ALTERNATIVE FUELS

Alternative fuel systems from storage to engine

How biogas, CNG, LNG, hydrogen, ammonia and methanol change the design of the fuel line. A guide from the storage boundary to the engine.

Tubing Supply AS | 23 November 2026



BMT SUPERLOK

Ammonia FVU

Ammonia fuel valve unit for a WinGD engine. The return and purge connections are part of its job. BMT · Eco-Fuel Conversion and Supply Units, R2 · p. 2

DESIGN BASIS

Phase

The engine may burn methane while the tank holds liquid and the valve train handles warm gas. Mark the fluid state on both sides of every equipment boundary.

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METHANE PATHWAYS

From raw biogas to LNG

Biogas, CNG and LNG name different things. Biogas identifies an origin and a gas mixture. CNG and LNG describe how natural gas is stored. The first question for a component is what reaches its inlet.

Four methane duties

Where in the system	What reaches the line	What governs selection
Raw biogas	Methane and CO_2 with variable water and contaminants, including H_2S.	Obtain the gas analysis, expected condensate and upset composition. Check wetted trim and seal compatibility under wet conditions.
Upgraded biomethane	Methane-rich gas after removal of much of the CO_2 and contaminants.	Set the acceptance limits at the compressor or liquefier inlet. A renewable origin says little about residual moisture or sulphur.
CNG or bio-CNG	Natural gas or specification-grade biomethane stored under pressure as a gas.	Separate filling and storage pressure from downstream regulated pressure. Record the storage pressure cycle, the regulator outlet setpoint and the maximum pressure the downstream line can withstand if regulation fails.
LNG or bio-LNG	Cryogenic liquid near storage, typically around −162 °C near atmospheric pressure. Vapour is present elsewhere.	Locate each cold liquid, two-phase and warm gas section. Identify low-temperature isolation and the destination of boil-off.

Where FLNG fits

A floating LNG facility processes, liquefies, stores and offloads natural gas offshore. A valve on the loading system can face cryogenic liquid. An instrument branch elsewhere on the same facility can see warm gas, vibration and salt spray. “For FLNG” alone leaves both duties open.

SOURCES IEA · Introduction to biogas and biomethane / US DOE · Natural Gas Fuel Basics / Shell · Floating LNG

HYDROGEN, AMMONIA & METHANOL

Three fuels, three containment problems

Storage pressure is only one part of containment. Hydrogen brings a material and fatigue question, ammonia a toxic-release question, and methanol a toxic, flammable liquid and vapour exposure.

What the line specification must establish

Fuel and form	A question for the designer	Consequence for components
Hydrogen • compressed gas or cryogenic liquid	Which phase reaches this tag? What pressure cycles, purity and minimum metal temperature are credible?	Gas duty requires documented suitability of the materials, joints and seals for that duty. Liquid hydrogen boils near −253 °C at atmospheric pressure and requires a separate low-temperature qualification.
Ammonia • pressurised or refrigerated liquid, or vapour	Where do return, purge and relief streams terminate? What containment and release-detection provisions apply?	Check the wetted materials, including small trim parts, and state seat leakage and external leakage separately. Give the return line its own pressure and temperature envelope.
Methanol • commonly an ambient liquid	Which fuel composition, temperatures and cleaning media contact each seal? What happens to the inventory on isolation?	Check the actual seal compound, stem packing and static gaskets. Address vapour ignition, liquid exposure and the drain destination in the system design.

Why the engine interface matters

The fuel tank can dictate one set of materials while the engine return dictates another. On a marine project, the applicable IMO and class basis, engine maker’s specification and agreed interface drawing belong together. A catalogue pressure cannot resolve a missing return destination.

SOURCES US DOE · Liquid Hydrogen Delivery / Sandia · Hydrogen compatibility of 316-series stainless steels / NIOSH · Ammonia / NIOSH · Methyl alcohol / IMO · Safety guidelines for alternative marine fuels

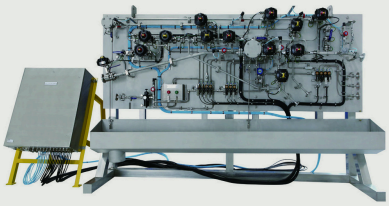
BMT EQUIPMENT

What BMT puts at the engine boundary

Revision 2 of BMT's fuel-unit catalogue gives four particularly useful reference configurations. Values below are design data for the illustrated unit. The fuel system upstream and the engine downstream each have their own limits.

Published BMT examples · pressures are gauge

Unit and duty	Design pressure / temperature	Function at the boundary
WinGD ammonia FVU	110 barg / 40 ± 5 °C	Isolates the ammonia supply, provides a return connection toward the separator and interfaces with nitrogen.
EVERLLENCE methanol FVT, 1 in.	16 barg / −25 to +60 °C	Isolates the engine fuel inlet and provides a nitrogen purge path. Identify the return or discharge destination on the project drawing.
WinGD methane GVU	16 barg / 0 to +60 °C	Feeds methane gas to the engine. The listed inlet range places this unit on the gas side of an LNG fuel system.
HiMSEN hydrogen GRU	80 barg / −50 to +100 °C	A hydrogen-engine test configuration with separate regulated paths to the main chamber and pre-chamber.



Methanol FVT



Methane GVU



Hydrogen GRU

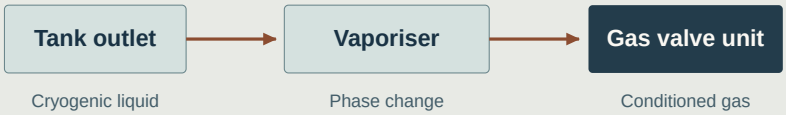
The 80 barg figure for the HiMSEN hydrogen test unit is its design pressure. The engine delivery setpoint, available differential and required flow are separate inputs. Use the relevant BMT data sheet for each interface.

SOURCES BMT · ammonia FVU · p. 2 / Methanol FVT · p. 4 / Methane GVU · p. 8 / Hydrogen GRU · p. 12

WORKED EXAMPLE

One LNG skid, three different line duties

Consider a marine fuel supply skid with a cryogenic storage outlet, a vaporiser and a gas valve unit ahead of the engine. Follow the fuel across the drawing and three purchasing descriptions emerge.



Illustrative boundary drawing. The temperatures at each interface belong on the line sheet.

Illustrative design review

Tank outlet to vaporiser	Liquid LNG, credible minimum metal temperature, allowable differential in each isolation direction, trapped-liquid sections and cross-boundary relief responsibility.
Vaporiser outlet to engine	Methane gas, gas temperature limits in normal and upset states, engine demand range, regulator inlet limits and the low-temperature shutdown condition agreed with the package designer.
Purge and return connections	Identity of the stream in each operating mode, permitted backpressure, ownership of the receiving system and the isolation status required by the control philosophy.

If the feed becomes bio-LNG

Confirm the delivered fuel meets the agreed composition and quality specification. Check whether the resulting composition changes the vaporiser duty or the engine's gas requirements.

What "clean energy" can substantiate

The IMO well-to-wake approach follows production and delivery through onboard use. Compare the fuel pathways on the same delivered-energy basis. Feedstock, production electricity, methane leakage before delivery and unburned methane in engine exhaust can change the well-to-wake result. Record the fuel pathway and the boundary behind an emissions claim.

A practical deliverable

Annotate each equipment interface with fluid, phase, pressure, temperature, flow, direction and destination. That one drawing lets the piping designer, engine maker and valve supplier check the same duty.

SOURCES BMT · WinGD GVU · p. 8 / DNV · Alternative fuels for shipping / IMO · Life-cycle GHG intensity of marine fuels

Tubing Supply catalogue · Fuel and skid systems