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Hydrogen fuel tank standards

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Agenda

- Available standards and scope
- Overall similarities/differences between the standards
 - Liquid hydrogen standards
 - Gaseous hydrogen standards
- Overview of ISO 15869
- Recommendations

Picture at a glance

Liquid hydrogen

ISO 13985

Covers the fuel tanks and accessories

EC Regulation

Articles 6-7, 8 and 9 cover the fuel tanks and accessories



Gaseous hydrogen

ISO 15869

Covers types 1, 2, 3 & 4 fuel tanks up to the working pressure specified by the manufacturer

EC Regulation

Articles 10 and 11 cover types 1, 2, 3 & 4 fuel tanks

JARI S001

Covers types 3 & 4 fuel tanks up to 35 MPa

SAE J2579

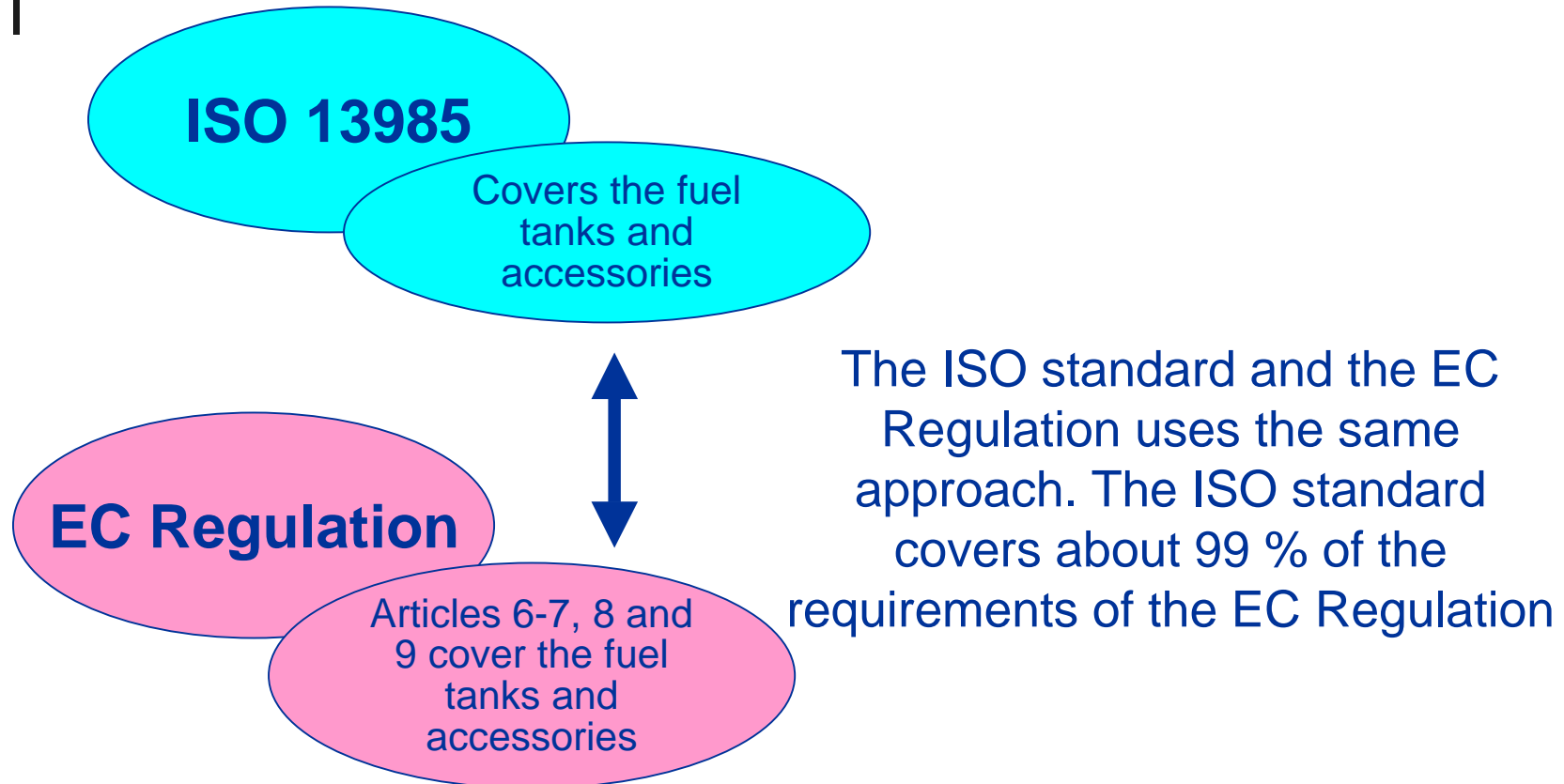
Section 5.2 covers fuel tank requirements (all types) up to 70 MPa



Liquid hydrogen fuel tank standards



Overall similarities/differences — Liquid hydrogen standards





Gaseous hydrogen fuel tank standards



Overall similarities/differences — Gaseous hydrogen standards

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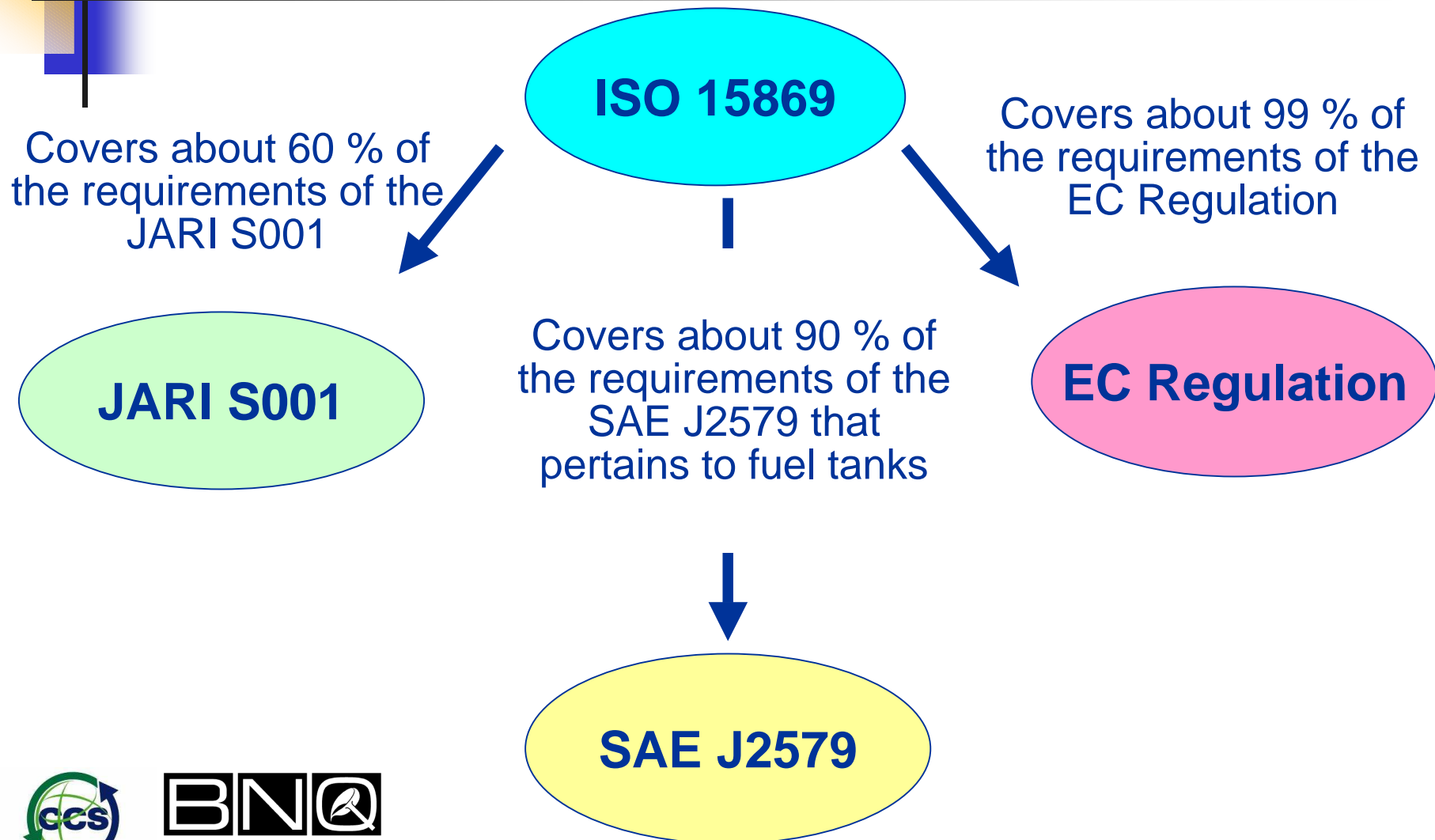
EC Regulation

Articles 10 and 11
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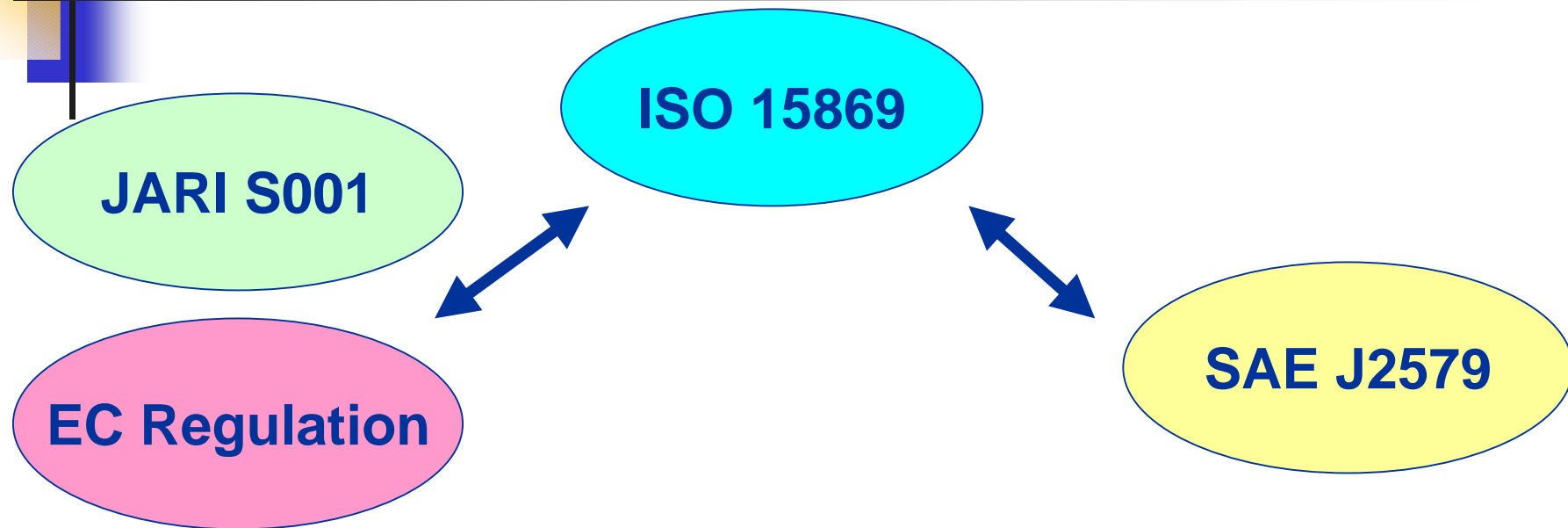
SAE J2579

Section 5.2 covers
fuel tank
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types) up to 70 MPa

Overall similarities/differences — Gaseous hydrogen standards



Overall similarities/differences — Gaseous hydrogen standards



The ISO standard proposes two methods for qualifying designs:

- One that is aligned with JARI S001 and the EC Regulation
- One that is aligned with SAE J2579

Description of ISO 15869



ISO 15869

- Performance based standard, reflecting the state-of-the-art
- Scope
 - Lightweight refillable fuel tanks intended for the on-board storage of high-pressure compressed gaseous hydrogen or hydrogen blends on land vehicles
 - Applies to Type 1, 2, 3 and 4
- Service conditions
 - Working pressure (WP) to be specified by the manufacturer
 - Maximum filling pressure: 125 % of WP
 - Filling cycles:
 - 11250 cycles, representing a 15-year life of use in a commercial heavy-duty vehicle
 - a reduced number of 5500 cycles may be specified
 - Design temperature: -40 °C to 85 °C

Description of ISO 15869



ISO 15869

- **Materials**
 - Requirements on hydrogen compatibility, exterior coatings, metal fuel tank and liner materials, plastic liner materials, resin properties
- **Design requirements**
 - **Minimum burst pressure and fibre stress ratio**
 - Requirements vary with the type of tank (Type 1, 2, 3 & 4) and the type of fibre
 - From 2,0 up depending on fibre
 - Stress analysis
 - Maximum defect size
 - Fire protection
- **Construction and workmanship**

Description of ISO 15869

ISO 15869

- **Qualification of new design**
 - Material tests
 - Hydrostatic burst
 - Ambient temperature pressure cycling
 - Leak-before-break (LBB)
 - Bonfire
 - Penetration
 - Chemical exposure
 - Composite flaw tolerance
 - Accelerated stress rupture
 - Extreme temperature pressure cycling
 - Impact damage
 - Permeation
 - Boss torque
 - Hydrogen gas cycling
- **Alternate method of qualification of new design**
 - Extreme temperature gas pressure cycle test (Fuelling / De-Fuelling)
 - Accelerated static stress test (Parking)
 - Leak/Permeation
 - Proof pressure
 - Residual burst strength
 - Material tests
 - Impact damage
 - Combined chemical exposure and composite flaw tolerance
 - Leak-before-break (LBB)
 - Boss torque
 - Bonfire
 - Penetration
 - Hydrostatic burst
 - Ambient temperature pressure cycling

Description of ISO 15869



ISO 15869

- Batch tests
 - Material tests
 - Hydrostatic burst
 - Periodic ambient temperature pressure cycling
- Production tests
 - Dimensional inspections
 - NDE and hardness test of metallic tanks and liners
 - Inspection of plastic liners
 - Hydraulic test
 - Leak test
- Markings

Recommendations

- The ISO international standards represent the consensus of stakeholders on a worldwide basis
 - 156 countries
- W.29 has recognized that the reference to ISO standards in the GTR simplify the regulatory process
 - Nov. 2003 WP.29 decision to refer to international standard instead of reproducing them in the regulations

Recommendations

- **Liquid hydrogen**

- The ISO 13895 covers the needs of the EC regulation and liquid hydrogen tank requirements are not covered by the Japanese regulations, nor the SAE J2579



Recommendations

■ Gaseous hydrogen

- The comparison analysis of ISO 15869 has revealed that it is close to the Japanese regulations, the EC Regulation and the SAE J2579
 - ISO 15869 represents the harmonization of the Japanese regulations, the EC regulation and the SAE J 2579
 - As the SGS progresses with its task, ISO would be pleased to perform a more thorough comparison



Thank you

