

ISO/TC20/SC16/WG9

Hydrogen Standards for Fuel Cell Powered UAS

ISO DIS 25009 & ISO DIS 25013

*"Bridging Regulatory Frameworks for Hydrogen Propulsion in Advanced
Air Mobility"*

Presenter: Mr. Hyunbeen Noh | KCL (Korea Conformity Laboratories), ISO TC20 SC16 WG9 Secretary

ANSI Hydrogen Webinar | 2026



Presentation Agenda

ISO/TC20/SC16/WG9 Hydrogen Standards Roadmap & Deep Dive

01



Activity Information

Scope of WG9 and active standards under development

02



Who Is Involved

Convener, presenter, P-members, and industry liaisons

03



Standards Deep Dive

ISO DIS 25009 (Pipes) & ISO DIS 25013 (Cylinders)

04



Regulatory Context

Why aviation-specific hydrogen standards matter

05



New Work Item Proposal

Global regulatory survey Technical Report (TR)

06



What's Next

2026–2028 roadmap and monitored trends

07



Process & Participation

ISO development workflow and how to get involved in WG9



01 Activity Information: WG9 Overview

Working Group Mandate

Operating under [ISO/TC20/SC16](#) (Unmanned Aircraft Systems), WG9 is dedicated to developing safety standards for **gaseous hydrogen fuel cell powered UAS (HFC UAS)**.

Active Draft International Standards

ISO DIS 25009 Requirements & test methods for **hydrogen fuel gas pipes** of HFC UAS

ISO DIS 25013 Requirements & test methods for **attachable hydrogen cylinders** of HFC UAS

 Standards Users: OEMs, Fuel Cell Developers, Regulators, Test Labs

Application Sectors

✓ UAM


✓ Cargo Drones

✓ Public Safety

✓ Agriculture

Asia-Pacific leadership in H₂ aviation standards

Safety & Integrity Focus

Pressure Integrity 

Leak Prevention 

Thermal Control 

Structural Robustness 

ISO/TC20/SC16/WG9



02 Who Is Involved

Leadership

Convener

Dr. Hyunyoung Jang

KATS (Korea Agency for Technology and Standards)

Presenter

Mr. Hyunbeen Noh

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Participating Countries

P-Members (Voting)

- ✓ South Korea
- ✓ China
- ✓ EU Member Bodies
- ✓ Japan
- ✓ USA

O-Members (Observers)

- ⊙ Singapore
- ⊙ UAE
- ⊙ Australia
- ⊙ Brazil

ISO Secretariat

ISO/TC20/SC16

Unmanned Aircraft Systems

Industry & Regulatory Liaisons

ICAO AAM Study Group

IEC/TC105

SAE AE-5CH/AE-7AFC

EUROCAE

ASTM F38/F39



CSA GROUP



03a ISO DIS 25009 — Hydrogen Fuel Gas Pipes

Technical Overview & Requirements

🎯 Scope

Specifies requirements and test methods to ensure **absolute sealing** of compressed gaseous H₂ piping for HFC UAS.



🔧 Key Structure Covered

- ✓ Piping design
- ✓ Flow control valves
- ✓ Excess flow protection
- ✓ Vibration & shock resistance
- ✓ Flexible connections
- ✓ Backflow prevention
- ✓ Pressure relief devices
- ✓ Thermal protection

📖 Normative References

ISO 11114-1/-4	IEC 60068-2
ISO 9227	ISO 19880-3/-5
ISO 20485	ISO 21384-4

🧪 Materials

METALLIC

- H₂ embrittlement & corrosion resistance

NON-METALLIC

- H₂ compatibility, thermal stability, performance verification

03a ISO DIS 25009

Key Test Requirements

HYDROGEN FUEL GAS PIPES

Proof Pressure

Verify structural integrity at **1.5x** maximum allowable working pressure (MAWP).

Sealing Performance

Ensure **zero leakage** using Helium or inert tracer gas per ISO 20485 standards.

Installation Cycling

500+ repeated connect/disconnect cycles; verify wear resistance and seal integrity.

Vibration & Shock

Simulate flight-induced stresses per IEC 60068-2-6/-2-27; **no failure** or leakage post-test.

Env. Durability

Assessment of temperature extremes, humidity, and UV exposure for **long-term degradation**.

Aviation Durability

Specific **1.2m drop test** and flight profile vibration profiling for extreme conditions.

KGS AH373 Safety Upgrades Incorporated

MANDATORY

REDUNDANT VALVES

Series redundant valve concept; fail-safe automatic shutdown on control power loss (<1s closure).

DIRECT DISCHARGE

H₂ vented outside UAS enclosure; internal concentration must remain <1%.

PROTOCOL ALIGNMENT

Standardized testing methods aligned with global aerospace safety benchmarks.

03b ISO DIS 25013

Attachable Hydrogen Cylinders Overview

AVIATION SAFETY STANDARD



Scope & Objective

Defines minimum safety, performance, and integrity for **attachable cylinders** in HFC UAS unitized power packs.

PRIMARY SAFETY GOAL

Prevention of hydrogen cylinder runaway under all flight phases & emergency conditions.



Key Structure Covered

- ✓ Pressure Vessel Design (Wall thickness, Safety margins)
- ✓ Primary + Secondary Attachment Retention
- ✓ Interface Design & Sealed Protective Features
- ✓ Safety Valves, Seals & Burst Disc Integration
- ✓ Standardized Maintenance & Removal Procedures



Normative References

RTCA DO-160 / EUROCAE ED-14

SAE J2579 (H₂ Fuel Systems)

ISO 9227 (Corrosion)

IEC 60068-2-6 / ISO 7137

**Ensures mechanical, sealing, and environmental robustness for UAM applications.*

03b ISO DIS 25013 — Key Test Requirements

CYLINDER INTEGRITY

Validation of Attachable Hydrogen Cylinders for UAS Safety

Internal Pressure

Must withstand burst pressure $\geq 2\times$ **rated working pressure** without failure.

Sealing Performance

Valve and connector seals verified with **helium leak detection** at full rated pressure.

Installation Cycle

1,000+ attach/detach cycles to verify mechanism functionality and durability.

Vibration & Shock

Simulate flight stresses per **IEC/UAS profiles**; no structural failure or detachment allowed.

Receptacle Tests

Material and functional tests on **fill/vent receptacles** under extreme pressure cycling.



KGS AH373 SAFETY UPGRADES

✓ Secondary Retention

Redundant locking for all flight phases.

✓ High-Freq Reliability

1,000-cycle test for battery-swap reliability.

✓ Global Harmonization

Aligned with RTCA DO-160/ISO 7137 protocols.

03c Why These Standards Matter — Regulatory Context

⚠️ Current Challenge

Fragmented Ground Standards

- ✘ ISO 14687 / SAE J2601: Designed for ground vehicles.
- ✘ Lacking high-altitude pressure behavior requirements.
- ✘ Insufficient vibration profiles for aviation flight cycles.

✓ WG9 Solution

Aviation-Specific Standards

- ⊕ ISO DIS 25009 & 25013: Purpose-built for HFC UAS.
- ⊕ Introduces UAS-specific attachment & durability tests.
- ⊕ Harmonized with aerospace lightweighting constraints.

Path to Certification (AMC/MoC)

These ISO standards serve as **Acceptable Means of Compliance (AMC)** referenced by global authorities like **EASA** and **FAA** for H₂ UAS airworthiness certification.

Coordination

ICAO

EASA

FAA

SAE

IEC

EUROCAE

STANDARDIZATION TRAJECTORY

NOW

Fragmented Standards

2026-27

ISO 25009 & 25013 Published

2028+

Harmonized Global Framework

03d New Work Item Proposal — Technical Report

Survey on Global Regulations for Hydrogen Fuel Cell Powered UAS

🎯 Objective

A comprehensive survey of current global regulations for HFC UAS to identify standardization gaps and inform future WG9 projects.

❓ Why This TR Is Needed

- ✓ **Regulatory Complexity:** Rapid HFC UAS growth requires a clear map of global rules.
- ✓ **Standardization Gap:** Current standards focus on components; system-level survey is required.

📍 Strategic Regulatory Mapping

ICAO

Global hydrogen aviation safety framework and SARPs.

FAA (USA)

Type Certification procedures under 14 CFR for hydrogen propulsion.

EASA (EU)

Special Conditions (SC) and Certification Specifications (CS).

KATS/KGS (Korea)

KGS AH 373: World's first legislated standard for HFC UAS safety.



03d New Work Item — Global Harmonization Strategy

Scope of Work

- Comparative analysis of certification frameworks: USA, EU, Korea, China
- Review of operational safety & H₂ infrastructure requirements

Expected Strategic Impact

- **Regulatory Harmonization:** Align ISO with international aviation law
- **Priority Setting:** Contribution to future WG9 work items

DETAILED SURVEY CATEGORIES



System-Level Safety

Fuel cell stacks, thermal mgmt, fuel delivery integration



Operational Constraints

Flight zone restrictions, emergency H₂ leakage protocols



Infrastructure Synergy

Mobile H₂ stations and storage facility regulations

Methodology

Multi-national data gathering via WG9 bodies:

ANSI BSI DIN JSA KATS

Proposed Implementation Timeline

2026 Q2

NP Submission

2026 Q3–Q4

Drafting Phase

2027

TR Publication

04 What's Next Roadmap 2026 – 2028



Short-Term

TARGET: 2026

- ✓ Complete DIS ballot review for ISO 25009 & 25013
- ✓ Incorporate member body comments; progress to FDIS
- ✓ Initiate NP for H₂ fuel quality specification (adapt ISO 14687)



Medium-Term

TARGET: 2026–2027

- Standardize lightweight composite & cryogenic storage
- Define high-altitude fuel cell performance requirements
- Establish vertiport hydrogen infrastructure interfaces



Strategic Monitoring

FORWARD TRENDS

Liquid Hydrogen (LH₂)

Hybrid H₂ / Battery

Digital Quality Monitoring

ICAO Annex Amendments

Supply Chain Data

AAM Integration

TIMELINE



2026 Q2
DIS Completion

2027 Q1
IS Publication

2028+
Harmonized Framework


05 ISO Development Process


Standardization Workflow for Hydrogen UAS


STATUS UPDATE

 **Next Meeting: TBD 2026**

01  **NWIP**
New Work Item Proposal. KATS proposes; requires P-member vote and 5+ experts.

02  **WD**
Working Draft. WG9 experts draft the technical text during plenary discussions.

03  **CD**
Committee Draft. Broader SC16 vote; national bodies submit formal revisions.

04  **DIS** CURRENT STAGE
Draft International Standard.
Ballot open to P-members; final comments being incorporated. (End: 2026-07-09)

05  **FDIS**
Final DIS. Near-final text for approval vote; minimal changes permitted.

06  **IS**
International Standard. Published by ISO; adopted into national regulations.



LATEST MILESTONE

Plenary Session: Tokyo, November 2025

"Accelerating aviation-specific hydrogen safety globally"

06 Participation — How to Get Involved

Shape the future of global hydrogen aviation standards



Join as a P-Member

National standards bodies (e.g., **ANSI, BSI, DIN, KATS**) can register as P-Members of ISO/TC20/SC16 to vote on ballots and contribute experts to WG9.



Contribute as an Expert

Engineers, researchers, and industry specialists can be nominated by their national body to participate directly in **WG9 drafting sessions** and technical reviews.



Submit DIS Comments

ISO DIS 25009 & 25013 are currently open for national body comments. Contact your local standards organization to submit technical feedback.



Observe / Liaison

Industry organizations and SDOs (**SAE, EUROCAE, RTCA, IEC**) can apply for liaison status with ISO/TC20/SC16 to coordinate parallel work and avoid duplication.

CONTACT POINT

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ISO/TC20/SC16/WG9

Thank You

Questions & Discussion

KEY TAKEAWAYS

- ✓ **First aviation-specific H₂ standards** for UAS fuel pipes & cylinders (ISO DIS 25009 & 25013).
- ✓ Addresses **critical gaps** in existing ground-vehicle standards for flight conditions.
- ✓ **Global Alignment:** Coordinated with ICAO, EASA, FAA, IEC, SAE, and EUROCAE.
- ✓ **Call to Action:** Open for DIS comments — shape the final standard through your national body.
- ✓ **New Work:** TR proposed for global regulatory survey — ANSI participation welcomed.

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