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MEASURING INSTRUMENTS PHYSICAL ENVIRONMENTAL FACTORS

Study guide for students

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The textbook is compiled in accordance with the work programs of the undergraduate disciplines “General Hygiene”, “State Sanitary and Epidemiological Surveillance” in the specialty “Public Health”.

This manual contains theoretical and practical material concerning basic hygienic research in the field of assessing the impact of physical environmental factors on human health, algorithms for operation and selection of measurement points, methods for assessing and processing materials, including requirements for drawing up measurement protocols as part of production control , certification of working conditions and sanitary and hygienic monitoring of physical factors, in accordance with the current regulatory documents of the Republic of Kazakhstan.

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List of abbreviations

MB– measuring block;
VT– Vibration transducer;
HF – high frequency
HS – hygienic standard;
E – electric fields;
MC–microphone condenser;
MNE RK – Ministry of National Economy of the Republic of Kazakhstan;
F – magnetic fields;
LF - low frequency
AB – analog board;
MPL - maximum permissible level;
PLM – programmable logic matrix
MP – microphone preamplifier;
EFD– energy flux density;
DSP– digital signal processor;
S– software;
DPB– digital processing board;
PEC– personal electronic computer;
WP–workplaces;
SR–sanitary rules;
A– amplifier
EL – energy load;

Normative references:

1. Hygienic standards for physical factors affecting impact on humans [Electronic resource]: order of the Ministry of National Economy of the Republic of Kazakhstan dated No. 169 of 02/28/2015.
2. On approval of the rules for mandatory periodic certification production facilities on working conditions [Electronic resource]: order of the Ministry of Health and Social Protection of the Republic of Kazakhstan No. 1057 dated December 28, 2015.
3. On approval of forms of accounting and reporting documentation in the field sanitary and epidemiological welfare of the population [Electronic resource]: order of the Ministry of National Economy of the Republic of Kazakhstan No. 415 dated May 30, 2015.
4. Sanitary and epidemiological requirements to objects industry [Electronic resource]: order of the Ministry of National Economy of the Republic of Kazakhstan No. 236 dated March 20, 2015.
5. Sanitary and epidemiological requirements for implementation production control [Electronic resource]: order of the Ministry of National Economy of the Republic of Kazakhstan No. 239 dated 06.06.2016
6. On approval of the Rules for mandatory periodic certification production facilities on working conditions, order of the Ministry of Health of the Republic of Kazakhstan and SR of the Republic of Kazakhstan No. 1057 dated December 28, 2015.

INTRODUCTION

Throughout his life and activity, a person is exposed to constant, continuous exposure to a complex of unfavorable environmental factors.

Responsibility for preventing adverse effects on human health rests with government authorities, heads of enterprises, institutions and organizations, regardless of their form of ownership. At the same time, administrative, disciplinary and criminal liability for sanitary offenses occurs after the issuance of a sanitary and hygienic conclusion, which is based on the results of measuring the magnitude of the adverse effects of the chemical factor.

When carrying out measurements, it is necessary to use measuring instruments specified in the regulatory documents of the Republic of Kazakhstan. The measuring instruments used must be metrologically certified and verified by state verification bodies within the established time frame.

Instrumental measurements of the levels of production factors are documented in protocols. The form of the protocols is established by regulatory documents that determine the procedure for measuring the levels of indicators of a particular factor.

Goals consists in mastering the methods and rules for carrying out hygienic measurements of microclimate parameters, illumination, noise, vibration and other physical factors, familiarization with the principles of operation on modern hygienic devices, requirements and standards for ensuring measurement quality, as well as general principles of regulation and safety of the working environment.

Tasks:

1. mastering the methodology of instrumental measurement of parameters environmental and industrial environment (microclimate, noise, local and general vibration, electromagnetic radiation, electrostatic fields);
2. familiarization students with rules conducting production control of physical factors and assessment of working conditions, maintaining accounting and reporting documentation.

The novelty of the educational visual aid is that it allows students to independently familiarize themselves with the recommended literature and regulatory documentation on the assessment of physical environmental factors. Mastering the skills of taking measurements and selecting measurement points, preparing instruments for performing laboratory measurements will allow them to be used both in practical activities and when performing tasks at the stages of passing the objective structured practical examination stations.

The manual complements the basic literature, which is used when teaching students of the specialty "Public Health" in section of the methodology for conducting sanitary and hygienic studies when assessing the physical factors of the environmental and production environment, taking into account new Standards of the Republic of Kazakhstan, as well as additions to the

Rules for certifying working conditions of the Ministry of Labour and Social Security of the
Republic of Kazakhstan.

MAIN PART

1. MEASURING INSTRUMENTS OF MICROCLIMATE PARAMETERS

The microclimate is assessed based on measurements of its parameters (temperature, air humidity, air speed).

1.1. COMBINED DEVICE “TKA-PKM” (52) THERMOVELOCIMETRIC DETECTOR

The device is designed to measure air temperature (t , °C) and air speed (V , m/s) and volumetric air flow (m/h, l/s)

Scope of application of the device: Sanitary and technical supervision in residential and industrial premises, museums, libraries, archives;
certification of workplaces and other areas of activity Specifications:

- air speed measurement range - 0.1...20 m/s;
- air temperature measurement range - 0...500C.

Limits of permissible basic absolute error in measuring air velocity at air temperature in the measurement zone (20 ± 5)°C:

- in the range **0.1...1.0m/s** $\pm(0.045+0.05V)$
- in the range **>1.0...20m/s** $\pm(0.1+0.05V)$

Limits of permissible basic absolute error of temperature measurements at air temperature in the measurement zone (20 ± 5)°C, °C ± 0.5

Device and principle of operation.

Structurally, the device is made in the form of two functional blocks: a signal processing unit (Figure 1) and a measuring head, connected to each other by a communication cable.

On the front side of the device body there are: LCD display and controls: buttons **On/off**, **Backlight** and three function buttons.

On the back of the case there is a battery compartment cover.

A probe with relative humidity and air temperature sensors is installed in the upper part of the measuring head.

Operating principle of the device consists of transformation by sensors microclimate parameters into electrical signals with processing and digital indication of the obtained numerical values of the parameters on the device display.

To determine the desired parameter, it is enough to place the device in the measurement area and read the measured value from the liquid crystal display.

The device is turned on and off by pressing the button once **On /off**.



Figure 1 - Appearance of the TKA-PKM 52 thermovelocimetric detector

Procedure for working with the TKA-PKM 52 device:

1. Place the measuring head of the device in the measurement area.
2. Turn on the device by pressing the “On/Off” button once.
3. Set the required options in the settings screen menu. To save the parameter settings set on the screen and exit it, press the button under the “SAVE” sign, the device will automatically go to the main screen (C).
4. Press “HOLD”, a timer will appear at the top left of the screen countdown of the exposure time and the device readings are recorded; after the exposure time has elapsed, the device sounds a sound signal, and the display, in addition to the instantaneous value of the air velocity, also displays the average.
5. To return to current measurement mode, press button under the “BACK” sign.
6. Upon completion of measurements, turn off the device once by pressing the “On/Off” button.

1.2. COMBINED DEVICE “TKA-PKM” (23) THERMOHYGROMETER

The device is designed to measure relative humidity (Rh, %) and air temperature (t, °C), as well as displaying parameters calculated in real time: wet bulb temperature ($t_{\text{в.л.}}$, °C) and dew point temperature ($t_{\text{т.п.}}$, °C) indoors).

Area of application of the device: sanitary and technical supervision in residential and industrial premises, museums, libraries, archives; assessment of workplaces

Specifications:

- relative humidity measurement range 10÷98%;
- air temperature measurement range 0÷+500C.

Limits of permissible basic absolute measurement error at air temperature in the measurement zone (20±5)°C:

- relative humidity, % ±5.0
- air and sphere temperatures, °C ±0.5

Device and principle of operation. Structurally, the device is made in the form of a single block (Figure 2).



Figure 2 – Appearance of the TKA-PKM device 23 THERMOHYGROMETER

On the front side of the device there are: LCD indicator, “On/Off”, “Backlight” buttons and three function buttons. On the back of the case there is a battery compartment cover. The probe with sensors for the measured parameters is installed on the upper end cover of the housing.

Principle of operation. The device consists in converting sensors microclimate parameters into electrical signals with processing and digital indication of the obtained numerical values of the parameters on the device display. Procedure for working with the TKA-PKM 52 device:

1. Mount the device on a tripod. Remove the protective cap from probe;
2. Place the device in the measurement area;
3. Turn on the device by pressing the “On/Off” button once;
4. To save the parameter settings made on the screen and exiting it, press the button under the “SAVE” sign, the device – 10 – will automatically go to the main screen;
5. Press “HOLD”, a timer will appear at the top left of the screen countdown of the exposure time and the device readings will be recorded (screen “E”);
6. After the exposure time has expired, the device gives a sound signal, and the display shows the result of the exposed (average over 5 minutes) RH and t values;
7. To return to the current measurement mode, press button under the “BACK” sign;
8. When the measurement ranges on the display are exceeded double sized symbols appear (0 C 0C, % %);
9. Upon completion of measurements, turn off the device once press the “On/Off” button and put the protective cap on the probe.

1.3. AIR PARAMETERS CONTROL DEVICE ENVIRONMENTS

" METEOROLOGICAL METER -MES - 200A"

The meter is designed to measure atmospheric pressure, relative air humidity, air temperature, indoor air flow speed.

Scope of application: control of atmospheric parameters in residential, administrative premises and work areas. Meteometers are intended for use in non-explosive areas of indoor and outdoor installations. When used outdoors, MES-200A should be protected from exposure to precipitation, dust and direct sunlight.

Specifications:

The electronics unit operates at temperatures from -20 to +600 °C and relative ambient humidity up to 95% at a temperature of 35 °C.

Measuring probe -1:

- temperature measurement range, °C – from -40 to +85
- measurement range of relative humidity, % - from 0 to 98 at temperature 35;
- measurement range of air flow speed, m/s – from 0 to 20;
- air pressure measurement range, kPa (mmHg) – from 80 to 110



Figure 3 – Appearance of “MES-200A” METEOROLOGICAL METER

Design and principle of operation:

MES-200A consist of an electronics unit and replaceable measuring probes (Figure3).

Operating principle of the device "MES -200A":

- used as an air flow speed sensor miniature thermistor (Honey Well, USA), heated by stabilized current to a temperature of (200–250) °C. Depending on the speed of the air flow, the degree of cooling of the heated thermistor and the voltage drop across it, which is a measure of the speed of the air flow, change;

- a miniature one is used as a temperature sensor a thermistor (Honey Well, USA) with a resistance of 1 kOhm (at a temperature of 0°C) with a normalizing amplifier assembled on an operational amplifier type OR 496.

- functionally used as a humidity sensor a complete humidity sensor (Honey Well, USA) with a normalized output voltage from 0.8 to 4.2 V with a high degree of linearity of the output voltage depending on relative humidity.

How to operate the device "MES -200A":

1. Connect the measuring probe to the indicator block, observing contacts;
2. Turn on the device by pressing the “ON” button for 2 seconds. (will appear on display temperature and humidity values);
3. Set the airflow speed measurement mode by pressing buttons “P” and “+” sequentially (wait 2-3 minutes). The next time the “P” button is measured, it is set to the temperature and humidity measurement mode;
4. Set the pressure measurement mode (P) by pressing the “P” and “-” buttons;
5. Write the parameters into the protocol;
6. Turn off the device by pressing the “OFF” button;
7. Place the device in the UT.

1.4. MICROCLIMATE PARAMETERS METER "METEOSCOPE-M"

The meter is designed to measure microclimate parameters in the mode of single or periodic measurements when monitoring sanitary and hygienic requirements for the air of a working area and residential buildings, as well as in open areas.

Scope of application: environmental control in terms of microclimate parameters by supervisory authorities in the field of consumer rights protection and public welfare in the Republic of Kazakhstan.

Specifications:

- temperature measurement range, °C – from -40 to +85
- measurement range of relative humidity, % - from 3 to 97
- measurement range of air flow speed, m/s – from 0.1 to 20
- air pressure measurement range, kPa (mmHg) – from 80 to 110

Limits of permissible absolute error of the device: - temperature measurement channel, °C - ± 0.2 ;

- relative humidity measurement channel, % - ± 3.0 ;
- speed measurement channel in the range from 0.1 to 1 m/s, m/s - $\pm(0.05+0.05V)$;
- speed measurement channel in the range of St. 1 to 20 m/s, m/s $\pm(0.1+0.05V)$;
- air pressure measurement channel, kPa (mm Hg) - $\pm 0.13 (\pm 1)$.

Device and principle of operation.

The device consists of a measuring and indicator block and sensory probe (Figure 4).



Figure 4 – Appearance of “Meteoscope-M”

The sensor probe is designed to measure such meteorological parameters as temperature, relative humidity, air flow speed. To measure these parameters, extend the telescopic sensory probe and position its head in the place where the measurement needs to be taken. The orientation of the anemometer sensor window should be chosen to match the expected direction of air flow, with the humidity sensor oriented AWAY FROM THE FLOW.

Principle of operation microclimate parameter meter "MeteoscopeM":

The Meter uses two temperature sensors (thermistors) to measure air flow velocity. One of which is in thermal equilibrium with the environment, and the other is heated by an electric

current of a given value. The data received from thermistors is processed by the processor. The processing results are displayed on the liquid crystal display of the device.

The measurement of air humidity is based on the ability of a capacitor to change its capacitance depending on the humidity of the environment in which it is located. In its simplest form, the humidity sensor used in the Measures is a capacitor with one (or two) perforated plates.

The humidity sensor and thermistors of the Measures are mounted in a sensor probe connected to the measuring and indicator unit by an electric cable.

The pressure sensor is made on the basis of a strain gauge resistance bridge and is installed directly in the housing of the indicator unit.

How to operate the device "Meteoscope-M":

1. Connect the probe observing the relationship with the red dot;
2. Select a measuring point;
3. Turn on the device by pressing the "O" button for 2-3 seconds (appear on panel date and time of registration);
4. Press "Start" (autotest will run with sound);
5. Press "Start" again (go to the main menu);
6. Moving the cursor up down select "Measure";
7. Click on the done
8. Turn off the device by pressing the "O" button and hold for 3 seconds;
9. Disconnect the probe from the indicator block;
10. Place the device in the UT.

"Points for measuring microclimate parameters" according to GOST 30494-2011 "Residential and public buildings. Indoor microclimate parameters."

During the warm season, microclimate measurements should be performed at an outside air temperature of at least 15°C. It is not allowed to carry out measurements under a cloudless sky during daylight hours.

Points for measuring microclimate parameters when compiling characteristics of working conditions:

- usually measurements are carried out at permanent workplaces;
- in places of temporary stay of an employee they measure only air temperature;
- if the workplace is several areas production premises, then measurements are taken at each site at the points of minimum and maximum distance from sources or local heat release, cooling or moisture release (heated units, windows, doorways, gates, open bathtubs, etc.);¹⁰
- in rooms with a high density of workplaces in the absence sources of local heat release, cooling and moisture release, measurement points are designated evenly throughout the room: a) for an area of up to 100 m²– 4 measurement points; b) with an area of 101-400 m²– 8 measurement points; c) with an area of 400 m²– every 10 m². Measurements are taken at a height h from the surface of the floor or working platform:
 - when working sitting at h=1 m;
 - when working standing at h = 1.5 m;

- when determining the difference in air temperature or air speed vertical movement of the working area, additional measurements are taken at $h=0.1$ m.

- in the presence of sources of radiant heat, the intensity of thermal irradiation is measured from each source, placing the receiver of the device perpendicular to the incident flux. Measurements are carried out at heights h 0.5; 1 and 1.5 m from the floor or working platform.

The temperature of the inner surface of walls, partitions, floors, and ceilings should be measured at the center of the corresponding surface.

Table 1. Measurement locations

Building	Selecting a room	Measurement location
Single-family	In at least two rooms with an area of more than 5 m ² each having two outer walls or rooms with big windows, the area of which is 30% or more external wall area	In centerplanes, distant from internal surfaces outdoor walls and heating device at 0.5 m, and in the center of the room (point intersections of diagonal lines premises)
Apartment	In at least two rooms with an area of more than 5 m ² each in apartments on the first and last floors	
Hotels, motels, hospitals, children's institutions, schools	In one corner room of the first or last floors	

Other public and administratively household	In everyone representative indoors	In centerplanes, distant from internal surfaces outdoor walls and heating device at 0.5 m in premises with an area of 100 m ² and more, measurements are being implemented on areas
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Evaluation of research results for compliance with hygienic standards carried out in accordance with HS "Hygienic standards for physical factors affecting humans." Order of the Ministry of National Economy of the Republic of Kazakhstan dated February 28, 2015 No. 169 (Table 2);

Table 2. Standardized values of temperature, relative humidity and air speed in working area of production premises

No.	Period of the p/p year	Temperature oC					Relative humidity on jobs - permanent and nonpermanent, no more		Movement speed, m/s at workplaces - permanent and non-permanent*	
		Optimal	Acceptable			Optimal	Acceptable	Optimal, no more	Acceptable	
			Upper limit in the workplace		Lower limit					
		permanent	non-permanent	permanent	non-permanent					
1	2	4	5	6	7	8	9	10	eleven	12
1	Cold period of the year	22-24	25	26	21	18	40-60	75	0.1	no more than 0.1
		21-23	24	25	20	17	40-60	75	0.1	no more than 0.2
		18-20	23	24	17	15	40-60	75	0.2	no more than 0.3
		17-19	21	23	15	13	40-60	75	0.2	no more than 0.4
		16-18	19	20	13	12	40-60	75	0.3	no more than 0.5
2	Warm period of the year	23-25	28	30	22	20	40-60	55 at 28 oC	0.1	0.1-0.2
		22-24	28	30	21	19	40-60	60 – at 27oC	0.2	0.1-0.3
		21-23	27	29	18	17	40-60	65 – at 26 oC	0.3	0.2-0.4
		20-22	27	29	16	15	40-60	70 – at 25oC	0.3	0.2-0.5
		18-20	26	28	15	13	40-60	75 – at 24 oC From and below	0.4	0.2-0.6

2. MEASURING INSTRUMENTS LIGHT INDICATORS ENVIRONMENTS

Creating favorable lighting helps improve performance, prevent injuries and functional visual impairment.

Basic light concepts: luminous flux, luminous intensity, luminous efficiency (light source), illumination and brightness.

2.1 COMBINED DEVICE “TKA-PKM” (09) PULSE METER+LUXMETER+BRIGHT METER

The meter is designed to measure the pulsation coefficient (%), radiation sources and illumination, in the visible region of the spectrum (380...760) nm and brightness (cd/m²), display screens and extended self-luminous objects in the visible region.

Application area: sanitary technical supervision in residential and production facilities, museums, libraries, archives, certification of workplaces and other areas of activity.

Specifications:

- illumination measurement range in the visible region of the spectrum, 10-2000;
- limit of permissible basic relative error ± 8.0 ;
- pulsation coefficient measurement range, % 1-100;
- limit of permissible basic relative error ± 10 ; - brightness measurement range, cd/m² 10- 200000 ;
- limit of permissible basic relative error ± 10 .

Design and principle of operation:

The combined device consists of two functional blocks, a photometric head and a signal processing unit, connected to each other by a flexible multi-core cable (Figure 5).



Figure 5 – Appearance of “TKA-PKM-09”

On the body of the device there are: liquid crystal indicator; controls, markings; remote probe with sensors of measured parameters.

In the measuring room head installed two primary

radiation converter - semiconductor silicon photodiodes with a system of light filters and diaphragms. All measured values are displayed on the built-in digital indicator (display). The first screen displays the parameters of illumination and pulsation coefficient, the second screen displays brightness (switched by the "Mode" button).

Operating principle of the "TKA-PKM" device (09) is conversion of radiation into an electrical signal by a photodetector device, followed by its processing by a micro converter

Procedure for working with device "TKA-PKM" (09):

1. Determine the measuring workplace and measuring point (Application 2) subject to the following parameters:

- when measuring illumination, position the photometric head parallel to the plane of the measured object;

- when measuring the brightness of video display screens, electronic computers, place the photometric head of the device parallel to the screen plane at a distance of (1. 4) mm. The input window of the photodetectors should be facing towards the screen plane, and the diameter of the measured area should not exceed (7. 9) mm.

- when measuring the brightness of extended self-luminous objects position the photometric head of the device parallel to the measured plane at a distance of (1. 4) mm.

2. Turn on the device with the button **ON/OFF**, after which according to inscriptions on the LCD, you should darken the sensor and press the button "**Pause**";

3. According to the inscription on the LCD, wait for the measurement time;

4. After digital values appear on the LCD, press button "**PAUSE**" and fix the parameter values;

5. Write the values into the protocol;

6. Using a button **MODE** select measuring channel (**brightness - L**), which will appear on the LCD (liquid crystal display);

7. After digital values appear on the LCD (**L**) press the button "**PAUSE**" and fix the parameter values;

8. Write the values into the protocol;

9. After completing the measurements, turn off the device using the button **ON/OFF**.

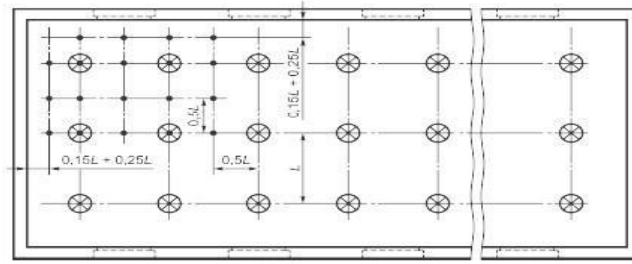
According to GOST 24940-2016 "Buildings and structures. Illumination measurement methods" illumination measurement points:

1. Placement of control points when measuring the minimum room illumination.

1.1 Control points for measuring minimum illumination from working and backup lighting is placed in the center of the room under the lamps, between the lamps and their rows, near the walls at a distance of 0.15 L before 0.25L, but not more 1m from the wall, where L - distance between rows of lamps.

1.2 Test points for measuring the minimum illumination from evacuation lighting should be placed on the floor along the route of evacuation of people from the premises.

1.3 Examples of location of measurement control points illumination in the premises of industrial and public buildings when using lamps with point and linear light sources for lighting are shown in Figures 6.7.





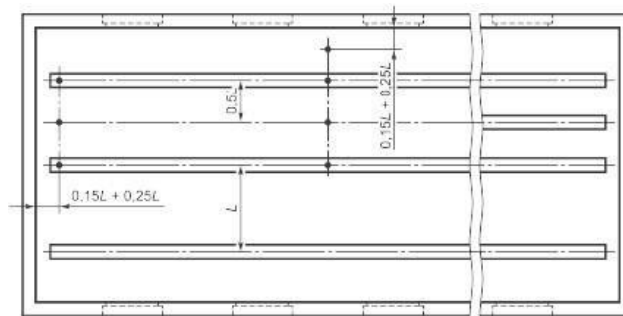
- - check Point; -  lamp; —  conditional section grid area of the room into parts to determine the location of control points; L- distance between rows of lamps.

Figure 6 – Location of control points when measuring the minimum illumination of a room from luminaires taken as point emitters





- - check Point;  - lamp;  - conditional grid dividing the area of the room into parts to determine the location of control points; L- distance between rows of lamps.

Figure 7 – Location of control points when measuring the minimum illumination of a room from luminaires taken as linear emitters

2. Placement of control points when measuring the average illumination of premises and places of work outside buildings and security lighting.

2.1 To measure average illumination, use control point grid, in which control points are placed at the nodes of a rectangular grid within the work area or room in accordance with the requirements. The ratio of the length of the lattice cell to its width should be in the range from 0.5 to 2. The maximum size of the lattice cell in meters is calculated using formula 1.

$$R=0.2*5lg(d), \tag{1}$$

Where d— the largest size of the work area or room, m.

Maximum grid pitch size R should not exceed 10 m. A strip of 0.5 m from the boundaries of the zone or from the walls or boundaries of the work area is excluded from the measured zone, except for cases where workplaces are located there.

NOTE For example, R= 0.2 m at d=1m;R= 1 m at d= 10m;R= 5 m at d= 100 m.

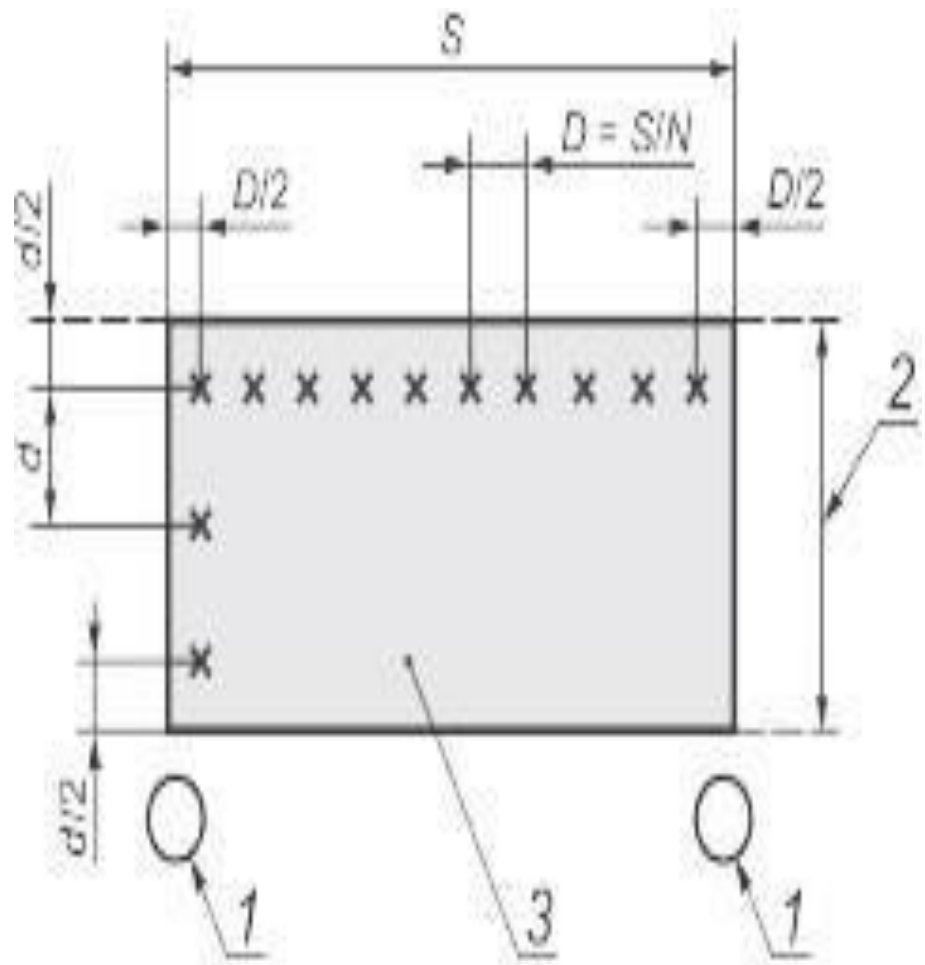
Typical parameters of the grid of control points when measuring average illumination in rooms and work areas are given in Table 3.

Table 3. Control points when measuring average illumination in rooms and work areas

Room length or working area, m	Maximum distance between control points, m	Minimum number control points
0.40	0.15	3
0.60	0.20	3
1.00	0.20	5
2.00	0.30	6
5.00	0.60	8
10.00	1.00	10
25.00	2.00	12
50.00	3.00	17
100.00	5.00	20

2.2 When placing control points on the floor plan, their grid should not coincide with the grid of fixtures. If the grids coincide, it is advisable to increase the number of control points on the floor plan in accordance with Table 3. When placing large equipment in the room, control points are not allowed to be placed on the equipment. If the control points coincide with the equipment, then the grid of control points should be made more frequent and points falling on the equipment should be excluded.

2.3 For security lighting, control points are located according to the perimeter of the illuminated area, the number of control points along the perimeter of the illuminated area must be at least five.



1- lamps;2— width of the road or control section W_r ;3— control area; x - control points for illumination measurement

Figure 8 — Location of control points on the site at measuring average street illumination

3. Placement of control points when measuring cylindrical illumination of premises.

3.1 Cylindrical illuminance measurement reference points should be placed evenly throughout the room under the lamps, between the lamps and on the central longitudinal axis of the room at a height of 1.5 m above the floor and at a distance of at least 1.0 m from the wall.

3.2 Number of control points for measuring cylindrical illumination should be at least five.

4. Placement of control points when measuring the average illumination of streets, roads, squares.

4.1 Determine the calculated field on the illuminated object or control area. For objects with standard geometry, the control section is a part of a straight line horizontal road surface, the width of which is equal to the width of the entire carriage way W_r (when traveling in one direction), and the length is a step S between lighting fixtures located on one side of the road or in the center when installing lighting fixtures along the center line. When determining

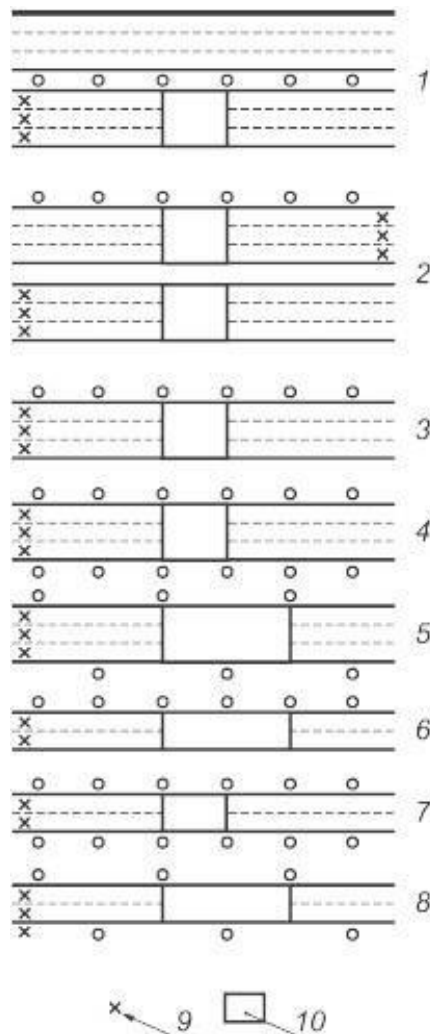
illumination for a checkerboard arrangement of lighting fixtures, the length of the control section S determined projection onto the longitudinal axis of the road of the distance between two adjacent lighting fixtures located on opposite sides of the roadway. Control points for measuring the average illumination of streets, roads and squares should be located evenly on a section of the road surface limited by the spacing of the lamps, at a distance $D = S/N$, Where S —step between lighting devices.

When stepping between lighting fixtures $S \leq 30m$ $N=10$, when stepping between lighting fixtures $S > 30$ m $D \leq 3m$.

d — distance between control points in transverse direction, $d = W_r/n$,

Where n — number of design points in the transverse direction, $n \geq 3$ ($n=3$ at $d \leq 1.5$ m). The distance of the extreme control points on the control section is $D/2$ in the longitudinal direction and $d/2$ in the transverse direction, as shown in Figure B.3 of application B.

4.2 The number of control points must be at least ten. Examples The locations of control points for different positions of luminaires, as well as in places of rounding and intersection, are shown in Figure 9.



1- six-lane road with a central dividing strip at double central arrangement of lamps;2- six-way a road with a central dividing strip with a one-sided single-row arrangement of lamps;3- three-lane road one-sided single-row arrangement of lamps;4— three-lane road with two-sided rectangular arrangement of lamps;5- three-lane road with two-way staggered location of lamps;6- two-lane road one-sided single-row arrangement of lamps;7— two-lane road with two-sided rectangular arrangement of lamps;8- two lane road with two-way staggered location of lamps;9— location of the observer;10— location of the control area.

Figure 9 — Location of the control area when measuring average street illumination

5 Placement of control points when measuring the coefficient of natural illumination of premises

5.1 Control points are placed at the intersection of the vertical the plane of the characteristic section of the room and the conventional working surface (or floor). The first and last points are taken at a distance of 1 m from the surface of the external walls and internal partitions (or the axis of the columns).

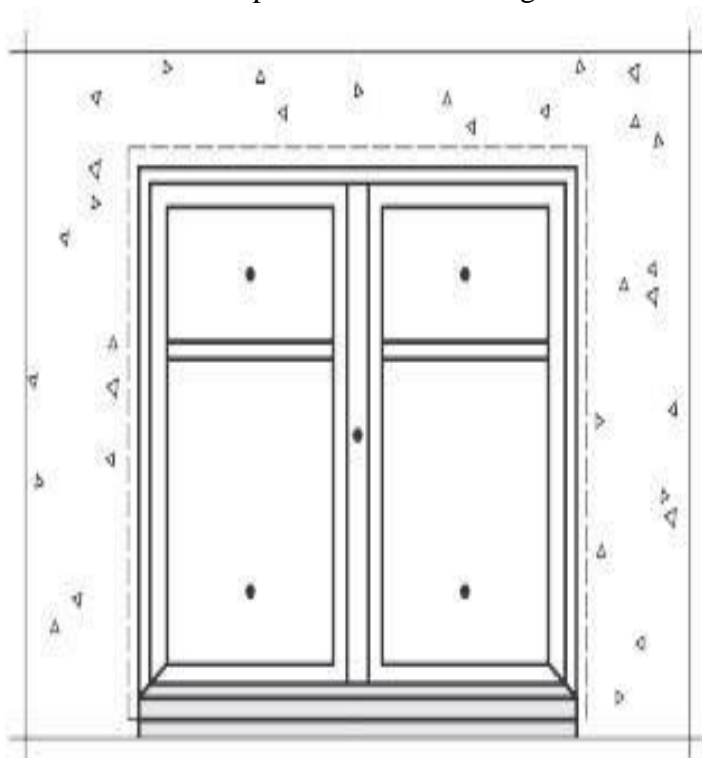
5.2 The number of control points must be at least five. In number control points should include the point at which illumination is normalized.

6 Placement of control points when measuring vertical illumination of building windows

6.1 Control points are placed on the outer surface of the window.

6.2 The number of control points must be at least five for each measured window.

An example of the location of control points is shown in Figure 10.



• - check Point

Figure 10 — Location of control points on the outer surface windows when measuring vertical illumination (window illumination)

Evaluation of research results for compliance with hygienic standards carried out in accordance with HS "Hygienic standards for physical factors affecting humans." Order of the Ministry of National Economy of the Republic of Kazakhstan dated February 28, 2015 No. 169. Illumination levels for precision visual work are given in Table 4.

Table 4. Illumination levels for precision visual work

No. p/p		Size object distinctions, ang . min	Time accurate visual work in % of work shift time	Illumination	Working brightness surfaces, cd/m ²
1		2	3	4	5
1		Less than 1.5	More than 60 From 60 to 30 Less than 30	4000 3000 2000	From 300 to 500
2		From 1.5 to 3.0	More than 60 From 60 to 30 Less than 30	2000 1500 1000	From 150 to 300
3		From 3.5 to 5.0	More than 60 From 60 to 30 Less than 30	1000 750 500	From 750 to 150

Application 1 and 2 provide the Standardized indicators for lighting of general industrial premises and structures and the main premises of public, residential and auxiliary buildings.

3. NOISE MEASUREMENT

Noise measurements should be made to monitor whether actual noise levels in workplaces comply with those permitted by current regulations.

3.1. NOISE ANALYZER “ASSISTANT”

The device is designed to measure average (equivalent), exponentially averaged and peak levels of sound, infrasound and ultrasound; sound pressure levels (SPL) in octave and one-third octave frequency bands in the sound, infrasound and ultrasound ranges.

Field of application of the device: measurement of parameters of sound, infrasound, ultrasound in workplaces, in residential and public buildings, in territories.

Specifications:

Sound – A, C – sound levels, Z – SPL for all frequency corrections simultaneously, equivalent levels and levels with RMS detectors slow (S), fast (F), pulse (I), maximum and minimum values over time are calculated in real time measurements; infrasound G – sound levels, ZI – SPL, RMS detector slow (S) or 30s.

For octave filters of the audio range with nominal geometric mean frequencies – 31.5 Hz - 16 kHz;

For one-third octave audio range filters with nominal geometric mean frequencies – 25 Hz – 20 kHz.

Measurement modes:

- acoustics (sound, infrasound – dB SLM, dB 1/3, dB INF, dB C/Z, AWP Sh, ARM I);
- acoustics (ultrasound – dB ULT);

Frequency range of measurements, Hz:

- with microphones MC 265, HMWK 205 – 2 – 2000;
- with microphones MC233 – 2 – 4000.

Limits **deflection** frequency response of the spectrum analyzer for electrical input in the range: 0.8-4000 Hz, dB±0.3

Limits **deviations** frequency response of the acoustic signal spectrum analyzer:

- for HMWK 205 and MC265 – ±2 dB in the range 2 - 2000 Hz;
- for MC233 – -4 - 0 dB in the range 2 – 3.15 Hz;
±2dB in the range 3.15 – 4000 Hz.

Basic error under normal conditions (temperature 20±5) – ±0.7 dB, additional error in sound level meter readings caused by temperature changes (-10 - +45°C) – ±0.5 dB.

Design and principle of operation

The device is designed as a small-sized device with autonomous power supply. On the upper end wall of the housing of the measuring instrument (MI) unit there is a connector for connecting the MP with the MC when working as a sound level meter for a spectrum analyzer. (Figure 11).



Figure 11 – Appearance of the noise analyzer “ASSISTANT”

Operating principle of the noise analyzer “Assistant” based on the conversion of sound vibrations into electrical vibrations with their subsequent processing. The conversion of sound vibrations into electrical vibrations is carried out by MC. From the output of the MP, the signal goes to the input of the amplifier U. The gain U is set using a range switch in increments of 20 dB. Further signal processing is carried out digitally. The signal sampling frequency is 96 kHz, in the ultrasonic range 192 kHz. Bit size 24 bits. The digital representation of the signal enters the DSP and is processed according to the algorithm corresponding to the selected measurement mode.

How to operate the noise analyzer “Assistant”:

1. Remove the device from the packing bag and inspect it for no external damage. Select a measurement point;
2. Connect the MP assembly with the MC to the MB using a connecting cable from set of instrument for measuring acoustic parameters in **sound level meter**;
3. Turn on the power of the device using the “ON” key on the MB keyboard;
4. The device software is loaded. At this time on the indicator The BIOS6 version number, the device serial number and an indication of the current boot stage are displayed. Loading the software takes no more than 15 seconds;
5. After downloading the software, testing automatically begins device. Indication of successful execution of a separate test is a green square, unsuccessful - red;
6. If any of the tests on the indicator fails test results remain. To continue the work, press the “ENTER” key;

7. The main menu consists of three items: ACOUSTICS, SERVICE. The required item is selected by moving the marker using the keyboard buttons. The selected item is activated by pressing the "ENTER" button. In the main menu, the bottom line of the indicator displays the current time and battery voltage;

8. Enter the "ACOUSTICS" item, make sure that the device readings react to changes in noise. You should wait 1 minute after turning on the power to establish the operating status of the device;

9. The device is turned off using the "ON" button. In to avoid loss of information due to an erroneous press, shutdown occurs when the button is pressed for at least 2 seconds.

Noise measurement points according to GOST 12.1.050-86

Interstate standard. "System of occupational safety standards. Methods for measuring noise in workplaces."

1. Measurements infixed point carry out:

1.1 if the position of the operator's head is known accurately. At In the absence of the operator, the microphone is installed at a given measurement point located at the level of his head.

1.2 If the position of the operator's head is not precisely known and measurements is carried out in the absence of the operator, then the microphone is installed for a seated workplace at a height of (0.91 ± 0.05) m above the center of the seat surface with its average adjustment position according to the operator's height, and for a standing workplace - at a height of (1.550 ± 0.075) m above the support on a vertical line passing through the center of the head of an upright person.

1.3 If the presence of an operator is necessary, then the microphone positioned approximately 0.1 m from the ear receiving the higher (equivalent) sound level and oriented in the direction of the operator's gaze, if possible, or in accordance with the manufacturer's instructions.

1.4 If the microphone is attached to the operator, then it is installed on a helmet or shoulder using a frame, as well as on a collar at a distance of 0.1-0.3 m from the ear, but so as not to interfere with the operator's work and not create danger for him.

1.5 If the operator is very close to the noise source, the position and orientation of the microphone must be precisely specified in the test report. The microphone must be at least 0.5 m away from the operator conducting the measurements.

2. To evaluate the noise at permanent jobs measurements should be carried out at points corresponding to established permanent locations.

3. To estimate the noise at non-permanent jobs operator measurements are carried out at each of his workplaces and determine the equivalent sound level of noise affecting the operator during a work shift.

To assess noise in work areas where there are several workers, zones with approximately equal noise are identified to reduce the volume of measurements. These may include areas where the same type or identical work is performed at workplaces (for example, a turning area), or areas where noise is mainly determined by distant noise sources (at a distance of more than 5-20 m). If the equivalent sound level within the working area does not differ by more than 5 dBA, then measurements are taken at sample typical workplaces, the measurement result is averaged and applied to all workplaces in a given work area. Additionally, in case of doubt, measure the noise at a specific workplace. If the equivalent sound level in the working area differs by more than 5 dBA noise measurements are carried out at each workplace.

4. When taking measurements octave sound pressure levels. The frequency response switch of the device is set to the “filter” position. Octave sound pressure levels are measured in bands with geometric mean frequencies of 63-8000 Hz.

5. When taking measurements sound levels and octave levels sound pressure of constant noise time switch the characteristics of the device are set to the “slow” position. Level values are taken according to the instrument reading at the time of counting.

6. Values sound levels and octave sound pressure levels read from the instrument scale with an accuracy of 1 dBA, dB.

7. Measurements sound levels and octave sound pressure levels constant noise must be carried out at each point at least three once.

Evaluation of research results for compliance with hygienic standards carried out in accordance with HS "Hygienic standards for physical factors affecting humans." Order of the Ministry of National Economy of the Republic of Kazakhstan dated February 28, 2015 No. 169 (tables 7,8); Sound pressure limits for the main most typical types of work activity and permissible sound pressure levels, dB, permissible equivalent sound levels at workplaces in industrial buildings, in residential and public buildings and in residential areas are given in Application 3.4.

4. MEASUREMENT OF GENERAL AND LOCAL VIBRATION

4.1. VIBRATION ANALYZER “ASSISTANT”

The device is designed to measure adjusted levels of vibration acceleration of general and local vibration and levels of vibration acceleration in octave and one-third octave frequency bands in the ranges of general and local vibration.

Field of application of the device: measurement of general and local vibration parameters in workplaces, residential and public buildings, and territories.

Specifications:

For local vibration - current and equivalent levels of vibration acceleration in octave bands with nominal geometric mean frequencies- 8-1000 Hz, third octave bands with nominal geometric mean frequencies – 6.3-1250 Hz;

For general vibration - current and equivalent levels of vibration acceleration in octave bands with nominal average geometric frequencies - 1-63 Hz, third-octave bands with nominal average geometric frequencies - 0.8-80 Hz

Measurement modes:

- vibration (X – VwbX - General vibration, X, SwbX - General vibration, X, VhaX - Local vibration, X, ShaX, - Local vibration, X, ARM-L, ARM-T, ARM-O);

- vibration (Y – VwbY - Total vibration, Y, SwbY - Total vibration, Y, VhaY - Local vibration, Y, ShaX, - Local vibration, Y, ARM-L, ARM-T, ARM-O);

- vibration (Z - VwbZ - Total vibration, Z axis, SwbZ - Total vibration, Z, VwbZ -Local vibration, Z, ShaZ, - Local vibration, Z, ARM-L, ARM-T, ARM-O).

frequency range measurements vibrations corresponds frequency range third octave filters with nominal geometric mean frequencies, Hz – 0.8-1250Hz.

The maximum deviation of the frequency response of the spectrum analyzer for the electrical input is 0.8 – 4000 Hz, ± 0.3 dB.

The maximum deviation of the frequency response of the vibration acceleration spectrum analyzer is ± 1 dB in the range of 0.5-1000 Hz for AP40 and AP38 (AP38R).

Basic error under normal conditions (temperature 20 ± 5) – ± 0.3 dB, additional error in sound level meter readings caused by temperature changes ($-10 - +50^\circ\text{C}$) – ± 0.5 dB.

Design and principle of operation

The device is designed as a small-sized device with autonomous power supply (Figure 12).



Figure 12 – Appearance of the vibration analyzer “ASSISTANT”

On the upper end wall of the housing of the measuring instrument unit there is a connector for connecting the MP VT when working as a vibration meter for a spectrum analyzer. The MP is connected to the BI preamplifier connecting cable (vibration transducer: AR38R, AR38 and AR 40, preamplifier connecting cable, acoustic calibrator).

Operating principle of the device vibration analyzer is based on converting oscillations into an electrical signal using VT with its subsequent processing. Further signal processing is carried out digitally. Signal sampling frequency up to 48 kHz. Bit depth - 24 bits. The digital representation of the signal enters the DSP and is processed according to the algorithm corresponding to the selected measurement mode.

How to operate the vibration analyzer “Assistant”:

1. Remove the device from the packing bag and inspect it for no external damage. Select measuring point(Application 4);

2. Connect the VT to measure vibration parameters as spectrum analyzer vibrometer. When connecting a three-coordinate VT , the markings of its output connectors must match the markings of the MB inputs;

3. Turn on the power of the device using the “ON” key on the MB keyboard;

4. The device software is loaded. At this time on the indicator The BIOS6 version number, the device serial number and an indication of the current boot stage are displayed. Loading the software takes no more than 15 seconds;

5. After downloading the software, testing automatically begins device. Indication of successful execution of a separate test is a green square, unsuccessful - red;

6. If any of the tests on the indicator fails test results remain. To continue the work, press the “ENTER” key. The malfunction identified during testing should be eliminated;

7. The main menu consists of three items: VIBRATION, SERVICE. The required item is selected by moving the marker using the keyboard buttons. The selected item is activated by pressing the “ENTER” button. In the main menu, the bottom line of the indicator displays the current time and battery voltage;

8. Enter the “VIBRATION” item, make sure that the device readings respond to vibration changes;

9. The device is turned off using the “ON” button. In to avoid loss of information due to an erroneous press, shutdown occurs when the button is pressed for at least 2 seconds.

Noise measurement points at workplaces are carried out in accordance with GOST 31192.2-2005 (ISO 5349-2:2001) Vibration. Measuring local vibration and assessing its impact on humans. Part 2. Requirements for measurements at workplaces.

Organization of measurements.

1. Long-term measurements during continuous operation:

- if the work operation is not interrupted for a long period of time, during which the operator maintains contact with the vibrating surface, vibration measurements can be taken throughout this period.

To assess vibration exposure per shift, in addition to information on the level of vibration, it is also necessary to estimate the duration of exposure to vibration during the working day.

2. Continuous measurements during the operation with interruptions:

- if a work operation performed over a long period of time period of time, includes short stops when there is no exposure to vibration, then vibration measurements can also be taken throughout this period, provided that the specified stops are an integral part of the operation and the operator maintains constant contact with the handheld machine or workpiece, essentially without changing the position of your hands.

To assess vibration exposure per shift, in addition to information on the level of vibration, it is also necessary to estimate the duration of exposure to vibration during the working day.

3. Short-term measurements during an operation with interruptions:

- if during operation the operator can often let go (put aside) the hand-held machine or the workpiece, move the hands to other parts of the machine or pick up new parts for processing, or if any changes may be made to the hand-held machine (for example, different sanding belts or drills are inserted) or the operator takes another manual machine, then in all these cases only short-term measurements during each phase of the working operation are applicable.

To assess vibration exposure per shift, in addition to information on the level of vibration, it is also necessary to estimate the duration of vibration exposure for each working phase of the operation.

4. Measurements over a fixed period of time of vibration bursts, single or multiple shocks during an operation:

- if, when performing individual operations (for example, with using riveting hammers, nailing machines, etc.) short-term bursts of vibration are observed, which can be in the nature of single or multiple impacts, or the impact of vibration itself can be short-term (for example, when using impact wrenches). In this case, it is recommended that measurements be taken over a fixed time interval, which includes the time spent on one or more completed operations using a manual machine. The measurement period, if possible, should include minimum intervals before the start, after the end and during the break between pulse effects.

To assess vibration exposure per shift, in addition to information on the number of vibration pulses during the working day and their levels, information is also required on the duration of measurements and the number of vibration pulses in each measurement period.

Accelerometer installation locations

Vibration measurements should be taken in close proximity to the area on the palm(s) that comes into contact with the vibrating surface. It is recommended to install the accelerometer in the center of the grip zone, if this does not interfere with the normal grip of the manual machine (control, workpiece) by the operator's hand.

Taking measurements directly under the palm is usually only possible using a special adapter. This adapter should be attached under the palm or between the fingers. In practice, in most cases, the accelerometer is mounted either to the side of the palm or on the underside of the handle in a place that corresponds to the middle of the palm. If the adapter is clamped between the fingers, the accelerometer should be as close to the surface as possible manual machine handles to minimize the amplification of the angular component of vibration.

The results of measurements at different points of a vibrating surface at a distance less than the width of the palm can differ significantly from each other. In particular, this is typical for hand-held machines with side handles (often found, for example, on angle grinders), especially when the rigidity of their attachment to the body of the hand-held machine is low. In these cases, it is recommended to install the accelerometer at two points (on both sides of the palm) and then average the results of the two measurements to obtain an assessment of the vibration impact.

For many types of hand-held machines, the local vibration measurement points and directions (Figure 13) used in the test process to state the vibration performance of the machine can be specified in the appropriate vibration test codes. Measurement points in test codes are set based on specific measurement purposes (often in only one axis direction), so they will not always satisfy the purpose of assessing vibration exposure for a shift. However, when selecting vibration measurement points and directions in the workplace, it is useful to compare them with those used in the testing process to state the vibration characteristics of hand-held machines.

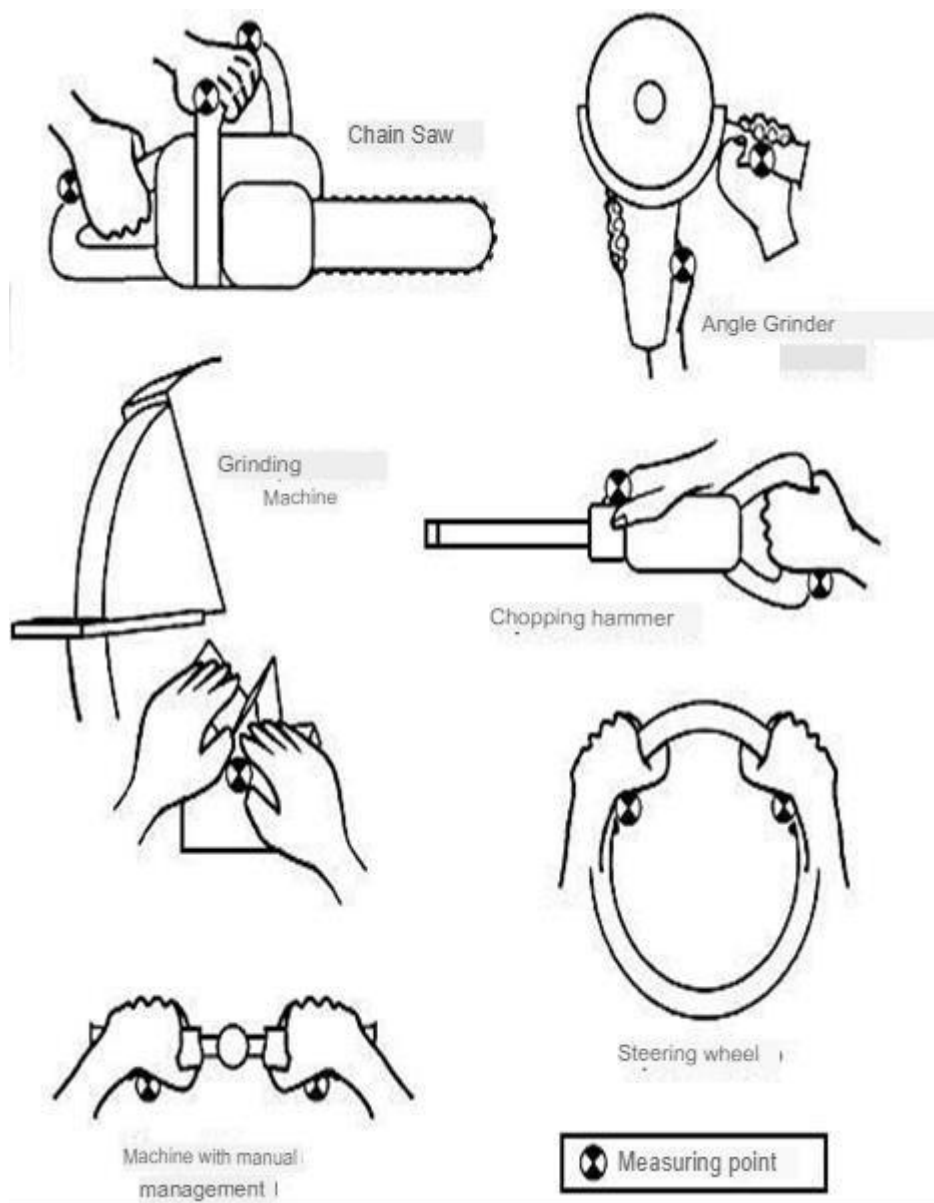


Figure 13 - Examples of measuring point locations for typical cases of exposure to local vibration

Noise measurement points in work places and in residential areas carried out according to GOST 12.1.047-85 System of standards Occupational Safety and Health . Vibration. Method of control in workplaces and living quarters of sea and river craft

Vibration measurements are carried out according to a program developed and agreed upon in the prescribed manner, included in the design documentation of the vessel and containing diagrams of the location of measurement points and guidelines for carrying out measurements.

1. In the engine room, isolated control stations, production premises located in the engine room and outside it, vibration measurement points are selected at the main workplaces and in service areas of the power plant, mechanisms and devices: at the main and auxiliary engines, at the control station, in workshops, at the front of the boiler, etc. .

2. In the service areas of the main engine, measuring points should be located on the engine room flooring, at a distance of 0.7-1.0 m from the engine. For large engines (for example, low-speed diesel engines), measurement points are located on platforms near the engine. If there are two or more engines located side by side, measurements should be taken on the floor between them.

3. In isolated control posts, production and in office premises with an area of up to 20 m, measurements are taken in the center of the room. In larger rooms, the number of measurement points should be increased at the rate of one additional point every 20-30 m and they should be placed evenly throughout the room.

In workplaces, vibration measurements can also be performed on seats if the main working position is a sitting position.

4. Vibration measurements are carried out in at least 30% of residential and public premises.

Evaluation of research results for compliance with hygienic standards carried out in accordance with SS 2.2.4/2.1.8.566. Sanitary standards. Industrial vibration, vibration in residential and public buildings. Part 3.

Maximum permissible quantities standardized parameters industrial local vibration with a duration of vibration exposure of 480 minutes (8 hours) and permissible vibration values in administrative and management premises and in public buildings are given in Table 5.6.

Table 5. Maximum permissible values of industrial local vibration

Average geometric frequencies of octave bands, Hz	*Maximum permissible values for axes X_{II}, Y_{II}, Z_{II}			
	vibration acceleration		vibration speeds	
	m/s ²	dB	m/s 10 ⁻²	dB
8	1,4	123	2,8	115
16	1,4	123	1,4	109
31,5	2,8	129	1,4	109
63	5,6	135	1,4	109
125	11,0	141	1,4	109
250	22,0	147	1,4	109
500	45,0	153	1,4	109
1000	89,0	159	1,4	109
Adjusted and equivalent adjusted values and their levels	2,0	126	2,0	112

* Work under conditions of vibration exposure with levels exceeding the present sanitary standards by more than 12 dB (4 times) according to the integral evaluation or in any octave band, is not allowed.

Table 6. Permissible vibration values in administrative and management premises and in public buildings

The average geometric frequencies of the bands, Hz	Acceptable values by axes X_0, Y_0, Z_0			
	vibration acceleration		vibration speeds	
	2^{-3} m/s · 10 ⁻³	dB	10^{-3} m/s · 10 ⁻³	dB
2	10,0	80	0,79	84
4	11,0	81	0,45	79
8	14,0	83	0,28	75
16	28,0	89	0,28	75
31,5	56,0	95	0,28	75
63	110,0	101	0,28	75
Adjusted and equivalent adjusted values and their levels	10	80	0,28	75

5. MEASUREMENT OF ELECTROMAGNETIC FIELDS

The assignment of working conditions to one or another class of hazard and danger when exposed to non-ionizing EMBs and radiation is carried out based on the following factors:

- ◆ static electric fields (represent the fields stationary electric charges or stationary electric fields of direct current);

- ◆ constant magnetic fields (their sources on the WP are permanent magnets, electromagnets, direct current transmission lines, electrolyte baths and other electrical devices);

 - ◆ electromagnetic fields of industrial frequency 50 Hz;
 - ◆ electromagnetic radiation of the radio frequency range;
 - ◆ electrostatic field;
 - ◆ constant magnetic field.

The operation of DPB devices creates ER in the frequency range from 5 Hz to 400 kHz.

Measurement of the levels of alternating electric and magnetic fields on a WP equipped with a DPB is carried out at a distance of 50 cm from the screen at three levels at a height of 0.5 m, 1.0 m and 1.5 m. When carrying out measurements, all computer equipment and equipment located indoors.

5.1. METER OF ELECTRICAL AND MAGNETIC FIELDS PARAMETERS BE-METER-AT-002

Scope of application: Measuring parameters of electric and magnetic fields of video display terminals. The meter is used when conducting a comprehensive sanitary and hygienic inspection of premises and workplaces.

Specifications:

- frequency range from 2Hz to 400 kHz
- frequency bands, rms voltage electric field and magnetic flux density:
 - band 1 – from 5 Hz to 2000 Hz;
 - band 2 – from 2 kHz to 400 kHz;
- range of rms voltage values electric field:
 - band 1 – from 8 V/m to 100 V/m;
 - band 2 – from 0.8 V/m to 10 V/m;
- range of root mean square values of magnetic density stream:
 - band 1 – from 0.08 μ T to 1 μ T;
 - band 2 – from 8 μ T to 100 μ T .

Device and principle of operation.

The meter is made in the form of a portable device that combines in one housing sensors measuring magnetic flux density and electric field strength, a block of bandpass amplifiers-detectors, a block for digital processing of registration results, a control and indication unit, and a power supply. The device body is made of synthetic material with low dielectric losses (Figure 14).

The principle of operation of the electric and magnetic field parameter meter is to convert fluctuations of electric and magnetic fields into fluctuations of electrical voltage, frequency filtering and amplification of these fluctuations, followed by their detection.

Detected signal arrives on analog-digital converter, resulting numeric values of quantities. The recorded oscillations of the electric and magnetic fields are analyzed by a microprocessor built into the measures, the measurement result is displayed on a matrix liquid crystal display.



Figure 14 "VE-METER-AT-002" Meter parameters electric and magnetic fields

Operating procedure for the device "VE-METER-AT-002":

1. Attach the device to the dielectric rod;
2. Press the "Power" button and check the battery charge on the LCD;

3. Select a workplace measurement point(Application5);
4. Place the device with its front end at the measuring point;
5. Press the “Power” button;
6. Following the LCD instructions, select the mode (CONTINUOUS, ATESTATE , CERTIFICATE),by clicking on the “Select” button;
7. After selecting the desired mode, press the “Enter” button;
8. After the warning signal, read the readings on the LCD;
9. Record the results in the measurement protocol;
10. Turn off the device by pressing the “Power” button;
11. Place the device in the stowage bag.

Noise measurement points according to GOST 12.1.006-84 (NS CMEA 5801-86)

Electromagnetic fields of radio frequencies. Permissible levels at workplaces and requirements for monitoring.

1. EMBs measurements at workplaces are carried out at distances from sources of EMBs corresponding to the location of the workers' body at several levels from the surface of the floor or ground with determination of the maximum value of intensity or flux density of EMBs energy for each workplace. At each point, at least 3 measurements are taken. The highest recorded value is recorded in the protocol.

During measurements, personnel should not be in the measurement area. If it is impossible to fulfill this requirement, a special note is made in the measurement protocol.

The person conducting the measurements must not be between the radiation source and the measuring antenna.

2. With multiple operating modes of the EMBs source, differing in generation parameters, type and location of working elements or radiating systems, measurements should be carried out in each mode.

3. Energy flux density of radiation of rotating and scanning antennas is measured with the antenna stopped in the direction of maximum radiation at all operating values of the inclination angle. For an open area with a uniform topography, the results obtained with one direction of radiation apply to the entire sector covered by the antenna during its movement, within the radius at which the measurements were made. In cases characterized by heterogeneous terrain, the presence of buildings and other structures, it is necessary to carry out measurements at each workplace with radiation directed to the measurement location.

3. When personnel are exposed to EMBs from several sources in the case of sources operating in frequency ranges for which uniform maximum permissible levels (MPLs) are established, the total intensity of exposure should be determined by devices with isotropic sensors.

In the frequency range 300 MHz-300 GHz, in the case of simultaneously operating sources, impact assessment can be carried out by summing the EFD values measured from each source; summation of the measured EFD values is not carried out in cases of irradiation from two or more rotating or scanning antennas, due to the extremely low probability of simultaneous coincidence at one point of the maxima of the radiation patterns of two or more antennas.

In the case of sources operating in frequency ranges for which different MPLs values are established, measurements are carried out from each source separately, the permissible impact is assessed as follows: in the frequency range 60 kHz-300 MHz, the sum of the ratios of energy loads created by each source to the corresponding maximum permissible parameter values must meet the conditions of formula 2:

$$\frac{\partial H_{E_1}}{\partial H_{E_{\text{нпд}1}}} + \frac{\partial H_{E_2}}{\partial H_{E_{\text{нпд}2}}} + \dots + \frac{\partial H_{E_n}}{\partial H_{E_{\text{нпд}n}}} \leq 1 \quad ; \quad (2)$$

(∂H -energy load нпд - energy flux density)

at exposure of personnel to EMFs with various standardized parameters correspondence levels exposure hygienic standards are achieved subject to formula 3:

$$\frac{\partial H_{\text{нпд}\partial}}{\partial H_{\text{нпд}\partial_{\text{нпд}}}} + \frac{\partial H_E}{\partial H_{E_{\text{нпд}}}} \leq 1 \quad ; \quad \frac{\partial H_{\text{нпд}\partial}}{\partial H_{\text{нпд}\partial_{\text{нпд}}}} + \frac{\partial H_H}{\partial H_{H_{\text{нпд}}}} \leq 1 \quad (3)$$

Evaluation of research results for compliance with hygienic standards carried out in accordance with HG "Hygienic standards for physical factors affecting humans." Order of the Ministry of National Economy of the Republic of Kazakhstan dated February 28, 2015 No. 169 (tables 7,8,9);

Table 7. Maximum permissible levels of electric and magnetic field strength, EMBs energy flux density in the frequency range > 30 kHz—300 GHz

Parameter	Maximum permissible levels in frequency ranges (MHz)				
	\geq 0.03—3.0	\geq 3.0—30.0	\geq 30.0— 50.0	\geq 50.0—300.0	\geq 300.0—
1	2	3	4	5	6
V/m	500	300	80	80	—
A/m	50	—	3.0	—	—
$\mu\text{W}/\text{cm}_2$	—	—	—	—	1000 5000*

Table 8. MPL of electric and magnetic fields of industrial frequency for the population

N p/p	Type of impact, area	Intensity frequency 50 Hz (values), μT (A/m)
	2	3
	In residential premises, children's, preschool, school, general education and medical institutions	5(4)
	In non-residential premises residential buildings, public and administrative buildings, in residential areas, including garden plots	10(8)
	In populated areas outside of residential areas, including in the area of overhead and cable power lines with voltages above 1 kV; when persons who are not professionally involved in the operation of electrical installations are in the area where overhead and cable power lines pass	20(16)
	In an uninhabited and inaccessible area with occasional presence of people	100(80)

Table 9. Permissible EMBs levels in the frequency range 30 kHz—300 GHz for the population (in residential areas, in places of public recreation, inside residential, public and industrial premises)

Frequency range	30- 300 kHz	0.3 — 3 MHz	3— 30 MHz	30- 300 MHz	0.3—300 GHz
1	2	3	4	5	6
Normalized parameter	Tension electrical fields, (V/m)				Density energy flow, ($\mu\text{W}/\text{cm}^2$)
Maximum permissible levels	25	15	10	3	10 25*

6. MEASUREMENT OF ELECTROSTATIC FIELDS

6.1. ELECTROSTATIC FIELD STRENGTH AND POTENTIAL METER “ST-01”

The measure is designed to measure electrostatic field strength while ensuring control over biologically dangerous levels of electrostatic fields in accordance with the requirements of the joint venture “Sanitary and Epidemiological Requirements for Working Conditions with Sources of Physical Factors (computers and video terminals) that have an impact on humans”

Scope of application: when conducting a comprehensive sanitary and hygienic inspection of premises and workplaces (for the purpose of sanitary supervision for monitoring the electrostatic potential on the screen of video display terminals). Specifications: Has 2 operating modes:

- measurement of the projection value of the tension vector electrostatic field on the plane of rotation of the modulator lobe;

- measurement of the modulus of tension and electrostatic field, including the measurement of three orthogonal components of the electrostatic field strength vector, followed by calculation of its modulus.

Measurement range electrostatic field strength - from 0.3 to 180 kV/m.

Limits of permissible main relative error measurement of electrostatic field strength $\pm 15\%$, unit of measurement - kV/m (kilovolt per meter). Device and principle of operation.

The meter is designed as a portable device with autonomous power supply. Structurally, the meter consists of an electrostatic field strength converter, a control and indication unit and a power supply unit. (Figure 15).



Figure 15 - Voltage and potential meter electrostatic field "ST-01"

Operating principle of the device "ST-01". The main element of the conversion unit is a modulator, which is a metal plate (modulator blade), asymmetrically mounted on the axis of rotation of the micro electric motor and electrically isolated from the motor axis. When the modulator blade rotates in a uniform electrostatic field, the potential of the modulator blade relative to the ground changes according to a sinusoidal law with a frequency equal to the rotation frequency of the blade, and the amplitude of this variable potential is proportional to the projection of the electrostatic field strength onto the plane of rotation.

Procedure for working with the ST-01 device:

1. Connect the converter with the modulator to the control unit panels;
 2. Turn on the device, placing it in position "1" (Application 6);
 3. Check the battery voltage by pressing button number 4. On the liquid crystal display, the voltage should be within (8.0 ± 1.5) V;
 3. After checking, press the green "reset" button;
 4. Launch the program by clicking one of the panel buttons:
 - Button No. 1 – for recording tension values electrostatic field (maximum and current);
 - Press the same button again to fix the measurement, which will appear on the liquid crystal indicator ($E(m) = 0.00$ kV/m, $E(t) = 0.00$ kV/m);
- Note: $E(m)$ – highest value; $E(t)$ - last current value.

- Button No. 2 - for registering the electrostatic field in three orthogonal components with calculation of the module $E(xy)$, $E(xz)$, $E(yz)$ - by pressing button No. 2, we change the components, after completion we record all measurements and write them down in the protocol.;

- Button No. 5 – for measurement superficial electrostatic potential of the display screen. $F(m)$, $F(t)$;

Note: before measuring, install the plate on a tripod with the cord being grounded.

6. After taking measurements, press the green "reset" button;
7. Turn off the device by placing it in position "0";
8. Disconnect the converter from the modulator using the union nut from the control unit panel;
9. Place a protective film on the modulator and secure the blocks in portable bag.

Measuring points noise according to GOST 12.1.045-84
 Interstate standard. "System of occupational safety standards. Electrostatic fields. Permissible levels at workplaces and requirements for monitoring."

The intensity of electrostatic fields is controlled at the level of the head and chest of workers, in their absence, at least three times. The determining factor is the highest value of the measured field strength.

Monitoring the strength of electrostatic fields in space is carried out by component-by-component measurement of the total intensity vector or by measuring the modulus of this vector.

Electrostatic voltage measurements are carried out in the range fields from 0.3 to 300 kV/m. The relative measurement error should not exceed $\pm 10\%$.

Grade results research. Acceptable levels tensions electrostatic fields are installed depending on the time spent by personnel at work.

Maximum permissible level of electrostatic voltage fields $(E_{пред})$ set to 60 kV/m for 1 hour.

When the electrostatic field strength is less than 20 kV/m, the time spent in electrostatic fields is not regulated.

In the voltage range from 20 to 60 kV/m, the permissible time for personnel to stay in an electrostatic field without protective equipment in hours is determined by formula 4.

$$t_{\text{доп}} = \left(\frac{E_{\text{пред}}}{E_{\text{факт}}} \right)^2$$

Where $E_{\text{факт}}$ - , meaning tensions electrostatic field, kV/m. (4)

7. REGISTRATION OF MEASUREMENT PROTOCOLS

The results of measurements of physical factors of the production (working) environment are presented in the form of a measurement report and contain all the information necessary to interpret the results. When carrying out measurements, modern high-precision measuring equipment that has state verification is used. Measurements are carried out by specialists from the Testing Laboratory who have undergone special training and have the qualifications necessary to conduct professional activities in this field.

7.1. PRODUCTION CONTROL

The purpose of production control is to ensure the safety and (or) harmlessness of products, works and services to humans, by organizing and conducting self-monitoring at the facility for compliance with the requirements established in the documents of the state system of sanitary and epidemiological regulation.

Organization of activities for the implementation of production control is carried out by individual entrepreneurs and legal entities.

Production control includes:

- 1) development of a production control program;
- 2) implementation (organization) of laboratory research and measurements in cases established by standardization documents:

- at workplaces, on the territory of an industrial site, for the purpose of assessment the impact of production on people and their health;

- behind atmospheric air at the border of the sanitary protection zone, carried out under the environmental production control program, to assess the risk to public health and compliance of the established sanitary protection zone (hereinafter referred to as the sanitary protection zone) with the requirements of sanitary rules and hygienic standards;

- realization , collection, disposal, destruction, as well as funds measurements that provide the necessary reliability and completeness of control, etc.

During the control, adjustments are made to measures and implementation of measures aimed at eliminating identified violations.

The production control program is developed taking into account the hazards (risk factors) existing at the facility.

Instrumental and laboratory tests are carried out by an individual entrepreneur, a legal entity on the basis of production laboratories or with the involvement of laboratories (testing centers) that have a sanitary and epidemiological conclusion on their compliance with regulatory legal acts in the field of sanitary and epidemiological welfare of the population and hygienic standards issued in accordance with paragraph 2 Article 21-1 of the Code.

Production control is carried out using laboratory research and testing on the following categories of objects:

- 1) industrial and radiation hygiene facilities (production facilities) – workplaces, production premises and sites (territory), etc. Production control includes laboratory research and testing of potentially hazardous factors in the production environment (physical factors: temperature, humidity, air speed, thermal radiation; non-ionizing electromagnetic fields (hereinafter referred to as EMF) and radiation (electrostatic field); constant magnetic field (including hypogeomagnetic); electric and magnetic fields of industrial frequency (50 Hz); broadband EMFs created by personal computers; electromagnetic radiation of the radio frequency range; broadband electromagnetic pulses; electromagnetic radiation of the optical range (including laser and industrial noise, ultrasound, vibration (local, general);

natural lighting (absence or insufficiency), artificial lighting (insufficient lighting, pulsating lighting, etc.

Information on the results of production control carried out at production facilities is submitted to the territorial divisions of the department of the state body in the field of sanitary and epidemiological welfare of the population in the corresponding territory once every six months by the 5th day of the next month in Form 1, according to the joint venture "Sanitary and epidemiological requirements for the implementation of production control" Order of the Minister National Economy of the Republic of Kazakhstan dated June 6, 2016 No. 239.

Form 1

Information on the results of production control*

Name of the facility _____

Field of activity of the facility _____

Reporting period for ____ (six months, per year)

No.	Information , control,		Production control results		
	P/	about the			
P	person	carrying out			
	industrial	including			
	on the base	With involving	Total researched	revealed	Accepted
	production	laboratories	(transfer objects	inconsistencies	measures and
	laboratories	(trial	external	(transfer indicators	carried out
	object	center)	environmentand num	security, according	events for
			samples– raw materi	to which revealed	eliminating
			ready products,	inconsistency –	
			flushes, air, and	coliform,	
			other)	pathogenic	
				Flora, toxic	
				substances and	
				other)	
1	2	3	4	5	6

* Information is provided on an incremental basis (for half a year and for a year)

7.2. CERTIFICATION OF PRODUCTION FACILITIES ACCORDING TO LABOR CONDITIONS

Certification is carried out by specialized organizations for certification of production facilities, accredited in accordance with the legislation of the Republic of Kazakhstan, periodically, at least once every 5 years.

All production facilities of organizations operating in the territory of the Republic of Kazakhstan are subject to certification. To organize certification of production facilities by working conditions, the employer issues an appropriate order to create certification commission consisting of a chairman, members and a secretary responsible for drawing up, maintaining and storing documentation for the certification of production facilities for working conditions.

Certification includes a comprehensive assessment of the actual working conditions of the organization's production facilities at compliance with their standards in the field of occupational safety and health, and consists of:

- 1) assessment of the degree of harmfulness and danger of work, occupational hygiene;
- 2) assessing the severity and intensity of the labor process;
- 3) assessing the degree of injury safety;
- 4) assessing the provision of workers with personal and collective defense.

The procedure for processing and presenting the results of certification of production facilities for working conditions.

Protocols of measurements and assessments, drawn up in Form 2 in accordance with the Rules for mandatory periodic certification of production facilities for working conditions Order of the Minister of Health and Social Development of the Republic of Kazakhstan dated December 28, 2015 No. 1057.

Form 2

Place for a sign accreditation	<p>_____</p> <p>(name of the specialized organization for certification of production facilities)</p> <p>Republic of Kazakhstan, _____, city _____,</p> <p>street _____, index building No. tel.: _____;</p> <p>e-mail: _____</p> <p>Accreditation certificate No. _____ from _____, to _____</p>
--------------------------------	---

PROTOCOL No. _____
measurement of harmful production factors

page ____
total pages ____

1. Name, address of the customer: _____
2. Place of measurements (production, area): _____
3. Date of measurements: _____
4. Characteristics of the premises:
 - square: _____
 - collective defense system: _____
 - types of equipment and their quantity: _____
 - names of professions, positions: _____
5. Measuring instruments:

No.	Name	Factory number	Verification date

6. Regulatory document for products (object):

7. Environmental conditions: temperature - ____ C, relative humidity 0 - ____%, atmospheric pressure - ____ millimeters of mercury

8. Results of measurements of harmful production factors:

Code workin	Name profession	Quantity quality	Named no factors	Normative document	Normal extremely	Actu	Condition classes labor

g places	position	workers X places	productions environment, unit measurements	on method measurements	acceptable concentration /maximum permissible level	al level	harmful		
							accepta ble	3. 1	3.2
							2		

The assessment was carried out by _____
 _____ signature last name, first
 name, patronymic (if any)
 Representative of the organization/
 employees _____
 signature last name, first name, patronymic (if available)

End of document

Measurement results apply only to objects that have been measured
 The measurement report cannot be partially reproduced without the permission of the
 testing laboratory

Results certification are issued specialized organization in the form of a report.

A report on the results of mandatory periodic certification of production facilities for
 working conditions, containing an assessment of all indicators, drawn up in Form 3, in
 accordance with the Rules for mandatory periodic certification of production facilities for
 working conditions

Form 3

_____ (name of the specialized organization for certification of production facilities) Republic of Kazakhstan, city _____, street _____, telephone: _____; email: _____ Accreditation certificate No. _____ from _____, to _____

**Report on the results of mandatory periodic certification of production
 facilities according to working conditions**

1. Name, address of the customer: _____
2. Place of assessment (production, workshop, site): _____
3. Workplace code _____, number of workplaces _____ of them:
men _____
women _____
4. Date of assessment: _____
5. Results of assessment of working conditions:

Factor	Class of working conditions					
	Acceptable	Harmful, heavy and tense				Dangerous (extreme)
		2	3.1	3.2	3.3	
Chemical						
Biological						
Aerosols mainly fibrogenic action						
Noise						
Vibration						
Ionizing radiation						
Non-ionizing radiation						
Lighting						
Infrasound						
General vibration						
Local vibration						
Electrostatic field						
Constant magnetic field						
Electrical fields industrial frequencies (50 hertz)						
Magnetic fields industrial frequencies (50 hertz)						
Electromagnetic fields, created video display						
terminal and personal computer						

Radio frequency electromagnetic radiation						
range						
Laser radiation						
Ultraviolet radiation						
Difficulty of work:						
men						
women						
Labor intensity:						
men						
women						
General assessment of working conditions:						
men						
women						

The assessment was carried out by _____
 _____ signature surname, name, patronymic (if
 any) Representative of the organization/employees _____

 signature last name, first name, patronymic (if available)

7.3. CONDUCTING MEASUREMENTS OF PHYSICAL FACTORS OF THE ENVIRONMENTAL AND WORKING ENVIRONMENT

Measurement of physical factors is carried out in form 4,5,6,7,8 in accordance with the Order of the Minister of National Economy of the Republic of Kazakhstan dated May 30, 2015 No. 415 "On approval of forms of accounting and reporting documentation in the field of sanitary and epidemiological welfare of the population."

Below are Forms 4,5,6,7,8:

PROTOCOL measurement of meteorological factors

№ " " 20 y.

1. Name and address of the customer
2. Name of the test object, type of test
3. Place of testing
4. Date of sampling
5. Date of the test
6. RD according to the test method
7. Measuring tools
8. Information about the inspection
9. Measurements were carried out in the presence of a representative of the object
10. Grounds for testing
11. Description of the premises
 - a) area (total m₂; volume cubic capacity) m₃
 - c) the number of working people
 - d) moisture distribution: significant, insignificant
 - d) excessive heat : absent , insignificant , significant
12. A sketch of the premises showing the location of the equipment and measuring points



WP is a workplace.

12. Results of measurement of meteorological factors of atmospheric air

a) dry air temperature C_o, wet thermometer C_o

b) relative humidity %:

c) pressure mm. rt. st. :

Test results (Results of tests)

Registration number	Image according to points No.	Measurement place	Category of work by severity	Time of day for measurements	Air temperature oC		Relative air humidity %	
					measured	Norms according to optimal/permission	measured	Norms according to optimal/permission
1	2	3	4	5	6	7	8	9
1								
2								
3								
4								

Speed of air movement		Heat release				note
Measured	According to the norms optimal/allowed	Heat release source name	Distance from the source in cm	Actinometer indicator W/ m ₂	Acceptable according norms kW/m ₂	
10	11	12	13	14	15	16

Studies were conducted on the conformity of the samples to

the RD:

Researcher T.A.A. _____

(F.P.S., specialist conducting research)

The signature of the head of the laboratory, T.A.A. _____

(F.P.S., signature of the head of the laboratory)

Place of stamp

The protocol is filled out in 2 copies

Light measurement test PROTOCOL

№ ___ " ___ " _____ 20 y.

1. Name and address of the customer
2. Name of the test object, type of test
3. Place of testing
4. The sample was taken
5. The date of the test
6. RD according to the test method
7. Measuring tools
8. Information about the inspection
9. Measurements were carried out in the presence of a representative of the facility.
10. Grounds for testing
11. The image of the premises showing the location of equipment, lights, lighting devices (windows, light bulbs) and measuring points.



WP-working place.

- - Control point
- ⊗ - luminous tube lamp

Result of artificial light measurement

Test results

Registration number	No Points for sketching	Measurement place	Work category junior discharge	Lighting system general, local, combined	Species, type and brand lamp	Measured lighting In candle-meter	Unacceptable according to the norm
1	2	3	4	5	6	7	8

Registration	Image	Measurement	weekendy 52	daily	Natural light in the room	External	DF
--------------	-------	-------------	----------------	-------	------------------------------	----------	----

Registration number	No Points for sketching	Measurement place	Work category	Measurement time	Natural lighting inside premises						Outside illumination	Average value Of DF
					At the up		At the side		combined illumination			
					illumination		illumination		illumination			
DF measured	Acceptable by standards	DF measured	Acceptable by standards	DF measured	Acceptable by standards							
1	2	3	4	5	6	7	8	9	10	11	12	13
1	-	-	-	-	-	-	-	-	-	-	-	-

Studies were conducted on the conformity of the samples to

the RD:

Researcher T.A.A. _____

(F.P.S., specialist conducting research)

The signature of the head of the laboratory, T.A.A. _____

(F.P.S., signature of the head of the laboratory)

Place of stamp

PROTOCOL for measurement of noise

№ _____ " _____ " _____ 20 y

1. Full name and address of the object

_____workshop, site

2. The purpose of measurement _____

3. Measurements were carried out in the presence of a representative of the object

4. Measuring tools _____ name, type, inventory number

5. Information on state inspection _____

6. The date and number of the certificate

7. The measurements and sanitary-epidemiological report were carried out in accordance with RD _____

8. The main sources of noise and the nature of the generated noise _____

9. Value _____ -

10. Batch number _____

11. Date of manufacture _____

12. The number of working people

13. The image of the premises (territory, workplace, manual machine) with the location of the noise source and microphones (sensors) and their direction indicated by language (territory, workplace, manual machine) _____

14. Serial numbers of measurement points. (Sketch premises (territory, workplace, hand-held machine) with the drawing of the noise source and indicating with arrows the place of installation and orientation of microphones (sensors). Serial numbers of measurement points).

Research was carried out on the conformity of the samples to the RD

15. Results of measurements

Registration number	The image according to point number	Measuring location (specify brand, type, equipment specifications)	additional information (measuring conditions, duration of	The nature of the noise	
				Along the spectrum	Time characteristics of time

			noise exposure during a work shift)										Spacious	Toned	Stable	Hesitating	Intermittent	Impulsive			
1	2	3	4	5	6	7	8	9	10												
Levels of sound pressure in dB octave bands with geometric mean frequencies in Hz													LA, dBA maximum sound level (equivalent sound level) / Maximum sound level LA, dBA					Permissible sound level LA according to the norm / Maximum permissible sound level LA, dBA			
1		25	268	16	31.5	63	125	250	500	1000	2000	4000	8000								
11		12	13	14	15	16	17	18	19	20	21	22	23	24	25						26

Studies were conducted on the conformity of the samples to

the RD:

Researcher T.A.A. _____

(F.P.S., specialist conducting research)

The signature of the head of the laboratory, T.A.A. _____

(F.P.S., signature of the head of the laboratory)

Place of stamp

PROTOCOL for measurement of vibration levels

№ " " 20 y

1. Full name, address of the object _____
workshop, site
2. Purpose of measurement _____
3. Measurements were carried out in the presence of a facility representative

4. Measuring tools _____
name, type, inventory number
5. Information on state inspection _____ issued date and
number of the certificate (
6. Amount _____
7. Batch number _____
8. Date of manufacture _____
9. The measurements and the given sanitary-epidemiological report were carried out in
accordance with the following RD _____
10. The measurements and the given sanitary-epidemiological conclusion were carried out in
accordance with the following RD _____
11. The main sources of vibration and the nature of the vibration they cause
12. Number of people employed
13. The image of the premises where the source of vibration is indicated (the area,
workplace, hand machine) and the test results apply only to the samples taken to the
test.

Partial reprinting of the protocol without permission is PROHIBITED

No pp	The device for which the assessment of the impact of vibration was carried out	Type of vibration		Accelerometer orientation (axis)
		General	Local	
1	2	4	5	6

Measurement results (Measurement results)

No p/p	Levels of vibration acceleration, dB, in third- octave bands with geometric mean frequencies, Hz	Corrected level for vibrous roots axis, dB	Vibrous roots for cycle, operation, dB	Equivalent adjusted vibration acceleration level, dB	Permissible equivalent adjusted level of vibration acceleration, dB

PROTOCOL measurements of the electromagnetic field

№ _____ " _____ " _____ 20 y

1. Full name and address of the object
_____ workshop, section _____
2. Purpose of measurement _____
3. Measurements were carried out in the presence of a facility representative _____
4. Measuring tools _____ name, type, inventory number
5. Information about the state inspection
_____ Date of issuance and number of the certificate
6. Measurements and provision of sanitary-epidemiological conclusions were carried out in accordance with the following regulatory and technical documentation _____ mention
7. Sketch of the location of the equipment, sources of electromagnetic radiation (indicated by the numbers of the organizations-manufacturers) and the drawing of measurement points)
8. Amount _____
9. Batch number _____
10. Date of manufacture _____

Number in order	Number of points according to the sketch	Measurement location	Distance from source in m.	Height from floor in m.	Time spent in the EMBs zone during a shift	EMBs voltage					
						electric component, kV/m, V/m		It is magnetic component A /m, μT		Electrostatic field kV/m,	
						Measured	Maximum permissible	Measured	Maximum permissible	Measured	extremely permissible
1	2	3	4	5	6	7	8	9	10	11	12
Intensity of infrared, ultraviolet laser radiation Intensity:						Energy flow density W/m ² , MW/cm ²					
Measured		Maximum permissible				Measured				Maximum permissible	
13		14				15				16	

Lists and parameters of installations that emit EMF energy

Naming installation	Frequency electromagnetic radiation	Power source electromagnetic radiation	During measurement work mode (power)	Factory number source	Year of release source	Note
17	18	19	20	21	22	23

The study was carried out for compliance with RD _____
 unipolarity coefficient by calculation method.

Researcher T.A.A. _____

(F.P.S., specialist conducting research)

The signature of the head of the laboratory, T.A.A. _____

(F.P.S., signature of the head of the laboratory)

Place _____ of _____ stamp

CONCLUSION

One of the important stages in assessing the parameters of the environmental and working environment is the hygienic assessment of the factors of the working environment and the labor process. As a result of such an assessment, the actual values of the levels of factors (physical, chemical, biological) are established, comparing them with standard values. Exceeding hygienic standards is the basis for production control.

The given laboratory works are intended to give students an idea of the methods of measuring factor levels, the instruments used for these purposes, the requirement to ensure the quality of measurements and design.

The results of the hygienic assessment are used to:

- control of the environment and production environment;
- certification of workplaces according to working conditions;
- production monitoring of working conditions;
- establishing the priority of preventive measures activities and determining their effectiveness;
- drawing up sanitary and hygienic characteristics of working conditions workers.

This manual is literature on laboratory and instrumental measurements and studies of environmental and industrial environmental factors for students studying the discipline: “General Hygiene”, “Fundamentals of General Hygiene”, “Expertise in Occupational Health”, “Environment and Health”, "Expertise in the field of municipal hygiene."

It outlines measurement techniques, characteristics of instruments, and test protocols.

Application 1.

Standardized lighting indicators for general industrial premises and structures

Premises and production areas, equipment, structures	Working surface and plane, on which normalized illumination (G-horizontal, B-vertical)	Discharge visual work on table 1	Standardized illumination			Index blindness, no more	Coefficient pulsation, % not more	Additional instructions
			at in general lighting	at combined lighting				
				Total	from general			
1	2	3	4	5	6	7	8	9
Warehouses								
1 Warehouses, storerooms for oils, paints and varnishes:			75	-	-	-	-	
1) with spill in the warehouse								
2) no spill in the warehouse			50	-	-	-	-	
2 Warehouses, storerooms for chemicals, calcium carbide, acids, alkalis, etc.			50	-	-	-	-	
3 Warehouses, storerooms for metal, spare parts, repair stock, finished products; parts awaiting repair, instrumental			75	-	-	-	-	
4 Warehouses with rack storage:								
1) expedition for receiving and issuing cargo			200	400	200	40	20	In storage areas of rack warehouses with automatic stacking cranes, working lighting is not
2) transport and distribution system			150	-	-	40	20	
3) storage area:			50	-	-	-	-	

on cells and shafts on arrows			75	-	-	-	-	required; emergency lighting, repair lighting for trolleys and emergency lighting for aisles are required
			200	-	-	40	20	
5 Warehouses, storerooms, open areas under the canopy of gas cylinders			50	-	-	-	-	
6 Warehouses for bulky items and bulk materials (sand, cement, etc.)			75	-	-	-	-	
7 Lifting mechanisms (beam			50	-	-	-	-	

cranes, hoists, overhead cranes, etc.) indoors	B - crane hook, reception areas and submission equipment and details		50	-	-	-	-
outside buildings	G, B - remote control management		30	-	-	-	-
	B - crane hook		10	-	-	-	-
	G - platforms reception and delivery equipment, materials, details		10	-	-	-	-

8 Draining and loading racks	G - floor of the site		5	-	-	-	-	
	G - neck tanks		20					
Electrical rooms								Provide sockets for portable lighting
9 Switchgear rooms, control rooms, control rooms (electrical control rooms): 1) with permanent presence of people	G-0.8 m from the floor		200	-	-		20	
	G-desk operator		300	750	200		20/15	
	G, B-1.5 m per remote control panels scale control devices		150	-	-		20	

	B-1.5 m rear shield side		50	-	-		-	
2) with periodic presence of people	G-0.8 m from the floor		150	-	-	40	20	
	G, B-1.5 m panels, remote controls		150	-	-		20	
	scale control devices							
	B-1.5 m rear shield side		50	-	-		-	
10 Control panels and panels: a) in premises: with measuring equipment	G-0.8 m scale devices		150	-	-		20	
	B - 1.5 m							
without measuring equipment	G - 0.8 m							
	B-1.5 m levers, handles, buttons		150	-	-		-	
2) outside buildings	B-1.5 m levers, handles, buttons		50	-	-		-	
11 Freestanding appliances	G, B-scale		200	-	-		20	Provide

control in premises: 1) with constant monitoring	devices							sockets for portable lighting
2) with periodic monitoring	G, B-scale devices		150	-	-		20	
3) outside buildings	G, B-scale devices		50	-	-		-	
12 Rooms and chambers of transformers, reactors, static capacitors, batteries	B - 1.5		75	-	-	-	-	
13 Electrical machine rooms: with permanent presence of people	G-0.8 m from the floor B-1.5 m on boards		200	-	-	40	20	
with periodic presence of people	G-0.8 m from the floor B-1.5 m on boards		150	-	-	40	20	
14 Electrical switchboards in residential and public buildings	G-0.8 m from the floor B-1.5 m on boards		75	-	-	-	-	
Boiler rooms								
15 Shut-off and control valves: 1) indoors	B - on the fireboxes, valves, valves, levers, bolts, bin loops and etc.		75	-	-	-	-	
2) outside buildings	Same		30	-	-	-	-	

16 Platforms and stairs of boilers and economizers, passages behind boilers	G-gender		50	-	-	-	-	
17 Fuel recovery room	G-0.8 m from the floor		150	-	-	40	20	
18 Smoke exhaust room,	G, B-0.8 m from the floor		150	-	-	40	20	
fans, bunker compartment								
19 Condensation, chemical water treatment, boiler room, deaerator room, ash room	G-gender		75	-	-	-	-	
20 Chemical water treatment room and generator room	G-gender		50	-	-	-	-	
21 Above the bunker room	G-0.8 m from the floor		50	-	-	-	-	
Utility rooms and other technical rooms								
22 Machine rooms of pumping stations (technological, water pumping and oil-block cluster pumping stations, etc.), blowers	G-0.8 m from the floor		200	-	-	40	20	
1) with permanent staff on duty	B - on scales devices control		150	-	-	-	20	Provide sockets for portable lighting
	G - table driver		200	400	200	-	20/15	
2) without constant staff duty	G-0.8 m from the floor		150	-	-	40	20	

	B - on scales devices control		150				20
23 Rooms for air conditioners, heating points	G-0.8 m from the floor		150	-	-	40	20
24 Compressor rooms (blocks, stations, rooms, halls) 1) with permanent personnel on duty	G-0.8 m from the floor		200			40	20
	B -on scales devices, panel management compressor		150	-	-	40	20
	G - table driver		200	400	200		20/15
2) without constant staff duty	G-0.8 m from the floor		150			60	20
	B - on scales devices control		150	-	-	-	20
Utility rooms							
25 Ventilation rooms of the installation: 1) chambers of exhaust and supply fans	G-0.8 m from the floor		50	-	-	-	-
2) compartments for heaters and filters	G-0.8 m from the floor		20	-	-	-	-
26 Galleries and tunnels of conductors, conveyors, conveyors	G-gender		20	-	-	-	-

27 Cable tunnels, heating, oil, pulp pipelines, water supply	G-gender		20	-	-	-	-	
Car service companies								
28 Inspection ditches: indoors and outdoors	G- bottom of the car		200	-	-	40	20	Provide sockets for portable lighting
29 Washing and cleaning stations for rolling stock: outside buildings	G-coating		10	-	-	-	-	
in room	G-gender		150	-	-	40	20	
30 Washing units, components, parts	G-place loading and unloading		150	-	-	40	20	
31 Diagnostic areas for cars and trucks	G-0.8 m from the floor		200	-	-	40	20	
32 Maintenance and technical repair area for cars, trucks and buses	G-0.8 m from the floor		200			40	20	
33 Lifts	Underbody of the car		150**	-	-	40	20	Provide sockets for portable lighting lifts
34 Tire rolling section	G-0.8 m from the floor		300			40	20	
35 Forging and spring section	G-0.8 m from the floor		200			40	20/20	

36 Welding and tinsmith section	G-0.8 m from the floor		200				20
37 Mednitsky section	G-0.8 m from the floor		200				20
	G-workbench		-	500	200		20/20
	G-bath		-	400	200		20/20
38 Repair area electrical equipment and power supplies	G-0.8 m from the floor		300			40	20
	G-workbench, stand		-	750	200		20/15
39 Woodworking area	G-0.8 m from the floor		200				20
	G-processing zone, marking plate		-	1000	200		20/15
40 Wallpaper area	G-0.8 m from the floor		300			40	20
41 Vulcanization area	G-0.8 m from the floor		300			40	20
	G-workbench, bath		300	1000	200	40	20/15
	G-place loading and unloading		200	-	-	40	20
42 Taxi station	G-0.8 m from the floor		300			20	20
	G-table top		-	2000	200		20/10
43 Plumbing and mechanical section	G-0.8 m from the floor		300	-	-	20	20

44 Metal-cutting machines: lathes, turning-backing machines, thread turning machines, jig boring machines, thread grinding machines, sharpening machines, gear cutting machines, thread rolling machines;	G-zone processing	of	-	2000	200		20/10	
turning-turret, turning-screw, surface grinding, cylindrical grinding, internal grinding;	G-zone processing	of	-	1500	200		20/10	
milling	G-zone processing	of	-	2000	200		20/10	
rotary turning	G-zone processing	of	-	1500	200		20/10	
longitudinal planing	G-zone processing	of	-	1000	200		20/10	
cross-planing	G-zone processing	of	-	1500	200		20/10	
loboturning, drilling	G-zone processing	of	-	1000	200		20/10	
chiselling, lingering, edged	G-zone processing	of	-	750	200		20/15	
45 Paint preparation	G-0.8 m from the floor		300	-	-	40	15	Use lamp type LDC
	G-workbench, paint mixer		-	1000	200	40	20/15	
46 Painting area for cars	G, B-body car		300	-	-	40	15	

47 Painting area for trucks and buses	G, B- body car, bus		200	-	-	40	20
48 Drying cars and buses	G-0.8 m from the floor		200	-	-	-	-
49 Passenger car assembly area	G-0.8 m from the floor		300	750		40	20
	G-workbench		300		200		20/15
50 Aggregate section of trucks and buses	G-0.8 m from the floor		200	400	200	40	20
	G-workbench		200				20/20
51 Body section	G-0.8 m from the floor		200	-	-	40	20
52 Open parking areas, storage areas for mobile vehicles composition: 1) without heating	G- on the coating		2	-	-	-	-
	2) with electric, gas, air and other types of heating	G- on the coating	5	-	-	-	-
53 Closed room storage of rolling stock	G-gender		50	-	-	-	-

Application 2.

Standardized lighting indicators for the main premises of public, residential and auxiliary buildings

Premises	Plane (G horizontal, B vertical) standardization of illumination and daylight factor, height of the plane above the floor, m	Level and sublevel of visual work	Artificial lighting					Natural lighting		Combined lighting	
			Illumination workers surfaces,		Cylindrical illumination,	Index discomfort, no more	Illumination pulsation coefficient, %, no more	daylight factor n%,		daylight factor n, %	
			with combined lighting	in general lighting				with overhead or combined lighting	with side lighting	with overhead or combined lighting	with side lighting
1	2	3	4	5	6	7	8	9	10	11	12
Administrative buildings (ministries, departments, committees, departments, design and engineering organizations, research institutions, etc.)											
1 Offices and workrooms	G-0.8	B-1	400/200	300	—	40	15	3.0	1.0	1.8	0.6
2 Project halls and rooms, design, drawing offices	G-0.8	A-1	600/400	500	—	40	10	4.0	1.5	2.4	0.9
3 Book depositories and archives, premises open fund access	B- 1.0 (at racks)	—	15	—	—	—	—	—	—	—	—
	G-0.8, on										

4	Breadboard, carpentry and repair shops	workbenches and workers tables	IIIb	750/200	300	—	401)	15/20	—	—	3.0	1.2
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5	Premises for working with displays and video terminals, display rooms	B- 1.2 (at screen display) G-0.8 on workers tables	B-2 A-2	— 500/300	200 400	— —	— 15	— 10	— 3.5	— 1.2	— 2.1	— 0.7
6	Conference rooms, halls meetings	G-0.8	G	—	300	75	60	20	2.5	0.7	1.5	0.4
7	Reading rooms	G-0.8	A-2	500/300	400	150	40	15	3.5	1.2	2.1	0.7
8	Lobby (foyer)	Floor	E	—	150	50	90	—	—	—	—	—
9	Laboratories: organic and inorganic chemistry, thermal, physical, spectrographic, stylometric, photometric, microscopic, X-ray diffraction analysis, mechanical and radio measuring, electronic devices, preparatory	G-0.8	A-2	500/300	400	—	40	10	3.5	1.2	2.1	0.7
10	Analytical laboratories	G-0.8	A-1	600/400	500	—	40	10	4.0	1.5	2.4	0.9

Banking and insurance institutions												
11 Operating room, credit group, cash register, premises for counting money	G-0.8 on workers tables	A-2	500/300	400	—	15	10	3.5	1.2	2.1	0.7	

Institutions of general education, primary, secondary and higher specialized education												
12 classrooms, classrooms, educational laboratories, education schools, secondary specialized and professionally technical institutions	B -1.5 at middle boards	A-1	—	500	—	—	10	—	—	—	—	
	G-0.8 on workers tables and desks	A-2	—	400	—	40	10	4.02)	1.52)	2.1	1.3	
13 Auditoriums, educational laboratories in technical schools and higher educational institutions	G-0.8 on workers tables and desks	A-2	—	400	—	40	10	3.5	1.2	2.1	0.7	
14 Cabinets computer science and computing technology	B- 1.0 (at screen display)	B-2	—	200	—	—	—	—	—	—	—	
	G-0.8 on workers tables and desks	A-2	500/300	400	—	15	10	3.5	1.2	2.1	0.7	

15 Cabinets technical drawing and drawing	B - on the board	A-1	—	500	—	40	10	—	—	—	—
	G-0.8 on workers tables and desks	A-1	—	500	—	40	10	4.0	1.5	2.1	1.3
16 Workshops metal processing and wood	G-0.8 on workbenches and workers tables	IIIb	1000/200	300	—	401)	15	—	—	3.0	1.2
17 Cabinets service types	G-0.8	A-2	—	400	—	40	10	4.02)	1.52)	2.1	1.3

labor for girls											
18 Gyms	Gender, G-0.0	B-2	—	200	—	60	20	2.52)	0.72)	1.5	0.4
	B - at level 2.0 m from the floor from both sides on longitudinal axes premises	—	—	75	—	—	—	—	—	—	—
19 Indoor pools	G-surface water	C 1	—	150	—	60	20	2.0	0.5	1.5	0.4
20 Assembly halls, film audiences	G-0.0	d	—	200	75	90	—	—	—	—	—

21 Assembly stages halls	B-1.5	G	—	300	—	—	—	—	—	—	—	—
22 Teachers' offices and rooms	G-0.8	B-1	—	300	—	40	15	3.0	1.0	1.8	0.6	—
23 Recreation	Gender, 0.0	G- E	—	150	—	90	—	2.0	0.5	1.2	0.3	—
Leisure institutions												
24 Multipurpose halls appointments	G-0.8	A-2	—	400	100	40	10	—	—	—	—	—
25 Auditoriums theaters, concerts halls	G-0.8	G	—	300	100	60	—	—	—	—	—	—
26 Auditoriums clubs, club-lounge, room for leisure activities, meetings, theater foyers	G-0.8	D	—	200	75	90	—	—	—	—	—	—
27 Exhibition halls	G-0.8	D	—	20033)	75	90	—	2.5	0.7	1.5	0.4	—
28 Auditoriums	G-0.8	Z-1	—	75-	—	90	—	—	—	—	—	—
29 Cinema foyers, clubs	Gender, 0.0	G- E	—	150	50	90	—	—	—	—	—	—
30 Club rooms, music classes	G-0.8	B-1	—	300	—	60	20	3.0	1.0	1.8	0.6	—
31 Cinema, sound lighting equipment	G-0.8	C 1	—	150	—	60	20	—	—	—	—	—
Children's preschool institutions												
32 Receptions	Gender, 0.0	G- B-2	—	200	—	25	15	—	—	—	—	—
33 Changing rooms	Gender, 0.0	G- B-2	—	200	—	60	15	2.5	0.7	1.5	0.4	—

	0.0											
34 Group, gaming, dining rooms, rooms musical and gymnastics classes	Gender, 0.0	G- A-2	—	400	—	15	10	4.02)	1.52)	—	—	
35 Bedrooms	Gender, 0.0	G- C-2	—	150	—	25	15	2.0	0.5	—	—	
36 Isolators, rooms for sick children	Gender, 0.0	G- B-2	—	200	—	25	15	2.0	0.5	—	—	
Sanatoriums, holiday homes												
37 Chambers, sleeping rooms	Gender, 0.0	G- C-2	—	100	—	25	15	2.0	0.5	—	—	
Sports and recreational institutions												
38 Sports halls	G-0.0	B-1	—	200	—	60	20	3.0	1.0	1.8	0.6	
	B-2.0 on both sides on longitudinal axes premises	—	—	75	—	—	—	—	—	—	—	
39 Pool hall	G- surface water	B- 1	—	150	—	60	20	2.0	0.5	1.2	0.3	
Catering establishments												
40 Dining rooms	G-0.8	B-2	—	200	—	60	20	—	—	—	—	

restaurants, canteens											
41 Handouts	G-0.8	B-1	—	300	—	40	15	—	—	—	—
42 Hot shops, cold shops, pre-production and procurement shops	G-0.8	B-2	—	200	—	60	20	—	—	1.2	0.3
43 Washing kitchen and tableware, cutting rooms bread, room head production	G-0.8	B-2	—	200	—	60	20	—	—	1.5	0.4
The shops											
44 Trading halls shops: bookstores, ready-made dresses, linen, shoes, fabrics, fur products, head headdresses, perfumes, haberdashery, jewelry, electrical, radio goods, food without self-service	G-0.8	B-1	—	300	100	40	15	—	—	—	—
45 Trading halls food shops self-service	G-0.8	A-2	—	400	100	40	10	—	—	—	—

46 Trading halls shops: tableware, furniture, sports goods, building materials,	G-0.8	B-2	—	200	75	60	20	—	—	—	—
electrical, cars, toys and stationery											
47 Fitting rooms cabins	B-1.5	B-1	—	300	—	—	20	—	—	—	—
48 Department premises orders, office service	G-0.8	B-2	—	200	—	60	20	—	—	—	—
49 Main premises cash register	G-0.8	B-1	—	300	—	40	15	—	—	1.8	0.6
Consumer service enterprises											
50 Baths:											
1) expected, cooling	G-0.8	B- 1	—	150	—	90	—	—	—	—	—
2) dressing rooms, washrooms, showers, steam rooms	Gender, G- 0.0	Z-1	—	75	—	—	—	—	—	—	—
3) swimming pools	Gender, G- 0.0	B- 2	—	100	—	—	—				
51 Hairdressers	G-0.8	A-2	500/300	400		40	10/15			2.1	0.7
52 Photos:											
1) salons for receiving and issuing orders	G-0.8	B-2	—	200	—	60	20	—	—	1.5	0.4

2) film studio photo studio	G-0.8	B-2	—	100	—	—	20	—	—	—	—
3) photo labs, premises for preparations solutions and silver regeneration	G-0.8	B-2	—	200	—	60	20	—	—	—	—
4) premises for	G-0.8	III6	1000/200	—	—	401)	15/20	—	—	—	—

retouching											
53 Laundries:											
1) departments for receiving and issuing linen:											
reception with a label and accounting, issue	G-0.8	B-2	—	200	—	60	20	—	—	1.5	0.4
laundry storage	B-1.0	VIII6	—	75	—	—	—	—	—	—	—
2) washing departments:											
washing, cooking solutions	Gender, G-0.0	VI	—	200	—	401)	20	—	—	—	—
storage of washing materials	G-0.8	VIIIB	—	50	—	—	—	—	—	—	—
3) dry in gironing compartments:											
mechanical	G-0.8	VI	—	200	—	401)	20	—	—	1.8	0.6
manual	G-0.8	IVa	—	300	—	401)	20	—	—	2.4	0.9
4) departments for disassembling and packaging linen	G-0.8	VI	—	200	—	401)	20	—	—	1.8	0.6

5) mending clothes	G-0.8	IIa	2000/750	750	—	201)	10/20	—	—	4.2	1.5
54 Laundries self-service	Gender, G-0.0	G-B-2	—	200	—	60	20	—	—	1.5	0.4
55 Chemical Atelier cleaning clothes:											
1) salon for receiving and issuing clothes	G-0.8	B-2	—	200	—	60	20	—	—	1.5	0.4
2) premises dry cleaning	G-0.8	VI	—	200	—	401)	20	—	—	1.8	0.6
3) excretion departments spots	G-0.8	IIIa	2000/200	500	—	401)	15/20	—	—	—	—
4) premises for	G-0.8	VIII B	—	50	—	—	—	—	—	—	—

storage of chemicals											
56 Manufacturing studio and repair of clothing and knitwear:											
1) sewing workshops	G-0.8 on workers tables	IIa	2000/7504)	750	—	201)	10/20	—	—	4.2	1.5
2) cutting compartments	G-0.8 on workers tables	IIb	—	750	—	201)	10	—	—	4.2	1.5
3) repair departments clothes	G-0.8	IIa	2000/7504)	750	—	201)	10/20	—	—	4.2	1.5
4) departments for the preparation of applied materials	G-0.8	IVa		300		401)	20			2,	0.9
5) hand and machine knitting sections	G-0.8	IIv	—	500	—	201)	10	—	—	4.2	1.5

6) ironing, decatifying	G-0.8	IVa	—	300	—	401)	20	—	—	2.4	0.9
57 Rental locations:											
1) premises for visitors	G-0.8	B-2	—	200	—	60	20	—	—	1.5	0.4
2) storage rooms	G-0.8	IN 1	—	150	—	—	—	—	—	—	—
58 Repair workshops:											
1) manufacturing and head repair headdresses, furriers work	G-0.8	IIa	2000/7504)	750	—	201)	10/20	—	—	4.2	1.5
2) shoe repair, haberdashery, metal products, plastic products,	G-0.8	IIIa	2000/3004)	—	—	401)	10/15	—	—	3.0	1.2
household electrical devices											
3) watch repair, jewelry and engraving work	G-0.8	IIb	3000/300	—	—	201)	10/20	—	—	4.2	1.5
4) repair of photo, film, radio and television equipment	G-0.8	IIv	2000/200	—	—	201)	10/20	—	—	4.2	1.5
59 Recording studio:											
1) premises for records and auditions	G-0.8	B-2	—	200	—	60	20	—	—	—	—
2) music libraries	G-0.8	B-2	—	200	—	—	—	—	—	—	—

Hotels											
60 Service Bureau	G-0.8	B-2	—	200	—	60	20	—	—	1.5	0.4
61 Premises duty officer serving personnel	G-0.8	B-2	—	200	—	60	20	—	—	1.5	0.4
62 Living rooms, rooms	G-0.0	C-1	—	150	—	—	20	2.0	0.5	—	—
Residential buildings, dormitories											
63 living rooms, living rooms, bedrooms	Gender, G-0.0	G- C-1	—	150h)	—	—	—	2.0	0.5	—	—
64 Kitchens	Gender, G-0.0	G- C- 1	—	150h)	—	—	—	2.0	0.5	1.2	0.3
65 Corridors, bathrooms, latrines	Gender, G-0.0	G- Z-2	—	1503)	—	—	—	—	—	—	—
66 Common houses premises:											
1) lobbies	Gender, G-0.0	G- 3-1	—	30	—	—	—	—	—	—	—
2) floor corridors and elevator halls	Floor. G-0.0	3-2	—	20	—	—	—	—	—	—	—
3) stairs and landings	Floor (sites, steps)	3-2	—	204)	—	—	—	—	—	—	0.14)
Auxiliary buildings and premises											
67 Sanitary facilities premises:											
1) washrooms, restrooms, smoking rooms	Floor	Z-1	—	75	—	—	—	—	—	—	—

2) showers, dressing rooms, drying rooms, dust removal and decontamination of clothing and shoes, heating rooms working	Floor	Z-2	—	50	—	—	—	—	—	—	—
68 Health centers:											
1) expected	G-0.8	B-2	—	200	—	60	20	—	—	1.5	0.4
2) registry, duty room personnel	G-0.8	B-2	—	200	—	60	20	—	0.7	1.5	0.4
3) doctors' offices, dressings	G-0.8	B-1	—	300	—	40	15	3.0	1.0	1.8	0.6
4) procedural offices	G-0.8	A-1	—	500	—	40	10	4.0	1.5	2.4	0.9
Other premises of production, auxiliary and public buildings											
69 Lobbies and outdoor wardrobes clothes:											
1) in universities, schools, theater clubs, dormitories,	Floor	E	—	150	—	—	—	—	—	1.2	0.3
hotels and main entrances to large industrial enterprises and public buildings											

2) in others industrial, auxiliary and public buildings	Floor	Z-1	—	75	—	—	—	—	—	—	—	—
70 Stairs:												
1) main staircases public cells, production and auxiliary buildings	Floor (sites, steps)	C- 2	—	100	—	—	—	—	—	—	—	0.24)
2) the rest staircases	Gender, G-0.0	Z-2	—	50	—	—	—	—	—	—	—	0.14)
71 Elevator halls in public, production and auxiliary buildings												
	Gender, G-0.0	Z-1	—	75	—	—	—	—	—	—	—	—
72 Corridors and passages:												
1) main corridors and passages	Floor G-0.0	Z-1	—	75	—	—	—	—	—	—	—	0.14)
2) floor corridors residential buildings	Floor. G-0.0	3-2	—	20	—	—	—	—	—	—	—	—
3) other corridors	Gender, G-0.0	Z-2	—	50	—	—	—	—	—	—	—	—

Application 3.

Sound pressure limits, sound levels, equivalent sound levels for the main most typical types of work activities and workplaces

Labor activity, workplaces	Sound pressure levels, dB, in octave bands with geometric mean frequencies in Hz									Sound levels and equivalent sound levels,
	31.5	63	125	250	500	1000	2000	4000	8000	

1	2	3	4	5	6	7	8	9	10	11
Enterprises, institutions and organizations										
1. Creative activity, leadership work with increased requirements, scientific activity, design and engineering, programming, teaching and learning, medical activity: workplaces in the premises of the directorate, design bureaus; calculators, computer programmers, laboratories for theoretical work and data processing, receiving patients at health centers	86	71	61	54	49	45	42	40	38	50
2. Highly qualified work that requires concentration, administrative and managerial activities, measuring and analytical work in the laboratory: workplaces in the premises of the shop management apparatus, in working	93	79	70	<u>63</u>	58	55	52	<u>50</u>	49	60
office rooms, laboratories										

<p>3. Work performed with frequently received instructions and acoustic signals, work requiring constant auditory control, operator work according to a precise schedule with instructions, dispatch work: workstations in dispatch service rooms, offices and observation and remote control rooms with voice communication by telephone , typing offices, precision assembly areas, telephone and telegraph stations, craftsmen's premises, processing rooms information on computers</p>	96	83	74	68	63	60	57	55	54	65
<p>4. Work requiring concentration, work with increased requirements for observation processes and remote control of production cycles: workstations at consoles in cabins monitoring and remote control without voice communication by telephone; in laboratory premises</p>	103	91	83	77	73	70	68	66	64	75

with noisy equipment, in rooms for placing noisy computer units										
5. Perform all types of work (except for those listed in paragraphs 1-4 and similar) on permanent workplaces in production premises and on the territory of enterprises	107	95	87	82	78	75	73	71	69	80
Railway rolling stock										
6. Workplaces in the driver's cabins of diesel locomotives, electric locomotives, metro trains, diesel trains and railcars	<u>99</u>	95	87	82	78	75	73	71	69	85
7. Workplaces in the driver's cabins of high-speed and suburban electric trains	<u>99</u>	91	83	77	73	70	68	66	64	75
8. Premises for personnel of long distance train cars and service departments refrigerated sections, power station cars, rest rooms in baggage and post offices	93	79	70	63	58	55	52	50	49	60
9. Service rooms of baggage and mail cars, dining cars	<u>96</u>	87	79	72	68	65	63	61	59	70
Sea, river, fishing and other vessels										

10. Indoor work area	107	95	87	82	78	75	73	71	69	80
energy department of sea vessels with permanent watch (rooms in which the main power plant, boilers, engines and mechanisms that generate energy and ensuring the operation of various systems and devices)										
11. Working areas in the central control posts (CCP) of sea vessels (soundproof), rooms separated from the power department, in which control devices, indicating devices, and controls are installed control of the main power plant and auxiliary mechanisms	96	83	74	68	63	60	57	55	54	65
12. Work areas in the service rooms of sea vessels (helms, navigation, bagger master's rooms, radio rooms, etc.)	89	75	66	59	54	50	47	45	44	55

Application 4.

Acceptable levels sound pressure, dB, (equivalent levels sound pressure, dB), permissible equivalent and maximum sound levels at workplaces in industrial and auxiliary buildings, on the sites of industrial enterprises, in residential and public buildings and in residential areas

Purpose premises or territories	Time of day, h	Sound pressure levels (equivalent sound pressure levels), dB, in octave frequency bands with geometric mean frequencies, Hz										LevelLA, (equivalent sound level LAeq), dBA	Maximum sound level, LAmax, dBA
		31, 5	63	125	250	500	1000	2000	4000	8000			
1	2	3	4	5	6	7	8	9	10	11	12	13	
Workers premises administrative and management personnel production enterprises, laboratories, rooms for measuring and analytical work	-	93	79	70	63	58	55	52	50	49	60	70	
2 Working premises of dispatch services, observation and remote control cabins with voice communication by telephone, precision-assembly areas, telephone and telegraph stations,	-	96	83	74	68	63	60	57	55	54	65	75	
3 Premises laboratories For carrying out experimental works, cabins observations and remote control without	-	103	91	83	77	73	70	68	66	64	75	90	

voice communication by telephone												
4 Premises with permanent workplaces of manufacturing enterprises, territories enterprises With permanent workplaces (except for the works listed in items 1-3)		107	95	87	82	78	75	73	71	69	80	95
5 Chambers of hospitals and sanatoriums	7.00-23.00	76	59	48	40	34	30	27	25	23	35	50
	23.00-7.00	69	51	39	31	24	20	17	14	13	25	40
6 Operating rooms of hospitals, doctors' offices of hospitals, clinics, sanatoriums	-	76	59	48	40	34	30	27	25	23	35	50
7 Classrooms, study rooms, audience educational establishments, conference rooms, reading rooms halls libraries, halls clubs visual cinemas, halls judicial meetings, club halls judicial auditoriu cult building, equipment ms with conventional		79	63	52	45	39	35	32	30	28	40	55
8 Cinemas with Dolby equipment	-	72	55	44	35	29	25	22	20	18	30	40
9 Music classes	-	76	59	48	40	34	30	27	25	23	35	50
10 Living rooms of apartments	7.00-23.00	79	63	52	45	39	35	32	30	28	40	55
	23.00-7.00	72	55	44	35	29	25	22	20	18	30	45

11 Residential rooms of dormitories	7.00-23.00	83	67	57	49	44	40	37	35	33	45	60
	23.00-7.00	76	59	48	40	34	30	27	25	23	35	50
12 Numbers hotels:												
- hotels, having by international classifications five	7.00-23.00	76	59	48	40	34	30	27	25	23	35	50
And fourstars	23.00-7.00	69	51	39	3	24	20	17	14	13	25	40
- hotels, having by international classifications three stars	7.00-23.00	79	63	52	45	39	35	32	30	28	40	55
- hotels, having by international classification less than three stars	23.00-7.00	72	55	44	35	29	25	22	20	18	30	45
	7.00-23.00	83	67	57	49	44	40	37	35	33	45	60
	23.00-7.00	76	59	48	40	34	30	27	25	23	35	50
13 Residential premises of holiday homes, boarding houses, boarding houses for the elderly and disabled, sleeping quarters of preschool institutions and boarding schools	7.00-23.00	79	63	52	45	39	35	32	30	28	40	55
	23.00-7.00	72	55	44	35	29	25	22	20	18	30	45
14 Office premises, work premises And offices administrative buildings, design, design and research organizations:	-	86	71	61	54	49	45	42	40	38	50	65
15 Halls of cafes, restaurants	-	89	75	66	59	54	50	47	45	43	55	65
16 Foyers of theaters and concert halls	-	83	67	57	49	44	40	37	35	33	45	55
17 Auditoriums of theaters and concert halls	-	72	55	44	35	29	25	22	20	18	30	40

18 Multi-purpose rooms	-	76	59	48	40	34	30	27	25	23	35	45
19 Gyms	-	83	67	57	49	44	40	37	35	33	45	55
20 Trading hallsshops,	-	93	79	70	63	58	55	52	50	49	60	70

passenger hallsstations air terminals, gyms												
21 Territories, directly adjacent to the buildings of hospitals and sanatoriums	7.00-23.00	86	71	61	54	49	45	42	40	38	50	65
	23.00-7.00	79	63	52	45	39	35	32	30	28	40	55
22 Territories, directly adjacent to residential buildings, res homes, boarding homes for the elderly and disabled	7.00-23.00	90	75	66	59	54	50	47	45	44	55	70
	23.00-7.00	83	67	57	49	44	40	37	35	33	45	60
23 Territories, directly adjacent to the buildings of clinics, schools and other educational institutions, preschool institutions, recreation areas of micro districts and groups of residential buildings		90	75	66	59	54	50	47	45	44	55	70

Test tasks

1. List the indicators of microclimate parameters.

- A) air speed, illumination, temperature, air humidity;
- B) air speed, EMBs, atmospheric pressure, temperature, air humidity;
- C) air speed, atmospheric pressure, temperature, air humidity;
- D) air speed, vibration, temperature, air humidity;
- E) noise, atmospheric pressure, temperature, air humidity.

2. What is a production microclimate:

- A) meteorological conditions at the workplace;
- B) a complex of meteorological factors affecting the body of workers;
- C) a complex of meteorological factors in the workplace that determine the heat exchange between a person and the environment;
- D) a complex of meteorological factors affecting the habitat;
- E) meteorological conditions in residential and public buildings.

3. Terms choice hygienic standards production microclimate are

- A) year, category of work by level of energy consumption, execution time works;
- B) season of the year, category of work according to the level of energy consumption, time of work;
- C) period of the year, category of work according to the level of energy consumption, time of work;
- D) period of the year, work intensity levels, completion time works;
- E) season of the year, category of work by level of energy consumption, levels of work by intensity;

4. To indicators characterizing production microclimate include:

- A) air temperature, corpuscular radiation, relative air humidity, air mobility, intensity of thermal radiation;
- B) air temperature, surface temperature, relative air humidity, air mobility, light intensity;
- C) air temperature, surface temperature, relative air humidity, air mobility, intensity of thermal radiation, air ion composition;
- D) air temperature, surface temperature, relative humidity, stimulated radiation, intensity of thermal radiation;
- E) air temperature, surface temperature, relative humidity, air mobility, intensity of thermal radiation.

5. The microclimate of the premises is characterized by a complex indicators

- A) air temperature, air humidity, corpuscular radiation, air ion composition;
- B) air temperature, air humidity, air mobility, temperature of enclosing surfaces;
- C) air temperature, air humidity, air mobility, air ion composition;
- D) air temperature, air humidity, environmental fluctuations, temperature of enclosing surfaces;
- E) air temperature, air humidity, air mobility, corpuscular radiation.

6. From a physical point of view, electromagnetic fields are...

- A) environmental fluctuations;
- B) corpuscular radiation;
- C) periodic changes in the strength of the magnetic and electric fields;
- D) quantum flow;

E) periodic changes in the electric field strength.

7. In what units is the intensity of tension assessed magnetic field:

- A) V/m ;
- B) A/m ;
- C) W/m^2 ;
- D) Hz;
- E) m/s.

8. In what units is the intensity of tension assessed electric field:

- A) V/m ;
- B) A/m ;
- C) W/m^2 ;
- D) Hz;
- E) m/s.

9. An electrostatic field is...

- A) a field created by direct electric current or substances that have the properties of permanent magnets;
- B) the field of stationary electric charges and their interaction;
- C) current field of any voltage with a frequency of 50 Hz;
- D) corpuscular radiation;
- E) stimulated emission.

10. A constant magnetic field is...

- A) a field created by a direct electric current;
- B) the field of stationary electric charges and their interaction;
- C) current field of any voltage with a frequency of 50 Hz;
- D) stimulated emission;
- E) a field created by a non-direct electric current.

11. In what units is the frequency of electromagnetic waves estimated fields:

- A) V/m ;
- B) A/m ;
- C) W/m^2 ;
- D) Hz;
- E) m/s.

12. The following measuring instruments are subject to verification:

- A) all instruments included in the State Register of Measuring Instruments;
- B) subject to State metrological control and supervision;
- C) all measuring instruments used in the Centers for Hygiene and Epidemiology;
- D) measuring instruments used at the Centers for Hygiene and Epidemiology for the first time or after long-term storage;
- E) all means of measuring physical factors used in the measurement.

13. In what units is energy flux density measured frequency range above 300 MHz:

- A) in volts per meter;
- B) in amperes per meter;
- C) in microwatts per square centimeter;
- D) in Nano Teslas.
- E) in Coulomb/kg.

14. Specify the noise measurement parameters:

- A) sound levels in dB A and sound pressure levels;
- B) maximum sound level and sound pressure levels measured in octave mean geometric frequencies;
- C) sound levels in dB A and measured on the Lin scale;
- D) sound levels in dB A and measured on the C scale;
- E) sound levels in dB A and sound pressure levels measured in octave geometric mean frequencies.

15. Specify the normalized frequency range of measurement general vibration:

- A) from 0 to 31.5 Hz;
- B) from 1 to 63 Hz;
- C) from 2 to 80 Hz;
- D) from 10 to 63 Hz;
- E) from 16 to 1000 Hz.

16. Constant noise is a sound level that:

- A) over an 8-hour working day changes over time by no more than 5 dBA;
- B) over an 8-hour working day changes in time by more than 5 dBA;
- C) remains constant during the technological process cycle;
- D) does not exceed 110 dB A;
- E) over 110 dB A;

17. Equivalent industrial noise level in dBA define for:

- A) constant in time;
- B) intermittent in level;
- C) fluctuating over time;
- D) intermittent in level and fluctuating over time;
- E) constant in time and intermittent in level.

18. What is the unit of illumination:

- A) candle-meter
- B) lumen;
- C) candela;
- D) nit;
- E) volt.

19. Illumination is -

- A) radiant energy, causing the sensation of light;
- B) the density of the light flux incident on the surface;
- C) surface density of luminous intensity in a given direction;
- D) radiant energy;
- E) natural light ratio.

20. Industrial natural lighting is standardized according to

- A) level of illumination of the working surface, glare indicator, pulsation coefficient;
- B) light coefficient;
- C) coefficient of natural light;
- D) luminous flux density;
- E) coefficient of artificial lighting.

21. Traffic noise measurements are carried out

- A) 7.5 m from the axis of the second lane of vehicles at a height of 1.2 m from the level of the roadway;

- B) 8.5 m from the axis of the first lane of vehicles at a height of 1.2 m from the level of the roadway;
- C) 9.5 m from the axis of the first lane of vehicles at a height of 1.2 m from the level of the roadway;
- D) 10.5 m from the axis of the first lane of vehicles at a height of 1.2 m from the level of the roadway;
- E) 10.5 m from the axis of the first lane of vehicles at a height of 2.4 m from the level of the roadway;

22. The territory where the level of electromagnetic energy from a radio technical object exceeds the maximum limit at a height of more than 2 meters, is called:

- a) sanitary protection zone;
- b) sanitary protection zone;
- c) restricted development zone;
- d) sanitary zone;
- E) endemic zone.

23. The normalized parameters of non-constant noise are

- A) time of exposure to noise;
- B) equivalent sound levels;
- C) maximum sound levels;
- D) sound pressure;
- E) minimum sound levels.

24. The main standardized parameters of vibration in residential houses are:

- A) root-mean-square value of the vibration intensity fields;
- B) root mean square value of vibration velocity;
- C) time of exposure to vibration;
- D) vibration with a wide range of effects on biological objects;
- E) vibration with a wide range of frequencies.

25. Hertz is a unit:

- A) volume level;
- B) sound intensity level;
- C) sound frequencies;
- D) height of pitch ;
- E) sound levels.

26. Unity of measurements is a state of measurements that characterized by the following provisions:

- A) the results are expressed in units of quantities approved for use in the Republic of Kazakhstan, and the measurement accuracy indicators do not go beyond the established limits;
- B) measurement results are expressed in legal units;
- C) measurement errors do not go beyond the established limits with a given probability;
- D) measurements were made using verified measuring instruments;
- E) measurements were performed using the latest measuring instruments.

27. When the distance from the worker's eyes to the object is up to 0.5 m the level of visual work is established taking into account:

- A) the angular size of the object of discrimination;
- B) the minimum size of the object of discrimination;
- C) equivalent size of the object;
- D) the maximum size of the object of discrimination;

E) the equivalent and maximum size of the object.

28. In what units is EMF intensity measured ultra high frequencies:

- A) V/m;
- B) A/m;
- C) W/m²;
- D) in Nano Teslas.
- E) in Coulomb/kg.

29. State metrological control is:

- A) control activities in the field of state regulation of ensuring the uniformity of measurements, carried out by authorized State executive bodies;
- B) inspection to determine compliance with mandatory requirements of state standards;
- C) ensuring the uniformity of measurements for the purposes of state defense;
- D) ensuring uniformity of measurements for healthcare purposes;
- E) ensuring uniformity of measurements for educational purposes.

30. Measurement is:

- A) a set of operations performed to determine the quantitative value of a quantity;
- B) a set of operations performed to determine the composition of chemical substances;
- C) a set of operations performed to determine the concentrations of chemical substances;
- D) a set of operations performed to determine the composition of physical substances;
- E) a set of operations performed to determine physical factors.

31. Measuring parameters when working while standing must be carried out at a height... from floor level.

- A) 0.3 m;
- B) 0.5 m;
- C) 0.7 m;
- D) 1.0 m;
- E) 1.5 m.

32. Relative air humidity is

- A) the content of water vapor in the air;
- B) absolute pressure of water vapor;
- C) the ratio of the partial pressure of water vapor to the maximum possible under given conditions;
- D) combination of temperature and pressure of water vapor;
- E) a combination of temperature and air speed.

33. Confidence probability P=95% means that the risk make an error is no more than:

- A) 95%;
- B) 1%;
- C) 5%;
- D) 10%;
- E) 20%.

34. Name the means for measuring microclimate parameters.

- A) TKA-PKM-09, TKA-PKM-23, TKA-PKM-52, Meteoskop-M;
- B) Meteometer-MES-200A, TKA-PKM-23, TKA-PKM-52;
- C) Ve-meter-AT-002, TKA-PKM-23, TKA-PKM-52, Meteoskop-M;

- D) TKA-PKM-23, TKA-PKM-52, Meteoskop-M, Meteometr-MES-200A;
- E) Assistant, TKA-PKM-23, TKA-PKM-52, Meteoskop-M.

35. Optimal relative air humidity, according to sanitary standards is:

- A) 20–30%;
- B) 30 - 40%;
- C) 40 - 60%;
- D) 50-70%;
- E) 60 - 90%.

36. Luminous flux unit:

- A) candle-meter ;
- B) luxury;
- C) candela;
- D) dB;
- E) Hz

37. Measurement of microclimate parameters should be carried out in within 1 day.

- A) 1 time
- B) 2 times
- B) 3 times
- D) 4 times
- D) 5 times

38. How are the standardized microclimate parameters determined in premises?

- A) the number of people staying in them;
- B) heat protective properties of clothing;
- C) orientation of the room according to the cardinal points; D) purpose of the premises;
- E) heating system.

39. In rooms with a high density of workplaces, with no sources of local heat release and an area larger than 400 m² measurement of microclimate parameters should be carried out through...

- A) 3m;
- B) 5m;
- C) 10m;
- D) 15m;
- E) 20m.

40. Measuring parameters when working while sitting must be carried out at a height... from floor level.

- A) 0.1 m;
- B) 0.3 m;
- C) 0.5 m;
- D) 0.7 m;
- E) 0.1 m;

Standards of answers to test tasks

No.	Option answer	No.	Option answer	No.	Option answer	No.	Option answer
1	C	11	D	21	C	31	E
2	A	12	B	22	C	32	C
3	C	13	C	23	E	33	C
4	E	14	E	24	B	34	D
5	B	15	B	25	C	35	C
6	C	16	A	26	A	36	A
7	B	17	D	27	B	37	C
8	A	18	A	28	C	38	D
9	B	19	B	29	A	39	C
10	A	20	C	30	A	40	E

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