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PRESSURE INDICATORS

MA - 1T

Technical Specifications

TY 25-02.110461-85

TRANSLATED	CHITRALA	CC2	15791	Ordnance Factory Project
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The present technical specifications are pertaining to Pressure indicators ИД-1Т (further referred to as Indicators) which are intended for remote control of excessive pressure of oil in the lubrication systems of internal combustion engines and in transmission and pressure of other non-corrosive liquids and gases.

The indicators consist of pressure head ИД-1Т (further referred to as Head) and pressure gauge YД-801 (further referred to as gauge).

Regarding resistance to the effect of ambient temperature and humidity, indicators are manufactured in all-weather version for operating at temperature from minus 60 to plus 130°C - for head and from minus 60 to plus 60°C - for gauge.

List of the documents referred in the present TY is given as Annexure 1.

Indicators are intended to operate:

under the effect of vibration with frequency from 20 to 500 Hz and acceleration 100m/s² for head and 15m/s² for gauge;

after the effect of impact loads: 10,000 impacts with acceleration of 150m/s² for head and 100m/s² for gauge; 9 impacts with an acceleration of 1000m/s² for head.

It is permitted to supply the heads and gauges separately.

Examples for indicating the designation of indicators or their components while ordering and in documents for other products where the indicators can be utilised:

1) Indicator ИД-1Т with upper measurement limit 1.5MPa (15kgf/cm²) of set 1 (K1, see table 2) -

"Pressure indicator ИД-1Т-1.5 МПа-K1 TY25-02.110461-85"

2) Gauge YД-801 with upper measurement limit 1.5MPa (15 kgf/cm²), of set 5 (K5, see table 2) -

"Pressure gauge YД-801-1.5MPa-K5 TY25-02.110461-85".

3) Head ИД-1Т with upper measurement limit 1.5MPa (15kgf/cm²) of set 3 (K3, see table 2) -

"Pressure head ИД-1Т-1.5MPa-K3 TY 25-02.110461-85."

1. Technical requirements

1.1. Basic parameters and dimensions.

1.1.1. The indicators should comply with requirements of the present TV and set of documents 2B0.289.034.

1.1.2. Upper measurement limits are 100, 300, 600 kPa; 1.5, 8.0 MPa (1,3,6,15,80 kgf/cm²).

Operating measurement ranges are 20-60, 60-240, 100-500 kPa; 0.2-1.2, 1-5 MPa (0.2-0.6, 0.6-2.4, 1-5, 2-12, 10-50 kgf/cm²).

Quality department codes of indicators, heads and gauges are given in Table 1.

Table 1

Quality code	Nomenclature
42 1223 0180	Pressure indicator PA-1T-K1
42 1223 0179	- do - PA-1T-K2
42 1221 1915	Pressure head PA-1T-K3
42 1221 1914	- do - PA-1T-K4
42 2373 0132	Pressure gauge PA-801-K5

1.1.3. D.C. voltage 27^{+2.7}_{-5.0} V.

1.1.4. Current strength to be consumed by indicator should not exceed 0.1A.

1.1.5. Power to be consumed by indicator should not exceed 3 W.

1.1.6. Length of the connecting cord between the head and gauge along the run should not be more than 15m with the area of cross-section not less than 0.5mm².

1.2. Design-technical requirements.

1.2.1. Over-all dimensions and connecting dimensions of the head, gauge and flexible hose are given at Annexures 2,3,4.

1.2.2. Weight of the indicator should not exceed 0.6 kg.

1.2.3. Needle of the gauge should be below the zero marking while in de-energized (disconnected) condition.

1.2.4. Maximum permissible error (Δ_п) of the indicator from upper measurement limit should not exceed $\pm 4\%$ in the working zone ($\pm 1.5\%$ for gauge) and 6% in the remaining zone ($\pm 2\%$ for gauge).

1.2.5. Variations in the indicator readings should not exceed the absolute value of maximum permissible error.

1.2.6. Sensitive element unit of the head should be made airtight at pressures exceeding the upper measurement limit by 50%.

1-2-7- The indicator should be able to withstand the high pressures exceeding the upper measurement limit by 50%.

1.2.8. The indicators should be able to withstand 10,000 cycles of excessive pressure ranging from 10-20 to 80-90% of upper measurement limit.

1.2.9. Difference in readings of gauge while inclined by 90° from the usual working position should not exceed $\pm 1.5\%$ of the upper measurement limit and that of head in any position other than usual position should not exceed $\pm 1\%$ of the upper measurement limit.

1.2.10. Electric insulation of indicators between electric circuit and body should withstand the effect of below specified test voltages for 1 min:

- 1) 500 V - under normal conditions;
- 2) 150 V - under increased humidity.

1.2.11. Insulation resistance between electric circuits and the body should not be less than:

- 1) 20 M ohm - under normal conditions;
- 2) 5 M ohm - under increased ambient temperatures;
- 3) 1 M ohm - under increased humidity.

1.3.

1.3. Requirements for resistance, strength and stability to the external effecting factors:

1.3.1. The indicators should be resistant to the effect of ambient temperature from minus 60 to plus 130°C - for heads and from minus 60 to plus 60°C - for gauges.

1.3.2. The indicators should be resistant to the effect of

ambient 100% relative humidity of surrounding air at 35°C.

1.3.3. The indicators should be stable to the effect of vibration with frequency of 20-500 Htz at acceleration upto 100m/S^2 - for heads and 15m/S^2 - for gauges.

1.3.4. The heads should withstand 10,000 impacts with acceleration upto 150m/S^2 and gauge - 10,000 impacts with acceleration upto 100m/S^2 at frequency of 40-100 impacts per minute.

1.3.5. The indicators should be serviceable after the effect² of 150 single-action impacts with acceleration 196m/S^2 with pulse duration 0.033 and with frequency not exceeding 20 impacts per minute.

1.3.6. The heads should withstand three impacts each in three mutually perpendicular planes with acceleration upto 1000m/S^2 .

1.3.7. The needle should not oscillate by more than $\pm 1\text{mm}$ along the scale with the effect of vibration on indicators (cl. 1.3.3.).

1.3.8. Error in indicators should not exceed the permissible error with the effect of vibration.

1.3.9. Maximum permissible change in indicator error caused due to the change in ambient temperature in working zone (cl 1.3.1.) from temperature $(23\pm 5)^\circ\text{C}$ and expressed in terms of permissible error limits should not exceed 0.2 (ΔH) for every 10°C .

1.3.10. When supply voltage deviation is maximum in compliance with cl 1.1.3., the difference in readings should not double the absolute value of maximum permissible error.

1.3.11. The indicators should be serviceable:

- 1) after the effect of overvoltage pulses with amplitude upto 70V and with duration of 3 ms;
- 2) after the effect of short-period voltage reductions upto 10 V (duration upto 1min);
- 3) after the effect of short-period voltage connections of 30 V with reverse polarity (duration upto 1 min).

1.3.12. The change in readings caused due to the external static magnetic field of strength upto 400 A/m, variable magnetic field of 80 A/m with frequency of 50 and 400 Hz at most unfavourable phase and direction of pole should not exceed the absolute value of maximum possible error.

1.3.13. The indicator should be completely protected from the effect of rain: head - completely and gauge - from the side of glass.

1.3.14. The indicators should be resistant to the effect of dynamic dust (sand).

1.3.15. The indicators should be resistant to the effect of dew and frost.

1.3.16. The indicators should be resistant to the effect of sea fog.

1.3.17. The indicators should be resistant to the effect of fungus.

Degree of the biological growth should not ^{exceed} ~~the~~ point 4 as per GOST 9.048-75.

1.4. Requirements for reliability.

1.4.1. Probability of trouble-free operation of the indicators should not be less than 0.96 in 5000 hrs.

1.4.2. Service life of the indicators is 15 years.

1.4.3. The indicators belong to irreparable, single-channel and single-purpose articles.

1.4.4. Noncompliance with maximum permissible error is taken as the parameter for rejection.

1.5. Set

1.5.1. Complete set of indicators and their component parts should be supplied as per the list specified in Table 2.

Table 2

Nomenclature and conventional designation	Quantity, pcs					Remarks
	1	2	3	4	5	

Set of head

Pressure head ПД-1Т	1	1	1	1	-	Head with damper is supplied on Customer's demand.
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Socket 2РМДТ18КПН4
Г531 (or)

2 РМДТ18КПН4Г5В1

	1	1	1	1	-	In compliance with the order.
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Set of gauge

Pressure gauge PA-801	1	1	-	-	1	
Fastening ring	1	1	-	-	1	
Plug W00M-3	1	1	-	-	1	

Set of hose

Flexible hose WF-16	-	1	-	1	-	For indicators
Union	-	1	-	1	-	with upper
Washer	-	1	-	1	-	measurement limit upto 1.5 MPa (15kgf/cm ²) inclusively.
Pressure indicator PA-1T. Certificate	1	1	-	-	-	Supplied on Customer's demand

Technical description and operating instructions.

Pressure head ПД-1Т. Certificate	1	1	1	1	1	For 10 devices.
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Pressure gauge

Pressure gauge PA-801. Certificate

	-	-	1	1	-	1
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1.6 Marking.

1.6.1. The followings should be specified on the casing of head and on the dial of gauge:

- 1) Conventional designation of head (gauge);
- 2) Power supply voltage;
- 3) Serial No.

Maximum measurement limit should be specified on the casing of head.

1.6.2. Marking of the transportation container should correspond

to the manufacturer's drawings and should have precautionary signs: "Fragile", "Keep dry", "Do not tilt".

1.7. Packing.

- 1.7.1. Packing of indicators should comply with the set of manufacturer's documents and should ensure preservation of indicators during transportation and storage.
- 1.7.2. The box with packed indicators should be tied from outside with steel tape. Tape pieces should not be used.
- 1.7.3. The box with packed indicators should be sealed with the manufacturer's and Customer's representative's TID seals.
- 1.7.4. Packing list, certificate, technical description & operating instructions and list of packed items should be placed along with the indicators in the box.

The documents should be wrapped in waterproof paper and placed in airtight polyethylene bag.

- 1.7.5. Weight of the box with packed indicators should not exceed 50 kg.

2. Safety Requirements

- 2.1. Safety requirements are ensured by the design of indicators

3. Acceptance Rules

- 3.1. The following tests should be carried out for indicators:
acceptance;
periodical;
type;
control tests for reliability.
- 3.2. The Customer's representative should look after the manufacture, testing and acceptance of the indicators.
- 3.3. Amount and sequence of the acceptance and periodical tests are given in Table 3.

Table 3

Name of the tests (checkings)	Clause No.		Type of tests (Checkings)	
	Technical requirements	Testing methods	Acceptance	Period of cal.
1	2	3	4	5
1. Checking of compliance of indicators with requirements of technical documents, supply set, marking and packing.	1.1.1; 1.1.2; 1.1.3; 1.1.5; 1.2.1; 1.5.1; 1.6.1; 1.6.2; 1.7.1; 1.7.2; 1.7.3; 1.7.4.	4.1; 4.2	+	+
2. Checking of air tightness	1.2.6	4.3	+	+
3. Determination of main error, variation in readings and position of needle in idle condition.	1.2.3; 1.2.4; 1.2.5.	4.1; 4.4	+	+
4. Determination of current consumption	1.1.4	4.5	-	+
5. Test for overload.	1.2.7	4.6	-	+
6. Test for cyclic load.	1.2.8	4.7	-	+
7. Checking of effect of connecting cable.	1.1.6	4.8	-	+
8. Test for the effect of inclinations.	1.2.9	4.9	-	+
9. Checking of electric strength and insulation resistance: 1) under normal conditions. 2) under increased humidity.	1.2.10; 1.2.11	4.10; 4.11	+	+
10. Determination of effect of ambient temperature.	1.2.10; 1.2.11	4.10; 4.11; 4.11	-	+
11. Determination of effect of increase in humidity of surrounding air.	1.3.1; 1.3.9	4.12; 4.13	-	+
12. Vibration test.	1.3.3; 1.3.7; 1.3.8	4.14 4.15	-	+

	2	3	4	5
13. Impact test.	1.3.4; 1.3.5; 1.3.6.	4.16; 4.17; 4.18	-	+
14. Checking of effect of fluctuations in supply voltage.	1.3.10	4.19	-	+
15. Serviceability test after the effect of: overvoltage pulses short-period voltage drops polarity changes	1.3.11	4.20 4.21 4.22	-	+
16. Checking of effect of magnetic field.	1.3.12; 1.	4.23	-	+
17. Test for protection from water & dust.	1.3.13; 1.3.14	4.24; 4.25	-	+
18. Test for the effect of dew and frost.	1.3.15	4.2	-	+
19. Checking of weight.	1.2.2; 1.7.5	4.2	-	+

Note: 1. Sign "+" indicates that the test is carried out,
sign "-" indicates that the test is not carried out.

- During acceptance tests, the Customer's representative has the right to select the indicators from the batch submitted for selective tests as per the points of the present TV which are not intended for testing during acceptance tests.
- Sequence of tests can be altered on agreement with the Customer's representative.
- Compliance of the indicators with requirements of Cl.1.2.6; 1.2.7 need not be checked, if they are checked on the heads
- Compliance of the indicators with requirements of Cl.1.3.16 1.3.17 is checked once on the first samples of series production, and also whenever necessary during the type tests.
- Test as per Cl. 1.4.3 is not carried out as this requirement is ensured by the design.
- Tests as per Cl. 1.3.5 for the effect of vibration with frequency from 300 Hz to 500 Hz - for head and from 80 to 500 Hz - for gauge are carried out together only during type tests.

8. During acceptance tests, the main error of indicators should not exceed $\pm 0.8 \Delta A$ and variation should not exceed $0.8 \Delta A$. During all other tests, the main error should not exceed $\pm \Delta A$, and variation should not exceed ΔA .

3.4. Acceptance tests.

3.4.1. Each indicator should be subjected to acceptance tests in the scope specified in Table 3.

3.4.2. If, it is found during acceptance tests, that the indicators do not comply with any one of the points of TY, then the same are rejected and returned to the production agency for detecting the defects and their elimination and for retesting.

All the acceptance tests are repeated for the rejected indicators after rectification of the defects.

3.4.3. Quality mark or seal should be put on the indicators accepted by the Quality Control Department and then they are submitted to the Customer's representative in batches containing not more than 50 pcs. by informing in the established form.

The Customer's representative carries out acceptance tests on 10% of indicators from the submitted batch, but not less than 5, the remaining indicators from the submitted batch are checked for their compliance with TY in respect of appearance and completeness.

Selection of the indicators is done by the Customer's representative in the presence of QAD representative.

It is permitted to submit the indicators individually to the Customer's representative, in which case all the acceptance tests stated in Table 3 should be carried out.

3.4.4. If tests of the submitted batch of indicators reveal that even one of the indicators does not comply with requirements of TY, then entire batch from which the indicators are selected, should be returned to the manufacturer for analyzing the cause of defects, for their elimination and retesting by QAD.

3.4.5. Repeated tests of the returned batch of indicators are carried out after the reports of defects of analysis, their rectification and retesting by QAD are submitted by the manufacturer,

3.4.6. During repeated tests of the returned batch, number of indicators, for which acceptance tests are carried out, should be doubled.

3.4.7. If non-compliance of indicators with requirements of TV is observed during the repeated tests, then testing should be stopped, and further supply should be decided by the Chief engineer of the manufacturer and the Customer's representative.

3.4.8. The indicators which have passed the tests, made into sets and packed according to the TV requirements and submitted for storage are considered as accepted indicators.

3.5. Periodical tests.

3.5.1. The periodical tests are carried out once in a year for confirming the compliance of the indicators with requirements specified for them.

Three indicators are selected at random from the accepted batches for carrying out the tests.

The indicators are selected by the Customer's representative in the presence of QAD representative. The selection of the indicators should be recorded.

Quantity of indicators and sequence of their periodical tests are as per Table 5.

3.5.2. If it is observed during the periodical tests that the indicator does not comply with any one requirement of TV, then the subsequent batches as well as the earlier accepted batches should not be received for analysing the causes of all the detected defects and for their rectification.

3.5.3. After rectification of all the detected defects, the indicators should be tested again on double the quantity of indicators.

On agreement with Customer's representative, all the tests need not be repeated but those points, with which the indicators did not comply, should be checked.

3.5.4. If it is found that even one indicator does not comply with requirements of TV during the repeated tests, then

acceptance and unloading of the indicators is stopped. Further manufacture of the indicators is stopped and their acceptance is decided by the Customer and higher committee from the manufacturer's side.

In case of positive results of repeated periodical tests, acceptance and unloading of the indicators should be restored.

Acceptable parts and units of the rejected indicators can be used on approval from the Customer's representative.

Results of the periodical tests should be recorded in the specified format.

3.5.5. Having passed the periodical tests, the indicators need not be unloaded further.

3.6. Control tests for reliability.

3.6.1. Control tests for trouble-free service are carried out on first samples of established series and in established series production, once in three years per the procedure and programme approved by _____.

Note: 1. The reliability tests are carried out in the established series production, when the annual output is at least 500 indicators.

2. Series production of indicators, acceptance by the Customer's representative at the manufacturing plant and despatch to the Consumer can be completed before completing the reliability tests.

3.7. Type tests.

3.7.1. Type tests of indicators are carried out by the manufacturer while changing the design of indicators or their manufacturing procedure which effects the technical and metrological parameters specified in the present TV.

3.7.2. For carrying out the type tests, 5 devices are made in compliance with the proposed changes (amendments).

3.7.3. Type tests are carried out as per the programme, approved

by the Chief-engineer from the manufacturing plant and Customer's representative.

3.7.4. No. of type tests should be determined on the basis of nature of amendments carried out in the design of indicators or their manufacturing procedures.

3.7.5. The test results should be recorded and should be approved by the Chief-engineer and Customer's representative.

3.7.6. In case of positive results, the proposed amendments are incorporated in the documents.

4. Testing methods

4.1. All the tests are carried out under the below specified normal conditions, if other conditions are not specified in the description of individual testing methods:

head and gauge should set to the working position in accordance with the technical description and operating instructions;

ambient temperature $(23 \pm 5)^{\circ}\text{C}$;

relative humidity upto 80%;

deviation from power supply voltage from the nominal value should not exceed $\pm 0.5\%$;

checking vibration for gauge upto 5 m/s^2 (it is permitted to tap the body of gauge while taking readings);

effect of magnetic field should be avoided;

length of connecting cable between head and gauge should not exceed 2m.

4.2. Design of the indicators (cl. 1.1.1, 1.1.2, 1.1.3, 1.1.5), dimensions (cl. 1.2.1), weight (cl. 1.2.2; 1.7.5), completeness (cl. 1.5.1), marking (cl. 1.6.1, 1.6.2), packing (cl. 1.7.1 - 1.7.4) are checked visually by comparing with the drawings, by measuring the dimensions with measuring tools, by weighing which are ensure the required accuracy. List of equipment required for testing the indicators is given at Annexure 5.

4.3. Airtightness of sensitive element unit of the head (cl. 1.2.6) is checked as given below:

A pressure equivalent to that specified in cl. 1.2.6. is created in the sensitive element of the head and kept it for 1 minute.

The heads are considered to have passed the tests, if there is no drop in pressure while testing.

4.4. Main error of the indicators (cl. 1.2.4) and variation (cl. 1.2.5) are checked in the following way:

Connect the circuit as per Annexure 6, connect the power supply and keep for 2 minutes before starting the test. By gradually increasing the pressure in the head upto the required measurement point as per gauge, the readings in the manometer and error are determined. The pressure is maintained at the upper measurement limit for 1 minute and by gradually reducing the pressure, error is determined at the same points.

The error is taken as the difference between the gauge reading and pressure value and is determined in the dummy device.

Variation is determined as the difference in readings during direct and reverse operations at the same point on the scale.

The main error should be determined at the numerals equally distributed in the measurement range.

Variation is determined at the same points where the error is determined. Simultaneously, checking as per cl. 1.2.3 is carried out when the power supply is off. The indicators are considered to have passed the test, if they meet the requirements of cl. 1.2.4, 1.2.5, 1.2.3.

4.5. The current consumed (cl. 1.1.4) is checked with milliammeter of electromagnetic system with measurement limit 500 mA in compliance with the circuit given at Annexure 6.

4.6. Effect of overload on indicators (cl. 1.2.7) is checked: a pressure is developed in the head in accordance with cl. 1.2.7, held for 5 minutes, then the pressure is dropped.

The main error and variation is determined after holding the indicators under normal conditions (cl. 4.1) for 15 minutes.

While holding the indicators under pressure, drop in pressure should not be noticed.

The indicators are considered to have passed the test, if they, after testing correspond to cl. 1.2.4 & 1.2.5.

4.7. Effect of variable pressure on indicators (cl. 1.2.8) is checked on the device which creates cyclic and gradually changing pressure at frequency not exceeding 60 cycles per minute.

The indicators are considered to have passed the test, if they correspond to cl. 1.2.4 & 1.2.5 even after holding them at zero pressure for 2 hours.

4.8. Effect of length of cable connecting head and gauge (cl. 1.1.6) is checked: head and gauge are placed in normal working position and connected with 15m long cable according to Annexure 6, power is supplied and the readings are taken.

The indicators are considered to have passed the test, if they comply with requirement of cl. 1.1.6, 1.2.4 & 1.2.5.

4.9. Effect of inclination on the indicators (cl. 1.2.9) is checked: the gauge is fixed on a stand, which provides free rotation through 90° from vertical position towards right, left and from itself;

the gauge is connected to the head as shown in Annexure 6 and power is supplied. Then the gauge needle is set at any point on scale by gradually increasing the pressure in the head. The gauge is inclined through 90° towards right, left and from itself and the error is determined by holding in each position for 5 minutes. Then the head is fixed on the stand which provides free rotation into any position with respect to the vertical axis. The error is determined as per the above specific procedure inclining the head in any direction.

The indicators are considered to have passed the test, if they comply with requirements of cl. 1.2.9

All the tests are carried out in cold chamber without replacing the indicators. During the entire tests, indicators should be 'ON' and should be without pressure.

The indicators are considered to have passed the tests, if at the temperature $(-60 \pm 3)^{\circ}\text{C}$ change in readings does not exceed the values given in cl. 1.3.9 and if at temperature $(23 \pm 5)^{\circ}\text{C}$ - conform to the requirements (cl. 1.2.4 & 1.2.5) and if the coating is not damaged due to the effect of temperature $(-60 \pm 3)^{\circ}\text{C}$.

Note: After testing at minus temperature, the indicators should be dried at 60°C for 1 hour. Drying may be combined with the test procedure at plus temperature.

4.13. Test for the effect of increased temperature and determination of insulation resistance at increased temperature (cl. 1.3.1 & 1.3.9) are carried out as shown below.

The indicators are placed in testing chamber (head and gauge should be placed in separate chambers) and the main error is determined as per the procedure given in cl. 4.4 at normal conditions cl. 4.1. The measurements can be taken outside the chamber.

Temperature inside the chamber is raised upto the extreme value $(130 \pm 3)^{\circ}\text{C}$ for head and $(60 \pm 3)^{\circ}\text{C}$ for gauge. Indicators are held at the given temperature for atleast 2 hrs and the error is again determined as per the procedure given in cl. 4.4.

Simultaneously, insulation resistance is determined at this temperature as per the procedure given in cl. 4.11. The temperature is reduced upto $(23 \pm 5)^{\circ}\text{C}$ and after holding the indicators at this temperature for atleast 2 hrs, the error is again determined as per the procedure given at cl. 4.4. Difference in test results at extreme temperature and test results at $(23 \pm 5)^{\circ}\text{C}$ before and after testing is taken as the change in readings.

All the tests are carried out in heat chamber without replacing the indicators. During the entire testing procedure, the indicators should be in 'OFF' condition and without pressure.

The indicators are considered to have passed the test, if change in readings at $(130 \pm 3)^{\circ}\text{C}$ for head and

during test and correspond to cl. 1.2.4 & 1.2.5 after testing.

4.10. Electric strength of the insulation (cl. 1.2.10) is checked on the device which provides gradual increase in test voltage from 0 to 500 V, with a power of 0.5 kV on the higher voltage side. The indicators are held at this voltage for 1 minute and then it is gradually reduced upto zero.

While checking, one contact of the source of test voltage supply is connected to gauge (head) plug pins and the second contact - to non-insulated part of the gauge (head).

The indicators are considered to have passed the test, if they comply with requirements of cl. 1.2.10 and correspond to cl. 1.2.4 & 1.2.5 after testing.

4.11. Insulation resistance of electric circuits of indicators (cl. 1.2.11) is checked with ohmmeter voltage 0.5 kV. One of its wires should be connected to the plug pins and the second wire - to the non-insulated part of the gauge (head).

The indicators are ~~examined~~ considered to have passed the test, if they comply with requirements of cl. 1.2.11 during test and should correspond to cl. 1.2.4 & 1.2.5.

4.22. Test for the effect of low ambient temperature (cl. 1.3.1 & 1.3.9) is carried out in the following way. The indicators are placed in the testing chamber and the main error is determined as per the procedure given in cl. 4.4. under normal conditions (cl. 4.1). Measurements can be taken outside the chamber.

The temperature in the chamber is reduced upto $(-60 \pm 3)^{\circ}\text{C}$ and the indicators are held at the given temperature for atleast 2 hrs and the error is again determined as per cl. 4.4.

Difference between the test result at the extreme temperature and test result at $(25 \pm 5)^{\circ}\text{C}$ before and after the tests, is taken as the change in readings.

(60 ± 3)°C for gauge do not exceed the values specified in cl. 1.2.9, if the change in readings at (23 ± 5)°C conform to the requirements given at cl. 1.2.4 & 1.2.5, if the coating is not damaged due to the temperature (130 ± 3)°C for head and (60 ± 3)°C for gauge and if the insulation resistan at increased temperature is not less than 5 Mohm.

4. 14. Test for the effect of increased humidity (cl. 1.3.2) is carried out in the following way:

After determining the main error at normal condition the indicator is placed in heat and moisture chamber.

The indicators are subjected to the effect of the following cycles one after another with a duration of 24 each. Total number of cycles is 24. Each cycle consists of the following steps:

1) temperature in the chamber is increased upto (40 ± 2)°C for 1 to 3 hrs. Relative humidity during this period should not be less than 95%.

During this period of increasing temperature moisture should be condensed on the indicators;

2) a temperature of (40 ± 2)°C is maintained in the chamber for (12 ± 0.5) hrs from the beginning of cycle. Relative humidity during this period should be (93 ± 3)%

3) temperature in chamber is reduced upto 25°C in 4 to 9 h. During this period, relative humidity should not be less than 95%.

Temperature of 25°C and relative humidity not less than 95% are maintained in the chamber till the end of cycle.

During the last cycle, temperature in the chamber is reduced from 40 to 35°C and relative humidity not less than 95% in the first half of the cycle and not more than (95 ± 3)°C.

Note: If it is agreed by the Customer to reduce the duration of test upto 9 days with the following changes in the cycle:

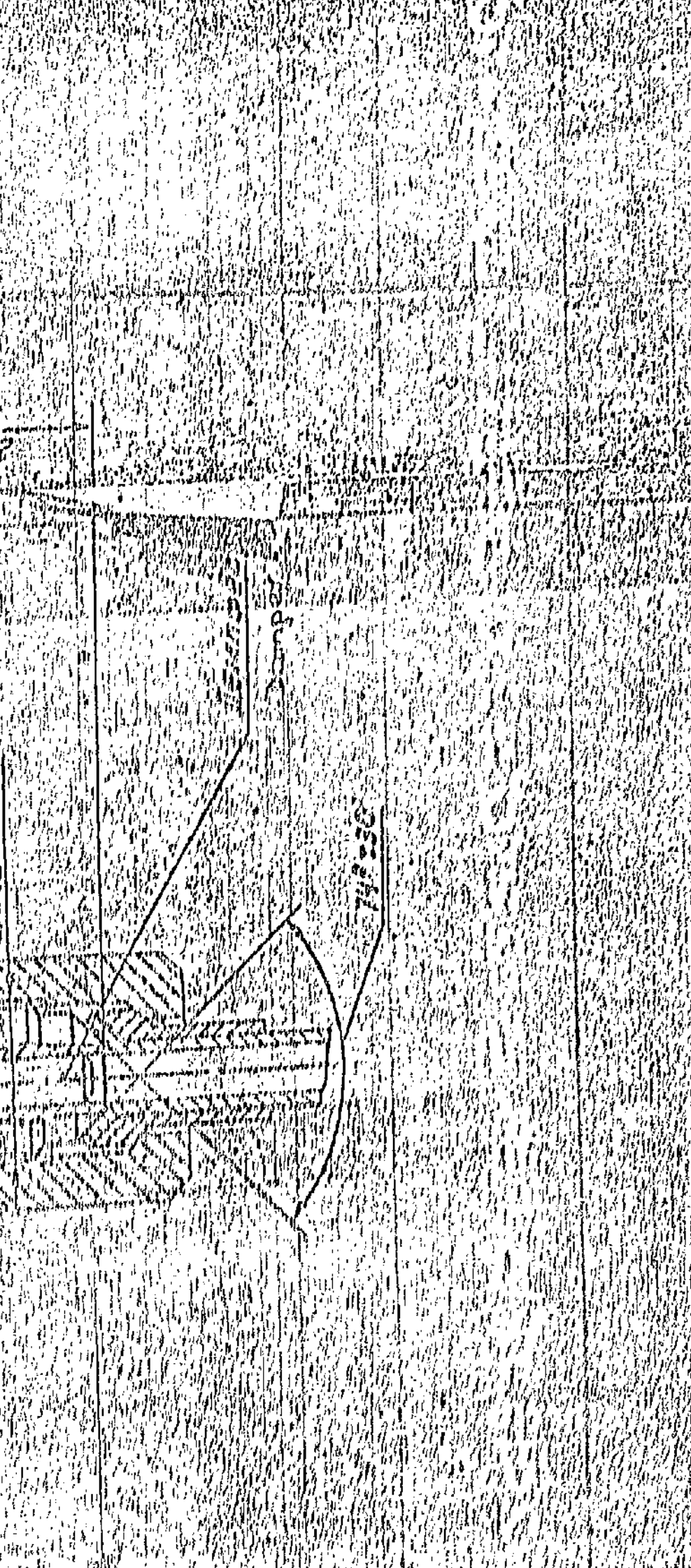
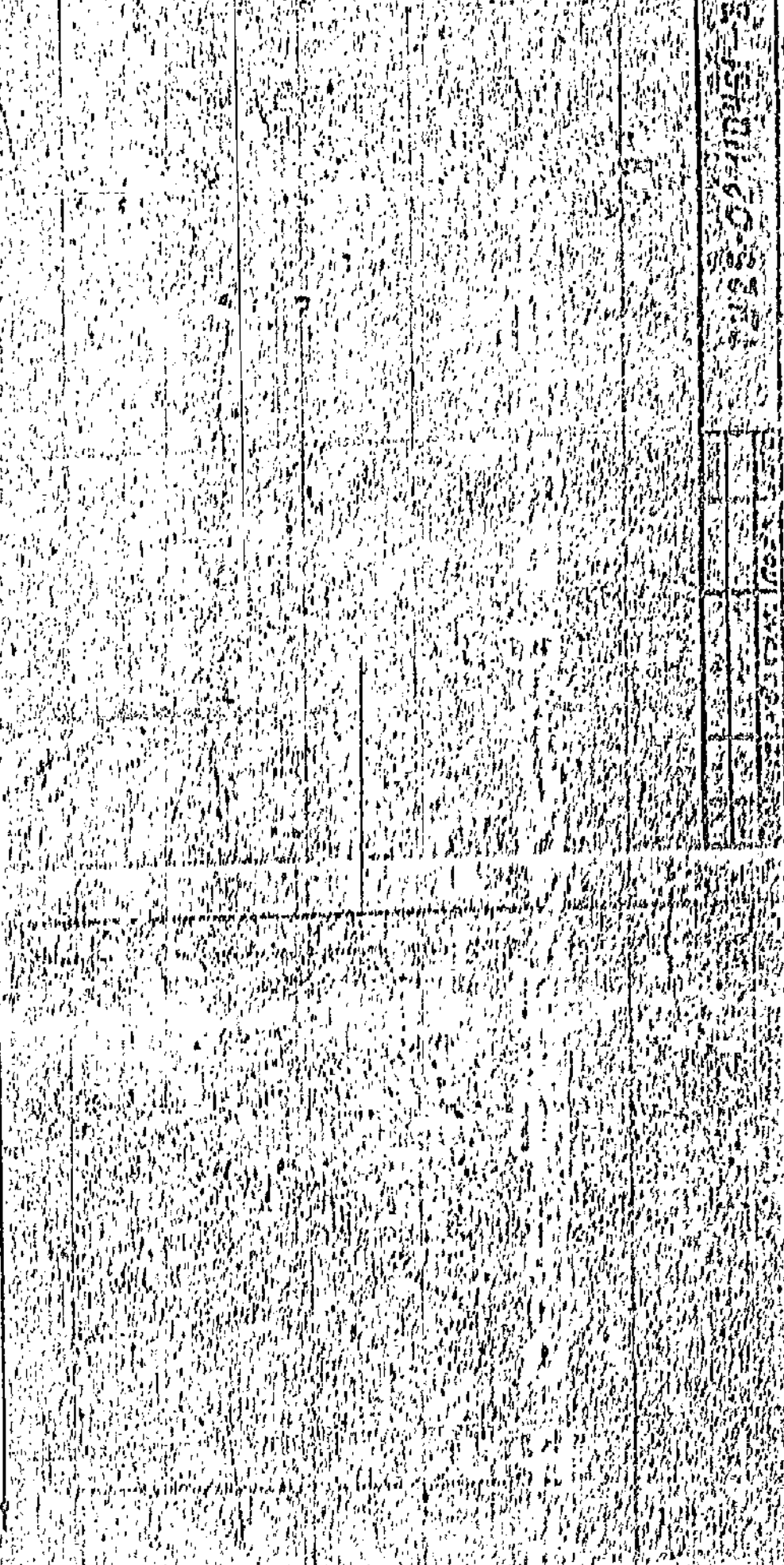
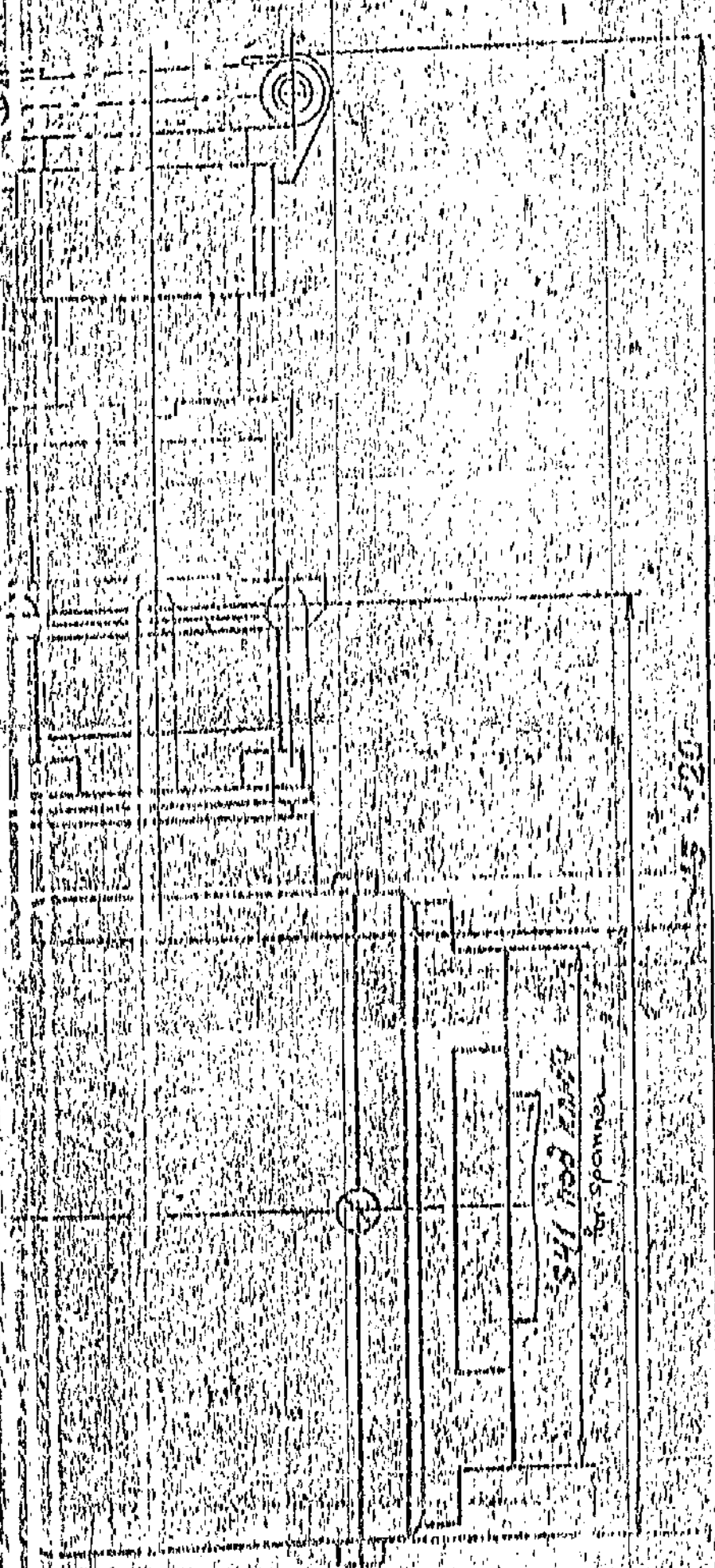
temperature in the chamber is increased upto 55°C (instead of 40°C) in 1 to 3 hrs;

maintain the temperature in chamber as 55°C (instead of 40°C) for (12 ± 0.5) hrs from the beginning of the cycle.

ПРИЛОЖЕНИЕ 2
Ameyare 2

РАЗМЕРЫ И ПРОСЕКАЮЩИЕ РАЗМЕРЫ ПРИЕМНИКА ДАВЛЕНИЯ ПО-11
Overall and connecting dimensions of receiver

Размеры и просекающие размеры приемника давления по-11



341 103 2254

for spanner

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for spanner

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for spanner

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for spanner

20

In technically based cases, intervals not exceeding two days are permitted during the test, but this period of interval will not be included in the duration of test. During the intervals, the indicators should be kept in closed chamber and relative humidity of air in it should not be less than 90%.

At the end of last cycle, error of the indicator is determined (change in readings is determined as per the procedure given in cl 4.13) and electric strength and insulation resistance are determined as per the procedures given in cl. 4.10 & 4.11. At this time, moisture condensate should not be present on the indicator surfaces.

If it is not possible to determine the error without removing out the indicators from the chamber, then measurement should be carried out not later than 15 minutes after removal from the chamber.

Electric strength and insulation resistance can be determined in 3 minutes after removing the indicators from the chamber.

Then the indicators are taken out from the chamber, kept in normal conditions for 6 hrs, visually checked for absence of corrosion, condition and quality of coating and the main error is determined.

The indicators are considered to have passed the test as per cl. 1.3.2, if they conform to the requirements given in sl. 1.2.4 & 1.2.5 after keeping in normal conditions.

Traces of corrosion in splines and on the edges of fastening parts are permitted on metallic & non-metallic inorganic coatings after testing provided these places can be dressed and subsequently coated with grease and varnish on all the units of acceptable batch.

4.15. Test for the effect of sinusoidal vibration on the indicators (cl. 1.3.3, 1.3.7 & 1.3.9) is carried out as per the norms given in table 4, by gradually changing the frequency in each subrange from lower to upper limits and vice versa with an acceleration of one octave per minute (1 subrange frequency per minute)

Table 4

Frequency subrange, Hz	Amplitude of vibration acceleration m/s ²	
	for head	for gauge
16 to 31.5		
31.5 to 63		
63 to 125		
125 to 250		
250 to 500	100	15

Duration of effect of vibration in each subrange and in one plane is not less than 2 minutes.

Before starting the tests, main error is determined under normal conditions (cl. 4.1) in accordance with cl. 4.4.

The test is carried out in each of the planes and change in readings is determined in each frequency subrange.

The test may be carried out separately for head and gauge in each of the planes.

Indicators are considered to have passed the test, if they, during the vibration test, conform to the requirements given at cl. 1.3.7 & 1.3.8 and after testing they should conform to the requirements given in cl. 1.2.4 & 1.2.5.

1.16. Resistance of indicators to the effect of impact loads (cl. 1.3.4) is checked: the head and gauge are fixed on the device one after another, which ensures overload with acceleration upto 150 m/s^2 - for head and upto 100 m/s^2 - for gauge at frequency 40 to 120 impacts per minute in three mutually perpendicular planes. The head and gauge are connected as shown in Enclosure 6 and a pressure equivalent to half of measurement range is developed in the head.

The test is carried out in 'ON' condition. Total number of impacts is 10000 and number of impacts in each direction is 3333.

The indicators are considered to have passed the test, if they, after completing the test, comply with the requirements at cl. 1.2.4 & 1.2.5.

4.17. Impact resistance of the head (cl. 1.3.6) is checked on the device, which ensures overload of 1000 m/s^2 in 3 mutually perpendicular planes. Number of impacts in each plane is 3. The head is connected to the gauge according to Annexure 6. A pressure equal to half of measurement range is raised in the head. Checking is carried out when the supply is 'ON'.

The indicators are considered to have passed the test, if they, after testing, conform to the requirements given at cl. 1.2.4 & 1.2.5.

4.18. Test for the effect of single stroke impacts (cl. 1.3.5) is carried out on the device, which ensures an overload of 196 m/s^2 in working mode of the indicator. Number of impacts is 150, acceleration 196 m/s^2 , pulse duration is 0.03 s , frequency of impacts is 20 impacts per minute.

The indicators are considered to have passed the test, if they, after testing, correspond to the requirements given at cl. 1.2.4 & 1.2.5.

4.19. Error from change in supply voltage of indicators (cl. 1.3.10) is checked:

connect the gauge to the head according to Annexure 6. Set the needle on one of the indicators on scale by gradually increasing the pressure in the head at nominal supply voltage; error in readings which causes change in supply voltage is determined by changing the supply voltage upto the maximum permissible value towards minus and plus sides.

The indicators are considered to have passed the test, if they conform to the requirements given at cl. 1.3.10.

4.20. Test for the effect of overvoltage pulses (cl. 1.3.11) is carried out by connecting the gauge to the head according to circuit given at Annexure 6. The overvoltage pulse is supplied to the special device with amplitude upto 70 V and duration of 3 ms coming after every three minutes in 1 hr.

The indicators are considered to have passed the test, if they, after testing, conform to the requirements given at cl. 1.2.4 & 1.2.5.

4.21. Test for the effect of short-period voltage drops (cl. 1.3.11) is carried out by connecting the gauge to the head according to Annexure 6; supply with voltage of 10 V is given and held for 1 minute. After an interval of 1 minute, the supply with

voltage of 10 V is given and held for 1 minute. After an interval of 1 minute, the supply with voltage of 10 V is given again. The specified cycle is repeated 10 times.

The indicators are considered to have passed the test, if they, after testing, conform to the requirements given at cl. 1.2.4 & 1.2.5.

1.2.2. Test for the effect of short-period supply of reverse polarity voltage (cl. 1.3.11) is carried out by connecting the gauge to the head according to Annexure 6. Reverse polarity voltage of 30 V is supplied for 1 minute.

The indicators are considered to have passed the test, if they, after testing, conform to the requirements given at cl. 1.2.4 & 1.2.5.

1.2.3. Effect of variable magnetic fields (cl. 1.3.12) with a capacity of 80 A/m, obtained by a.c. with frequency 50 and 400 Hz, is checked by placing the indicators in the centre of solenoid of diameter 1m at 400 ampere-coils.

Change in readings is observed when the indicators are placed in the variable magnetic field. Checking is carried out within the limits of 90 to 180° at maximum motion limit when the solenoid is revolved through 90, 180 & 270° in two mutually perpendicular planes.

Effect of constant magnetic field with capacity 400 A/m on indicator is checked on special device by placing the indicator in magnetic field.

The indicators are considered to have passed the test, if they conform to cl. 1.3.12.

1.2.4. Protection from water falling inside the indicator body (cl.

1.3.13) is checked:

The indicators are placed in spray chamber and water is sprayed uniformly on the gauge from all sides of glass, while the remaining part of the body should be protected from the water splashes (making part of body with tape to be covered with insulated tape); on the head from 150° to 225° and top at an angle of 40 to 45° with intensity (5±2) mm/min for atleast 2 hrs.

Temperature of water in the begining of test should be less than the temperature of indicator by 5 to 10°C.

Spray effective area should be atleast 30 cm more than the overall dimensions of the indicators. Intensity of the spray is measured at the place of location of indicator for atleast 30 seconds with the help of cylindrical collector of diameter 10 to 20 cm and depth not less than half of the diameter.

The plug connectors should be protected.

The indicators are considered to have passed the test, if they, after testing, correspond to cl. 1.2.4 & 1.2.5 and no water is detected inside the indicator.

4.25. Inorder to test the indicator for dynamic effect of dust (cl. 1.3.14), they are placed in the chamber is such a way that, the conditions are most suitable to the working conditions. The plug pins should be connected with braiding and union should be closed with plug.

Minimum distance from the indicator to the chamber walls should not be less than 10cm. If more than one indicator are tested at a time, then the distance between them should not be less than 10cm.

The test is carried out by blowing the indicator with air containing dry dust mixture (70% of quartz sand, 15% of chalk & 15% of china clay) quantity of which is equal to $15 \pm 2 \text{ gm/m}^3$ (or 0.1% of working volume of the chamber). The dust is supplied uniformly during the entire testing period with an acceleration of 10 to 15 m/s in 2 hrs.

Size of the particle in the dust mixture should not be more than 2mm. Residue of particles, which do not pass through the sieve No. 0.2 as per GOST 6613-86 should not exceed 5%.

Silica dust of the same dispersity is permitted in place of the quartz sand.

Inorder to determine the dust penetration of the indicator fluorescent powder (luminophore $\phi \text{KN-03}$) is added, quantity of which is equal to 10% of total quantity of the mixture.

Size of the powder Φ K Π -03 should be such that it pass through the sieve No. 005 to GOST 6613-86.

Temperature of air in the chamber during the test should not exceed the working temperature.

After testing, the indicators are removed from the chamber, dust is removed from the outer surfaces by wiping with soft flannel cloth and they are visually checked.

Then the main error and variation are determined. After this, the indicators are opened and inner surfaces are checked. If the fluorescent powder is used for detecting the dust entered inside, the indicators are placed in dark room, opened and subjected to ultraviolet rays.

The indicators are considered to have passed the test, if varnish coating on outer surfaces is not damaged and if the indicators, after testing, correspond to cl. 1.2.4 & 1.2.5.

Dust inside the body is not permitted.

4.26. Test for the effect of dew & fog (cl. 1.3.15) is carried out in the following way:

The indicators are placed in the testing chamber and main error is determined as per the procedure given at cl. 4.4 of TY under normal conditions.

Temperature in chamber is reduced upto 20°C . The indicators are held at this temperature for 2 hrs in 'OFF' condition.

Then the chamber is opened, temperature is raised upto the normal temperature, then it is started and held for 3 hrs. Error readings of the indicators are taken immediately after the normal temperature is attained in the chamber and after every hour. Then the indicators are visually checked.

Note: The indicators can be taken out of the chamber before the temperature is increased upto the normal.

The indicators are considered to have passed the test, if they correspond to the requirement given at cl. 1.3.9 at minus $(20\pm 3)^{\circ}\text{C}$ and conform to the requirements given at cl. 1.2.4 & 1.2.5 after holding the indicators at $23\pm 5^{\circ}\text{C}$ and if coatings are not damaged and corrosion is absent.

4.37. Service life (cl. 1.4.2) is confirmed by collecting and working out the statistical data under operating conditions.

- 4.28. Trouble-free working of the indicators (cl. 1.4.1) is tested as per the programme.

5. Transportation & Storage

- 5.1. The packed indicators can be transported to any distance ~~be~~ by all means of transport.
- 5.2. Transportation conditions, in case of climatic factors, are applicable to open areas.
- 5.3. The indicators in packing can be stored for a period of 6 years provided they are represerved once in 3 years (in heat controlled store houses) and for a period of 2 years in open areas.
- 5.4. The boxes containing packed indicators should ^{be} layed in not more than 6 rows one above the other during storage and transportation.

6. Operating Conditions

- 6.1. The operating conditions are given in technical description and in the operating instructions.
- 6.2. The head and gauge (from the side of glass) can be treated with degasing, deactivating and disinfectious solutions, which avoid negative effect on external materials and coatings.

Annexure I

List of documents, for which reference is made
in the present TY

Designation of the document	Nomenclature of the document	Sheet No in TY
GOST 9.048-75	Unified system ^{of} protection from corrosion and ageing. Technical units. Testing method for resistance to the effect of fungus.	6
GOST 6402-70	Spring washers. Technical requirements.	29
GOST 6613-86	Fabric gauze with square cells. Technical requirements.	25

Annexure 5

List of the equipment for testing the indicators

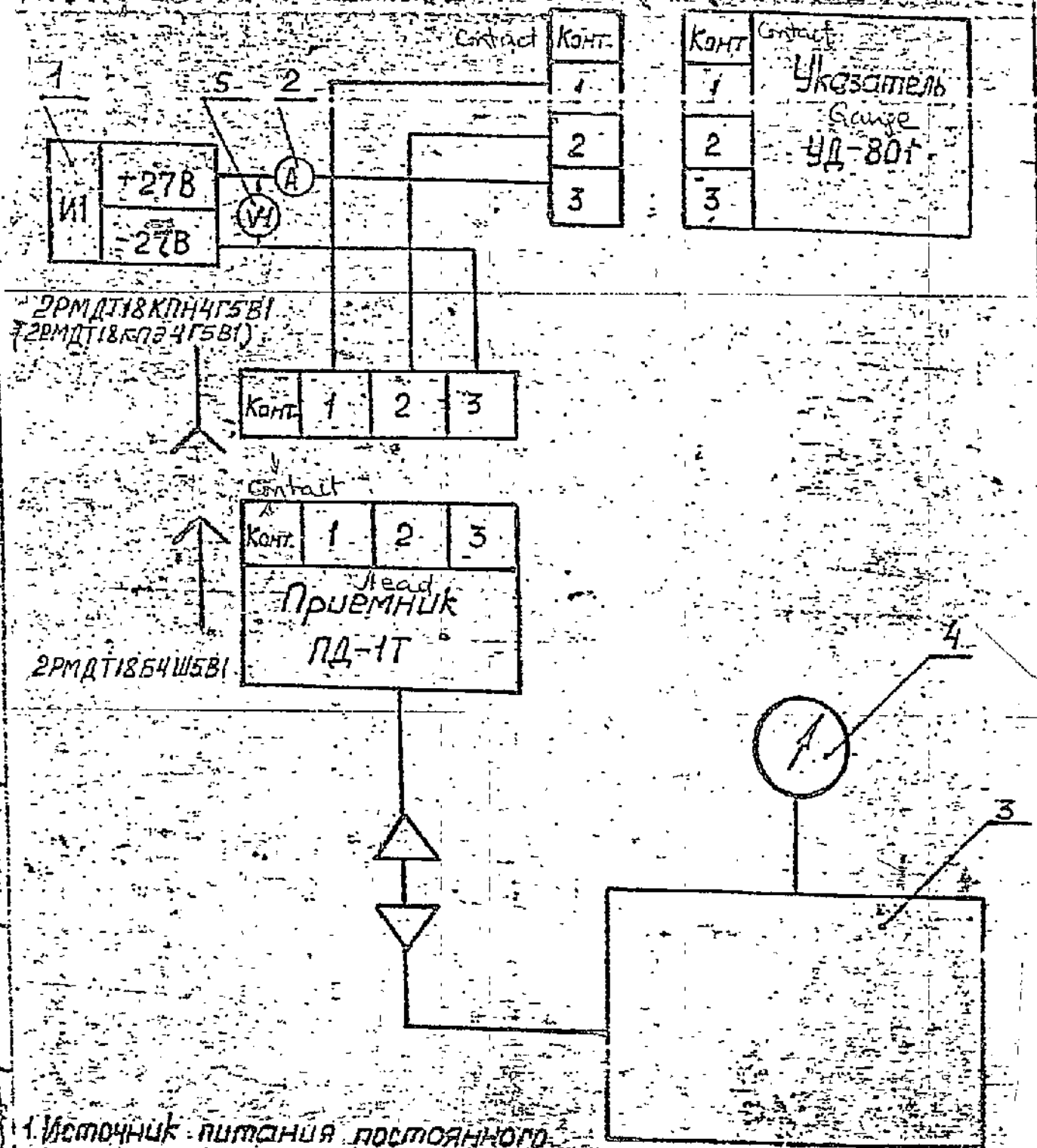
Name		Main technical characteristics
Balance for statistical weighing		Measurement limit from 0.05 to 1 kg; value of a division - 1 gm.
Vernier calipers		MM -1-100-0.1
Heat and humidity chamber		Temperature - upto 100°C; relative humidity - upto 100%.
Heat chamber for testing		Temperature - upto +100°C.
Heat chamber for testing		Temperature - upto +150°C.
Cold chamber		Temperature - upto minus 70°C.
Spray chamber		Spray intensity - upto 15 mm/min.
Electromagnetic vibration chamber		Frequency - from 5 to 5000 Hz; acceleration - upto 392 m/s ² (40g).
Device for overload impacts		Maximum number of impacts per minute - upto 120; acceleration - upto 50g; maximum drop height of table - 30mm.
Dust chamber		Speed of air stream - from 1 to 15.8m/s
Impact stand		Speed of rotation of table - 9 rpm.
Impact stand		1470 m/s ² (150g).
		Peak impact acceleration - upto 9800m/s ² (1000g).
Manometer		Accuracy class 0.4
D.C. power supply source		Voltage - 30 V.
Device for checking electric strength of the insulation		Voltage - 5000 V; power - 0.5 kW.
Ohmmeter		Voltage - 250 V.
D.C. Voltmeter		Class not less than 1.
D.C. Milliammeter		Measurement limit - 500 mA; class 0.5
Device for determining the effect of inclination (in any position direction).		
Device for developing variable pressure.		Frequency of pressure change - not more than 28 cycles per minute.
Pulse formation block		Duration - 3 ms.
Cylindrical collector		Diameter 10 to 20 cm, depth - 0.5 diameter.

Note: Other equipment and testing devices can with similar characteristics can also be used.

Приложение 6
 Annexure 6
 СХЕМА ПРОВЕРКИ ИНДИКАТОРОВ

ИДПМ-3

ВИА-3



1. Источник питания постоянного тока. 1. D.C. power supply source.
2. Амперметр. 2. Ammeter.
3. Источник давления. 3. Pressure developing source.
4. Манометр образцовый 10. 4. Manometer MO.
5. Вольтметр. 5. Voltmeter.