M10 Protection of internal combustion engines against crankcase explosions

(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) (Rev.5 Nov.2024)

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.

M10.2 Additional relief valves are to be fitted on separate spaces of crankcase such as gear or chain cases for camshaft or similar drives, when the gross volume of such spaces exceeds 0.6 m^3.

M10.3 Scavenge spaces in open connection to the cylinders are to be fitted with explosion relief valves.

M10.4 Crankcase explosion relief valves are to comply with UR M9.

Note:

1. The requirements of M10 Rev. 3 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 2010; or
   ii) which are installed in new ships for which the date of contract for construction is on or after 1 January 2010.

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 requirements of M10 Rev.5 are to be uniformly implemented by IACS Societies for engines:

   i) when an application for certification of an engine is dated on or after 01 January 2026; or
   ii) which are installed in new ships for which the date of contract for construction is on or after 01 January 2026.

~~3~~4. 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.

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M10.5 Ventilation of crankcase, and any arrangement which could produce a flow of external air ~~within~~ into the crankcase, is in principle not permitted except for ~~dual fuel~~ engines fuelled with gas or low-flashpoint fuel, where ~~crankcase ventilation is to be provided in accordance with UR M59.3.2.(1)~~this might be necessary to maintain the gas concentration in the crankcase below LEL provided that: ~~.~~

1) It is demonstrated that the risk connected with a crankcase explosion is not increased by the ventilation system.
2) The operation of the ventilation system is monitored.
3) The automatic safety actions to be activated and / or the risk mitigation measures to be implemented in case of detection of a ventilation failure are specified by the engine manufacturer and justified in the safety concept of the engine.

Note: LEL means the Lower Explosive Limit, as defined in IEC 60079-10-1 (February 2021) standard, paragraph 3.6.12. The lowest applicable LEL of all possible gas or low flashpoint fuels, fuel vapours or mixture is to be considered.

M10.5.1 Crankcase ventilation pipes, where provided, are to be as small as practicable to minimise the inrush of air after a crankcase explosion.

M10.5.2 ~~If a forced extraction of the oil mist atmosphere from the crankcase is provided (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)~~ When forced extraction of crankcase atmosphere is provided, the crankcase pressure level is not to influence the reliable function of measurement and safety devices (such as oil mist detection) in the crankcase.

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.

M10.6 For engines fuelled with gas or low flashpoint fuel a detailed evaluation regarding the safety of crankcase is to be carried out justifying that:

1) either the gas concentration in the crankcase remains below the LEL without specific measures, or
2) the risk of a crankcase explosion is reduced through specific measures (see, for example, M10.5 or M10.23).

M10.~~6~~7 Lubricating oil drain pipes from the engine sump to the drain tank are to be continuously submerged at their outlet ends.

M10.~~7~~8 A warning notice is to be fitted either on the control stand or, preferably, on a crankcase door on each side of the engine. This warning notice is to specify that, whenever overheating is suspected within the crankcase, the crankcase doors or sight holes are not to be opened before a reasonable time, sufficient to permit adequate cooling after stopping the engine.

M10.~~8~~9 Oil mist detection arrangements (or engine bearing temperature monitors or equivalent devices) are required:

- for alarm and slow down purposes for low-speed ~~diesel~~ I.C engines of 2250 kW and above or having cylinders of more than 300 mm bore

- for alarm and automatic shutoff purposes for medium- and high-speed ~~diesel~~I.C engines of 2250 kW and above or having cylinders of more than 300 mm bore

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Oil mist detection arrangements are to be of a type approved by classification societies and tested in accordance with UR M67 and comply with UR M10.~~9~~10 to UR M10.2~~0~~1. Engine bearing temperature monitors or equivalent devices (see Note below) used as safety devices have to be of a type approved by classification societies for such purposes.

For the purpose of this UR, the following definitions apply:

Low-Speed Engines means ~~diesel~~ I.C engines having a rated speed of less than 300 rpm.

Medium-Speed Engines means ~~diesel~~ I.C engines having a rated speed of 300 rpm and above, but less than 1400 rpm.

High-Speed Engines means ~~diesel~~ I.C engines having a rated speed of 1400 rpm and above.

Note: For equivalent devices for high-speed engines, refer to UI SC 133.

Note: Engine bearing temperature monitors or equivalent devices are defined as follows:

a) For crosshead engines:
The wording “engine bearing” of the term “engine bearing temperature monitors or equivalent devices” includes at least journal and connecting rod bearings and the crosshead bearings.

b) For trunk piston engines:
“Engine bearing temperatures monitors” may be accepted as an alternative to the oil mist detector only when the temperature of all bearings, including the piston pin bearings, are monitored.

c) The expression “equivalent devices” includes measures applied to engines where specific design features to preclude the risk of crankcase explosion are incorporated, subject to satisfactory justifications.

d) The examples of acceptable “temperature monitors or equivalent devices” are as follows:

.1) a temperature monitoring system of the bearing concerned
.2) a bearing oil outlet temperature monitoring system
.3) a splash oil temperature monitoring system
.4) measures applied to engines where specific design features to preclude the risk of crankcase explosions are incorporated, subject to satisfactory justifications.

M10.~~9~~10 The oil mist detection system and arrangements are to be installed in accordance with the engine designer’s and oil mist detection system 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.

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- 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.

M10.1~~0~~1 A copy of the oil mist detection equipment maintenance and test manual required by UR M10.~~9~~10 is to be provided on board ship.

M10.1~~1~~2 Oil mist detection and alarm information is to be capable of being read from a safe location away from the engine.

M10.1~~2~~3 Each engine is to be provided with its own independent oil mist detection arrangement and a dedicated alarm.

M10.1~~3~~4 Oil mist detection and alarm systems are to be capable of being tested on the test bed and board under engine at standstill and engine running at normal operating conditions in accordance with test procedures that are acceptable to the classification society.

M10.1~~4~~5 Alarms and shutdowns for the oil mist detection system are to be in accordance with UR M35 and UR M36 and the system arrangements are to comply with UR M29 and UR M30.

M10.1~~5~~6 The oil mist detection arrangements are to provide an alarm indication in the event of a foreseeable functional failure in the equipment and installation arrangements.

M10.1~~6~~7 The oil mist detection system is to provide an indication that any lenses fitted in the equipment and used in determination of the oil mist level have been partially obscured to a degree that will affect the reliability of the information and alarm indication.

M10.1~~7~~8 Where oil mist detection equipment includes the use of programmable electronic systems, the arrangements are to be in accordance with individual classification society requirements for such systems.

M10.1~~8~~9 Plans ~~of~~ showing details and arrangements of oil mist detection and alarm arrangements are to be submitted for approval in accordance with UR M44~~ under item 28~~ table 2 item 26.

Documentation containing evidence of studies justifying the selected location of sample points and the sample extraction rate (if applicable), supported by a confirmation from the oil mist detection system manufacturer, from the crankcase and the spaces mentioned in M10.2, is to be provided to the Classification Society for reference purposes only.

As an alternative to the evidence of studies, an oil mist inlet test may be performed on a running engine. Test conditions such as setup, records or engine loads are to be agreed upon between engine designer, oil mist detector (OMD) manufacturer and respective class society. The test engine is to be chosen to demonstrate OMD arrangement suitability to cover a specified range of engine types and configurations. To allow a repeatable and comparable test, an oil mist generator as described under UR M67 is to be used.

M10.~~19~~20 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.

M10.2~~0~~1 Where sequential oil mist detection arrangements are provided the sampling frequency and time is to be as short as reasonably practicable.

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M10.2~~1~~2 Where alternative methods are provided for the prevention of the build-up of oil mist that may lead to a potentially explosive condition within the crankcase details are to be submitted for consideration of individual classification societies. The following information is to be included in the details to be submitted for consideration:

- Engine particulars – type, power, speed, stroke, bore and crankcase volume.
- Details of arrangements prevent the build up of potentially explosive conditions within the crankcase, e.g., bearing temperature monitoring, oil splash temperature, crankcase pressure monitoring, recirculation arrangements.
- Evidence to demonstrate that the arrangements are effective in preventing the build up of potentially explosive conditions together with details of in-service experience.
- Operating instructions and the maintenance and test instructions.

M10.2~~2~~3 Where it is proposed to use the introduction of inert gas into the crankcase to minimise a potential crankcase explosion, details of the arrangements are to be submitted to the classification society for consideration.

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