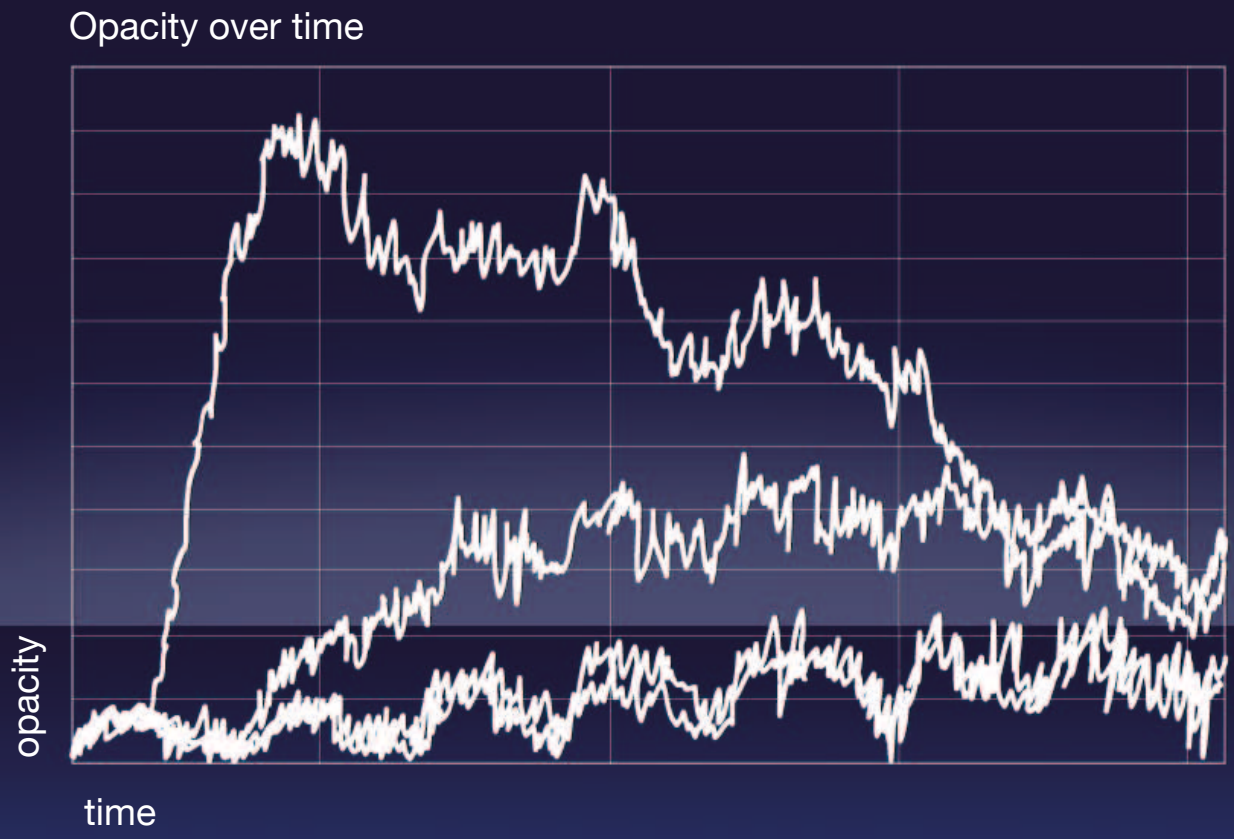
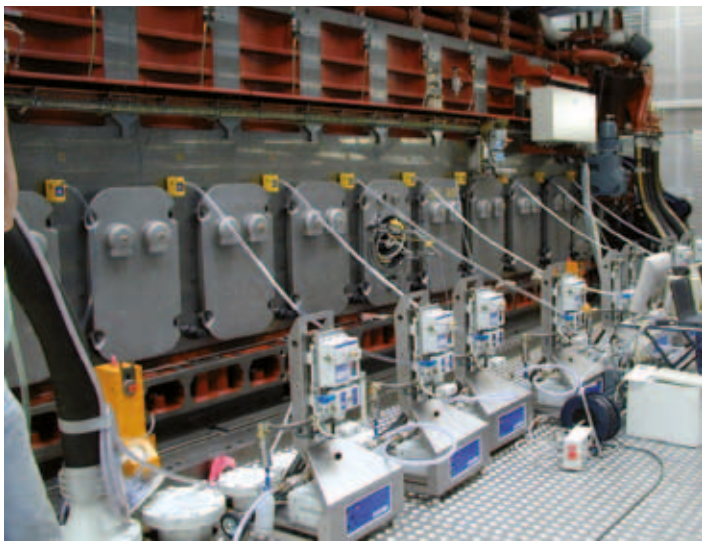
OMDEA®
Oil Mist Detection Efficiency Approval



Maximum false alarm immunity
Minimum response time



SYSTEM FEATURES:

The idea of OMDEA is to find out the highest possible OMD sensitivity and so the shortest response time at maximum false Alarm immunity adapted to a specific engine type.

With release of The Unified Requirements (UR) M10 ('Protection of internal combustion engines against crankcase explosions') and M67 ('Type Testing Procedure for Crankcase Oil Mist Detection and Alarm Equipment') in 2006, IACS first-time requested similar tests via classification societies for new engine types resp. vessel new buildings.

SCHALLER AUTOMATION
SINCE 1956

OMDEA
WHAT IS IT ABOUT

FUNCTION DESCRIPTION

Oil Mist Detection today is accepted as an engine protection system of highest importance. In 1998, a first approach has been started by SCHALLER AUTOMATION to define a test procedure to determine the efficiency of Oil Mist Detection (OMD) Systems on large combustion engines.

Following a long procedure of investigations, SCHALLER AUTOMATION started in 2002 to execute specific measurements on different engine types -in cooperation with the engine makers- in order to integrate its VISATRON Oil Mist detection Systems in a best possible manner into the different types of Diesel, Gas and Dual Fuel engines.

This test procedure is called OMDEA Oil Mist Detection Efficiency Approval.

The idea of OMDEA is to find out the highest possible OMD sensitivity and so the shortest response time at maximum false Alarm immunity.

With release of The Unified Requirements (UR) M10 ('Protection of internal combustion engines against crankcase explosions') and M67 ('Type Testing Procedure for Crankcase Oil Mist Detection and Alarm Equipment') in 2006, IACS first-time requested similar tests via classification societies for new engine types resp. vessel new buildings.

Affected by UR M10 are new developed resp. redesigned engine types.
Moreover, OMDEA tests are also suitable for the improvement of existing OMD installations.

For a best possible integration of the OMD-Systems into new engine types, the following 3 OMDEA steps should be carried out in cooperation with the engine maker:

Step 1 Determination of best possible oil mist sampling point per engine compartment
considering the different engine running conditions
This step is mandatory for a good OMD system functionality

Step 2 Determination of the oil mist distribution and behaviour within engine crankcase
considering the different engine running conditions.
Some influencing criteria are e.g. the wash out effect of splashing luboil, execution of crankcase ventilation or blow-by-effects of piston ring/cylinder liner-combinations.

Step 3 Design and adaptation of an appropriate OMD System
based on results of Step 1 and 2 and particularities of the relevant engine type. Results of Step 1 and 2 give e.g. an appropriate OMD sensitivity setting and hints for the mechanical design of the tubing system

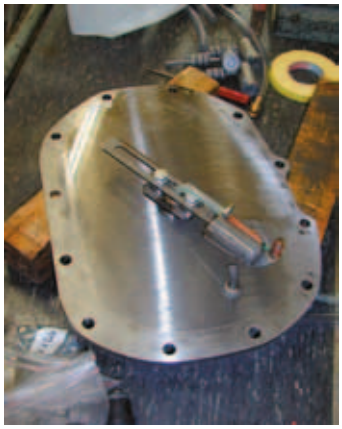
The examples on following pages shall give you an idea about procedure and result of a typical OMDEA measurement project.

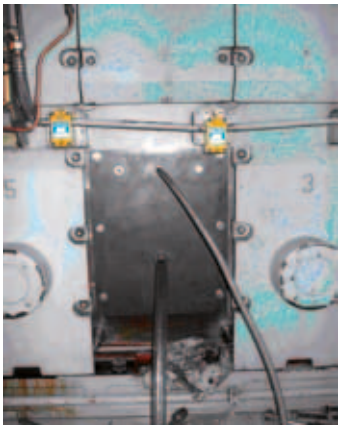
THE PROCEDURE

STEP 1: HOW TO DETERMINE THE BEST POSSIBLE OIL MIST SAMPLING POINT PER ENGINE

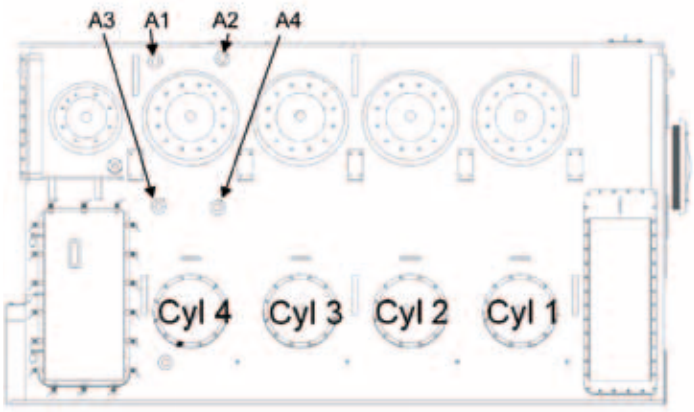
Together with the engine manufacturer, some reasonable positions for sample points for oil mist extraction should be choosen and, if necessary, holes have to be drilled to install the sampling equipment.

In some applications a special mechanical device is needed to be installed on the compartment to allow the sample point to be adjusted from outside the engine while engine is running.

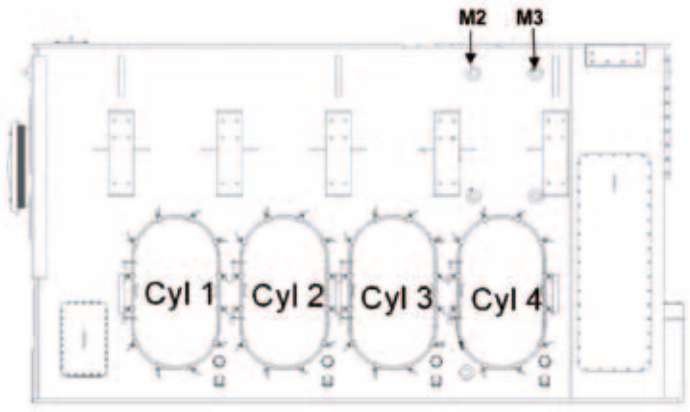




CHOICE OF POSSIBLE SAMPLING POINTS



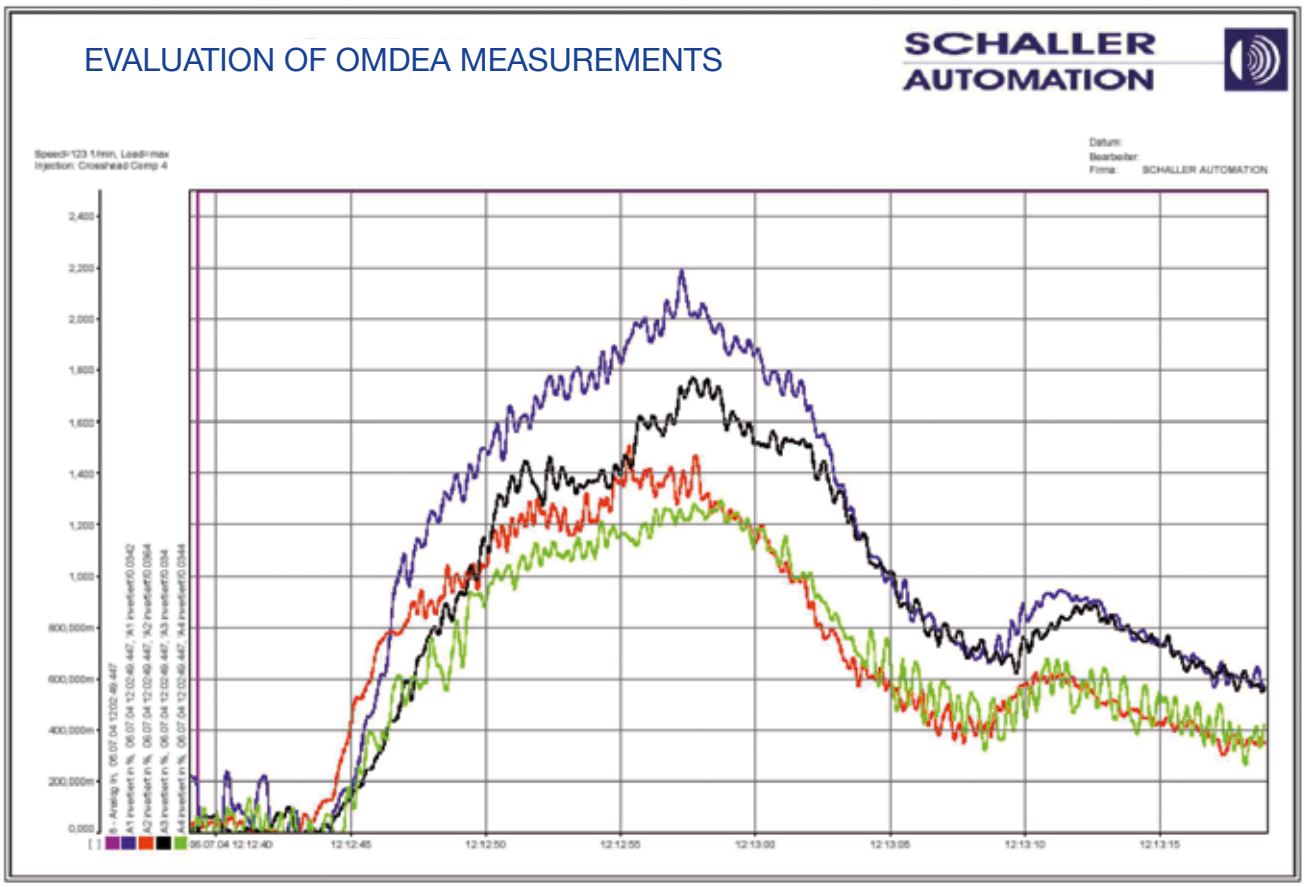
Engine wall of a 2-stroke engine, Exhaust side



Engine wall of a 2-stroke engine, Manoeuvre side

Each chosen sampling point is connected with hoses of the same length to its own dedicated OMDEA-measuring unit.
The detected oil mist concentrations of all detectors will be recorded in parallel or repeated after change the sample point position.
For the tests in compartment No. 4, shown as a sample in above engine crankcase, a certain quantity of oil will be evaporated during a certain time, utilizing a special OMDEA -oil mist generator.
The oil mist is lead into the engine crankcase/chain drive under utilization of pressurized inert gas, also for safety reason.

OMDEA MEASUREMENT TO DETERMINE BEST SAMPLING POINT, SAMPLE OF RESULT AT MAX. ENGINE LOAD

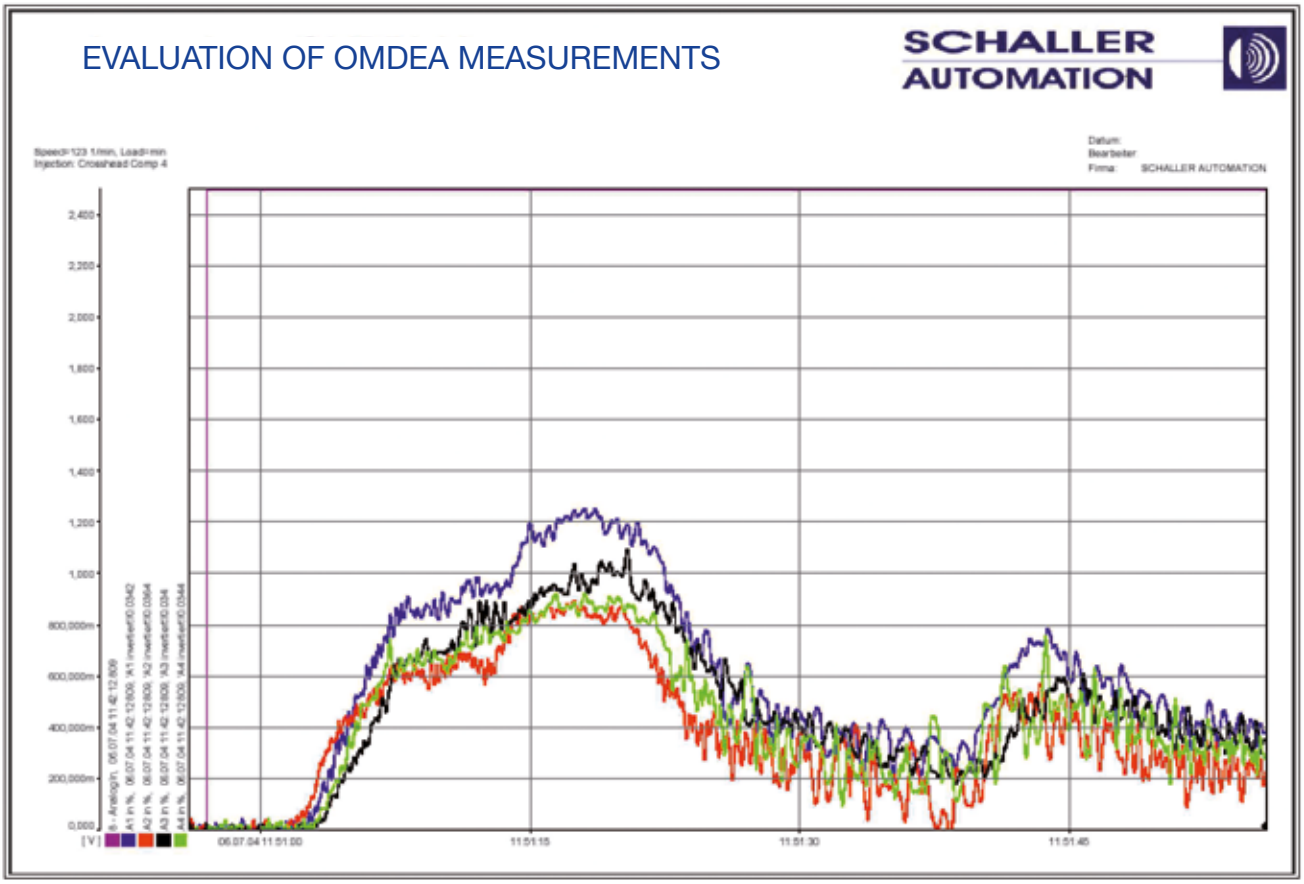


The tests are getting conducted under different realistic engine load and speed conditions, in agreement with engine manufacturer:

DEFINITION OF TEST PROCEDURE TO DETERMINE BEST POSSIBLE OIL MIST SAMPLING POINT:

	INJECTION POINT		SUCTION POINTS	ENGINE CONDITIONS	
TEST-NO.	COMP.	BEARING		SPEED	LOAD
12	4	Crosshead	Comp.4: M2,M3,A1-4	60 RPM	Min.
13	4	Main bearing	Comp.4: M2,M3,A1-4	60 RPM	Min.
14	Aft	Chain drive	Comp.4: M2,M3,A1-4	60 RPM	Min.
15	4	Crosshead	Comp.4: M2,M3,A1-4	125 RPM	Min.
16	4	Crosshead	Comp.4: M2,M3,A1-4	125 RPM	Max.
17	4	Main bearing	Comp.4: M2,M3,A1-4	125 RPM	Max.
18	Aft	Chain drive	Comp.4: M2,M3,A1-4	125 RPM	Max.
19	4	Main bearing	Comp.4: M2,M3,A1-4	125 RPM	Min.
20	Aft	Chain drive	Comp.4: M2,M3,A1-4	125 RPM	Min.

OMDEA MEASUREMENT TO DETERMINE BEST SAMPLING POINT, SAMPLE OF RESULT AT MIN. ENGINE LOAD



RESULT

BEST POSITION FOR OIL MIST SUCTION:

Sensitivity of each suction point A1 – M3 is assessed. Suction point with highest sensitivity is evaluated with 1 point, next lower one with 2 points and so on. Suction point with lowest sum is the best one:

	INJECTION POINT		ENGINE CONDITIONS		SUCTION POINTS ASSESSMENT					
TEST-NO.	COMP.	BEARING	SPEED	LOAD	A1	A2	A3	A4	M2	M3
13	4	Main bearing	60 RPM	Min.	2	4	2	4	3	1
14	Aft	Chain drive	60 RPM	Min.	1	3	1	2	2	1
15	4	Crosshead	125 RPM	Min.	1	3	2	3	4	3
16	4	Crosshead	125 RPM	Max.	1	3	2	3	4	5
17	4	Main bearing	125 RPM	Max.	1	3	1	3	2	1
18	Aft	Chain drive	125 RPM	Max.	1	4	2	2	3	1
19	4	Main bearing	125 RPM	Min.	1	4	1	3	2	1
20	Aft	Chain drive	125 RPM	Min.	1	3	1	2	2	1
				SUM	**9**	**27**	**12**	**22**	**22**	**14**

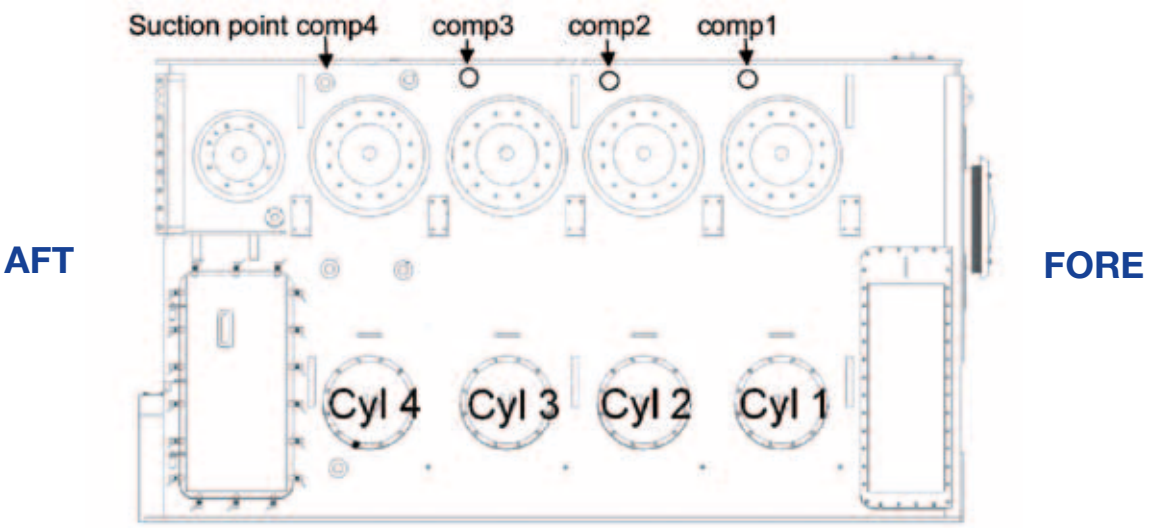
Result: Most sensitive sampling point on engine's exhaust side is sampling point A1,
Result: Most sensitive sampling point on engine's manoeuvre side is sampling point M3

STEP 2: DETERMINATION OF OIL MIST DISTRIBUTION AND BEHAVIOUR WITHIN ENGINE CRANKCASE CONSIDERING THE DIFFERENT ENGINE RUNNING CONDITIONS

POSITION OF SUCTION POINTS

To investigate the oil mist distribution within engine crankcase, the best sampling point per compartment is chosen as the result of Step 1 investigation.

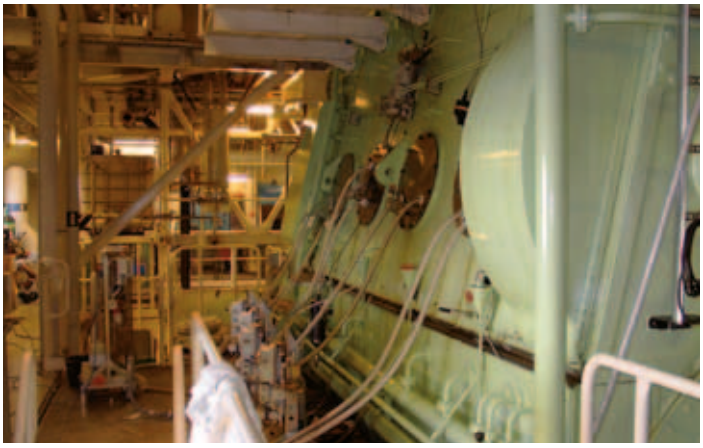
Engine Exhaust side:



TEST PROCEDURE

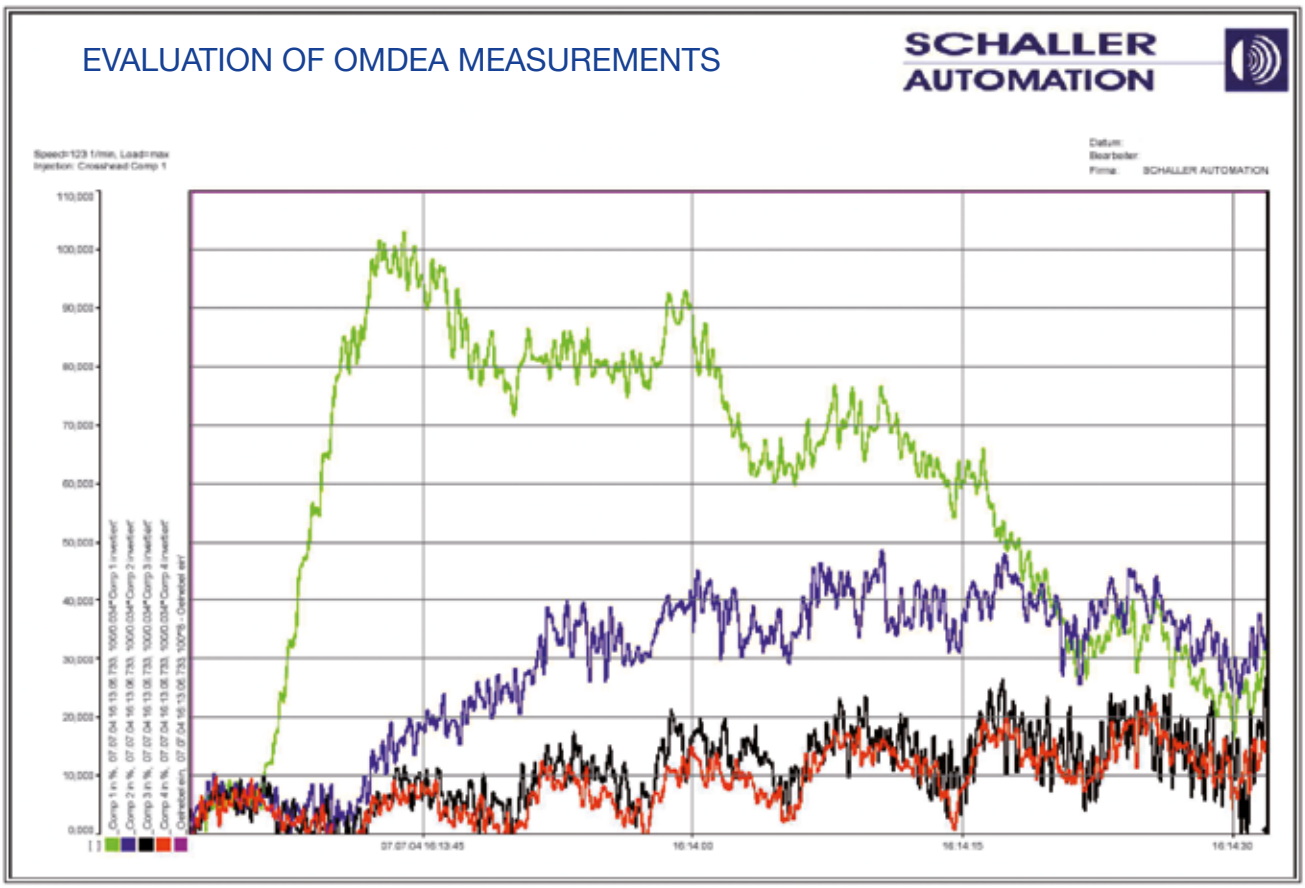
Every sampling point is getting connected with hoses of same length to its own dedicated OMDEA-measuring unit. The detected oil mist concentrations of all detectors will be recorded.
For all tests, a specially designed OMDEA Oil Mist Generator is used to generate a certain amount of real oil mist for test purposes. The oil mist is lead into the engine crankcase/chain drive under utilization of pressurized inert gas, also for safety reason.
The tests are getting conducted under different realistic engine load and speed conditions, in agreement with engine manufacturer:

Test equipment on 4-stroke engine



Test equipment on 2-stroke engine

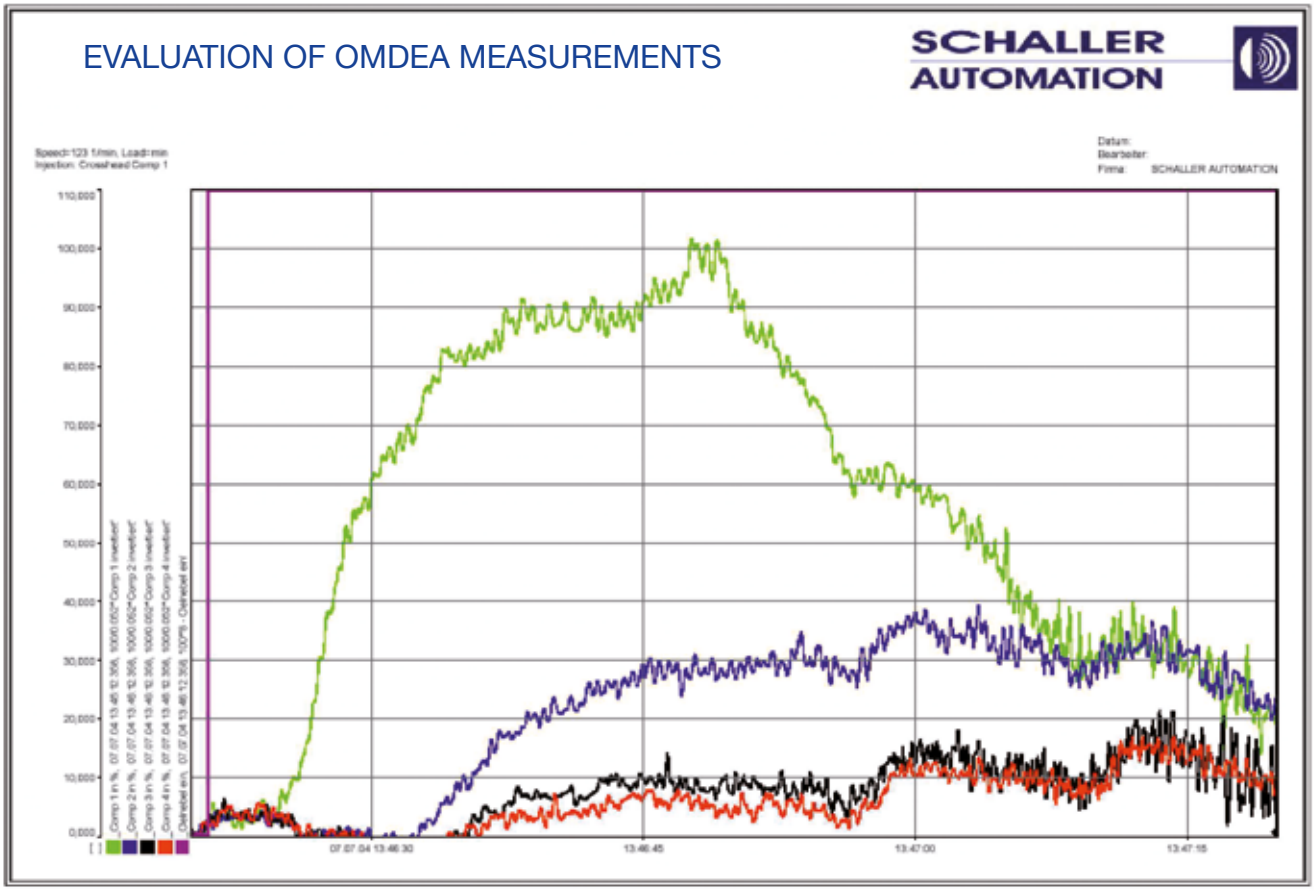
OMDEA MEASUREMENT TO INVESTIGATE OIL MIST DISTRIBUTION, SAMPLE OF RESULT AT MAX. ENGINE LOAD



DEFINITION OF TEST PROCEDURE TO INVESTIGATE THE OIL MIST DISTRIBUTION INSIDE ENGINE CRANKCASE:

	INJECTION POINT		SUCTION POINTS	ENGINE CONDITIONS	
TEST-NO.	COMP.	BEARING		SPEED	LOAD
23	3	Crosshead	M2,M3, Comp.1-4	60 RPM	Min.
24	3	Main bearing	M2,M3, Comp.1-4	60 RPM	Min.
25	2	Crosshead	M2,M3, Comp.1-4	60 RPM	Min.
26	2	Main bearing	M2,M3, Comp.1-4	60 RPM	Min.
27	1	Crosshead	M2,M3, Comp.1-4	60 RPM	Max.
28	1	Main bearing	M2,M3, Comp.1-4	60 RPM	Max.
29	4	Crosshead	M2,M3, Comp.1-4	60 RPM	Max.
30	4	Main bearing	M2,M3, Comp.1-4	60 RPM	Min.
⋮	⋮	⋮	⋮	⋮	⋮

OMDEA MEASUREMENT TO INVESTIGATE OIL MIST DISTRIBUTION, SAMPLE OF RESULT AT MIN. ENGINE LOAD



OIL MIST DISTRIBUTION INSIDE THE CRANKCASE

Example shown on simulated damage in compartment 1

	INJECTION POINT		ENGINE CONDITIONS		RELATION OF SUCTION POINT			
TEST-NO.	COMP.	BEARING	SPEED	LOAD	COMP	COMP	COMP	COMP
27	1	Crosshead	60 RPM	Min.	100%	35%	15%	8%
28	1	Main bearing	60 RPM	Min.	100%	85%	32%	15%
39	1	Crosshead	123 RPM	Min.	100%	35%	15%	15%
40	1	Main bearing	123 RPM	Min.	100%	80%	45%	38%
49	1	Crosshead	123 RPM	Max.	100%	40%	20%	20%
50	1	Main bearing	123 RPM	Max.	100%	80%	30%	30%

INTERPRETATION:

Result: Damage at crosshead in compartment 1 creates opacity of 100% in compartment 1.
A sampling point in compartment 2 will detect 35%, in compartment 3 15% and in compartment 4 being farthest away 8%.

Result: Damage at Main bearing in compartment 1 creates opacity of 100% in compartment 1.
A sampling point in compartment 2 will detect 85%, in compartment 3 32% and in the 4 being farthest away 15%.

STEP3: DESIGN AND ADAPTATION OF AN APPROPRIATE OMD SYSTEM

based on results of Step 1 and 2 and particularities of relevant engine type

After analysis and evaluation of step 1 and 2, the choice of a suitable OMD system with appropriate sensitivity setting finalizes the investigation and the mechanical adaptation can be completed.

As a confirmation, a last test run, similar to Step 2, needs to verify the final result which will also be documented.

The OMDEA test procedure can be used, together with drawing documentation of OMD installations on particular engine type requested by IACS and classification societies, to match the Unified requirements given in UR M10.8 and UR M10.9.

YOUR ADVANTAGE
DOCUMENTATION OF THE OMDEA-TESTS

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OMDEA-tests on a 2-stroke diesel engine

Place :
Date :
Operators: Dipl. Ing. Manfred Dürr
Dipl. Ing. Helmuth Uebel
Hr. Franz Kunz
Responsible for OMDEA-tests (HPV) Dipl. Ing. Manfred Dürr

1. The aim of the tests:

1.1 Clarify the best point for oil mist suction for this type of diesel engine, within an exemplary crankcase compartment.

1.2 Clarify the oil mist distribution inside the entire crankcase of this type of diesel engine.

2. Measurements:

2.1 Measurement to verify the best suction point.

2.1.1 Arrangement.

2.1.1.1 Position of suction points.

To find out the best suction point to detect oil mist inside a selected compartment, 6 suction points were installed on compartment 4:

Exhaust side:
A1: Upper aft side of compartment 4
A2: Upper fore side of compartment 4
A3: Middle of the crosshead-way, aft side
A4: Middle of the crosshead-way, fore side

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OMDEA INCLUDES THE REQUESTS, GIVEN IN THE FOLLOWING HIGHLIGHTED PARAGRAPHS WITHIN IACS R M10

SCHALLER AUTOMATION

IACS
INTERNATIONAL ASSOCIATION OF CLASSIFICATION SOCIETIES

M10 Protection of internal combustion engines against crankcase explosions

M10 (1972) (Rev.1 1991) (Corr. 1997) (Rev.2 Jan 2005) (Corr.1 Nov 2005) (Corr.2 Oct 2007) (Rev.3 Sept 2008) (Rev.4 July 2013)

M10.1 Crankcase construction and crankcase doors are to be of sufficient strength to withstand anticipated crankcase pressures that may arise during a crankcase explosion taking into account the installation of explosion relief valves required by UR M9. Crankcase doors are to be fastened sufficiently securely for them not be readily displaced by a crankcase explosion.

M10.9 The oil mist detection system and arrangements are to be installed in accordance with the engine designer's and oil mist manufacturer's instructions/recommendations. The following particulars are to be included in the instructions:

- Schematic layout of engine oil mist detection and alarm system showing location of engine crankcase sample points and piping or cable arrangements together with pipe dimensions to detector.
- Evidence of study to justify the selected location of sample points and sample extraction rate (if applicable) in consideration of the crankcase arrangements and geometry and the predicted crankcase atmosphere where oil mist can accumulate.
- The manufacturer's maintenance and test manual.
- Information relating to type or in-service testing of the engine with engine protection system test arrangements having approved types of oil mist detection equipment.

(for mist detection purposes for instance), the vacuum in the crankcase is not to exceed 2.5 x 10^{-4} N/mm^2 (2.5 m bar).

M10.5.3 To avoid interconnection between crankcases and the possible spread of fire following an explosion, crankcase ventilation pipes and oil drain pipes for each engine are to be independent of any other engine.

M10.19 The equipment together with detectors is to be tested when installed on the test bed and on board ship to demonstrate that the detection and alarm system functionally operates. The testing arrangements are to be to the satisfaction of the classification society.

2. The requirements of M10 Rev.4 are to be uniformly implemented by IACS Societies for engines:

   i) when an application for certification of an engine is dated on or after 1 January 2015; or

   ii) which are installed in new ships for which the date of contract for construction is on or after 1 January 2015.

3. The "contracted for construction" date means the date on which the contract to build the vessel is signed between the prospective owner and the shipbuilder. For further details regarding the date of "contract for construction", refer to IACS Procedural Requirement (PR) No. 29.

■ **SERVICE PARTNER: CONTACT DETAILS SEE www.schaller.de**

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