

	002.016 TIC	NUMBER I-4483
		SHEET 1 OF 6
		SUPERSEDES

CONVERTER
ПАС-10

CERTIFICATE
002.016 TC

For Article No. --

TRANSLATED	T.K. Gopalan			Ordnance Factory Project Hyderabad.
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1. BASIC TECHNICAL DATA

S.No.	Description of parameters	Characteristics
1.	Supply voltage (DC), in volt. AC voltage	27±2.7
2.	in volt A.C. Voltage, in volt →	36±7
3.	A.C Frequency, HZ	400±60
4.	Rated load current, in A: -for supplying one device -for supplying two devices	0.32 0.65
5.	No. of phases of generator	3
6.	Idle run current, in A, not exceeding	2.5
7.	Current consumption, in A not exceeding: -while supplying one device -while supplying two devices	3 3.5
8.	Power factor (inductive)	0.65
9.	Weight of article, in Kg, not exceeding	3.5

Note:-1. While operating converter, adjusted for feeding two devices, with article AAK-5, current consumption may be increased up to 4-6A.

2. Load current may be increased upto 0.8A while operating for 2 devices. For this case, A.C. voltage should not be less than 29V and frequency-not less than 320HZ.

2 DELIVERY SET

Description	Type	qty	Plant No.	Note
1. Converter spare parts	ПАГ-10	1		
2. Brush	555.121	6		

3. LIFE, SERVICELIFE, SHELF LIFE.

Life of the article before the first overhanling is-
flying hours for service life of _____ years, including
shelf life of _____ years(year) in preservation
(packing) of manufacturer.

Inter overhand life is _____ flying hours of
shelf life of _____ Years.

Specified life is _____ flying hours during
_____ repair (repairs) during service life of
_____ years.

~~Indicated life, service life and shelf life are guaran-~~
teed only when the customer observes the requirements of effe-
ctive operation manual.

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4. PRESERVATION AND DEPRESERVATION.

Date	Name of operation	Duration	Signature
Preservation by using corrosion preventive compound BK			
Gost 19537-75-74		As per Section 3	

5. ACCEPTANCE CERTIFICATE

Converter 7AV-40 No..... is manufactured and accepted in compliance with operative technical documentation and found suitable for operation.

Chief Inspector _____
(Signature)

Round seal

Date:

6. MOVEMENT OF ARTICLE IN OPERATION.

Date of mounting	Type and Vehicle No.	Date of removal	Running time from start of operation	Reason for removal	Signature of Filter/sorter
1	2	3	4	5	6

7. REPAIRS AND SERVICING UNDERTAKEN AS PER
BULLEFIN AND INSTRUCTION

Date	Name of operation	Basis (Name, member, and Date of document.)	Organisation that under the work	New operating life and service life of article	Signature of maintenance personnel

8. INFORMATION FOR OPERATION AND STORAGE.

- 8.1 Information about interchangeability.
It is not interchangeable with article [AF-100]
- 8.2 Check the operation of article in idle running, before it is installed on the vehicle.
- 8.3 For setting article for operation on two devices, the slide of adjustable resistor, mounted on the lower part of body should be brought to the position of mark 2NP.
- 8.4 During operation, perform the following operations periodically.
- Check working surface of commutator and brushes. Brushes having chips and cracks should be replaced by new ones, and the same should invariably be lapped and ground to suit to the working surface of commutator.
 - Observe the height of brushes, minimum permissible value should not exceed the limits indicated in table for the following interoperational period.

	Frequency of operation, in hrs.		
	50	100	200
Minimum permissible height of brush, in mm	10.5	11	12

If the height of brush is found less than the above mentioned, it should be replaced with new one and the same should be lapped and ground to be fit to the working surface of commutator.

Maximum wear of brush is 1 mm for 100 hrs. of operation.

While replacing individual brush or the complete set, specify number of working hours and actual height of removed brushes in the certificate.

Check for the operation of bearing.

8.5 If the working surface of commutator is burned out or the bearing gives abnormal noise, article should be sent for repair.

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CONVERTER'S
 ПAI-1Ф, ПAI-1ФП, COMMON

TECHNICAL SPECIFICATIONS

002.016 ETY

TRANSLATED				Ordnance Factory Project Hyderabad.
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C O N T E N T S

- I Definition and purpose
- II Completeness and relation with drawings
- III Basic technical data
- IV Technical requirements
- V Acceptance test
- VI ~~Guarantee~~ Periodical test
- VII Guarantee
- IX Transportation and storage
- X Appendix for common technical specifications.

I DEFINITION AND PURPOSE

1. Present common technical specifications pertain to converters of type $\Pi A \Gamma - 1 \phi$, $\Pi A \Gamma - 1 \phi \Pi$, converting direct current of vehicle mains into alternating three phase current with the voltage of 23V and current frequency of 400Hz.

Converters may be repaired.

Maintenance kits of spare parts, intended for devices repair are supplied separately by manufacturing plant.

2. Converters are units consisting of motors of direct current with compound excitations and three phase generator of alternating current, excited by permanent magnet.

Converters are provided with special filters for eliminating the interference in radio reception.

Converters $\Pi A \Gamma - 1 \phi$ and $\Pi A \Gamma - 1 \phi \Pi$ are ~~identical~~ identical and distinguished from each other only by technical data.

(according to their structure and working principle).

Converter $\Pi A \Gamma - 1 \phi$ works in case of two different loads, corresponding to the loads, produced by one or two devices.

Converter $\Pi A \Gamma - 1$ is regulated for charging one or two devices by corresponding alternating built-in adjustable resistor, connected ~~by~~ shunt winding of electric motor.

It is not allowed to regulate the converter $\Pi A \Gamma - 1 \phi \Pi$ in operating condition. Version of the converter is protected one with self-ventilation. Switching on in circuit is done with the help of connector.

3. II. COMPLETENESS AND RELATION WITH DRAWINGS.

Each ^{set} of the converter contains of the following:-

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- | | | |
|---------------------|----|---|
| 1. Converter | .. | 1 piece |
| 2. Spare brushes | .. | 5 pieces |
| 3. Certificate | .. | 1 piece |
| 4. Technical papers | .. | 1 sketch for 5 devices,
but not less than 1 sketch
for the batch, supplied
to one address. |

4. Converters should correspond with the drawings of manufacturing plant 002.016, 002.016X and 042.010 as per the structure, overall dimensions, set dimensions and schematic diagram.

III. BASIC TECHNICAL DATA

5. OPERATING CONDITION.

Converters ПAI-14, ПAI-14П should normally work in following condition:-

- Altitude above the sea-level should be upto 18,000, m.
NOTE: It is allowed to operate converters at a altitude upto 20,000m, in this case, input voltage and frequency are not specified.
- Ambient temperature should be from plus 60°C to minus 60°C.
- Devices should be operate after the effect of cyclic temperature variations from minus 60°C to plus 60°C.
- Relative humidity may be upto 98%.
- Mechanical effects:-

In the conditions of mechanical effect converter should:-

- be vibration-resistant in a frequency range from 5 to 300Hz at an acceleration upto 5g.

- b) be vibration proof in a frequency range from 20 to 300Hz at an acceleration upto 5g;
- c) be shock-proof^{resistant} during the overloading upto 4g and to frequency of 40 to 50 impacts in a minute;
- d) d) be resistant to linear overload upto 10g;
- e) not have resonance of structural elements in frequency range from 5 to 40 hertz;
- f) be resistant to linear acceleration upto 15g applied for not more than 30 seconds in perpendicular direction and along the axis of the shaft.;

NOTE: Dependence of variation of acceleration on current frequency in the range specified in items "a" and "b" is mentioned in §43 of present common technical specifications.

6. WEIGHT:

Weight of the converter should not exceed 3.5kg.

RATED DATA OF CONVERTER

S. No.	Description of the parameter	ПАИ-1Ф	ПАИ-1ФП
A) FOR ELECTRIC MOTOR			
1.	Supply voltage, Volts	27	27
2.	Consumption current A(max)	1.device 3, 2 devices 3.5	4.5
3.	Rotation speed r/min.	8,000	8,000
4.	Working modes	-continuous-	
5.	Direction of rotation if seen from the side of commutator.	Right	
B) FOR GENERATOR.			
6.	Voltage, Volts	36	36
7.	Load current, A	1 device 0.32 2 devices 0.65	0.85

S.No.	Description of the parameter	ПАИ-1φ	ПАИ-1φΠ
8.	Power, BA	20/40.5	53
9.	Power factor	0.65	0.65
10.	Frequency in hertz	400	400
11.	Number of phases	3	3
12.	Connecting of phases	Star connection	
13.	Working modes	Continuous	

NOTE:

1. For converter ПАИ-1φ it is allowed to increase output current while working on one device upto 0.4A and while working on two devices upto 0.8A. Generator voltage within five minutes after starting, in case of specified loads and supply voltage variations within the range of $27 \pm 10\%$ and ambient temperature from plus 60°C to minus 60°C , should not be less than 29B, and frequency should not be less than 320 hertz.
2. For converter ПАИ-1φΠ load current may vary during the working within the limits 0.8 to 0.9A.
3. Consumption current should exceed 4.6A, while working with converter ПАИ-1φ adjusted for the supply of two devices.

IV. TECHNICAL REQUIREMENTS.

8. Permissible voltage fluctuations and alternating current frequency.

1. Output voltage and alternating current frequency of the converter at nominal load should be within the limits shown

in table 2. When fluctuations of voltage supply is within the limits of $\pm 10\%$ from nominal value in case of normal atmospheric pressure and ambient temperature $+20^{\circ} \pm 5^{\circ}\text{C}$.

TABLE 2

Type of Converter parameters	ПАГ-1Ф		ПАГ-1ФП	
	During the acceptance test	During periodical test & in working conditions.	During acceptance tests.	During periodical test & in working conditions.
Alternating current voltage volts.	36 ± 4.2	36 ± 5	36 ± 3.55	36 ± 3.6
Alternating current frequency, Hz	400 ± 41	400 ± 45	400 ± 39	400 ± 40

Difference of linear voltages at no load should not exceed 0.35Volts.

- In case of fluctuation of supply voltage within the limits 27 ± 2.7 volts, ambient temperatures and altitude within the limits specified in §5 items 1;2 and nominal load voltage of generator should be within the limits 29 to 43V and frequency 340 to 460 hertz.

NO - LOAD CURRENT

Current consumed by converter motor in case of no-load and nominal supply voltage should not exceed the value specified in table no.3.

TABLE NO.3

Type of converter	No - load current	
	During acceptance test	During periodical tests and in working condition
ПАГ-1Ф	2.45	2.5
ПАГ-1ФП	2.55	2.6

Current variation, in this case, should not exceed 0.1A.

6.10. PERMISSIBLE OVERHEATING.

Overheating of armature, commutator and excitation winding after the working of converter under nominal load for 1 hour should not exceed 60°C.

NOTE: For converter ПАГ-1 load is set for the supply of of two devices.

11. STABILITY OF PERMANENT MAGNET.

Voltage of the generator of converter measured for no-load after short-time three phase short circuit, should not change on more, than ± 0.5 volts under the previous frequency. In this case the voltage (in case of nominal voltage supply and nominal load) should be within the limits specified in table 2.

12. RADIO INTERFERENCE.

Level of the radio interference generated by converter (in dv with respect to 1 MC volts) should not exceed the value specified below:-

Frequency, Mhz	0.15	0.25	0.35	0.5	1	1.5	2.5	4	10-150
From the side of the motor	30	30	30	30	28	28	28	24	24
From the side of generator	58	56	55	54	51	49	48	45	44

13. ⁸ START OF THE CONVERTER .

Converters in case of ambient temperature from minus 60°C upto plus 60°C and nominal load should be started at a supply voltage not exceeding 20 volts.

14. COMMUTATION.

Commutation of electric motor at nominal load and nominal frequency of rotation should be such that sparking does not exceed the degree "1 1/2" along the scale GOST 183-74.

14a. MECHANICAL STRENGTH

Converters should withstand the works at no load for 2 minutes at a frequency of rotation 10,000r/min.

15. INSULATION RESISTANCE

Insulation resistance of the converter should be:-

1. Insulation resistance in off condition should not be less than 20 M Ohms.
2. After nominal heating condition according to §10.
 - a) During acceptance test not less ^{than} 5.5M Ohms.
 - b) During periodical tests not less than 5M Ohms.
3. After testing for moisture resistance should not be less than 1 M Ohm.

16. ELECTRIC STRENGTH OF INSULATION.

Insulation of converter, after nominal condition in accordance with §10 and after testing for moisture resistance, should undergo a test for break-down relation to body:-

- a) With a voltage of 330 volts of direct current for 10 seconds - on the side of motor;
- b) With the voltage of 500V of alternating current with a frequency of 50 hertz for one minute - on the side of generator.

NOTE: While checking the electrical strength of insulation by consumer testing voltage should be decreased by 15%.

17. DIRECTION OF THE ROTATION OF MAGNETIC FIELD

Direction of the rotation of magnetic field, generated by alternating current of converter, should be constant and should correspond to the clockwise rotation of phase monitor.

18. MANUFACTURING QUALITY AND OUTER FINISHING

Assembly of the converter should be accurate and set in accordance with the drawings and technology.

All security screws and nuts should be tightened and locked.

On the surfaces of parts of converter there should be no cracks, dents, shearing of electroplating and varnish coating and other defects degrading the external view.

19. ANTI-CORROSIVE resistance

Anti corrosive electroplating and varnish coating should provide anti-corrosive resistance to converter in the operating conditions over the period of guaranteed life of the converter.

20. RADIAL RUN OUT OF THE COMMUTATOR.

Radial run out of the commutator of motor in assembled converters should not exceed 0.02mm.

21. HEAT RESISTANCE

Converters should withstand in non-operating conditions 2 hours keeping at a temperature of $+80^{\circ}\text{C}$.

After this converters, in normal conditions should have technical parameters within the norms specified in present ETY.

22. RESISTANCE AGAINST THE SUPPLY VOLTAGE DEVIATION.

Converters should shortly withstand supply voltage deviation on $\pm 15\%$ from its nominal value; in this case technical parameters of converters are not specified.

23. INTERCHANGEABILITY

The following units and parts of the converters should be interchangeable.

<u>S.No.</u>	<u>Description</u>	<u>No.of drawing</u>
1.	Body (unit)	100.018
2.	Panel (Unit)	120.018
3.	Panel (Unit)	120.053
4.	Armature (Unit)	500.017
5.	Cap	151.009
6.	Cover	132.014

24. WEAR OF THE COMMUTATOR AND BRUSH.

Wear of the commutator after every 150 working hours should not exceed 0.1mm at the diameter.

Wear of brushes of the converters should be:

- a) In normal conditions after every 150 working hours, it should not exceed 1mm;

b) During the test for altitude as per §ETY41 it should not exceed 0.3mm after 5 working hours;

c) During the speed up test for guaranteed life after 50 working hours it should not exceed 0.85mm.

25. LIFE TIME OF THE CONVERTER.

Converters should provide continuous reliable operation under operating conditions specified in present ETY.

PAF-10

2600 hours

PAF-10M

2600 hours

V. ACCEPTANCE TEST

26. CONTENTS AND SEQUENCE OF ACCEPTANCE TEST IS DETERMINED IN FOLLOWING TABLE:

Sl. No.	Description of checking/test	Paragraph of the requirement	ETY testing method
1.	Visual Inspection	3.18	27
2.	Checking for the continuity of phase alternating	17	28
3.	Checking of no-load current and linear voltage symmetry	8.9	29
4.	Checking of nominal data and of variation limit of voltage and frequency	7.8	30
4a	Checking of mechanical strength	14a	30a
5.	Checking of commutation	14	31
6.	Checking of the stability of permanent magnet	11	32
7.	Checking of insulation resistance	15	33
8.	Test for electric strength of the insulation	16	34
9.	Checking of the radial run-out of the commutator	20	35

METHOD OF ACCEPTANCE TESTS

The following devices could be used during the acceptance test:-- Wattmeters, voltmeters of accuracy class 1 and frequency indicator ⁰⁴ accuracy class 1.5.

27. VISUAL INSPECTION

For the quality of the assembly and external finishing converters are checked for:-

- a) Conformity to drawings of overall and set dimensions, as well as pressure of springs on brushes (operational check) and the degree of the axial play of armature;
- b) Strength of tightening of screws and reliability of locking of nuts;
- c) Conformity of assembly to the diagram;
- d) Absence of cracks, cavities, dents on the body;
- e) Panel board and other visual parts;
- e) Absence of cracks, burn-out, dirt on commutator and quality of sections soldering;
- f) Conformity of the brushes to drawings, accuracy of their installation, absence of jamming in the holders, pressure of surface grinding of brushes to the commutator (grinding surface 100%);
- g) Smooth rotations of armature;
- h) External view of protective coatings (as per the standard);
- i) Presence of tags of specified sample;
- j) Presence of completed and signed certificate and test records;
- k) Completeness in accordance with §3ETY.

§28. CHECKING OF THE SEQUENCE OF PHASE ALTERNATING.

Checking of the sequence of phase alternating is carried out with the help of three-phase synchro. Checked on standard ~~connector~~. converter.

§29. CHECKING OF NO-LOAD CURRENT AND SYMMETRY OF LINEAR VOLTAGE:

Checking of no load current of converter is carried out under nominal supply voltage;

Checking of the symmetry of linear voltage is carried out under no load at a frequency of 400 hertz. Checking results should correspond to requirements of §8 and §9 of present ETY.

30§; CHECKING OF NOMINAL DATA AND VARIATION LIMITS OF VOLTAGE AND FREQUENCY.

Checking of nominal data is carried out at a temperature of $+20 \pm 5^{\circ}\text{C}$ and normal atmospheric pressure.

Converters are started at a nominal supply voltage, after this 90 minutes operation is carried out at a nominal load.

The following are measured at the end of operation.

- a) Consumption current
- b) Generation voltage
- c) Generator current
- d) Capacity of the generator
- e) Frequency

Load of the generator is set by inductive $\cos \varphi = 0.65$.

Co-efficient of the capacity is calculated as per the formula

$$\cos \varphi = \frac{P}{\sqrt{3} u_n I_n} \quad \text{where,}$$

P - Capacity of the generator, measured by wattmeter

u, I - Voltage and current of the generator.

Results of the test are considered to be satisfactory. If measurable values fulfil the requirements of §7 and 8 of present ETY provided after the 90 minutes of operation of converter under nominal load and in case of voltage variation, within the limits of $\pm 10\%$ from nominal load.

- NOTE:** 1. While checking the variation limits of voltage and frequencies, loading device is regulated at current rate and COS ϕ at rated supply voltage and is kept steady at variation of supply voltage within the specified limits.
2. While installing the regulating resistor on two devices operation of ПАГ-1 ϕ is carried out for 90 minutes.

Variation limits of voltage and frequencies are checked while installing on two devices and on one device.

3. Readjustment of clamp on regulated resistor of converter ПАГ-1 ϕ according to the load is carried out as per the marks applied on stand of the body.

In this case, it is necessary to be sure that readjustment of clamp is done properly, at that do the following:

- a) While readjusting the converter on two devices provide supply voltage of 24.3volts and 29.7volts in succession.

Output voltage of the converter at supply voltage of 24.3 volts should not be less than 31.8V and frequency at supply voltage 29.7volts should not exceed 441 hertz.

- b) While readjusting the converter on one device again provide supply voltage of 24.3V and 29.7volts in succession. Frequency of the converter at supply voltage of 24.3volts should not be less than 359 hertz, and output voltage at supply voltage of 29.7volts should not exceed 40.2volts.

Test as per item No. "a" and "b" is carried out after the heating operation. In case if parameters of converter π AF-14 are not contained in above mentioned standards, then it is allowed to displace the clamp of resistor from the mark ^{not} on more than 1mm.

§30a. TEST FOR MECHANICAL STRENGTH.

Converters are tested at rotation frequency of 10,000r/min. at no-load for 2 minutes.

Results of the test are satisfactory, if there are no deformations and mechanical damages on the parts of the converter.

31. COMMUTATION TEST

Commutation of electric-motor is determined after carrying out the nominal operation at a nominal load and rated frequency of rotation.

Results of the tests are considered to be satisfactory, if commutation fulfills the requirements of §14 of ETY.

32. TEST FOR THE STABILITY OF PERMANENT MAGNET.

While checking the stability of permanent magnet, the value of the generator voltage is measured at a frequency of 400Hz before and after five short-circuit at no load.

Duration of each short circuit should be 2-3 seconds.

Measurement results taken immediately after five short circuits should satisfy the requirements of §11 of present ETY.

33. TEST FOR INSULATION RESISTANCE

Insulation resistance is measured in the following

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normal conditions:-

1. In off condition of the converter.
2. Not later than 3 minutes after carrying out the heating operation as per method §30 of ETY.

3. Measurement is carried out:-

- a) On the side of generator - with the help of volt-megohm-meter, one clamp of which is connected to the body and other to one of the terminals 3, 4, 5 of the connector.

On the side of the motor with the help of 100 voltmegohm-meter, in this case electric circuit should be disconnected from the body ^{by} lifting negative brush and I QBP-25 clamp. Clamps of megohmmeter are connected: One to the body and another to the terminal, 1 of the connector.

Results of test are considered to be satisfactory if insulation resistance fulfils the requirements §15 of ETY.

34. TEST FOR ELECTRIC INSULATION STRENGTH

Test is carried out after nominal heating operation directly after testing the insulation resistance (§33)

Circuit conditions and voltage applying points are the same as while checking the insulation resistance.

Testing is started at voltage, equated to 0 (zero) with its gradual increase upto 500 volts for generator and 3300 volts (during 5 sec) for motor.

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Voltage from the side of generator is kept for 1 minute, and from the side of motor for 10 seconds, after this voltage gradually comes down upto zero.

Results of test are considered to be satisfactory, if there is no insulation break down.

35. TEST FOR THE RADIAL RUN-OUT OF COMMUTATOR.

Test for radial run out of commutator is carried out on special fixture with the help of pointer indicator with value of division not exceeding 0.002mm.

Results of the test are considered to be satisfactory, if run-out of the commutator does not exceed the value 0.02mm

VI. PERIODICAL TESTS

36. Contents and the sequence of the periodical tests is determined in the next table -

S. No.	Description of checking and test	Paragraph of ETY	
		Require-ments	Methods of test
1.	Tests, enumerated in §26 of ETY	Specified in §26	37 item 5
2.	Checking radio interference level	12	38
3.	Checking of weight	6	39
4.	Test for moisture resistance	5, 15, 16	41

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S. No.	Description of checking & test	Paragraph of ETY	
		Require-ments	Methods of test
5.	Test for heat resistance	5	42
6.	Test for vibration resistance & and vibration strength	5	43
7.	Test for the detection of resonance of structural elements	5	44
8.	Test for impact strength	5	45
9.	Test for the stability against effect of linear acceleration	5	46
10.	Test at a temperature of -60°C	5,13	47
11.	Test for the stability of cyclic changes of temperature	5	48
12.	Test in condition of high altitudes	5, 24	48
13.	Test for guaranteed period	24, 26	50
14.	Checking of overheating	10	40

PERIODICAL TEST PROCEDURE

37. GENERAL INSTRUCTIONS

1. Measuring devices of 0.5 accuracy class 0.5", frequency meter of 1.5 accuracy class 1.5 (GOST 7590-78) should be used during the periodical test.
2. Periodical tests are carried out on 2 converters of any modification as per the selection of customer twice a year in terms agreed between the manufacturing plant and customer representative.

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3. Test for guaranteed period (item No.13 §36) is carried on two converters, which have undergone preliminarily the test as per item No.1 to 12 § 36.

4. Change in the sequence of test is allowed according to the agreement between the manufacturing plant and customer's representative.

5. That part of the periodical test, which corresponds to acceptance test enumerated in §26, is carried out in accordance with instructions given in section "Acceptance tests".

All other tests (item No.2 to 14§36) are carried out in accordance with the instructions given below.

38. CHECKING OF THE LEVEL OF RADIO INTERFERENCE.

This checking is carried out immediately after the test as per §36 in screened room at rated supply voltage and nominal load of converter.

Measurement is carried by special device for measuring the radio interference from the side of direct and alternating current of converter at a frequency specified in §12 of ETY.

Measurement is carried out after every 10MHz within the frequency range from 10 to 150MHz.

Test results are considered to be satisfactory, if radio interference level does not exceed the value specified in §12 of ETY.

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39. DETERMINATION OF WEIGHT.

Weight is determined on counter balance with weighing accuracy upto 20 gms. Weight the converter should not exceed the value specified in §6 of ETY.

40. DETERMINATION OF TEMPERATURE EXCESS,

Converters are tested for 60 minutes at rated supply voltage and nominal load at ambient temperature of $+20^{\circ}\pm 5^{\circ}\text{C}$ and at normal atmospheric pressure.

NOTE: For converter MAI-14 load is set as for two devices.

Overheating of winding of armature and excitation is determined after heating operation by method of resistance and for commutator by thermocouple. Test results are considered to be satisfactory, if overheating doesn't exceed value, specified in §10 of present ETY.

41. TEST FOR MOISTURE RESISTANCE.

Converters are kept in idle condition in hydrostat at relative humidity of 95 to 98% and ambient temperature of $+20^{\circ}\pm 5^{\circ}\text{C}$ for 48 hours.

Checking of resistance and electrical strength of insulation of converter, carried out not later than 3 minutes after removing them from hydrostat on the side of generator. And the same on the side of motor as per the procedure §33 and 34.

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After this converters are put for 60 minutes operation with nominal load and checking of nominal data and voltage and frequency variation is carried out as per procedure §30.

Insulation resistance is measured after the above operation on the side of motor and generator, and external inspection is carried out for the detection of corrosion on visible external parts.

Test results are considered to be satisfactory, if converters fulfil the requirements of §7, 8, 15 as per item No.3, 16 of §ETY and there are no corrosion traces on their parts.

42. TEST FOR HEAT RESISTANCE.

Converters are placed in thermostat and are switched on at nominal load (for MAI-1 load is set as on two devices).

Consumption current, voltage and frequency of alternating^{current} supply voltage of 24.3volts, 27 volts, 29.7volts is measured in normal climatic conditions.

In case of switched on converters in thermostat temperature is set at $+60^{\circ} \pm 3^{\circ}\text{C}$.

NOTE: It is allowed to place the converter in thermostat, in which temperature is set earlier at $+60 \pm 3^{\circ}\text{C}$.

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Converters are kept in thermostat in switched on condition for 1 hour at nominal load after setting the given value of ambient temperature. Electrical characteristics of the converter are checked at the end of operation.

Insulation resistance is measured not later than 3 minutes after operation.

Test results are considered to be satisfactory, if converter correspond to the requirements of §78 item No.2 and §15 of ETy.

43. TEST FOR VIBRATION STRENGTH AND VIBRATION RESISTANCE

1. TEST FOR VIBRATION RESISTANCE.

Test for vibration resistance is carried out on special stand in case of vibration effect, applied alternatively in ^{three} those inter-perpendicular directions.

Test is carried out in switched on condition at nominal value of load and rated supply voltage at, smooth variation of frequency within every sub range in one direction from lower frequency upto upper or vice versa, as per table:-

~~1. Sub-range of frequency (Hz)~~

~~2. Acceleration (g)~~

~~3. Amplitude~~

~~4. Testing time.~~

~~5. Periodic time of every frequency sub-range should be enough for checking the parameters, but not less than two minutes.~~

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Sub-range of frequency(Hz)	Accolera-tion,g	Amplitu-de.	Testing time
5-10	0.1-0.4	1	Periodic time of every frequency sub-range should be enough for checking the parameters, but not less than two days minutes.
10-20	0.28-1.12	0.7	
20-30	1.12-2.52	0.7	
30-40	1.8-3.2	0.5	
40-50	3.2-5	0.5	
50-60	5	0.35	
60-80	5	0.195	
80-100	5	0.125	
100-120	5	0.087	
120-150	5	0.055	
150-200	5	0.031	
200-250	5	0.02	
250-300	5	0.0139	

NOTE: It is allowed to carryout the test beginning with 10Hz in case of abasnece of testing devices.

Consumption current, output voltage and frequency is checked with setting data for limit frequencies of every sub-range during test for vibration resistance.

2. TEST FOR VIBRATION STRENGTH

Converters are fixed in horizontal position on special

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Subjected to stand and are tested in switched on condition at nominal load and rated supply voltage.

Vibration is created by the method of fixed frequencies.

Frequencies accelerations(amplitudes) and their holding duration are given in the following table.

Fixed frequency	Acceleration	Amplitude	Total duration of test in Hrs.
18	0.65	0.5	15
	0.908	0.7	4
24	1.156	0.5	11
	1.61	0.7	4
36	1.55	0.3	9
	2.59	0.5	3
48	2.76	0.3	8
	4.6	0.5	3
52	3	0.145	5
	5	0.24	2
100	5	0.125	3
144	5	0.061	1
200	5	0.031	1
288	5	0.015	1

Consumption current, output voltage and frequency is checked during vibration strength test with fixing data for beginning and end of test along each step of table.

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Test results for vibration resistance vibration strength are considered to be satisfactory, if:-

- a) during the test converters fulfil the requirements §7, 3, 14 of present ETV.
- b) during the test no deformations, ~~losses~~ ^{loosening} of sectional and one piece joints and parts ruptures do not occur.

44. TEST FOR THE DETECTION OF RESONANCE OF STRUCTURAL ELEMENTS.

Converters are strongly fixed on special vibration stand and are alternatively tested in three inter-perpendicular directions in switched off condition.

Test is carried within the frequency range from 5 to 40Hz during the smooth variation of frequency of vibration in the four sub ranges from 5 to 10Hz at amplitude 0.5 to 0.8mm.
Over 10 to 20Hz at amplitude 0.5 to 0.8mm;
Over 20 to 25Hz at amplitude 0.5 to 0.8mm;
Over 25 to 40Hz at amplitude 0.3mm.
for the time enough for the occurrence of resonance, but not less than 2 minutes in each sub range.

The absence of resonance of structural elements of converter is checked visually or with the help of device during the process of test.

Test results are satisfactory - in in given frequency range, resonance of structural elements is absent or amplitudes

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of vibration the elements and parts do not exceed more than twice the amplitude of vibration of their fixing points.

45. TEST FOR IMPACT STRENGTH

Test for impact strength is carried out in switched off condition of converter.

10000 impacts at a acceleration of 4g. are given to the converter, fixed on special stand and the number of impacts per minute should be 45 $\pm$ 5. After this converter is put for nominal operation as per the method §30 of present ETY.

Test results are considered to be satisfactory, if converters fulfil the requirements §7, 8, 12, 14 of present ETY and have no mechanical damages.

4.6 TEST FOR THE STABILITY AGAINST THE EFFECT OF LINEAR ACCELERATION

Converter is fixed on centrifuge and is subjected to linear overload 10g in working condition in three inter-perpendicular positions with duration not less than 3 minutes in each position. Consumption current and frequency and voltage stability is measured during the test.

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Test results are satisfactory, if during and after the test parameters of converter correspond to the requirements of §7, 8 of present ETY and there are no mechanical damages and loosening of fixing parts.

7. TEST AT A TEMPERATURE OF -60°C .

Converters are placed in cold chamber switched on at an nominal load and voltage and frequency of alternating current is measured at supply voltage. of 23.3, 27, 29, 7volts in normal climatic conditions.

After that converters are switched off temperature in the chamber is brought down upto $-60^{\circ}\text{C} \pm 3^{\circ}\text{C}$.

Converters are kept at given temperature for 2 hours.

Time reading is taken from the moment of attainment of converter surface of given temperature.

NOTE: It is allowed to place the converters in the chamber, in which temperature is set earlier at $-60^{\circ} \pm 3^{\circ}\text{C}$.

Converters should normally rotate at supply voltage not exceeding 20 volts.

After the completion of holding time converter is switched on and rotation voltage is checked.

Frequency and alternate current voltage are checked after five minutes after starting at supply voltage of 24.3volts for $\Pi\text{AI}-1\phi$ at nominal load, and for $\Pi\text{AI}-1\phi$ at load of 0.8A.

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Results of test are considered to be satisfactory, if alternate current voltage is not below 29 volts and frequency is not below:

340Hz for V $\square$ I-1 $\oplus$ $\square$

320Hz for V $\square$ I-1 $\oplus$

§48. TEST FOR THE STABILITY TO CYCLIC CHANGES OF TEMPERATURE

Before testing converters are switched on at nominal load and voltage & alternate current frequency is measured at nominal supply voltage.

After that, 8 converters in idle condition are subjected to the effect of three temperature cycles, continued one after another in the following sequence:-

- Converters are placed in cold chamber, in which temperature is earlier brought upto $-60^{\circ} \pm 3^{\circ}\text{C}$ and are kept there for 2 hours;
- After this converters are placed in hot chambers, in which temperature is earlier brought upto $+60^{\circ} \pm 3^{\circ}\text{C}$ and are kept there for 2 hours;

Converters in the chamber should be located at a minimum distance of 50mm from wall and from each other.

The shifting time of the converter from chamber to chamber should be maximum 3 minutes. Holding time of the converter in cold and hot chamber counted from the moment of achievement of given surrendering temperature in chamber after charging.

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NOTE: It is allowed to carry out the test in one chamber, at that temperature variation rate should be minimum $0.5^{\circ}\text{C}/\text{min}$.

B After the completion of last cycle converters are removed from hot chamber and are kept in normal climatic condition for 2-4 hours for cooling down to the full extent after which external inspection and heating operation is carried out for 1 hour at nominal value of load and at rated supply voltage.

Consumption current, voltage and alternate current frequency is checked at a supply voltage of 24.3, 25 and 29.7 volts after 5 minutes of switching on and at the end of heating operation.

Results of test are satisfactory, if

- a) during the external inspection no mechanical damages and loosening of fixing parts are detected.
- b) there is no corrosion on the units and parts.

Blackening of coating and fogging of passive film of cadmium coating and minor white deposits are allowed.

- c) Parameters of the converter correspond to the requirements §7,8 of present ETY.

49. TEST AT HEIGHT ALTITUDES:

Test at high altitudes is carried out in thermal vacuum chamber at rated supply voltage and nominal load of the

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converter (for $\Pi A I - 1 \phi$ load is set as for two devices). Pressure and temperature in thermal vacuum chamber and duration of test is set in accordance with the following table.

Type of converter	Pressure of mercury column in mm	Temperature, °C	Testing time in hours
$\Pi A I - 1 \phi$	56.2	-(60-2)	4
$\Pi A I - 1 \phi$	41	-(60-2)	1
$\Pi A I - 1 \phi$	56.2	-(40±5)	4
$\Pi A I - 1 \phi$	41	-(40±5)	1

The following are checked after at the end of the 4th hour of testing:-

Loading current, consumption current, voltage and frequency of generator.

At the end of the 5th hour of the operation of converter wear of brushes is measured.

Test results are considered to be satisfactory, if-

- loading current and consumption current fulfil the requirements §7 of ETY.
- Voltage and frequency of the generator fulfil the requirements §8 of as per item No.2 of ETY.
- Wear of the brushes should not be more than 0.3mm after 5 hours of operation.

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50. TEST FOR GUARANTEED PERIOD.

Test of converter $\Pi AI-1\phi$ (Π) for its guaranteed period is carried out by accelerating method for 332 hours which equals to 2500 hours of normal test.

Acceleration tests are carried out in thermal vacuum chamber at ambient temperature of $+55^{\circ}\text{C}$ and normal atmospheric pressure.

Converters are placed in thermal vacuum chamber and are kept in idle condition for one hour. After that it is switched on and checking for guaranteed period is carried out for 332 hours in accordance with the following :-

Duration of test, Hours	Supply Voltage, V	Loading Δ	
		$\Pi AI-1\phi$	$\Pi AI-1\phi \Pi$
83	24.3	0.65	0.85
166	27	0.65	0.85
83	29.7	0.65	0.85

Output voltage consumption current and frequency of the converter is measured during test, these characteristics should correspond to §7,8 item No.2 of present ETY.

It is necessary to check the condition of commutator, brush and dry the motor with dry compressed air after every 50 operating hours.

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After the test for guaranteed period cooling of convertes is carried out upto the ambient temperature ($+20^{\circ}\text{C} \pm 5^{\circ}\text{C}$) and converters are checked for the conformity to requirements §26 item Nos.3, 4, 5, 8 (with half voltage). Results of the test are considered to be satisfactory, if converters have withstood the tests as per programme §26 item No.3, 4, 5, 8 (with half voltage).

Wear of the brushes after 50 hours should not be more than 0.85mm. In technically valid cases, normal tests for guaranteed period are carried out for 2600 hours as per the decision of customer and manufacturing plant.

Supply voltage and loading of converter varies as per the steps given in following table:

Duration of the step, hours.	Supply Voltage, V	Leading, A	
		ПАІ-1φ	ПАІ-1φΠ
600	24.3	0.65	0.85
1400	27	0.65	0.85
600	29.7	0.65	0.85

During the test of the converter ПАІ-1φ and ПАІ-1φΠ, it is necessary to check the condition of commutator, brushes and to blow the motor with dry compressed air after every 150 hours of operation.

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Test results are considered to be satisfactory, if there was no break down during the test of the working of converter, wear of brushes and commutator does not exceed the value specified in §24 and converters would withstand the tests as per the programme §26 of item No. 3, 4, 5, 8 (with half voltage) and of present ETY after the test for guaranteed period.

NOTES:

1. Number of operative hours of the converter during the periodical test, in accordance with items No.1 to 8 §26 of ETY is included in test of the converter for guaranteed period.
2. After the completion of test for guaranteed period test is continued for double guaranteed period, result of which does not effect current acceptance and shipment of the converter.

VII.3 GUARANTEE PERIOD, LIFE AND STORAGE

51. GUARANTEE

Manufacturer guarantees conformity of the quality of converter ПAI-1Ф and ПAI-1ФП to the requirements of present technical documents if consumer observes the rules of operation, storage and transportation, specified in operational documents.

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Guarantee period is 7 years, including the guarantee period of storage in preservation and package of manufacturer of not more than 2 years from the day of manufacturing.

Guaranteed life is 2600 hours of service time within the limits of guarantee period.

NOTE: While sending the converters to the storehouse their packaging is carried out with the time of storage in usual storehousing conditions upto 3 years (In open area under cover upto 2 years) with keeping guarantee period of subsequent operation for at least 5 years. On such converters there is a stamp having the words:-
"Warehousing guarantee period in the package of the supplier is 3 years".

In case of the guarantee of direct operation of main object for more than 5 years, it is allowed to extent ^{the} direct operation of the article, for 6 years at the extent of shorter warehousing period.

IX. TRANSPORTATION AND STORAGE.

52. Converters may be transported in the packages of manufacture by following means of transportation -

a) By railway without any speed limit at a distance of 10,000 KM.

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APPENDIX FOR ETY

1. General view of the converter ПАГ-1Ф , ПАГ-1ФП
Drawing No.002.016.
2. Schematic diagram Drawing No.042.010.
3. Schematic diagram of testing of converter ПАГ-1Ф (П)
4. Certificate for ПАГ-1Ф.
5. Test records
6. Technical description and service instructions
7. Outline drawing of converter ПАГ-1Ф (П) 002.016 П.
8. Amendment registration list.

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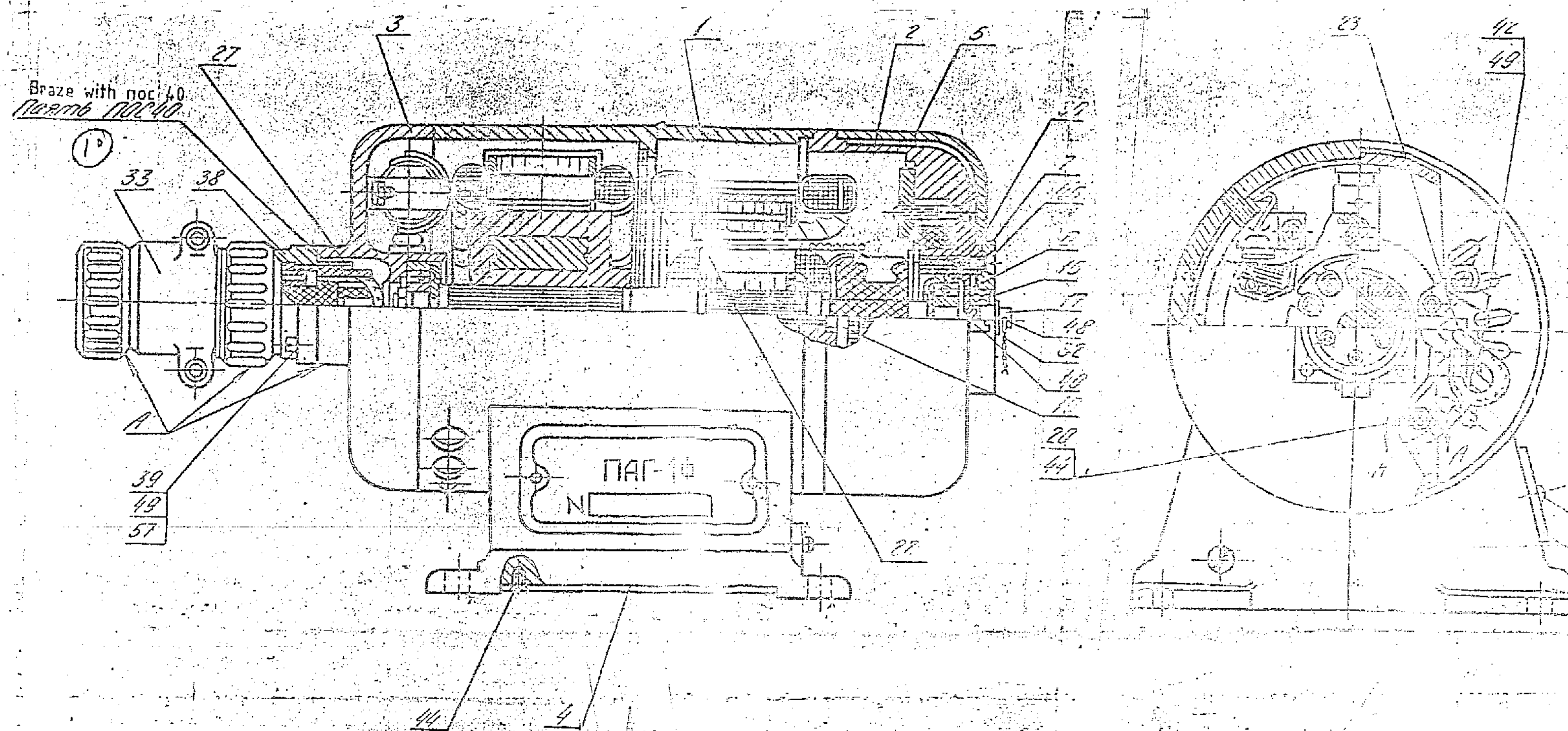
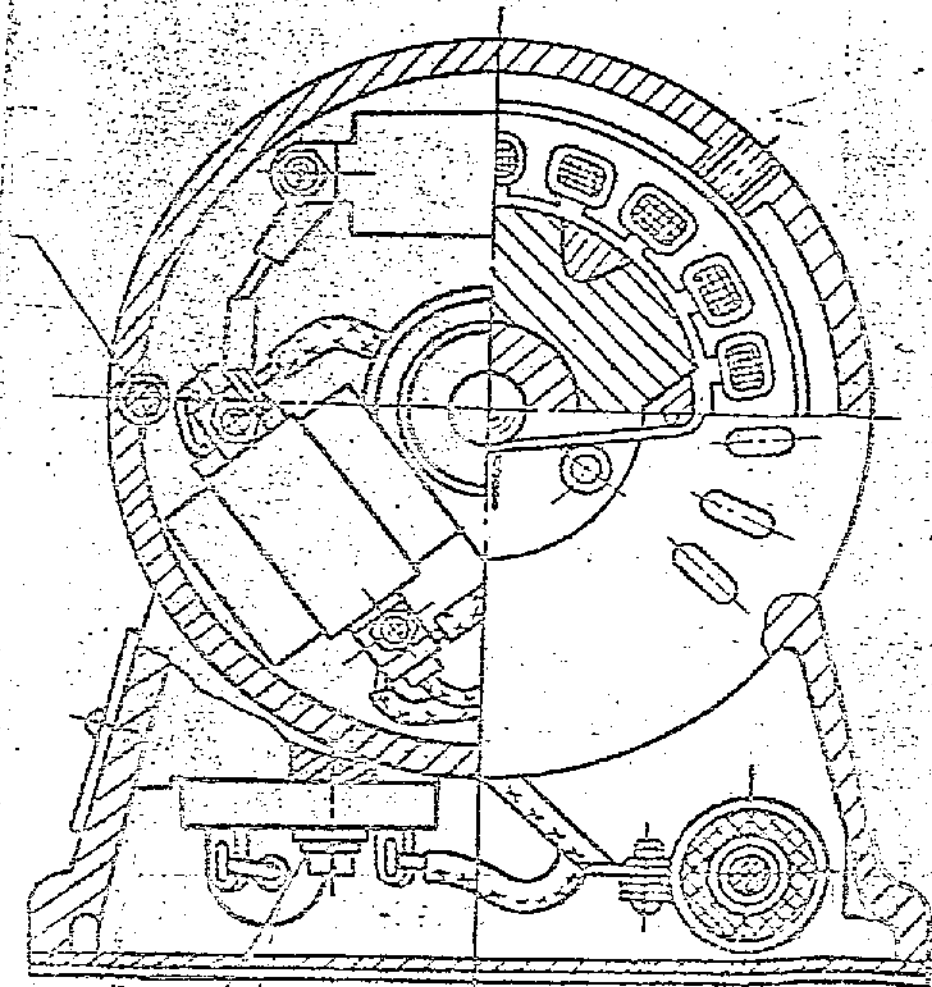
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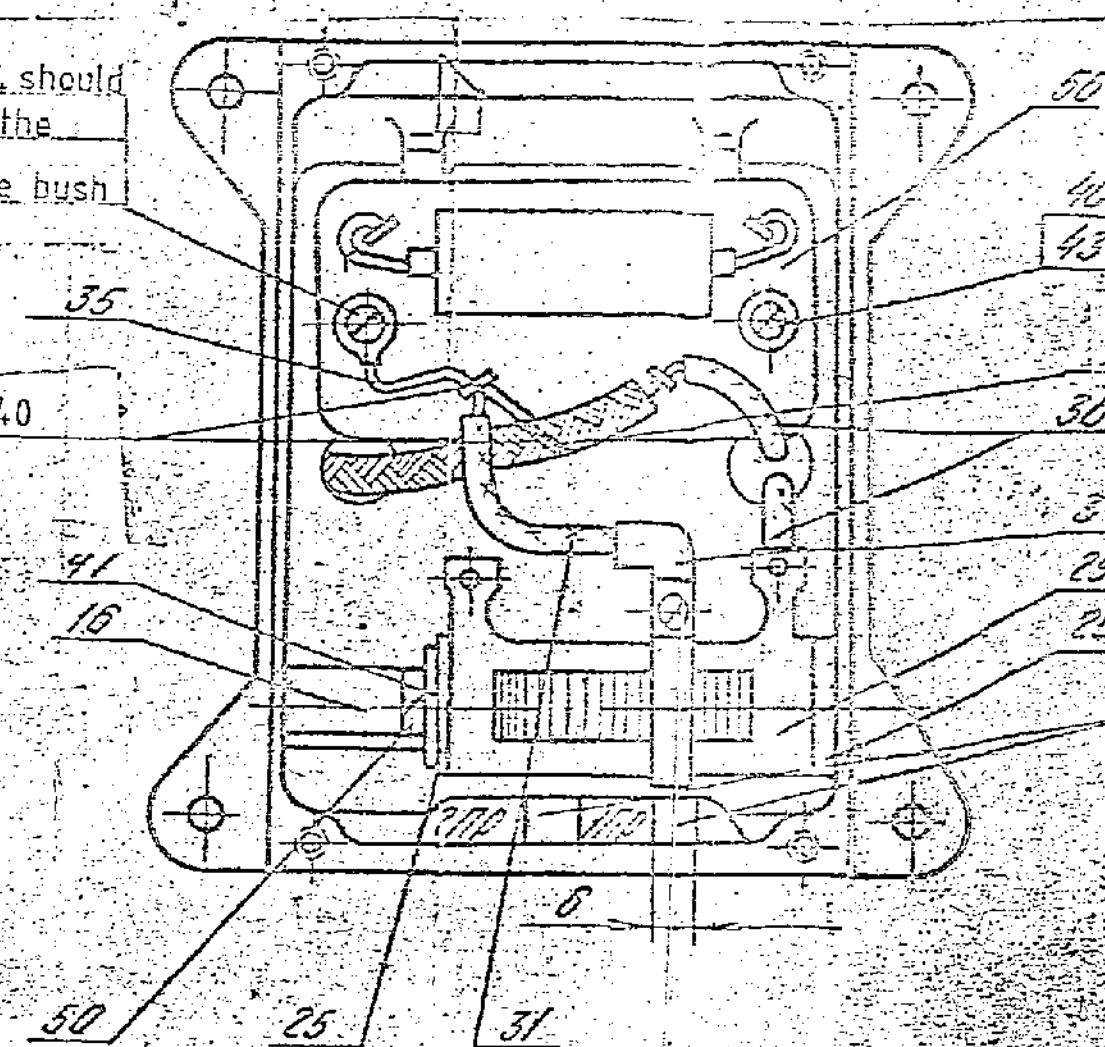
View on the arrangement along the arrow N with removed cover

End face Ref.No.24 should be on top of the one-sided end of the bush

Braze with noc 40

Soldering wires should be dressed

Apply dirt in enamel on frequency on adjusting the radio station to be tested

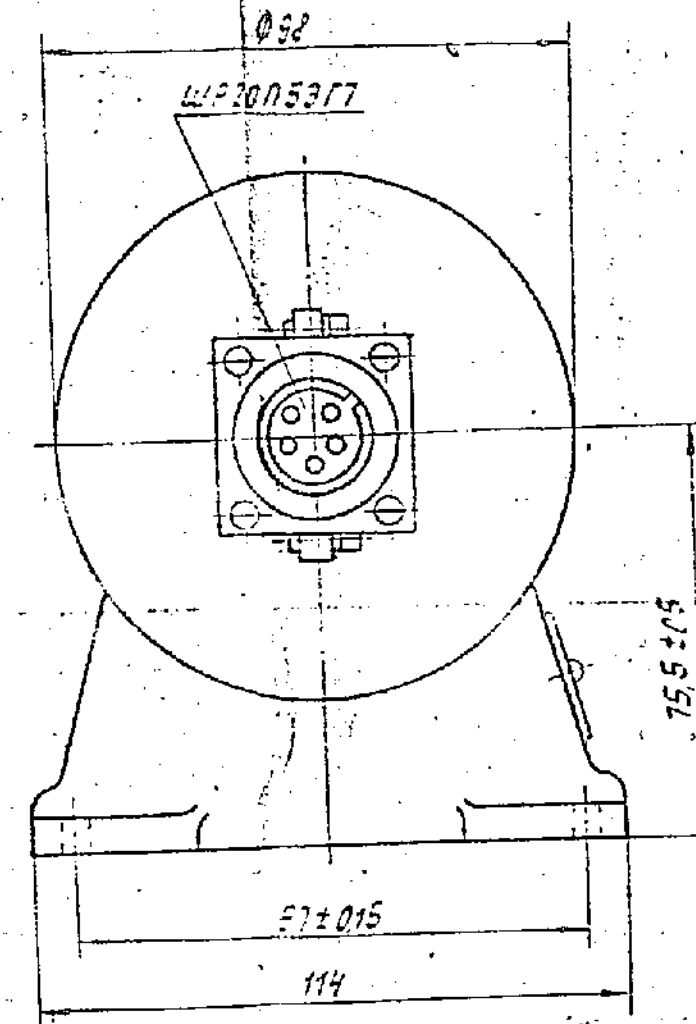
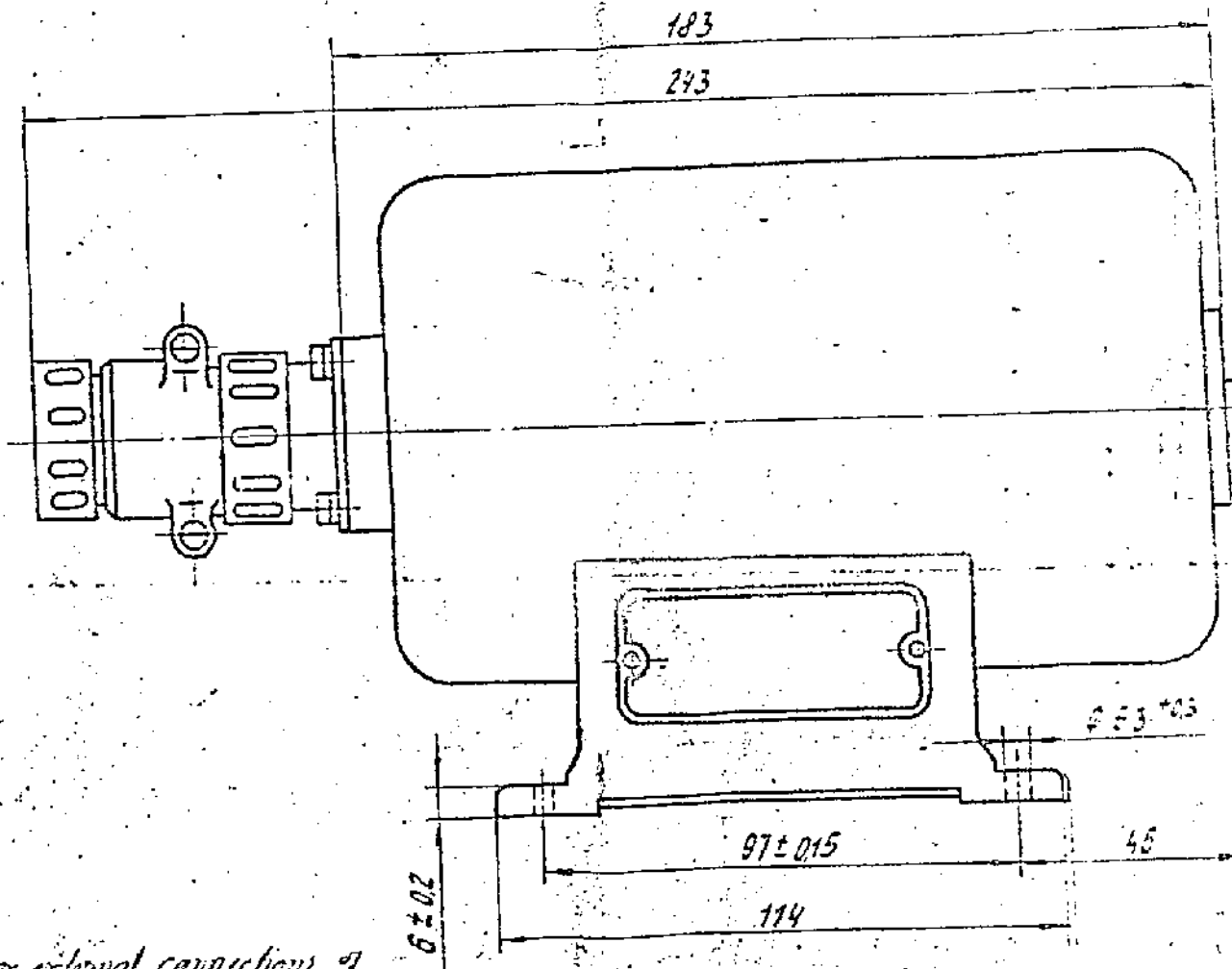


1. Assembly sketch No. 002.026
2. Radial play of commutator should be 0.02 mm.
3. Apply the grease of grade GKB - 122-7 in ball bearings in flush with balls from both the sides.
4. Rotor magnet of the generator after removing from stator pack is compulsory subjected to magnetization, therefore it is not permissible to remove the armature from the motor without any specific need.
5. Screws Ref.No.44, fixing the cover Ref.No.4 should be set on enamel HL-929.
6. Provide the proper contact of metalization and painting between the body, board and places "A", oxidized and greased surfaces are not allowed.
7. Adjustment of axial play of the armature 0.3 to 0.5 mm is done by an distant washers Ref.No.21 with thickness of 0.1, 0.2, 0.5 which are set between the caps Ref.No.6 and race of the ball bearing.
8. After setting the screws of support, do a mark on the base against the mark on the support with a width of 0.5 mm with enamel HL-929.
9. After adjusting the neutral set heads of screws fixing the support on enamel HL-929.
10. Clean off the surfaces from coatings.
11. Secure the screws Ref.No.11 on backlite varnish.
12. It is allowed to coat the internal surfaces with enamel HL-929 by dry spraying.
13. Coat the heads of screws, nuts inside the article and soldering places with primer AK - 070, and coat from the outside with the enamel MC - 160, silver III HAO. 050. 001. 8.
14. It is permissible to shorten pressings of the end-piece Ref. No. 24 in situ.
15. Coat the threaded part of the resistor screw with grease QUATUM - 201 after soldering the jumper Ref.No.31 to resistor.
16. Coat the embossed number with varnish AK - 113.

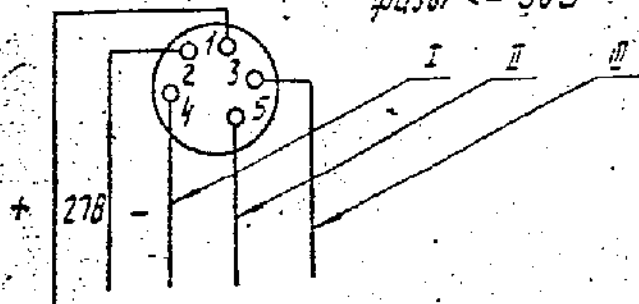
No.	Designation	Quantity	Remarks
10	002.016-1	1	
11	002.016-2	1	
12	002.016-3	1	
13	002.016-4	1	
14	002.016-5	1	
15	002.016-6	1	
16	002.016-7	1	
17	002.016-8	1	
18	002.016-9	1	
19	002.016-10	1	
20	002.016-11	1	
21	002.016-12	1	
22	002.016-13	1	
23	002.016-14	1	
24	002.016-15	1	
25	002.016-16	1	
26	002.016-17	1	
27	002.016-18	1	
28	002.016-19	1	
29	002.016-20	1	
30	002.016-21	1	
31	002.016-22	1	
32	002.016-23	1	
33	002.016-24	1	
34	002.016-25	1	
35	002.016-26	1	
36	002.016-27	1	
37	002.016-28	1	
38	002.016-29	1	
39	002.016-30	1	
40	002.016-31	1	
41	002.016-32	1	
42	002.016-33	1	
43	002.016-34	1	
44	002.016-35	1	
45	002.016-36	1	
46	002.016-37	1	
47	002.016-38	1	
48	002.016-39	1	
49	002.016-40	1	
50	002.016-41	1	
51	002.016-42	1	
52	002.016-43	1	
53	002.016-44	1	
54	002.016-45	1	
55	002.016-46	1	
56	002.016-47	1	
57	002.016-48	1	
58	002.016-49	1	
59	002.016-50	1	
60	002.016-51	1	
61	002.016-52	1	
62	002.016-53	1	
63	002.016-54	1	
64	002.016-55	1	
65	002.016-56	1	
66	002.016-57	1	
67	002.016-58	1	
68	002.016-59	1	
69	002.016-60	1	
70	002.016-61	1	
71	002.016-62	1	
72	002.016-63	1	
73	002.016-64	1	
74	002.016-65	1	
75	002.016-66	1	
76	002.016-67	1	
77	002.016-68	1	
78	002.016-69	1	
79	002.016-70	1	
80	002.016-71	1	
81	002.016-72	1	
82	002.016-73	1	
83	002.016-74	1	
84	002.016-75	1	
85	002.016-76	1	
86	002.016-77	1	
87	002.016-78	1	
88	002.016-79	1	
89	002.016-80	1	
90	002.016-81	1	
91	002.016-82	1	
92	002.016-83	1	
93	002.016-84	1	
94	002.016-85	1	
95	002.016-86	1	
96	002.016-87	1	
97	002.016-88	1	
98	002.016-89	1	
99	002.016-90	1	
100	002.016-91	1	

1. Размеры без допусков
даны: максимальные.

1. Dimensions without tolerances are
given as maximum.



Sketch for external connections of
Схема внешних соединений phase ~ 36 volts
фазы ~ 36В



ENGINEER	DRAWN	CHECKED	DATE

Approximate Coating

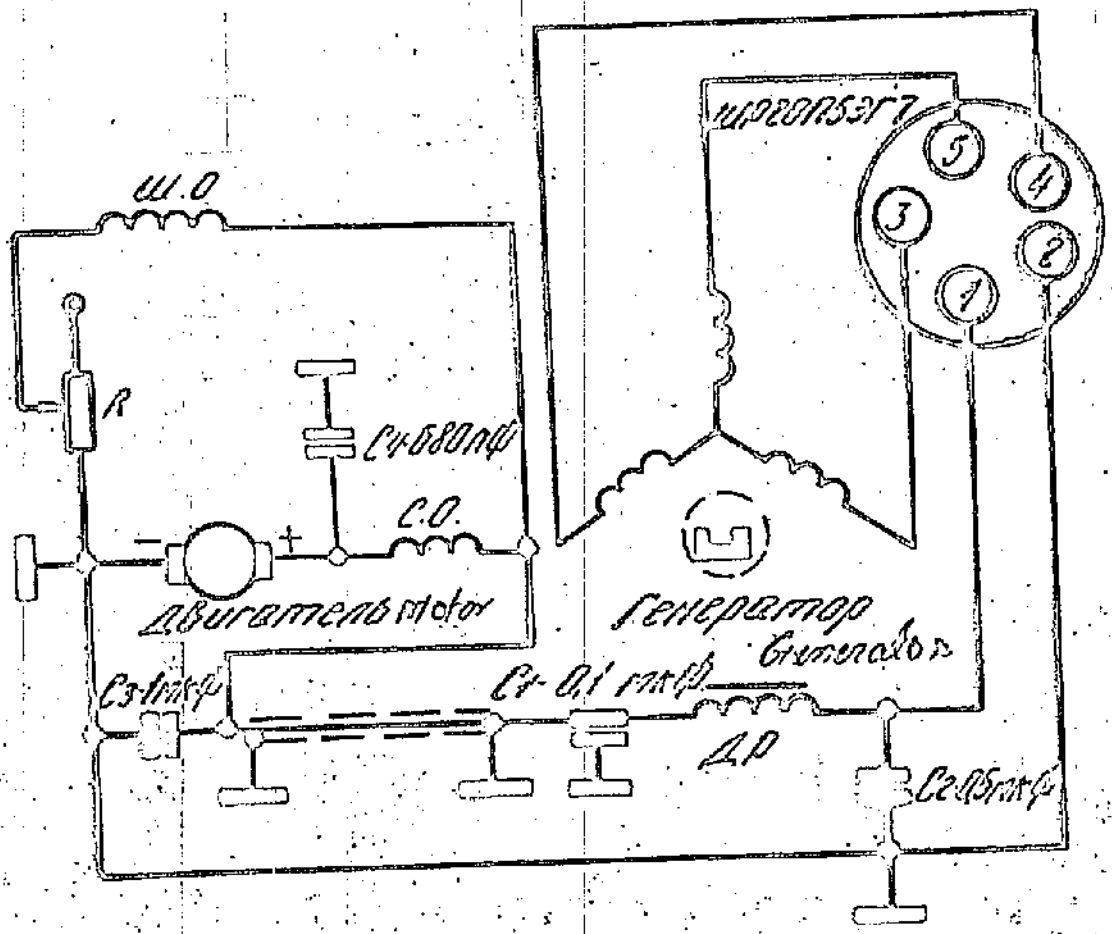
Outline drawing
of converter
part- 34 (n)

002.0167

SHEETS	WEIGHT	SCALE
1/1		1:1
TOTAL SHEETS		
ORDNANCE FACTORY PROJECT HYDERABAD		

SH-430-43
442

001-100



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042.040

SNOSHT DOC NO		SIGN	DATE
DRAWN			
EDT, CHKO			
F/M, DC			
DIV. OFFR			
NAME		SIGN	DATE

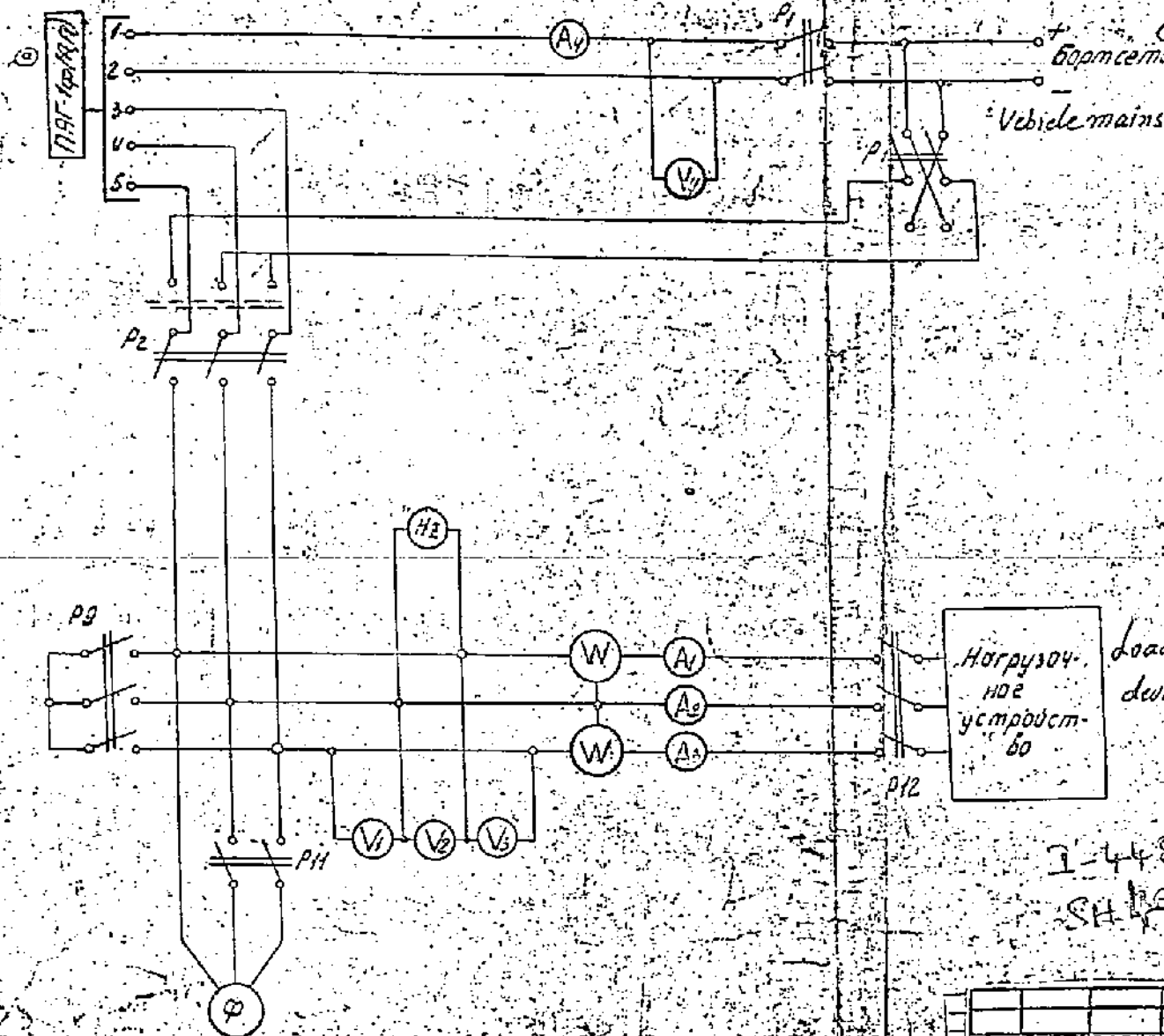
SCHEMATIC DIAGRAM

SHEET WEIGHT		SCALE
4	1	
TOTAL SHEETS		
ORDNANCE FACTORY		
PROJECT		
HYDERABAD		

002016CX

1. For measuring the voltage of the generator voltmeter with input resistance of at least 1500 Ohm is used.

2. For measuring the frequency of alternating current frequency meter ГП-450 or Б-10 or its similar as per the value of consumption capacity is used.



Нагрузочное устройство
loading device

I-4482

SH 10 0 43

№ п.п.	Обознач.	Наименование	Кол. шт.
1	ГП-100/100	Испытательный преобразователь	
2	V1, V2, V3	Вольтметры voltmeters	
3	A1, A2, A3	Амперметры ammeter	
4	V4	Вольтметр Voltmeter	
5	A4	Амперметр Ampere meter	
6	H2	Герцметр Hz Frequency meter	
7	Ф	Фазоуказатель phase indicator	
8	W	Ваттметр Wattmeter	
9	P1	Рудильник Knife switch	
10	P2	Рудильник Knife switch	
11	P11	Рудильник Knife switch	
12	P9, P12	Рудильники Knife switch	
13	P10	Рудильник Knife switch	

SHEET DOGNO SHEET

DRAWN BY

EDITED AND CHECKED BY

FOREMAN OF DC

DIVISIONAL

SCHEMATIC DIAGRAM FOR TESTING THE CONVERTER OF TYPE ПП-14(П)

SHEETS WEIGHT SCALE

TOTAL SHEETS

Ordnance Factory Project Hyderabad.	I 4482	NUMBER 002.016 ETY p.U SHEET 40 OF 43
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RECORD OF THE ACCEPTANCE TESTS OF CONVERTER. $\Pi A \Gamma - 1 \phi$

S. No.	Description	Dimensions	No. as per TY	Results
1.	Quality of the assembly and external structure	--	Conformity to drawings and technology	--
2.	Insulation resistance in switched off condition	M Ohm	Minimum 20	--
3.	Alternating of phases	--	Clockwise	--
4.	No load current		Minimum	
	a) for $\Pi A \Gamma - 1 \phi$ b) for $\Pi A \Gamma - 1 \phi (\eta)$	-- A	2.45 max. 2.55 max.	-- --
5.	Parameters of heating operation. Duration of the operation supply voltage	Minutes	90	--
		Volts	27	--
	Load current			
	a) for $\Pi A \Gamma - 1 \phi$	--	0.65	--
	b) for $\Pi A \Gamma - 1 \phi$	A	0.85	--
	Co-efficient of capacity	--	0.65	--
6.	Consumption current at nominal load		Maximum	
	a) for $\Pi A \Gamma - 1 \phi$ b) for $\Pi A \Gamma - 1 \phi (\eta)$	-- A	3.5 4.5	-- --
7.	Voltage and frequency stability			

Type of article	Supply voltage, volts.	Load current, A	COS φ	Voltage of generator		Frequency	
				Norm as per TY	Results	Norm as per TY	Results
$\Pi A \Gamma - 1 \phi$	24.3	0.65					
	27	0.65	0.65	31.8		35950	
	29.7	0.65		to 40.2		441	
	24.3	0.32					
	27	0.32	0.65				
	29.7	0.32					
$\Pi A \Gamma - 10 \eta$	24.3	0.85	0.65	32.45		361 to	
	27	0.85		to 31.55		439	
	29.7	0.85					

S. No.	Description	Dimensions	No. as per TY	Results
3.	Difference in linear voltage at no-load	Volts	Maximum 0.35	--
9.	Mechanical strength at 10000r/min.	--	--	--
10.	Commutation	--	--1 1/2 max	--
11.	Stability of permanent magnet	Volts	± 0.5 max.	--
12.	Insulation resistance in hot condition	M Ohm	5.5 min.	--
13.	Electrical strength of insulation	--	Absence of the break-down of insulation	--
14.	Radial play of commutator	MM	0.02 max	--
15.	Projection of separate plates of the commutator	MM	0.004 max	--
16.	Checking for the switching on after final finishing and acceptance at a supply voltage of 27Volts	PAF-1P	PAF-1P	
a)	Voltage of the generator (volts)	36 ± 2 - 1	36 ± 3.55	
b)	Frequency of alternate current Hz	400^{+10}_{-25}	400 ± 39	

Signatures: Test performer

Testing stand operator.

ATTESTATION

Converter, No. of which is specified above, corresponds to technical specifications and drawings.

TESTING STAND FOREMAN

TID REPRESENTATIVE