

Technology Qualification

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Technological innovation drives the maritime industry forward, improving safety and propelling decarbonization. However, many new technologies face challenges in aligning with existing regulations. DNV's Technology Qualification (TQ) process bridges this gap, as demonstrated by the Candela P-12 ferry.

Several completely novel technologies have emerged in shipping in recent years, increasing the energy efficiency of vessels or facilitating the use of alternative fuels. However, due to their novelty, many of these innovations operate

beyond the confines of established regulatory frameworks. This creates uncertainty that can negatively impact the innovation process.

"Many shipowners are currently evaluating the adoption of novel technologies at different stages of readiness. However,

this introduces inherent risks concerning the effectiveness of energy efficiency measures and fosters uncertainty with respect to investment decisions," says Carl Erik Høy-Petersen, Business Development Leader, Maritime Advisory at DNV.

The need for a different approach to support new technologies

These uncertainties have created a need for assurance in the development of novel technologies. With the TQ process, DNV Maritime Advisory provides clients with high-end consultancy throughout the innovation process,

independent of its classification services.

Technology is often far ahead of regulation in the maritime sector, so we need alternative approaches to ensure the safe implementation of innovative technologies. This inspired TQ to become a methodology

and process at DNV. With it, we have been able to qualify a variety of maritime technologies, such as fuel cells in cruise ships, propulsion systems, waste treatment systems, and the introduction of new marine fuels, among others.



Photos: Candela

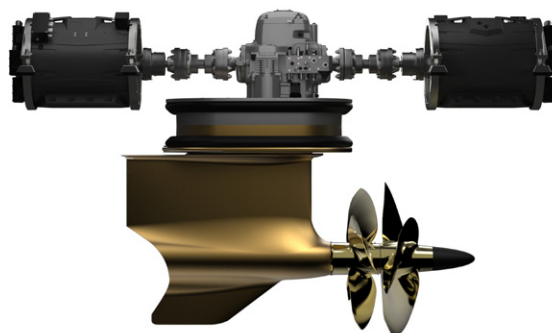
How does DNV's TQ process work?

Technology Qualification provides evidence that technology will function within specified limits with an acceptable level of confidence. In practical terms, this means that companies wanting to develop novel concepts will engage with DNV from the early stages of their innovation process to gain an independent evaluation of their technology.

DNV experts work closely with clients to develop a deeper understanding of their technology, focusing on several different perspectives, such as safety, efficiency, operability, and profitability. The results provide the clients with insights into how their technology can fail at any stage of its

journey, supporting them in establishing a more robust development, manufacturing, testing, and commissioning plan. Identification of technical, compliance, safety, or performance issues at the earliest possible point in the development process helps minimize the cost and time of rework. This way, the TQ process helps reduce the expenses

of qualifying new technologies and reduces to-market time.



The Volvo Penta IPS Professional Platform Inboard Performance System is another recent invention that has benefited from DNV's Technology Qualification service. Photo: Volvo Penta

Iterative approach for social and economic realities

At the core of the TQ process is an iterative, systematic approach that addresses each stage of the technological journey. This starts with an initial qualification basis, working

through technology assessment and threat assessment (hazard identification, HAZID, and failure mode, effects, and criticality analysis, FMECA), all the way through to

qualification plan, qualification execution, and performance assessment. If the technology is deemed to be below the required standards, practical recommendations will

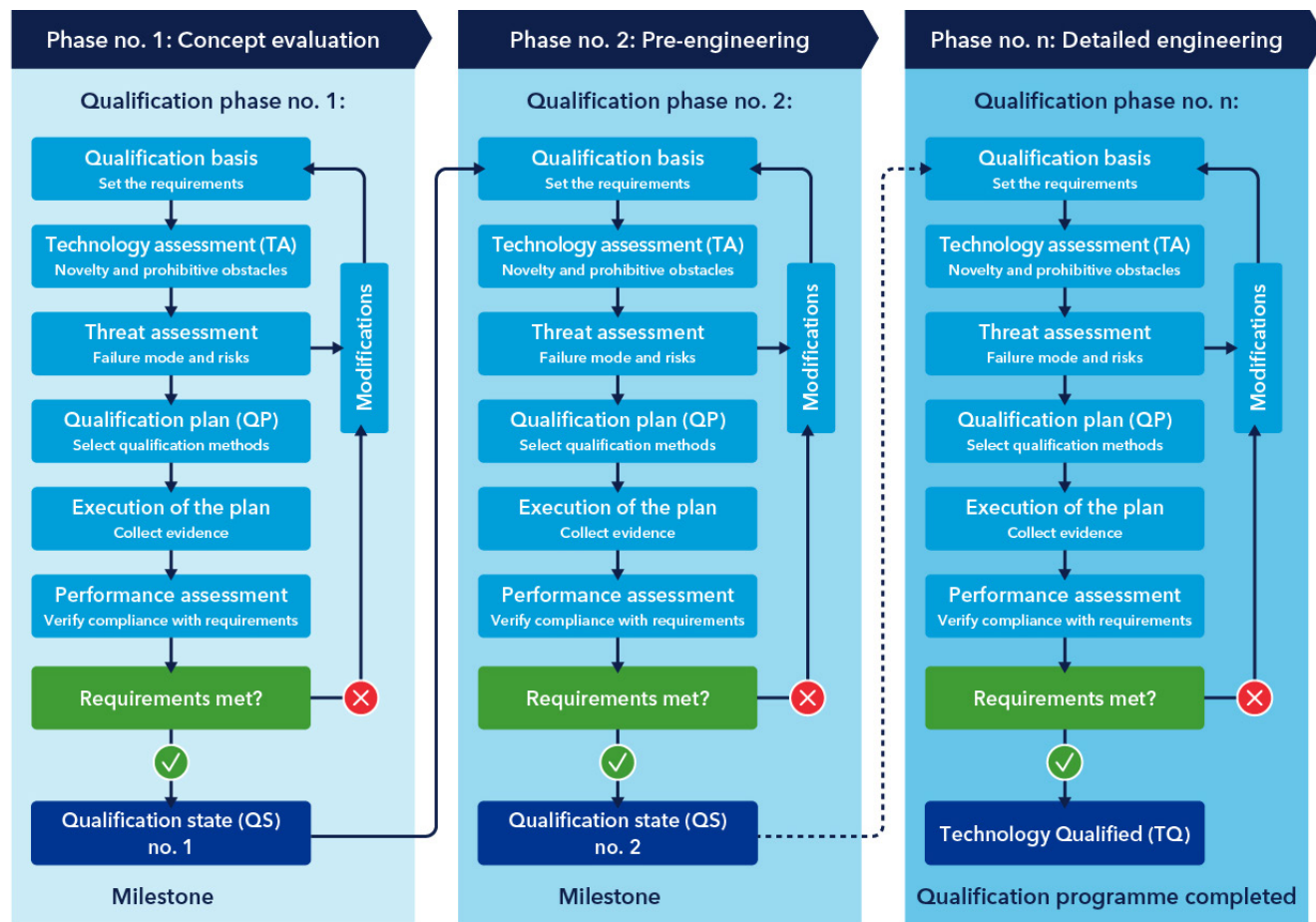
be made, usually resulting in alterations.

As a main principle, we engage in close dialogue with our clients, leveraging their knowledge and expertise alongside that of our subject matter experts at DNV. Together,

we systematically address challenges and uncertainties and identify inherent hazards in each technology. This provides us with a high-level risk assessment, not only covering safety-related matters but also looking

at other important aspects like efficiency, maintainability, profitability, public opinion, and environmental aspects. This holistic approach prepares the technology for social and economic realities.

Fig. 1. Visualization of DNV's Technology Qualification programme¹



¹ Illustration of the Technology Qualification programme iterating through different phases, each of which includes a cycle of the basic technology qualification process that requires to be successfully concluded before going on to the next phase.

Source: DNV

Candela P-12 developed with the TQ process

Candela is a prime example of an innovative organization that has benefited from a close partnership with DNV through the TQ process. For the past few years, the Swedish company has been developing the Candela P-12 ferry based on hydrofoil technology, successfully launching the vessel towards the end of 2023.

Partnership with DNV through the TQ process has been a key part of the development of this unique craft. "The TQ process is more detailed and comprehensive compared to standard type approvals for conventional vessels," says Rasmus Kratz, Compliance Engineer at Candela. "While

the risks with traditional boats are widely recognized and understood, the TQ process compelled us to meticulously assess and address the unique risks involved in constructing an electric hydrofoil vessel. This has ensured that the P-12 is designed to be an exceptionally safe watercraft."

Advantages of the hydrofoil technology

Hydrofoil technology – where a foil lifts the vessel from the water as it gathers speed – has a range of benefits. "The key advantage is that the hydrofoil system reduces energy consumption by more than 90% compared to conventional diesel vessels if one calculates savings from energy

converted from battery/diesel to propulsion," explains Kratz. "This, in turn, enables long range and high speed on battery power only – a first in the industry – and halves operational costs."

Hydrofoil technology is also ideal for operation in busy urban environments,

where vessels often face added restrictions. "One of the key advantages of this technology is that it has low wake generation," continues Kratz. "This makes it exempt from speed limits in cities like Stockholm, which increases its attraction as a passenger ferry."



Early partnership with DNV in the TQ process

“Candela consulted DNV at an early stage of the development,” says Kristoffer Uulas, Senior Consultant, Maritime Advisory at DNV. “They had questions about safety and compliance but also about how to navigate the approval process for a new technology that doesn’t fit any of the currently existing rules.”

This early engagement with DNV experts provided Candela with the confidence that their concept was fundamentally sound, smoothing the path of further technological

progress and development. “We moved from the general concept of the foiling technology through to HAZID challenges and uncertainties,” shares Uulas. “This provided a solid basis for the qualification and further development of the technology.”

The identification of potential hazards and pitfalls throughout the TQ process often led to alterations to the originally planned technological pathway. Mitigation of potential risks and failure modes was ensured by executing the qualification plans, providing

evidence through analyses and tests, and adding control measures in design, manufacturing installation, commissioning operation, and maintenance. Doing this has made the P-12 safe, robust, and prepared to deal with any challenges that it might face in the future. “There have been a lot of changes and iterations to the design along the way, and DNV has been a vital part in helping Candela navigate this map, providing evidence through the qualification plan,” adds Kratz.

Greater levels of safety and redundancy with the TQ process

Clearly, understanding the risk picture has helped the Swedish innovators adjust the technology to achieve a higher level of safety and redundancy beyond

the initial plans.

Rather than merely aiming for compliance, Candela chose to have more redundancy and safety functionality

throughout the process than required. This has increased the vessel’s reliability, minimizing the risk of safety incidents or technical failures in the future.

The TQ process provides the basis for future safety and operability

As the successful launch of the Candela P-12 prototypes in 2023 has shown, close cooperation with DNV through the TQ process provides a sound basis to assure future safety performance and operability, increasing the likelihood of vessels

reaching full development stage, while also improving their future economic prospects.

“Introducing a totally new type of vessel, which is significantly more sustainable than anything that has come before,

has been a complex process,” concludes Kratz. “Drawing on DNV’s experience and expertise through the TQ process and partnering with some of the foremost experts in marine safety has been invaluable to its development.” ■