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VERT Filter Test, Phase 3 with the Diesel Particle Filter DCL MINE-X Particle Filter SOOTFILTER® on the Liebherr D 934 S Engine

according to the VERT *) measuring procedure (VFT 3)

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1. SUMMARY

This report summarizes the investigations with the Diesel Particle Filter DCL MINE-X on a Liebherr construction engine according to the VERT*) Filter Test Phase 3 after 2004 hours of field operation.

The investigations comprise all measurements and evaluations, which were performed on construction site engines within the scope of the VERT*) project. The size distributions of the particulates were systematically measured besides the usual engine operating parameters, volatile pollution emissions and particulate mass emissions.

The analysis was performed at four operating points of the engine and during the attempt of charging and regeneration of the DPF.

The results can be summarized as follows:

- with the investigated DPF there is a very efficient filtration of nanoparticulates (up to 99.7 %)
- the used DPF eliminates very well the opacimetric acceleration smoke
- the passive regeneration of the DPF with precatalyst and catalytic filter coating worked very well
- due to the catalytic activity there is efficient reduction , or elimination of CO & HC, and an increase of Δ NO_2 / NO_x ratio up to 58%.

From the point of view of product quality and filtration efficiency the investigated DPF DCL MINE-X fulfils the criteria of the VERT filter test phase 1, 2 and 3.

2. INTRODUCTION

The occupational health authorities of Switzerland, Austria and Germany: SUVA, AUVA and TBG together with the Swiss clean air authority BAFU have performed the VERT project 1994-1999 to satisfy the increasingly stringent demands on air quality in underground workplaces and offroad [1].

Targets of VERT

- Evaluate aftertreatment systems for existing engines to reduce particulate emissions to < 5 % of engine-out emissions levels - with respect to total EC+OC-mass and particle number count in the size range 10-500 nm
- Define certification procedures for such aftertreatment systems
- Establish rules for monitoring field emissions of offroad engines
- Define application guidelines in consensus with engine manufacturers and operators.

VERT was concluded 3/2000 [2] with application tools such as trap-system-specification, certification procedures and field monitoring standards and a list of VERT-approved trap-systems published in the SUVA/BAFU-Filter-List [3], yearly updated. Only traps systems which have successfully passed the VERT-Filter-Test VFT will be listed in this document and they will only remain in this list if they continue to prove their quality in the field.

The particulate trap system has proved to be the only available effective measure to curtail particulate emissions. Regeneration of such traps requires appropriate technical means such as burners, heaters, catalytic coatings or fuel additives. All such means must be certified together with the trap system and quality-monitored in the field. Continuous electronic OBD is a further requirement to control such systems, which need to perform automatically and safe for the engines and the environment.

Research on trap systems has revealed that traps can become highly active chemical reactors because of their extremely high specific surface. They can adsorb any substances offered by the exhaust gas, extent their residence time under high temperature conditions and thereby create products which did not exist in the exhaust before or in much lower concentrations. This chemical activity can

*) VERT… Verminderung der Emissionen von Realmaschinen im Tunnelbau
Verification Emission Reduction Traps