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# Dual-Fuel Ammonia Engine Introduction

X52DF-A-1.0, X52DF-A-S1.0, X62DF-A-1.0, X62DF-A-S1.0,  
X72DF-A-1.0, X82DF-A-1.0

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## 1 Introduction

WinGD takes the next step in the path towards decarbonisation by introducing ammonia-fuelled engines. Available for order now and with first engine delivery committed for early 2025, X-DF-A will enable deep-sea ship owners and operators to harness carbon-free ammonia in their main engines, powering the transition to sustainable shipping.

Already traded globally as a fertiliser feedstock, refrigerant and industrial chemical, ammonia is set to become a mainstream energy carrier and fuel in the coming decades. Greenhouse gas emissions associated with its production and distribution can be nearly eliminated with the use of renewable electricity, making green ammonia a viable option for meeting societal and corporate climate goals – at the same time minimising owner and charterer exposure to forthcoming carbon pricing.

Safety has been a key priority during the development of engines using ammonia due to the inherent characteristics of the fuel. Already supported with Approval-in-Principle from Lloyd’s Register, X-DF-A delivers the assurance that ship owners and operators need to integrate ammonia-fuelled engines into vessel designs today.

The high-pressure injection concept deployed in X-DF-A engines will be familiar to operators of the WinGD well-established, highly efficient diesel-fuelled X-Engines. Notable features include comparable performance with X-Engines in both ammonia mode and diesel mode, low pilot fuel requirements precisely controlled through common rail injection and NO<sub>x</sub> Tier III compliance in both modes with Selective Catalytic Reduction (SCR).

The roadmap for X-DF-A engines development is presented in this paper. The first engine to be launched is the 6X52DF-A-1.0, followed by other engine types and configurations.

### 2 Ammonia technology

The X-DF-A is a dual-fuel engine equipped with a technology enabling the engine to operate either on ammonia or diesel fuel. The engine operates according to the diesel principle in both diesel mode and ammonia mode. It is equipped with two separate fuel injection systems. The diesel fuel injection system is used for diesel mode and remains active in ammonia mode for injecting a small amount of pilot fuel. The pilot fuel is needed for stable ignition of ammonia fuel.

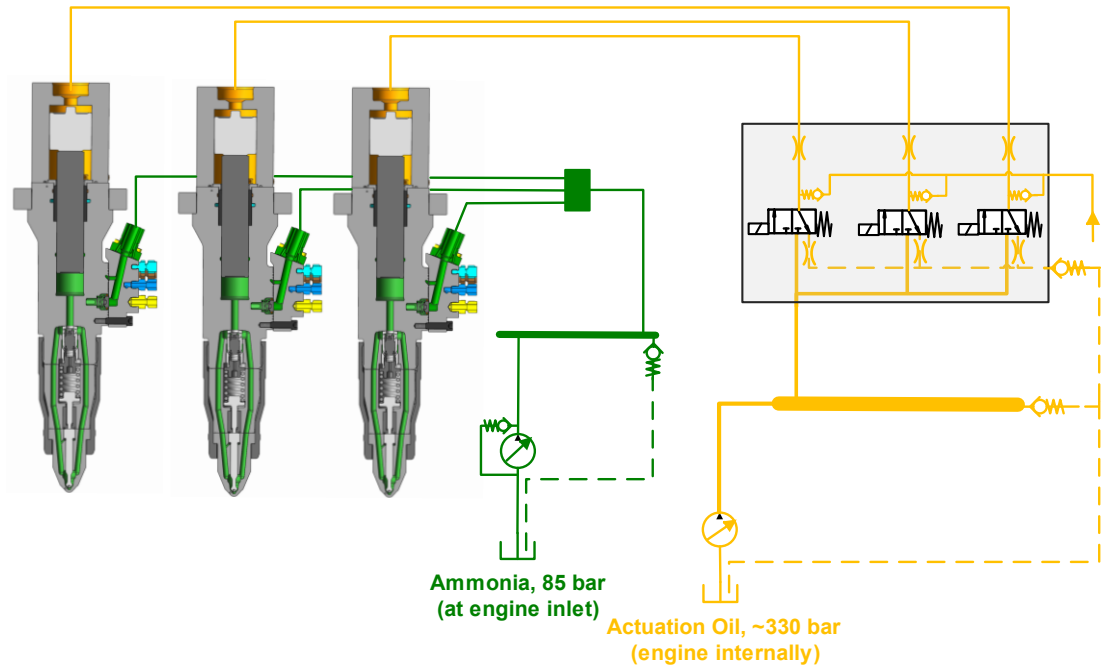


Figure 2-1: Ammonia fuel injection system principle

### 3 Main engine parameters

The ammonia engines have the same rating field as the diesel engines and will be available with the same cylinder configurations. The mechanical design is based on today's WinGD X-engine portfolio, with the addition of an ammonia fuel injection system including the additional servo oil system to drive it.

### 4 IMO Tier III solutions

The X-DF-A engines are IMO Tier II NO<sub>x</sub> compliant without an exhaust gas aftertreatment in both diesel mode and ammonia mode. IMO Tier III compliance can be reached in both operating modes with a high-pressure SCR (HP SCR) installed upstream the turbochargers. The HP SCR system can be installed off-engine or on-engine (iSCR) depending on the engine type. The on-engine option (iSCR) is feasible only on single turbocharger engines.

### 5 Documentation availability

The schedule for the drawing and product documentation is presented in the Table 5-1 below. The 6X52DF-A-1.0 and 6X72DF-A-1.0 engines are contracted to date. The priority and schedules of other engine types can change according to actual orders.

Table 5-1: Ammonia engine development schedule

Engine type	MIM/MIDS	GTD*	Safety Concept	Full documentation set	Earliest expected first engine delivery date**
6X52DF-A-1.0	Available	Available	Available	Q2/24	Q2/2025
6X72DF-A-1.0	Available	Available	Available	Q4/24	Q3/2025
X62DF-A-1.0	Available	Q4/24	Available	Q3/25	Q1/2026
X82DF-A-1.0	Available	Q1/25	Available	Q1/26	Q3/2026
X62DF-A-S1.0	Available	Q2/25	Available	Q3/26	Q1/2027
X52DF-A-S1.0	Available	Q3/25	Available	Q1/27	Q3/2027

\* Preliminary performance data can be provided on request for engines where GTD is not available

\*\* Indicative dates, to be confirmed by engine builder project specifically

The indicated documentation and engine delivery schedules are valid for the first contracted cylinder configuration. Other cylinder numbers will follow earliest four months later.

More available documentation can be found here:

<https://www.wingd.com/en/engines/engine-types/x-df-dual-fuel-ammonia/ammonia-documentation/>