M77 Storage and use of SCR reductants

(Sep 2016) (Rev.1 Aug 2019) (Rev.2 Dec 2020) (Rev.3 Sep 2021) (Rev.4 Feb 2023) (Rev.5 July 2025)

1. General

The NOx Technical Code, in 2.2.5 and elsewhere, provides for the use of NOx Reducing Devices of which Selective Catalytic Reduction (SCR) is one option. SCR requires the use of a reductant which may be a urea/water solution or, in ~~exceptional~~ conditional cases, aqueous ammonia or even anhydrous ammonia. These requirements apply to the arrangements for the storage and use of SCR reductants.

The requirements for SCR reductants tanks with volume below of 500 L are left to the discretion of individual Classification Societies. This discretion is only applicable to Section 2 of the UR.

Note:

1. This UR is to be uniformly implemented by IACS Societies for the storage tank of SCR reductants:

   i) when an application for installation, i.e. submission date of plans, is made on or after 1 January 2018; or

   ii) which is installed in ships contracted for construction on or after 1 January 2018.

2. 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.

3. Rev. 1 of this UR is to be uniformly implemented by IACS Societies for the storage tank of SCR reductants:

   i) when an application for installation, i.e. submission date of plans, is made on or after 1 January 2021; or

   ii) which is installed in ships contracted for construction on or after 1 January 2021.

4. Rev.2 of this UR is to be uniformly implemented by IACS Societies for the storage tank of SCR reductants:

   i) when an application for installation, i.e. submission date of plans, is made on or after 1 January 2022; or

   ii) which is installed in ships contracted for construction on or after 1 January 2022.

5. Rev.3 of this UR is to be uniformly implemented by IACS Societies for the storage tank of SCR reductants:

   i) when an application for installation, i.e. submission date of plans, is made on or after 1 July 2022; or

   ii) which is installed in ships contracted for construction on or after 1 July 2022.

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6. Rev.4 of this UR is to be uniformly implemented by IACS Societies for the storage tank of SCR reductants:

   i) when an application for installation, i.e. submission date of plans, is made on or after 1 January 2024; or

   ii) which is installed in ships contracted for construction on or after 1 January 2024.

7. Rev.5 of this UR is to be uniformly implemented by IACS Societies for the storage tank of SCR reductants:

   i) when an application for installation, i.e. submission date of plans, is made on or after 1 January 2027; or

   ii) which is installed in ships contracted for construction on or after 1 January 2027.

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2. Reductant using urea based ammonia (e.g. 40%/60% urea/water solution)

2.1 Where urea based ammonia (e.g. AUS 40 – aqueous urea solution specified in ISO 18611-1:2014) is introduced, the storage tank is to be arranged so that any leakage will be contained and prevented from making contact with heated surfaces. All pipes or other tank penetrations are to be provided with manual closing valves attached to the tank. Tank and piping arrangements are to be approved.

2.2 The storage tank may be located within the engine room.

2.3 The storage tank is to be protected from excessively high or low temperatures applicable to the particular concentration of the solution. Depending on the operational area of the ship, this may necessitate the fitting of heating and/or cooling systems. The physical conditions recommended by applicable recognized standards (such as ISO 18611-3:2014) are to be taken into account to ensure that the contents of the aqueous urea tank are maintained to avoid any impairment of the urea solution during storage.

2.4 If a urea storage tank is installed in a closed compartment, the area is to be served by an effective mechanical ventilation system of extraction type providing not less than 6 air changes per hour which is independent from the ventilation system of accommodation, service spaces, or control stations. The ventilation system is to be capable of being controlled from outside the compartment. A warning notice requiring the use of such ventilation before entering the compartment shall be provided outside the compartment adjacent to each point of entry.

Alternatively, where a urea storage tank is located within an engine room a separate ventilation system is not required when the general ventilation system for the space is arranged so as to provide an effective movement of air in the vicinity of the storage tank and is to be maintained in operation continuously except when the storage tank is empty and has been thoroughly ventilated.

2.5 Each urea storage tank is to be provided with temperature and level monitoring arrangements. High and low level alarms together with high and low temperature alarms are also to be provided.

2.6 Where urea based ammonia solution is stored in integral tanks, the following are to be considered during the design and construction:

- These tanks may be designed and constructed as integral part of the hull, (e.g. double bottom, wing tanks).

- These tanks are to be coated with appropriate anti-corrosion coating and cannot be located adjacent to any fuel oil and fresh water tank.

- These tanks are to be designed and constructed as per the structural requirements applicable to hull and primary support members for a deep tank construction.

- These tanks are to be included in the ship’s stability calculation.

2.7 The requirements specified in M77.2.4 also apply to closed compartments normally entered by persons:

- when they are adjacent to the urea integral tanks and there are possible leak points (e.g. manhole, fittings) from these tanks; or

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- when the urea piping systems pass through these compartments, unless the piping system is made of steel or other equivalent material with melting point above 925 degrees C and with fully welded joints.

2.8 The reductant piping and venting systems are to be independent of other ship service piping and/or systems. Reductant piping systems are not to be located in accommodation, service spaces, or control stations. The vent pipes of the storage tank are to terminate in a safe location on the weather deck and the tank venting system is to be arranged to prevent entrance of water into the urea tank.

2.9 Reductant tanks are to be of steel or other equivalent material* with a melting point above 925 degrees C.

Pipes/piping systems are to be of steel or other equivalent material with melting point above 925 degrees C, except downstream of the tank valve, provided this valve is metal seated and arranged as fail-to-closed or with quick closing from a safe position outside the space in the event of fire; in such case, type approved plastic piping may be accepted even if it has not passed a fire endurance test. Reductant tanks and pipes/piping systems are to be made with a material compatible with reductant or coated with appropriate anti-corrosion coating.

2.10 For the protection of crew members, the ship is to have on board suitable personnel protective equipment. Eyewash are to be provided, the location and number of these eyewash stations are to be derived from the detailed installation arrangements.

2.11 Urea storage tanks are to be arranged so that they can be emptied of urea and ventilated by means of portable or permanent systems.

3. Reductant using aqueous ammonia (28% or less concentration of ammonia)

~~Aqueous ammonia is not to be used as a reductant in a SCR except where it can be demonstrated that it is not practicable to use a urea based reductant. Where an application is made to use aqueous ammonia as the reductant then the arrangements for its loading, carriage and use are to be derived from a risk based analysis.~~

Aqueous ammonia may be used as a reductant in an SCR, provided that the arrangements for its loading, where applicable, as well as its carriage and use, are assessed through a risk-based analysis in order to ensure an equivalent level of safety to a urea-based installation, taking into account MSC.1/Circ.1687.

4. Reductant using anhydrous ammonia (99.5% or greater concentration of ammonia by weight)

~~Anhydrous ammonia is not to be used as a reductant in a SCR except where it can be demonstrated that it is not practicable to use a urea based reductant and where the Flag Administration agrees to its use. Where it is not practicable to use a urea reductant then it is also to be demonstrated that it is not practicable to use aqueous ammonia. Where an application is made to use anhydrous ammonia as the reductant then the arrangements for its loading, carriage and use are to be derived from a risk based analysis.~~

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Anhydrous ammonia may be used as a reductant in an SCR, subject to agreement with the Flag Administration. The arrangements for its loading, carriage, and use are to be in accordance with the requirements set out in MSC.1/Circ.1687, as applicable for the intended service. In addition, the risk-based analysis as set out in MSC.1/Circ.1687 should be carried out to ensure an equivalent level of safety to a urea-based installation.

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* Footnote to 2.9: Material requirement “to be of steel or other equivalent material” in the first paragraph with a melting point above 925 degrees C is not applicable for integral tanks on FRP vessels such as those listed below, provided that the integral tanks are coated and/or insulated with a self-extinguishing material.

1) FRP vessels complying with Regulation 17 of SOLAS Chapter II-2 based upon its associated IMO guidelines (MSC.1/Circ.1574), and

2) FRP vessels exempted from the application of SOLAS e.g., yachts, fast patrol, navy vessels, etc., generally of less than 500 gross tonnage, subject to yacht codes or flag regulations.