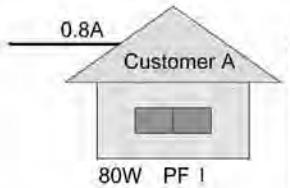
Example of household electricity consumption and electricity usage (14)

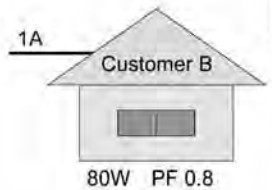
Energy

$$\text{Energy} = \text{Power} \times \text{Time}$$

- Active energy = Active power × Time
  $= V \times I \cos\theta \times t$
- Reactive energy = Reactive power × Time
  $= V \times I \sin\theta \times t$

Example of household electricity consumption and electricity usage (15)





Reasons for measuring the reactive power.

Even if the current is the same, electricity consumption varies depending on the power factor.

Example of household electricity consumption and electricity usage (16)

Electricity tariffs:

Suppose 1kWh=¥10, and electricity is used for one hour.

Both customer A and customer B will be charged ¥ 0.8, but customer B will require equipment that can generate a current 0.2A larger than for customer A.

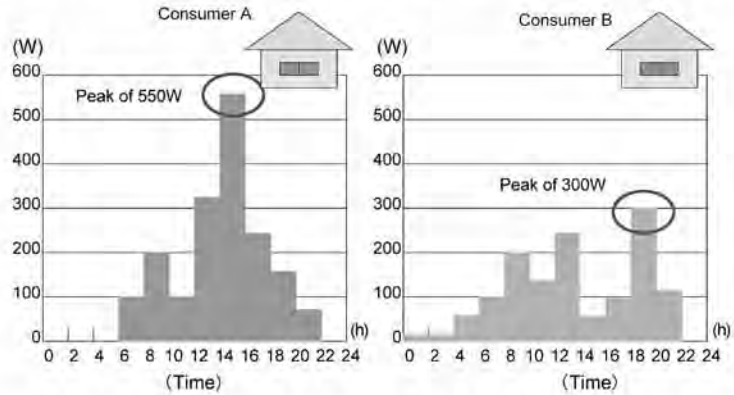
Therefore, to work out the power factor we have to measure reactive power.

Example of household electricity consumption and electricity usage (17)

Power factor

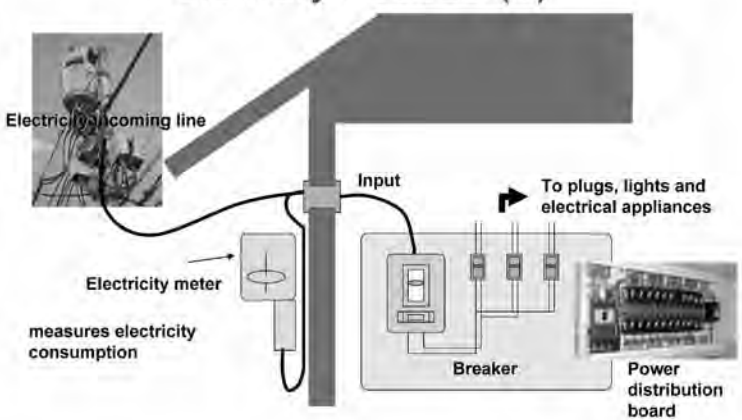
$$\text{Power factor} = \frac{\text{Active power}}{\sqrt{(\text{Active power})^2 + (\text{Reactive power})^2}}$$

Example of household electricity consumption and electricity usage (18)



Types of electricity meters and precision classification

Supplying electricity to ordinary houses (1)



Supplying electricity to ordinary houses (2)

The electricity output from transformer substations is supplied to ordinary households where it is used for lighting and to power various electrical appliances, through drop wires. Electricity usage is measured in terms of electrical energy used.
The amount of the electrical energy used, which determines the monthly electricity tariff, plays a very important role in the transactions between consumers and power companies.

Supplying electricity to ordinary houses (3)

There are various types of electric meter that vary in structure, usage, installation environment and the range of energy amounts they can measure.

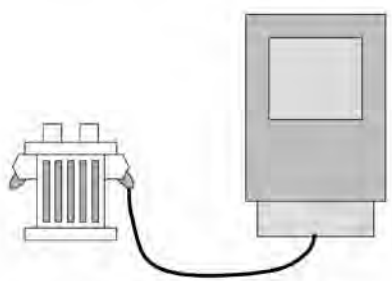
Direct connection type meters and Transformer operated Meter (1)

Direct Connection Type meters → Watt-hour meters used alone.

Transformer Operated Meters → Watt-hour meters use in combination with transformers.

Transformers — Transformers are voltage transformers that convert high-voltages into low voltages or current transformers that transform large currents into small currents.

Direct connection type meters and Transformer operated Meter (2)



Transformer Meter

Direct connection type meters and Transformer operated Meter (3)

(Example) Calculating energy usage

(In case of meter with multiplier)

- Voltage ratio (primary voltage / secondary voltage)
- Current ratio (primary current / secondary current)

This product is then multiplied by the previous reading on the meter to give the actual energy consumption.

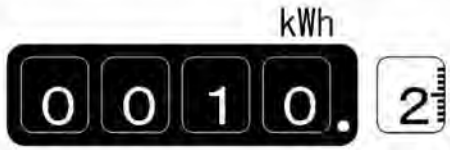
Direct connection type meters and Transformer operated Meter (4)

If primary voltage = 6600V, secondary voltage = 110V,
primary current = 10A, and secondary current = 5A,

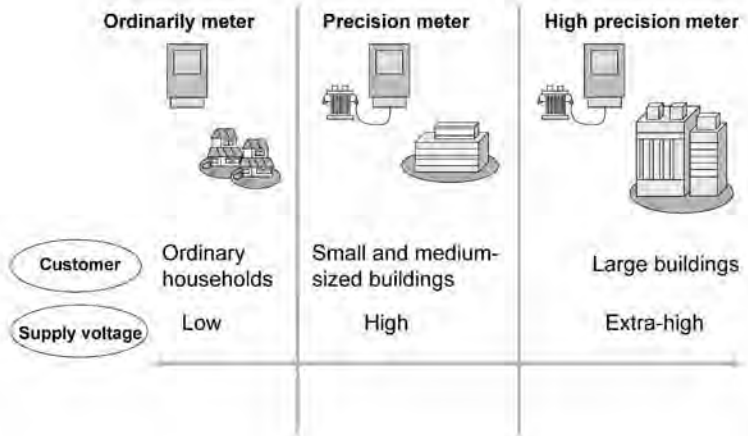
then

$$10.2 \times (6600 / 110) \times (10 / 5) = 1224\text{kWh}$$

The amount of electricity used in this example is 1224 kilowatt-hours.



Classification (1)



Classification (2)

Types of electricity meters and precision classification

Meter type	Error (%)
・Ordinary watt-hour meter (ordinary class)	±2.0
・Precision watt-hour meter (precision class)	±1.0
・High precision watt-hour meter (Hi-precision class)	±0.5
・Var-hour meter	±2.5
・Maximum demand meter	±3.0

Types of meter

There are some kinds according to contractual coverage.
Moreover, it may be used combining two or more meters.

Meter type	Usage
・High precision watt-hour meter	・Contracts over 10,000kW
・Precision watt-hour meter	・Contracts over 500kW
・Ordinary watt-hour meter	・Contracts under 500kW
・Var-hour meter	・Calculating power factor
・Maximum demand meter	・Maximum power demand

Electromechanical induction meters

Fundamental structure of electromechanical induction meters

Fundamental principles (1)

The fundamental principles of these meters were discovered in 1885 by the Italian scientist Ferraris, and as such they are sometimes called Ferraris meters.

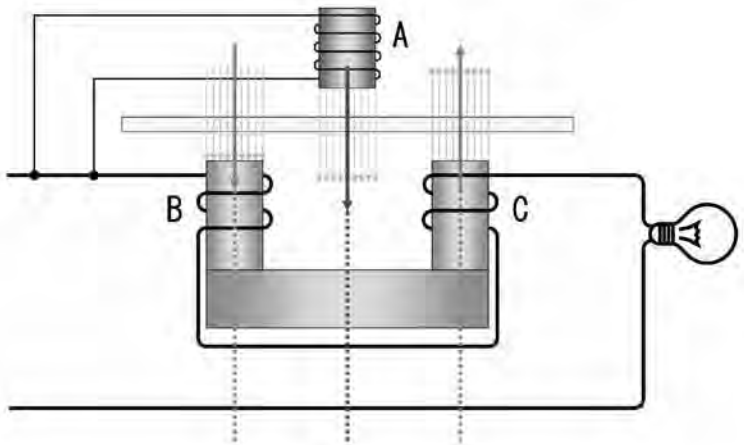
Fundamental principles (2)

This meter is based on the principle that moving a magnet close to the periphery of an aluminum rotating disc causes the disc to rotate in the same direction as the magnet movement, due to the interaction of the magnetic field with the current（eddy current）generated by the disc.

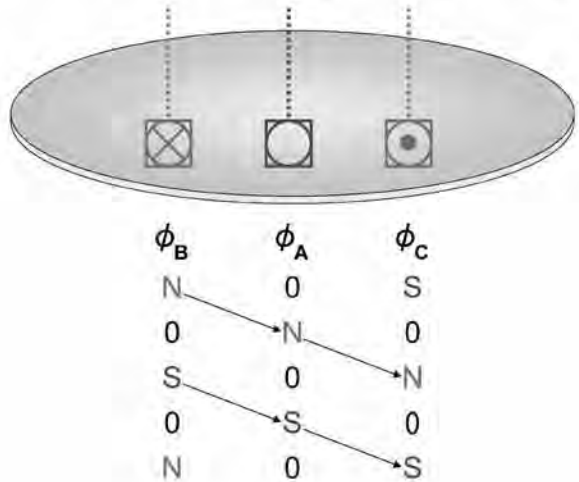
Fundamental principles (3)

DVD showing Arago's disc.

Fundamental principles (4)



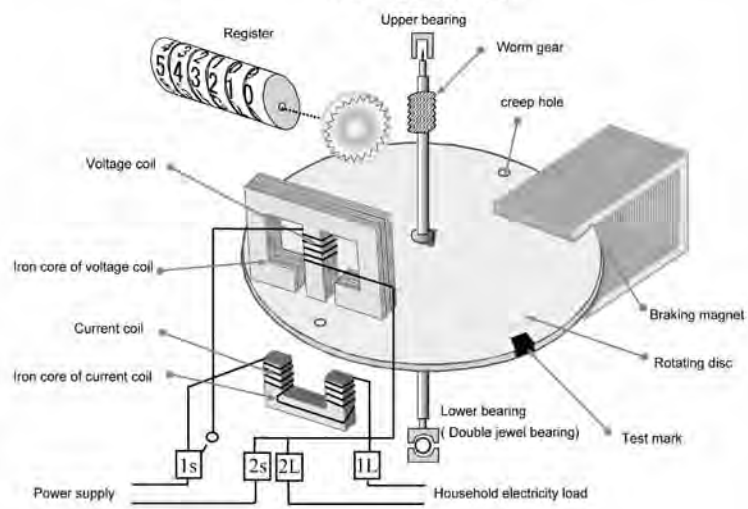
Fundamental principles (5)



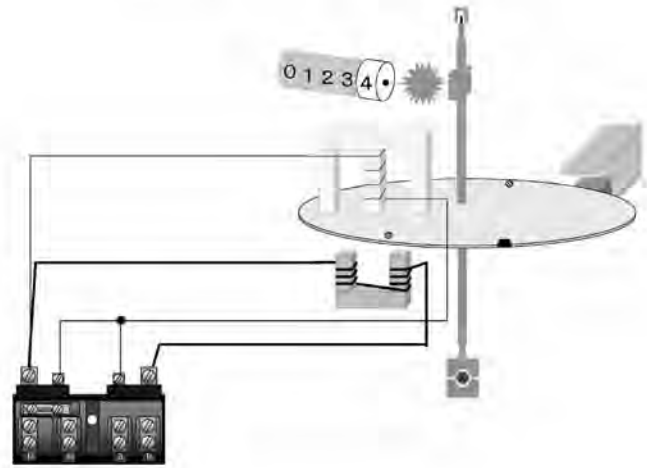
Fundamental structure of electromechanical induction meters

- The voltage coil, current coil and iron core
- Rotating disc and its bearings
- Braking magnet
- Adjusting devices
- Compensating devices
- Register

Structural



Structural (voltage coil)

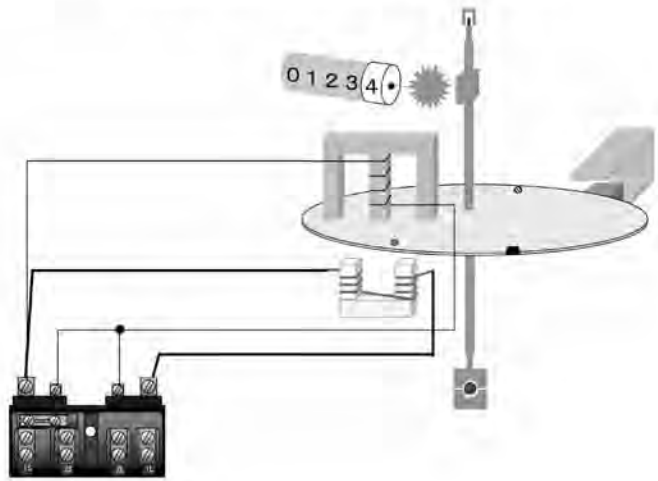


The voltage coil, current coil and iron core (1)

(1) Voltage coil

- The magnetic field lines produced by the voltage coil produce torque in the disc.
- The voltage coil wires are wound around more times than those in the current coil.

Structural (current coil)

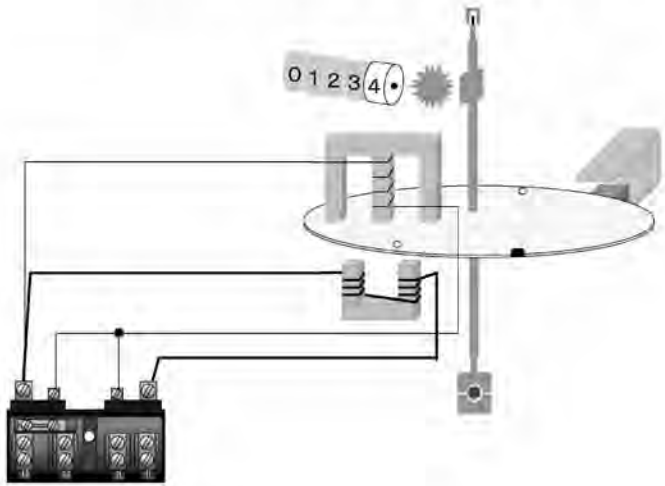


The voltage coil, current coil and iron core (2)

(2) Current coil

- The current coil is the coil for transmitting the load current.

Structural（rotating disc）

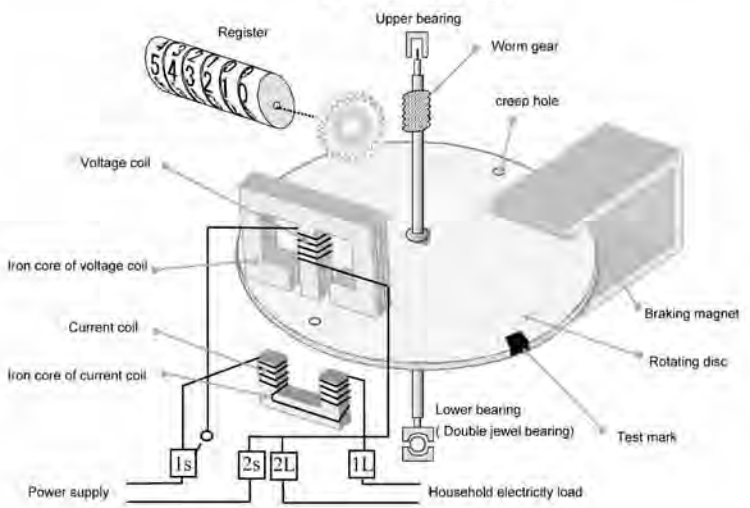


Rotating disc and its bearings（1）

(1)Rotating disc

- The disc is made of aluminum, which is 99.98% percent pure as the aluminum's properties affect meter performance.
- It is attached to a duralumin or brass axle using a diecast made from a compound composed principally of lead, and it revolves with the upper and lower bearings as its support point.
- The disc also includes a worm for transmitting the revolutions to the register and holes to prevent creeping.

Structural

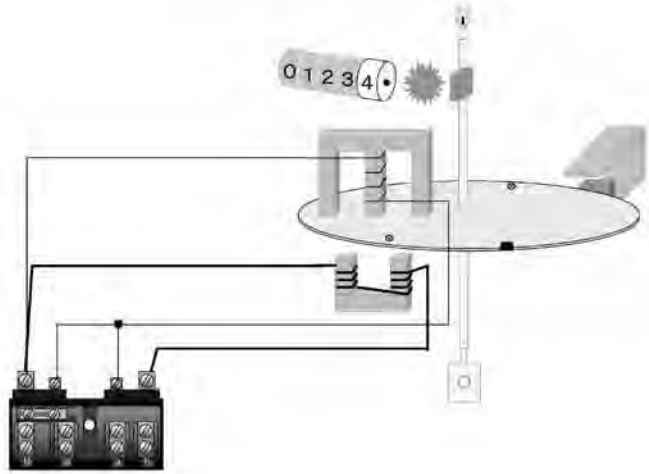


Rotating disc and its bearings (2)

- The disc also includes a worm for transmitting the revolutions to the register and holes to prevent creeping.

The electromechanical induction meters rotating disc has two creep holes to ensure that the disc does not revolve when no power is being consumed. This arrangement works on the principle that if the creep holes come beneath the drive magnetic pole, the eddy current in the disc alternates, and is pulled towards the electromagnet.

Structural（bearing）

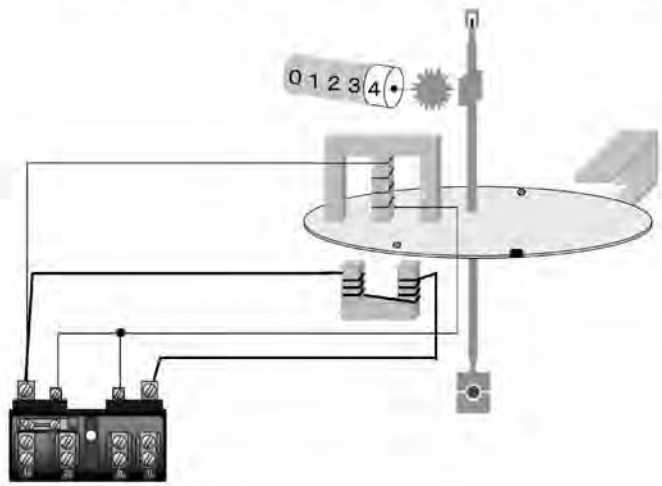


Rotating disc and its bearings (3)

(2) Bearings

- The upper bearing is a steel needle fixed into the meters supporting structure. It is inserted into the hole on the end of the disc axle and prevents the upper part of the disc from vibrating.
- The lower bearing consists of a steel ball sandwiched in between jewel bearings such as sapphire or ruby bearings.

Structural（braking magnet）



Braking magnet

- The braking magnet is used to make sure the disc revolutions are proportional to the load.
- It should have strong remnant magnetization and high coercivity.

Adjustment devices

The register indicates the volume of power consumed in accordance with the revolutions of the disc, which rotates in proportion to the power consumption.

There are two adjustment devices; dial register and cyclometer counter.

Adjusting devices

- The adjusting devices adjust the speed of disc rotation to precisely reflect the amount of power consumption.
- There are the following types of adjusting devices;
  (1) The heavy-load adjusting device
  (2) The light-load adjusting device
  (3) The phase adjusting device

Compensating devices (1)

- The compensating devices maintain the meters load, voltage, power factor and temperature within an acceptable range.

Therefore, compensating devices differ from adjusting devices.

Compensating devices (2)

There are the following types of compensating devices.

(1) The heavy-load compensating device

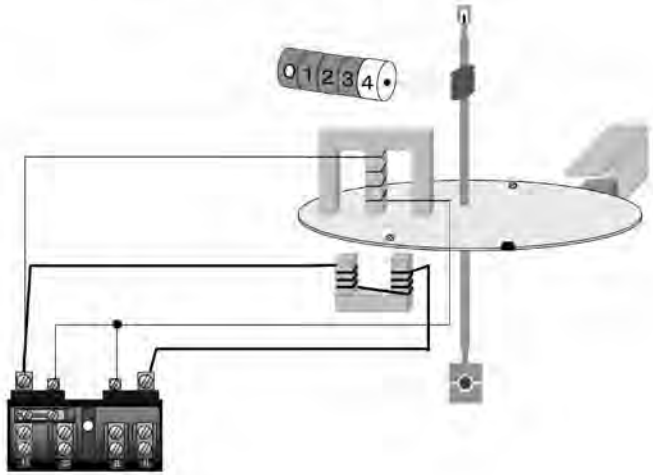
(2) The light-load compensating device

(3) The phase compensating device

(4) The voltage characteristic compensating device

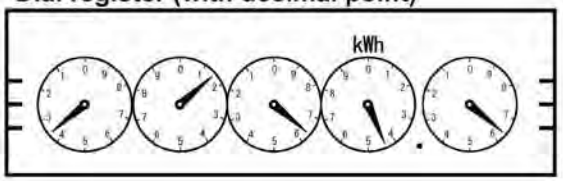
(5) The temperature compensating device

Structural（register）

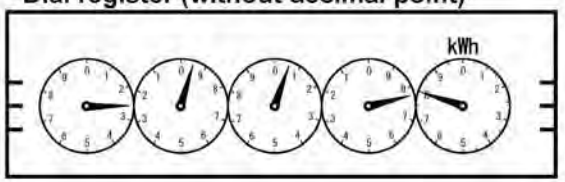


Example register display (1)

Dial register (with decimal point)



Dial register (without decimal point)



Example register display (2)

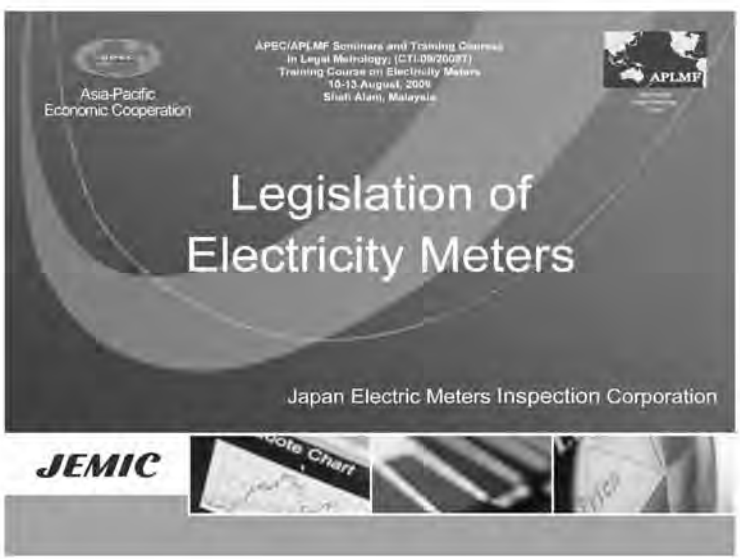
Cyclometer type register (with decimal point)

Cyclometer type register(without decimal point)

Question? & Comment

Thank you for your attention

JEMIC



Contents

1. Measurement Law
2. Government Ordinance
3. Ministerial Ordinance
4. Verification and Inspection for WHM
5. Inspection of Legal Standards
6. Legal standard Watt-Hour Meters
7. National Standard for power and energy
8. JEMIC
9. Traceability system

JEMIC

Measurement Law

Structure of the Measurement Law

Law	Measurement Law
Government Ordinance	Order for Enforcement of the Measurement Law
Ministerial Ordinance	Regulations for Enforcement of the Measurement Law

JEMIC

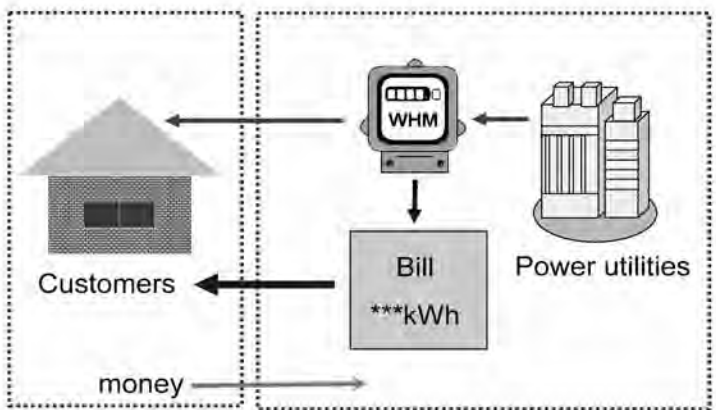
Article 2.

The term "**transaction**" as used in this Law shall mean any act in business, irrespective of compensation or not for the purpose of supply of goods or services and the term "**certification**" shall mean to express to other persons, in public or in business that a certain fact is true.

transaction **certification**

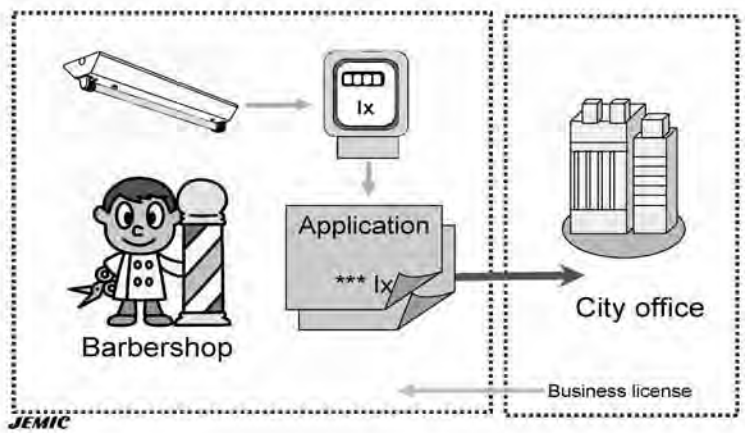
JEMIC

transaction



JEMIC

certification



JEMIC

Article 4.

The term "measuring instruments" as used in this Law shall mean appliances, machines or equipment used for measurements and the term "**specified measuring instruments**" shall mean measuring instruments used in transaction or certification or supplied chiefly for the life of general consumers and prescribed by Cabinet Order as being necessary to establish the standards with respect to the construction or the instrumental error for the purpose of securing performance of proper measurements.

etc.

specified measuring instruments

JEMIC

Classification of specified measuring instruments

Watt-hour meter	**Maximum demand meter**
Var-hour meter	**Illuminometer**
Weighing instrument	Taxi meter
Thermometer	Hide planimeter
Volume meter	Current meter
Density hydrometer	Pressure gauge
Flow meter	Calorimeter
Vibration level meter	Noise level meter
Relative density hydrometer	
Instruments for measuring concentration	

JEMIC

Government Ordinance(1)

1.Ministry of Economy, Trade and Industry (METI)

2. Local Government

3. JEMIC

JEMIC

Government Ordinance(2)

Verification period for specified measuring instruments

1year 8years 4years

JEMIC

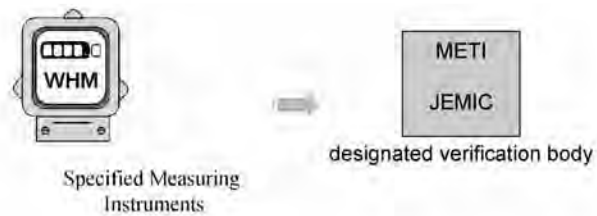
Ministerial Ordinance(1)

Application for type approval

JEMIC

Ministerial Ordinance(2)

Verification for WHM



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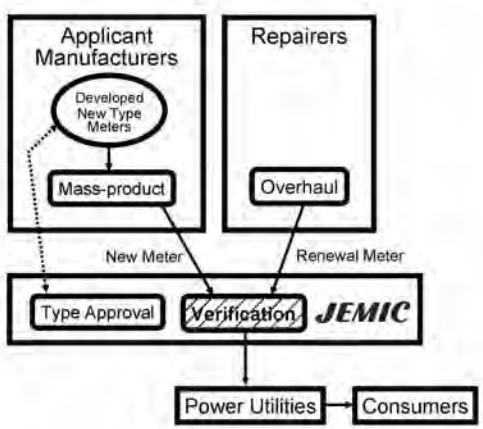
Verification and Inspection for WHM(1)

Until 1993



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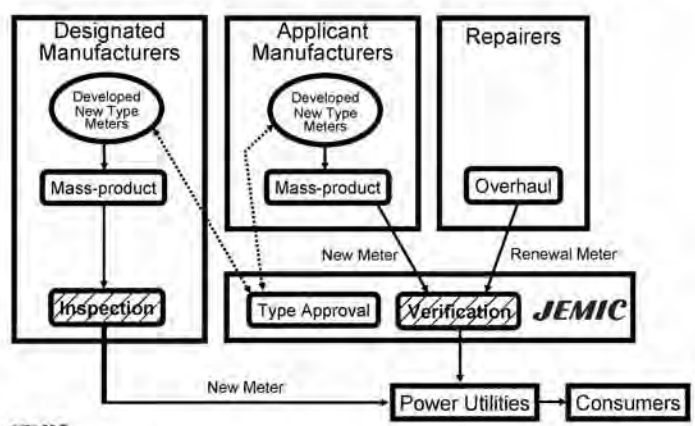
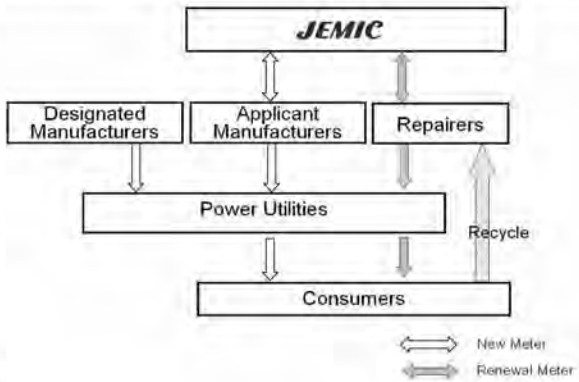
Verification and Inspection for WHM(2)



JEMIC

Life Cycle of Electricity Meter



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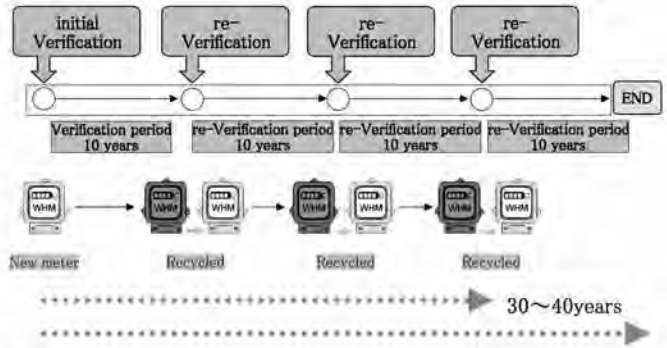
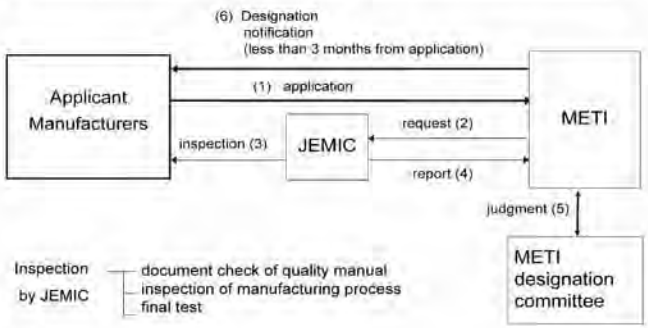
Verification & Re-Verification



JEMIC

Designation Procedure for Manufacturers



JEMIC

Measurement Law (2)

JEMIC (main activities by law)

Article 70: Application for Verification

Article 73: Application for Inspection of Electric Meter with Transformer

Article 76: Type Approval

Article 102: Inspection of Verification Standards

JEMIC

Inspection of Legal Standards(1)

JEMIC

↓ inspection

	term of validity
legal standards resistor	1year
legal voltage standard	1year
legal standard ammeter	6months
legal standard voltmeter	6months
legal illuminance standard	5years
legal standard watt-hour meter class1	1year
legal standard watt-hour meter class2	1year
legal standard watt-hour meter class3	6months

JEMIC, Manufacturers and Repairers

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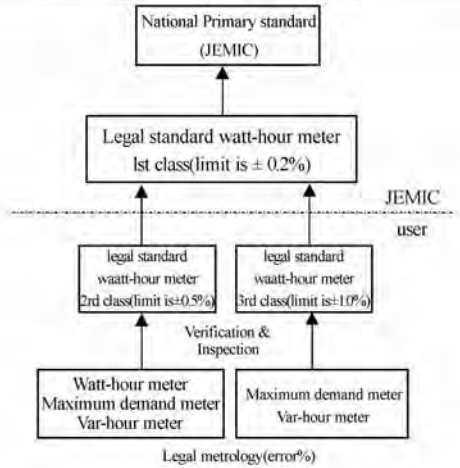
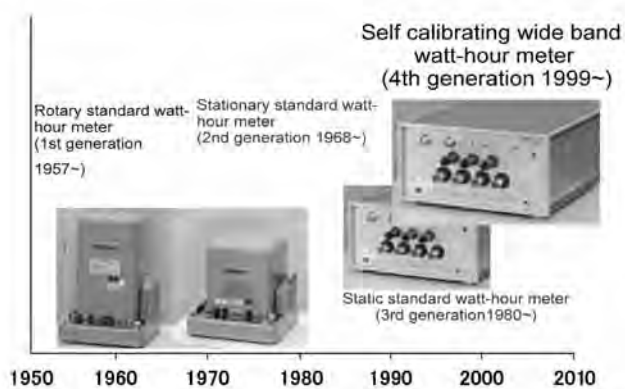
Inspection of Legal Standards(2)



JEMIC

Legal standard Watt-Hour Meters(1)



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Legal standard Watt-Hour Meters(2)

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National Standard for power and energy(1)

A Digital System for Calibrating
Active/Reactive Power and Energy Meters

Voltage : 100V
Current : 5A
Frequency : 50, 60Hz
Multifunction
- RMS value of voltage and current
- Active/reactive power
- Phase angle
- Frequency

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→ Video(48sec)

Traceability System

JEMIC

National Standard for power and energy(2)

Calibration range		Calibration and measurement capability (Coverage factor k = 2)			
Power converter	100 V, 120 V 5 A 50 Hz to 60 Hz	120 V, 5 A 50 Hz, 60 Hz (Rated output voltage: 10V)		PF 1	0.000 23 V
				PF 0.5 Lead, Lag	0.000 15 V
				PF 0 Lead, Lag	0.000 11 V
		100 V, 5 A 50 Hz, 60 Hz (Rated output voltage: 1 V)		PF 1	0.000 023 V
				PF 0.5 Lead, Lag	0.000 015 V
				PF 0 Lead, Lag	0.000 011 V
Power meter	100 V, 110 V, 120 V 5 A 50 Hz to 60 Hz	100 V, 5 A 50 Hz, 60 Hz		PF 1	0.014 W
				PF 0.5 Lead, Lag	0.012 W
				PF 0 Lead, Lag	0.011 W
Energy meter	100 V, 110 V 5 A 50 Hz to 60 Hz	Single-phase 2-wire	100 V, 5 A 50 Hz, 60 Hz	PF 1	0.005 %
				PF 0.5 Lead, Lag	0.007 %
		Single-phase 3-wire	100 V, 5 A 50 Hz, 60 Hz	PF 1	0.007 %
				PF 0.5 Lead, Lag	0.009 %
		Three-phase 3-wire	110 V, 5 A 50 Hz, 60 Hz	PF 1	0.006 %
				PF 0.5 Lead, Lag	0.011 %

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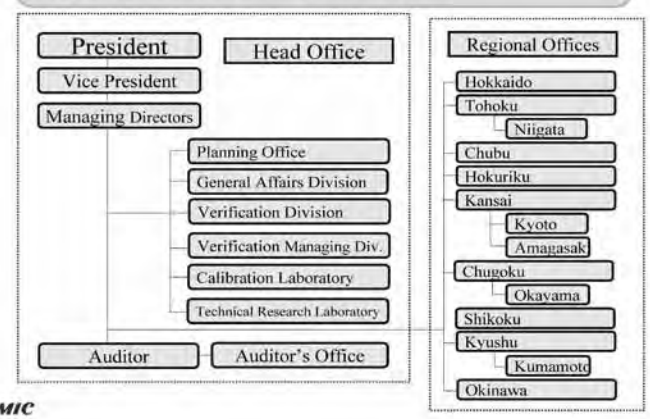
organization and department



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Traceability system

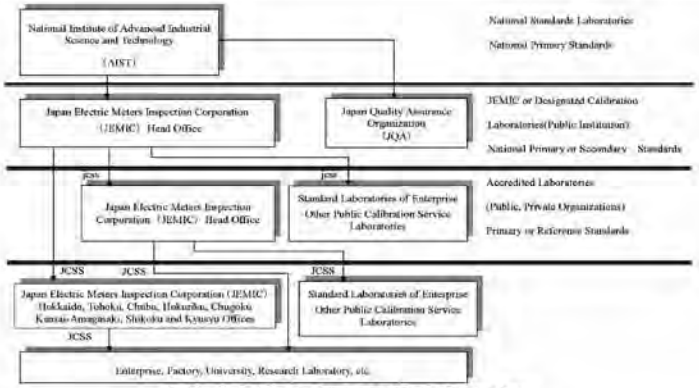

Fig. 2-3 Outline of New Traceability System of Electrical Standards in Japan

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Maintenance and Distribution of Measuring Standards

Calibration Service

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❖Comments ?

❖Questions ?

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Thank you for your Attention

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History of verification period

ordinaryWHM(100V30A)				
year	MPE	in use	verification period	TYPE
1955	±3.0	±4.0	5	—
1967	±2.0	±3.0		TYPE Ⅱ
1973			7	TYPE Ⅲ
1983			10	

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Asia-Pacific Economic Cooperation

APEC/APLMF Seminars and Training Courses
in Legal Metrology; (CTI-09/2009T)
Training Course on Electricity Meters
10-13 August, 2009
Shah Alam, Malaysia

APLMF

Overview of International Standards relating to Electricity Meters

-International Standards of IEC TC 13-

JEMIC

IEC

International Electrotechnical Commission

Foundation	**June 1906**
Central Office	**Geneva, Switzerland**
Members	**76countries**
TCs&SCs	**94TCs, 80SCs**

TC:Technical Committee, SC:Sub Committee

IEC

TC 1	Terminology	TC 32	Fuses
TC 2	Rotating machinery	SC 32A	High-voltage fuses
TC 3	Information structures, documentation and graphical symbols	SC 32B	Low-voltage fuses
TC 4	Hydraulic turbines	SC 32C	Miniature fuses
TC 5	Steam Turbines (IN STAND BY)	TC 33	Power capacitors
TC 7	Overhead electrical conductors	TC 55	Winding wires
TC 8	Systems aspects for electrical energy supply	TC 56	Dependability
TC 9	Electrical equipment and systems for railways	TC 57	Power systems management and associated information exchange
TC 13	Electrical energy measurement, tariff- and load control	TC 59	Performance of household and similar electrical appliances
TC 14	Power transformers	TC 64	Electrical installations and protection against electric shock

IEC

TC 66	Safety of measuring, control and laboratory equipment	TC107	Process management for avionics
TC 68	Magnetic alloys and steels	TC108	Safety of electronic equipment within the field of audio/video, information technology and communication technology
TC 69	Electric road vehicles and electric industrial trucks	TC109	Insulation co-ordination for low-voltage equipment
TC 70	Degrees of protection provided by enclosures	TC110	Flat panel display devices
TC 72	Automatic controls for household use	TC111	Environmental standardization for electrical and electronic products and systems
TC 73	Short-circuit currents	TC112	Evaluation and qualification of electrical insulating materials and systems
TC 76	Optical radiation safety and laser equipment	TC113	Nanotechnology standardization for electrical and electronics products and systems
TC 77	Electromagnetic compatibility	TC114	Marine energy - Wave, tidal and other water current converters
TC 87	Ultrasonics	TC115	High Voltage Direct Current (HVDC) Transmission for DC voltages above 100kV (Provisional)
TC 88	Wind turbines	TC116	Safety of hand-held motor-operated electric tools

IEC

Mission

IEC is the leading global organization that prepares and publishes international standards for all electrical, electronic and related technologies. These serve as a basis for national standardization and as references when drafting international tenders and contracts.

IEC

Objectives

— meet the requirements of the global market efficiently
— ensure primacy and maximum world-wide use of its standards and conformity assessment systems
— assess and improve the quality of products and services covered by its standards
— establish the conditions for the interoperability of complex systems
— increase the efficiency of industrial processes
— contribute to the improvement of human health and safety
— contribute to the protection of the environment

IEC TC 13

Electrical energy measurement, tariff- and load control

Scope

to prepare international standards for
equipment for electrical energy measurement, tariff- and load control, customer information, payment, local and/or remote data exchange.

The standards may include requirements and test methods to cover mechanical, environmental, electrical, safety, metrology, dependability aspects, as well as functional requirements and data models.

IEC TC 13

Membership:

ALBANIA, AUSTRALIA, AUSTRIA, BELGIUM, BRAZIL, BULGARIA, CHINA, COLOMBIA, CROATIA, CZECH REPUBLIC, DENMARK, FINLAND, FRANCE, GERMANY, GREECE, HUNGARY, INDIA, INDONESIA, IRAN,IRELAND, ISRAEL, ITALY, JAPAN, KOREA(R.), MALAYSIA, NETHERLANDS, NEW ZEALAND, NORWAY, POLAND, PORTUGAL, ROMANIA, RUSSIAN FEDERATION, SERBIA, SLOVAKIA, SLOVENIA, SOUTH AFRICA, SPAIN, SWEDEN, SWITZERLAND, TURKEY, UKRAINE, UNITED KINGDOM, UNITED STATES OF AMERICA

43 countries

Participant :30
Observer:13

IEC TC 13

Meeting

- 1990 Beijing(with IEC 54. General Meeting)
- 1993 Sydney(with IEC 57. General Meeting)
- 1995 Durban(with IEC 58. General Meeting)
- 1998 Helsinki
- 2001 Winterthur
- 2005 Cape Town(with IEC 69. General Meeting)
- 2008 Poitiers,France

IEC TC 13

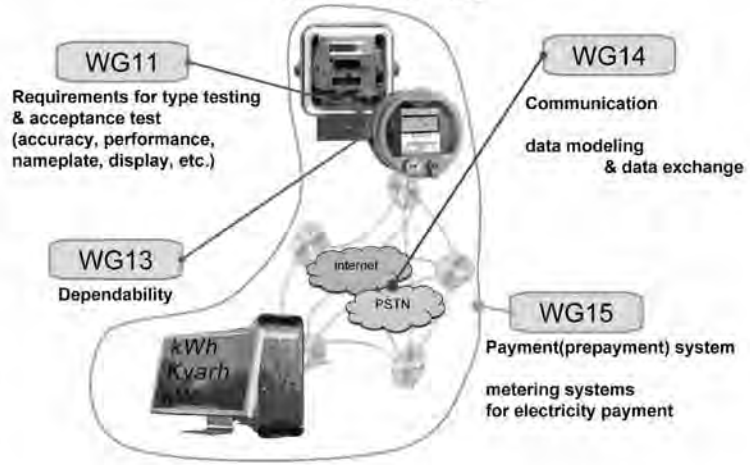
Working groups

WG 11	Electricity metering equipment
WG 13	Dependability of electricity metering equipment
WG 14	Data exchange for meter reading, tariff and load control
WG 15	Electricity metering ——Payment systems

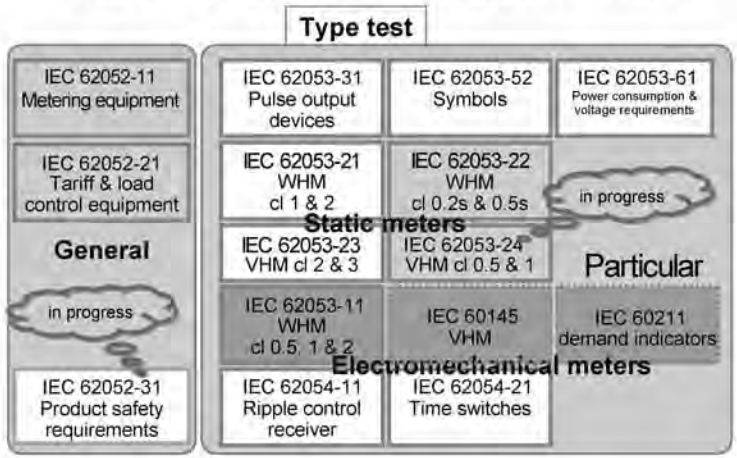
project teams

PT 62052-31	Safety requirements
PT 62053-24	Static meters for reactive energy (classes 0,5 and 1)
PT 62057	Test equipment, techniques and procedures for electrical energy meters

IEC TC 13



IEC TC 13 WG11 Documents



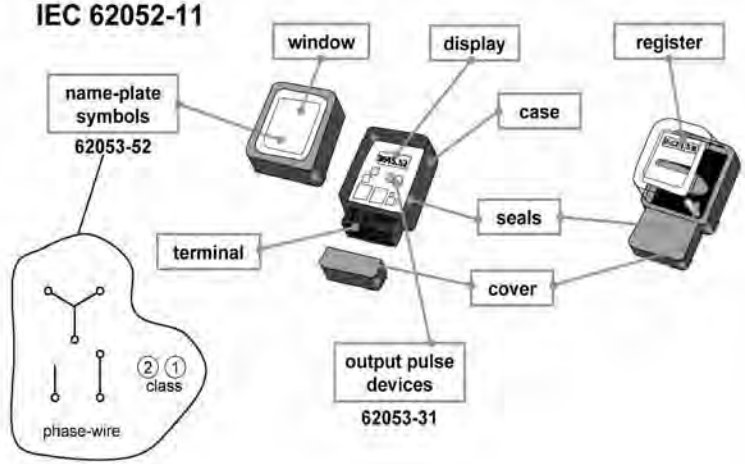
IEC TC 13 WG11 Documents

Acceptance test

IEC62058-11 Acceptance inspection methods	General
IEC62058-21 Electromechanical WHM Cl 0.5, 1 & 2	Particular
IEC62058-31 Static WHM Cl 0.5s, 1 & 2	

IEC TC 13 WG11 Documents

IEC 62052-11



IEC TC13 WG11 Documents

IEC 62053-11, -21, -22, -23

kwh, kvarh

Accuracy class
2, 1, 0.5, 0.2

Requirements
Mechanical aspects
Electrical aspects
Accuracy
Test condition

Tests
Current
Voltage
Frequency
Temperature
Starting
No-load
Influence of;
vibration
shock
magnetic
EMC
Etc.

IEC TC13 WG13 Documents

IEC/TR 62059-11 General concepts	General
IEC/TR 62059-21 Collection of meter dependability data from the field IEC 62059-31-1 Accelerated reliability testing -Elevated temperature and humidity IEC/TR 62059-41 Reliability prediction	Particular
IEC 62059-32-1 Durability-Testing of the stability of metrological characteristics IEC 62059-51 Software aspects of reliability	in progress

IEC TC13 WG13 Documents

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IEC/TR 62059-21 Collection of meter dependability data from the field IEC 62059-31-1 Accelerated reliability testing -Elevated temperature and humidity IEC/TR 62059-41 Reliability prediction	Particular
IEC 62059-32-1 Durability-Testing of the stability of metrological characteristics IEC 62059-51 Software aspects of reliability	

IEC TC13 WG14 Documents

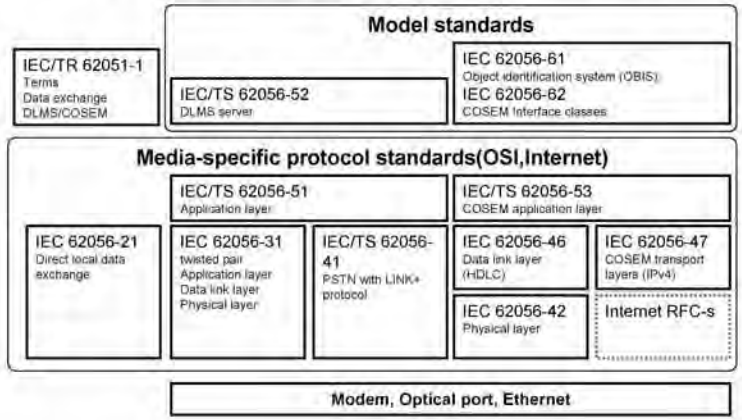
IEC/TR 62051-1 Terms related to data exchange with metering equipment using DLMS/COSEM
IEC 62056-21 Direct local data exchange
IEC 62056-31 Use of local area networks on twisted pair with carrier signalling
IEC/TS 62056 -41 Data exchange using wide area networks: PSTN with LINK+ protocol IEC/TS 62056 -42 Physical layer services and procedures for connection-oriented asynchronous data exchange IEC/TS 62056 -46 Data link layer using HDLC protocol IEC/TS 62056 -47 COSEM transport layers for IPv4 networks

IEC TC13 WG14 Documents

IEC/TS 62056 -51 Application layer protocols
IEC/TS 62056 -52 Communication protocols management DLMS server
IEC/TS 62056 -53 COSEM application layer

IEC 62056 -61 Object identification system (OBIS)
IEC 62056 -62 Interface classes

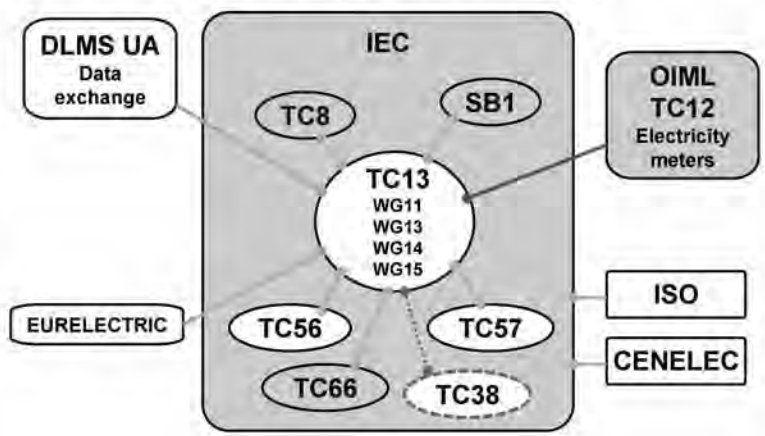
IEC TC13 WG14 Documents



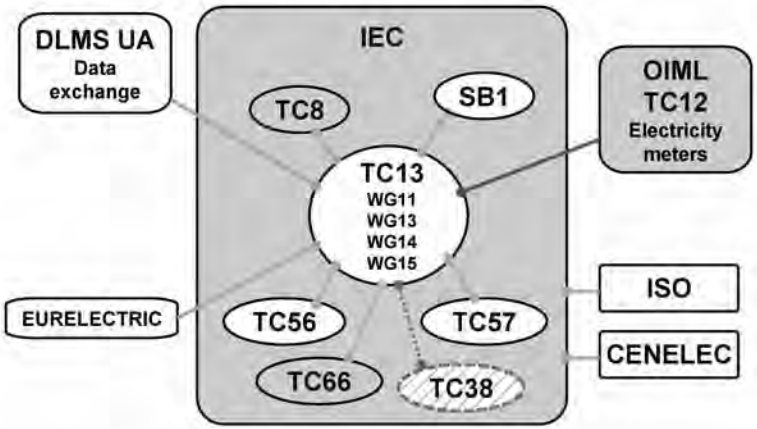
IEC TC13 WG15 Documents

IEC/TR 62055-21 Framework for standardization
IEC/TR 62055-31 Static payment meters for active energy CI1 & 2
IEC 62055-41 Standard Transfer Specification(STS)
Application layer protocol for one-way token carrier systems
IEC 62055-51 Standard transfer specification (STS) -
Physical layer protocol for one-way numeric and magnetic card token carriers
IEC 62055-52 Standard transfer specification (STS) –
Physical layer protocol for a two-way virtual token carrier for direct local connection

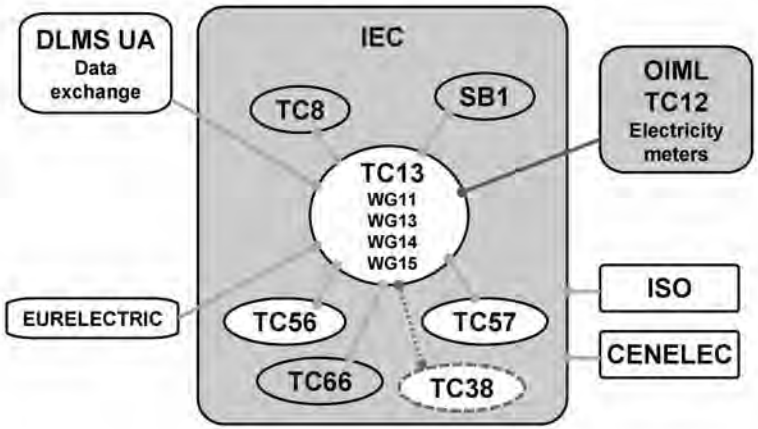
Liaison(relationship)



Liaison(relationship)



Liaison(relationship)



Liaison(relationship)

OIML:International Organization of Legal Metrology
IEC TC8:System aspects of electrical energy supply
IEC TC56:Dependability
IEC TC57:Power system control and associated and communications
IEC TC66:Safety of measuring, control and laboratory equipment (informal)
DLMS UA:DLMS User Association
STS:STS association
ISO:International Standardization Organization
CENELIC:European Committee for Electrotechnical Standardization
EURELECTRIC:Union of the Electricity Industry

On-going and Future work

WG11	—IEC6 2052-31(Product safety) , CD —IEC6 2053-24 (varh meter Cl 0.5 & 1) , NP —Revision of the IEC62052 and IEC62053 series
WG13	—IEC 62059-32-1 (durability) , CDV —IEC 62059-51 (Software aspects of reliability)
WG14	—Data exchange have to update and extent IEC 62056 series cover smart metering
WG15	—IEC 62055-32 (Multi-Part Payment Metering Installations)

International Standards

Comments ?

Questions ?

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Asia-Pacific
Economic Cooperation

APEC/APLMF Seminars and Training Courses
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APLMF
Asia-Pacific
Legal Metrology
Forum

Current situation of OIML Recommendation's revision

-R46 Electricity meters-

JEMIC

OIML

TC 1	Terminology	TC 11	Instruments for measuring temperature and associated quantities
TC 2	Units of measurement	TC 12	Instruments for measuring electrical quantities
TC 3	Metrological control	TC 13	Measuring instruments for acoustics and vibration
TC 4	Measurement standards and calibration and verification devices	TC 14	Measuring instruments used for optics
TC 5	General requirements for measuring instruments	TC 15	Measuring instruments for ionizing radiations
TC 6	Prepackaged products	TC 16	Instruments for measuring pollutants
TC 7	Measuring instruments for length and associated quantities	TC 17	Instruments for physico-chemical measurements
TC 8	Measurement of quantities of fluids	TC 18	Medical measuring instruments
TC 9	Instruments for measuring mass and density		
TC 10	Instruments for measuring pressure, force and associated quantities		

OIML TC12

- OIML TC12
  "Instruments for measuring electrical quantities"

  member

  AUSTRALIA, AUSTRIA, BELGIUM, BRAZIL, BULGARIA, CANADA, CUBA, CZECH REPUBLIC, DENMARK, EGYPT, FINLAND, FRANCE, GERMANY, HUNGARY, INDONESIA, IRELAND, ISRAEL, JAPAN, KOREA(R.), NETHERLANDS, NORWAY, P.R.CHINA,POLAND, ROMANIA, RUSSIAN FEDERATION, SERBIA, SLOVAKIA, SLOVENIA, SOUTH AFRICA, SWEDEN, SWITZERLAND, UNITED KINGDOM, UNITED STATES

  33 countries P-member:22
  O-member:11

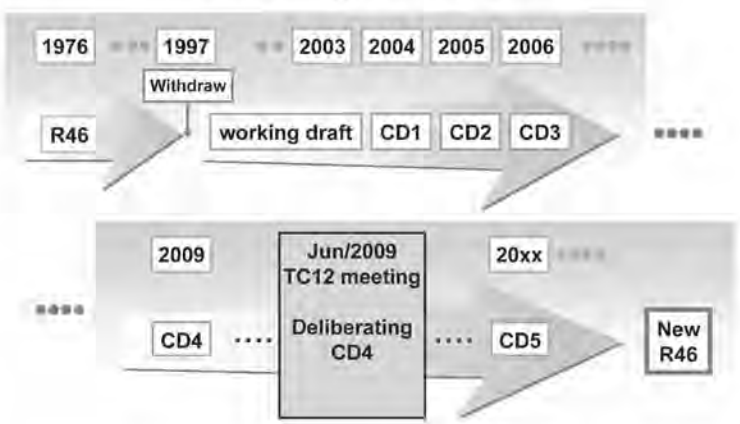
OIML TC12

- R46(1976)
  "Active Electrical Energy Meters
  for Direct Connection (class 2)"

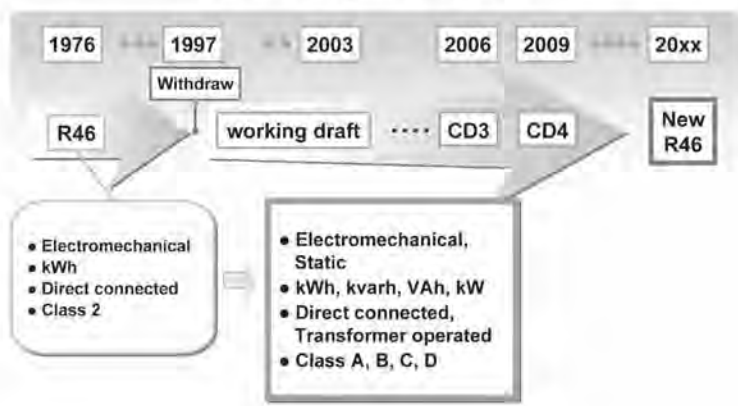
- Revision Committee Draft CD4(2009)
  "Electricity Meters"

  TC 12 meeting in June 2009 in Bled
  (Slovenia)

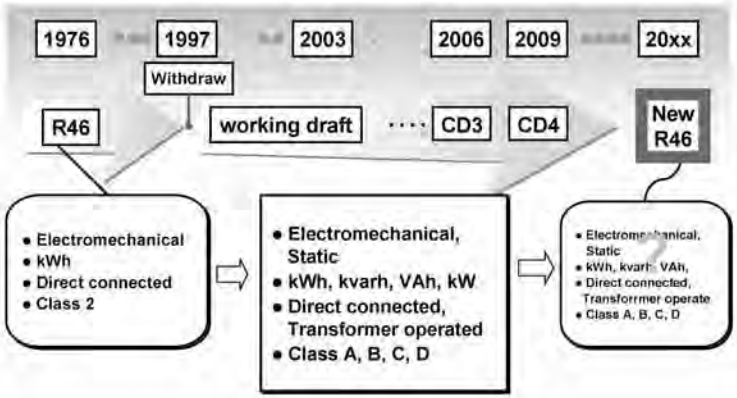
Working Progress



Working Progress



Working Progress



Contents

Previous (1976) <<- INDEX ->> Draft (2009)

- Terminology
- Scope
- Unit
- Technical requirements
- Pattern approval
- Initial verification
- Examination for conformity with approved pattern
- Statutory markings

20pages

- Scope
- Terminology
- Metrological Requirements
- Type approval
- Test program
- Test procedures for type approval
- Examination for conformity with type
- Verification

over 40pages

Contents

Previous (1976) <<- INDEX ->> Draft (2009)

- Terminology
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- Terminology
- Metrological Requirements
- Type approval
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- Examination for conformity with type
- Verification

Contents

Previous (1976) <<- Tests ->> Draft (2009)

- Accuracy test
  current 0.05Ib - Imax

15 test items

- Influence test
  Voltage , Frequency ,
  Temperature,
  Magnetic fields, Waveform,
  Position, Register,
  Over-current, self-heating,
  No-load, Starting

- Accuracy test
  current Ist - Imin - Imax

more than 30 test items

- Influence test
  Voltage , Frequency,
  Temperature,
  Magnetic fields, harmonic, Tilt,
  Over-current,
  Continuous current, No-load,
  Starting, Impulse Voltage,
  EMC, Vibration, Shock,
  Climatic, etc.

Contents

Previous (1976) <<- Tests ->> Draft (2009)

- Accuracy test
  current 0.05Ib - Imax

IEC 521(1976)

- Influence test
  Voltage , Frequency ,
  Temperature,
  Magnetic fields, Waveform,
  Position, Register,
  Over-current, self-heating,
  No-load, Starting

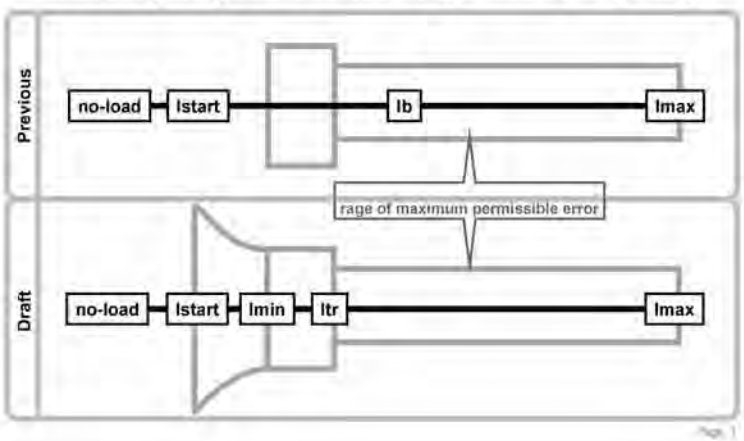
- Accuracy test
  current Ist - Imin - Imax

IEC Standards from TC13, TC77 etc

- Influence test
  Voltage , Frequency,
  Temperature,
  Magnetic fields, harmonic, Tilt,
  Over-current,
  Continuous current, No-load,
  Starting, Impulse Voltage,
  EMC, Vibration, Shock,
  Climatic, etc.

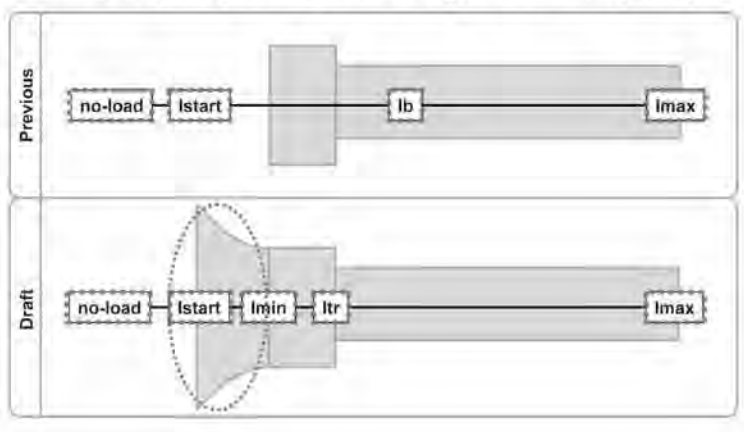
Contents

Previous (1976) <<- Current range ->> Draft (2009)



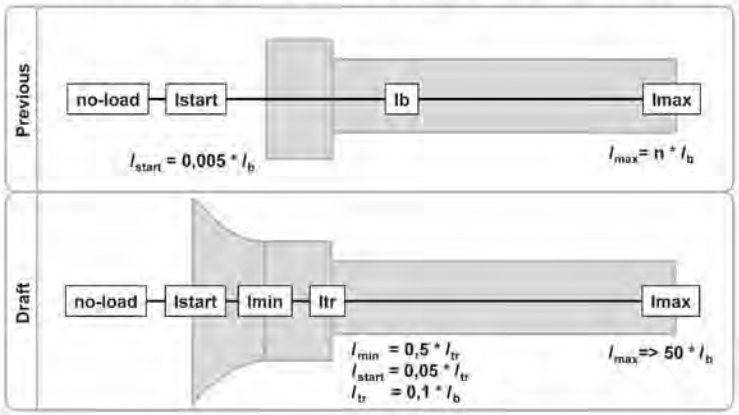
Contents

Previous (1976) <<- Current range ->> Draft (2009)



Contents

Previous (1976) <<- Current range ->> Draft (2009)

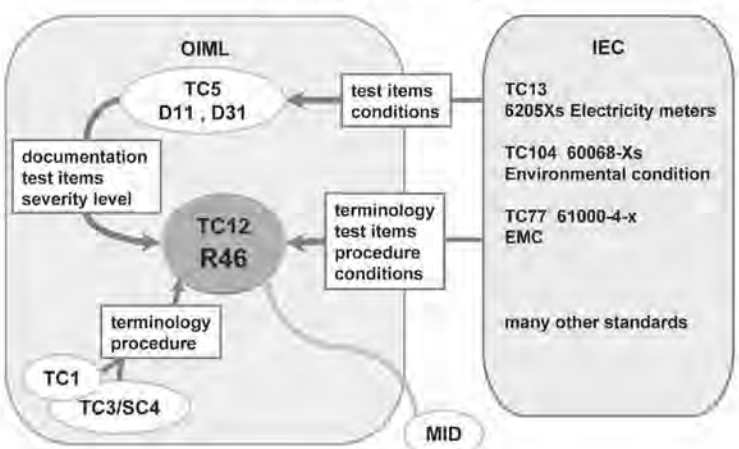


Terminology

Ist Starting Current	OIML-the lowest value of current specified by the manufacturer at which the meter should register electrical energy at unity power factor and, for poly-phase meters, balanced load. IEC-the lowest value of the current at which the meter starts and continues to register.
Imin minimum current	The lowest value within the manufacturer's specified range of current values at and above which the m.p.e requirement is constant with regard to current variations.
Itr transitional current	The value of current at and above which the meter is specified by the manufacturer to lie within the smallest m.p.e corresponding to the class index of the meter.
Ib basic current	Value of current in accordance with which the relevant performance of a direct connected meter are fixed.
Imax maximum current	OIML-The highest value of current at which the meter is specified by the manufacturer to meet the accuracy requirements of this recommendation. IEC-Highest value of current at which the meter purports to meet the accuracy requirements of this standard.

m.p.e : maximum permissible error

Relationship



Relationship

TC5 : General requirements for measuring instruments

SC1 :Environmental conditions

D 11—

General requirements for electronic measuring instruments

SC2 :Software

D 31—

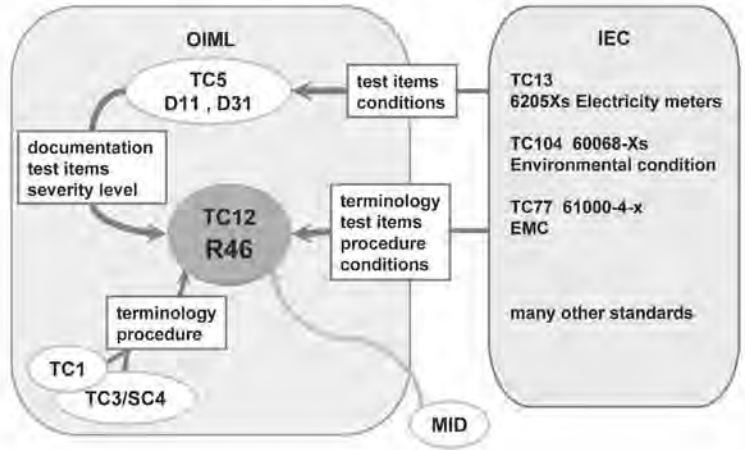
General requirements for software controlled measuring instruments

Relationship

international recommendations（OIML R）
which are model regulations that establish the metrological characteristics required of certain measuring instruments and which specify methods and equipment for checking their conformity

international documents（OIML D）
which are informative in nature and intended to improve the work of the metrological services

Relationship



Conclusion

- **OIML TC12**
  "Instruments for measuring electrical quantities"
- **Committee Draft 5th edition(20xx) work in progress**
  "Electricity Meters"
- **Electric & Mechanical Meters**
  Classification —— A, B, C, D
  Lots of test items —— EMC, climatic, harmonics
  New item —— software aspects

? var-hour meter, Demand meter

OIML Recommendation

Comments ?

Questions ?

Asia-Pacific Economic Cooperation

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APLMF
Asia-Pacific Legal Metrology Forum

Measuring Instruments Directives (MID)

(informative article)

- Annex MI-003 Electricity meters-

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MID

- EU regional directive
- New approach for measuring instruments
- To prescribe the performance requirements
- To cover a number of measuring instrument types, including water, gas and electricity meters, petrol pumps , automatic weighing instruments and taximeters

MID

Contents

- Introduction
- Scope / General requirements
- Essential requirement ← Annex 1
- Conformity assessment Module Annex A - H1
- Instruments Specific Annexes ← Annexes MI-001 - MI-010

MID

Annex 1, Essential Requirements

- Definitions
- Allowable Errors
  - MPE, Operating conditions, Climatic, Mechanical, Electromagnetic Environments, Influence quantities
- Reproducibility,Repeatability, Discrimination, Sensitivity, Durability, Suitability
- Protection against corruption
- Information,Indication of result, Processing of data, Designed to evaluation

MID

Annex	OIML Recommendation
MI-001 (Water meters)	R49
MI-002 (Gas meters)	R137
MI-003 (Electricity meters)	R46
MI-004 (Heat meters)	R75
MI-005 (Liquid meters)	R81,R105,R117,R119
MI-006 (Automatic weighing)	R50,R51,R61,R106,R107,R134
MI-007 (Taxi meters)	R21
MI-008 (Material measure)	R29
MI-009 (Dimensional)	R66,R129,R136
MI-010 (Exhaust gas)	R70,R99

MID

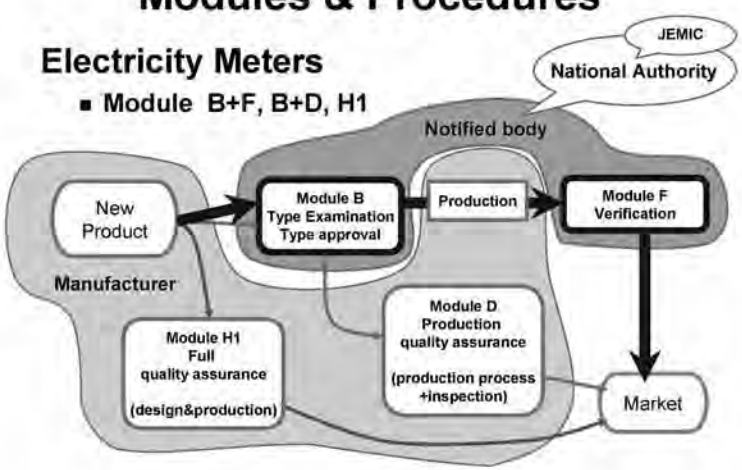
Annex MI-003
"ACTIVE ELECTRICAL ENERGY METERS"

- Definitions
- Specific requirements
  - Accuracy, Rated operating conditions
  - MPE
  - Permissible effect of disturbances
  - Suitability
  - Units
  - Putting into use
- CONFORMITY ASSESSMENT
  - B + F , B + D , H1

Modules & Procedures

Electricity Meters

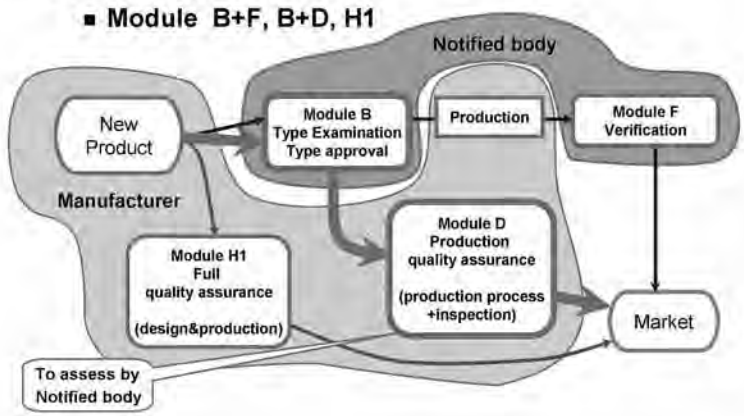
- Module B+F, B+D, H1



Modules & Procedures

Electricity Meters

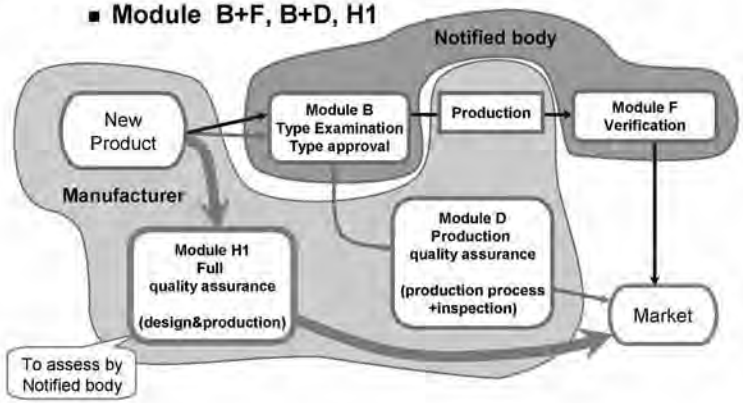
- Module B+F, B+D, H1



Modules & Procedures

Electricity Meters

- Module B+F, B+D, H1



Asia-Pacific Economic Cooperation

APEC/APLMF Seminars and Training Courses
in Legal Metrology; (CTI-09/2009T)
Training Course on Electricity Meters
10-13 August, 2009
At Concorde Hotel, Shah Alam, Malaysia

APLMF
Asia-Pacific Legal Metrology Forum

Conformity Assessment in Europe

(informative article)

- Modules -

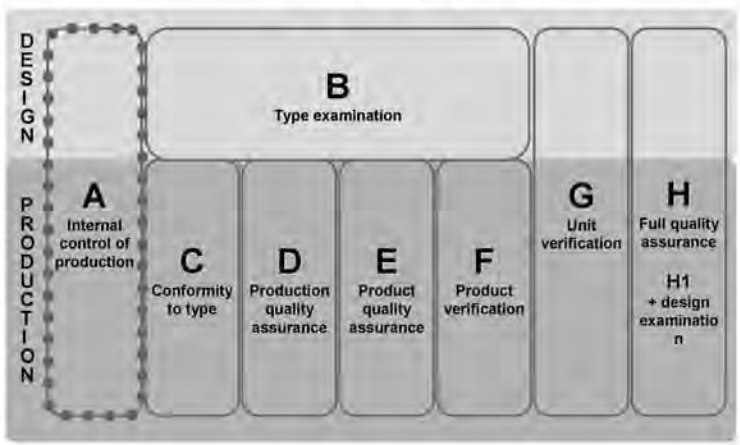
JEMIC

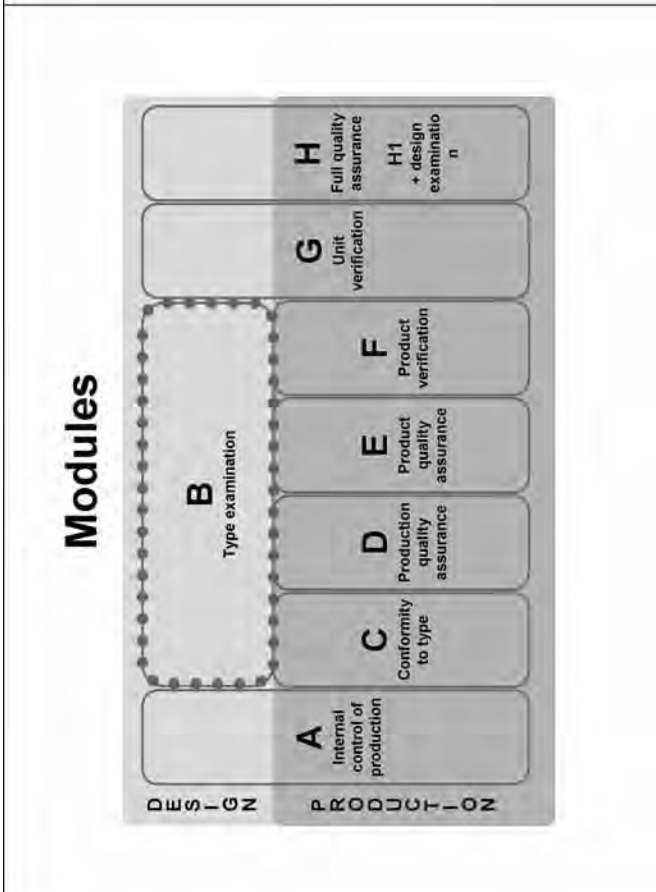
Conformity Assessment

"Guide to the implementation of directives based on the New Approach and the Global Approach" (Blue book)

- Introduction/Scope
- Responsibilities
- Compliance with directives
- Conformity assessment procedure
- Notified bodies
- CE marking
- Market surveillance
- External aspects

Modules




Modules
DESIGN
PRODUCTION
A
Internal control of production
B
Type examination
C
Conformity to type
D
Production quality assurance
E
Product quality assurance
F
Product verification
G
Unit verification
H
Full quality assurance
H1
+ design examinatio
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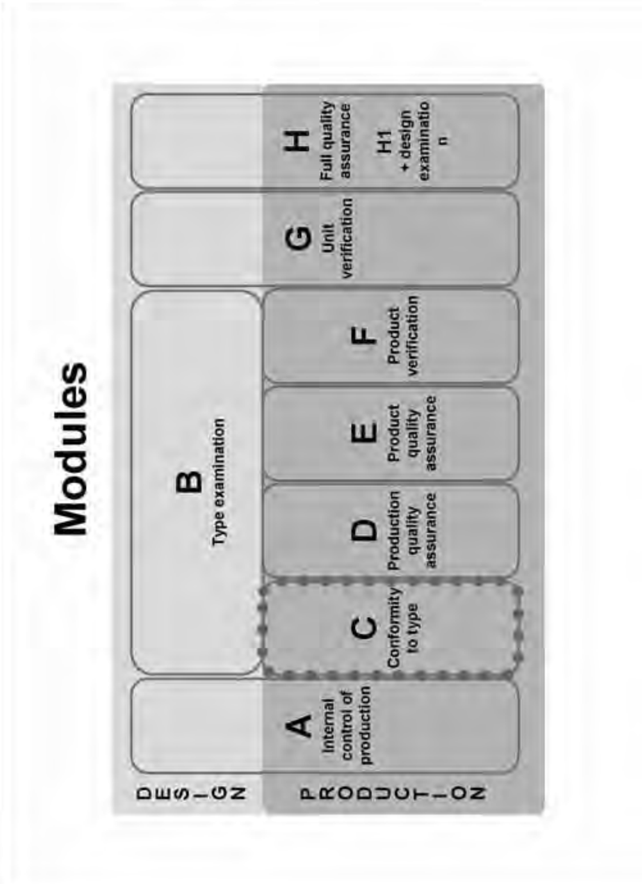
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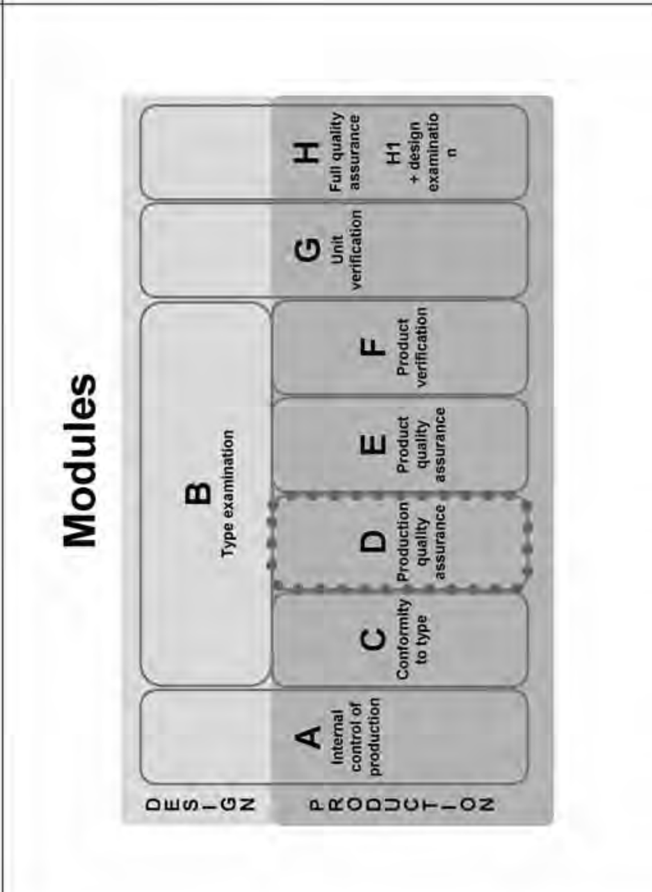
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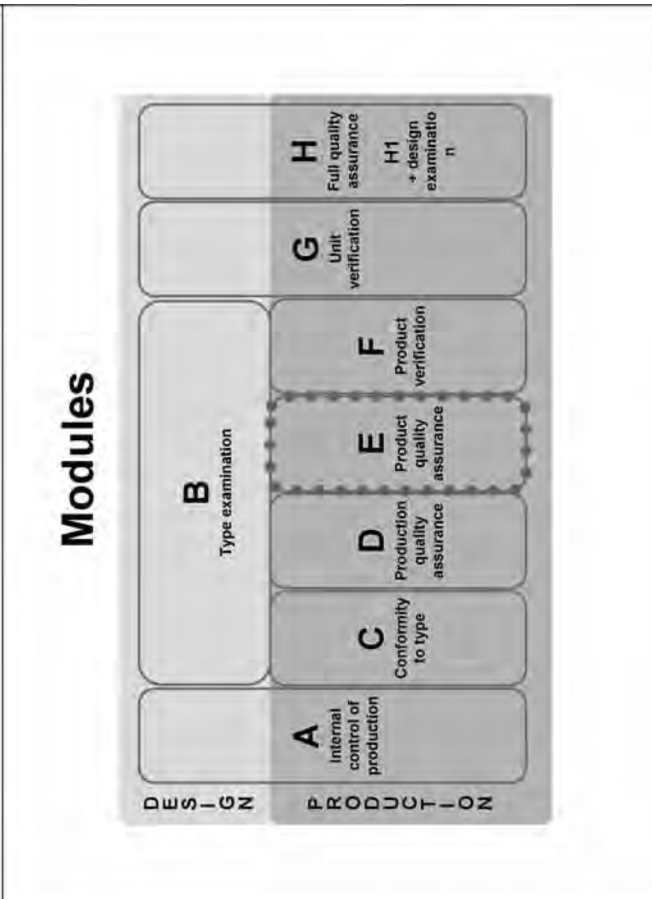
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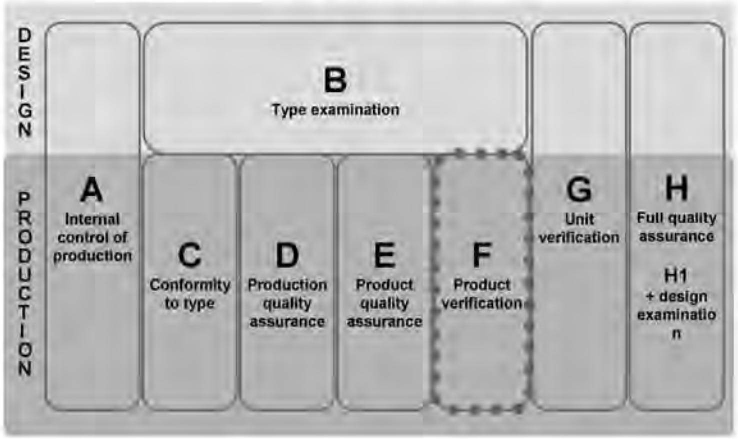

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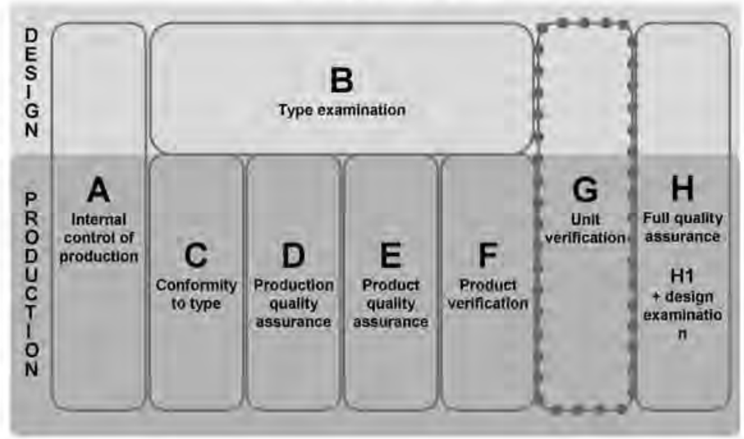

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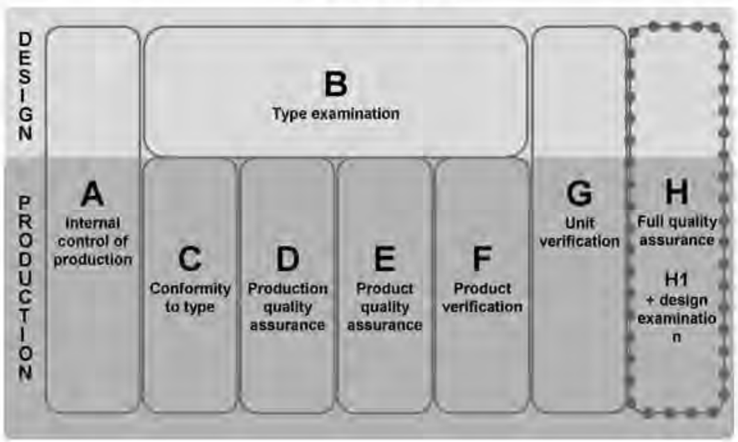


Modules

A Internal control of production	Covers internal design and production control. This module does not require a notified body to take action.
B EC type-examination	Covers the design phase, and must be followed up by a module providing for assessment in the production phase. The EC type-examination certificate is issued by a notified body.
C Conformity to type	Covers the production phase and follows module B. Provides for conformity with the type as described in the EC type-examination certificate issued according to module B. This module does not require a notified body to take action.
D Production quality assurance	Covers the production phase and follows module B. Derives from quality assurance standard EN ISO 9002, with the intervention of a notified body responsible for approving and controlling the quality system for production, final product inspection and testing set up by the manufacturer.

Modules

E Product quality assurance	Covers the production phase and follows module B. Derives from quality assurance standard EN ISO 9003, with the intervention of a notified body responsible for approving and controlling the quality system for final product inspection and testing set up by the manufacturer.
F Product verification	Covers the production phase and follows module B. A notified body controls conformity to the type as described in the EC type-examination certificate issued according to module B, and issues a certificate of conformity.
G Unit verification	Covers the design and production phases. Each individual product is examined by a notified body, which issues a certificate of conformity.
H Full quality assurance	Covers the design and production phases. Derives from quality assurance standard EN ISO 9001, with the intervention of a notified body responsible for approving and controlling the quality system for design, manufacture, final product inspection and testing set up by the manufacturer.

MID

Comments ?

Questions ?

Thank you for your attention

Contents

Verification and Inspection body(1)

1.Verification Body: JEMIC

2.Inspection Body: Designated Manufacturers

- Fuji Electric Co., Ltd.
- Toshiba Corp.
- Mitsubishi Electric Corporation
- Osaki Electric Co., Ltd.

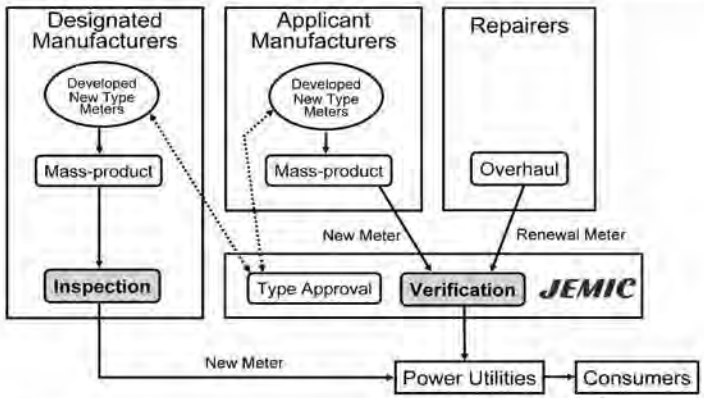
Verification and Inspection body(2)

Applicant manufacturer, Importer

Business classification	Manufacturer name
High-precision watt-hour meter	•Osaki Electric Co., Ltd. •Tohoku Keiko Co., Ltd. •Chugoku Keiko Co., Ltd. •Toshiba Corp. •Chubu Seiki Co., Ltd. •Toshiba Meter Techno Co., Ltd. •Fuji Electric Systems Co., Ltd. •Shikoku Keisoku Co., Ltd. •Hokuriku Keiko Co., Ltd. •Mitsubishi Electric Corporation •Kyuhki Co., Ltd
Maximum demand meter Precision watt-hour meter Ordinary watt-hour meter Var-hour meter	•Osaki Electric Co., Ltd. •Kyushu Keiso Engineering Co., Ltd. •Hokkaido Keiko Co., Ltd. •Tohoku Keiko Co., Ltd. •Toshiba Corp. •Okinawa Electric Co., Ltd. •Hokuriku Keiko Co., Ltd. •Kyuhki Co., Ltd. •Fuji Electric Co., Ltd. •Koshin Electric Co., Ltd. •Chugoku Keiko Co., Ltd. •Chubu Keiko Co., Ltd. •Mitsubishi Electric Corporation •Shikoku Keisoku Co., Ltd. •Toshiba Meter Techno Co., Ltd. •Enegate Co., Ltd. •Attract Co., Ltd. •Toko Co., Ltd.
d.c. watt-hour meter	Tsuda Electric Co., Ltd.

Foreign manufacturer Itron, Inc.

Verification and Inspection body(3)



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Measurement Law (1)

Article 70: Application for Verification

Electricity meter

Any person who intends to receive a verification ... as to a specifid measurineg instrument shall submit an application to the Ministory of Economy, Trade and Industry or

Japan Electric Meters Inspection Corporation, or a designated verification body in accordance with …

JEMIC

Measurement Law (2)

Article 72: Verification Mark

A specified measuring instrument which has passed a verification test shall be affixed with a verification mark …

Article 96: Indication

A designated manufacturing … affix an indication to specified measuring instruments belonging to the type pertaining to the approval … that are manufactured in its factory or workplace pertaining to the designation.

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Test Conditions

1. **Temperature:** 23°C ± 5 °C
   (23 °C ± 2 °C for high precision watt-hour meters)
2. **Voltage:** rated voltage ± 0.3%
3. **Frequency:** rated frequency ± 0.5%
4. **Voltage and Current waveforms:** Distortion Factor
   Mechanical Type ⩽ 3%
   Static Type ⩽ 2%
   (⩽ 1% for high precision watt-hour meters)

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Type Approval(1)

1. To save huge cost and time

2. Type approval number

JEMIC

Verification Service

Type Approval

JEMIC

Type Approval(2)

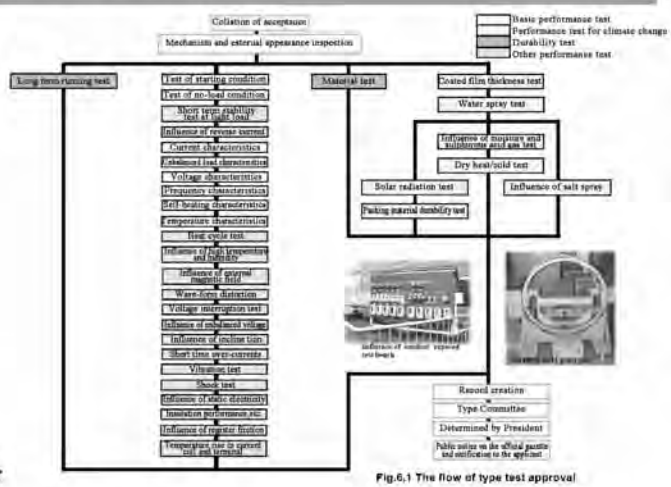

Fig.6.1 The flow of type test approval

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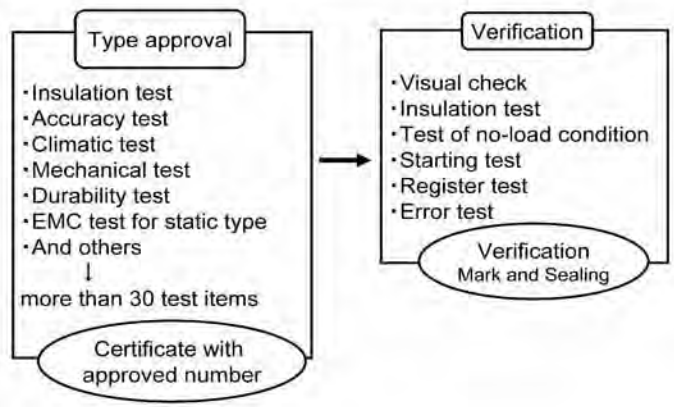
Verification Procedure(1)



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Visual check (Mechanism and external appearance inspection)

Inspection shall be made to check whether or not the description on the name plate is correct, and the structure and external appearance conform to type approval requirements.

There must be check description error, coating condition, outer or inner deposition of foreign substances, failure of the structure and mechanism.

JEMIC

Insulation resistance test

Inspection shall be conducted to make sure that the insulation resistance exceeds the value specified to ensure that electric leakage does not occur due to the insulation failure of the electricity meter.

Use DC voltage of **500V** to test the insulation resistance between the voltage-current, circuit-base, voltage-base and current circuits, and make sure that it is **5megohms** or more.

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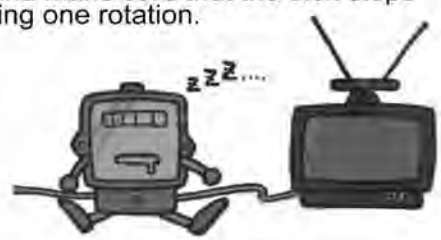
Test of no-load condition

Inspection shall be made to check that the disk is stopped when electricity is not used.

Open the current circuit, and apply **110%** of the rated voltage, and make sure that the disk stops before completing one rotation.



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Test of starting condition

Inspection shall be made to see that the disk continues rotation when electricity is used.

Apply electric power of **1/375** of the rated current at the rated voltage and make sure that the disk makes continuous rotation for Type III electricity meter.

1/375 of the rated current is **80mA** for the **30A** electricity meter, and is 320mA for 120A electricity meter.

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Registering test (Indication mechanism measuring test)

Test shall be made to check if the indication mechanism measures the used electric energy correctly or not. Add the rated voltage, rated current and electric power of power factor 1.

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Error test

The errors of electricity meter shall be measured at a specified testing point, and test shall be conducted to make sure that the errors of electricity meter is within the limit.

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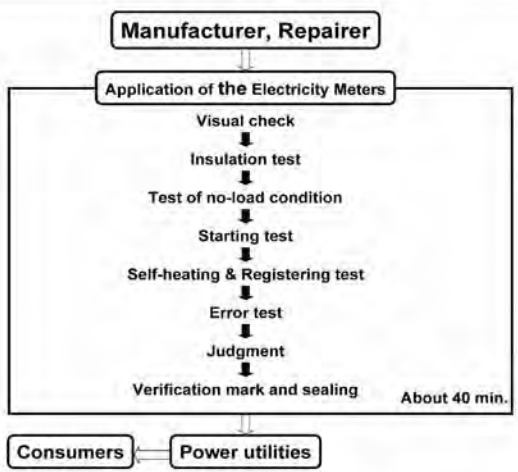
Verification Procedure (2)



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Verification Mark and Sealing

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Time Limit to Perform Verification

Type approved direct-connected meter	20 days
Type approved transformer operated meter	20 days
Type approved transformer operated meter and instrument transformer	30 days
Inspection of instrument transformer carried out at consumer's premises	30 days

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Automatic Testing System

The automatic watt-hour meter testing system consists of 4 meter benches, a power source unit and PC.

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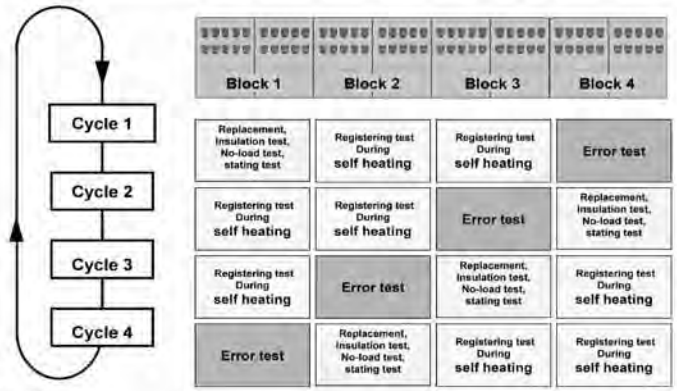
Cyclic Operation of the Automatic Testing Equipment



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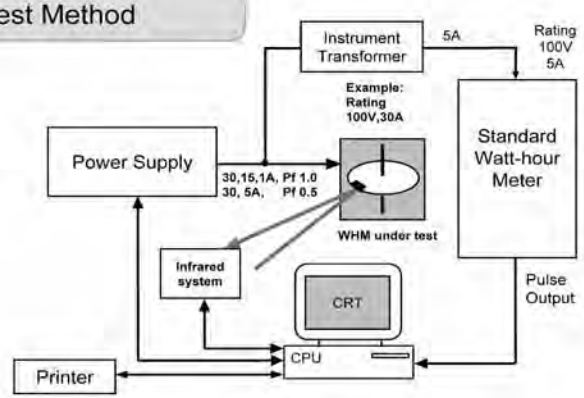
Test Method



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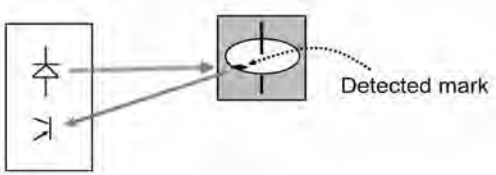
Infrared System

The rotating disc is detected by an infrared sensor.



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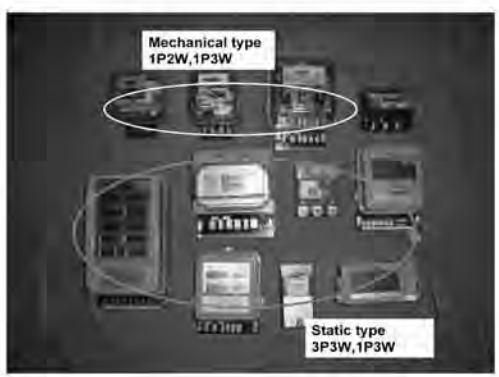
Verification for various other meters



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Verification Service

Verification of various other meters

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Inspection of Instrument Transformers (1)

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Inspection of Instrument Transformers (2)

Instrument transformers are classified as follows:

1	A current transformer (CT) that transfers current of a large-current to small current (usually 5A).
2	A voltage transformer (VT) which steps down high voltage to low voltage (usually 110V).
3	Transformer (VCT) which contains both a current transformer and a voltage transformer and is mainly used for measuring electric power.

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Matching number

To ensure the combination between electricity meter and instrument transformer.

VCT(6600V 20A)

JEMIC

Standard High Voltage Transformer

Rated primary voltage
550/√3kV
500/√3kV
275/√3kV

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Maximum Permissible Errors(1)

1. Domestic meters (Direct-connected watt-hour meters)

Type	Maximum Permissible Errors	Power Factor	Test Current
Type2	2.0%	1	5%In, 50%In, 100%In
	2.5%	0.5 inductive	20%In, 100%In
Type3	2.0%	1	3.3%In, 50%In, 100%In
	2.5%	0.5 inductive	20%In, 100%In
Type 4	2.0%	1	2.5%In, 50%In, 100%In
	2.5%	0.5 inductive	20%In, 100%In
Type 5	2.0%	1	2%In, 50%In, 100%In
	2.5%	0.5 inductive	20%In, 100%In

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Maximum Permissible Errors(2)

2. Transformer operated meters

	Maximum Permissible errors	Power factor	Test current
Ordinary watt-hour meters	2.0% (2.0%)	1	5%In, 50%In, 100%In
	2.5% (2.5%)	0.5 inductive	20%In, 100%In
Precision watt-hour meters	1.0% (1.2%)	1	20%In, 50%In, 100%In
	1.5% (1.8%)		5%In
	1.0% (1.3%)	0.5 inductive	20%In, 50%In, 100%In
	1.5% (2.0%)		5%In
High precision watt-hour meters	0.5% (0.6%)	1	20%In, 50%In, 100%In
	0.8% (1.0%)		5%In
	0.5% (0.7%)	0.5 inductive	20%In, 50%In, 100%In
	0.8% (1.1%)		5%In
Var-hour meters	2.5% (2.5%)	0	100%In
		0.866 inductive	20%In, 50%In, 100%In
Maximum demand meters	3.0% (3.0%)	1	10%In, 50%In, 100%In
		0.5 inductive	100%In

Note (1) In: Rated current
(2) ( ): Maximum Permissible errors for a meter error + an instrument transformer error

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Maximum Permissible Errors(3)

3. Maximum Permissible Errors for Meters in-service and Validity of Verification

Electricity meters	Maximum permissible errors in-service	Validity of verification (years)
Domestic Watt-hour meter 100%In to 20%In, pf 1 Rated current: 30, 120, 200 , 250A Rated current: 20, 60 A	+/-3.0%	10 7 (20, 60A)
Precision watt-hour meter 100%In to 10%In, pf 1 5%In, pf 1 Rated current: 5 A	+/-1.7% +/-2.5%	5(mechanical Type) 7(static Type)
High precision watt-hour meter 100%In to 10%In, pf 1 5%In, pf 1 Rated current: 5 A	+/-0.9% +/-1.4%	5(mechanical Type) 7(static Type)
Var-hour meter 50%In, pf 0.866 Rated current: 5 A	+/-4.0%	5(mechanical Type) 7(static Type)
Maximum demand meter 50%In, pf 1 Rated current: 5 A	+/-4.0%	5(mechanical Type) 7(static Type)

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- Comments ?
- Questions ?

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Thank you for your Attention

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Verification Fee

Direct connection type meters

unit: yen(95yen÷1dollar)

	non multi-function watt-hour meter or one function of multi-function watt-hour meter			the rest of function of multi-function watt-hour meter		
	1φ2W	1φ3W	others	1φ2W	1φ3W	others
~30A	300	360	400	10	10	10
~100A	540	670	690	10	10	10
~150A	640	720	760	10	10	10
over 150A	950	1150	1200	10	10	10

1φ2W 30A

1φ3W 40A

fee=670+10+10
=690yen

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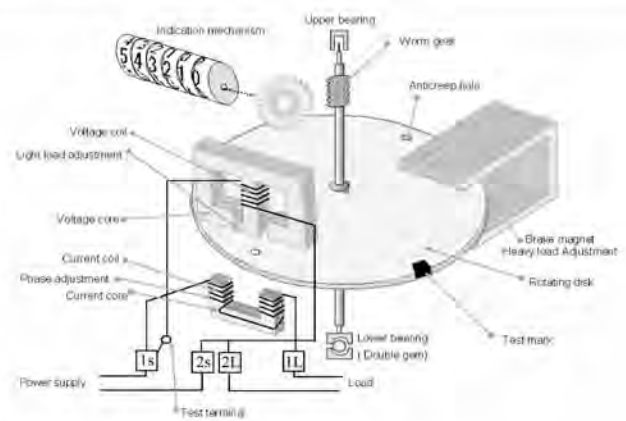
Inducting type electricity meter



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Asia-Pacific Economic Cooperation

Asia-Pacific Legal Metrology Forum

APEC/APLMF Seminars and Training Courses in Legal Metrology
(CTI-09/2009T)
Training Course on Electricity Meters
Concorde Hotel, Shah Alam, Malaysia

Date : 11th August 2009

Speaker background

- Jumary Jaapar
- Executive Director
- BEng. Hons. (Electrical & Electronic) University of Brighton 1993
- 1993 – 1996 Tenaga Nasional Berhad
- 1996 – present Krizik (Malaysia) Sdn. Bhd.
- A member of SIRIM Working Group on Electrical Energy Measurement

Presentation content

- Introduction on Malaysia's electricity industry
- Overview on Malaysia's electricity meter manufacturers
- Meter types and installed quantity
- Type test / test approval of electricity meter
- Traceability structure of electricity meter industry
- Traceability of electricity meter
- Type of electricity meter
- Future trend and demand

Introduction of Malaysia's electricity industry

- These are the 3 main suppliers of electricity in the economy

Introduction of Malaysia's electricity industry

- Tenaga Nasional Berhad

- 6,688,426 customers
- Average consumer growth rate of 4.2%
- Average Demand growth of 5.2%
- Maximum demand of 14,000 MW

Customers
- Domestic
- Commercial
- Industrial
- Public lighting
- Mining
- Agriculture

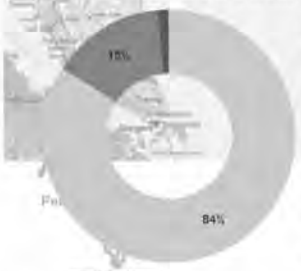
Peninsula Malaysia

TENAGA NASIONAL

Introduction of Malaysia's electricity industry

- SESCO

- 447,750 customers
- Average consumer growth rate of 4.6%
- Average Demand growth of 5.6%
- Maximum demand of 840 MW



Customers
- Domestic
- Commercial
- Industrial
- Public lighting
- Mining
- Agriculture

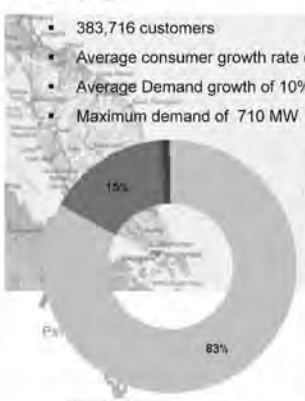
Sarawak

SESCO

Introduction of Malaysia's electricity industry

- SESB

- 383,716 customers
- Average consumer growth rate of 4.0%
- Average Demand growth of 10%
- Maximum demand of 710 MW



Customers
- Domestic
- Commercial
- Industrial
- Public lighting
- Mining
- Agriculture

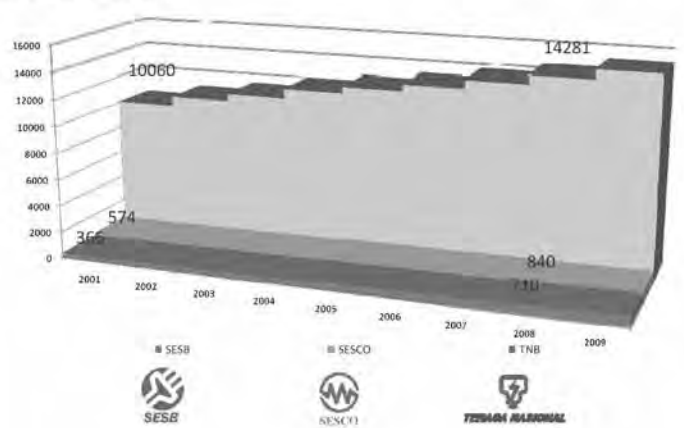
Malaysia

Sabah

SESB

Maximum demand – Illustration of size (MW)

Source : EC 2008 annual report



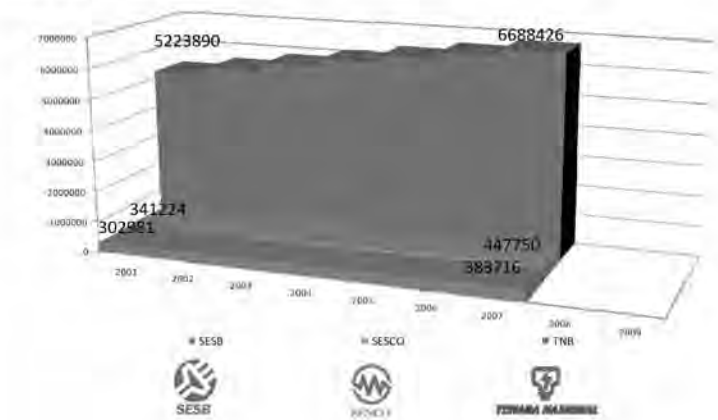
SESB

SESCO

TENAGA NASIONAL

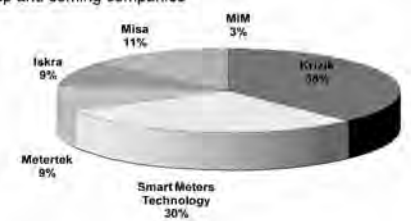
Customers– Illustration of size

Source : EC 2008 annual report

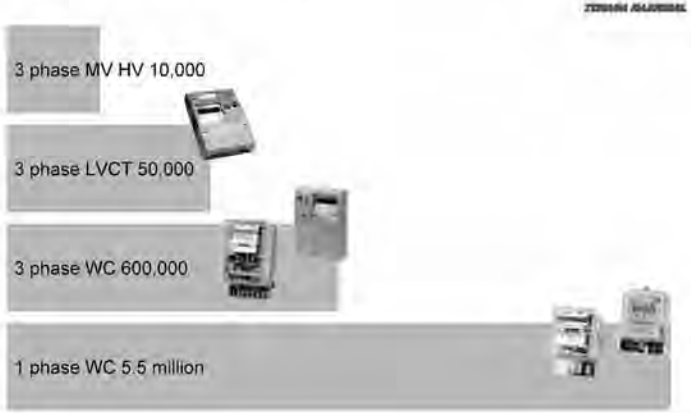


Overview of Malaysian's electricity meter manufacturers

- There are 6 main suppliers of electricity meters
  a) Krizik (M) Sdn. Bhd.
  b) Smart Meters Technology Sdn. Bhd.
  c) Misa Sdn. Bhd.
  d) MIM Sdn. Bhd.
  e) Metertek Sdn. Bhd.
  f) Iskra Iemico Sdn. Bhd.
- There are others, smaller and up and coming companies



Meter types and installed quantity



Type test / test approval of electricity meter

- Electricity meter approval is based on utility requirement :

  a) Compliance to critical and mandatory technical specification
  b) Type test approval from recognized laboratory
  c) Field trial of six months or more

- Electricity meter standard

a)	BS5685	Specification for single phase and polyphase wh meters
b)	IEC 62052-11	Metering equipment
c)	IEC 62053-11	Electromechanical meters for active energy (Class 0.5, 1 and 2)
d)	IEC 62053-21	Static meters for active energy (Class 1 and 2)
e)	IEC 62053-22	Static meters for active energy (Class 0.2 and 0.5)
f)	IEC 62053-23	Static meters for reactive energy (Class 2 and 3)

Traceability structure of electricity meter industry

- Ministry
  - Ministry of Energy, Green technology & Water
  - Ministry of science, technology and innovation
- Regulation body
  - STANDARDS MALAYSIA Department of Standards
  - SIRIM
  - Suruhanjaya Tenaga Energy commission
- Enforcement and delegation
  - TENAGA NASIONAL
  - SESB
  - SESCO
- Public/independent laboratory

ISO/IEC 17025 certified laboratories

a) TNB Laboratory, Petaling Jaya (Utility owned)
b) TNB Laboratory, Ipoh (Utility owned)
c) Metertek Sdn. Bhd.
d) Iskrameco Sdn. Bhd.
e) Krizik (M) Sdn. Bhd.

Traceability of electricity meter

- Sequence

a) National Metrology Laboratory (NML-SIRIM)
b) Accredited laboratory

Reference standard

SIRIM

TENAGA NASIONAL (Accredited Laboratory)

Traceability of electricity meter

-

SIRIM (NML-SIRIM)

Reference Std

Working standard

Type of electricity meter

- 1 phase whole current kWh 10-100A Class 2
- 3 phase whole current kWh/kVarh 10-100A Class 2
- 3 phase LVCT kWh/kVarh x/5A Class 2
- 3 phase MV/HV kWh/kVarh x/5A, x/1A class 0.5, 0.2

TENAGA NASIONAL

- By comparison, TNB utilises simple measurement method of 1 element metering —— for single phase, and 3 element metering for three phase.

SESCO

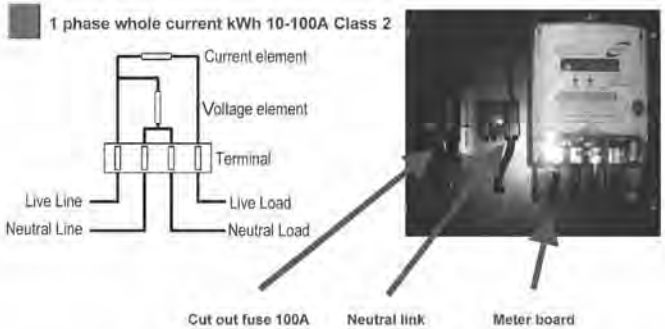
- Even though, there are still 2 element metering around (Old installation with 2 CTs and PTs), mostly in MV/HV installation, steps have been taken to rectify this issue.

SESB

- TNB has embarked on 100% installation of electronic meters program since 2004 for the whole range of metering scheme.
- It is expected, electromechanical meters will be phased out by 2014.

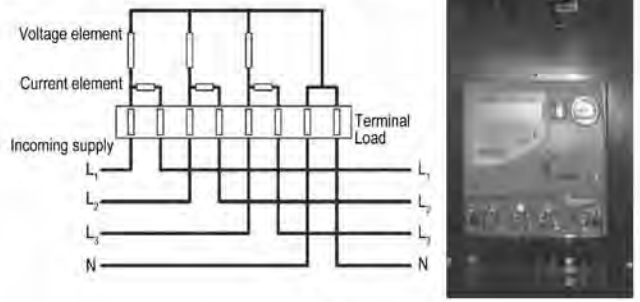
Type of electricity meter

1 phase whole current kWh 10-100A Class 2



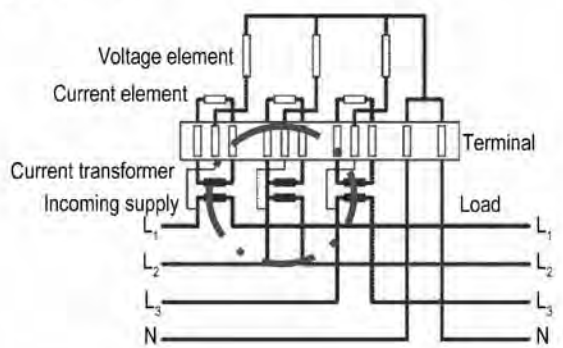
Type of electricity meter

3 phase whole current kWh/kVarh 10-100A Class 2



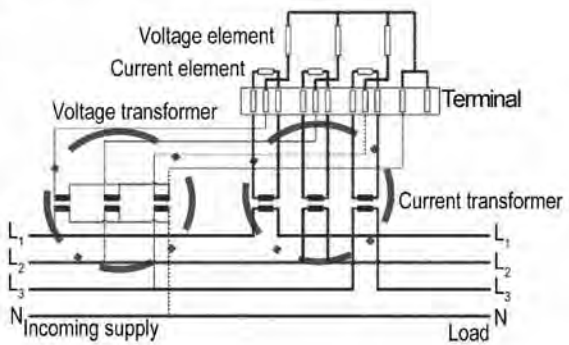
Type of electricity meter

3 phase LVCT kWh/kVarh x/5A Class 2



Type of electricity meter

3 phase MV/HV kWh/kVarh x/5A, x/1A class 0.5, 0.2



Future trend and demand

- Electricity meter specification requirement
  a) More robust and long lasting
  b) Enhance Revenue Protection futures
  c) Physical and electrical properties standardization
- Technology requirement
  a) Prepayment facilities
  b) Radio frequency capability
  c) Smarter AMR
  d) AMI – Advance Metering infrastructure

Automatic Meter Reading

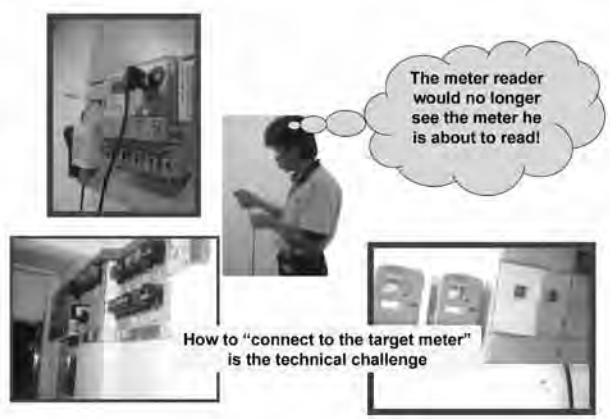
RMR Phase 2 (LV LPC)
Communication Equipment Installation

Automatic Meter Reading – Project status

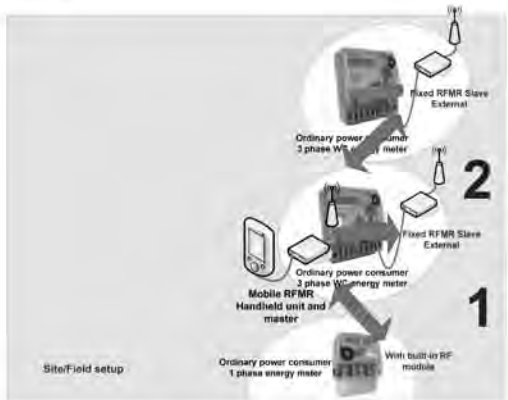
Project Description	Metering Points/ Customers	Communication Medium	Status
RMR for PMU/Power Station/IPP/Inter-connection	865 metering points	TNB Fiber Network/PLC/ GSM	Completed in January 06
RMR Pilot Project (MV & LV CT Customers in Metro)	1400 Customers	Wavenet / Paknet (wireless 413-423 MHz)	Completed January 06
RMR Phase 1 (HV/MV Customers)	2869 Customers	GSM	Completed June 06
RMR Phase2 (LV CT Customers)	60,000 Customers	GSM	Started in March 2007 90%

TENAGA NASIONAL BERHAD

RF meter reading



RF meter reading



Prepayment system

LIBERTY PAYMENT SOLUTIONS

Advance metering infrastructure

Home Energy Controller (HEC)

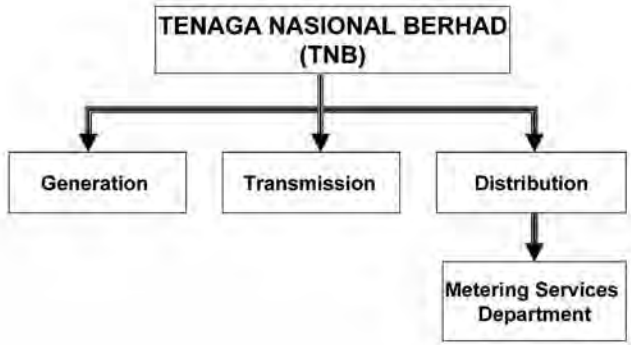
Customer Interface

Thank you

Type Approval
And
Electricity Meter Testing

Saraswathy Sinniah
Metering Services Department
Distribution Division TNB

ORGANIZATIONAL STRUCTURE



Testing in Metering Services

- Testing of meters (Petaling Jaya and Ipoh)
  - Single Phase Electromechanical
  - Single Phase Electronic
  - Three Phase Electromechanical
  - Three Phase Electronic Whole Current
  - Three Phase Electronic LV CT Operated
  - Three Phase Electronic MV CT Operated
  - Three Phase Electronic HV CT Operated
- Testing of current transformer (Petaling Jaya) HV and LV
- Energy standard and meter test set calibration (Petaling Jaya and Ipoh)

(All test are accredited under ISO/IEC 17025:2005)

WHY TESTING ?

- TO ENSURE THE QUALITY OF METERS
- TO ENSURE THE ACCURACY CLASS OF METERS AS PER STANDARD
- TO GAIN CONSUMER CONFIDENCE
- TO IDENTIFY FAULTY METER & AVOID REVENUE LOSS TO UTILITIES

STANDARDS TO BE FOLLOWED

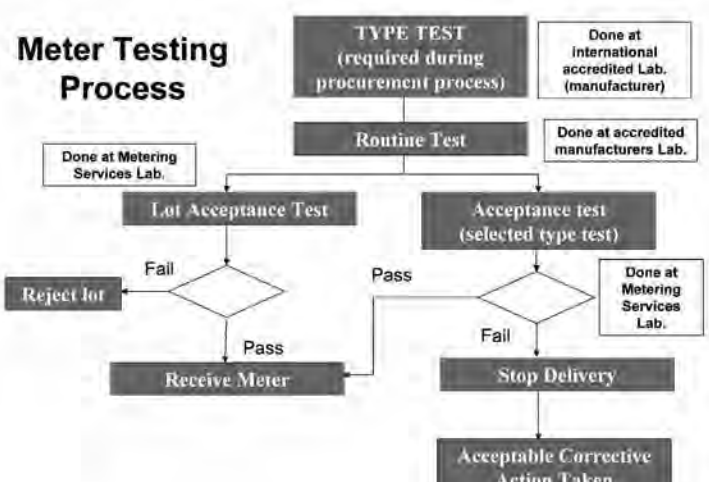
ENERGY METERS

- Electro mechanical meter
  (class 0.5,1.0 & 2.0)
  IEC 60521-1988 x
  IEC 62052-11
  IEC 62053-11
- Static Meter
  - (class 1 & 2.0)
    IEC 62052 - 11
    IEC 62053 - 21
  - (Class 0.2 & 0.5)
    IEC 60687 - 1992 x
    IEC 61036 – 1996 x
    IEC 62052 - 11
    IEC 62053 - 22

Evaluation of energy meters can be broadly classified as given below:

SL. No.	NAME OF THE TEST	DESCRIPTION
01.	TYPE TEST	Series of tests shall be carried out on one sample or a small number of samples of same type having identical characteristics to prove conformity with all requirements of the standard for relevant class. These are intended to prove the ruggedness of the design of a given type of sample.
02.	ROUTINE TEST	Tests shall be carried out on each & every sample at manufacturer's premises or utility lab to check conformity with the requirements of the standard mainly in term of accuracy which are likely to vary during production.
03.	LOT ACCEPTANCE TEST	Tests shall be carried out on samples taken from a lot for the purpose of acceptance of lot.
04.	ACCEPTANCE TEST (Qualification test)	Small number of samples shall be picked up from the production at manufacturer's premises. These samples shall be subjected to accuracy & influence quantities thoroughly and other test (relevant type test).

Meter Testing Process



ROUTINE TEST AND ITS SIGNIFICANCE FOR ENERGY METERS.

[TEST - ACCURACY REQUIREMENTS]

TEST OF ACCURACY REQUIREMENTS:

» The percentage of error shall not exceed the limits for the relevant accuracy class when the meter is under reference conditions.

» If the meter is designed for the measurements of energy in both direction, the limits is recommended in the standard for each direction.

LIST OF TESTS RECOMMENDED:

1. Limits of error due to variation in the current (Balanced load).
2. Limits of error due to variation in the current (Unbalanced load).
3. Test of meter constant.
4. Test of starting condition.
5. Test of no-load condition.

LIMITS OF ERROR DUE TO VARIATION OF THE CURRENT FOR DIRECT (WHOLE CURRENT) OR CT OPERATED STATIC METER OF CLASS 1 & 2

(FOR SINGLE PHSE & POLYPHASE WITH BALANCED LOAD)

Value of current		Power factor	% Error limits	
for whole current meter	For CT operated		1	2
0.05Ib≤I≤0.1Ib	0.02In≤I≤0.05In	1	±1.5	±2.5
0.1Ib≤I≤ 0.1Imax	0.05In≤I≤Imax	1	±1.0	±2.0
0.1Ib≤I≤ 0.2Ib	0.05In≤I≤0.1In	0.5Ind 0.8Cap	±1.5 ±1.5	±2.5 —
0.2Ib≤I≤ Imax	0.1In≤I≤ Imax	0.5Ind 0.8Cap	±1.0 ±1.0	±2.0 —

LIMITS OF ERROR DUE TO VARIATION OF THE CURRENT FOR DIRECT (WHOLE CURRENT) OR CT OPERATED STATIC METER OF CLASS 1 & 2

(FOR POLY PHASE METERS CARRYING SINGLE-PHASE LOAD)

Value of current		Power factor	% Error limits	
for whole current meter	For CT operated		1	2
0.1Ib≤I≤1max	0.05In≤I≤Imax	1	±2.0	±3.0
0.2 Ib≤I≤Imax	0.1 In≤I≤Imax	0.5Ind	±2.0	±3.0

LIMITS OF ERROR DUE TO VARIATION OF THE CURRENT FOR DIRECT (WHOLE CURRENT) OR CT OPERATED STATIC METER OF CLASS 0.5s & 0.2s (FOR SINGLE PHSE & POLYPHASE WITH BALANCED LOAD)

Value of current For CT operated	Power factor	% Error limits 0.2s	0.5s
0.01In ≤ I ≤ 0.05In	1	±0.4	±1.0
0.05In ≤ I ≤ Imax	1	±0.2	±0.5
0.02In ≤ I ≤ 0.1In	0.5Ind 0.8Cap	±0.5 ±0.5	±1.0 ±1.0
0.1In ≤ I ≤ Imax	0.5Ind 0.8Cap	±0.3 ±0.3	±1.0 ±1.0

LIMITS OF ERROR DUE TO VARIATION OF THE CURRENT FOR DIRECT (WHOLE CURRENT) OR CT OPERATED STATIC METER OF CLASS 0.5s & 0.2s.

(FOR POLY PHASE METERS CARRYING SINGLE-PHASE LOAD).

Value of current For CT operated	Power factor	% Error limits 0.2s	0.5s
0.05In ≤ I ≤ Imax	1	±0.3	±0.6
0.1 In ≤ I ≤ Imax	0.5Ind	±0.4	±1.0

TEST OF METER CONSTANT

SCOPE:

- **To verify that the relation between the number of revolution of the rotor of the meter and indication of the register is correct (For Electromechanical).**

TEST CONDITIONS:

Energized the meter at rated voltage, current and at UPF for a known time.

TEST REQUIREMANT:

Meter shall update energy by kWh after completion of known time.

TEST OF STARTING CONDITION:

- **SCOPE:**
- **Rotor of the meter should start and continue to register at the starting current value (staticmeter class 1&2)**

TEST CONDITIONS:

Meter for	Class of meter 1	2	Power factor
Direct connected	0.004Ib	0.005Ib	1
CT Op.	0.002In	0.003In	1

TEST OF NO-LOAD CONDITION:

Scope:

- Rotor of meter shall not make a complete rotation when specified voltage is applied with no current shown in the current circuit

- TEST CONDITION

  Between (110~115)% reference voltage

- TEST REQUIREMENT

  Rotor disc shall not make a complete revolution

TYPE TEST AND ACCEPTANCE TEST AND ITS SIGNIFICANCE FOR ENERGY METERS.

[TEST - ACCURACY REQUIREMENTS AND RUGGEDNESS OF THE DESIGN OF A GIVEN TYPE OF METER]

TYPE TEST and ACCEPTANCE TEST (CATEGORIES)

1.0 TEST OF INSULATION PROPERTIES

2.0 TEST OF ACCURACY REQUIREMENTS

3.0 TEST OF ELECTRICAL REQUIREMENTS

4.0 TEST FOR ELECTROMAGNETIC COMPATIBILITY (EMC)

5.0 TEST OF THE EFFECT OF THE CLIMATIC ENVIRONMENTS

6.0 MECHANICAL TEST

TEST OF INSULATION PROPERTIES :

- IMPULSE VOLTAGE TEST
- AC VOLTAGE TEST

(These test are conducted to confirm capability of meter to withstand short time over voltage of high value, High voltage withstanding effect, safety aspects. Type of failure due to weak insulation material, inadequate spacing of components will be observed by occurrence of flashover)

TEST OF ACCURACY REQUIREMENTS :

- **LIMITS OF ERROR DUE TO VARIATION OF THE CURRENT**
- **TEST OF METER CONSTANT**
- **TEST OF STARTING CONDITION**
- **TEST OF NO-LOAD CONDITION**

CONTD...

TEST OF INFLUENCE QUANTITIES :

——LIMITS OF ERROR DUE TO INFLUENCE QUANTITIES

- **AMBIENT TEMPERATURE VARIATION**
- **VOLTAGE VARIATION**
- **FREQUENCY VARIATION**
- **REVERSED PHASE SEQUENCE**
- **VOLTAGE UNBALANCE**
- **AUXILIARY VOLTAGE**
- **HARMONIC COMPONENTS IN THE CURRENT & VOLTAGE CIRCUITS**
- **SUB-HARMONICS IN THE A.C. CURRENT CIRCUIT**
- **CONTINUOUS MAGNETIC INDUCTION OF EXTERNAL ORIGIN**
- **MAGNETIC INDUCTION OF EXTERNAL ORIGIN 0.5mT**
- **DIRECT MAGNETIC EFFECT 500mT**

◆ AMBIENT TEMPERATURE VARIATION

Significance

To check whether the meter is capable of operating at higher or lower temperature without degradation or change of characteristic of components.

Influence of variation in ambient temperature is determined by obtaining temperature coefficient over range of ±10°C of reference temperature.

$$\text{Temp Coeff.} = \frac{\text{Error at reference temp.} - \text{Error at given temp.}}{\text{Difference in temperature}}$$

◆ VOLTAGE VARIATION

Significance

To check whether the meter is able to operate at lower and higher voltage during variation in supply voltage.

Test condition
Measuring circuit voltage : ±10%, + 15% of Vref

TEST OF ELECTRICAL REQUIREMENTS :

- **TEST OF POWER CONSUMPTION**
- **TEST OF INFLUENCE OF SUPPLY VOLTAGE**
- **TEST OF INFLUENCE OF SHORT-TIME OVERCURRENTS**
- **TEST OF INFLUENCE OF SELF-HEATING**
- **TEST OF INFLUENCE OF HEATING**
- **TEST OF IMMUNITY TO EARTH FAULT**

- **TEST OF POWER CONSUMPTION**

Significance

To ensure the meter itself will not consume more power in both voltage and current circuit

- **TEST OF INFLUENCE OF SELF-HEATING**

Significance

In order to ensure that the current carrying capacity of cables, size of terminal block, screw used for cables are not over heated during full load condition for longer duration minimum 1 hr

- **TEST OF INFLUENCE OF HEATING**

Significance

To verify if the meter restores the dielectric properties due to excessive heating of terminal block

Test condition

Meter energized with 115% Vref and I max for 2hr. At an ambient temperature of 40°C

TEST FOR ELECTROMAGNETIC COMPATIBILTY :

- RADIO INTERFERENCE SUPPRESION
- FAST TRANSIENT BURST TEST
- DAMPED OSCILLATORY WAVES IMMUNITY TEST
- TEST OF IMMUNITY TO ELECTROMAGNETIC RF FIELDS
- TEST OF IMMUNITY TO CONDUCTED DISTURBANCES, INDUCED BY RADIO-FREQUENCY FIELDS
- TEST OF IMMUNITY TO ELECTROSTATIC DISCHARGES
- SURGE IMMUNITY TEST

TEST OF THE EFFECT OF THE CLIMATIC ENVIRONMENTS :

- **DRY HEAT TEST**
- **COLD TEST**
- **DAMP HEAT, CYCLIC TEST**
- **SOLAR RADIATION TEST**

MECHANICAL REQUIREMENT AND TEST

GENERAL MECHANICAL REQUIREMENTS

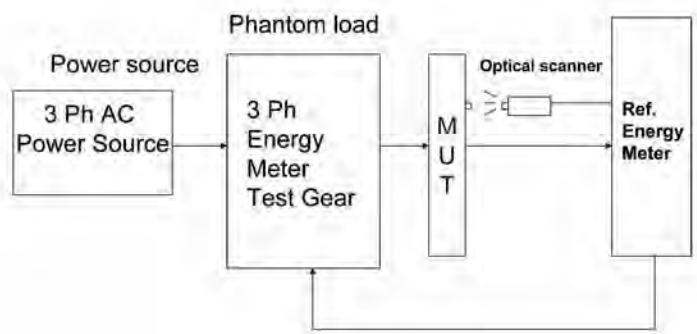
- **Meters shall be designed and constructed in such a way as to avoid introducing any danger in normal use and under normal condition, so as to ensure especially;**
  - **Personal safety against electric shock**
  - **Personal safety against effects of excessive temperature**
  - **Protection of against spread of fire**
  - **Protection against penetration of solid objects, dust and water**

All parts which are subject to corrosion under normal working condition shall be protected effectively. Any protective coating shall not be liable to damage by ordinary handling nor damage due to expose to air, under normal working condition. Outdoor meters shall withstand solar radiation.

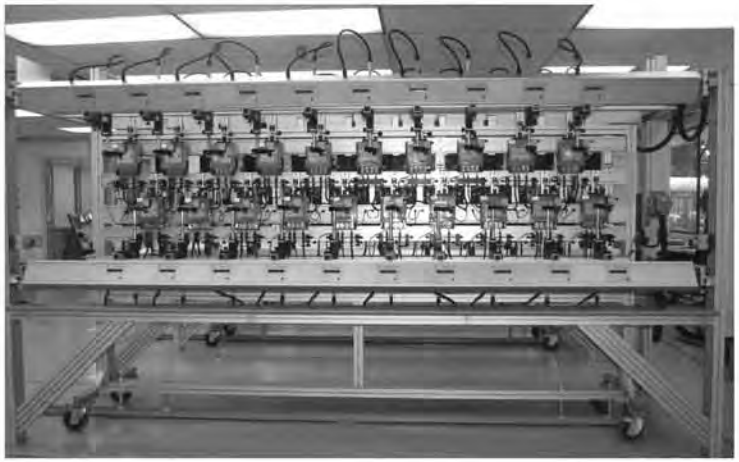
MECHANICAL TEST :

- **VIBRATION TEST**
- **SHOCK TEST**
- **SPRING HAMMER TEST**
- **TESTS OF PROTECTION AGAINST PENETRATION OF DUST AND WATER**
- **TEST OF RESISTANCE TO HEAT AND FIRE**

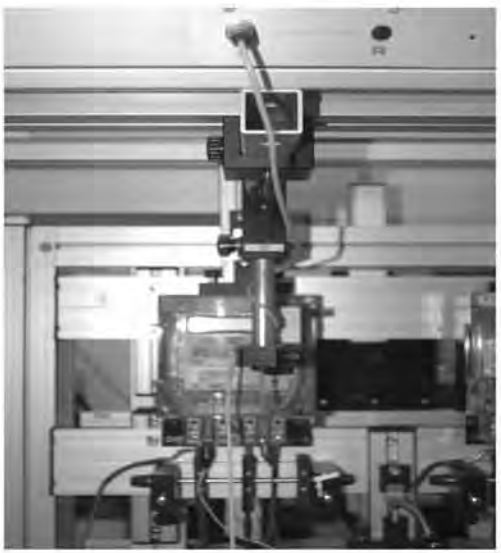
GENERAL TEST SETUP ARRANGEMENT :



FULLY AUTOMATIC MULTI TEST BENCH
(MAKE: MTE, GERMANY)



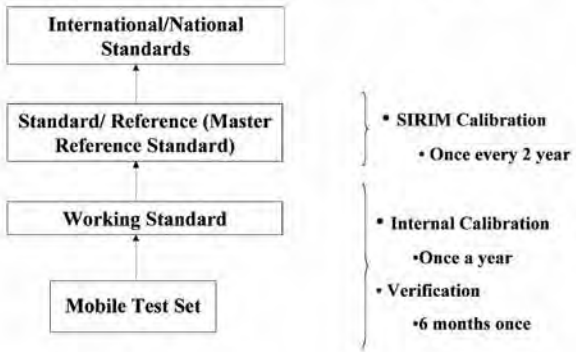
THREE PHASE PHANTOM LOAD SOURCE



IMPULSE TESTER (MAKE: MTE GERMANY)

MTE MAKE REFERENCE STANDARD METER-PRS1.3

The Chain Of Traceability To National Measurement System



Thank YOU

The Brief Introduction of electricity meter and type test in P.R.China

National Quality Inspection Center for Electricity Meters (Jiangsu) P.R.China
Jiangsu institute of metrology (JSMI)
Lilin
13951644448@139.com

Catalog

The Brief Introduction of Center

National Quality Inspection Center for Electricity Meters (Jiangsu) is a legal organization of measuring verification, quality inspection and supervision for Electricity Meters .

- Quality assurance system in the center has been established in accordance with international practice based on international laboratory, which is in conformity with the relevant requirements.
- The certificates of calibration and test reports have been admitted by the members of the Asia-Pacific Laboratory Accreditation Co-operation (APLAC), such as the U.S.A, Japan, Australia, South Korea, Chinese Taiwan and Hong Kong China.

- The center can supply verification and calibration service of measurement standard equipments for clients, offer verification and test reports accord with National standards and IEC Standards.

The authority awarded of Center

- In 1985, began watt-hour meter type test in Jiangsu province.
- In 2000, awarded authority as National watt-hour meter type test lab by AQSIQ of China .
- In Aug, 2003,awarded authority as compulsory verification lab of CNCA (Certification and Accreditation Administration of the P. R. China).
- In Nov, 2003 awarded authority as testing lab of CEMC (China certification center for electromagnetic and compatibility).
- In 2003,founded EMC testing and material researching center.
- In 2004, awarded authority as electricity meter testing lab of China Quality Cetification Center (CQC).
- In 2004, founded Jiangsu metrology instruments quality testing center.

Since we began our type tests from 1985 we have accomplished 400 batchs electricity meter quality inspection ,2500 batchs electricity meter type tests.

The mainly electricity meter type tests equipments in the center

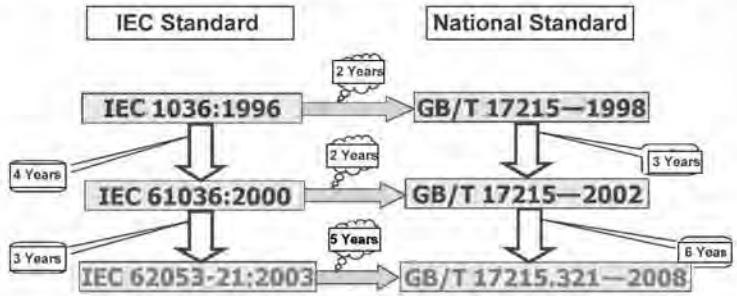
- EMH 3-phase high precision meter calibration system
- NST-3500 3-phase watt-hour meter calibration system
- SEWTH-Z-250L step-in temperature and humidity chamber
- EMCPro Electromagnetic immunity test system
- MZ-15/EC ESD simulator
- ESCS30 Electromagnetic interference receiver
- FACT3_3 Meter Anechoic Chamber
- BC-10C Impulse voltage tester
- CJ2671D AC voltage testing system
- Spring percussive instrument
- FM5004 RF immunity test system
- Magnetic induction of external tester
- Motor-driven vibration sys

The staff of the center

◆The staff in the electricity meter testing department have high quality with special technical knowledge, which includes 2 Doctors, 4 Masters, 9 senior engineers, 13 engineers. Now our testing ability have covered all our National standards of electricity meter and IEC 62052 Series, IEC 62053 Series and IEC 60001-4 CISPR 22.

IEC Standard and National Standard of China GB/T 17215 Series

Compare between IEC Standard and National Standard



Electicity meter National Standard of China

GB/T 17215 Series and GB/T 15284-2002

IEC 62052-11:2003 Electricity metering equipment (a.c.) General requirements tests and test conditions Part 11: Metering equipment	GB/T 17215.211—2006
IEC 62053-11:2003 Electricity metering equipment (a.c.) Particular requirements Part 11: Electromechanical meters for active energy (classes 0.5. 1 and 2)	GB/T 17215.311—2008
IEC 62053-21:2003 Electricity metering equipment (a.c.) Particular requirements Part 21: Static meters for active energy (classes 1 and 2)	GB/T 17215.321—2008
IEC 62053-22:2003 Electricity metering equipment (a.c.) Particular requirements Part 22: Static meters for active energy (classes 0.2 S and 0.5 S)	GB/T 17215.322—2008

IEC 62053-23:2003 Electricity metering equipment (a.c.) Particular requirements Part 23: Static meters for reactive energy (classes 2 and 3)	GB/T 17215.323—2008

GB/T 17215.301—2007
Particular requirements For multi - function electricity meters

Draft by National Standardization Commission

GB/T 15284—2002
Particular requirements for multi-rate electricity meters

Q&A

1 What organizations regulate the measurement of electricity in your economy and what are the legal units of measure for the sale of electricity?

In China the AQSIQ is the organization regulates the measurement of electricity. And the NIM is the technical organization support the management of AQSIQ.

2 Do electricity meters require approval of type and what organization performs approval of type testing ?

In China all electricity meters require a type approval which are carry out by local department of Quality Technical Inspection Bureau. The type test are authorised and assigned to the National Quality Inspection Center for Electricity Meters or National authorized type testing lab.

3 Is meter verification testing required in your economy and what organization performs the meter verification?

In China all electricity meter need to be done first verification test according to National regulations before it been used. The first verification tests are performed by authorized measuring organization of local power company and all these tests all inspected by the local institute of Metrology. Commonly the meters in service can be given a reverification .The interval for electronic meter is 5 years and for mechanical meter is 8 yeas or much longer.

Thank you for your attention!

The Mechanism of Verification of Electricity Meters In Indonesia

by

Iyus Ruslan

DIRECTORATE OF METROLOGY
MINISTRY OF TRADE REPUBLIC OF INDONESIA

Seminar on electricity meters 10-13 Agustus, 2009 in Malaysia

APLMF

Indonesia Map

Estimation of :

Land areas	**: 1,919,440 km²**	**Capital city**	**: Jakarta**
Population	**: 237,512,352 million**	**DOM location**	**: Bandung**

Approximation 250 km from Jakarta

OUTLINE

- Organization
- Legislation
- Verification system
- Test type of the verification
- Future Plan

ORGANIZATION

Organization of Directorate of Metrology (DOM)

LEGISLATION

The measuring instruments used for trading transaction are regulated by the following law and regulation:

- **Measurement Law**
  Law No. 2 the year 1981 concerning legal metrology
- **Government Regulation**
  Regulation No. 2 the year 1985 concerning verification and re-verification requirement for legally controlled measuring instruments
- **Ministerial Decree**
  The ministerial decrees are regulations to implement government regulation for legally controlled measuring instruments
- **Director Decree**
  Technical manual concerning type approval testing and verification for legally controlled measuring instruments

VERIFICATION

Verification system is carried out on purpose to control usage of legal measuring instrument.

Verification system of W-H meters carried out in Indonesia is divided into two type of verification, that is:

1. Type approval

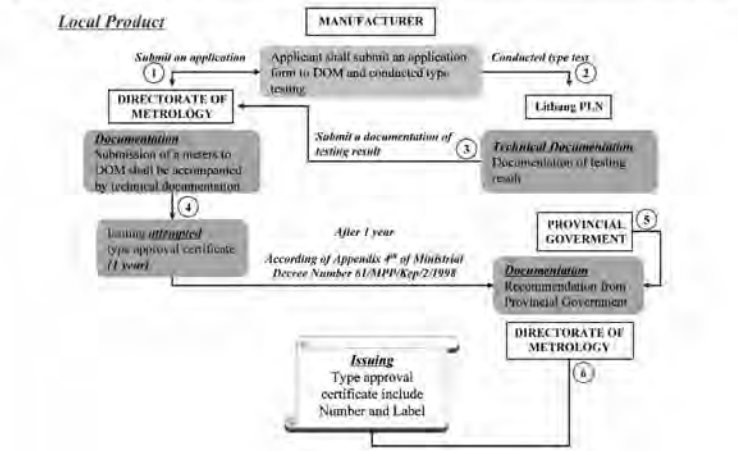
used for new type of W-H meters, and institution that competence for type approval testing is Litbang PLN and given testing by the sample of W-H meters.

- **PLN** (*Perusahaan Listrik Negara*) is the major power company in Indonesia. The supply area covers almost the whole country. PLN was established as governmental enterprise in 1964.
- **Litbang-PLN** is one of all business units in PLN, main functions are research, development & engineering services, but this institution is independence to carry out its duty although its organization structure is under PLN. Litbang PLN in 1994 is changed to be JTK (Services of Electrical Engineering).

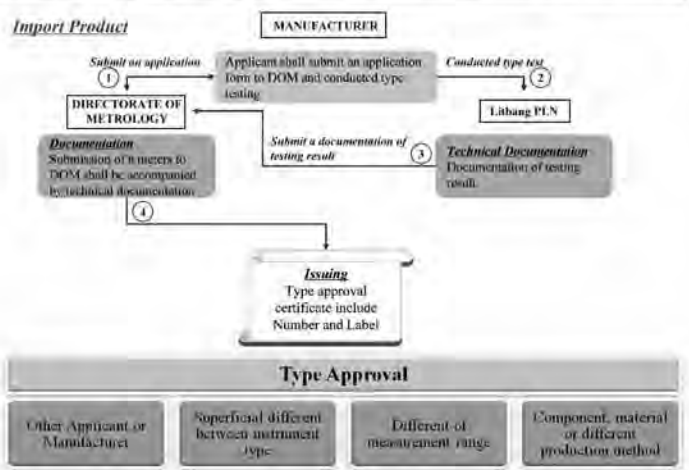
Reason of DOM refer to Litbang PLN for perform type approval testing

Litbang-PLN was applied international regulation to perform type approval testing (IEC 62053-11, first edition 2003-01 for electromechanic W-H meters and IEC 62053-21, first edition 2003-01 for static W-H meters).

VERIFICATION



VERIFICATION



- **What organization performs type approval ?**
  Directorate of Metrology : Issuing certificate of type approval;
  Litbang-PLN : Type approval testing
- **How many type approvals that perform in a year ?**
  Average anmual is 25.
  Test are conducted on samples or prototype of electricity meters and if the meter is passing the test, DOM will give certificate including type approval number and label.
- **How long is the validity of a type approval ?**
  No validity of the type approval.
- **When the type approval expired, is the meter tested again ?**
  No expired of type approval and not tested again.
  Type approval are conducted on new type of electricity meters.

2. Initial Verification

Initial verification are performed after type approval certificate and label are issued. Performing initial verification is devided into two category as follows:

- **Non-PLN owner** are performed verification by DOM.
  Example: W-H meters are installed in Apartement.

  Each of apartement owners are paying electric invoice to the apartement management. Apartement management has W-H meters centre, so their position as customer of PLN.
- **PLN owner** are performed verification by RVOs* (Regional Verification Offices) at the area of regional PLN office.
  Example: W-H meters at PLN Jakarta are verified by RVO Jakarta.

  *RVOs performing their duty are responsible to provincial government after the existence of regional autonomy.

- **How many electricity meters are verified in a year ?**
  Estimated is 1 millions.
- **How long to perform subsequent verifications (validity initial verification) ?**
  10 years, *according of Ministrial Decree.*
- **When the initial verification expired, are the meters re-verified or discarded ?**
  Re-verification, but this moment to perform it, especially who performed by third party, it will encumber to the owner of electricity meters, generally price charges is very expensive, and need long time, some owners occasionally change the expired meters with new meters. New policy is being made currently by involving related institution in the case of electricity policy (*joint Ministerial Decree of Ministry of Trade and Ministry of Energy concerning verification of electricity meters*).

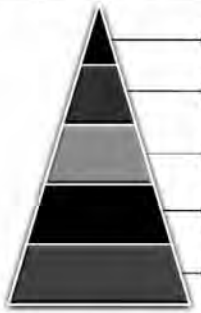
- **What Organization performs re-verification ?**
  - RVOs;
  - PLN (using their facilities)

  In principle, RVOs is responsible to conduct re-verification of electricity meters, but they often use PLN facilities.
- **Number of PLN customers by type of customers**

Customer	2003	2004	2005	2006
Household	29,997,554	31,095,970	32,174,922	33,301,044
Business	1,310,651	1,382,416	1,455,797	1,506,750
Industry	46,818	46,520	46,475	48,102
Social Institution	659,034	686,850	716,194	741,261
Public	137,324	154,689	16,5965	171,774
Total	**32,151,381**	**33,366,445**	**34,559,353**	**35,768,930**

Average annual increase about 3.6%

VERIFICATION



Reference Standard for W-H meters
Accuracy Class 0.01
Owned by DOM

Working Standard for W-H meters
Accuracy Class 0.02 & 0.05
0.02 Owned by PLN
0.05 Owned by DOM

W-H meters
Accuracy Class 0.1

W-H meters
Accuracy Class 0.2 & 0.5

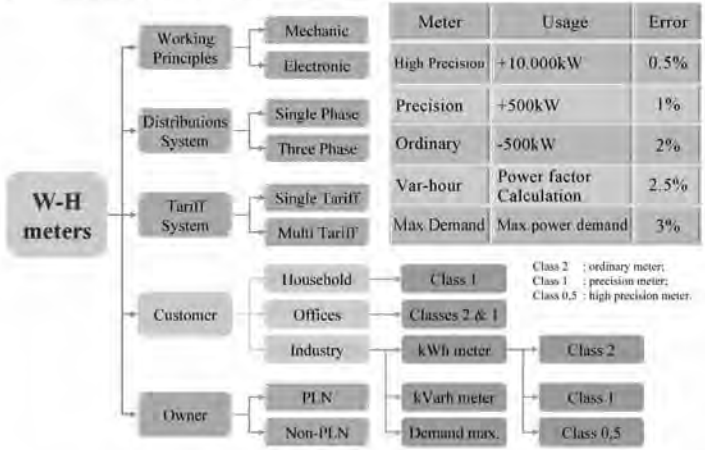
W-H meters Accuracy Class 1 and 2
Used for tariff transaction

Electricity reference standard made by Radian **(RD-30)** is **used reference instruments** (0.01).

Multi-meters made by Schlumberger **(SM 7050)** are used reference instruments (0.05) **for verification of Electricity meters**.

VERIFICATION

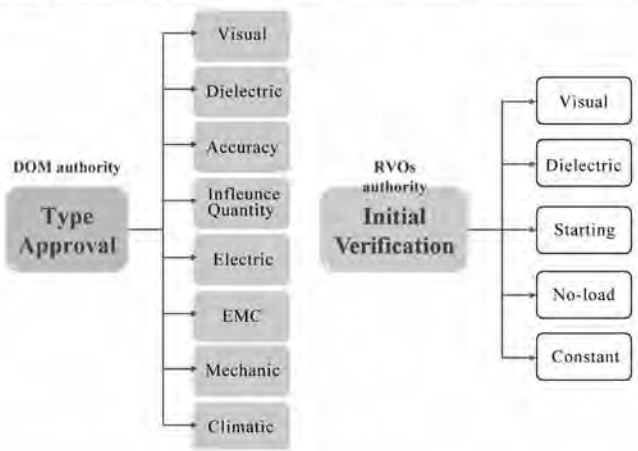
Classifications of electricity meters in Indonesia



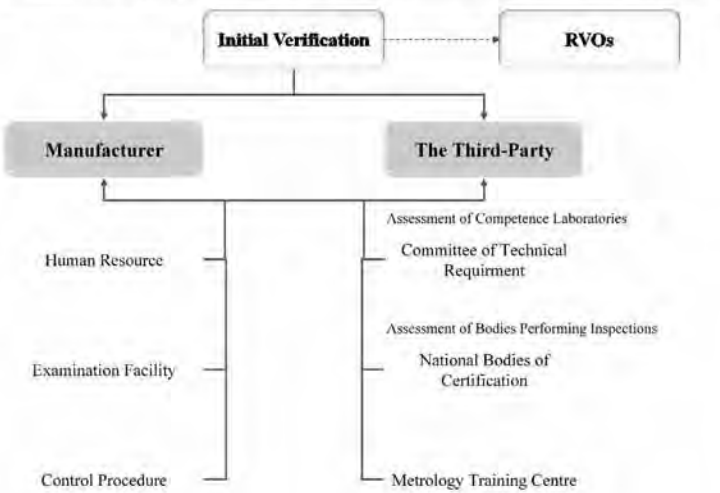
Meter	Usage	Error
High Precision	+10.000kW	0.5%
Precision	+500kW	1%
Ordinary	-500kW	2%
Var-hour	Power factor Calculation	2.5%
Max Demand	Max.power demand	3%

Test Type

OIML R46 and IEC 62053 adopted by SNSU



Future Plan



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in Legal Metrology; (CTI-09/2009T)
Training Course on Electricity Meters
10-13 August, 2009
Shah Alam, Malaysia

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Legal Metrology System on Electricity Meters in JAPAN

Japan Electric Meters Inspection Corporation

1.Self introduction(1)

organization

Ministry of Economy,
Trade and Industry
(METI)

Technical Guidance

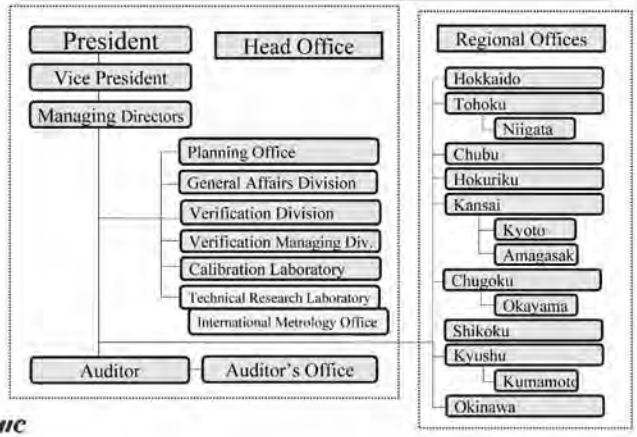
National Institute of
Advanced Industrial
Science and Technology
(AIST)

Japan Electric Meters Inspection Corporation
(JEMIC)

JEMIC

1.Self introduction(2)

organization and department



JEMIC

1.Self introduction(3)

professional experience in JEMIC

Law

JICA, AOTS & APMP

JEMIC

2. Eelectric meter in JAPAN(1)

1. regulation	METI (Ministry of Economy, Trade and Industry)
2. legal units of measure for the sale of electricity	kWh
3. require approval of type	Yes
4. performs approval of type testing	JEMIC
5. verification testing required?	Yes

JEMIC

2. Electric meter in JAPAN(2)

6. verification test organization	JEMIC & Designated Manufacturers
7. tests in service	Yes
8. Reverification interval	10 years(ordinary WHM)
9. complaint/dispute resolution process	

・customer →power utilities (nearly 100% satisfaction)

JEMIC

3. Legal metrology system
4. compliance to the international standards
5. legal metrology system

→ lecture

Thank you for your Attention

JEMIC

Asia-Pacific Economic Cooperation

SIRIM

APLMF Asia-Pacific Legal Metrology Forum

OVERVIEW ON ELECTRICITY METERS IN MALAYSIA

Nazri Marzuki
Metrologist
National Metrology Laboratory
SIRIM Berhad

Asia-Pacific Economic Cooperation

SIRIM

APLMF Asia-Pacific Legal Metrology Forum

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APEC/APLMF Seminars and Training Courses in Legal Metrology
Training Course on Electricity Meters
August 10-13, 2009 Malaysia

Asia-Pacific Economic Cooperation

SIRIM

APLMF Asia-Pacific Legal Metrology Forum

1. SIRIM Berhad

History

September 1975	Standards and Industrial Research Institute of Malaysia (SIRIM) was established with the merger of Standards Institution of Malaysia (SIM) and National Institute for Scientific and Industrial Research (NISIR) A Statutory Body under the Ministry of Science, Technology and Environment Malaysia Governed by SIRIM Council
July 1993	SIRIM Act was amended to allow SIRIM to operate as a contract research organisation, and to establish joint ventures and subsidiaries
November 1995	SIRIM Berhad was incorporated
1 September 1996	SIRIM Berhad came into operation as a successor company to the Standards and Industrial Research Institute of Malaysia under the Standards Act 1996.

Asia-Pacific Economic Cooperation

SIRIM

APLMF Asia-Pacific Legal Metrology Forum

ORGANISATION STRUCTURE 2008
STRUKTUR ORGANISASI 2008

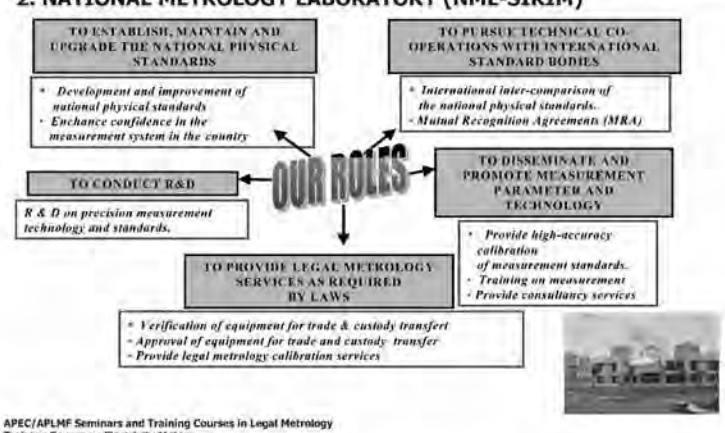
APEC/APLMF Seminars and Training Courses in Legal Metrology
Training Course on Electricity Meters
August 10-13, 2009 Malaysia

Asia-Pacific Economic Cooperation

SIRIM

APLMF Asia-Pacific Legal Metrology Forum

2. NATIONAL METROLOGY LABORATORY (NML-SIRIM)



APEC/APLMF Seminars and Training Courses in Legal Metrology
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SIRIM

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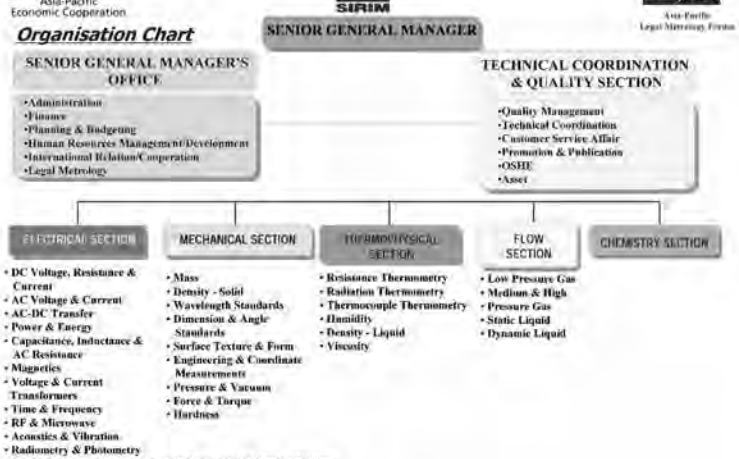
Organisation Chart



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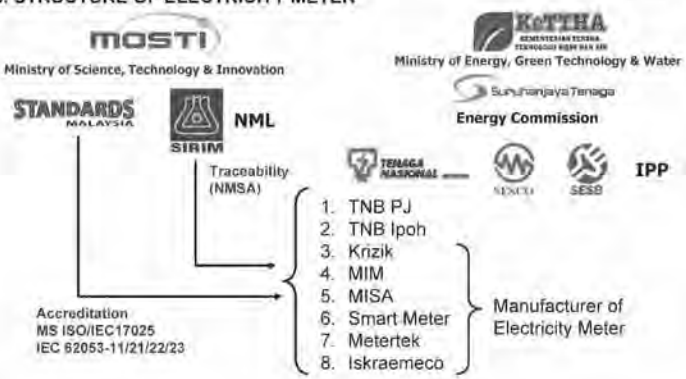
3. STRUCTURE OF ELECTRICITY METER



Regulatory Organisation

SIRIM & Energy Commission - regulate the measurement of electricity in Malaysia under National Measurement System Act, 2007 and Electricity Supply Act, 1990

Legal unit

The legal unit of measure for sale electricity are kilowatthour (kWh)

Type Approval

- Type approval is based on power company requirement and IEC standard
- Compliance to critical and mandatory technical specification from power company
- Type test approval based on IEC standards from recognized laboratory such as
  a) OFFER Measurement Laboratory, Birmingham, UK
  b) Parkside Laboratories Ltd, New Zealand
  c) TUV Product Service Ltd Hampshire, UK
  d) PTB Braunschweig, Germany
  e) YMPL Udaipur, India
  f) BIS laboratory Guwahati, India
- Field trial of six months or more

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Training Course on Electricity Meters
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Verification Process

- Performed by utility (TNB) and meter manufacturers accredited under MS ISO/IEC 17025
- Also performed on site verification.
- The validity of verifications is about 15 years depend on meter utilization and accuracy class.
- The length of validity of verifications is based on sample testing, analytical study and scheduled on site verification report.
- For low voltage consumers (single phase/three phase), no specific verifications interval.
- Verification is done when have differences in bill's statistic or complain by the consumers.
- For medium and high voltage consumer where used of electricity meters with transformer, the verification interval is once a year.
- After the initial verification expired the meters will be discarded.

Resolution process for complaint/dispute

- Complaint can be reported to power company and Energy Commission.

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4. NATIONAL MEASUREMENT SYSTEM ACT 2007

The totality of administrative and technical arrangements within a country which enables an individual or organization to have the means to make accurate and traceable measurements.

Objective

- To provide for uniform Units of Measurement based on SI Units
- To provide for the establishment of national measurement standards
- To provide for measurement traceability to national standards
- To provide for the coordination of Malaysia's national measurement system

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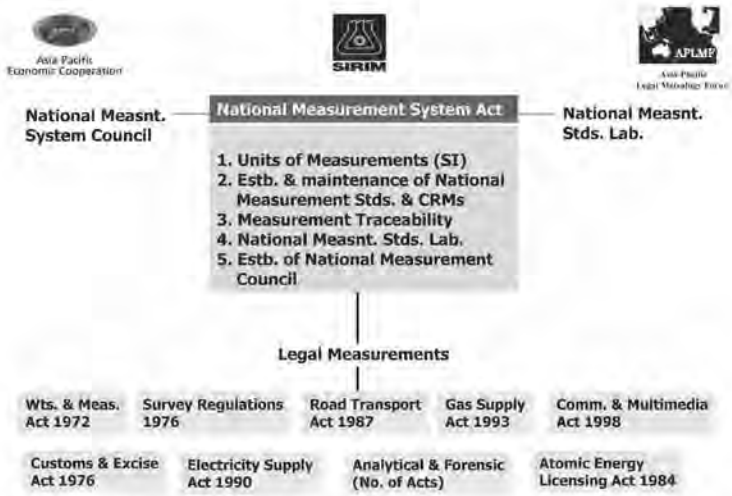


APEC/APLMF Seminars and Training Courses in Legal Metrology (CTI-09/2009T)
Training Course on Electricity Meters

Overview of the Legal Metrology System on Electricity Meters in Papua New Guinea

Introduction

Name: Roland Tagis

Position: Metrologist

Organization: PNG NISIT

Division: Metrology

PNG – NISIT

The National Institute of Standards and Industrial Technology is the National Standards Body responsible for overseeing to all standardization and conformance activities in Papua New Guinea.

Enacted as an Act of Parliament in 1993 —— NISIT Act 1993 and commenced operations in 1994.
In summary, NISIT is obligated under NISIT Act——1993 to perform the following:

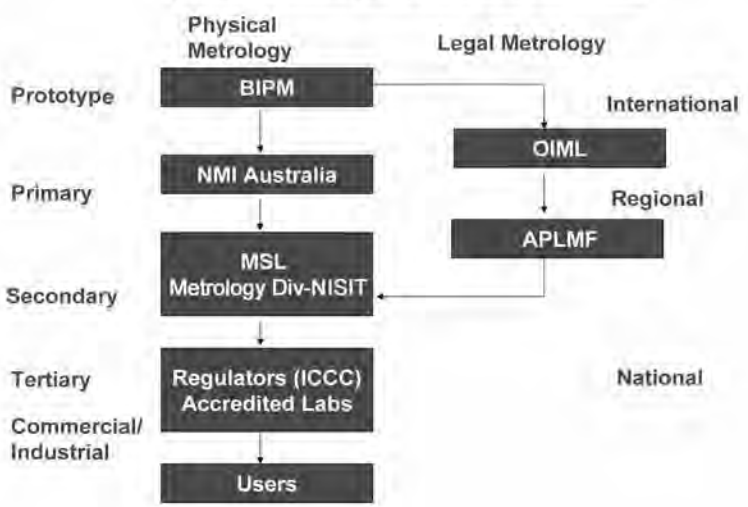
- Standards Development and Publication
- Standards Information Dissemination and Sales of Standards or Publications
- Calibration, Verification and Testing of Measuring Equipment and Artifacts
- Laboratory Accreditation
- Management System Certification
- Conduct Professional Training programs on standardization and quality assurance

Measurement Standards Laboratory (MSL)

Metrology is the national body in charge of Legal and Physical Metrology in PNG. Empowered by our mandated functions and responsibilities, the Institute through the Metrology Division is nationally recognized as the custodian of Papua New Guinea National Standards of Measurement.
At present, all measurement services offered come under the Metrology (Measurement Standards) Division of the Institute and are facilitated or conducted through the Measurement Standards Laboratory.
The Measurement Standards Laboratory in its current capacity and capability is responsible for the provision of Calibration and Verification Services in Papua New Guinea.
The services offered by MSL to date include:

- Calibration Services
- Verification Services
- Training Services
- Advisory & Consultation Services (Measurement)

Traceability of Measurement



Electricity Meters in Papua New Guinea

What Organization(s) regulates the measurement of electricity in PNG?

•PNG Power Limited
Service delivery and Regulatory functions (testing/verification/inspection)
•ICCC (Independent Consumer and Competition Commission)
Consumer protection and consumer rights
•NISIT
Called upon for Standards and Conformance

Legal units of measure for sale of electricity in PNG
•Kilowatt-Hour (kWH)

Do electricity meters require approval of type?
• Yes they do require type testing approval

Electricity Meters in Papua New Guinea

What organization performs approval of type testing?

•PNG Power Limited

Is meter verification required?

•Yes

What organization performs the meter verification tests?

•PNG Power Limited.

Are tests performed on meters in service?

•Yes

Electricity Meters in Papua New Guinea

Are meters given a reverification interval? (8 years? 12 years?)

•No, there is no program in place for reverification of meters.

Is there a measurement complaint/dispute resolution process?

•Yes. Before a meter is checked/ verified, a complaint has to be lodged in an application for the meter to be tested. If the meter is faulty, the energy lost is calculated and credited back to the customer's account and meter is replaced.

CURRENT SITUATION IN ECONOMY ABOUT THE COMPLIANCE TO THE INTERNATIONAL STANDARDS/RECOMMENDATIONS FOR ELECTRICITY METERS

PNG Power Limited currently the only organization that performs approval/ verification on meters in PNG. PPL uses sub-standards traceable to their supplier: Energex, Australia.

THANK YOU

APEC/APLMF Seminars and Training Courses in Legal Metrology

Current Situation of Electricity Meters in Chinese Taipei

Chiung-Ting Kuo
Bureau of Standards, Metrology and Inspection, MOEA
August 10 , 2009

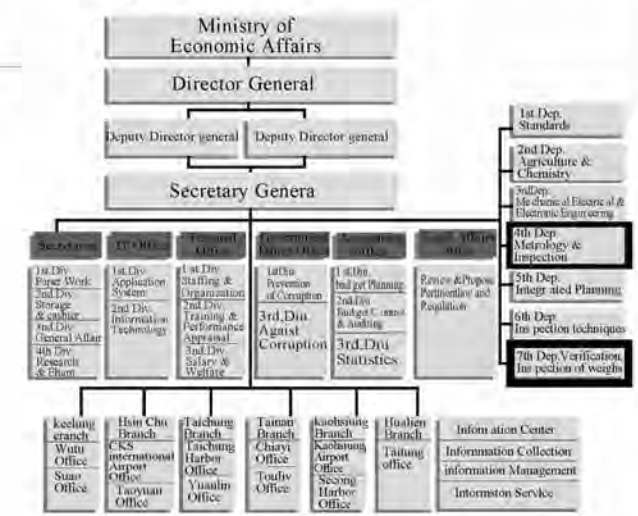
Introduction

- The Bureau of Standards, Metrology and Inspection (BSMI) under the Ministry of Economic Affairs is the regulatory authority for legal metrology.
- With a view to maintaining an effective metrology system and to facilitating trade, the BSMI has been working towards promoting the use of international system of units, harmonizing technical requirements for weights and measuring instruments with international requirements, and implementing a sound verification/inspection scheme in line with international practices.

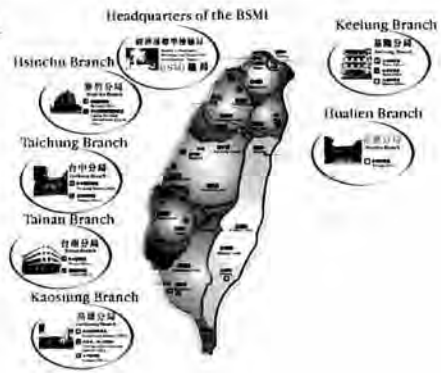
Introduction

- The Ministry of Economic Affairs (MOEA) regulates metrological control of measuring instruments.
- Bureau of Standards, Metrology and Inspection(BSMI) verifies measuring instruments before they sale or usage.
- BSMI inspects measuring instruments when they are in use.

Organization Chart



Locations of BSMI offices



Laws on Legal Measuring Instruments

- The Weights and Measures Act
- Enforcement Rules of Weights and Measures Act The Business Operation Licensing and Administration
- Regulations of Measuring Instrument Enterprises Regulations Governing Type Approval of Measuring Instruments
- Regulations Governing Verification and Inspection of Measuring Instruments
- Regulations Governing Commissioned Metrological Activities
- Regulations Governing Self-verification Conducted by Measuring Instrument Enterprises

Categories of Legal Measuring Instruments Subject to Verification (Regulations Governing Verification and Inspection of Measuring Instruments)

- 1. Taximeters;
- 2. Weighing instruments;
- 3. Mercury clinical thermometers;
- 4. Volumeters (including liquid dosage meters, diaphragm gas meters, water meters, oil meters, liquefied petroleum gas flow meters) ;
- 5. Milk hydrometers;
- 6. Electricity meters;

Categories of Legal Measuring Instruments Subject to Verification (Regulations Governing Verification and Inspection of Measuring Instruments)

- 7. Radar speedometers;
- 8. Sound level meters;
- 9. Concentration meters (including breathe alcohol testers and analyzers, rice moisture meters, vehicle exhausts emissions analyzers);
- 10. Illuminance meters;
- 11. Liquid column pressure gauges (including sphygmomanometers)

Organization of verification of Electricity Meters

- The BSMI entrust well-equipped, independent, and impartial testing institutions to carry out the verification.
- BSMI entrusts TERTEC（Taiwan Electric Research & Testing Center）, a non-profit professional institute, to carry out the verification of electricity meters.
- All electricity meters are verified at the TERTEC's testing laboratory.
- Laboratory tests ensure that electricity meters comply with **"Technical Specification for Verification and Inspection of Electricity Meters"** .

Management of Electricity Meters

- At present, the electricity meters are subject to verification and inspection.
- Electricity meters are not subject to type approval, but we are going to set up the technical specification for type approval of electricity meters.

Management of verification

- All new and repaired electricity meters are required to be verified.
- When the initial verification expired, the meters shall be re-verified.
- There are more than one million electricity meters to be verified annually.

The validity of verification

- Diamond bearing watt-hour meter is valid for 7 years.
- Non-bearing (electronic) meter is valid for 8 years.
- Surge proof with transformer or with a demanding meter is valid for 8 years.
- Surge proof (magnet bearing watt-hour meter) without transformer or without demanding meter is valid for 16 years.
- Single-phase socket is valid for 20 years.

Primary measurement standard

- NML has established measurement standards in the fields of electricity to provide traceability of electrical standards for domestic industry.
- It has established standards including DC/AC voltages, DC/AC currents, AC power and impedance.

Complaint/dispute resolution process

- Users can apply for meters identification.
- Staff of BSMI, users and staff of power company attend the meeting for meters identification.
- TERTEC provides the identification results to both power company and users.

Types of Electricity Meters

- Residential : Watt-hour meters, 1 phase - 3 wire, 110V/220V, 30A, 60Hz.
- Commercial and industrial : demand meters , 3 phase – 3 wire/ 3 phase – 4 wire,110V/220V, 30A, 60Hz.

Website

BSMI
http://www.bsmi.gov.tw

TERTEC
http://www.tertec.org.tw

NML
http://www.nml.org.tw/

~ The End ~

Thanks for your kind attention

Electricity Meters

Electricity Meters in Thailand

By: Mr.Nopporn Choopol

Organization and Department

⌘ Mr. Nopporn Choopol

⌘ Phuket Weights and Measures Branch Office

Address : 38/12 Rattanakosinthr 200 yrs Rd. Taladnue , Muang , Phuket 83000

Tel : 66 7621 2947 Fax : 66 7621 7746

E-mail : mynokky@hotmail.com , Phuket@cbwmthai.org

⌘ Bureau of Weights and Measures

⌘ Department of Internal Trade

⌘ Ministry of Commerce

⌘ Thailand

Organization and Department (2)

⌘Bureau of Weights and Measures consist of

* Central Bureau of Weights and Measures (Head office in Nonthaburi)
* Verification Centers (Northern , Northeastern , Eastern , Southern)
* Weights and Measures Branch Offices (23 Branches)

Responsibility

Goal and Intention

* Supervising manufacturers, importers, repairers, sellers and service providers of weighing and measuring instruments
* Establishing the standards of weighing and measuring instruments
* Providing verification services for weighing and measuring instruments
* Prescribing the displaying methods of net content of packaged goods
* Inspecting the net content of packaged goods

Responsibility (2)

⌘Duties and Services

1. Services to be carried out for the purpose of consumers protection
   * Keeping and maintaining the standards of legal metrology
   * Inspecting a weighing and measuring instruments used at purchasing places
   * Making a public understanding the correct meaning of weighing and measuring instruments using

Responsibility (3)

Duties and Services

2. Services which aim to promote the standards of weights and measures
   * Supervise manufacturers, importers, repairers, sellers and service providers of weighing and measuring instruments.
   * Issue license to service providers for carrying on the business.
   * Issue license to manufacturers or repairers to verify weighing and measuring instruments.
   * Provide verification services for weighing and measuring instruments.

My Professional Experience

⌘ Truck scales Verification and Inspection

* Mechanical Truck scales
* Electronic Truck scales

⌘ Non-automatic Weighing Instruments Verification and Inspection

* Mechanical balances
* Electronic balances

Electricity meter in Thailand

In Thailand there is no organization that are responsible for the measurement of electricity directlv.

Electricity meter in Thailand

- **Metropolitan Electricity Authority (MEA)**
  - *** Bangkok, Nonthaburi, Samutprakarn area**
- **Provincial Electricity Authority (PEA)**
  - *** Another provinces in regional area**

- **Metropolitan Electricity Authority (Head office located in Bangkok)**
- **Provincial Electricity Authority (Head office located in Bangkok)**

Unit

The legal unit of measure

for electricity sale in

Thailand is kilowatt hour.

1 Unit = 1,000 Whr

Verification

Import : All imported meters have to be verified by the standard referring to the reference of original country. Such as imported meters from USA, the meters will be verified by ANSI standard.

Domestic : Reference base on IEC standard and verification will be operated at random.

Verification tests

- The organizations which performs the meter verification tests are
- **Metropolitan Electricity Authority (MEA)**
- **Provincial Electricity Authority (PEA)**

Type Approval

* Manufacturer have to send a type approval test to

  MEA and PEA.

* Verification base on IEC 521:1976.

Testing services

- Both organizations have a plain to test the using electricity meter by sending an technical officer doing a precision test at user place throughout the year.
- After years of installation, the using meters will be checked and replaced by new meters.
  * 20 years for **MEA**
  * 15 years for **PEA**

Verification interval

No re-verification for electricity meters in Thailand.
In case of doubting in precision of measurement, people can complain to MEA or PEA for meter checking.

Measurement complaint

Both organizations find measurement complaints are approximately 0.4% per year.

Measurement complaint (2)

In case of measurement complaint or dispute of precision. The doubted meter will be checked and tested at laboratory meanwhile the officer replace a new meter at user place.

Measurement complaint (3)

If the meter checking result is precise the user has to pay for checking fee.

Measurement complaint (4)

Other fees in case the meter is imprecise officer will do as follows

* The meter reading is more than the standard then the organization have to pay for surplus.
* The meter reading is less than the standard then the user have to pay for surplus.

Requirements

- ⌘ Budget
- ⌘ Human resources
- ⌘ Research and Development
- ⌘ Knowledge and Management
- ⌘ Support from developed country

<u>All is necessary and needed</u>

The end

Electricity meters in Viet Nam

Presented by : Nguyen Ngoc Hue, Eng.

DIRECTORATE FOR STANDARDS, METROLOGY AND QUALITY (STAMEQ)

Legal Metrology System in Viet Nam

1. Legal document system on metrology

- Ordinance on Measurement (1999) issued by Standing Committee of Assembly
- Decree on detailing implementation of Ordinance on measurement (2002) & the System of Legal Units of measurement in Vietnam (2007) issued by Government.
- A set of Decision promulgating regulations on legal metrology issued by Ministry of Science & Technology such as:

Legal Metrology System in Viet Nam

- Recognition of working standards used for verification;
- List of measuring instruments subject to verification;
- Pattern approval of measuring instruments;
- Recognition of capability for verification of measuring instruments;
- Certification and granted verified card for measuring verifiers;
- Verification mark, stamp and granted verification certificate;
- List of prepackaged goods subject to state management over measurement;
- Metrology control for prepackages by weight or volume or area or length or count;
- Requirement for measuring in retail sale;
- Verification fees; etc.

2. Organization Chart

Electricity meters in Viet Nam

1. Legislation on electricity meters

- Technical regulations on electricity meters are issued by STAMEQ, including:
- Verification Procedure for inductive meters 1 phase and 3 phase " DLVN 07:2003" and Vietnamese Standards "TCVN6572—1999". It follow to IEC 62053-21 (IEC 521 : 1998)

Electricity meters in Viet Nam

- Verification Procedure for electronic meters 1 phase and 3 phase "DLVN 39 : 2004" and Vietnamese Standards "TCVN 6571—1999". It follows to IEC 62053-22 (IEC 1036, IEC 678, IEC 1268)
- Type testing procedure for pattern approval for electricity meters 1 phase and 3 phase. It follows to IEC 62053-21, IEC 62053-22.

Electricity meters in Viet Nam

2. Organization responsible for control

- Directorate for Standards, Metrology and Quality (STAMEQ) is responsible for control and inspection of electricity meters in whole country
- Branches of STAMEQ in 63 provinces are in charge of control and inspection of electricity meters in their localities

Electricity meters in Viet Nam

3. Legal unit of measure for the sale of electricity

- kWh (kilowatt-hour)
- kVArh (Kilovar-hour)
- kVAh (Kilova-hourr)

In Vietnam, all the meters used for electricity sales by contract have to be verified.

Electricity meters in Viet Nam

4. Type approval

- For new design of meters (domestic manufacturer) and the imported meters must be subjected to conduct type approval
- STAMEQ issued certificate for type approval
- Vietnam Metrology Institute, QUATEST 1, 2, 3 performs approval of type testing

Electricity meters in Viet Nam

5. Verification

- Initial verification for new design of meters (domestic manufacturer) and the imported meters
- Subsequent verification for used meters
- Inspection verification for justice activities
- Re-verification interval: 5 years for 1 phase, 2 years for 3 phases

Electricity meters in Viet Nam

6. Typical electrical meters of used

- Reference (electronic)
  - —— Classification: 0.05-0.01-0.02-0.1-0.2-0.5
  - —— Re-verification interval: 1 year
- Consumers (inductive & electronic type)
  - ——1 phase (2 wire)
  - —— 3 phases (3 elements-4wire, 2elements-3wire)
  - —— 3 phases multi tafiff
  - —— Classification: 0.5—2.0 (follow to IEC)
  - —— Re-verification interval: 5 year for 1 phase,2 years for 3 phases.

Electricity meters in Viet Nam

7. Verification organizations

- Vietnam metrology institute, QUATEST 1, 2, 3
- 63 the provincial verification offices
- The authorized verification organizations including 63 power company & 3 testing centers belong to EVN; and 5 authorized Labs belong to Industrial secter
- Total electricity meters in VN: 15 millions

Thank you for your attention !

Asia-Pacific Economic Cooperation

APLMF

APEC/APLMF Seminars and Training Courses in Legal Metrology (CTI-09/2009T)
Training Course on Electricity Meters
August 10-13, 2009
at Concorde Hotel, Shah Alam, Malaysia

Presentation

On Electricity Meters in Cambodia

Present by YIN Vanndeth
Officer in Department of Metrology

1. Overview of Department of Metrology

——To implement the National Metrology Policy and issue documents concerning manufacture, import-export and repair of manufacturing equipments.
——To assure the conservation of the secondary and working standards.
——To ensure the proper design, verification and use of the measuring instruments.
——To review the need, establish the work plan and monitor the implementation.
——To carry out the evaluation and supervision of measuring equipment to ensure their effectiveness and efficiency.
——To disseminate and improve the national technology of metrology.
——To organize the training of metrological staff.
——To co-operate with international Metrology organizations.

1. Overview of Department of Metrology

- 1995 We established the weight and measure unit under Ministry of Industry Mines and Energy (MIME).
- 1999 We upgraded the weight and measure unit to the Department of Metrology (DOM) under MIME.
- Cambodia jointed ASEAN in April 1999.
- Also Cambodia belongs to the ACCSQ WG3 member, the Corresponding member of OIML in 2000 and the full member of APLMF in 2002.

2. My professional experience in Department

- I have worked in Department of Metrology (DOM) since 2004 with skill of Electricity Power Engineering.
- I am in charge of DOM laboratory in the field of legal metrology.

3. Current Situation of Electricity in Cambodia

- Ministry of Industry, Mines and Energy (MIME) shall be responsible for setting and administrating the policies, strategies and planning in the privatepower sector named Electricity ofCambodia (EDC).

3. Current Situation of Electricity in Cambodia

- Electricity Authority of Cambodia (EAC) is the legal public entity, being granted the rights by the Royal Government of Cambodia to be an autonomous agency to regulate the electricity power services and govern the regulation between the delivery, receiving and use of Electricity.
- Electricity of Cambodia (EDC) is a public company of State under administration of MIME and Ministry of Economic and Finance, which produces and distributes the Electric Power around economy.

4. Organization performs the measurement of Electricity

- Electricity Authority of Cambodia (EAC) shall ensure the provision of services and use of electricity and be performed efficiently, qualitatively, sustainable and in a transparent manner.
- EAC shall require each licenses to ensure and certify that metering equipment and meter testing facilities to comply with all applicable standards. Any metering equipment and meter testing facility may be inspected by Authority from time to time.

5. Organization performs Type Approval

- The metrology law has drafted by Department of Metrology (DOM) and MIME and already approved by National Assembly and will implement soon.
- In the Article of draflaw for use in trade and purpose shall be:
  - ——subject to pattern approval
  - ——subject to initial verification in accordance with requirement
  - ——subject in service of verification
  - ——subject to verify after repair or modification

5. Organization performs Type Approval

- In the Article of drafted law is also specified on:
  - ——weighing or measuring equipment for use in the field of public health.
  - ——weighing or measuring equipment for use in the field of postal service.
  - ——weighing or measuring equipment for use in the field of Electricity, Gas and Water.
- DOM has not measurement standard equipments and regulatory control for Pattern approval and verification such instruments.
- Under UNIDO project in Third phase for Market Access and Trade Facilitation, supports for MEKONG DELTA Country to assist and establish new measurement Standard facilities for verification of Electricity Meters and Water Meters in the near future.

6. Kinds of Electricity Meters in Cambodia

- Active Power in kw
- Reactive Power in kvar
- Single tariff and Multiple tariff

7. Issues and Conclusion

- National Metrology Center will set up soon, so
- Limited human Resource.
- the fatal fact is that knowledge not sufficient to evaluate the test results.
- No laboratory facilities for type approval/verification tests.
- We request for assisting technical training and practice on Electricity Meters.

Thank you for your attention!

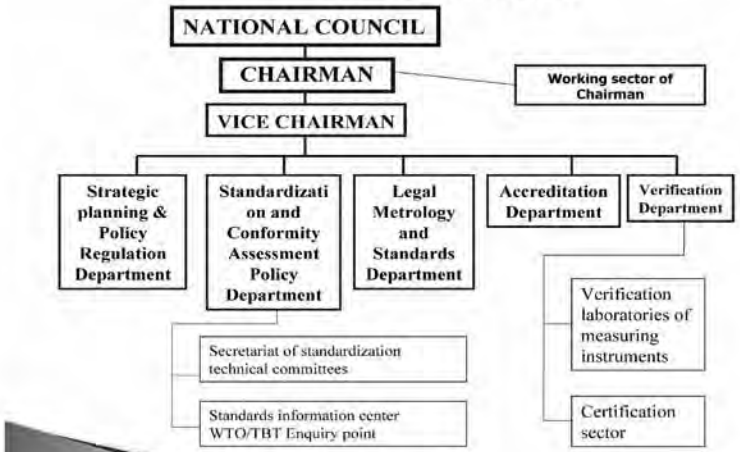
MASM

Head of verification laboratory
electricity meters
Ts.Enkhbaatar

MASM

Metrology Department of MASM is the oldest and largest department in our agency. We realize Mongolian Governmental policy on measurement according to the law on "Traceability of Measurement Uniformity" approved in 1994 and renewed in 2003.

MASM chart



MAIN FUNCTIONS

- Development and registration of certified reference materials
- Development of national measurement standard system
- Maintenance and improvement of accuracy of measurement standards
- Traceability of measurement standards
- Pattern approval of measuring instruments
- Calibration of measurement standards or measuring instruments
- Verification of mandatory instruments as required by the law
- Licensing for manufacture, repair, installation and sale of measuring instruments
- Training
- Others

HISTORY

1924 – Weights and Measures Unit was established
1931 – It was changed to Commission of Measuring Instruments
1944 – Weights and Measures was established
1955 – It was changed to Administration for Measures and Measuring Instruments
1972 – State Committee of Quality, Standards and Measures was established
1988 – It was renewed to State Department of Standards
1990 – It was renewed to National Research Institute of Standardization, General Department of Metrology Bodies
1992 – It was renamed to Mongolian National Center for Standardization and Metrology
2002 – It was renamed to Mongolian Agency for Standardization and Metrology

ELECTRICAL STANDARD LABORATORY

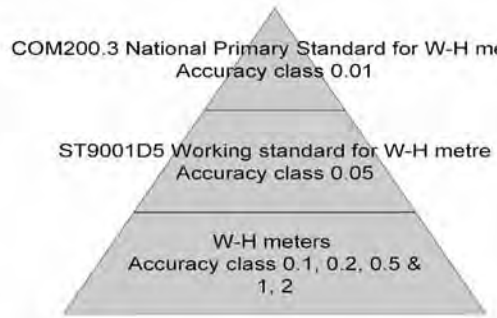
Electrical standard laboratory was established in 1989.

Since its establishment, the laboratory has developed and maintained the following national electrical standards:

1. DC voltage (approved in 1999)
2. DC resistance (approved in 2002)
3. AC voltage (approved in 2003)
4. Energy and power (approved in 2003)

National Primary Standard of Electrical Energy

Power Standard for Watt-Hour Meters



National Primary Standard of Electrical Energy

Electricity power standard COM200.3 made by MTE is used for calibration equipment for verification of Electricity meters.

National Primary Standard of Electrical Energy

Range and Uncertainty
Frequency: 45Hz to 65Hz
Voltage: 60V to 480V
Current: 0,5 A, 1A, 2A, 5A, 10A directly
20A, 50A, 100A, 120A with a CT
Power Factor: 0 lead to 1.0 to 0 lag
Uncertainty: 50 μW/ W

Pattern approval

- The electricity meters are required to have type approval.
- A pattern approval for electricity meters according to MNS/IEC 61036 and IEC 62053-11 it does by the electrical standard laboratory of the MASM.
- MASM perform around 20 type electrical meters approval in a year.
- Test are conducted on samples, if the meters passing the test are given certificate including type approval number.

ELECTRICAL VERIFICATION LABORATORY

Electrical verification laboratory was established in 1955.

It verifies watt-hour meters, current transformers and other electrical measuring instruments.

Range:

Voltage: (100 to 400) V (for watt-hour meters)

Current: (1.5 to 120) A (for watt-hour meters)

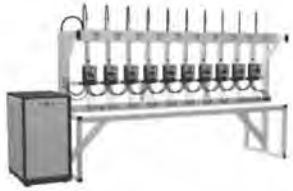
Accuracy of standard: 0.1 %

Verifications electricity meters

- The electricity meters are required to have verifications.
- This verification is performed by the MASM.
- All new and repaired electricity meters require verification testing.
- The licenses for manufacture, repair, servise and sale of electricity meters are authorized by MASM. (to 40 more companies and organizations have licenses)

BRANCHES OF MASM

MASM possesses twenty two branches in administrative regions of Mongolia. Calibration and Verification Laboratories, which were accredited by National Accreditation Body, realize measurement policy in those regions.



Future plan

MASM makes planning as following below:

——Build facilities and equipment: (new types testing equipment CT/PT)

——Human resources:build knowledge and skill of watt-hour verification and type approval testing

Nature of Mongolian

Nature of Mongolian

Nature of Mongolian

Nature of Mongolian

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END

THANK YOU