American Journal Of Applied Science And Technology
(ISSN – 2771-2745)
VOLUME 04 ISSUE 11 Pages: 81-88
OCLC – 1121105677
Crossref doi Google Scholar WorldCat MENDELEY

Publisher: Oscar Publishing Services

Journal Website: https://theusajournals.com/index.php/ajast

Research Article

METHODOLOGY OF EXPERIMENTAL TESTS ON AN EXPERIMENTAL RESEARCH STAND FOR CAPTURE AND UTILIZATION OF NOXIOUS GASES

Submission Date: November 19, 2024, **Accepted Date:** November 24, 2024,
Published Date: November 29, 2024
Crossref doi: https://doi.org/10.37547/ajast/Volume04Issue11-13

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ABSTRACT

The main volume of planned emissions falls on operations performed during start-up and shutdown of gas pumping units. In order to reduce the amount of exhaust gases at gas filling stations for cars, an optimal technological scheme of the station has been created, an experimental stand has been developed taking into account the safety of equipment during experimental work, a description of the stand, the procedure for conducting the experiment and the results obtained are presented in this article.

KEYWORDS

Compressor, waste gases, pressure relief unit, pressure relief cylinders, air compressor, separator, check valve.

INTRODUCTION

We will describe in detail the working principle of the laboratory model developed during the implementation of experimental tests.

Experimental trials are conducted in an experimental test model with dimensions (60x100x60 cm). The experimental model consists of the following structural parts: separator, compressor, pressure relief cylinders, accumulator unit, manometer, thermometer, reverse valve, release valve (sbros), stand (stand).

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Implementation of the experiment, all elements and equipment are optional and selected according to the stand. Also, taking into account the safety of the equipment, an oil-free and noiseless 24L TEXA T-72524 air compressor was selected as a gas compressor for the invention. The characteristics and parameter indicators of the above air compressor are presented during experimental tests.

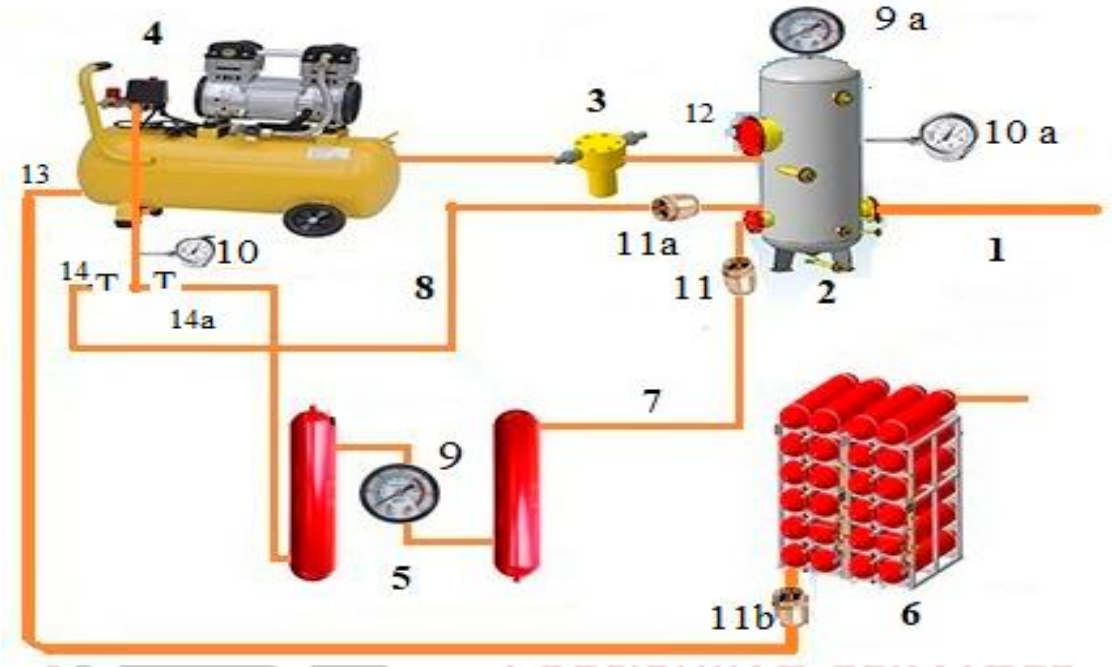

Figure 1. The principle scheme of the research stand.

1 - existing gas pipeline, 2 - separator, 3 - filter, 4 - compressor, 5 - extinguishing unit, 6 - accumulator unit, 7 - supply pipe passing through the pressure extinguishing unit, 8 - direct supply pipe, 9 - pressure gauge after the first cylinder cylinder, 9a - pressure gauge in the separator, 10 - thermometer after the compressor, 10a - thermometer after the separator, 11 - 8 pipes installed in the reverse separator valve, 11a - check valve installed through pipe 9, 11b - check valve in the battery block, 12 - sbros valve installed in the separator, 13 - gas pipe to the battery.

The purpose and task of the laboratory work: to measure the parameters of gas and air after the pressure relief cylinder cylinders ( ) with high accuracy when we turn off the compressor, and get the results.

The research stand is equipped with a gas pipe with a diameter of d = 6 mm through a pipe (1), material - steel, working pressure - 18 bar (1.8 MPa), burst

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pressure - 60 bar (6 MPa), test pressure - 27 bar (MPa), comes to the separator (2) with a wall thickness greater than or equal to 2.0 mm. (The separator was selected and installed according to the scale of the stand, compressor power and operating parameters.) From the separator, through the filter (3), the 24L TEXA T-72524 compressor (4) reaches for gas compression, where the gas pressure is 8 kg/scm2 (8 bar), the compressed gas is sent to the accumulator unit for consumption through the pipe (13). The compressor is turned off when the required pressure is reached, the control valve (14a) is closed when the waste gas discharged due to excess pressure passes through the direct supply pipe (8) installed on the compressor, 14 is in the open position, and the control valve (14) is in the closed position, and in the (14a) position, it is sent to the separator when it passes through the pipe (7) passing through the pressure relief unit (5). In order to obtain pressure measurement results, i.e. to determine how much pressure drops from the hydraulic resistance of one cylinder cylinder, a Pegas Pneumatic 4801 brand manometer (9) is installed after the first cylinder cylinder in the pressure relief unit, without cylinder cylinders and from the hydraulic resistance of two cylinders. in order to determine pressure dynamics, we installed the second manometer (9a) in the separator. In order to obtain temperature measurement results after the compressor, that is, to determine the temperature of the gas itself, we installed the TPM-10 electronic thermometer (10) before the cylinder cylinders, and the second thermometer (10a) was installed in the separator after the volume expansion process. A non-return valve (11a), a non-return valve (11) on the pipe leading to the separator, and a non-return valve (11b) on the supply pipe leading to the accumulator block are installed. Taking into account the technical safety of our laboratory stand, a manual override valve (suppressor) is installed.

In the pressure relief unit, we pay attention to the connection scheme (up-down, down-up) of the pipe with cylinder cylinders (Fig. 2). In this case, the reason for the y connection is to reduce the pressure by increasing the hydraulic resistance of the exhaust gases coming at high pressure.

Pressure relief unit. We can call this constructive part the main mechanism of our scientific research work. When our compressor is stopped, the high-pressure air lowers its pressure through the block and goes to the separator with the specified pressure. The pressure relief unit consists of the following parts: two cylinder cylinders with a volume of 0.04 cm 3, a manometer, an anchor. (4 pictures)Our cylinder cylinders are made of steel, the wall thickness is 3 mm, the volume is 0.04 cm3, the test pressure is 15 kgs/cm2. (Figure 3.3)

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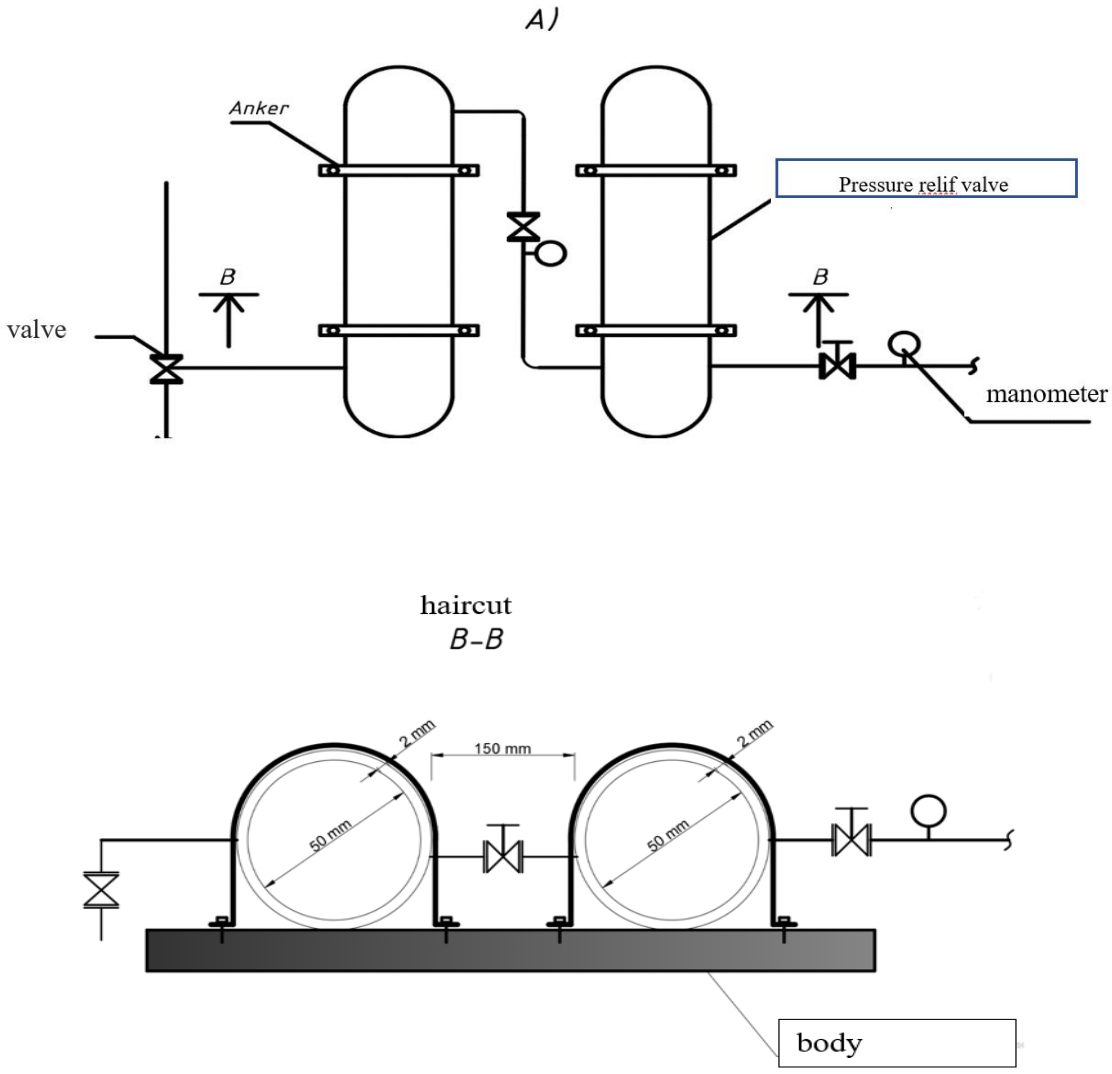

Picture 2. Scheme of the pressure relief unit.

Methods of conducting experimental tests on an experimental test stand can be carried out as follows:

- pressure quenching of exhaust gases when using cylinders without cylinders;

- when using one of the pressure relief cylinder cylinders in the device;

- When using two pressure relief cylinder cylinders in the III pilot device;

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Experimental method I. Control taps (14) are in open position (14a) in closed position when exhaust gas pressure relief cylinder is used without cylinders. The purpose of this laboratory experiment is to determine the pressure and temperature changes when high-pressure waste gases are sent directly to a separator without pressure relief cylinders. This will serve to show the effectiveness of the proposed project. From the existing gas pipeline (1), the gas comes to the separator (2) and passes through the filter (3) to the compressor (4) for compressing the gas, using the compressor to increase the pressure.

adjusted to the indicator. After the compressor is turned off, it is sent back to the separator (2) through the pipe (8).

if there is, the reversing valves will start automatically. In this experimental test method, P2 after the compressor, P3 pressure manometer in the separator (9a, 9) and T2 after the compressor, T3 temperature thermometer in the separator (10, 10a) are recorded,

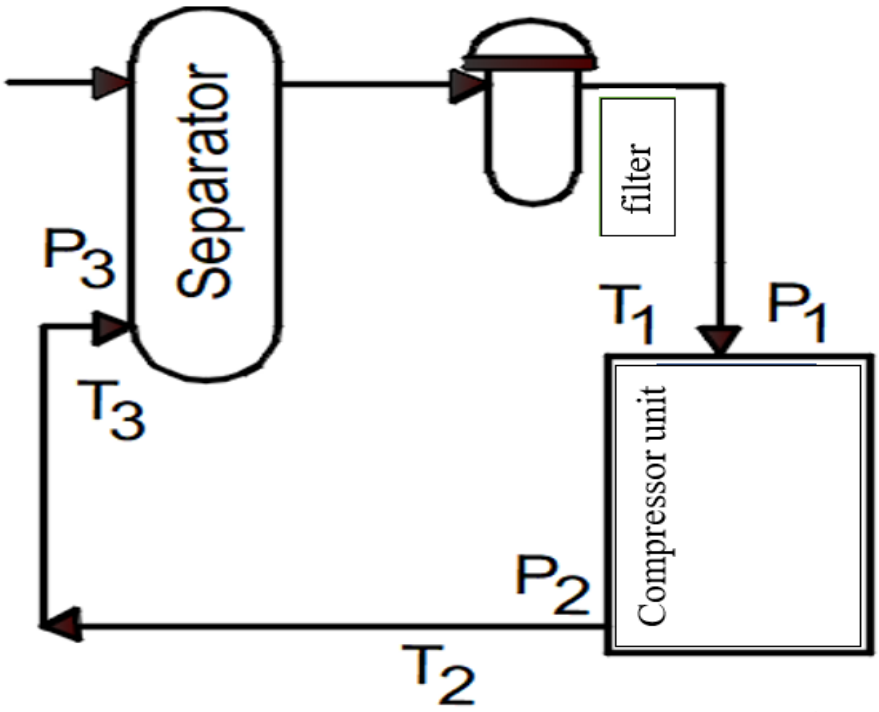

Figure 3. Scheme of the first experimental method

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As a result P 2= 8 kgs/cm2, P 3= 6 kgs/cm2, T2 head= 21 °C, T3= 20 °C. After recording the results, we will put the device back into working condition to start the experimental tests in the next method, that is, we will release the gas or air from the separator through the spark plug (12) located in the separator.

Experimental method II. Control taps (14a) are in the open position (14) in the closed position when the exhaust gas pressure relief cylinder is used without cylinders. The purpose of this laboratory experiment is to determine the pressure and temperature changes when using only one of our 0.4 cm3 pressure relief cylinder cylinders to send high-pressure waste gases to a separator. From the existing gas pipeline (1), the gas comes to the separator (2), passes through the filter (3) and is sent to the compressor (4) for gas compression. The high-pressure gas enters the pressure relief unit (5), enters only the first cylinder from the lower part of the cylinder, and exits from the upper part, and is sent to the separator through the pipe (7). P2 after the compressor, pressure relief cylinder P3 after one of the cylinders, P4 pressure manometers in the separator (monometer in the compressor device, 9. 9a,) sensor readings are recorded, T2 after the compressor, pressure relief cylinder P3 thermometers in the separator (10, 10a) sensor readings are recorded.

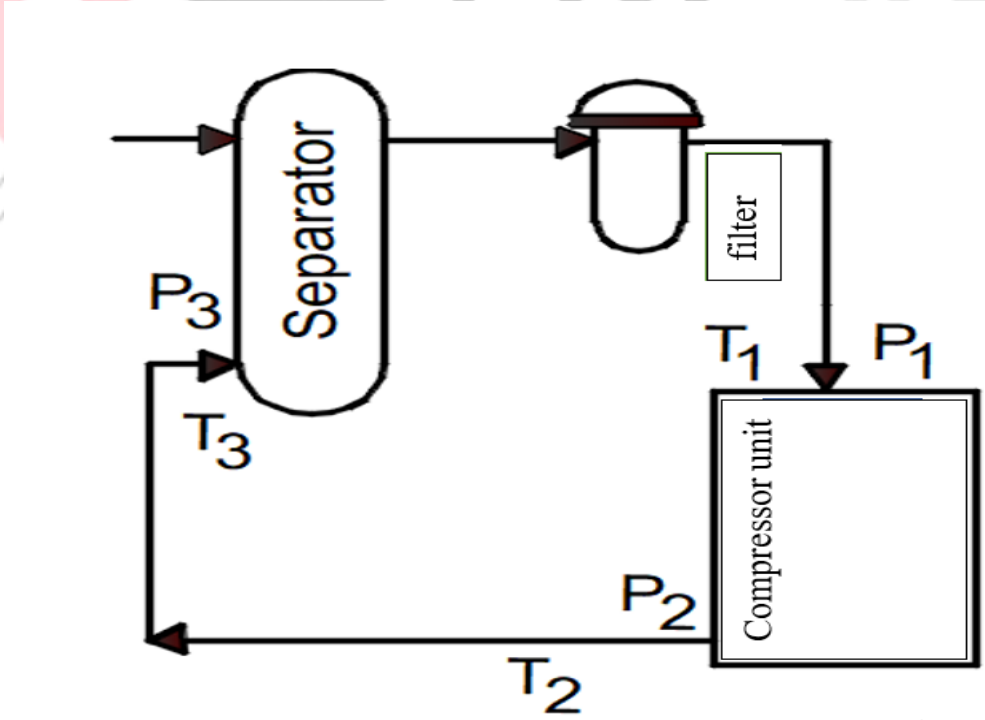

Figure 4. Scheme of the second experimental method

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As a result, P2 = 4 kgs/cm2, P3= 3.8 kgs/cm2, P4= 3.2 kgs/cm2 T2= 21 °C, T3= 19 °C.

Experimental method III. Control taps (14a) are in the open position (14) in the closed position when the exhaust gas pressure relief cylinder is used without cylinders. The purpose of this laboratory experiment is to determine the pressure and temperature changes when sending high-pressure waste gases to a separator using two of our 0.4 cm3 pressure relief cylinder cylinders. From the existing gas pipeline (1), the gas comes to the separator (2), passes through the filter (3) and is sent to the compressor (4) for gas compression. High-pressure gas enters the pressure relief unit (5), enters from the lower part of the first cylinder cylinder, from the upper part and after the manometer (9) enters from the lower part of the second cylinder and exits from the upper part, it is sent to the separator through the pipe (7). P2 after the compressor, P3 after the pressure relief unit (two cylinder cylinders), P4 pressure gauges (9, 9a) in the separator are recorded, T2 after the compressor, T3 thermometers in the pressure relief cylinder separator (10, 10a) sensor readings are recorded.

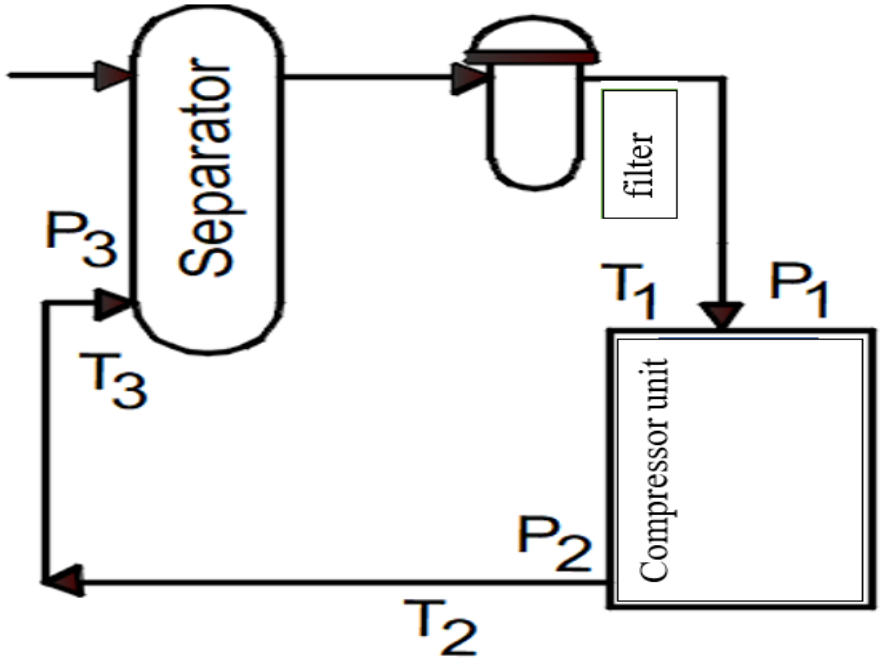

Figure 5. Scheme of the third experimental method

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As a result, P2 = 8 kgs/cm2, P3 = 4 kgs/cm2, P4= 2.3 kgs/cm2, T2= 21 °C, T3= 18 °C.

During experimental studies, air parameters were measured with Testo 405i brand thermoanemometers and TPM-10 brand electronic thermometer. It was measured with a Pegas Pneumatic 4801 manometer (accuracy level 1.0). Pressure difference in each element of the experimental research stand. Water consumption in the device (water meter brand) was measured using the brand's water consumption meter.

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