

TECHNICAL REGULATION OF MEASURING INSTRUMENTS FOR THE MEASUREMENT AND CALCULATION OF ELECTRICAL ENERGY

CHARTER 1

GENERAL

1.1. Purpose and scope

- 1.1.1. The purpose of the technical regulation is to establish the mandatory specific metrological, technical and operational requirements for electrical measuring instruments (hereinafter referred to as “electrical measuring instruments”), such as measuring transformers and electricity meters for measuring and calculating electrical energy, and to protect the market and consumers from the risk of counterfeit products.
- 1.1.2. This technical regulation covers measuring transformers, active and inactive meters used at the stage of source of energy and electricity transmission and distribution network, and at the consumer level.
- 1.1.3. The technical regulation shall be mandatory followed by and organizations for metrology, citizens and legal entities authorized to manufacture, import, sell, install, repair, to perform type testing and verification of electricity measuring instruments on the territory of Mongolia.

1.2. Normative references

The following referenced documents are indispensable for the application on this technical regulation. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document applies.

- MNS IEC 61869-1 Instrument transformers. Part 1: General requirements
- MNS IEC 61869-2 Instrument transformers.. Part 2: Additional requirements for current transformer
- MNS IEC 61869-3 Instrument transformers. Part 3: Additional requirements for inductive voltage transformers
- IEC 61869-4 Instrument transformers. Part 4: Additional requirements for combined transformers
- MNS IEC 61869-5 Instrument transformers. Part 5: Additional requirements for capacitor voltage transformers;
- MNS OIML R 46-1/-2 Active electrical energy meters. Part 1: Metrological and technical requirements/ Part 2: Metrological controls and performance tests;
- MNS IEC 62056-21 Electricity metering-Data exchange for meter reading, tariff and load control- Part 21: Direct local data exchange;
- MNS IEC 61968-9 Application integration at electric utilities – System interfaces for distribution management -Part 9: Interfaces for meter reading and control;
- MNS IEC 61968-1 Application integration at electric utilities – System interfaces for distribution management -Part 1: Interface architecture and general recommendations;
- MNS OIML V1 International vocabulary of terms in legal metrology;
- MNS ISO/IEC Guide 99 International vocabulary of metrology. Basic and general concepts and associated terms;
- MNS OIML D31 General requirements for software controlled measuring instruments;
- MNS OIML D11 General requirements for measuring instruments -Environmental conditions;
- MNS IEC 60050-601 International Electrotechnical Vocabulary -Part 601: Generation, transmission and distribution of electricity -General;

- MNS IEC 60050-312 International Electrotechnical Vocabulary -Part 312: General terms relating to electrical measurements;
- MNS IEC 60050-313 International Electrotechnical Vocabulary -Part 312: General terms relating to electrical measurements;;
- MNS IEC 60050-321 International Electrotechnical Vocabulary -Part 321: Instrument transformer.

1.3. Terms and definitions

The terms used in the technical regulation shall have the following meanings, defined in the terminology section of the standards below.

1.3.1. Metrological terms shall be understood in accordance with the standards MNS OIML V1; MNS ISO/IEC Guide 99;

1.3.2. Terms related to electricity meters shall be understood in accordance with the standards MNS IEC 60050-601, MNS IEC 60050-312, MNS IEC 60050-313, MNS OIML R 46-1/-2, MNS IEC 62056-21, MNS IEC 61968-1, MNS IEC 61968-9;

1.3.3. Terms related to instrument transformers shall be understood in accordance with the standards MNS IEC 60050-321, MNS IEC 61869-1, MNS IEC 61869-2, MNS IEC 61869-3, MNS IEC 61869-4, MNS IEC 61869-5.

CHAPTER 2

METROLOGICAL AND TECHNICAL REQUIREMENTS FOR ELECTRICAL MEASURING INSTRUMENTS

2.1. Requirements for electricity meters

2.1.1. Electricity meters used in Mongolia shall meet the requirements of standards MNS OIML R 46-1, MNS OIML D31 and series standards MNS IEC 62056.

2.1.2. Electricity meters used in the electricity distribution and transmission network of Mongolia shall meet the following requirements, and other parameters shall be the same as specified in MNS OIML R 46-1. It includes:

- Normal voltage frequency: $f=50 \text{ Hz} \pm 2\%$;
- Normal voltage: $U_{\text{nom}} \pm 20 \%$, (with direct connection $U_{\text{nom}} = 220 \text{ V}$, 380 V , when working with a transformer $U_{\text{nom}} (+10) \%$, $(-10) \%$ $U_{\text{nom}} = 57.7 \text{ V}$, 100 V). During the test the error permissible shift is within the limits of the error permissible shift on the influencing factor specified in the MNS OIML R 46-1.
- Base maximum permissible error shall not exceed that specified in the following table.

Table 1. Base maximum permissible errors

Quantity		Base maximum permissible errors (%) for meters of class			
Current, I	Power factor	A	B	C	D
$I_{tr} \leq I \leq I_{max}$	1	± 2.0	± 1.0	± 0.5	± 0.2
	0.5 L and 0.8 C	± 2.5	± 1.0	± 0.6	± 0.3

$I_{min} \leq I < I_r$	1	± 2.5	± 1.5	± 1.0	± 0.4
	0.5 L and 0.8 C	± 2.5	± 1.8	± 1.0	± 0.5
$I_{st} \leq I < I_{min}$	1	$\pm 2.5 \cdot I_{min}/I$	$\pm 1.5 \cdot I_{min}/I$	$\pm 1.0 \cdot I_{min}/I$	$\pm 0.4 \cdot I_{min}/I$

d) Operating temperature: lower limit -45°C, upper limit 70°C. The cold test is carried out under operating conditions at -45°C \pm 3°C. Permissible error shall meet the requirements specified in Table 1.

e) Sea level height: more than 1000 m.

g) The maximum permissible error is calculated only for one influencing parameter.

2.1.3. The electricity meter must be included the information specified in clause 3.5 of the MNS OIML R46-1 standard.

2.1.4. The accuracy of the electricity meter and base maximum permissible error must provide the provisions of clause 3.3.3 of the MNS OIML R46-1/-2 standards, and the direction of the energy flow must also satisfy the provisions of clause 3.3.2.

2.1.5. The electricity meters should have an error of the following accuracy classes:

- 0.2 % for source of energy and electricity transmission network more than 110 kV;
- 0.5 % for electricity distribution and transmission network 6-35 kV;
- 1.0 % for electrical meter (digital and mechanical combination meter);
- max 2.0 % for mechanical meter.

2.1.6. MNS OIML D31 applies to determine a set of risk levels, to software protection, to realise durability protection, protection of transmitted data and during use, and verifications by functional testing of the metrological functions and of the software functions, and verification of a measuring instrument for software-based electricity meters.

2.1.7. The safety of electrical measuring instruments against cyber attacks shall be regulated by the procedure by the competent authority.

2.1.8. Environmental conditions for electrical measuring instruments shall meet the MNS OIML D11 standard.

2.1.9. The internal data exchange interface of the electricity distribution network shall work in the protocol mode specified in the MNS IEC 62056-21 standard, supporting the DLMS/COSEM protocol.

2.2. Requirements for measuring transformers

2.2.1. The measuring (Instrument) transformers used in Mongolia shall meet the requirements of standards MNS IEC 61869-1, MNS IEC 61869-2, MNS IEC 61869-3, MNS IEC 61869-4, MNS IEC 61869-5.

2.2.2. The rated primary current of the measuring current transformers is 5-10-12-15-20-25-30-40-50-60-75-80, and these currents can be multiplied by 0.1, 10, 100, 1000. The rated secondary currents of current transformers are 1 and 5A.

2.2.3. The normal voltage classes of the measuring transformers are 0.4, 0.66, 2, 6, 10, 15, 20, 35, 110, 220, 330, 500 kV. The normal secondary voltage ratings for voltage transformers are 100, 100/ $\sqrt{3}$, 100/3 V.

2.2.4. The measuring transformers should be selected for use and installation at altitudes above 1000 m sea level according to the MNS IEC 61869-1 standard.

2.2.5. In addition to clause 6.13 of the MNS IEC 61869-1 standard, the following information must be included in the marking on the plate of measuring transformers.

- Normal voltage, U_{nom}
- Normal current, I_{nom}
- Ratio of the measuring transformers
- Normal secondary load with a specified power factor, Z_{2nom} (can be expressed as S_{2nom})
- Normal accuracy classes of the current transformers
- Type of insulator
- Environmental conditions.

2.2.6. The rated accuracy classes for measuring current transformers must be provided the requirements of the MNS IEC-61869-2 standard.

2.2.7. The calculation for commercial data of measuring current transformer shall be carried out with the following accuracy classes:

- 1) 0.2 6a 0.2S for source of energy and electricity transmission network 110 kV and higher;
- 2) 0.5 6a 0.5S for electricity network up to 110 kV;
- 3) 1.0 for electricity network to 1 kV.

2.2.8. Limits of ratio error and phase displacement on accuracy classes shall not exceed the values in the following tables 2, 3, 4 and 5. Other requirements shall be the same as in IEC 61869-2 standard.

Table 2. Limits of ratio error and phase displacement for measuring current transformers class 0.1 and 1

Accuracy class	Ratio error, $\pm \%$				Phase displacement							
					\pm Minuts				\pm Centiradian			
	at current (% of rated)				at current (% of rated)				at current (% of rated)			
	5	20	100	120	5	20	100	120	5	20	100	120
0,1	0,4	0,2	0,1	0,1	15	8	5	5	0,45	0,24	0,15	0,15
0,2	0,75	0,35	0,2	0,2	30	15	10	10	0,9	0,45	0,3	0,3
0,5	1,5	0,75	0,5	0,5	90	45	30	30	2,7	1,35	0,9	0,9
1	3,0	1,5	1,0	1,0	180	90	60	60	5,4	2,7	1,8	1,8

Table 3. Limits of ratio error and phase displacement for measuring current transformers class 0.2 and 0.5

Accuracy class	Ratio error, $\pm \%$					Phase displacement									
						\pm Minuts					\pm Centiradian				
	at current (% of rated)					at current (% of rated)					at current (% of rated)				
	1	5	20	100	120	1	5	20	100	120	1	5	20	100	120
0,2 S	0,75	0,35	0,2	0,2	0,2	30	15	10	10	10	0,9	0,45	0,3	0,3	0,3
0,5 S	1,5	0,75	0,5	0,5	0,5	90	45	30	30	30	2,7	1,35	0,9	0,9	0,9

Table 4. Limits of ratio error for measuring current transformers class 3 and 5

Class	Ratio error, \pm %	
	at current (% of rated)	
	50	120
3	3	3
5	5	5

Table 5. Error limits for protective current transformers class P and PR

Accuracy class	Ratio error at rated primary current, \pm %	Phase displacement		Composite error at rated accuracy limit primary current, %
		\pm Minuts	\pm Centiradian	
5P 6a 5PR	1	60	1,8	5
10P 6a 10PR	3	–	–	10

2.2.9. The rated accuracy classes for measuring voltage transformers must be provided the requirements of the MNS IEC-61869-3 and MNS IEC-61869-5 standards.

2.2.10. The calculation of measuring voltage transformer shall carried out with the following accuracy:

- 1) 0.2 6a 0.2S for source of energy and electricity transmission network 110 kV and higher;
- 2) 0.5 6a 0.5S for electricity network up 1 to 110 kV.

2.2.11. The accuracy class of the measuring voltage transformers shall be determined by the maximum permissible relative error in rated voltage.

2.2.12. Limits ratio error and phase displacement on accuracy classes shall not exceed the values in the following tables 6 and 7. Other requirements shall have same as in IEC 61869-3 standard.

Table 6. Limits of voltage error and phase displacement for measuring voltage transformers

Class	Voltage (ratio) error, ϵ_u \pm %	Phase displacement, $\Delta\phi$	
		\pm Minuts	\pm Centiradian
0,1	0,1	5	0,15
0,2	0,2	10	0,3
0,5	0,5	20	0,6
1,0	1,0	40	1,2
3,0	3,0	Not specified	Not specified

Table 7. Limits of voltage error and phase displacement for protective voltage transformers

Анги	Voltage (ratio) error, ϵ_u \pm %	Phase displacement, $\Delta\phi$	
		\pm Minuts	\pm Centiradian
3P	3,0	120	3,5
6P	6,0	240	7,0

2.2.13. Do not use an intermediate current transformers in measuring meter.

CHARTER 3

OPERATIONAL REQUIREMENTS FOR ELECTRICAL MEASURING INSTRUMENTS

3.1. Central and professional organizations for metrology shall adhere to MNS OIML R 46-1/2/3 standards for electricity meters and MNS IEC 61869 series standard for current transformer to implement type testing of measuring instrument.

3.2. Central and professional organizations for metrology shall be issued confirming the approval of the measuring instrument type in the event of type testing results accepted or recognition of type testing results for the electrical measuring instrument.

3.3. The verification of electrical measuring instrument shall be carried out by the organization specified in Section 3.1 of this regulation in accordance with the "Procedure for inspection and verification of measuring instruments".

3.4. The issue for extension warranty period of the type of electrical measuring instrument shall be submitted and resolved to the Central Organization for metrology by the enterprise registered with the state integrated database of metrology

3.5. The Laboratory that performs type test, verification, and repair shall meet the following requirements:

- Equipment that are being used to test the measuring instrument shall have a sufficient accuracy level and the traceability should be ensured for calibration.
- The room shall have sufficient space and is required to maintain appropriate environmental conditions related to vibration, dust level, illumination level, and earthed.
- Room temperature shall be $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$, relative humidity shall be (20-60) %, the temperature variation should be $< \pm 2\text{ }^{\circ}\text{C}$ during calibration period.
- The laboratory shall make arrangements for regulated and uninterrupted power supply to be achieved required accuracy of measurement.

3.6. Verification officer shall be sealed to secure measuring instruments appropriate sealing by mechanical, electronic and/or cryptographic means, making an unauthorized intervention impossible or evident.

3.7. The Verification officer, inspector, and authorized person of legal entities engaged in the metrology activities are allowed to access a limited set of device-specific parameters such as zeroing the register, and change the tariff according to 3.6.4 of MNS OIML R 46. This activity is coordinated with a contract.

3.8. The Verification officer and inspector are allowed to access an audit trail to check and verification of the electricity meter.

3.9. The interface of the electricity meter in the electricity distribution network should be designed according to the MNS IEC 61968-1 standard, and the meter reading and monitoring interface should be performed according to the MNS IEC 61968-9 standard.

CHARTER 4

ЦАХИЛГААНЫ ХЭМЖИХ ХЭРЭГСЛИЙН СУУРИЛУУЛАЛТ, АШИГЛАЛТ, ХЯНАЛТ

4.1. The manufacturer and importer shall hand over to the authorized person for install and use measuring and calculating instrument with operational instruction and manual.

4.2. When installing the electrical measuring equipment, the instructions for its use and safety requirements shall be followed, and the legal entities as an electricity supplier and consumer shall jointly check and confirm the calculation circuit according with the relevant regulations (the secondary circuit of the instrument transformer, the integrity and security of the connection clamps, sealing against external attacks, and technical normative documents).

4.3. Rules for the electricity use, Rules for electrical facilities, Safety rules for use of electrical facilities and Rules for electrical equipment use of consumer will be followed that during installation and use of the electrical measuring instruments, electricity meter tested according to MNS OIML R46-2, and current transformer to MNS IEC 61869-1 standards, electricity meter organized according to standards MNS IEC 61968-1 and MNS IEC 61968-9.

4.4. State inspection for metrology shall be carried out by the state administrative body in charge of metrology.