JOINT-STOCK COMPANY
RESEARCH-AND-INDUSTRIAL ENTERPRISE
«ETALON»

"Etalon" provides complex supplying with temperature measurement instrumentation over the temperature -200°C to 2500°C.

"Etalon" designs and produces working and standard temperature measurement instrumentation for all the branches of industry.

Temperature measurement and regulation means;

Metrologic equipment:

Automated working station of testing resistance transducers,

Thermostats, completely black bodies, precision millivoltmeter.

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METROLOGY EQUIPMENT

INTRODUCTION

FROM PRIMARY REFENRECE STANDARDS TO AUTOMATED METROLOGY LABORATORIES

Nowadays we cannot imagine operation of modern production facilities, oil and gas transport systems, weather forecasting systems, in aviation, marine transport and automotive transport, food industry, water supply facilities, and many other areas without temperature measuring instruments. Metrology services at companies ensure data accuracy by periodic control of measuring instruments operation using reference standards and calibration instruments.

Metrology instruments produced by JSC Research and Production Company "ETALON" provide highly accuracy of temperature meters calibration and make it possible to perform practically any task both in production process metrology support and in activities of Russian Federation "GosStandard" (State Standard Authority). Federal Inspection Authority of Russian Federation on nuclear and radiology safety has issued a licence ("GosAtomNadzor" of Russian Federation), which give authorization to design and produce equipment for nuclear energy consuming facilities.

Equipment produced by JSC Research and Production Company "ETALON" makes it possible to equip contact and radiation calibration temperature meters laboratory.

To control and to calibrate temperature probes we produce Unit UPST-2M, which is an integrated metrology complex mounted on a laboratory table (except for thermostats), This unit is simple in operation, allows carrying out simultaneous calibration of up to eight thermocouples and up to ten resistance temperature devices. Unit UPST-2M has been in operation for several years at Kursk Nuclear Power Station, Kolskaya Power Station.

Resistance temperature devices calibration workstation (PTS Work Station) which is used for calibration of operating resistance temperature devices of all types, it is linked to PC and generates thermal resistance calibration charts, calibration data recording and storage.

Our Company can supply a wide range of temperature measuring instruments and metrology equipment for calibration laboratories of Russian State Standard Authority and Metrology Services in Industry.

REFERENCE TEMPERATURE SENSORS

REFERENCE THERMOELECTRIC PLATINUM-RHODIUM PLATINUM REFERENCE TRANSDUCERS (PPO)

PPO is registered in Public Register of Measuring Instruments under No. 1442-00.

Function:

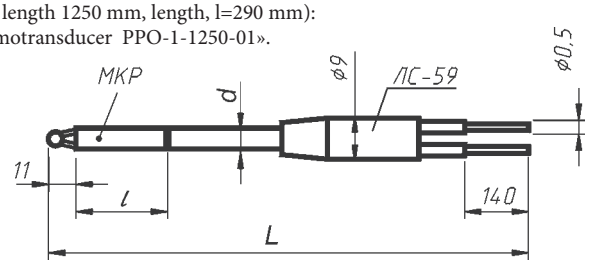
Thermoelectric platinum-rhodium platinum transducers are used as calibration means for testing thermoelectric thermometers in air or neutral environment within the temperature range of 300…1200 ° C.

Specifications according to design requirements TU 50-104-2000:

- key specifications in compliance with State Standard regulations GOST R 52314-2005;
- probability of failure-free operation withiin 500 hours, min - 0.90;
- unit lifetime, hours, min 500.

Order sample:

PPO, Grade 1, Model 01
(total length 1250 mm, length, l=290 mm):
Thermotransducer PPO-1-1250-01».



Type	Grade	Model	Length L, mm	l, mm	d, mm	Mass,gr
for MTP-2MR -50-500 Heater (work surface length : 500 mm)						
PPO	1	00	1000	290	4.0	50.02
		01	1250			52.48
		02	1600			56.21
	2	00	1000			50.02
		01	1250			52.48
		02	1600			56.21
	3	00	1000			50.02
		01	1250			52.48
		02	1600			56.21
For Heaters MTP-2MR-50-500 and MTP-2MR-70-1000 (work surface length 500 and 1000 mm)						
PPO	1	03	1250	530	4.0	57.52
		04	1600			68.61
	2	03	1250			57.52
		04	1600			68.61
	3	03	1250			57.52
		04	1600			68.61

REFERENCE THERMOELECTRIC PLATINUM-RHODIUM REFERENCE TRANSDUCERS (PRO)

The type of measuring instrument is registered in the Federal Information Fund for Ensuring the Uniformity of Measurements under No. 41201-09

Function:

Thermoelectric platinum-rhodium transducers are used as calibration means for testing thermoelectric thermometers in air or neutral environment within the temperature range of 900…1800°C.

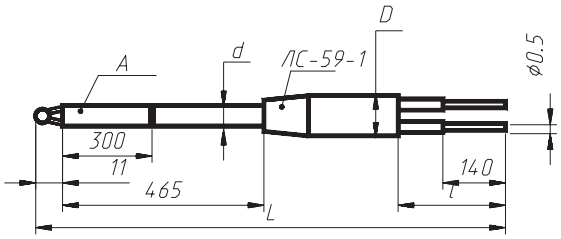
Specifications according to design requirements TU 50-314-2002:

- key specifications in compliance with State Standard regulations GOST R 52314-2005;
- probability of failure-free operation withiin 80 hours, min - 0.92;
- transducer average lifetime, years, min - 6.

Order sample:

PRO, Grade 2, Model 02
(length 1600 mm, tube material grade - K TU 14-8-190-91):
«Thermotransducer PRO-2-1600-02».

Type	Grade	Model	Dimensions, mm			Mass, kg	Tube A material grade
			d	D	L		
PRO	1-3	01	4,7	9	1250	0.064	Ceramic C799, 4.7×1.0×500 mm
		02			1600	0.084	
PRO	1-3	07	4,0	9	1250	0.068	Sapphire, 4.0×0.7×500 mm
		08			1600	0.086	



REFERENCE RESISTANCE THERMOMETERS (ETS-100), GRADE 3

ETS-100 is registered in Public Register of Measuring Instruments under No. 70903-18

Function:

Reference resistance thermometers ETS-100 are desinged for calibrating temeperature measuring instruments within the range of temperatures -196…0 °C or 0...+660 °C in compliance with State Standard GOST 8.558-93.

Confidence error at confidence probability 0.95, ° C	
at t= -196°C	0.05
0.01°C	0.02
231.928°C	0.04
419.527°C	0.07
660.323°C	0.15

Specifications	ETS-100
Measured temperatures range, °C	-196…0; 0…+419,5
Grade	3
Rated resistance at 0°C R_0, Ohm	100±0.05
Temperature instability equivalent to the water triple point after annealing at the temperature of 10°C above the upper-range value, °C, max	0.01
Resistance ratio at the temperature of 100°C to the resistance of water triple point, , W_{100}	1.3910
Electric resistance of isolation between connection terminals and case under the temperature (20±2)°C and the relative humidity (60±15)%, MOhm, min	100
Diameter of protective tube, mm	5
Thermometer head diameter, mm	20
Length of installation base, mm	670
Mass, gr, max	100

CALIBRATION RIGS OF TEMPERATURE SENSORS

GRADUATION AND CALIBRATION RIG OF TEMPERATURE SENSORS (UPST-2M)

UPST-2M is registered in Public Register of Measuring Instruments under No. 6173-02

Function:

Calibration rig of temperature sensors UPST-2M is a uniform metrological complex and is designed for :

- control and calibration of 2D and 3Dclass standard thermoelectric transducers and all models of operating thermoelectric transducers of the temperature range from 0 to 1200 ° C by two methods (direct and electrode-by-electrode testing) in compliance with Russian State Standard GOST 8.338-2002, MI 1744-87

- control and calibration of resistance thermometers at the temperature range from 0 to 1200 ° C in compliance with Russian State Standard GOST 8.461-82.

The installation supports simultaneous control and calibration of 8 thermotransducers and 10 resistance thermometers.

Installation UPST -2M completely substitutes off-the-shelf installations UPST -1, UPST -2 and UTT-6 and has following advantages:

- an opportunity for calibration and graduation of thermotransducers by two methods – direct and electrode-by-electrode checking
-an opportunity for calibration and graduation of standard thermotransducers
-smaller overall dimensions and test unit weight as compared to UTT-6 and UPST -2
-universal application (unit construction gives an opportunity to provide various configurations)
-each unit being a part of UPST -2M can be supplied independently.

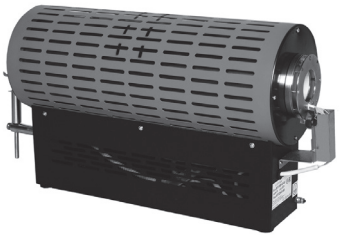
Thermostats and heaters are used as temperature generation units in UPST -2M.
Temperature control devices delivered as parts of thermostats (accept neutral or steam ones) and heaters provide independent setting and automatic maintenance of specified temperature modes in heaters and thermostats which ensure simple operation.
Precision millivoltmeter V2-99 is used as measuring device.
Along with precision millivoltmeters, heaters and thermostats the main parts of UPST -2M are measuring devices BI-1 and BI-2.
Measuring device BI-1 is intended for switching of measuring circuits on calibration and graduation of thermoelectric transducers.
Measuring device BI-2 is designed for electrical current regulations and switching of measuring circuits during resistance thermotransducers calibration.
To increase the accuracy of of temperature readings of hermostats and heaters a nickel leveling block can be used. The company can deliver the leveling blocks made upon customers' specifications or blank parts in which a user can drill apertures for specific temperature gauges independently

TN-1M

TP-2

BI-2, BI-1

V2-99



MTP-2MR

UPST-2M is produced according to design requirements TU 50-96 DDSH1.270.003 TU

Specifications	UPST-2M
Range of reproducible temperature, °C	Within the limits of 0..1200, depends on thermostats and heaters being a part of specific UPST-2M
Range of measured DC voltage, mV	-300…+300
Compartible voltage precision measuring instrument	millivoltmeter V2-99*
Quantity of simultaneously checked (calibrated, graduated) sensors, items.:	
- thermoelectric transducers	Up to 8
- resistance thermotransducers	Up to 10
Type of climate group as per GOST 15150-69	UHL4.1
Ambient air temperature, °C	20±5
Power supply	~ 220 V; 50 Hz
Input power**, W, max:	
- unit BI-1	Power is not required
- unit BI-2	10
Overall Dimensions**, mm, max:	
- unit BI-1	242x132x470
- unit BI-2	242x132x470
Mass**, kg, max:	
- unit BI-1	5
- unit BI-2	6.5
* if required any type of DC voltmeter fidelity class not worse than 0.01 on 100 mV measurement limit and with resolution capacity not more than 1 mcV can be used ** overall dimensions, mass and power consumption of thermostats, heaters, millivoltmeter B2-99 and other components of UPST-2M - see corresponding description in Section "METROLOGICAL EQUIPMENT "	

Equipment set UPST-2M:

Name of equipment	Quantity	Notes
Measuring unit 1 (BI 1)	1	Operating with thermoelectric transducers
Measuring unit 2 (BI 2)	1	Operating with resistance temperature devices
V2-99	1	
Zero thermostat TN-1M	1	
Steam Thermostat TP-2	1	
Heater MTP-2MR-50-500	2	
Documentation set	1 set	
Supplied additionally (if requested)*		
Zero thermostat TN-2M, Zero thermostat TN-3M		Temperature generation of 0°C
Regulated thermostat TR-1M-300, TR-1M-500		Range of generated temperatures +40...+200 °C
Heater MTP-2MR-70-1000		Range of generated temperatures +100...+1200 °C
Reference thermoelectric transducer (PPO)		1, 2, 3 classes length 1000, 1250, 1600 mm.
Reference resistance thermometer ETS-100		Range of temperatures -196...0 °C or 0...+660 °C
The leveling unit for heater MTP-2MR-50-500, length 140 mm. Model -00 (Fig.1) Model -01 (Fig.2) Model -03 (Fig.3)		 with one aperture for PPO with apertures for PPO and calibrated probes of glass type
Ice crushing unit UDL-1		
* Помимо указанного оборудования в состав UPST-2M может быть включено любое необходимое оборудование из раздела "МЕТРОЛОГИЧЕСКОЕ ОБОРУДОВАНИЕ"		

Leveling Unit
Nickel NP1 GOST 492-73

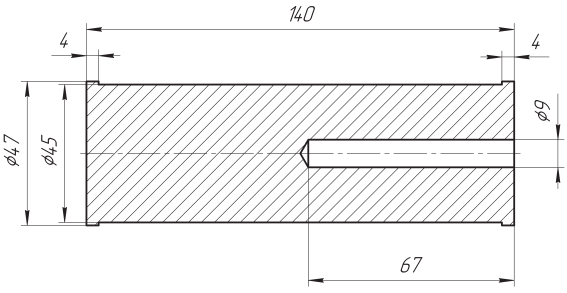


Fig.1

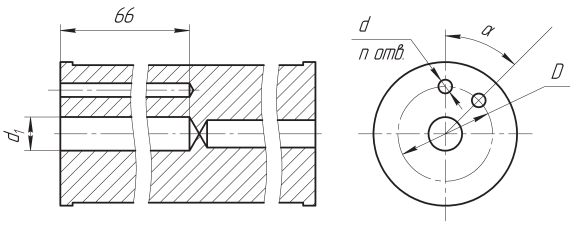


Fig.2
See Fig.1 for more details

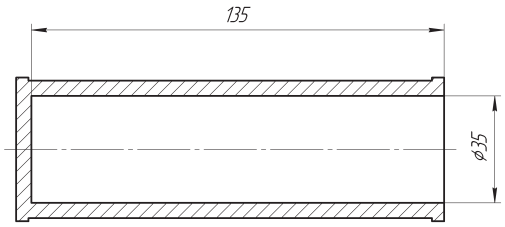


Fig.3
See Fig.1 for more details

Order sample:

"Installation UPST-2M and accessories:
Measuring units BI-1, BI-2, millivoltmeter V2-99, Zero thermostat TN-1M, Steam thermostat TP-2, Heater MTP-2MR-50-500 - 2 units."

- Dimensions (d, d_1),
- layout (D),
- Apertures quantity (n) -
is specified in the Customer's Order

AUTOMATED WORKSTATION FOR RESISTANCE TEMPERATURE DEVICES CALIBRATION (PTS WORK STATION)

PTS Work Station is registered in Public Register of Measuring Instruments under No. 22190-01.

Function:

Automated workstation for resistance temperature devices (PTS Work Station) is metrology complex designed for automatic calibration of resistance temperature devices according to Russian State Standard GOST 8.461-82 and sets of resistance thermotransducers, designed for measuring demperature difference in various services including State Metrology Service and Metrology Services of Leagal Bodies.
Installation consists of a measuring switchboard KI9901, PC, a set of thermostats and a number of auxiliary devices

Functions of automated workstation PTS Work Station:

When operating in a dialogue mode with the user the software performs the following functions:
- control over an operating mode of the measuring switchboard, input terminal being connected with calibrated temperature sensors and standard resistance thermometers
- checking the correct connection of sensors and express-test for operability
- control over the regulated thermostat operation (workstation can include ip to three regulated thermostats)
- tracking for stabilization of parameters of calibrated sensors and standard resistance thermometer after their installation in thermostat
- calibration results generation based on the number of measurements
- generating calibration reports and saving them in the database
- calibraiton of resistance temperature devices
- pair sensors calibration
- review the results of previous calibrations
- carrying out metrological service of automated workstation and generating corresponding protocols

- providing access to the detailed help file containing text and graphic information sufficient for training a beginner to work with automated workstation for resistance temperature devices

PTS Work Station is produced according to design specifications TU 50-00 DDSH1.270.004 TU

Specifications	PTS Work Station
Temperature range, in which calibration is possible	is defined by reproduction temperature range provided by thermostats
Types of calibrated sensors	Copper and platinum resistance thermotransducers with R_0 max 1000 Ohm
Quantity of simultaneously calibrated sensors, number.	up to 10
Classes of calibrated sensors in compliance with GOST 6651-94	A, B, C
Sensors connection circuit	2, 3, 4 wire
Time of measurement on one channel, sec	2 ...16
Warm-up time, hours, max	2, is defined by time of thermostat achieving specified temperature mode
Type of climate group as per GOST 15150-69	UHL4.1
Ambient air temperature, °C	20±5
Power supply	~ 220 V; 50 Hz
Input power KI9901*, W, max	15
Overall Dimensions KI9901 (without terminal panel)*, mm, max	270x110x355
Mass KI9901*, kg, max	4
*For overall dimensions, mass and power consumption of thermostats, cryostats and other components of PTS Work Station – see corresponding description in section " METROLOGICAL EQUIPMENT "	

One of the Models of PTS Work Station

During calibration in several temperature points it is sufficient to specify values of these points or temperature range limits and temperature resolution (the rest of calibration process is done automatically without user).

PC requirements to be used with PTS Work Station:

IBM PC 486 and above
coprocessor availability - not required
RAM - min 16 MB;
Disc space - min 15 MB;
OS - Windows 9^x, 2000, XP.

Equipment set PTS Work Station:

Required supplied set	
Software	1 set
Documentation set	1 set
Measuring switchboard KI9901 with connector block	1 set
Cables set	1 set
Supplied additionally (if requested)	
PC	required
Printer	
Standard reference resistance thermometer ETS-100	
Zero thermostat TN-1M, TN-2M, TN-3M	is defined by temperature values, which are planned to be reproduced during operation of PTS workstation
Steam thermostat TP-2	
Regulated thermostat TR-1M	
Regulated cryostat CR -40-2	
Ice crashing device UDL-1	applied with zero thermostats
Power cable	
* In additoin PTS Work Station can include any required equipment from Section "METROLOGY EQUIPMENT"	

Order sample:

«PTS Work Station in a set:
- Required supplied set,
- Zero thermostat TN-2M - 1 item.;
-steam thermostat TP-2 - 1 item.;
- unit UDL-1 - 1 item.»

PRECISION MULTIMETER INSTRUMENT V7-99 *(UNDER DEVELOPMENT)*

Function:

PRECISION MULTIMETER INSTRUMENT V7-99 is intended for high-precision measuring and statistical processing of measured values of the main measurable quantities: DC voltage, DC current, DC resistance and DC resistances ratio.

Besides, the implementation of mathematic calculations allow V7-99 to measure and perform statistical processing of the secondary measurable quantities, which are functionally related to the main measurable quantities – the temperature values of some thermoelements and various physical quantities which are transformed by the primary transformer into a unified output signal (0-5) мА (milliampere), (4-20) мА, (0-5) V, (0-10) V. Measurements are taken throughout two independent measuring channels, providing determination of the value difference in case of taking measurements throughout two channels of homogeneous values.

Besides the operation with the internal standards of resistance, the multimeter has the ability of taking resistance measurement by using external single-value measures of electric resistance with the measured resistance (resistance thermoelement) connected up to one channel and the external resistance measurement – to the other.

The precise value of the measurement resistance is entered into the multimeter and the multimeter having taken measurement of the resistance difference throughout the two channels, calculates the quantity of the resistance connected to the first multimeter channel. When the thermal resistance transducer being connected to the multimeter first channel, the multimeter can calculate the temperature value for the given resistance temperature devices by the measured resistance value.

V7-99

Multimeter can be used in the laboratories of the public metrological service and of legal entities to take precise measurements of electrical quantities and temperatures. The metrological specifications of the multimeter provide the opportunity of carrying out the calibration of the second- and third-class standard thermoelectric transducers, of all types of the operational thermoelectric transducers and resistance temperature devices.

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Specifications	V7-99
The types of sensors to be connected	
- thermoelectric converter	- all types under Russian Federation State Standard GOST R 8.585-2001, - individual calibration PPO under all-Russian Federation GOST P 8.611-2005
- resistance temperature device	- all types according to GOST 6651-94, - individual calibration under MTSh-90
Indicator resolution capacity	6; 7
The number of measuring channels	2 (while measuring the current and the resistance difference - 1)
Measuring values difference	under homogenous values throughout two channels
Statistical treatment	arithmetic mean, Standard deviation
Link to PC	RS-232
Ambient air temperature, °C	20±5
Power supply	~ 220 V; 50 Hz

Values measured by the precision multi meter instrument V7-99

Measured parameter	Measurement range	Relative error tolerance limit	input resistance, megaohm, min	Measuring current, mA
Voltage	300 mV	0.01%	min 500 MOhm	-
	3 V	0.02%	min 10MOhm	-
	30 V			
Resistance	30 Ohm	0.01 %,	-	4
	300 Ohm		-	1
	3 кOhm		-	0.1
	30 кOhm		-	0.01
Current	3 mA	0.05%	max 100 Ohm	-
	30 mA		max 10 Ohm	-
Resistance when using the external measure of electric resistance measurement	30 Ohm	0.005 %	-	4
	300 Ohm		-	1
	3 кOhm		-	0.1
	30 кOhm		-	0.01
Temperature	measured by the thermoelement in use			is measured in accordance with the primary measured value
Physical value , coverted into uniform output signal	A physical value converted into the uniform output signal is measured by the physical value conversion range and by the type of the uniform output signal			

CRYOSTATS. THERMOSTATS. HEATERS

DESCRIPTION OF CRYOSTATS AND THERMOSTATS

The present section will help choose a suitable thermostat or cryostat type.

To meet the requirements of Russian State Standard GOST 8.461-82 regarding thermometers calibration, thermostats of the type TN-1M and TP-2 are necessary, the former ensuring the temperature of 0°C and the latter ensuring the temperature of 100.0 °C.
The temperature of 0°C in the TN-1M type of thermostat is created in the melting broken ice medium, the ice having been frozen beforehand by any way currently in use from distilled water and splintered at the UDL-1 plant.

As needed, the small-size modification of the zero thermostat TN-2M or the desktop variant TN-3M can be used. The temperature of 100.0°C is amounted in the thermostat TP-2 in the boiling distilled water medium under normal atmospheric pressure. In case of pressure deviation from the normal value, allowance must be made for the correction by certain ratios or by means of measuring temperature with any standard resistance thermometer, for example of the kind PTS-10.

To calibrate temperature sensors in the range of -40.0…+40.0°C the cryostat of the type CR-40-2 can be used. In this cryostat the operating medium is antifreeze agent tosol A-40M. Utilization of a special cassette allows applying CR-40-2 for mercurial and alcohol full-immersion thermometers calibration. When dealing with temperatures -190.0…-60.0 °C one can utilize cryostats of the types CR-190-1 and CR-190-2.

To calibrate temperature sensors of the range 40.0…300.0°C an adjustable thermostat of the type TR-1M can be used.
Five thermostat versions differing by the depth of immersion and the range of operating temperatures are produced: TR-1M-300.TR-1M-500. TR-1M-V. TR-1M-U1 и TR-1M-U2. As a result of the fact that under high temperatures a special liquid used as a medium educes a specific smell an exhaust is required.
The enterprise supplies exhaust chambers KV-1 KV-1B on a buyer's demand. The buyer mounts the exhaust chambers according to his placement conditions

The use of a special cassette allows applying all the versions of TR-1M except for the TR-1M-B for calibration of mercurial and alcohol full-immersion thermometers. The heat carrier level goes up higher than the thermostat upper butt-end, the thermometer being able to submerge up to the level of the measured off mark of the scale in accordance with the requirements of all-Russian Federation Standard GOST 13646-68. For the accurate reading of the temperature measured by a glass thermometer the thermostat is provided with a view finder of sixfold magnification.

The thermostat of the TR-1M type consists of a thermo-bath TZh-1-300 (TZh-1-500) and a control unit BU-1M (three versions) provided with the proscribed and factual temperature indication. In emergency operation when exceeding the upper boundary of the operation range by more than 10.0°C, the thermostat is automatically switched off.

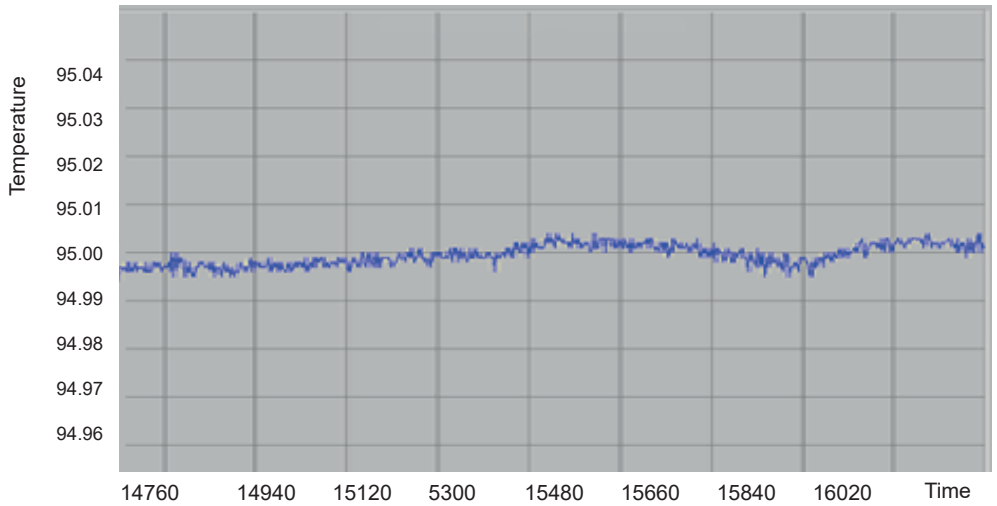
Dry thermostats of the types TS 250-2 and TC 600-2 intended for temperature up to 250. 0 °C and 600. 0°C correspondingly operate on the principle of metal units heating. Isothermal zone is obtained in removable leveling units having orifices for temperature sensors. The buyer has the opportunity of ordering a leveling unit billet; the orifices for the sensors can be drilled by him independently in line with the requisite sensor diameter. The length of the isothermal zone in the thermostat of TS 250-2 type is situated at a depth of 55-115 millimeters from the leveling unit upper end surface whereas in the thermostat of TS 600-2 type - at a depth of 80-160 millimeters from the leveling unit upper end surface. To ensure measurement error it is necessary to provide for a good thermal contact of the sensors with the leveling unit. .

The thermostat of TS 250-2 type is of a monounit design and can be easily carried with one hand. Thermostat of TS 600-2 type consists of thermostat TS-3 and control unit BU-1M. Thermostats of TS 250-2 and TS 600-2 types have a 4-discharge light-emitting diode display which indicates the proscribed and the actual temperature. The thermostats can be connected to a computer through the interface RS-232. Dry thermostats of TS 250-2 and TS 600-2 types are easy to service as they do not need filling with liquid. Their error is greater than that of liquid thermostats but a small size and ease of maintenance make them attractive for a number of measurements.

The adjustable thermostat of TR 20 type is intended for thermostating the set of standard resistors of P310. P321. P331 types and normal cells of X482 type in the temperature range of 15.0 -30.0 °C under laboratory conditions.

Utilization of TR 20 delivers from carrying out correction caused by the ambient air temperature deviation from the value of 20 °C. The fact simplifies and accelerates standard resistors and normal cells calibration. The virtue of the thermostat is the opportunity to select the required resistor or a normal cell out of all the connected ones by means of a switch. the current being fed to the terminals "IN + " and "IN -" and the voltage being measured at the terminals "UN +" "UN -".

Typical curve of maintaining temperature in Thermostat TR-1M



CRYOSTAT CR -190

Function:

The adjustable cryostat CR-190 is intended for cooling thermometry means when they are calibrated and researched in the laboratory.
The cryostat has two versions differing by quantity and diameter of compartments for placing the investigated thermometry means:
CR-190-1 and CR-190-2.

The cryostat consists of heat-setting unit (BTS-1or BTS-2) and control unit BU-7-9. The heat-setting unit constitutes cylindrical copper unit with drilled compartments. For the cryostat operation it is necessary to place the heat-setting unit into a cryogenic vessel of SK-25 model filled with liquid nitrogen.

CR -190 is produced according to design specifications TU 3443-007-02566540-2003

Specifications	CR -190-1	CR -190-2
Range of reproducible temperature, °C	-190…-60	
Thermal stabilizing unit applied	BTS-1	BTS-2
Diameters and Quantities of compartments to install measuring means:		
- compartments Ø 4.5 mm, quantity.	1	3
- compartments Ø 5.5 mm, quantity.	-	6
- compartments Ø 6.5 mm, quantity.	-	2
- compartments Ø 8.5 mm, quantity.	2	-
- compartments Ø 10 mm, quantity.	2	-
- compartments Ø 13.5 mm, quantity.	1	-
Pit Depth of Thermal Stabilyzing Unit mm, min	505	
The minimal length of the sensor submerged into the cryostat, mm	485	
Vertical temperature gradientin working area (60 mm from Thermal Stabilyzing Unit pit bottom), °C/sm, max	0.1	
Temperature instability during 30 minutes, °C, max	±0.05	
Temperature sensors response time (Thermal Stabilyzing Unit is put in cryogenic vessel and has the temperature lower than -190 °C), hour, max	1.5	
Indication type	digital LED, 5 digits (digits height 14 mm)	
Indicator resolution capacity, °C		
-within the range of -60.00…-99.99 °C	0.01	
-within the range of -100.0…-190.0 °C	0.1	
Required pre-set temperature resolution, °C	0.1	
Link to PC	RS-232	
Type of climatic conditions by GOST 15150-69	UHL4.1	
Ambient air temperature, °C	20±5	
Power supply	~ 220 V; 50 Hz	
Input power, W, max	100	
Overall dimensions, mm, max		
- Thermal Stabilyzing Unit BTS-1 (BTS-2)	Ø225x592	
- control unit BU-5	270x360x100	
Mass, kg, max:		
- Thermal Stabilyzing Unit BTS-1(BTS-2) without weight of cryogenic vessel and liquid nitrogen	4	
- control unit BU-5	4.5	

CR -190-1 (CR -190-2)

Croygenic vessel
SK-25

Thermal stabilizing unit
BTS-1 (BTS-2)

BU-7-9

Equipment set:

-Thermal Stabilyzing Unit (BTS-1 for CR-190-1 or BTS-2 for CR-190-2);
-control unit BU-5;
-cryogenic vessel SK-25 TU 26-04-622-88;
-connecting cables (2 items);
-registration certificate;
-operating manual.
.

Upon separate request:
-standard platinum low-temperature resistance thermometer of the second category;
-a cable for computer connection;
-software P tres which allows to reflect the schedule of cryostat during the real-time operation on the computer.
.

Note:
In case of simultaneous order of the models CR-190-1 and CR-190-2 the cryostat is replenished by two thermo-setting units (BTS-1 and BTS-2), the remaining items of the set being supplied as by ordering one of the versions of the cryostat. .

Order sample:

«Adjustable Cryostat CR -190-1»

CRYOSTAT CR-80

CR-80

Function:

Cryostat CR-80 is intended for heating and cooling temperature sensors (thermocouples and resistance thermometers), mercurial, Spiritus and other kinds of thermometers when calibrating thermometers under laboratory and shopfloor conditions:

Spiritus is used as a heat carrier.)!

Specifications	CR -80
Temperature reproduction range, °C	-80…+40
Heat carrier	spiritus
Calibrated simultaneously:	
- thermocouples and resistance thermometers	up to 6
- mercury and spiritus temperature meters	up to 13
Minimum imersion depth of sensor, mm	60 (without cover up to 15 mm)
Maximum sensor immersion depth, mm	300
Temperature difference at the depth from 300 to 200 mm, °C, max	0.03
Temperature mode instability during 30 minutes, °C, max	±0.05
Temperature sensors response time, hours, max	6
Indication type	digital LED 5 digits (digits height 14 mm),
Indicator resolution capacity, °C	0.01
Required pre-set temperature resolution, °C	0.01
Type of climatic conditions by GOST 15150-69	UHL4.1
Ambient air temperature, °C	20±5
Power supply	~ 220 V; 50 Hz
Input power, kW, max	5
Overall dimensions, mm, max	500x600x1200
Cryostat Mass without heat carrier, kg, max	80

CRYOSTAT CR -40-2

CR -40-2 is registered in Public Register of Measuring Instruments under No. 26147-09

Function:

Cryostat CR-40-2 is intended for calibration and testing of temperature measureemnt instruments in laboratory conditions.
Antifreeze agent 'tosol', Grade A40-M TU6-15-1701-92 is used as heat-carrier.

CR -40-2

CR -40-2 is produced in compliance with specifications TU 3443-002-02566540-2003

Specifications	CR -40-2
Range of reproducible temperature, °C	-40…+40
Heat carrier	antifreeze 'tosol' A40-M (12 kg)
Calibrated simultaneously:	
- thermocouples and resistance thermometers	up to 6
- mercury and spiritus temperature meters	up to 13
Maximum sensor immersion depth, mm	60 (without cover up to 15 mm)
Maximum sensor immersion depth, mm	300
Temperature difference in working chamber, °C, max:	
- vertically at the depth from 300 to 200 mm	0.02
- horizontally at the depth from 300 to 200 mm	0.02
Temperature instability during 30 minutes, °C, max	±0.03
Temperature sensors response time, hours, max	4
Indication type	digital LED, 5 digits (digits height 14 mm)
Indicator resolution capacity, °C	0.01
Required pre-set temperature resolution, °C	0.01
Link to PC	RS-232
Type of climatic conditions by GOST 15150-69	UHL4.1
Ambient air temperature, °C	20±5
Power supply	~ 220 V; 50 Hz
Input power, kW, max	3
Overall dimensions, mm, max	500x510x1350
Cryostat Mass without heat carrier, kg, max	80

Equipment set:

- -Cryostat CR-40-2 including the lid with 7 compartments;
-heat-carrier antifreeze agent 'tosol' A40-M (15 kg) including quality certificate
-a set of plugs with orifices for sensors of diameter: 10mm; 6mm;4mm; without orifices. - (7items of each kind);
-a cassette to calibrate glass thermometers of diameter 6.0…18.0 mm;
-a view finder of sixfold magnification;
-a card for connection of sensors during calibration;
-feeding cable;
-a computer connection cable;
-registration certificate;
-operating manual;
-calibration procedure.

By separate Order:
- standard reference resistance thermometer ETS-100;
- unit TPV-3 for calibration surface temperature sensors
- Program P_tres, makes it possible to present Cryostat operation schedule in real-time on PC.
* - for details see. "Auxuliary equipment for temperature sensors calibration""

Order sample:

«Regulated Cryostat CR -40-2»
«Regulated Cryostat CR -40-2 with reference resistance thermometer ETS-100»

ZERO THERMOSTATS TN-1M, TN-2M, TN-3M

Function:

Zero thermostats are designed for creation of 0° C point while testing and calibration of thermometers in laboratory and workshop environment.

Zero thermostat TN-1M is an analog of a thermostat produced by Akmolinsk Plant. "ETALON"

TN-1M and TN-2M are produced according to design specifications TU 50-95 DDSH2.998.004 TU

Specifications	TN-1M	TN-2M	TN-3M
Rated temperature of thermostat medium in process chamber, °C	0		
Operating environment	melting ice		
Number of calibrated sensors, items.	up to 13		
Process chamber rated volume, m	0.0236	0.0114	0.0049
Maximum depth of chamber, mm	480	460	195
Thermal gradient at the depth within the range of 300 to 200 mm °C/sm, max	0.006		-
Standard deviation of temperature readings at the depth of 200 and 300 mm, °C, max	±0.02		-
Standard deviation of temperature readings at the depth of 160 mm, °C, max	-		0.02
Temperature sensors response time, hour, max	0.5		
Type of climatic conditions by GOST 15150-69	U4.2	U3	-
Ambient air temperature, °C	25±10		
Power supply	-		
Overall dimensions, mm, max	950x500x500	260x280x750	270x255x255
Mass, kg, max	32	20	10

TN-1M

TN-2M

TN-3M

Equipment set TN-1M, TN-2M:

- Zero thermostat TN-1M (TN-2M);
- spare parts kit (sensors connection board, test tubes, hubs, blanks);
- technical passport;
- Operations Manual (only for TN-2M);
- spare parts list.

Equipment set TN-3M:

- Zero thermostat TN-3M;
- test tubes set (12 items.);
- technical passport.

Order sample:

«Zero thermostat TN-1M»

STEAM THERMOSTAT TP-2

TP-2 is registered in Public Register of Measuring Instruments under No. 25916-03

TP-2

Function:

Steam thermostat TP-2 is designed for creation reference point of water boiling while testing and calibration of thermometers in laboratory

Thermostat TP-2 completely substitutes thermostat TP-1M which had been produced before by our Company (at that time it was called Omsk Research Plant "Etalon"). In comparison with TP-1M this thermostat has lower weight/dimensions characteristics and improved emergency shut down system in case of water boiling-off. Introducing power control and external in thermostat TP-2 made it possible to reduce water consumptions and steam venting into atmosphere.

TP-2 is produced according to design specifications

TU 3443-003-02566540-2003

Specifications	TP-2
Rated temperature of thermostat medium in process chamber, °C	95…102 at the atmospheric pressure of 84-106 kPa
Operating environment	water steam
Number of calibrated sensors, items.	up to 13
Volume of water filled in, liter	approximately 3
Maximum chamber depth, mm	500
Thermal gradient at the depth ranging from 300 to 200 mm, °C/sm, max	0.006
Temperature instability in process chamber during 30 minutes, °C, max	±0.03
Temperature sensors response time, hour, max	1.0
Type of climatic conditions by GOST 15150-69	UHL4.1
Ambient air temperature, °C	20±5
Power supply	~ 220 V; 50 Hz
Input power, kW, max:	1.25
Overall dimensions, mm, max	260x400x980
Mass, kg, max	22

Equipment set TP-2:

- thermostat TP-2;
- spare parts kit:
  - sensors connection board;
  - test tubes d=8 mm (13 items), d=15 mm (13 items.), d=20 mm (13 items), d=23 mm (2 items.), d=29 mm (2 items);
  - hubs d=8 mm (12 items.), d=15 mm (12 items), d=20 mm (12 items.), d=23 mm (1 item), d=29 mm (1 item);
  - blanks (13 items.);
- power cable;
- technical passport,
- Operations Manual,
- test procedure.

Order sample :

«Steam thermostat TP-2»

REGULATED THERMOSTAT TR 20

Function:

Regulated thermostat TR 20 is designed for thermostatic control of standard reference electrical resistors, types P310, P321, P331 and half-cell elements, type X482 in laboratory conditions.
Heat carrier is dielectric oil which complies with Russian State Standard GOST 982-80.
Thermostat selector switch makes it possible to select the required resistor or half-cell element and electrical current goes to terminals "I_N+" and "I_N–", while voltage is measured at terminals "U_N+" and "U_N–".

TR 20 is produced according to design specifications
TU 3443-014-02566540-2004

Specifications	TR 20
Range of reproducible temperature, °C	15*…30
Heat carrier	dielectric oil, 30 liters
Simalteneous thermostatic control of resistances or half-cell elements, quantity	up to 10
Allowed absolute error of pre-set temperature reproducit-on during 30 minutes, °C, max:	
- for the pre-set temperature of 20 °C	±0.05
- for the temperature range	±0.2
Temperature difference between any two points in process chamber, °C, max	0.02
Heating rate, °C/hour, min	10
Cooling rate (depends on ambient air temperature), °C/ hours	0.5…2.5
Indication type	digital, LED, 4 digits (digits height 14 mm)
Indicator resolution capacity, °C	0.01
Required pre-set temperature resolution , °C	0.01
Type of climatic conditions by GOST 15150-69	UHL4.1
Ambient air temperature, °C	20±5
Power supply	~ 220 V; 50 Hz
Input power, kW, max	0.4
Overall dimensions, mm, max	790x470x580
Thermostat Mass (free from heat carrier), kg	60
* ambient air temperature 20 °C.	

TR 20

Equipment set:

- regulated thermostat TR 20;
- heat carrier, in compliance with Russian State Standard GOST 982-80, (30 liters);
- sealing plate
- power cable;
- technical passport;
- Operations Manual.

Order sample:

«Regulated thermostat TR 20»

REGULATED THERMOSTAT TR-1M

The type of measuring instrument is registered in the Federal Information Fund for Ensuring the Uniformity of Measurements under No. 24473-08

TR-1M

Function:

Regulated thermostat TR-1M is designed for calibration and testing of temperature measuring instruments in laboratory conditions.

There are five modifications of a thermostat produced which differ by the depth of immersion and the range of reproduced temperatures: TR-1M-300, TR-1M-500, TR-1M-V, TR-1M-U1 and TR-1M-U2. The advantage of this thermostat is its digital control which makes it possible to obtain high stability of temperature and low resolutions of temperature setting. Thermostat can be linked to PC via interface RS-232.

Models TR-1M-300 and TR-1M-500 reproduce temperature within the range from 40 to 200 °C. Polymethylmeth polymethylmethilsiloxane liquid PMS-100 GOST 13032-77 is used as a hear carrier within all the range and with the flash point of minimum 305 °C. When operating within the range from 40 to 95 °C water can be used as heat carrier. Model TR-1M-V can reproduce temperature within the range of 150 to 300 °C, and cylinder oil MTs-52 GOST 6411-76 is used as a heat carrier within all the range with the flash point of minimum 310°C. To provide for the whole range of temperatures one unit includes models TR-1M-U1 and TR-1M-U2. Heat carrier is oil, type ULTRA-300 with the flash point of minimum 310 °C, this oil has low viscosity factor in all the range of temperatures from 40 to 300 °C, it is transparent and evaporates less at 300 °C.

Regulated thermostat TR-1M consists of liquid bath (TZh-1-300 or TZh-1-500) and control unit (BU-1M-2, BU-1M-7 or BU-1M-6).

BU-7-5

TZh-1-300
(TZh-1-500)

TR-1M is produced according to design specifications TU 3443-001-02566540-2002

Specifications	TR-1M-300	TR-1M-500	TR-1M-V	TR-1M-U1	TR-1M-U2
Range of reproducible temperature, °C	40…200		150…300	40…300	
Heat carrier:					
- in all the range of reproduced temperatures	PMS-100 (13 kg)	PMS-100 (20 kg)	MTs-52 (13 kg)	ULTRA 300 (13 kg)	ULTRA 300 (20 kg)
-within the range of 40…95 °C	water		-		
Liquid bath applied	TZh-1-300	TZh-1-500	TZh-1-300		TZh-1-500
Control unit applied	BU-1M-2		BU-1M-7	BU-1M-6	
Exhaust chamber applied	KV-1		KV-1B		
Calibrated simultaneously:					
- thermocouples or reistsnace thermometers	up to 6				
- mercury and spiritus thermometers	up to 13		-	up to 13	
Minimum tested sensor immersion length, mm	60 (no cap-up to 15mm)				
Maximum sensor immersion depth, mm	300	500	300		500
Vertical temperature difference at depth, °C, max:					
- from 300 to 200 mm	0.02	-	0.04	0.02	-
- from 500 to 300 mm	-	0.03	-	-	0.04
Horizontal temperature difference at depth, °C, max:					
- 300 and 200 mm	0.02	-	0.02	0.02	-
- 500 and 300 mm	-	0.03	-	-	0.02
Temperature mode instability during 30 minutes, °C, max	±0.05				
Temperature sensors response time, hour, max	2		2.5	2	
Indication type	digital LED, 4 digits (digits height 14 mm)				
Indicator resolution capacity, °C					
-within the range of 100.0…300.0	0.1				
-within the range of 0…99.99)	0.01				
Required pre-set temperature resolution, °C	0.1				
Link to PC	RS-232				
Type of climatic conditions by GOST 15150-69	UHL4.1				
Ambient air temperature, °C	20±5				
Power supply	~ 220 V; 50 Hz				
Input power, kW, max	3				
Overall dimensions, mm, max:					
- liquid bath	256x280x746	256x280x946	256x280x746		256x280x946
- control unit	270x100x360				
- exhaust chamber	500x500x2000		500x500x2500		
Mass , kg, max:					
- liquid bath (free from heat carrier)	20	30	20		30
- control unit	3.2				
- exhaust chamber	45		50		

Equipment set TR-1M-300, TR-1M-500:

- liquid bath (TZh-1-300 for TR-1M-300 and TZh-1-500 for TR-1M-500)
- liquid PMS-100 (13 kg for TR-1M-300 and 20 kg for TR-1M-500)
- control unit BU-1M-2
- cooler
- tray, bail, cup
- sensors connection board
- set of plugs with orifices for sensors, diameter: 10 mm; 8 mm; 6 mm; 4 mm; no orifices (7 items of each type)
- cartridge* to calibrate galss temperature meters with diameter of 6…18 mm
- viewfinder* with magnification factor of 6
- set of connecting cables (3 items.)
- PC cable
- technical passport
- Operations Manual
- test procedure.

Upon separate request:
- exhaust chamber KV-1* with technical passport
- standard reference resistance thermometer ETS-100;
- Unit TPV-2M* for calibration surface temperture probes (is installed on P 1M-300, TR-1M-500);
- Program P_tres, makes it possible to present thermostat operation schedule in real-time on PC.

* -for details see. "Auxuliary Equipment for Temperature Sensors Calibration"

Equipment set TR-1M-V:

- liquid bath TZh-1-300;
- oil MTs-52 (13 kg);
- can
- control unit BU-1M-7;
- industrial soap "Dikorin" (0.3 kg)
- exhaust chamber KV-1B* with technical passport
- tray;
- sensors connection board;
- set of plugs with orifices for sensors, diameter:10 mm; 8 mm; 6 mm; 4 mm; no orifices (7 items of each type)
- set of connecting cables (3 items)
- PC cable
- technical passport,
- Operations Manual
- test procedure.

Upon additional Order:
- standard reference resistance thermometer ETS-100;
- Program P_tres, makes it possible to present thermostat operation schedule in real-time on PC.

*- for details see. "Auxuliary Equipment for Temperature Sensors Calibration"

Equipment set TR-1M-U1 and TR-1M-U2:

- liquid bath (TZh-1-300 for TR-1M-U1 and TZh-1-500 for TR-1M-U2);
- liquid type: ULTRA-300 (13 kg for TR-1M-U1 and 20 kg for TR-1M-U2);
- control unit BU-1M-6;
- exhaust chamber KV-1* with technical passport
- sensors connection board;
- set of plugs with orifices for sensors, diameter: 10 mm; 8 mm; 6 mm; 4 mm; no orifices (7 items of each type)
- cartridge* to calibrate galss temperature meters with diameter of 6…18 mm
- viewfinder* with magnification factor of 6
- set of connecting cables (3 items.);
- PC cable;
- technical passport,
- Operations Manual;
- test procedure.

Upon additional Order:
- standard reference resistance thermometer ETS-100;
- Unit TPV-2M* or calibration surface temperture probes (is installed onTP-1M-U1 and TR-1M-U2);
- Program P_tres, makes it possible to present thermostant operation schedule in real-time on PC.

* - for details see. "Auxuliary equipment for temperature sensors calibration""

Order sample:

«Regulated Thermostat TR-1M-300»
«Regulated Thermostat TR-1M-300 with exhaust chamber KV-1»

TR-1M is registered in Public Register of Measuring Instruments under No. 24473-03.

DRY THERMOSTAT TS 600-2

Function:

Dry thermostat TS 600-1 is designed for heating of temperature measurement means, including thermotransducers within the range from 50°C to 60°C while calibration testing and calibration in laboratory and workshop conditions.

-when operating with immersion thermal transducers leveling block with bored compartments of required diameter is applied.
-when thermal transducers are used to measure temperature a surface leveling block BVP-01 is used.
Thermostat can also be used for reference points In, Sn, Zn - see "Equipment for temperature scale reference points generation MTSh-90" for more details.
Thermostat TS 600-2 includes Dry thermostat TS-3 and Control unit BU-7-10.
Thermostat TS 600-2 completely substitutes Thermostat TS 600-1.

TS 600-2

BU-7-10

TS-3

TS 600-2 is produced according to design specifications DDSH2.998.015 TU

Specifications	TS 600-2	TS 600-2 when operating with surface leveling block BVP-01
Range of reproducible temperature, °C	50…600	50…400
Probes immersion depth, mm	160	-
Diameter of leveling block, mm	44	44
Diameter of isometric surface, mm	-	35
Allowed absolute error of temperature reproduction, °C, max	±0.6	±(0.3+0.005*t)
Temperature difference at the bottom of heating unit compartment, °C, max	0.1	-
Vertical temperature gradient in working area (length of working area is 80 mm from the bototm of compartment), °C/sm, max	0.1	-
Vertical temperature gradient in working area 55…115 mm from the top edge of leveling block,°C/sm, max	-	-
Temperature instability during 30 minutes, °C, max	±0.05	±0.1 (on the surface)
Temperature sensors response time, minutes, max	45	90
Link to PC	RS-232	
Type of climatic conditions by GOST 15150-69	UHL4.1	
Ambient air temperature, °C	20±5	
Power supply	~ 220 V; 50 Hz	
Input power, kW, max	3	
Overall dimensions, mm, max:		
- thermostat TS-3	155x195x375	
- control unit BU-1M-4	270x360x100	
Mass, kg, max:		
- thermostat TS-3	20	
- control unit BU-1M-4	3.2	

Equipment set TS 600-2:

- dry thermostat TS-3;
- control unit BU-1M-4;
- replacable leveling block with bores: d=4.5 mm (2 bores.), d=5.3 mm (2 bores), d=5.8 mm (1 bore), d=6.5 mm (2 bores), d=8.5 mm (1 bore), d=10.5 mm (1 bore)
- leveling block -workpiece (2 items.) (upon Customers request the leveling block bores-workpieces are bored to the diameter specified by customer)
- replacable screens (3 items. - one screen for each leveling block);
- lifeter to remove leveling block
- sensors connection board;
- thermostat recalibration software.
- connecting cables (4 items.);
- PC cable;
- technical passport;
- Operations Manual.

By separate Order:
- surface leveling block BVP-01 with techncial passport
- Program P_tres, makes it possible to present thermostat operation schedule in real-time on PC

Order sample:

«Dry thermostat TS 600-2»

DRY THERMOSTAT TS 1200-1

МКСН.681118.021 ТУ

TS 1200-1

Function:

The TS 1200-1 thermostat is designed to reproduce temperatures in the range from +100 to +1200 ° C during calibration (verification) of resistance thermal converters, thermoelectric converters and thermal converters with a unified output signal.

The TS 1200-1 thermostat is a monoblock structure, in one housing there is a heat tower, a digital microprocessor temperature controller, an indication unit and power elements.

Specifications	TS 1200-1
Range of reproducible temperature, °C	100.... 1200
Allowed absolute error of temperature reproduction, °C, max	±0,3
Горизонтальный перепад температуры между колодцами выравнивающего блока, не более, °С:	0,1
Vertical temperature gradient in working area (length of working area is 80 mm from the bototm of compartment), °C/sm, max	0,16
Dimensions of the thermostat workspace, mm: - diameter - depth	 50 325
Temperature sensors response time, minutes, max - mode +100 °C - mode +1200 °C	 60 120
The number of simultaneously verified sensors, pcs	от 1 до 4

Order sample:

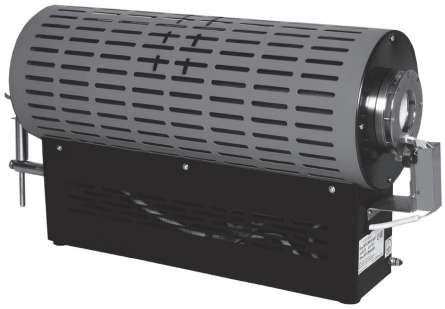
«Dry thermostat TS 1200-1»

FAST RESPONSE TUBE HEATER WITH THERMOSTATIC CONTROL MTP-2MR

TU 50-96 DDSH 1.298.000 TU
The MTP-2MR furnaces are certified as part of the UPST-2M installation

The EAEU Declaration no. RU D-RU.RA 01.B.52213/21 from 14.10.21 on compliance with the requirements TR CU 004/2011 "On the safety of low-voltage equipment", TR CU 020/2011 "Electromagnetic compatibility of technical means"

MTP-2MR



MTP-2M

BU-7-4

Function:

Fast response tube heater MTP-2MR is designed for heating temperature measuring instruments and any reference standards with the diameter of up to 70 mm within the range from 100 to 1200°C in laboratory conditions during their calibration and testing.

Heater MTP-2MR includes heater MTP-2M and control unit (temperature controller) BU-1M (BU-1M-1)

MTP-2MR is produced according to design specifications TU 50-96 DDSH1.298.000 TU

Specifications	MTP-2MR-50-500	MTP-2MR-70-1000
Range of reproducible temperature, °C	100…1200	
Principle of operatin	Resistance Heater of horizontal type	
Heater used	MTP-2M-50-500	MTP-2M-70-1000
Temperature controller*	BU-1M	BU-1M-1
Operating space dimentions, mm	Ø 50, length 500	Ø 70, length 1000
Thermal gradient in the middel part, °C/sm, max	0,8	
Temperature mode instability, °C/minutes, max	0.1	
Warm-up time to maximum temperature, minutes, max	90	
Type of climate group as per GOST 15150-69	UHL4.2	
Power supply	~ 220 V; 50 Hz	
Input power, kW, max:		
- heater	5	8
- temperature controller	0.022	
Overall dimensions, mm, max:		
- heater	730x200x350	1230x200x350
- temperature controller	270x360x100	
Mass, kg, max:		
- heater	16	39
- temperature controller	3.2	
* - it is possible to supply heater without temperature controller		

Equipment set:

- Heater (MTP-2M-50-500 for MTP-2MR-50-500 and MTP-2M-70-1000 for MTP-2MR-70-1000);
- control unit (BU-1M for MTP-2MR-50-500 and BU-1M-1 for MTP-2MR-70-1000);
- technical passport.

Order sample:

with temperature controller: «Heater MTP-2MR-50-500»;
without temperature controller: «Heater MTP-2M-50-500»
.
By additional order -
Reference thermoelectric transducer (PPO)

HIGH TEMPERATURE HEATER VTP 1600-1

Function:

High temperature heater VTP 1600-1 is designed for temperature measuring means in laboratory and workshop conditions.

Heater VTP 1600-1 consists of thermal units and control unit BU-1M-3.

Heater VTP 1600-1 is equipped with digital control which makes it possible to maintain high stability of temperature and low resolution of temperature setting.

VTP 1600-1 is produced according to design specifications TU 3443-022-02566540-2004

Specifications	VTP 1600-1
Range of reproducible temperature, °C	300…1600
Rated dimentions of heater workspace, mm:	
- diameter	40
- length	550
Thermal gradient along the heater in its middle part (± 25 mm from workspace center),°C/sm, max	1
Temperature mode instability, °C/minutes, max	±0,4
Heater warm-up time from the temperature of (20±5) °C to maximum operating temperature,1600 °C, hours, max	4
Heating rate and heater's cooling, °C/minutes, max	10
Type of climatic conditions by GOST 15150-69	UHL4.2
Ambient air temperature, °C	20±5
Power supply	~ 220 V; 50 Hz
Input power, kW, max:	
- termal unit	2.5
- control unit BU-1M-3	0.022
Overall dimensions, mm, max:	
- termal unit	700x300x400
- control unit BU-1M-3	270x360x100
Mass, kg, max:	
- termal unit	40
- control unit BU-1M-3	3.2

VTP 1600-1

thermal unit

BU-7-6

Equipment set:

- thermal unit ;
- control unit BU-1M-3
- spare parts kit
- connecting cable
- technical passport;
- Operations Manual.

Order sample:

«Heater VTP 1600-1»

Transporting of high temperature Heater VTP 1600-1 from manufacturing plant to Customer is done ex-works. In all other cases manufacturing plant is not responsible for failure of chromite-lanthanide heating elements during transportation.

HIGH TEMPERATURE HEATER VTP 1800-1

Function:

The high-temperature furnace VTP 1800-1 is designed to heat working and reference thermoelectric converters during their verification in the temperature range from 600 to 1780 ° C in accordance with GOST 8.338 and GOST 8.779, as well as for heating any objects in the specified temperature range.

The VTP 1800-1 furnace consists of a thermoblock, a power unit, a control unit BU-7-11 and a set of connecting cables.

The heater has the shape of a pipe, installed vertically in the furnace.
The working space of the furnace is the internal volume of the cover installed in the cavity of the heater.

The power unit is made in a separate metal housing and is designed to supply a reduced supply voltage to the VTP 1800-1 furnace. It contains a step-down transformer, power key elements for switching the supply voltage of the thermoblock and a cooling fan.

Temperature control is carried out by the control unit using BU-7-11. The BU-7-11 unit is made in a separate housing.

VTP 1800-1

The power unit

thermal unit

BU-7-11

FAST RESPONSE TUBE HEATER WITH THERMOSTATIC CONTROL MTP 1200

EAC

The EAEU Declaration no. RU D-RU.RA 04.B.32916/22 dated 06/21/12 on compliance with the requirements TR CU 004/2011 "On the safety of low-voltage equipment", TR CU 020/2011 "Electromagnetic compatibility of technical means"

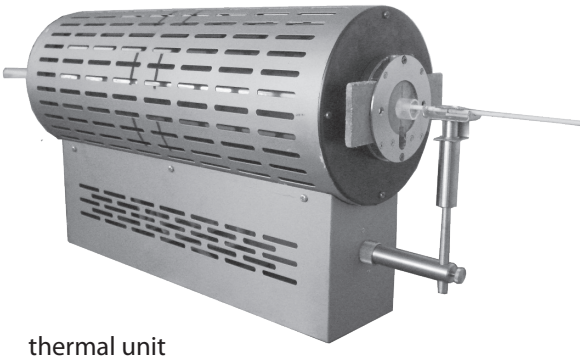
Function:

The MTP 1200 furnace is designed for heating temperature measuring instruments in laboratory conditions.

The MTP 1200 furnace consists of a thermoblock and a control unit BU-7-2.

The main feature of the furnace is the low-voltage supply of 36V heaters, which ensures high electrical safety and reliability.
In addition, the MTP 1200 furnace contains three heaters, which allow to obtain a unique temperature gradient along the axis of the furnace, and a microprocessor control unit and modern service software ensure convenient configuration and operation of the furnace.

MTP 1200



thermal unit

BU-7-2

The power unit

TEMPERATURE CALIBRATORS

DRY BLOCK CALIBRATOR
KS 100-1, KS 600-1

TU 4381-005-02566540-2007
The type of measuring instrument is registered in the Federal Information Fund for Ensuring the Uniformity of Measurements under No. 37366-08

KS 100-1
KS 600-1

Function:

Dry Block Calibrator KS 100-1 is designed for resistance temperature devices calibration in compliance with Russian State Standard GOST 6651-94 within the range of -10…+100 °C in laboratory and field conditions:

Function:

Dry Block Calibrator KS 600-1 is designed for resistance temperature devices calibration in compliance with Russian State Standard GOST 6651-94 and thermal transducers in compliance with Russian State Standard GOST R 8.585-2001within the range of 50…600°C in laboratory and field conditions:

Dry Block Calibrator is based on the method of comparison of the calibrated temperature sensor with individually calibrated platinum resistance temperature transducer of high accuracy which considerably reduces calibration error. Such temperature meter cranked at the angle of 120°C is installed next to the calibrated sensor and is connected to the special calibrator connector.

Calibrators make it possible to measure signals of calibrated resistance temperature meters and thermocouples (indication in °C, mV, Ohm).

There are the following modes: Voltmeter (Measurement range 0…55 mV), ohmmeter (Measurement range 0…2 k Ohm).

Specifications	KS 100-1	KS 600-1
Range of reproducible temperature, °C	-10…+100	50…600
Sensors immersion depth, mm	180	160
Diameter of leveling block, mm	35	44
Allowed absolute error of temperature reproduction with external temperature tranducer of advanced accuracy , °C	±0.1	±0.3
Allowed absolute error of temperature reproduction without external temperature tranducer of advanced accuracy , °C	±0.3	±0.6
Temperature drop at the bottom of working chamber, °C, max	0.05	0.1
Vertical temperature gradient in working area (working area length, 80 mm), °C/sm, max	0.1	
Temperature instability during 30 minutes, °C	±0.05	
Temperature stabilization time, minutes	30	45
Link to PC	RS-232	
Ambient air temperature, °C	20±10	
Power supply	~ 220 V; 50 Hz	
Input power, kW, max	1	1.5
Overall dimensions, mm, max	350x200x350	
Mass, kg, max	20	

Error of measuring unit inbuilt into calibrator

Input signals	Measurement accuracy
Measured voltage U: -300… +300 mV	0.000045*U+0.0006, mV
Measured resistance R: 0… 3000 Ohm	0.0001*R, Ohm

Additional options:

Additional options: KS 600-1 has an option of reference points of temperature scale MTSh-90. Reference points are made by applying special cartridges with the immersion depth of 160 mm. These cartridges provide high accuracy calibration of small diameter temperature sensors.

Equipment set KS 100-1:

- external resistance temperature devices of advanced accuracy
- inserted leveling block with a bore of d=4.5 mm; 5.3 mm; 5.8 mm; 6.5 mm
- leveling block blank without bores
- calibration device recalibration software
- PC cable.

Equipment set KS 600-1:

external resistance ttemperature devices of advanced accuracy
- inserted leveling block with a bore of d=4.5 mm; 5.3 mm; 5.8 mm; 6.5 mm 8.5 mm; 10.5 mm
- leveling block blank without bores (2 items)
- calibration device recalibration software
- PC cable.

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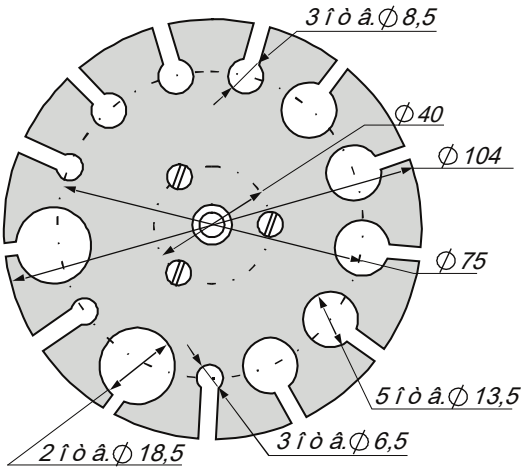
AUXILIARY EQUIPMENT FOR TEMPERATURE SENSORS CALIBRATION

CARTRIDGE TO CALIBRATE GLASS TEMPERATURE METERS

Function:

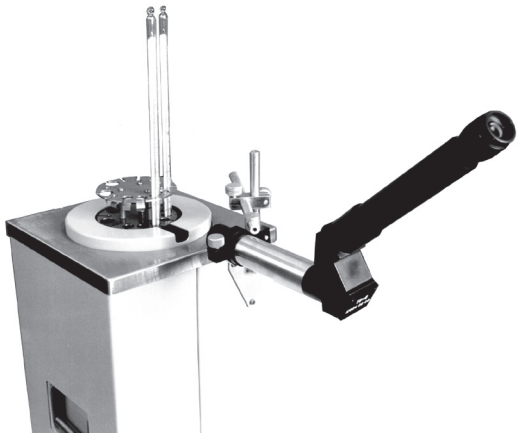
Cartridge* to calibrate glass temperature meters is used in regulated thermostats TR-1M-300, TR-1M-500 and in cryostat CR -40-2.
See Figure of "Viewfinder" for more details "



VIEWFINDER

Function:

Viewfinder is desinged for metering galss thermomethers during their calibration in thermostats and cryostats
Magnification factor equals 6

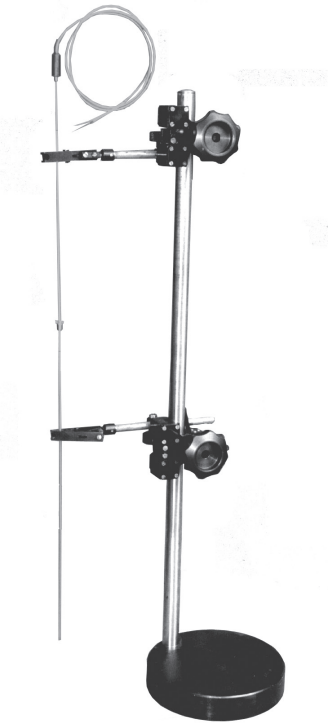


Thermostat TR-1M with installes cartridge to calibrate glass temperature meters and viewfinder

SUPPORT FOR TEMPERATURE SENSOR CALIBRATION

Function:

This support is designed for eaiser immersion of temperature sensors into thermostats TS 250-2, TS-600-2 and is applied during calibration of temperatire sensors in thermostats.



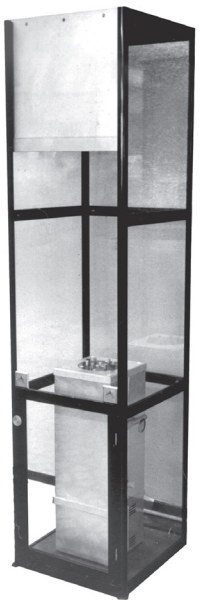
EXAUST CHAMBER KV-1 (KV-1V)

Function:

Exaust chamber KV-1 (KV-1V) is designed for proteciton of air in the buildings where there is chamber from hazadours vapours or substances emmitted by the objects (liquid bath TZh-1-300 or TZh-1-500 as part of thermostats TR-1M) which are inside the chamber.

Exaust chamber KV-1B is a chamber of KV-1 type with hood DDSH5.883.002 mounted on it..

Specifications	KV-1	KV-1B
Overall dimensions, mm, max	500x500x2000	500x500x2500
Mass, kg, max	45	50



Liquid bath TZh-1-300
(as part of thermostat TR-1M)
inside exhaust chamber KV-1

ICE CRUSHER UNIT UDL-2

Function:
Ice Crusher Unit UDL-2 is designed for ice crushing and is used in thermostats, which operating temerature is 0° C during calibration.

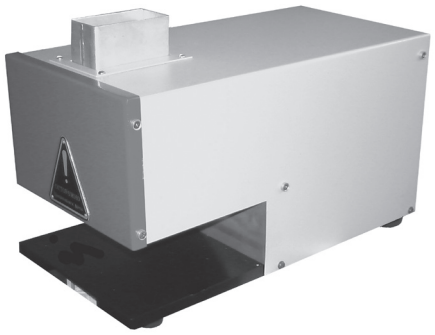
UDL-2 is produced according to design specifications TU 50-240-80

Specifications	UDL-2
Average size of granulated ice, mm, max	3
Ice bar crushing time, dimensions 40x80x95 mm, sec, max	5
Type of climatic conditions by GOST 15150-69	UHL4.2
Power supply	three-phase power supply ~ 380 V; 50 Hz
Input power, kW, max	1
Overall dimensions, mm, max	480x220x430
Mass,kg, max	40

The unit is supplied with trays for water freezing and for granulated ice.

Order sample:
"Ice Crushing Unit UDL-2"

UDL-2

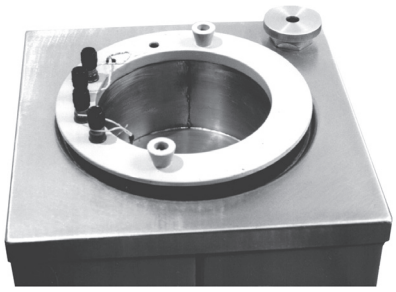


UNITS TPV-2M, TPV-3, BVP-01

Function

Units TPV-2M, TPV-3, BVP-01 are used for calibration of surface temperature sensors.
Units TPV-2M, TPV-3, BVP-01 are used only with cryostats and thermostats according to the table.

Specifications	TPV-2M	TPV-3	BVP-01*
Thermostat, used as a base	TR-1M	CR -40-2	TS 600-2
Range of reproducible temperature, °C	40...300	-40...+40	50...400
Working area diameter, mm	70		35
Temperature reproduction error, °C	1		0.3+0.005*t
Temperatrure difference within the work area, °C	0.7		0.1
* see additonal description TS 600-2			



Thermostat TR-1M with
Unit TPV-2M

EQUIPMENT FOR REPRODUCING REFERENCE POINTS OF THE MTSH-90 TEMPERATURE SCALE

FURNACES FOR THE IMPLEMENTATION OF REFERENCE POINTS OF THE MTSH-90 TEMPERATURE SCALE PRT 50-700, PRT 600-1100-2

Function
The furnaces PRT 50-700 and PRT 600-1100 are designed for the implementation of MTSH-90 reference points in laboratory conditions in the temperature range (50...700) °C and (600...1100) °C, respectively.

PRT 600-1100-2

BU-7-2

PRT 50-700

CALIBRATION EQUIPMENT FOR PRECISOIN PYROMETRIC MEASURING INSTRUMENTS

PRECISION PYROMETERS PD-4

FUNCTION:

Precision Pyrometers PD-4 are designed for high accuracy temperature measurement and control of solid bodies within the range of 800…2500°C Pyrometers are equipped with fiberglass viewfinder and make it possible to measure temperature of objects with diameter from 10 mm (800…2500°C) to 2 mm (1500…2500°C). Control over Pyrometer operation and indication of measured values is done via PC. Pyrometers can be used to replace existing optical thermometers of Type EOP-66, EOP-93. Precision Stationary Pyrometers PD-4 due to optical resolution provide for temperature measurements of small-sized objects, high-speed processor makes it possible to process and to transmit up to 100 measurements per second to PC and current output. Optical guidance system makes it possible to observe area of measurements on the background of controlled object.

PD-4

Pyrometers PD-4 have the following functions:

- measured focus distance
- PC interface link to RS-232
- measurement velocity selection out of the series 1; 5; 10; 25; 50; 100 measurements per second;
- internal digital filter (reducing noise-level) on/off switching
- the ability of altering digital filter parameters
- synchronous analog and digital output
- an option of digital results generation and transmitting to PC
- current output with programmable temperature range and uniform output current signal type (0-5), (0-20) or (4-20) mA
- output logical switches (5 V, 20mA) signal on current output loose wire
- two output logical switches (5 V, 20mA) for two variable set points
- Indication on PC the internal device temperature.

Models PD-4-03, PD-4-04 and PD-4-06 are designed for high accuracy of temperature measurement in the areas of standard emitters in the form of Absolute Black Body (ABB), cartridges for reference points, as well as calibration of operating pyrometric devices. These pyrometers use special interface filters to provide for narrow range of effective wavelength 656.3±10 and 950±10 nm.

Specifications	PD-4-01	PD-4-02	PD-4-03	PD-4-04	PD-4-05	PD-4-06
Measurement range, °C	1000...2500	800...2300	1200...2500	1000...2300	800...2500	1200...2500
Effective wavelength, nm	650±200	950±200	656.3±10	950±10	1550±200	656.3±10
Alignment index	1:100		1:300		1:100	1:500
Nominal operating mode, mm	1000±100				420±50	1000±100
Indication	on PC					
Indicator resolution capacity, °C	0.001					
Resolution capacity*, °C	up to 0.01					
Main reduced error, % from range, max	0.5		0.25		0.5	0.2
Output signal transition time, ms, max	50					
Warm-up time, min, max	15					
Range for possible setting of radiation capacity factor correction	0.100...1.500					
Radiation capacity factor correction resolutoin	0.001					
Link to PC	RS-232					
Ambient air temperature, °C	5...40		20±5		5...40	20±5
Power supply	+(18±0.5) V					
Input power, W, max	10					
Overall dimensions, mm, max:						
- pyrometer	257x290x56					435x300x80
- power unit	232x96x96					
Mass of pyrometer, kg, max	1.5					
*when digital filter is on						

Software capabilities

software Piro Visual, compatible with Windows 95/98/XP, enables:
- pyrometer identification;
- reflection of current, minimal, and maximal temperature value;
- presetting of emittance compensation factor;
- alerting of device malfunction or marginal fault;
- carrying out real-time graphical measurement visualization;
- continuous data recording on hard drive
- printing graphs or their fragments;
- varying parameters of digital filter PD-4 and measurement velocity;
- current output presetting;
- carrying out pyrometer trimming;
- and others.

Equipment set:

- Pyrometer PD-4 with sighting pipe T3-6
- optical filter
- Stabilised power unit DDSH2.087.006-02 with passport
- connecting cable
- Software Piro Visual (2 sets.);
- Operations Manual.

Upon additional Order:
- brackets for installation

PD-4 is registered in Public Register of Measuring Instruments under No. 29468-05.

Order sample:

"Precision Pyrometer" PD-4-XX»
XX - Model

ABSOLUTE BLACK BODIES (ABB)

Function:

Models of absolute blackbodies are primary standard emitters and are designed for calibration and testing of pyrometers and pyrometer converters at any sector of the spectrum.

EMITTERS: ABSOLUTE BLACK BODIES ABB 70/-40/80

ABB 70/-40/80

The type of measuring instrument is registered in the Federal Information Fund for Ensuring the Uniformity of Measurements under No. 69533-17

EEC Declaration № RU D-RU.RA04.B.32902/22 dated 06/21/22 on compliance with the requirements of TR CU 004/2011 "On the safety of low-voltage equipment", TR CU 020/2011 "Electromagnetic compatibility of technical means"

FUNCTION:

The radiator is in the form of a model of a completely black body 70/-40/80 (hereinafter referred to as the ACT, emitter) is designed for setting, checking and calibrating means of non-contact temperature measurement (pyrometers of full and partial radiation, scanning pyrometers and thermal imaging systems) in the temperature range from minus 40 to plus 80 ° C in laboratory and workshop conditions.

The radiator is a stationary, single-functional, non-mountable product in the conditions of the manufacturer.

Specifications	ABB 70/-40/80
Range of reproducible temperature, °C	-40...80
Emittence capacity factor	0.99
Grade	2
Emmitter temperature drift duriing 15 minutes, °C, max	±0.1
Link to PC	RS-232

EMITTERS: ABSOLUTE BLACK BODIES ABB 70/-40/80

ABB 70/-40/80

The type of measuring instrument is registered in the Federal Information Fund for Ensuring the Uniformity of Measurements under No. 89564-23

EEC Declaration №. RU D-RU.RA09.V.07754/23 dated 10/25.23 on compliance with the requirements of the technical regulations of the Customs Union TR CU 004/2011 "On the safety of low-voltage equipment", TR CU 020/2011 "Electromagnetic compatibility of technical means"

Function:

The emitter in the form of a blackbody model of the ABB 75/50/600 is designed for setting, checking and calibrating means of non-contact temperature measurement (pyrometers and pyrometric converters of full radiation, partial radiation and spectral ratio) in the temperature range from 50 to 600 ° C in laboratory and workshop conditions.

The ABB 75/50/600 is a monoblock design, in one housing there is an emitter, power elements, a microprocessor temperature controller, an indicator and control buttons.

Specifications	ABB 70/-40/80
Range of reproducible temperature, °C	50...600
Emittence capacity factor	0.99
Grade	2
Emmitter temperature drift duriing 15 minutes, °C, max	±0.1
Link to PC	RS-232

EMITTERS: ABSOLUTE BLACK BODIES ABB-45/100/1100

ABB-45/100/1100 are registered in Public Register of Measuring Instruments under № 23396-02 and 31042-06.

Function:

Absolute black body, ABB-45/100/1100 is designed for graduation and calibration of pyrometers in a range of temperatures of 100…1100°C in the laboratory and workshop environment.

Absolute black body, ABB-45/100/1100 is designed for graduation and calibration of pyrometers in a range of temperatures from 100 up to 1100 °C in the laboratory and workshop environment. ABB-45/100/1100 consists of tubular heater PT, control unit BU-1M, standard reference transducer PPO (Grade 2), zero thermostat DDSH5.868.003 and Precision Millivoltmeter V2-99. Control unit maintains the nearly pre-set temperature in work area of PT. The exact temperature of Absolute Black Body (ABB) is defined by the output voltage measured by Voltmeter V2-99 at the output of PPO (cold ends of PPO are in zero thermostate at the temperature of 0°C) converted into temperature value.

Specifications	ABB-45/100/1100
Range of reproducible temperature, °C	100 …1100
Control unit applied	BU-1M
Emittence capacity factor	0.99
Aperture (emission area output hole diameter), mm, min	45
Grade	2
Temperature reproduction confidence error at confidence probability of 0.95, max	±0,6% from the preset temperature
Error of keeping the temperature in stabilized mode, °C, max	±0.5
Emmitter temperature drift duriing 15 minutes, °C, max	0.5
Stabilized mode warm up time and transition time from one mode to another, minutes, max	120
Temperature indicator resolution capacity (at control unit), °C	0.1 (below 1000°C) 1 (above 1000°C)
Link to PC	RS-232 (temperature value measured by control unit is transmitted)

Equipment set ABB-45/100/1100:

- Piping Heater PT;
- emitting nikel plate for heater PT
- diaphragms (10 mm and 20 mm) (2 items.) - are used during calibration of pyrometers sightning index
- control unit BU-1M;
- reference thermal transducer PPO 2-1250 (2-Grade 2 with gradualtion from 100˚C to 1200˚C);
- Zero thermostat DDSH5.868.003 (for compensation of cold ends of PPO);
- Operations Manual.

Upon additional Order:
- precision millivoltemeter V2-99*;
- PC cable;
- Program P_tres, makes it possible to present Absolute Black Body (ABB) operation schedule in real-time on PC

* It is possible instead of millivoltmeter V2-99 to use another voltmeter having an accuracy grade not lower than 0.01 and resolution capacity max 0.1 mkV at the measuremet limit of 12 mV.

ABB-45/100/1100

Zero thermostat
DDSH5.868.003

Piping heater with diaphragm

BU-7-4

V7-99

EMITTER IN THE FORM OF ABSOLUTE BLACK BODY MODEL ABB-30/900/2500

ABB-30/900/2500 is registered in Public Register of Measuring Instruments under № 23397-02

ABB-30/900/2500

Function:

Absolute black body (ABB-30/900/2500) is designed for calibration and graduation of temperature measurement instrumentation (radiation pyrometers and pyrometer transducers, monochromatic radiation pyrometer, and spectral ratio) within the range of temperatures from 900 up to 2500°C under laboratory conditions.

Brief Description

ABB-30/900/2500 is a model of "absolute black body" with automatic temperature control of emitting cavity and of inert gas (argon) inside, ABB is a reference measure and represents temperature refrence measure within the range of from 900 up to 2500°C for non-invasive temperature probing.

In case of emitting cavity replacement for heater of special design by a separate order having a container for placing calibration points ampoules, ABB-30/900/2500 can be used as heater for ampoules to perform calibration of pure metals (Ag, Cu, Au, Pt, etc.) melting (solidification) temperatures.

ABB-30/900/2500 is produced as monoblock unit consisting of high-temperature heater, control cabinet (ShU) and feedback pyrometer (POS). Inside the high-temperature heater inert gas (argon) atmosphere is maintained, the gas incoming from cylinder (provided that argon-containing cylinder and its gear box are optional equipment and are purchased separately). Circulating water is used for cooling. ABB is provided with protection system. Argon or water supply being interrupted or the heater overheated, the protection system automatically switches ABB off. To eliminate environmental effects on the process of graduation (calibration), heater inlet is covered by the external diaphragm. ABB design has the possibility of quick replacing of the radiating cavity located inside the heater (max 15-20 minutes after the emitting cavity cooling off).

PID-control is carried out by in-built control unit which detremines by POS the approximate temperature value of ABB and maintains the temperature in the ABB operating area, the temperature approximately close to the preset temperature. The temperature value measured by the control unit is reflected on the indicator located at the ShU front panel.

ABB can operate in two modes – the automatic mode and the manual one. In case of automatic mode of operation selection, a user predetermines the desired temperature value; ABB heating control by varying supplied power is performed by control unit in automatic mode, the temperature predetermined by the user being reached. Specifications in the table are given for the automatic mode of operation. In case of manual operation mode selection, the user himself predetermines the supplied power value which affects the heating rate and the finite temperature value.

The control simplicity and the availability of manual operation mode make accessory convenience of using ABB-30/900/2500 as equipment for carrying out experimental and research work.

The design uniqueness

By its characteristics the given ABB does not have Russian or foreign off-the-shelf analogs.

The radiation cavity for such a wide range of operating temperatures (900...2500°C) has quite a large outcome aperture (diameter) (30 mm) and the required emissivity coefficient (0.99).

For accurate temperature measuring in ABB operation area reference pyrometer (Grade 1) is used. The temperature value measured by refrence pyrometer PD-4-06 is reflected on the computer to which PD-4-06 is linked.

Besides the reference pyrometer PD-4-06, a control unit can be connected to a computer; thus, a user can control two temperature values and monitor ABB performance.

For the period of transportation the extrenal diaphragm and POS are removed and installed on ABB-30/900/2500 immediately on-site.

History of developing ABB-30/900/2500:

At the stage of simulation and engineering solutions optimization, senior staff in temperature measurement in the field of non-invasive thermometry from Russian Research Institute named after D.I. Mendeleyev (VNIIM), St. Petersburg) as well as personnel from The High Temperatures Institute (ИВТАН, Moscow) took part in ABB-30/900/2500 development.

The first model of radiator ABB-30/900/2500, developed after Russian Research Institute named after D.I. Mendeleyev (VNIIM) requirements specification for use as measurement instrument forming a part of primary temperature standard for non-invasive measurement instruments in the range of from 900 up to 2500°C, was checked against declared description in Russian Research Institute named after D.I. Mendeleyev (VNIIM) and was used for pure metals phase change points realization (melting-consolidation) as part of State etalon during intercomparison of standards carried out among national laboratories (France, Germany and others) with a view of uniformity of measurements securing in conformity with international temperature scale IPTS (MTSh-90).

At present, radiator with installed heater of special design having a holder panel for placing ampoules of defined points, is used in Russian Research Institute named after D.I. Mendeleyev (VNIIM) for the research of new transition points of phase changes of melting and consolidation of high-temperature eutectics to further construct and correct the scale IPTS (MTSh-90).

Specifications	ABB-30/900/2500
Range of reproducible temperature,˚C	900...2500
Emitting capacity factor	0.99
Aperture (emission area output hole diameter), mm, min	30
Grade	2-ой
Temperature reproduction confidence error at confidence probability of 0.95, % from the preset temperature, max	0.3
Error of keeping the temperature in stabilized mode, ˚C, max	±0.5
Emmitter temperature drift duriing 15 minutes, ºC, max:	
-within the range of 900...1700˚C	0.25
-within the range of 1700...2500˚C	0.3
Stabilized mode warm up time, minutes, max for temperatures::	
- 900˚C	20
- 1700˚C	40
- 2500˚C	60
Temperature transition time from one mode to another, minutes, max:	
- from 900 to 1700˚C	25
- from 1700 to 2500˚C	25
Heating element type	graphite pipe heater with variable crossection and argon blow down
Argon flow rate, liters/minutes	0.55...0.75
Cooling	water
Water flow rate in cooling system, liters/minutes	5...6
Link to PC	RS-232 (to communication channels in cluding channem PD-4-06)
Type of climatic conditions by GOST 15150-69	UHL4.1 with location category of 4.2
Ambient air temperature, ˚C	20±5
Power supply	three phase circuit, ~ 380 V, 50 Hz
Input power, kW, max	20
Emitter Overall Dimensions (without external diaphragm and feedback pyrometer), mm, max	510×1250×750
Mass, kg, max	260

Equipment set:

- radiator (monoblock without feedback pyrometer and outer diaphragm);
- feedback pyrometer PD-4-05;
- cable of feedback pyrometer PD-4-05;
- external diaphragm;
- spare parts kit:
- nipple (2 items.)

(replacement parts for the radiating cavity);
- extractor (gadget for heater replacement);
- screwdrivers and face plate heads set;
- power cable;
- Operations Manual.

Upon additional Order:
- etalon pyrometer PD-4-06 (of first echelon)*;
- hoses set for water and argon connection (included in spare parts kit).

Instead of etalon pyrometer PD-4-06 (of first echelon) it is permitted to use another pyrometer which ensures operating characteristics as good as the ones of the former.

Note – argon cylinder and its reducer are optional equipment and are purchased by the buyer independently.

EMITTER IN THE FORM OF EXTENDED BLACK BODY MODEL EBB-540/40/100

The type of measuring instrument is registered in the Federal Information Fund for Ensuring the Uniformity of Measurements under No. 26476-10

EBB-540/40/100

IPT 540/40/100

V7-99

BU-7-8

Function:

Extended-black body (EBB-540/40/100) is intended for measurement range testing and defining accuracy of thermal imaging units (thermal imaging and thermographic systems, scanning pyrometers, infrared imagers and other non-invasive temperature control instruments) within the range of temperatures of 45-95°C, as well defining by using field of vision angular masks and resolution geometric parameters across and down the given thermal imaging units.

Brief description:

The main components of extended black body emitting model EBB-540/40/100 are the following:
- thermal emitter IPT 540/40/100;
- control unit BU-1M-10; -
-standard reference resistance thermometer ETS-100 (Grade 1);
- all-purpose voltmeter V7-54/3;
- set of masks (cross and slot masks).

Termal Emitter IPT 540/40/100 is designed as a metal casing on the front side of which there is an emitting surface having a special deep-matte coating providing the desired emittance factor. The heat carrier is distilled water (about 17 liters) which is supplied into the tank located inside IPT through the orifice in its top piece. The heat carrier level is controlled by the level indicator located at the IPT back panel.

Temperature of EBB-540-40-100 emitting surface is maitained by adjusting heat carrier temperature.

Control unit BU-1M-10 with the sensor located in the tank measures heat carrier approximate temperature value and maintains the heat carrier temperature approximately close to the desired one. By using a heat shield of special design and of forced fluid mixing system inside the tank, the temperature of emitting surface is kept practically equal to the heat carrier temperature, the desired temperature gradient on emitting surface being maintained.

The exact value of emitting surface temperature is measured by means of refrence resistance thermometer ETS-100, which is installed in a special compartment. To determine the ETS-100 temperature, the resistance measurement of ETS-100 is carried out by means of all-purpose voltmeter V7-54/3, then the resistance value is converted into the temperature value.

Specifications	EBB-540/40/100
Range of reproducible temperature, °C	45...95
Emitting capacity factor , min	0.96
Radiation surface dimensions, mm	540x540
Temperature reproduction confidence error in the central zone 100x100 mm at confidence probability of 0.95, % from the temperature value	0.5
Emitting surface temperature ripple, °C, max:	
–within the range of 45...50°C	1,0
–within the range of 50...100 °C	2
Error of keeping the temperature in stabilized mode during 15 minutes, °C, max	0.15
Emmitter temperature drift duriing 15 minutes for constant temperature mode, °C, max	0.1
Stabilized mode warm up time and temperature transition time from one mode to another, minutes, max	45
Link to PC	RS-232 (temperature value measured by control unit is transmitted)
Type of climatic conditions by GOST 15150-69	UHL4.1 with location category 4.2
Ambient air temperature, ˚C	20±5
Power supply	~ 220 V; 50 Hz
Input power, kW, max	4,8
Overall dimensions, mm, max:	
- IPT 540/40/100	696x654x300
- BU–1M–10	270x360x100
- slot mask	670x600x70
- cross mask	600x600x5
Mass, kg, max:	
- IPT 540/40/100 without hear carrier	60
- BU–1M–10	3.2
- slot mask	8
- cross mask	5
- round mask	6,5

The uniqueness of the development:

EBB-540/40/100 does not have analogs in Russia.

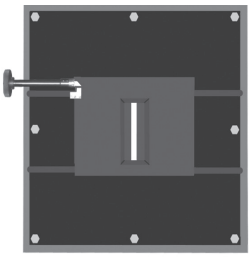
Today EBB-540/40/100 is the only instrument for thermal imagers and scanning pyrometers graduation and calibration.

History of EBB-540/40/100 development:

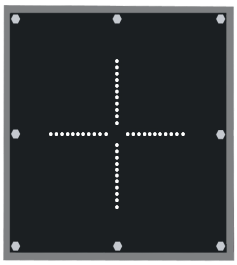
Leading specialists in temperature measurement in the field of non-invasive thermometry from Russian Research Institute named after D.I. Mendeleyev (VNIIM), St. Peterburg) took part in the process of EBB-540/40/100 development and engineering.

The first model of emitter EBB-540/40/100 together with the masks set was produced in 2001 after Russian Research Institute named after D.I. Mendeleyev (VNIIM) requirements specification for use as measurement instrument of thermal imaging systems specifications as well as the instrument of their calibration. The given design was checked in Russian Research Institute named after D.I. Mendeleyev (VNIIM) against its meeting the declared specifications. At present

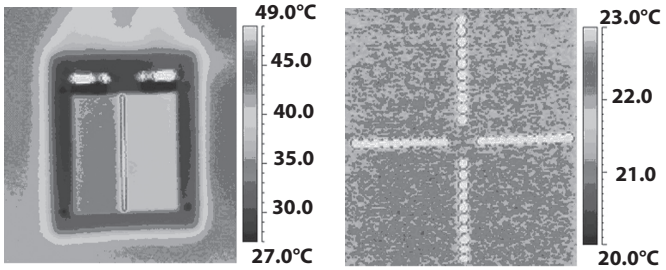
EBB-540/40/100 is applied in Russian Research Institute named after D.I. Mendeleyev (VNIIM) for the thermal imagers specifications research.



Slot mask



Cross mask



Slot and cross test pattern view on the thermal imager Thermovision 470 (produced by the company AGEMA) heat shield against the EBB-540/40/100 emitting surface.

Equipment set:

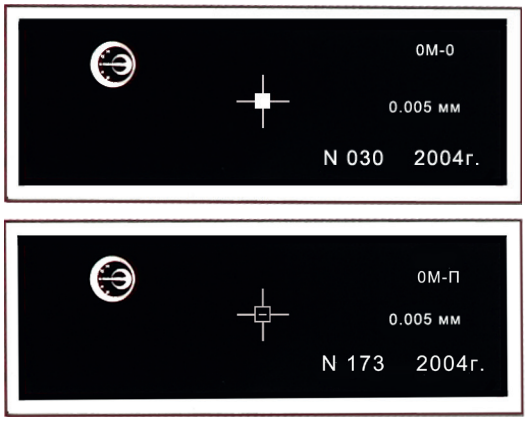
- Thermal Emitter IPT 540/40/100;
- Control Unit BU -1M-10;
- thermal test-object with slot mask
- thermal test-object with cross mask
- variable thermal test-object with variable slots (round mask)
- Reference temperature meter ETS-100;
- Connecting cables (3 items);
- test method
- Programme P_tres, which displays SBB operation curve in real time on PC
- Operations Manual

Upon additional Order:
-all-purpose voltmeter V7-54/3 (ohmmeter Sh306/1)*;
- PC cable;
- Program P_tres, makes it possible to present Semi-Black Body (SBB) operation schedule in real-time on PC. It is allowed instead of all-purpose voltmeter V7-54/3 to apply another instrument providing resistance measurement accuracy as good as that of V7-54/3.

LINEAR MEASUREMENT EQUIPMENT CALIBRATION DEVICES

STAGE MICROMETER OM-O, OM-P

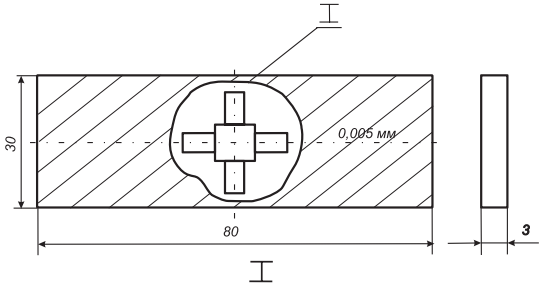
OM is registered in Public Register of Measuring Instruments under No. 28962-05



Function:

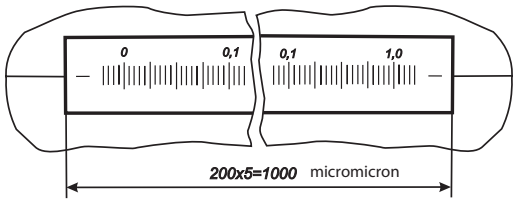
Stage micrometers OM are desinged for defining the in viewing field extension for microscopes, projectors, scale intervals of graticules and grids.

Two models are produced - for reflected light (OM-O) and for transmitted light (OM-P).



OM is produced according to design specifications TU 4381-018-02566540-2004

Specifications	OM
Main scale length, mm	1±0.0005
Distance beteen middles of adjecent marks of the first ten intervals of the main scale, mm	0.005±0.0003
Limits of absolute error allowance of OM, mm	±0.0001
Scale marks width, mm	0.002±0.0005
Type of climatic conditions by GOST 15150-69	UHL4.2
Overall Dimensions (without container), mm, max	80x30x3
Mass (without container), kg, max	0.035



Equipment set:

- Stage-micrometer
- container
- package
- technical passport
- test procedure.

Order sample:

«Stage-micrometer OM-P»