Sborník vědeckých prací Vysoké školy báňské – Technické univerzity Ostrava
číslo 1, rok 2008, ročník LI, řada hutnická
článek č. 1380

RESEARCH CONCERNING ON MECHANICAL PROPERTIES OF CYLINDER-HEAD GASKET MATERIALS

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ABSTRACT: The authors performed several experimental tests regarding on establishing the mechanical properties of two type of materials used for cylinder-head gasket in Romanian truck industry. These properties were used for Finite Element modelling of the stress-strain state evaluation of the cylinder-head gaskets. Were taken into consideration different modalities of the tightening for the cylinder-head fixing screws to obtain a better reliability of the engines.

KEY WORDS: mechanical properties, cylinder-head gasket material, Finite Element modelling

1. INTRODUCTION

Cylinder-head gasket represents the combustion chamber closing elastic element. Its elastic properties do strongly influence both engine reliability and pollution intensity.

Cylinder-head gasket qualities made of a certain material depends on some factors decisively:

- engine thermal regime;
- gasket strain-tension state both after assemblage and during engine function;
- combustion process character and cylinder pressure law variation $p(\alpha)$;
- cylinder shirt type;
- uniformity of cylinder-head gasket elements heighten.

The authors have investigated two types of cylinder-head gaskets made of MARSIT and DIROLASTIC respectively, which are used for six in-line Romanian trucks. These engines have had two half-cylinder-heads and a single gasket and the cylinders were "SLIP-FIT" type. In figure 1 the half-gasket has been presented, a,b,...,q representing its characteristic elements (flanged holes) and 1,....14 cylinder-head dowel pins (the number corresponds to the clamping order number).

For numerical calculus the following hypothesis have been considered:

- the gasket is composed of a series of parallel connected elastic elements which present different initial heighten;
- all the cylinder-head dowel pins are uniformly and simultaneously clamped, so that the cylinder-head to get to the cylinder block by a plane-parallel movement and gasket component elements to take over the total pre-stressing one by one.

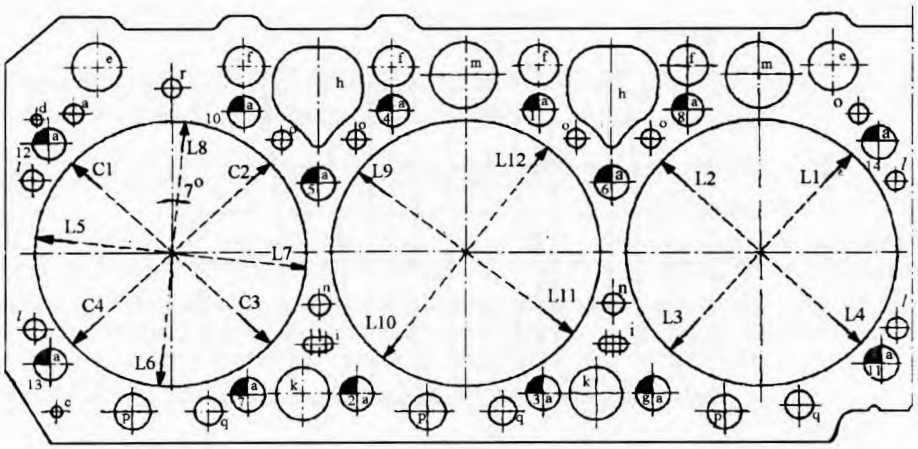

Fig. 1: Cylinder-head gasket for half engine

In respect to obtain some adequate values for numerical calculus and for Finite Element modelling, were necessary to perform several experimental investigation acceptable from statistical point of view.

2. EXPERIMENTAL SET-UP AND RESULTS

The authors conceived and realized some simply testing devices (fig.2) for obtain the adequate results. Starting from the above mentioned characteristic elements of cylinder-head gasket, were necessary to evaluate for 3 types of elements the mechanical properties: for cylinder-head gasket pure material (fig.2,a), for unfledged holes (fig.2,b) and for the metal (copper) flanged holes (fig.2,c).

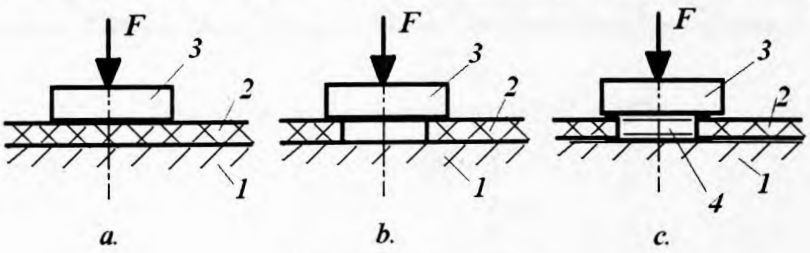

Fig. 2: Testing devices

In this figure, *1* represents the rigid metal support, *2*-the tested characteristic element, *3*- the pressure disc, *4* – the copper-flanged hole.

Using this simply testing devices, where established (of course, based on statistical evaluation of the measured data) both the force-displacement curves and stress-strain ones for all of these characteristic elements.

To eliminate the influence of the pressure discs finite stiffness were performed similar measurements for all of pressure discs (fig.3)

These stiffness values were extracted from the measured values for the characteristic elements and finally were obtained the mentioned curves. In fig.4 and fig. 5 are presented for MARSIT these characteristic curves.

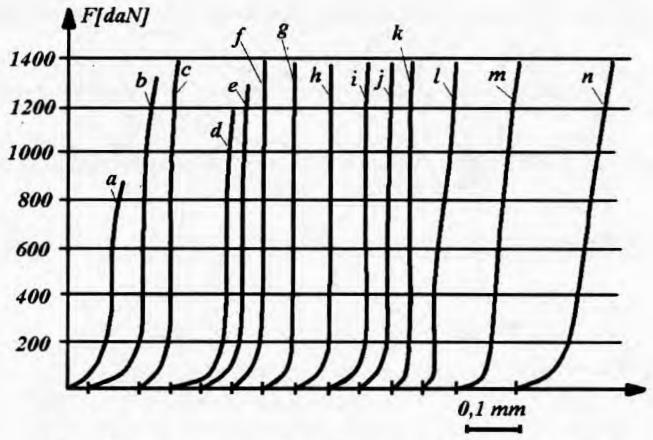

Fig. 3: *The pressure discs force-displacement curves*

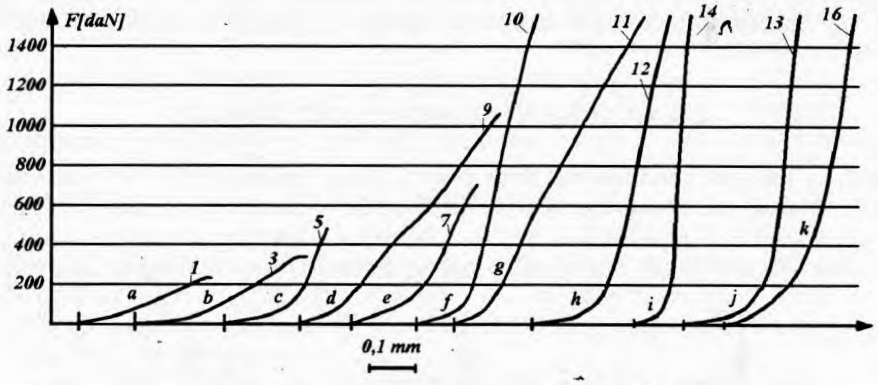

Fig. 4: Force-displacement curves for MARSIT

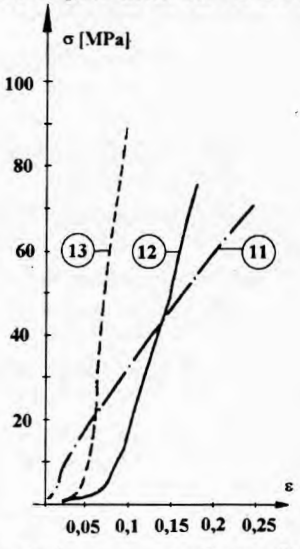

Fig. 5: Stress-strain curves specimens for MARSIT

3. CONCLUSIONS

The briefly presented method was used for optimisation of the tightening of the fixing screws for the above mentioned 6 in-line Romanian truck engine.

4. REFERENCES

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