



## DETERMINING THE ARCHITECTURE OF INTAKE AND EXHAUST COLLECTORS FOR A FOUR-STROKE ENGINE WITH ROTATING JACKET DISTRIBUTION

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**Abstract:** Constructive, the manifold is formed from a labyrinth of pipes with various diameters that are molded or joined together so that the contours of the inside volume are smooth and well processed to produce no pressure differences between different internal volumes. The exhaust manifold, component of the exhaust system, can influence the thermal efficiency of the engine through its shape and inner construction. During the functioning of the engine, the exhaust manifold has a high temperature due to heat flux lost through the burned gases. For an engine with slide-valves distribution and rotating jacket, the intake and exhaust manifolds geometry can significantly influence the gas exchange.

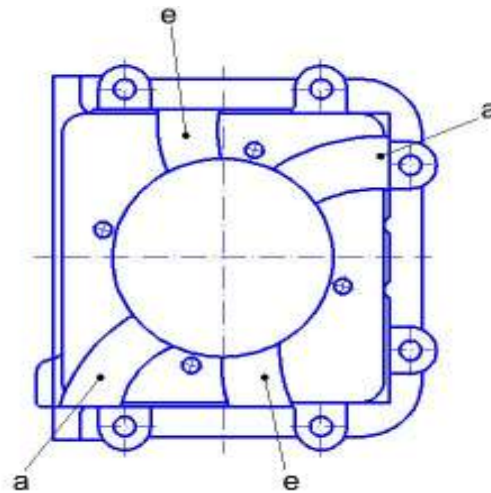
**Keywords:** engine, intake, exhaust, manifold;

### 1. INTRODUCTION

The principle of rotating jacket distribution requires that the intake of gases to be carried out through two windows in jacket, respectively, two channels in the cylinder. Consequently, the intake manifold was designed to satisfy this condition also. The exhaust is done similarly; the windows are disposed in both cases at the top of the cylinder. During an engine cycle, the two pairs of windows for intake/exhaust will be opened/closed by the two windows from the distribution rotating jacket. The architecture of the exhaust manifold will become as simple as possible so that the gas meets low gas kinetic resistances and therefore the exhaust of gases will be as effective as possible.

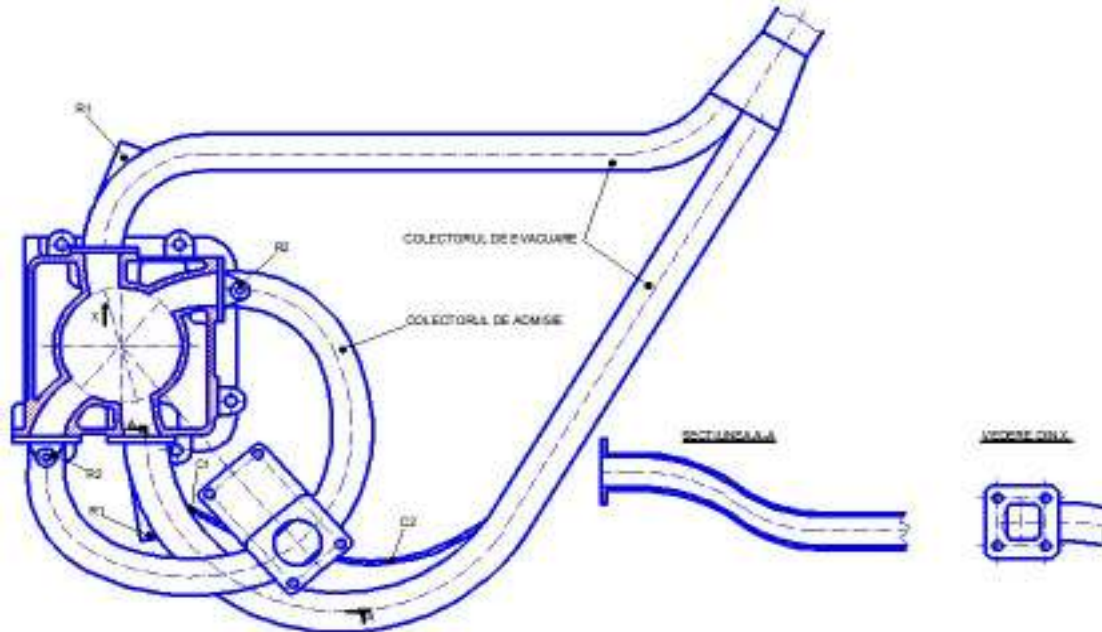
### 2. CONTENT

The cylinder of such an engine present at the top, inlet channels „a” and exhaust channels „e” (Figure 1), and on its side flanges are made to fix the collectors. Having a single cylinder engine, the inlet channels were oriented to supply from a single carburetor through a distributor with two branches. In the horizontal plane, the inlet channels have tangentially placed gates to each other, so that when the fresh load enters in the cylinder, the disturbance created by the load of mutual fresh currents is avoided. In the vertical plane the intake channels are oriented towards the bottom of the cylinder to reduce gas kinetic resistances in the process of filling. The channels have rectangular cross-sections, with rounded corners, the transition being continuous from the outside to inside. The exhaust channels also have a rectangular cross-section, are very short and are directed to collect the gas in a common collector.



**Figure 1:** The intake/exhaust channels

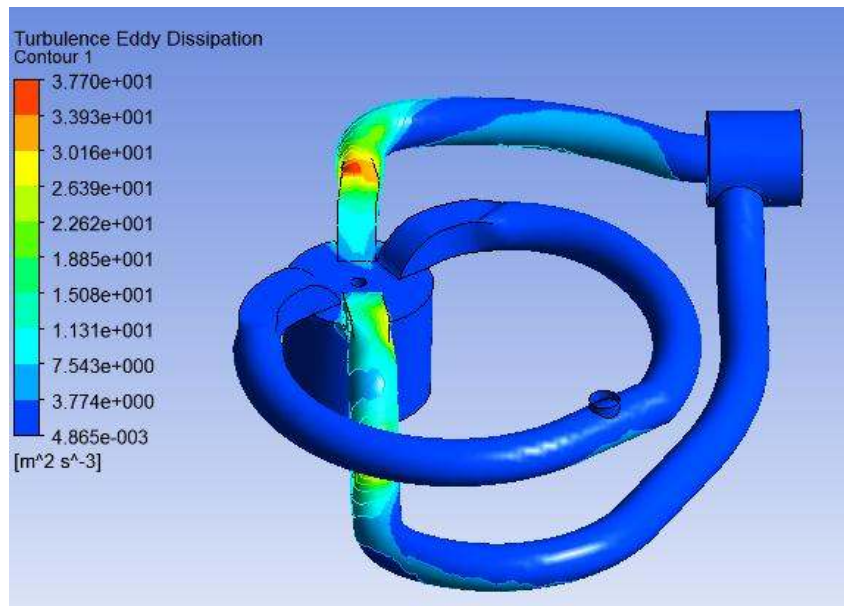
The intake manifold has two branches and is made of round section pipe line with connections to minimize gas kinetic resistances, with a similar configuration with the Wankel engine from Mazda. At the ends of the two branches have been executed some flattening to achieve smooth transition from the round section to the rectangular section of the two channels from the cylinder. In order to achieve the heating of the mixture near the carburetor, where there is a sudden deflection of the fresh load current, a K cavity was provided, where a quantity of exhaust gas is passed through pipelines C1, and C2. To avoid the leaking of a gas film toward the cylinder, which may form during cold start, the collector is slightly deformed in the lower part from the plane of the cylinder channels.



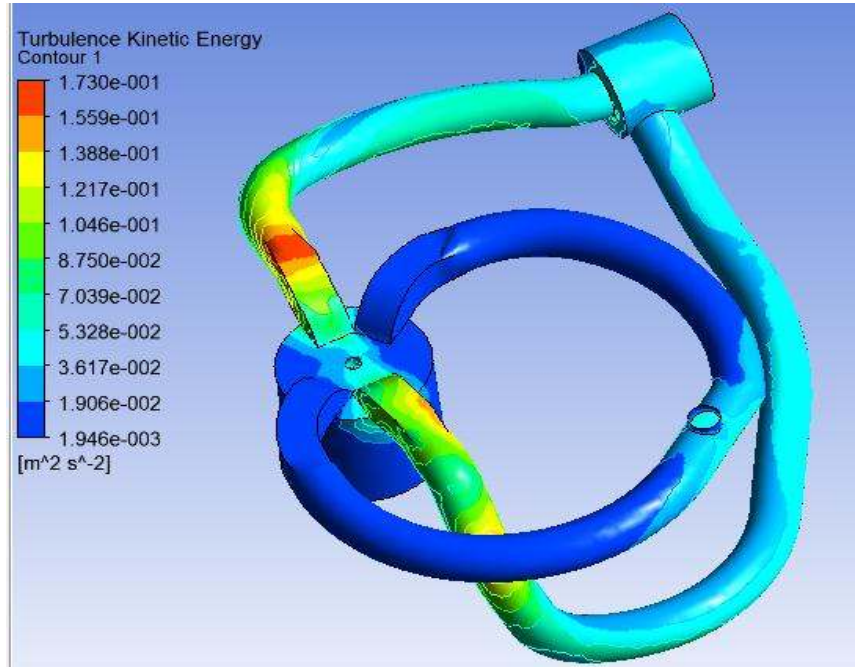
**Figure 2:** The position of intake/exhaust collectors

In order to research the phenomena of gas kinematic from the intake manifold, two R2 connections were provided in the nearest area from the cylinder, where the piezoelectric transducers will be mounted to measure the depression variations in that cross-section area. The architecture of the exhaust manifold was chosen as simply as possible to obtain low gas kinematics when exhausting the gases out of the cylinder. The two branches of the collector are connected to the exhaust channels in the cylinder so that the transition from one section to another to be as smooth and as small as possible and also with small variations of the section. On the direction of the Channels to the cylinder were welded R1 joints (Figure 2), where will be installed temperature measuring thermocouples for the exhaust gases.

The arrangement mode and the architecture of the collectors can be verified by analysis in virtual environment using specialized software. Having the thermal calculation of the engine, previously made, simulations can provide important data in the virtual environment on the behavior of the collectors during engine operation.



**Figure 3:** Eddy Dissipation Turbulence



**Figure 4:** Kinetic Energy Turbulence

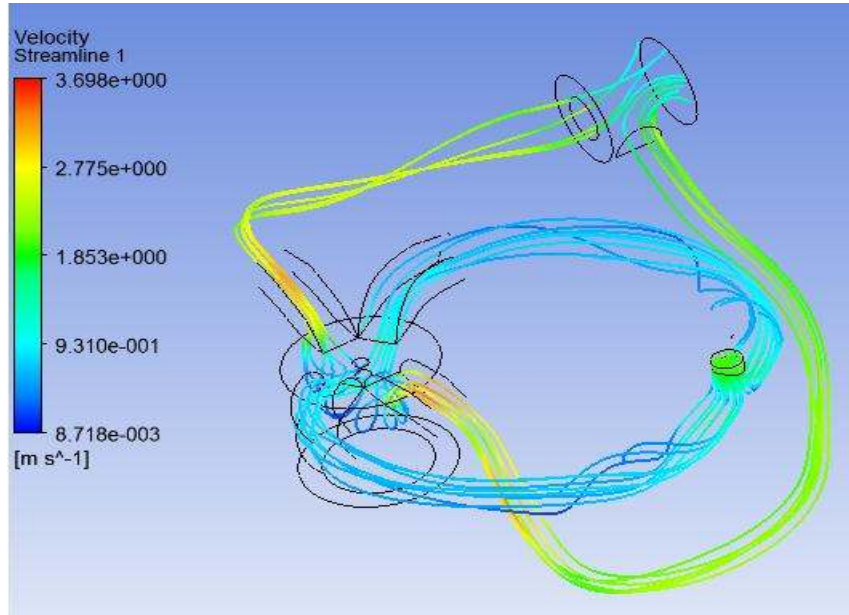


Figure 5: Velocity Streamlines

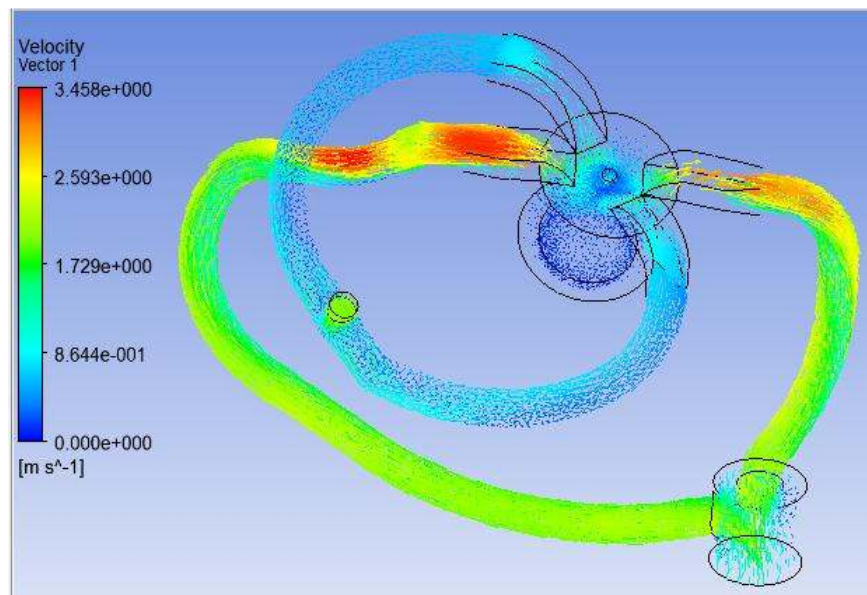


Figure 6: Velocity Vector

### 3. CONCLUSION

Given the conditions imposed by an engine with rotating jacket distribution, the intake and the exhaust manifolds were designed to facilitate the gas exchange. The intake manifold was designed to meet the conditions imposed by the two windows for the admission of the fresh charge in the cylinder. The exhaust manifold geometry was chosen as simple as possible so that the gas kinetics resistance to be very low at the exhaust from the cylinder. Consequently, the intake and the exhaust processes of the gases from the cylinder will be made with ease.

#### ACKNOWLEDGEMENT

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