КОМИТЕТ ПО ЧРЕЗВЫЧАЙНЫМ СИТУАЦИЯМ
МВД РЕСПУБЛИКИ КАЗАХСТАН

КОКШЕТАУСКИЙ ТЕХНИЧЕСКИЙ ИНСТИТУТ

№ 4 (20), 2015

ВЕСТНИК
КОКШЕТАУСКОГО ТЕХНИЧЕСКОГО ИНСТИТУТА
КОМИТЕТА ПО ЧРЕЗВЫЧАЙНЫМ СИТУАЦИЯМ
МВД РЕСПУБЛИКИ КАЗАХСТАН

КОКШЕТАУ 2015

УДК 614.8 (082)
ББК 68.69 (5Каз)

Вестник Кокшетауского технического института Комитета по чрезвычайным ситуациям МВД Республики Казахстан № 4 (20) – К.: КТИ КЧС МВД РК, 2015. – 93 с.

Журнал зарегистрирован Министерством культуры и информации Республики Казахстан. Свидетельство о постановке на учёт СМИ № 11190-Ж от 14.10.2010 г.

РЕДАКЦИОННАЯ КОЛЛЕГИЯ

«Вестник Кокшетауского технического института КЧС МВД РК» - периодическое издание, посвящённое вопросам обеспечения пожарной безопасности, предупреждения и ликвидации чрезвычайных ситуаций. Тематика журнала – теоретические и практические аспекты предупреждения и ликвидации чрезвычайных ситуаций; обеспечение пожарной и промышленной безопасности; проблемы обучения.

Научный журнал предназначен для курсантов, магистрантов, адъюнктов, профессорско-преподавательского состава образовательных учреждений, научных и практических сотрудников, занимающихся решением вопросов защиты в чрезвычайных ситуациях, пожаровзрывобезопасности, а так же разработкой, созданием и внедрением комплексных систем безопасности.

Издано в авторской редакции
ISSN 2220-3311

Нәтижелердің салыстырылуы теориялық зерттеулердің нәтижелерімен айтарлықтай айырмашылықтар бар екендігін көрсетеді.

Негізгі сөздер: отқа төзімділік, температура, құрылыс қабырғасы, қабаттың бұзылуы.

Semerak M.M., Taciy R.M., Pazen O.Yu.

MULTILAYER THERMAL INSULATION CAPACITY CONSTRUCTION WITH REGARD TO DAMAGE ARBITRARY LAYER

In the article the actual problem of the definition of fire resistance of heat-insulating capacity of multilayer building structures, taking into account the destruction of an arbitrary layer. The mathematical apparatus, which is summarized in the article, allows gradually solve the problem of the distribution of non-stationary temperature field in the thickness of the multilayer structure. Place your hands-on example of calculation of the fire resistance of four-layer building structure without destroying the layer and s destruction. Comparison of the results shows significant discrepancies in the results of theoretical research.

Keywords: fire resistance, temperature, wall construction, destruction layer.

UDC 621.43.068.4

S.O. Vambol' *– Dr.Sci.(Tech.), Professor, Head of Applied Mechanics Dept.,*
I.V. Mischenko *– Cand.Sci.(Tech.), Docent, Docent of Applied Mechanics Dept.,*
O.M. Kondratenko *– Cand.Sci.(Tech.), Docent of Applied Mechanics Dept.,*
O.A. Burmenko *– Training Platoon Commander, Lieutenant of CDSU,*
National University of Civil Defense of Ukraine, Kharkiv, Ukraine

METROLOGICAL MAINTENANCE OF EXHAUST GAS SAMPLING SYSTEM OF ENGINE TEST BENCH AS AN OBJECT OF RESEARCHES

Grounded urgency of the study of metrological aspects of researches on the engine test bench. Described the features of construction, composition, and shows a diagram of modernized system for taking samples of exhaust gases for obtaining they toxicity and opacity and also characteristics of measuring instruments of the bench.

Keywords: motor bench researches, diesel, metrology, civil protection, labor safety, ecological safety.

Introduction. As well known, the main porpoise of any kind of scientific researches is a creation of newest intellectual product of fundamental of applied nature, which characterized by scientific novelty, originality and practical value. At the same

time in this segment of life cycle it passes the stage of experimental studies of physical processes that form the basis of its functioning and also its operational characteristics as a finished product. Often, the programs of these studies and implement goals and objectives of so-called "pioneer" scientific research works for studying of "white spots" in specific fields of knowledge, that is the essence of scientific research. The implementation of such researches related with developing of appropriate programs and methods, designing and manufacturing of experimental samples and also creating and improvement of appropriate laboratory equipment – benches, plants, measuring instruments and etc. That means, objects of laboratory equipment are unique but designed for implementation of the widest possible range of experiment programs.

It also well known, that no changes can not be executed absolutely precisely and in any case contain some errors. We can only reliably determine its magnitude, which determines the value of obtained data [1]. That's why scientific works aimed at identification and analysis of metrological aspects of creation of new and modernization of existing laboratory equipment are relevant because accuracy of direct and indirect measurements has influence on clarity of the modern world view.

Purpose of the study is description of structure and construction of modernized exhaust gases (EG) toxicity and smokiness sampling system of engine test bench (ETB) of laboratory of Department of Power Piston Plants (DPPP) of A.N. Podgorny Institute for Problems in Machinery of National Academy of Science of Ukraine (IPMash NASU) for its following analysis as a metrological system [2].

The scheme of modernized exhaust system of ETB shown on Fig. 1 and its external view – on Fig. 2 [2, 3]. Options of measurement equipment of ETB summarized in Table 1, data in which taken from sources [3 – 5, 10 – 22].

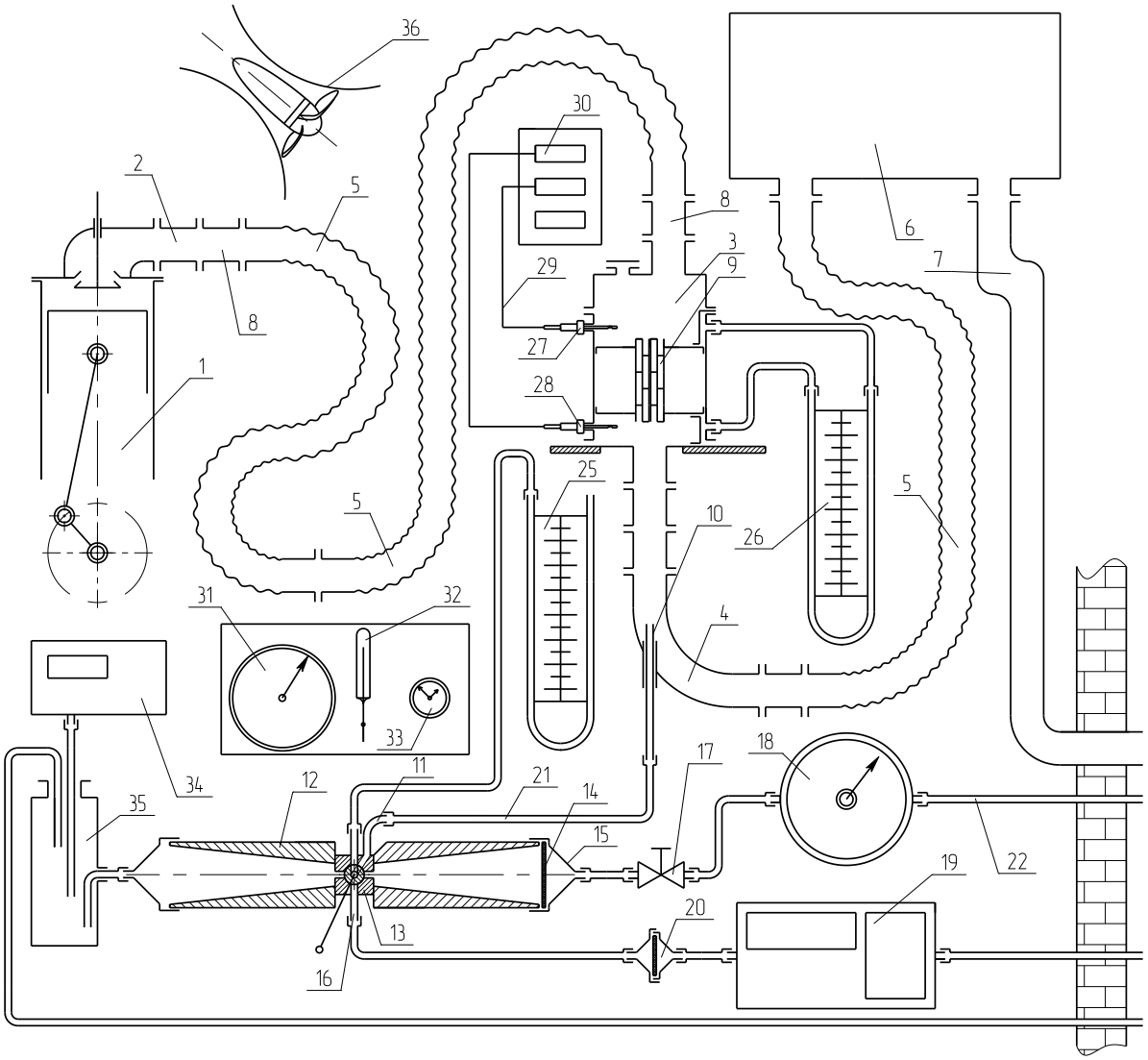


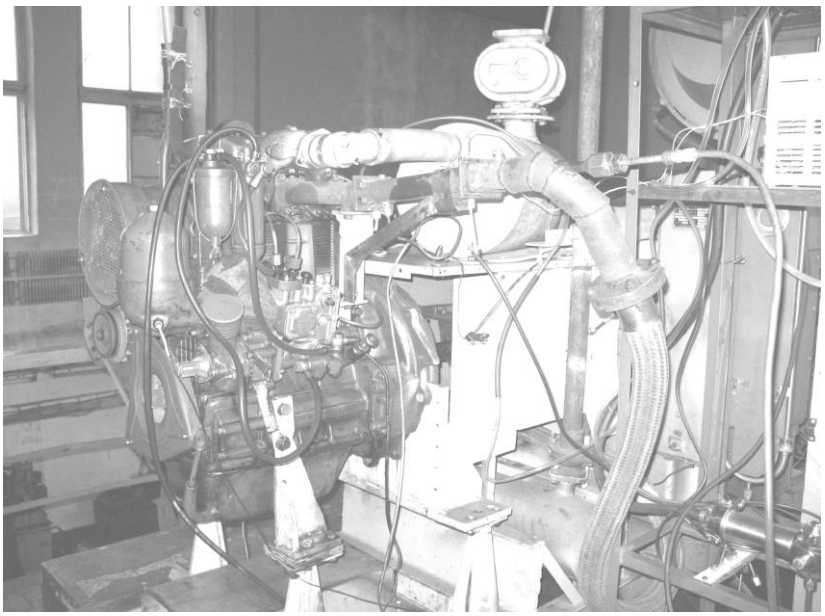
Fig. 1. **Scheme of EG sampling system of ETB:**

1 – diesel engine 2Ch10.5/12; 2 – diesel exhaust collector; 3 – insertion for experimental DPF samples; 4 – angled EG pipeline; 5 – flexible heat resistant EG pipelines; 6 – EG noise muffler; 7 – exhaust pipeline; 8 – adapters; 9 – operating sample of FE DPF; 10 – sample probe; 11, 12, 13, 15, 16 – intake fitting, cone, four way valve, cap and exhaust fitting of allonge; 14 – exchangeable filter; 17 – adjusting valve; 18 – gas flowmeter; 19 – five-component gas analyzer AUTOTEST-02.03.P; 20 – protective covering with holder; 21 – connection gas pipeline; 22, 23, 24 – outdoor gas pipeline; 25, 26 – differential U-shape hydraulic manometers; 27, 28 – thermometric sensors TKhA; 29 – electrical cord; 30 – appliance OVEN TRM-200; 31 – barometer-aneroid BAMM-1M; 32 – mercury thermometer; 33 – timer; 34 – opacitymeter INFRAKAR-D, 35 – measuring receiver (6,36 l); 36 – air pump

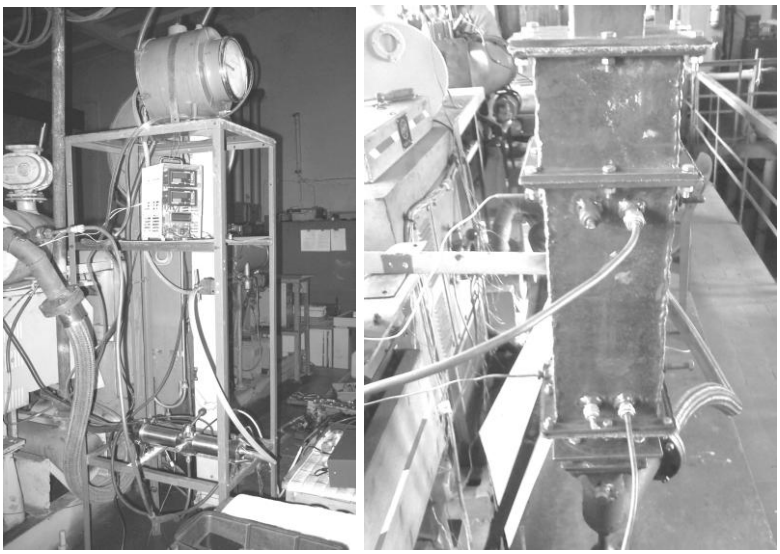
Statement of problem of the study and it solving. In DPPP vas developed modular diesel particulate matter filter (DPF) with new non conventional design and bulk natural zeolite in stainless steel mash cassettes – DPF IPMash.

Several variations of that DPF construction embodied in form of operating experimental samples of its filter element (FE). Its working characteristics under real

exploitation conditions vas studied on ETB [2]. ETB is a complex system of interrelated power plants and its structure and features of work described in [3].



a



b c

Fig. 2. Modernizing exhaust system of ETB equipped with insertion for DPF operating samples and EG toxicity and smokiness sampling system:

а – general external view, б – stand with measuring instruments,

в – insertion for DPF operating samples

For executing a bench motor researches of DPF IPMash the exhaust system of ETB vas modernized by adding to it a place for FE operating samples (insertion for samples (IS)) and the new EG sampling and EG flow thermodynamic parameters, toxicity and smokiness measuring systems [2, 3].

The tests executing in accordance with programs and methodics of DPPP and also GOST 18509-88 and GOST 14846-87 [4, 5], in which contains requirements for accuracy of measuring of some physical quantities.

Programs of the study developed on basis of standardized test 13- and 8-mode stationary cycles that are models of exploitation of automotive and tractor diesel engines respectively and are described in UNECE Regulations # 49 and # 96 [6, 7]. They were adapted to possibilities of equipment of DPPP laboratory by the way that described in [2, 3].

Table 1. **Measuring equipment of ETB and its parameters**

Name, designation of the measured parameter and its units	Limits and diapasons of measuring	Measuring instrument
Frequency of rotation of engine crankshaft and motor-generator rotor, n, min^{-1}	0 – 5000 800 – 1800	Measuring complex IDS-742 4/N or mark of TDC and five-ways gas analyzer Avtotest-02.03.P
Torque of engine, M, N·m	0 – 250 0 – 120	Measuring complex IDS-742 4/N with mechanical weight dynamometer
Time of consumption of diesel fuel weighed portion, τ, s	0 – 10000 0 – 600	Scales of 1st accuracy class and weighted portion and electrical hydraulic automatic valve for fuel refilling and optical sensor and frequencymeter-chronometer F-5041
Volume consumption of air, V_{air}, m^3/h	5 – 120 30 – 100	Gas counter RG-100 and frequencymeter-chronometer F-5040
Drop of intake air pressure, ΔP_{int}, mm w.col.	0 – 1200 0 – 300	Throttling washer and differential manometer type DM
Drop of exhaust gases pressure, ΔP_{exh}, mm w. col.	0 – 1500 0 – 300	Differential manometer type DM
Exhaust gas temperature, t_{exh}, °C	-50 – 1400 20 – 700	Device A566 and thermocouple type K
Engine oil temperature, t_{oil}, °C	-50 – 180 40 – 100	Sensor TM-100V and device A565 or sensor and five-ways gas analyzer Avtotest-02.03.P
Engine fuel temperature, t_{fuel}, °C	-50 – 180 10 – 40	Device A566 and sensor type 10011
Intake air temperature, t_{air}, °C	0 – 50 5 – 40	Mercury laboratory thermometer TL-4

Environment air temperature, t_0, °C	0 – 50 0 – 35	– // –
Environment air pressure, B_0, kPa	80 – 106 90 – 104	Aneroid barometer BAMM-1M
Relative air humidity, φ_0, %	0 – 100 0 – 100	Psychrometer
NO_x volume concentration in exhaust gas, C_{NOx}, ppm	0 – 5000 0 – 3000	Five-ways gas analyzer Avtotest-02.03.P
CO volume concentration in exhaust gas, C_{CO}, %	0 – 5 0 – 2	Five-ways gas analyzer Avtotest-02.03.P
O_2 volume concentration in exhaust gas, c_{O_2}, %	0 – 21 0 – 10	Five-ways gas analyzer Avtotest-02.03.P
CO_2 volume concentration in exhaust gas, c_{CO_2}, %	0 – 16 0 – 5	Five-ways gas analyzer Avtotest-02.03.P
C_nH_m volume concentration in exhaust gas, C_{CH}, ppm	0 – 2000 0 – 150	Five-ways gas analyzer Avtotest-02.03.P
Linear dimensions of experimental samples, l, mm	0 – 500 1 – 250	Caliper ShC-1 and locksmith ruler
Samples taking time, τ_{samp}, s	0 – 60 15 – 50	Timer SOSpr-2a
Opacity of exhaust gas: – weakening of light flow coefficient, N_D, %; – absorption of light flow coefficient, K, m^{-1}	0 – 100 10 – 75; 0 – ∞ 0 – 5	Exhaust gas sampling taker and Teflon filter in holder or opacitymeter INFRAKAR-D

The methodic of obtaining of errors of direct and indirect measuring of mode parameters diesel engine operation, EG gas dynamic parameters, EG toxicity and smokiness parameters on ETB will be the object of following studies.

A variety of measuring instruments on the bench allows us to conclude of rational use of the mathematical apparatus of the beta distribution as described in [8], to evaluate the measurement errors.

Conclusions. In present paper was considered structure, construction and features of EG toxicity and smokiness sampling system of ETB of DPPP IPMash NASU laboratory as a metrological system.

In following studies will be developed and described the method of obtaining

of direct and indirect measuring errors of regime parameters of diesel engine, EG gasdynamic parameters, EG toxicity and smokiness parameters on ETB.

References

1. Rabinovich S.G. (1978), "Pogreshnosti izmerenij" [The errors of measuring] [Text], Leningrad, Energija, 262 p. [in Russian].

2. Vambol' S.O., Strokov O.P., Kondratenko O.M. (2014), "Stendovi vyprobuvann'a avtotraktornogo dyzelja 2Ch10.5/12 za standartyzovannymy cyklamy dlja vyznachenn'a efektyvnosti roboty FTCh" [Bench researches of autotractor diesel engine 2Ch10.5/12 on standardized cycles for determination of operational efficiency of DPF] [Text], Herald of National Technical University "KhPI". Collection of scientific works. Series: Automobile- and Tractor Production, Kharkiv: NTU "KhPI", no 10 (1053), pp. 11 – 18. [in Ukrainian].

3. Strokov A.P. and etc. (2011), "Razrabotka malozatratnoj tehnologii i avtomatizirovannoj sistemy ochistki otrabotavshyh gazov dizelja ot tverdyh chastic. Otchet o NIR (zakljuchitel'nyj)" [Development of low-cost technology and automatical system for purification of exhaust gases of diesel engine from particulate matters. Scientific research report (final)] [Text], SR no. 0111U001 762, Kharkov: IPMash NASU, 131 p. [in Russian].

4. GOST 18509-88, (1988), "Dizeli traktornye i kombajnovyje. Metody stendovyh ispytanij" [GOST 18509-88. Diesel engines of tractors and combines. Methods of bench testing] [Text], Moscow: Izdatel'stvo standartov, 78 p. [in Rus.].

5. GOST 14846-87 (1987), "Dvigateli avtomobil'nyje. Metody stendovyh ispytanij" [GOST 14846-87. Automotive engines. Methods of bench testing] [Text], Moscow: Izd-vo standartov, 42 p. [in Russian].

6. Regulation № 49. Revision 5. Uniform provision concerning the approval of compression ignition (C.I.) and natural gas (NG) engines as well as positive-ignition (P.I.) engines fuelled with liquefied petroleum gas (LPG) and vehicles equipped with C.I. and NG engines and P.I. engines fuelled with LPG, with regard to the emissions of pollutants by the engine. – United Nations Economic and Social Council Economics Commission for Europe Inland Transport Committee Working Party on the Construction of Vehicles. –E/ECE/TRANS/505. –4 May 2011. –194p.

7. Regulation № 96. Uniform provision concerning the approval of compression ignition (C.I.) engines to be installed in agricultural and forestry tractors with the regard to the emissions of pollutants by the engine. Geneva, 1995. – 109 p.

8. Vambol' S.O., Mischenko I.V., Kondratenko O.M., Burmenko O.A. (2015), "Aproksymacija zakonu rozpodilu eksperymental'nyh danyh za dopomogoju beta-rozpodilu. Chastyna 1" [Approximation of experimental data distribution law using the beta-distribution. Part 1] [Text], Herald of National Technical University "KhPI". Collection of scientific works. Series: Automobile- and Tractor Production, Kharkiv: NTU "KhPI", no. 18 (1127), pp. 36 – 44. [in Ukrainian].

9. Kondratenko O.M. (2013), "Znyzhennja vykydu tverdyh chastynok transportnyh dyzeliv, scho perebuvajut' v ekspluatacii': avtoref. dys. na zdobuttjz nauk. stupenja kand. tehn. nauk: spec 05.05.03 – dvyguny ta energetychni ustanovky" [Reducing of emissions of particulate matter of transport diesel engines that are in operation: abstract of dissertation for obtaining of candidate of technical sciences degree in specialty 05.05.03 "Engines and Power Plants"] [Text], Kharkiv, Publ. NTU "KhPI", 20 p. [in Ukrainian].

10. DSTU ISO/IEC 17025:2006, IDT. "Zagal'ni vymogy do komplektnosti vyprobuval'nyh ta kalibruval'nyh laboratirij" [General requirements for the competence of testing and calibration laboratories] (National standard of Ukraine) [Effective as of 2007-07-01], Kyiv, Publ. Derzhspozhyvstandart Ukrainy. – 2007. – 26 p. [in Ukrainian].

11. Alexandrovskaja L.N., Kruglov V.I., Sholom A.M. (2002), "Teoreticheskije osnovy ispytanij I eksperimental'naja otrabotka slozhnyh tehnicheskih sistem" [Theoretical basis of the test and experimental development of complex technical systems], Moscow, Logos, 748 p. [in Russian].

12. Korobko A.I., Shei'n V.C., Radchenko Ju.A., Plotnikova M.V. (2014), "Validizacija vyprobuval'nogo obladnannja" [Valydation of testing equipment], Materials of International science and practical Internet-conference "Modern technologies and prospects of automotive transport" (08-04-2014), Vinnitca, Publ. VNTU, pp. 4 – 5.

13. GOST 18140-84 "Manometry differencyal'nyje GPS. Obschije tehnicheskije uslovija" [Differential manometers. General technical requirements], Moscow, Izd-vo standartov. – 1984. – 49 p.

14. TU 25-2021-88. "Termometry rtutnyje stekljannyje laboratornyje" [Mercury glass laboratory termometers], Moscow, Izd-vo standartov. – 1988. – 59 p.

15. Barometer-Aneroid BAMM-1M. Pasport L82.832.001PS.

16. GOST 166-89 "Shtangencyrkuli. Tehnicheskije uslovija" [Clipers. Technical requirements], Moscow, Izd-vo standartov. – 1989. – 11 p.

17. GOST 427-75 "Linejki izmeritel'nyje metallicheskije. Tehnicheskije uslovija" [Metallic measurement rulers. Technical requirements], Moscow, Izd-vo standartov. – 1975. – 7 p.

18. TU 25.1894.003-90 "Sekundomery mehanicheskije" [Mechanical timers], Moscow, Izd-vo standartov. – 1990. – 5 p.

19. GOST 6616-94 "Preobrazovateli termoelektricheskije. Obschije tehnicheskije uslovija" [Thermoelectric converters. General technical requirements], Moscow, Standartinform. – 1994. – 11 p.

20. Device A565. Operation manual 0273RE.

21. Rotational gas counter RG-100. Technical description and manual.

22. Electronic and computing frequencymeter F5080. Technical description and operation manual. – 1980. – 40 p.

Вамболь С.А., Мищенко И.В., Кондратенко А.Н., Бурменко А.А.

ТЕРГЕУ ОБЪЕКТІСІ РЕТІНДЕ ПАЙДАЛАНЫЛҒАН ГАЗ СЫНАМАСЫН ІРІКТЕУ ДИЗЕЛЬДІ ҚОЗҒАЛТҚЫШТАРДЫ СЫНАУ ҮШІН СТЕНД ӨЛШЕУ ДҰРЫСТЫҒЫН РАСТАУ ЖӨНІНДЕГІ

Қозғалтқыш стендте эксперименттік зерттеу зерттеу метрологиялық аспектілері өзектілігі. Құрылымы, құрамы, және жаңғыртылған жүйесі таңдама пайдаланылған газ улылығы және жабық диаграммаға ерекшеліктері, сондай-ақ құралдарын тірекке өлшеу сипаттамалары көрсетеді.

***Негізгі түсініктер*:** стендтік зерттеу моторлы, дизель, метрология, азаматтық қорғаныс, еңбекті қорғау, қоршаған ортаны қорғау.

Вамболь С.А. , Мищенко И.В., Кондратенко А.Н., Бурменко А.А.

МЕТРОЛОГИЧЕСКОЕ ОБЕПЕЧЕНИЕ СИСТЕМЫ ОТБОРА ПРОБ ОТРАБОТАВШИХ ГАЗОВ ДИЗЕЛЯ МОТОРНОГО ИСПЫТАТЕЛЬНОГО СТЕНДА КАК ОБЪЕКТ ИССЛЕДОВАНИЙ

Обоснована актуальность исследования метрологических аспектов экспериментальных исследований на моторном испытательном стенде. Описаны особенности конструкции, состав и приведена схема модернизированной системы отбора проб отработавших газов на токсичность и дымность, а также приведены характеристики средств измерительной техники стенда.

Ключевые слова: стендовые моторные исследования, дизель, метрология, гражданская защита, охрана труда, экологическая безопасность.

УДК. 355.1

***Г. Аубакиров*[1] -** *магистр военного и административного управления, доцент кафедры ГО и ВП*
***Г.А. Шарипова*[2] -** *преподаватель*
[1]*Кокшетауский технический институт КЧС МВД Республики Казахстан*
[2]*Многопрофильный колледж Гражданской защиты при Академии «Кокше»*

ОПТИМИЗАЦИЯ ТЫЛОВОГО ОБЕСПЕЧЕНИЯ ПРИ СОВМЕСТНЫХ ДЕЙСТВИЯХ ТЕРРИТОРИАЛЬНЫХ ПОДРАЗДЕЛЕНИЙ КЧС МВД РЕСПУБЛИКИ КАЗАХСТАН ПРИ ЧРЕЗВЫЧАЙНЫХ СИТУАЦИЯХ

В данной статье изложен взгляд авторов на основные направления оптимизации системы тылового обеспечения подразделении КЧС МВД, Вооруженных Сил Республики Казахстан в условиях чрезвычайных ситуаций.

МАЗМҰНЫ – СОДЕРЖАНИЕ – CONTENTS

ТЕОРЕТИЧЕСКИЕ И ПРАКТИЧЕСКИЕ АСПЕКТЫ ПРЕДУПРЕЖДЕНИЯ И ЛИКВИДАЦИИ ЧРЕЗВЫЧАЙНЫХ СИТУАЦИЙ

ОБЕСПЕЧЕНИЕ ПОЖАРНОЙ И ПРОМЫШЛЕННОЙ БЕЗОПАСНОСТИ

ПРОБЛЕМЫ ОБУЧЕНИЯ

Научный журнал

Вестник Кокшетауского технического института
КЧС МВД Республики Казахстан № 4 (20), 2015

Редакция журнала:
Кусаинов А.Б., Садвакасова С.К.

Кокшетауский технический институт КЧС МВД РК
Отдел организации научно-исследовательской
и редакционно-издательской работы
020000, Кокшетау, ул. Акана сері, 136
Тел. 8(7162) 25-58-95