



Work Order – WO0671825
New Technology Qualification of the Infinitely Variable
Transmission (IVT) – Concept Verification Stage

Attention: Dr. Gang Li, Mississippi State University (WCN: 501687)

The documents shown in the attached list have been reviewed in accordance with the applicable requirements of the following:

- ABS Rules for Alternative Arrangements, Novel Concepts, and New Technologies, Part 1D, Appendix 2, 2024
- ABS Rules for Building and Classing Marine Vessels, 2026
- ABS Rules for Building and Classing Offshore Units, 2026

Please note our review is based on the following conditions:

1. This review covers the verification of the subject arrangement required during the **Concept Verification Stage** under the ABS New Technology Qualification (NTQ) Process.
2. The review is limited to the mechanical gearbox assembly of the Infinitely Variable Transmission (IVT), including the non-circular gear pair, Input Control Module (ICM), Motion Conversion Module (MCM), and Scotch-Yoke system, as defined in the submitted System Requirements and Description Document (SRDD).
3. It is noted that our review at this time in no way precludes future comments, amendments, or additional qualification activities that may be deemed necessary following review of subsequent design submissions, analyses, testing, and qualification evidence.
4. ABS reserves the right to make further comments and amendments due to the submittal of additional information or document revisions as the design progresses through the NTQ process.
5. ABS review is based solely upon the information submitted for the Concept Verification Stage and does not constitute certification of performance claims, reliability targets, service-life projections, efficiency claims, or suitability for a specific application. These items remain subject to verification through subsequent NTQ phases.
6. ABS shall in no event be held liable for any identified or unidentified hazardous scenarios, qualification activities, testing deficiencies, or operational risks associated with this technology.

Based on the documentation submitted, the IVT SRDD provides a satisfactory conceptual description of the technology, identifies the principal novel features, establishes system boundaries and interfaces, and provides a preliminary mechanical risk register suitable for Concept Verification review.

Please refer to the attached list of comments associated with this review for further progress of the project development.

For any clarifications, please contact Suzy Jiang at sujiang@eagle.org.

Very truly yours,

Michael Kei

Vice President of Technology

Electronically Signed by: Quaim Choudhury

Documents List

Drawing No.	Rev. No.	Title	Status
1	0	2014 Modeling and Control of an Infinitely Variable Speed Converter	Filed by ABS for Reference Only
2	0	2014 Modeling and Control of an Infinitely Variable Speed Converter	Filed by ABS for Reference Only
3	0	2016 Design, Modeling, and Experimental Validation of a Novel Infinitely Variable Transmission Based on Scotch Yoke Systems	Filed by ABS for Reference Only
4	0	2021 Design and Power Loss Evaluation of a Noncircular Gear Pair for an Infinitely Variable Transmission	Filed by ABS for Reference Only
5	0	2021 Experimental Investigation on Control of an Infinitely Variable Transmission System for Tidal Current Energy Converters	Filed by ABS for Reference Only
6	0	2022 Time-Delay Closed-Loop Control of an Infinitely Variable Transmission System for Tidal Current Energy Converters	Filed by ABS for Reference Only
7	0	2024 Control and Flume Flow Experiments of a Tidal Current Energy Converter With an Infinitely Variable Transmission	Filed by ABS for Reference Only
8	0	2025 Hierarchical speed control of an infinitely variable transmission in tidal current energy converters using integral reinfor	Filed by ABS for Reference Only
9	0	2025 Study on Dynamic Behaviors of Hypoid Gears Under Variable Tidal Current Energy Harvesting Conditions	Filed by ABS for Reference Only
10	0	A Review on Up-to-Date Gearbox Technologies and Maintenance of Tidal Current Energy Converters	Filed by ABS for Reference Only
11	0	IVT Transfinity - report	Filed by ABS for Reference Only
12	2.1	IVT___SRDD V2.1 06172026	Reviewed

Electronic copies of the documents, appropriately stamped, are available in the [ABS MyFreedom™ Client Portal](#).

Comments List

1. The submitted SRDD provides sufficient concept-level system description, architecture definition, functional decomposition, interfaces, and identification of novel technology elements for Concept Verification review.
2. For next phase, submit an updated New Technology Qualification Plan (NTQP) reflecting the current SRDD and identifying planned qualification activities in compliance with Part 1D A2-4/3 and 5.
3. For next phase, submit a Preliminary Reliability, Availability, and Maintainability (RAM) Assessment, including assumptions, methodology, and planned validation activities in compliance with Part 1D A2-4/3 and 5.
4. For next phase, submit a Preliminary Manufacturing Plan identifying manufacturing processes, critical tolerances, inspection requirements, and fabrication constraints associated with the non-circular gears and principal mechanical assemblies in compliance with Part 1D A2-4/3 and 5.
5. Future submissions should include closure of identified risk items and qualification evidence supporting the proposed closure criteria identified in the Preliminary Mechanical Risk Register in compliance with Part 1D A2-4/3 and 5.

STATEMENT OF MATURITY



Client Name: Mississippi State University

Date Issued: August 14 2026

Certificate Number: WO0671825

TECHNOLOGY CONCEPT VERIFICATION STAGE

This is to certify that

INFINITELY VARIABLE TRANSMISSION (IVT)

has been reviewed in accordance with Part 1D – *ABS Rules for Alternative Arrangements, Novel Concepts and New Technologies*, Appendix 2 – Guidance on Qualifying New Technologies [1], *ABS Rules for Building and Classing Marine Vessels* [2], *ABS Rules for Building and Classing Offshore Units* [3]. The proposed technology concept is considered verified with respect to its intended functions in accordance with the defined performance requirements and design objectives outlined by Mississippi State University. The technology may proceed to the **Prototype Validation Stage**.

Description and Application: The Infinitely Variable Transmission (IVT) is an all-mechanical transmission for tidal energy systems. It converts variable low-speed turbine input into controlled output speed using non-circular gears, planetary differentials, and motion-conversion mechanisms. The design enables continuous speed variation, improves energy capture, reduces drivetrain losses, and supports constant-speed generator operation.

Boundaries: This Statement of Maturity is limited to the conceptual mechanical gearbox assembly of the Infinitely Variable Transmission (IVT), including the Non-Circular Gear Pair, Input Control Module, Motion Conversion Module, Scotch-Yoke systems, and defined mechanical interfaces. Control systems, software, actuator hardware, and operational implementation are excluded from this qualification scope.

Scope of Review:

- 1) Reviewed design basis, functional specification and/or technical specification of the new technology
- 2) Reviewed System Requirements and Description Document (SRDD)
- 3) Reviewed Risk mitigation plan, failure mode and effect analysis (FMEA), and mechanical risk register

Comments/Notes: Refer to the ABS New Technology Qualification of the Infinitely Variable Transmission (IVT) – Concept Verification Stage Review Letter for conditions and comments list

Reference Documents:

- [1] *ABS Rules for Alternative Arrangements, Novel Concepts and New Technologies*, Part 1D, Appendix 2, January 2024
- [2] *ABS Rules for Building and Classing Marine Vessels*, 2026
- [3] *ABS Rules for Building and Classing Offshore Units*, 2026

ABS shall in no event be held liable for any identified/unidentified hazardous scenarios or qualification activities associated with this technology.

Approved By:

A handwritten signature in black ink that reads "Mike" followed by a stylized flourish.

Michael Kei
Vice President, Technology