

REPORT QM/01/2004

Subject : Measurement and analysis of ½ cylinder liner 2C46-6055-AAA produced at MAHLE Krotoszyn S.A. which was after 27 000km and assesment of too high consumption of oil -2l/1000 km –visit of MAHLE in FORD Otosan Turkey on 19-21.01.2004

1 Scope of the measurements

- 1.1 Picture (photography) documentation of the ½ section the cylinder liner – attachment1
- 1.2 Set up of the cylinder liner location in the engine and determination of the measurement check points for surface roughness evaluation and honing picture– attachment 2
- 1.3 Measurement of roughness parameters acc. to technical specification of cylinder liner S2C46-6015-AAA and additionally measurement of Ra,Vo parameters in:
 - piston ring area
 - out of the piston ring areaAppliance Talysurf Series 2 – attachment 3
- 1.4 Scaning microscope analysis of the honing surface in :
 - piston ring area
 - out of the piston ring areaScaning microscope Leo 1430 – attachment 4
- 1.5 List of the received measurement results in compliance with specification requirements S2C46-6015-AAA – attachment 5

2. ANALYSIS OF RECEIVED RESULTS

- 2.1 The provided measurements and comparable analysis show that the evaluated section of ½ cylinder liner is characterized by the honing surface made acc.to valid and required technical specification for cylinder liners S2C46-6015-AAA
- 2.2 Values of each individual roughness parameters on the level 195 mm

(out of the piston ring area) :

Rz = 6,96	acc. specification required	Rz	3,0 – 7,0
Rpk = 0,29		Rpk	< 0,3
Rk = 2,16		Rk	0,8 – 1,7
Rvk = 3,14		Rvk	1,5 – 3,5
Mr1 = 3,1 %		Mr1	< 7 %
Mr2 = 70,76 %		Mr2	70 – 90 %

Except the Rk parameter all remain are within tolerance range which are determined by the specification,

2.3 Parameter Rk = 2.16 μm is outer upper tolerance - 0,46 μm
The upper tolerance limit Rk = 1.7

2.3 The diagrams of each roughness profile as well as the picture taken from scanning microscope very clearly identify the correctly formed geometrical structure – plateau type with required picture of graphite exits

2.4 Additional measurements of roughness parameters Ra and Vo which are not specified in the specification specify as follows:

- mean value Ra = 1,16 μm , this acc. to current demands of FO (Ra = 0,4 – 0,7) is evaluate as too high value
- mean value Vo = 0,01 mm /cm is too low value if we take into consideration its influence of oil consumption caused by roughness parameters .

3 Sum up and conclusion

3.1 The evaluated section $\frac{1}{2}$ of the cylinder liner is characterized by the honing surface performed acc. to required specification S2C46-6015-AAA

3.2 Non compliance of one Rk parameter by 6 required and where the 5 parameter of are in conformity provides to the conclusion that there is no direct influence of circumstances and values of high oil consumption in the engine

3.3 The roughness parameters of the surface the cylinder liner are one of these elements which have influence on oil consumption in the engine but they are not the dominant parameters which have directly influence of oil

consumption. They are secondary significance parameters

- 3.4 Therefore the cause analysis of the high oil consumption in the engine should be expanded of elements/ components which are working together with cylinder liner eg. piston rings or the form of the cylinder liner by assembling and during engine run should be analyzed as well

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