VOLTAMPEREPHASEMETER

«PARMA VAF-A(C)»

Method of verification

РА1.007.004 МП

2016

CONTENTS

The verification of voltamperephasemeters “PARMA VAF-A(C)” (hereinafter – VAF) is done as per this verification method.
The VAF verification is done by the state metrological service or certified metrological services of legal entities.
VAF, failed the verification, are not permitted to be produced or applied.
The interval between verifications is 4 years.

1 NORMALIZED METROLOGICAL CHARACTERISTICS

1.1 Normalized metrological characteristics of VAF are specified in table 1.

Table 1

Measured parameter	Measurement range	Limits of allowable error during measurement of corrected[1)], (γ) %, relative, (δ) % and absolute (Δ) values	Note
Direct current voltage, U, V	0.5 to 600	$\Delta = \pm (0.5+0.005*X)$	
Alternate current voltage, U_{RMS}, V	0.3 to 600	$\gamma = \pm 0.05$	at $U \le 0.1\ U_K$
		$\delta = \pm 0.5$	at $U \ge 0.1\ U_K$
Alternate current rate, I_{RMS}, A	0.004 to 40	$\gamma = \pm 0.01$	at $I \le 0.1\ I_K$
		$\delta = \pm 1$	at $I \ge 0.1\ I_K$
Alternate current frequency, *f*, Hz	45 to 55	$\Delta = \pm 0.01$	at U≥2 V & I≥100 mA
Phase displacement angles, deg	0 to 360	$\Delta = \pm 1$	at U≥10 V & I≥10 mA
[1)] For calculating the corrected measurement errors, the final range value is accepted as the normalized value. Where – U_{RMS}, I_{RMS} – valid value of AC voltage, rate, X – measured voltage value; U_K, I_K – final value of measurement range.			

2 VERIFICATION OPERATIONS

2.1 Verification operations

2.1.1 During the primary and periodical verification, the operations, specified in table 2, shall be done.

2.1.2 The verification is ended after the reception of negative results during any of operations, provided in table 2.

Table 2

Operation name	Item No.	Operation is done during	
		Primary verification	Periodical verification
Visual inspection	7.7.1	Yes	Yes
Electrical strength and insulation resistance check	7.7.2, 7.7.3, 7.7.4,	Yes	No
Parameter check of input electrical circuits	7.7.5	Yes	No
Start and testing	7.7.6	Yes	Yes
Software check	7.7.7	Yes	Yes
Determination of metrological characteristics	7.7.8	Yes	Yes

2.2 Arrangement of verification workplace

2.2.1 The list of instruments and equipment required for the verification is specified in table 3.

Table 3

Verification instrument	Type	Measuring limit	Accuracy class, error	Verification method item
Universal calibrator	FLUKE 9100E No. 25985-03	1000 V, 20 A, 400 MOhm,	U=±0.0065 % I=±0.014…0.055 %	7.7.8
Multifunctional reference voltage and current calibrator	PARMA GS8.03 No. 46614-11	U = 0…308 V, I = 0…7 A F=45…55 Hz φ=0…360 °	ER ±0.02 +0.0015(Uк/Uи-1) %; ER ± 0.1 + 0.005(Iк/Iи-1) % ER±0.001 Hz ER±0.02 °	7.7.8
Universal puncture plant	GPI-735A No. 27825-04	U=0.1…5.0 kV R=1…9900MOhm	ER U = ±(0.01*Uind.+ 5 ls dgt) ER R±5% at R from 1 to 500 Ohm ER R±10 % at R from 500 to 9900 MOhm	7.7.2 7.7.3 7.7.4
Universal voltmeter	B7-40 No. 9985-89	10 MOhm 0.1 mV…2 kV	ER=±(0.04 %+5 ls dgt)	7.7.5
Barometer aneroid	BAMM-1 No. 5738-76	80…106 kPa	ER ±200 PA	7.6
Temperature and humidity meter	TKA-PKM No. 24248-09	0 - 50 °C; 10 - 98 %	ER± 0.5 °C; ER ± 5 %	7.6

2.2.2 It is permitted to use other types of instruments and auxiliary equipment, ensuring the determination of metrological characteristics with the preset accuracy.

2.2.3 All the verification tools shall be eligible and have the duly confirmation of their operability.

2.3 Requirements to verification officer qualification

2.3.1 Persons duly certified as verification officers, having the qualification group of electrical safety of no lower than III, are permitted to have the VAF verification.

2.4 Safety requirements

2.4.1 During the verification, it is required to observe the safety requirements as per GOST 12.3.019-80, operation manual and other regulatory documents for instruments and test equipment.

2.4.2 Before testing, the instruments, which are the subject of grounding, shall be grounded. Connection of protective grounding clips to the grounding circuit shall be done prior to other connections, and disconnection – after all disconnections.

2.4.3 The preparation of instrument tests, assembly and disassembly of measuring circuits should be done when a voltage and residual charge is unavailable in the test object and instruments.

2.4.4 In order to relieve the voltage and residual charge from the instruments and test equipment and to prevent an erroneous voltage appearance in them, it is required to ensure:

— de-energization;
— grounding of instrument casings.

2.4.5 Erection, adjustment and repair works should not be done at the test objects, located under the test load.

2.4.6 Fuses or circuit breakers shall be in the power circuits of used test equipment.

2.4.7 Wires intended for the assembly of measuring circuits shall be equipped with tips and

marks.

2.5 Verification conditions and its preparation

ВНИМАНИЕ! На поверку предъявляются ВАФ с измерительными и опорными датчиками тока, если их наличие предусмотрено комплектом поставки в соответствии с п.5 РА1.007.004ФО.
CAUTION**!** For verification imposed VAF with measuring and reference current sensors that - on, if their presence is provided for delivery of a as per it 5 РА1.007.004ФО.

2.5.1 Premises, intended for tests, shall satisfy to the fire safety requirements as per GOST 12.1.004-91 and requirements of sanitary and epidemiological rules of SP 2.2.1.1312-03.

2.5.2 Test premises shall have:

- emergency lighting or portable lights with self-contained power;
- fire-extinguishing equipment;
- first-aid equipment;
- grounding bus.

2.5.3 Before the verification, it is required to be sure that the integrated power elements are completely charged. If required, charge them.

2.5.4 The verification is done in normal application conditions.

2.5.5 Normal instrument application conditions as per GOST 22261-94.

2.5.6 Normal application conditions:

- ambient air temperature of minus 30 to plus 55°C;
- relative air humidity of 90 % at 30°C;
- atmospheric pressure of 70 to 106.7 kPa.

2.5.7 The VAF are the subject of the primary verification after production and after repair.

2.5.8 The VAF should be the subjects of periodical verification upon the expiration of the interval between verification and after a routine maintenance (if such operations are provided by technical documents).

2.5.9 Pull the VAF out from the bag.

2.5.10 Inspect the cleanliness of end parts of current sensor clips, if required, clean them.
CAUTION! Before checking the electrical resistance and electrical strength of the VAF insulation, it is required to remove the power elements, and, after the verification completion, they shall be installed to their previous place.

2.5.11 Before the verification, keep the VAF in normal ambient conditions during no less than 4 hours if it has been located in climate conditions, different from the operating application conditions, the SB shall be fully charged.

2.5.12 Heat the samples and verification devices during 30 minutes before the verification of normalized metrological VAF characteristics.

2.5.13 The VAF verification is permitted for the separate channels of:

- voltage;
- current rate of the measuring and/or reference channel;

as per the supply set as per it.5 РА1.007.004ФО.

2.5.14 All the measurements are done in the single-phase VAF operation mode, except separately stipulated.

Note *– Connection of reference instruments shall be done as per the connection diagrams, specified in their operational documents and below diagrams.*

3 VERIFICATION PROCESS

3.1 Visual inspection

3.1.1 Visually check the casing of metering unit, reference and measuring current sensors, connecting cables, commutation ports. The VAF and accessories shall not have visible damages, hollows, ruptures and distortions of elements.

3.1.2 Check the availability and integrity of seals. Seals shall not be damaged. (During periodical verification).

3.1.3 Check closing of end clip parts.

3.1.4 Verification results shall be considered as positive if the metering unit, current sensors and commutation ports do not have visible damages, hollows, ruptures and distortions of elements.

3.1.5 If this requirement is not done, The VAF is considered as failed, and is the subject of repair.

3.2 VAF insulation resistance check

CAUTION! Before checking the electrical resistance and electrical strength of VAF insulation, it is required to remove the power elements.

3.2.1 The correspondence of requirements is checked with the help of a plant for checking the electrical safety parameters of GPI-735A (hereinafter – GPI-735A plant).

3.2.2 GPI-735A plant shall be prepared to the operation as per the operation manual.

3.2.3 Contacts shall be connected as follows as per the figure 1.

— “I meas” and “I ref” – K1;
— “U ref” channel and single terminal “B” – K2;
— “U meas” channel – K3;
— Wrap the VAF casing with foil, forming the contact K0.

3.2.4 The VAF in the off state shall be placed into a high-voltage interlocking chamber.

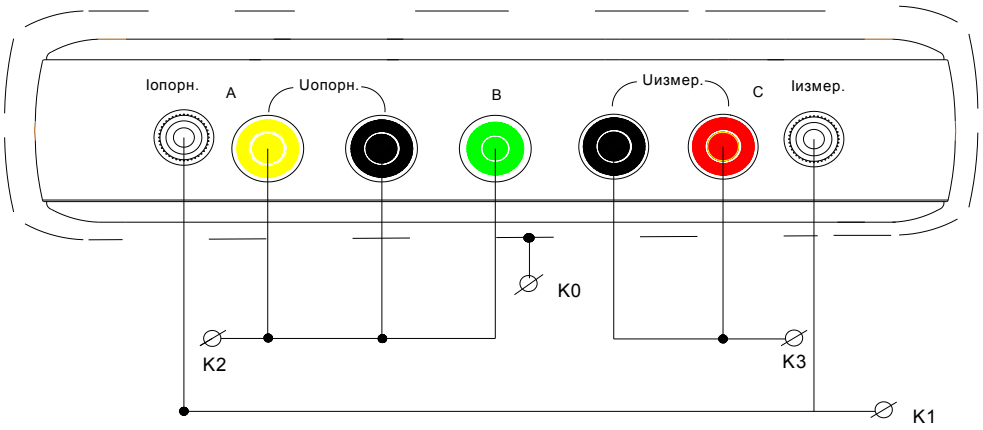

Figure 1

3.2.5 Set 1000 V test voltage with 50 Hz frequency at the GPI-735A plant, measure the insulation resistance between:

— K1 contacts and combined K2 and K3 contacts;
— K2 and K3 contacts.

3.2.6 Relieve the test voltage.

3.2.7 The verification results shall be considered as positive if as per the results of both measurements the insulation resistance is no less than 2 MOhm.

3.3 Electrical strength check of measuring unit insulation

CAUTION! Before checking the electrical resistance and electrical strength of VAF insulation, it is required to remove power elements.

3.3.1 The correspondence to the requirements is checked with the help of a GPI-735A plant.

3.3.2 Electrical strength tests of VAF insulation are done as per the requirements and methods of GOST 12.2.091.

3.3.3 The GPI-735A plant shall be prepared to the operation as per the operation manual.

3.3.4 Connect contacts as per the figure 1 of this verification method.

3.3.5 Supply 2.2 kV, 50 Hz test voltage and hold it during 1 minute between:

— K0 contacts and K1, K2 and K3 combined contacts;
— K1 contacts and K2 and K3 combined contacts;
— K2 and K3 contacts.

3.3.6 Noise appearance during tests is not a sign of improper test results.

3.3.7 Relieve test voltage.

3.3.1 Verification results shall be considered as positive if as a result of tests there was no insulation breakdown.

3.4 Electrical strength check of current sensor insulation

3.4.1 The check is to be done with the help of GPI-735A plant.

3.4.2 Current sensors of reference and measuring channels are the subject of tests as per the requirements and methods of GOST IEC 61010-2-032.

3.4.3 The GPI-735A plant shall be prepared to the operation as per the operation manual.

3.4.4 Clip end parts of current sensors –К1 contact, wrap the current sensor casing with foil so that the distance between foil and clip end part of current sensors is no less than 4 mm, by forming the К2 contact, as shown at figure 2.

3.4.5 Current sensors shall be placed into a high-voltage interlocking chamber.

3.4.6 Supply 4 kV, 50 Hz test voltage between К1 and К2 contacts and hold it during 1 minute, and then relieve the test voltage.

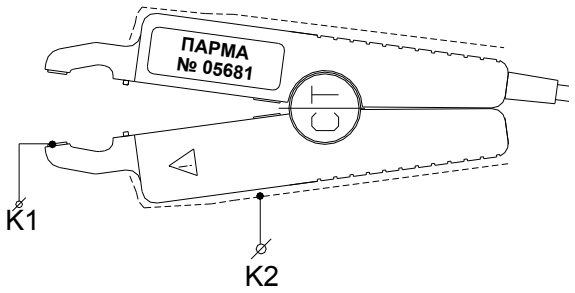

Figure 2

3.4.7 “Crown” or noise appearance during tests is not a sign of improper test results.

3.4.8 Relieve test voltage.

3.4.9 Current sensors are considered as passed the test of there was no insulation breakdown.

3.5 Parameter check of VAF input electrical circuits

3.5.1 The correspondence to the requirements is checked with the help of V7-40 voltmeter.

3.5.2 Measure impedances between:

- terminals A and B;
- terminal A and reference channel neutral;
- terminal C and measuring channel neutral.

3.5.3 Verification results shall be considered as positive if the impedances between terminals A and B are no less than 1500 kOhm, reference channel terminals – no less than 1000 kOhm, measuring channel terminals – no less than 1000 kOhm. If this requirement is not observed, the VAF is considered as failed the test and is the subject of repair.

3.6 Start and test running

3.6.1 Turn the VAF power on by brief pressing the button “⏻”, located at the front VAF panel. If the signal is absent, be sure that integrated power supply sources are available and/or integrated power elements are fully charged. If required, charge them.

3.6.2 Just after the VAF energization, the self-testing starts, the VAF screen displays the icon with logo, and then the icon with a plant VAF number, production year and plant numbers of measuring and reference current sensors, the lower line shall display the VAF SW version..

3.6.3 If the indication is done correctly, be sure that the VAF *automatically transfers into the main operation mode – single-phase.*

3.6.1 Verification results shall be considered as positive if the indication is done correctly, plant numbers of the metering unit and production year, numbers of reference and measuring current sensors correspond to this VAF set, batteries are not discharged, and the plant number of VAF me-

tering unit specified on the label in the battery compartment coincides with the plant number on the screen.

3.7 Software check

3.7.1 The software check is done simultaneously with the start and test running.

3.7.2 Turn the VAF power on by brief pressing the button "⏻", located at the front VAF panel. If the signal is absent, be sure that integrated power supply sources are available and/or integrated power elements are fully charged. If required, charge them.

3.7.3 Just after the VAF energization, the self-testing starts, the VAF screen displays the icon with logo, and then the icon with a plant VAF number, production year and plant numbers of measuring and reference current sensors, the lower line shall display the VAF SW version.

3.7.4 Verification results shall be considered as positive if the SW version indication on the VAF screen is no lower than the version 2.05.

3.8 Determination of metrological characteristics

3.8.1 The following metrological VAF characteristics are determined during the verification:

— VAF range and error during measurement of DC voltage;
— VAF range and error during measurement of AC voltage;
— VAF range and error during measurement of AC rate;
— VAF range and error during measurement of AC frequency;
— VAF range and error during measurement of phase displacement angles between input signals.

3.8.1.1 The determination of metrological VAF characteristics is done by the method of direct measurements.

3.8.2 For the verification of normalized metrological characteristics, the test signals specified in table 4 are used.

Table 4

Preset parameter	Test signal, it. No.						
	1	2	3	4	5	6	7
1. DC voltage							
	-600	-100	-6	6	100	600	0
2. AC voltage, rate and frequency of reference channel							
U, V	10	30	60	100	300	600	-
I, A	0.1	0.4	5	10	20	-	40
f, Hz	55	52	50	47	45	50	50
3. AC voltage, rate and frequency of measuring channel and phase displacement angles							
Ua, V Uc, V	10	30	60	100	300	600	-
Ia, A Ic, A	0.1	0.4	0.5 (5)*	1 (10)*	2 (20)*	-	4 (40)*
f, Hz	55	52	50	47	45	50	50
φIa, °	45	60	30	90	0	-	-
φUa, °	0	0	0	30	-120	-	-
φUc, °	0	120	120	90	0	-	-
4. AC voltage, phase displacement angles in three-phase system, determination of phase sequence							
Ua, V Ub, V Uc, V	10	30	60	100	300	600	-
φUa, °	0	0	0	30	-120	0	-
φUb, °	0	-120	90	0	120	0	-
φUc, °	0	120	120	90	0	0	-
Phase sequence	-	Direct	Inverse	Direct	Direct	-	-
**Note – ***During determination of VAF error when measuring the AC rate of 5, 10, 20 40 A, calibrated frames (Appendix B) with a number of coils n=10 shall be used. The value parameter assumed φIc to be zero by default.							

3.8.1 Determination of absolute VAF error during measurement of DC voltage

3.8.1.1 The correspondence to the requirements is determined with the help of a universal Fluke 9100E calibrator (hereinafter – calibrator).

3.8.1.2 The calibrator and VAF shall be prepared to the operation as per the operation manual.

3.8.1.3 The VAF shall be connected to the calibrator as shown at figure 20.

3.8.1.4 The calibrator forms a test signal No. 1 as per the data of it. 1 of table 4.

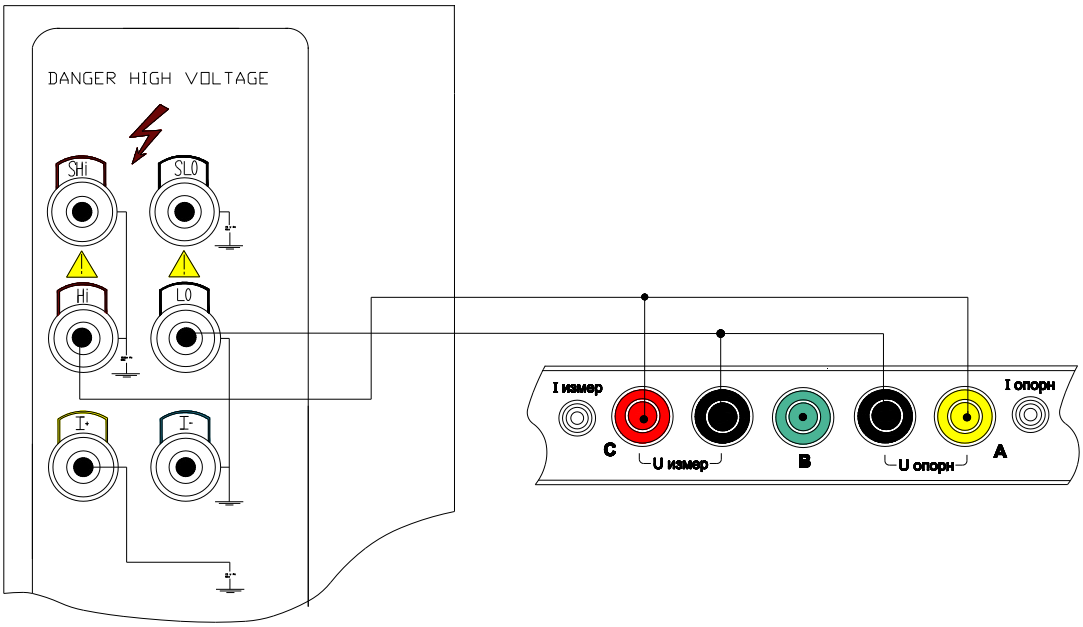

Figure 3

3.8.1.5 The measurement result of DC voltage of the measuring VAF channel (symbol Uc of measuring channel is displayed in the lower part of VAF screen) shall be entered into table 5 of the verification protocol (Appendix A).

3.8.1.6 The absolute error value of VAF measurement is determined by the formula (1), calculation results shall be entered into table 5 of the verification protocol (Appendix A).

$$\Delta A = A_{И} - A_{К}, \qquad (1)$$

where $\mathbf{A_К}$ – Preset parameter value
$\mathbf{A_И}$ – Measured VAF parameter value

3.8.1.7 Press the button  , be sure that a symbol Ua of reference channel voltage has appeared in the lower VAF screen.

3.8.1.8 Enter the measurement result of reference channel into table 5 of the verification protocol (Appendix A). A value of absolute measurement error is determined by the formula (1), the calculation result shall be entered into table 5 of the verification protocol (Appendix A). Return to the display of measuring channel results by pressing the button  .

3.8.1.9 Similarly form in series the rest test signals of DC voltage as per the data of it. 1 of table 6. The VAF measurement results and VAF absolute error determinations during the measurement of DC voltage by measuring and reference channels shall be entered into table 5 of the verification protocol (Appendix A).

3.8.1.10 The verification results shall be considered as positive if the measurement range and absolute VAF errors during the measurement of DC voltage corresponds to the requirements of table 1 of this method of verification. If this requirement is not done, The VAF is considered as failed the test and is the subject of repair.

3.8.2 Determination of VAF errors during AC voltage, rate and frequency measurement by reference VAF channel

3.8.2.1 The correspondence to the requirements is determined with the help of a multifunctional reference voltage and current calibrator of “PARMA GS8.03” (hereinafter – GS8.03) and multifunctional Fluke 9100E calibrator (hereinafter – calibrator).

3.8.2.2 Calibrators and VAF shall be prepared to operation as per the operation manual.

3.8.2.3 The VAF shall be connected to the GS8.03, as shown at figure 4.

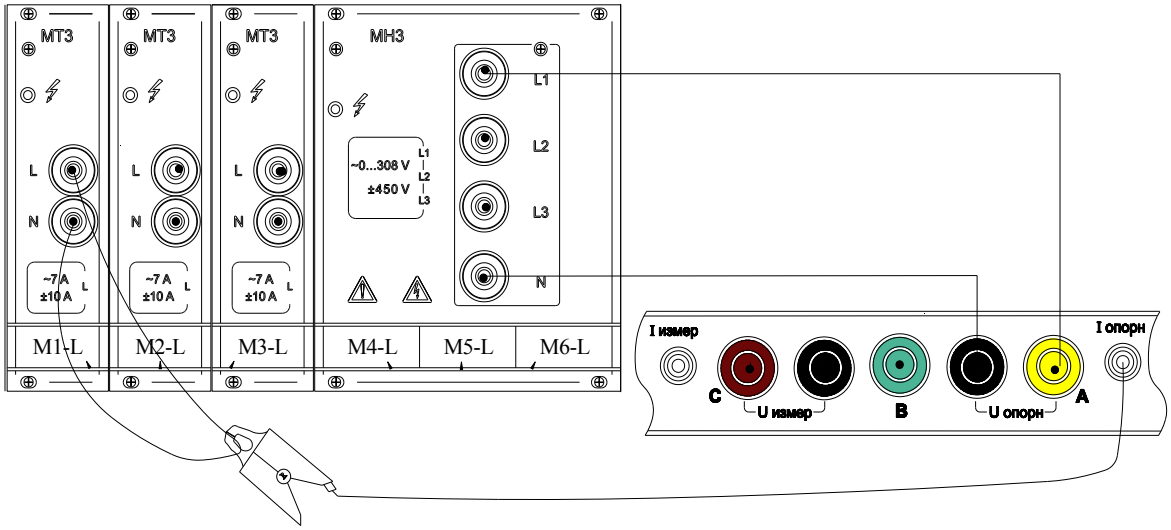

Figure 4

3.8.2.4 A test signal No.1 shall be formed in the GS8.03 as per the data of it. 2 of table 4.

3.8.2.5 Enter the VAF measurement result of AC voltage and frequency into the table 6 of the verification protocol (Appendix A).

3.8.2.6 Press the button , enter the result of measured AC VAF rate and frequency into the table 7 of the verification protocol (Appendix A).

3.8.2.7 Determine the reduced VAF errors during the measurement of AC voltage and rate by the formula (2), and the absolute VAF error during the measurement of AC frequency by the formula (1), the calculation result shall be entered into the corresponding tables of the verification protocol (Appendix A).

$$\gamma A = \frac{A_И - A_К}{A_Д} \cdot 100 \text{ , \%} \qquad (2)$$

where $\mathbf{A_к}$ – Preset parameter value
$\mathbf{A_И}$ – Measured VAF parameter value
$\mathbf{A_Д}$ – Final range value

3.8.2.8 Similarly form in series the test signals Nos. 2-5 of AC voltage, rate and frequency as per the data of it. 2 of table 4. Signals 4, 5 and 7 are formed using a calibrated frame.

3.8.2.9 Measurement results and determinations by the formulas (1), (2) and (3) of VAF errors during the measurement of AC voltage, rate and frequency shall be entered into the corresponding tables of the verification protocol (Appendix A).

$$\delta A = 100 \cdot \frac{A_И - A_К}{A_К} \text{ , \%} \qquad (3)$$

где $\mathbf{A_к}$ – Preset parameter value
$\mathbf{A_И}$ – Measured VAF parameter value

3.8.2.10 Disconnect the VAF from the GS8.03.

3.8.2.11 Prepare the calibrator to the operation as per the operation manual.

3.8.2.12 Connect the VAF to the calibrator.

3.8.2.13 Signal No. 6 shall be formed in calibrator as per the data of it. 2 and 3 of table 4 for measuring the AC voltage by reference and measuring VAF channels. The measurement results shall be entered into the table 6 of the verification protocol (Appendix A). The relative VAF error during the AC voltage measurement shall be determined by the formula (3), the result of error calculation shall be entered into the table 6 of the verification protocol (Appendix A).

3.8.2.14 The verification results shall be considered as positive if the measurement range and VAF errors during the measurement of AC voltage, rate and frequency in reference channel corresponds to the requirements of table 1 of this method of verification. If this requirement is not done, the VAF is considered as failed the test and is the subject of repair.

3.8.3 Determination of VAF errors during AC voltage, rate and frequency and phase displacement angle by measuring channel

3.8.3.1 The correspondence to the requirements is determined with the help of a GS8.03 calibrator.

3.8.3.2 The GS8.03 and VAF shall be prepared to the operation as per the operation manual.

3.8.3.3 The VAF shall be connected to the GS8.03, as shown at figure 5.

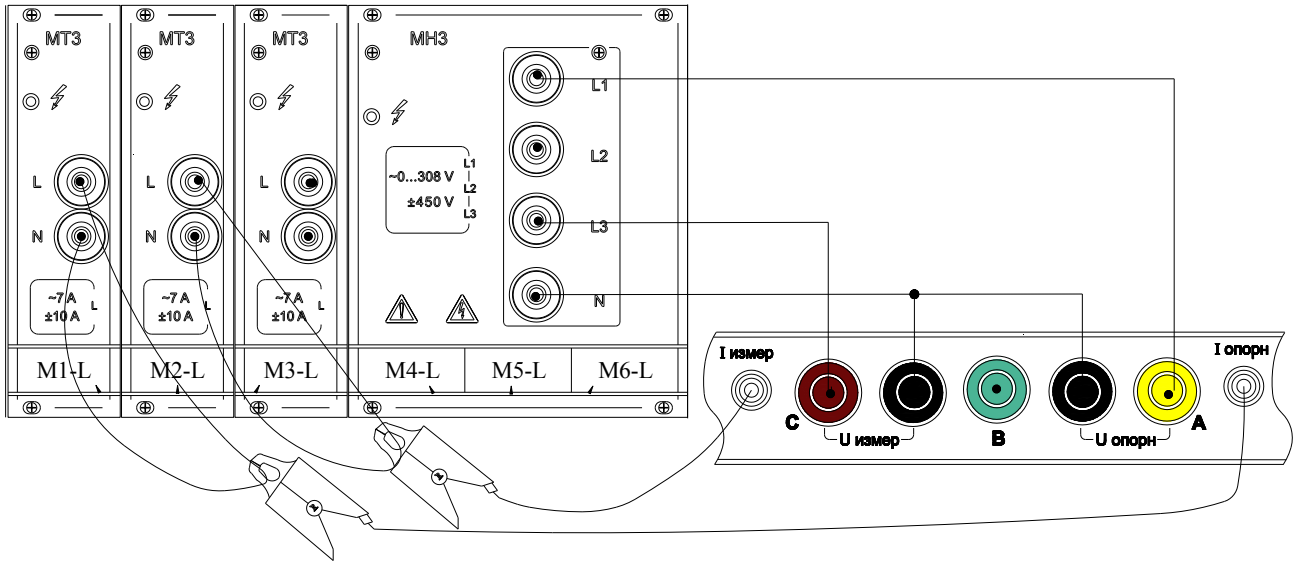

Figure 5

3.8.3.4 Brace the current lead with current sensors so that the sign "●", located at the casing of current sensors, indicate the direction towards the current source, clip ends is reliably closed, and, if possible, the current lead is in the clip middle.

3.8.3.5 A test signal No.1 shall be formed in GS8.03 as per the data of it. 3 of table 4.

3.8.3.6 Enter the measurement results into the verification protocol as follows:

— AC voltage into the table 6 of the verification protocol;

— AC rate into the table 7 of the verification protocol;

— AC frequency into the table 6 and 7 of the verification protocol;

— Phase displacement angle φUcIc, displayed at the first VAF screen, into the table 8 of the verification protocol;

— Phase displacement angle φUaUc, φUaIc, φIaUc, φIaIc, displayed at the second VAF screen, into the table 8 of the verification protocol (for switching between screens, press the button ).

3.8.3.7 Determine the VAF errors during the measurement of AC voltage and rate as well as the phase displacement angle by the formula (2), AC frequency as well as phase displacement angles by the formula (1), calculation results shall be entered into the corresponding tables 6, 7 and 8 of the verification protocol.

3.8.3.8 Similarly form in series in GS8.03 the rest test signals Nos. 2-5, 7 of AC rate and frequency as per the requirements of it. 3 of table 4. Signals 3, 4, 5 and 7 are formed using a calibrated frame.

3.8.3.9 The measurement results and determinations of relative VAF errors during the measurement of AC voltage and rate by the formula (3), absolute VAF errors during the measurement of phase displacement angles and AC frequency by the formula (1) shall be entered into the corresponding tables of the verification protocol of the (Appendix A).

3.8.3.1 The verification results shall be considered as positive if the VAF errors during the measurement of AC voltage, rate and frequency as well as phase displacement angles between input signals correspond to the requirements specified in table 1 of this method of verification. If this requirement is not done, the VAF is considered as failed the test and is the subject of repair.

3.8.4 Determination of VAF errors in three-phase mode and correctness check of phase sequence determination

3.8.4.1 The determination is done with the help of a GS8.03 calibrator.

3.8.4.2 The GS8.03 and VAF shall be prepared to the operation as per the operation manual.

3.8.4.3 The VAF shall be connected to the GS8.03, as shown at figure 6.

3.8.4.4 Set the three-phase operation mode in the VAF by pressing the button  .

3.8.4.5 A test signal No.1 shall be formed in GS8.03 as per the data of it. 4 of table 4.

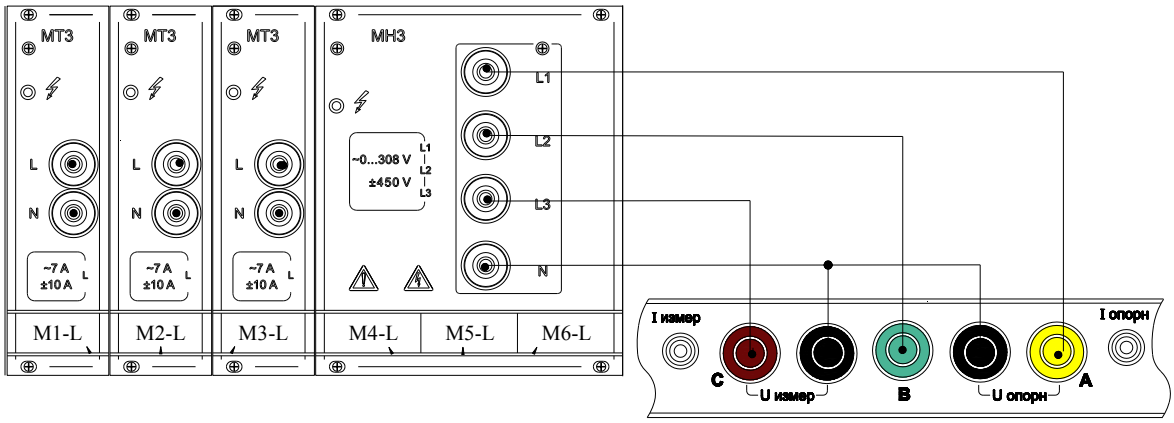

Figure 6

3.8.4.6 Enter the measurement results of AC voltage by the VAF channel Ub and determination of VAF phase sequence into the table 9 of the verification protocol (Appendix A).

3.8.4.7 Determine the VAF error during the measurement of AC voltage by the VAF channel Ub by the formula (2) and the phase sequence correctness, the results shall be entered into the table 9 of the verification protocol (Appendix A).

3.8.4.8 Press the button  , the measurement result of phase displacement angle φUaUb shall be entered into the table 9 of the verification protocol. Determine the values of absolute errors of the measurement of phase displacement angles, by the formula (1), the calculation results shall be entered into the table 9 of the verification protocol (Appendix A).

3.8.4.9 Similarly form in series in GS8.03 the rest test signals as per it. 4 of table 4. The measurement results and determinations of phase sequence, VAF errors during the measurement of AC voltage by the VAF channel Ub and phase displacement angles shall be entered into the table 9 of the verification protocol (Appendix A).

3.8.4.10 The verification results shall be considered as positive if the VAF errors during the determination of phase sequence and changes of AC voltages and phase displacement angles correspond to the requirements specified in table 1 of this method of verification. If this requirement is not done, the VAF is considered as failed the test and is the subject of repair.

4 PRESENTATION OF VERIFICATION RESULTS

4.1 The verification (calibration) results are entered into a protocol. The form of VAF verification protocol is specified in appendix A.

4.2 A verification (calibration) protocol can be submitted to the customer in a soft copy on a written customer's request.

4.3 In the primary verification protocol, the limits of allowable measurement errors are specified taking into account of the 0.8 factor as per the it 4.1.4 of TU 4221-028-31920409-2014.

4.4 During the primary verification, a positive result is marked in the VAF form indicating the next verification date and is certified by the verifier's signature with impressing of a verification sign, is formed in a duly made verification certificate, where the verification sign (impress) is drawn, and the verification sign is to be drawn to the fixing screw of back panel of the VAF casing by pressing at the special mastic.

4.5 For the periodical verification, the limits of allowable measurement errors are specified in

table 1 of this method of verification.

4.6 During the periodical verification (calibration), a positive result is formed in a duly made verification (calibration) certificate, and the verification sign is replaced.

4.7 During the verification (calibration) of separate VAF channels as per the supply set, corresponding to it.5 РА1.007.004ФО, in the verification (calibration) certificate, it is required to specify the information about the scope of executed verification.

4.8 The periodical VAF verification (calibration) is allowed being executed within the scope required for the VAF owner on the basis of a written owner's application, formed at random.

APPENDIX A

PRIMARY VERIFICATION PROTOCOL

No. _____ dated "_____" _____ 20___

VOLTAMPEREPHASEMETER "PARMA VAF-A(C)"

Plant No.	VAF		Current sensors		
SW version:					
Belongs to					

Verification tools

It. No.	Name	Pl. No.	Verification date
1			
2			
3			
4			

Verification conditions: T – _____ °C; Atmospheric pressure: - _____ kPa; Humidity: _____ %

VERIFICATION RESULTS

1. Visual inspection: metering unit, current sensors and commutation sources (____) have visible damages, hollows, ruptures and distortion of elements.
2. The results of electrical resistance check and electrical strength tests of VAF insulation are specified in table 1-3, check results of VAF input circuit parameters are specified in table 4.

Table 1 – Measurement of VAF insulation resistance

Measurement	Rated resistance, MOhm	Measured impedance, MOhm
Between **К1** contact and **К2 and К3** combined contacts	No less than 2.0	
Between **К2** and **К3** contacts	No less than 2.0	

Conclusion: ( ) corresponds to the requirements of TU 4221-028-31920409-2014, insulation resistance is ____ 2 MOhm.

Table 2 – VAF electrical insulation strength test

Measurement	Test voltage, kV	Interface time	Test results
Between **К0** contact and **К1, К2 and К3** combined contacts	2.2	1 minute	
Between **К1** contact and **К2 and К3** combined contacts	2.2	1 minute	
Between **К2 and К3** contacts	2.2	1 minute	

Conclusion: ( ) corresponds to the requirements of TU 4221-028-31920409-2014.

Table 3 – Test of electrical insulation strength of current sensors

Pl. No. of current sensors	Measurement	Test voltage, kV	Interface time	Test results
	Between **К1 & К2** contacts	4	1 minute	
	Between **К1 & К2** contacts	4	1 minute	

Conclusion: ( ) corresponds to the requirements of TU 4221-028-31920409-2014.

Table 4 – Parameter check of input electrical circuits of measuring unit

Measurement	Rated impedance, kOhm	Measured impedance, kOhm
Between terminals A and B	No less than 1500.0	
Measuring channel	No less than 1000.0	
Reference channel	No less than 1000.0	

Conclusion: ( ) corresponds to the requirements of TU 4221-028-31920409-2014.

3. Testing: the indication is done (____) correctly.
4. Check the correctness of the phase sequence: phase sequence is determined (____) correctly.
5. The check results of normalized metrological VAF characteristics are specified in table 5-9.

Table 5 – Determination of VAF errors during measurement of DC voltage

Preset value, U, V	Measured VAF value, U, V		Absolute measurement error, V		Limits of allowable absolute measurement errors, V
	Meas. channel	Ref. channel	Meas. channel	Ref. channel	
-600,00					±2,80
-100,00					±0,80
-6,00					±0,42
6,00					±0,42
100,00					±0,80
600,00					±2,80
0,00					±0,40

Conclusion: VAF errors during the measurement of DC voltage ( ) correspond to the requirements of TU 4221-028-31920409-2014.

Table 6 – Determination of VAF errors during measurement of AC voltage

Preset values		Measured VAF values				Measurement errors				Limits of allowable absolute measurement errors		
		Meas. channel		Ref. channel		Meas. channel		Ref. channel		U		*f*
U, V	*f*, Hz	U_{RMS}, V	f, Hz	U_{RMS}, V	*f*, Hz	U, %	*f*, Hz	U, %	*f*, Hz	γ, %	δ, %	Δ, Hz
10,00	55,000									± 0,04	-	±0,008
30,00	52,000									± 0,04	-	±0,008
60,00	50,000									± 0,04	± 0,4	±0,008
100,00	47,000									-	± 0,4	±0,008
300,00	45,000									-	± 0,4	±0,008
600,00	50,000									-	± 0,4	±0,008

Conclusion: VAF errors during the measurement of AC voltage and frequency ( ) correspond to the requirements of TU 4221-028-31920409-2014.

Table 7 – Determination of VAF errors during measurement of AC rate

Preset values		Measured VAF values				Measurement errors				Limits of allowable absolute measurement errors		
		Meas. channel		Ref. channel		Meas. channel		Ref. channel		I		*f*
I, A	*f*, Hz	I_{RMS}, A	*f*, Hz	I_{RMS}, A	*f*, Hz	I, %	*f*, Hz	I, %	*f*, Hz	γ, %	δ, %	Δ, Hz
0,1000	55,000									±0,008	-	±0,008
0,4000	52,000									±0,008	-	±0,008
5,000	50,000									-	±0,8	±0,008
10,000	47,000									-	±0,8	±0,008
20,000	45,000									-	±0,8	±0,008
40,000	50,000									-	±0,8	±0,008

Conclusion: VAF errors during the measurement of AC rate and frequency ( ) correspond to the requirements of TU 4221-028-31920409-2014.

Table 8 – Determination of VAF errors during measurement of phase angles in single-phase VAF mode

Preset values, °			Designed values of phase displacement angles, °					Measured VAF values of phase displacement angles, °					Absolute errors of VAF measurement, °					Limit of allowable meas.ER
φIa	φUa	φUc	φUcIc	φUaUc	φUaIc	φIaUc	φIaIc	φUcIc	φUaUc	φUaIc	φIaUc	φIaIc	φUcIc	φUaUc	φUaIc	φIaUc	φIaIc	φ
45,0	0,0	0,0	0,0	0,0	0,0	45,0	45,0											±0,8
60,0	0,0	120,0	120,0	240,0	0,0	300,0	60,0											±0,8
30,0	0,0	120,0	120,0	240,0	0,0	270,0	30,0											±0,8
90,0	30,0	90,0	90,0	300,0	30,0	0,0	90,0											±0,8
0,0	-120,0	0,0	0,0	240,0	240,0	0,0	0,0											±0,8

Conclusion: VAF errors during the measurement of phase displacement angles ( ) correspond to the requirements of TU 4221-028-31920409-2014.

Table 9 – Determination of VAF errors during measurement of AC voltage and phase displacement angles in three-phase VAF operation mode

Preset values					Value at VAF	Measured VAF values			Measurement error		Limits of allow. measurement ER			
											U		φ	Corr. of phase sequence to requirements
Phase sequence	U, B	φUa	φUb	φUc	φUaUb, °	Ub, B	φUaUb, °	Phase sequence	Ub	φUaUb	γ, %	δ, %	Δ, °	
-	10,00	0,0	0,0	0,0	0,0						± 0,04	-	±0,8	
direct	30,00	0,0	-120,0	120,0	120,0						± 0,04	-	±0,8	
reverse	60,00	0,0	90,0	120,0	270,0						± 0,04	± 0,4	±0,8	
direct	100,00	30,0	0,0	90,0	30,0						-	± 0,4	±0,8	
direct	300,00	-120,0	120,0	0,0	120,0						-	± 0,4	±0,8	
-	600,00	0,0	0,0	0,0	0,0						-	± 0,4	±0,8	

Conclusion: VAF errors during the measurement of AC voltage and phase displacement angles as well as the phase sequence ( ) correspond to the requirements of TU 4221-028-31920409-2014.

Conclusion by verification results:

Based on the verification results, the voltamperephasemeter “PARMA VAF-A(C)” pl. No. _____ is accepted as (____) is suitable for application.

Verification certificate is issued with No. _____ dated _____.

Unsuitability statement is issued with No. _____ dated _____.

The verification is made by: _____

APPENDIX B
(Reference)

Frame for VAF verification with current sensors

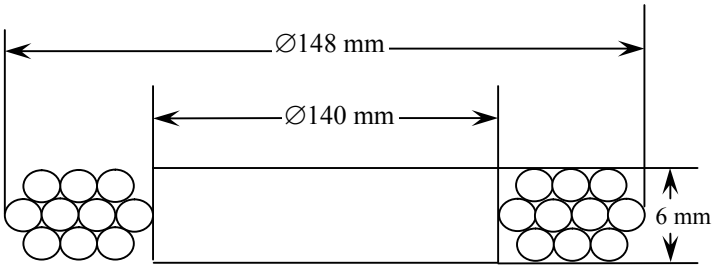

Figure 1 Frame of 10 coils

The maximum current shall be no more than 4 A. The conductor diameter is no more than ∅2.00 mm. Winding leads are of “Banana” type.

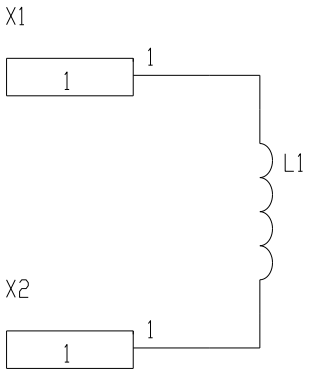

Figure 2 Electrical frame diagram