



Condor H₂

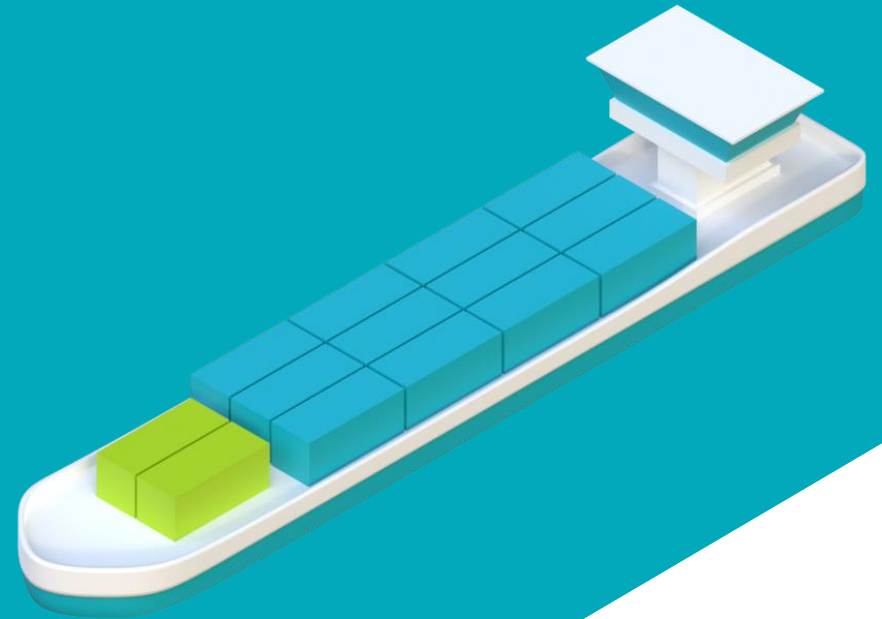
Hydrogen shipping

A RH₂INE zero-emission shipping project

Standardization tanktainer

RH₂INE conference

30 September 2024



WP4: Standardization

Standardized tanktainer will accelerate scaling of hydrogen shipping

Standard / Format / Design specification / Type

AA battery &

Dedicated location in appliance

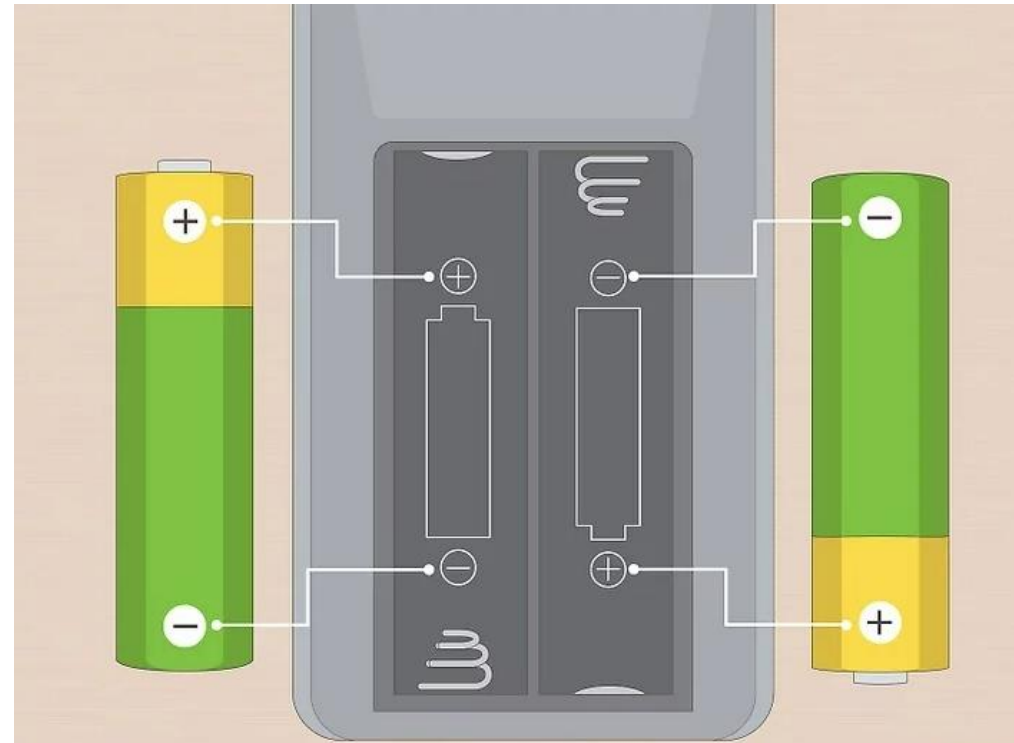
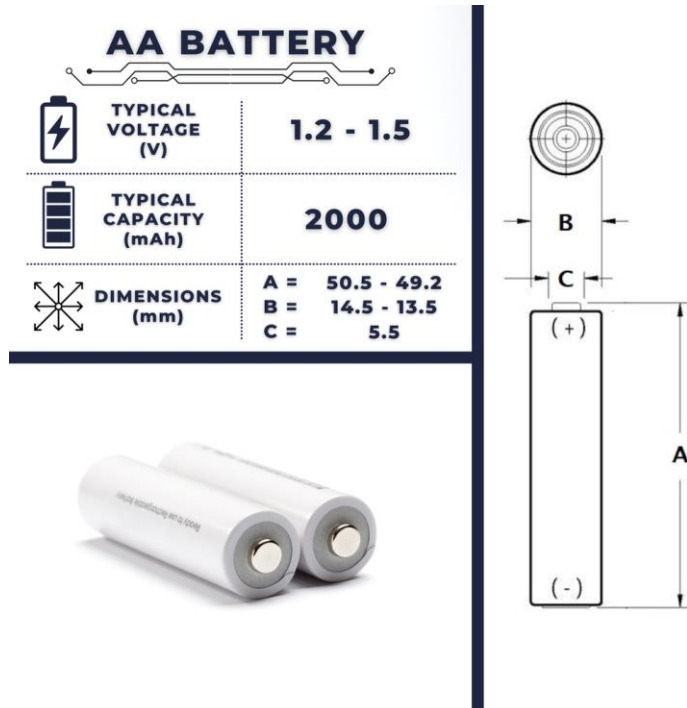
Types of AA Batteries:

Primary Battery

- alkaline battery
- lithium metal battery
- zinc-carbon battery
- zinc-chloride battery

Secondary Battery

- NiMH battery
- NiCd battery



Regulation & standardisation

Workshops Condor H2 partners:

- Air Liquide
- Argo Anleg
- BP
- H2Storage
- Linde
- Shell
- Vitrite

External participants/experts:

- Lloyd's Register
- ZBT



What does Condor H2 do?

Input on H2 requirements:

- Provide industry insights
- Support swappable tank pool storage solutions

Pro-actively involve class societies:

Discuss (in workshops) on requirements, certification process and standards

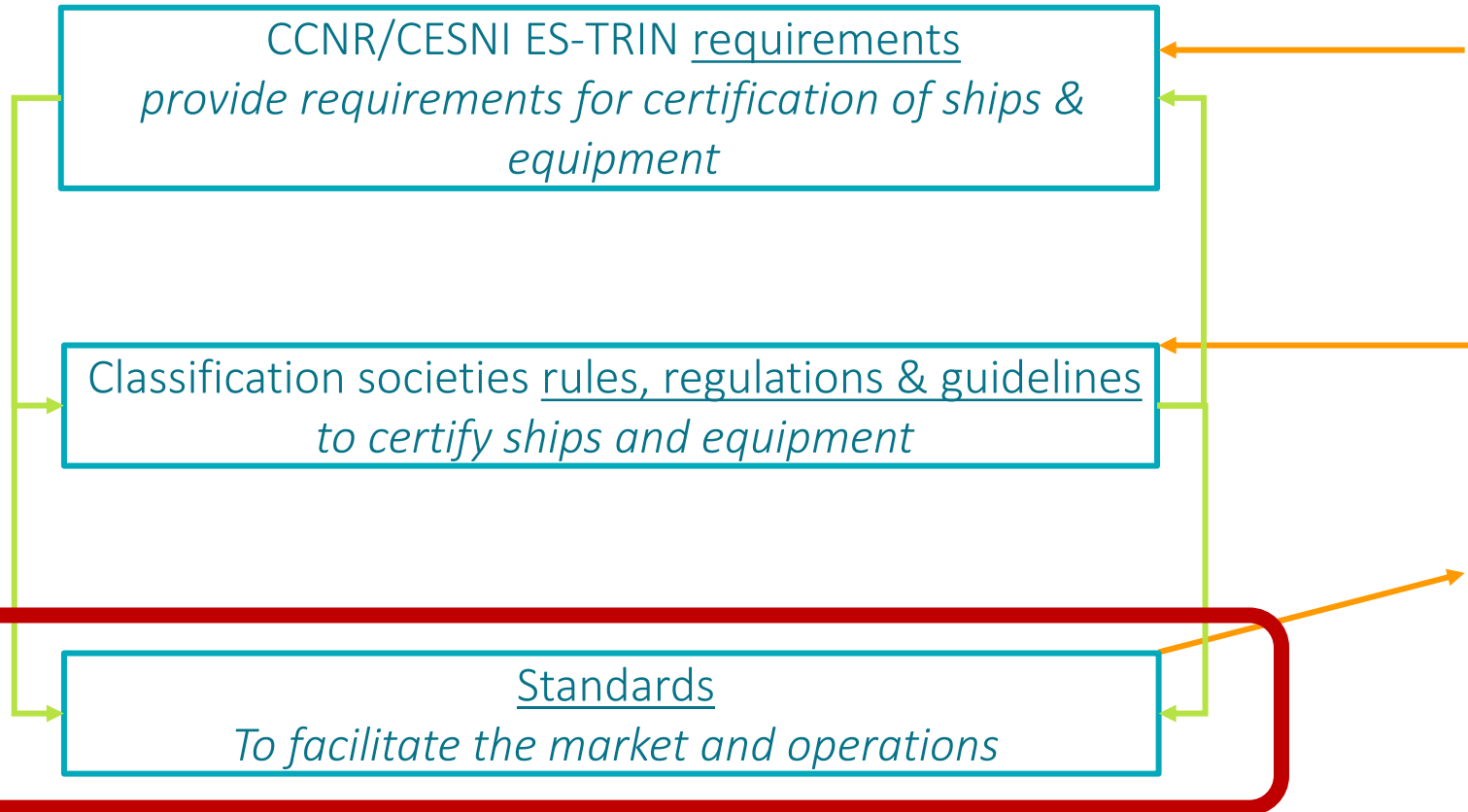
'Condor H2' standard to facilitate swappable tank pool:

- More detailed and specified interface elements (e.g. couplings, data gathering, size)
- Also based on operational & economical considerations
- Complies with ES-TRIN

CCNR/CESNI ES-TRIN requirements
provide requirements for certification of ships & equipment

Classification societies rules, regulations & guidelines
to certify ships and equipment

Standards
To facilitate the market and operations



Certification Process

Tanktainer 'category' certified
&
Ship certified for 'category' of tanktainers



Standardisation document : content

1. Pressure levels
2. Container sizes
3. Transport modes
4. Location of pressure regulation
5. Physical interface
6. Data communication
7. Communication protocol

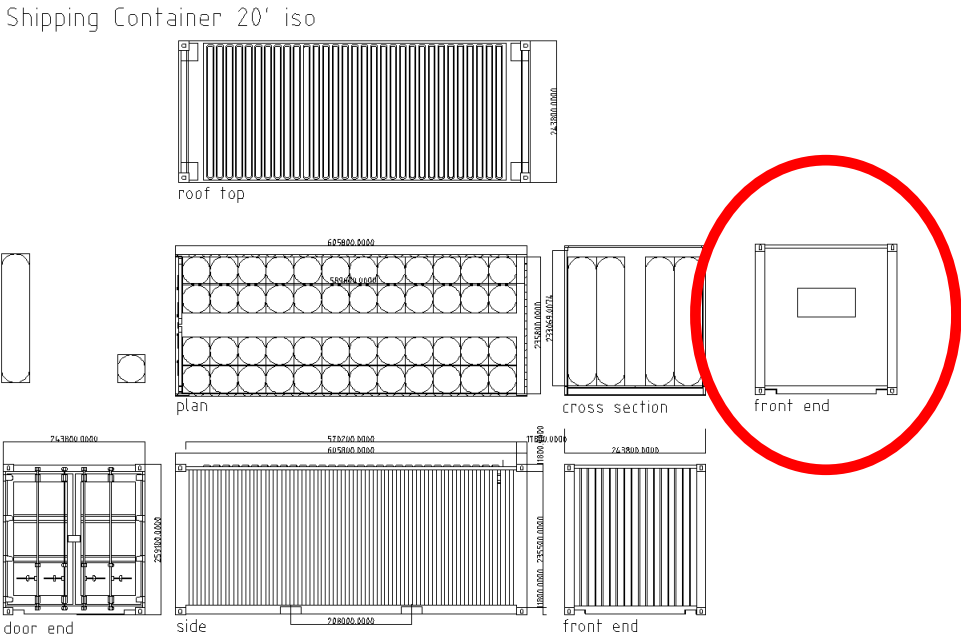
Standardisation document : pressure levels

- 300 bar
- 500 bar
- 700 bar

= maximum pressure level

Standardisation document : container sizes

- All standard container sizes possible :
 - 10", 20", 30" and 40" (+high cube)
- Standard fixing system : ISO blocks (twist locks on board)
- Connections on front side



Standardisation document : transport modes

- Suitable for all transport modes
 - Truck
 - Barge
 - Train
- As a result it has to comply to with the existing transport mode rules :
ADN, ADR, RID, Es-Trin, IMO

Standardisation document : location of pressure regulation

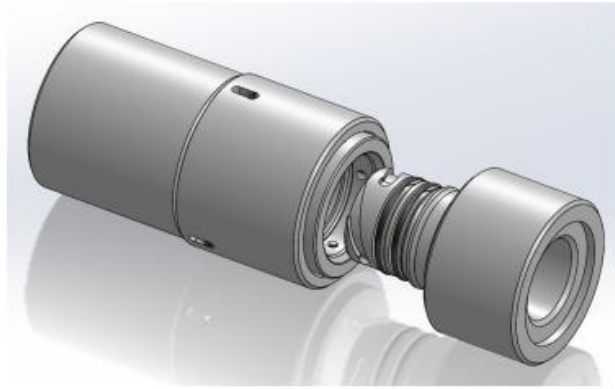
- The pressure regulator will be put **OUTSIDE** the tanktainer
 - Economical reasons
 - Technical reasons
 - Safety reasons

Standardisation document : physical interface

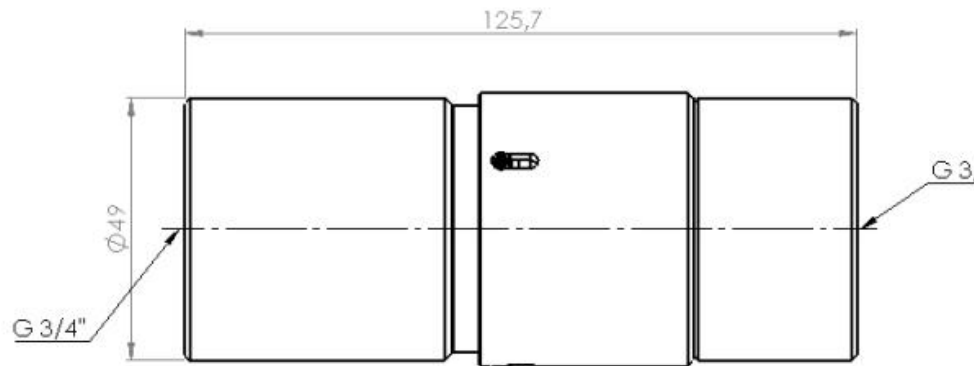
Mechanical interfaces :

- Main H₂ hose connection
- Vent hose connection
- Compressed air pressure hose connection(s)

Quick Coupling



The H2-Quick-Coupling is a fitting designed for fast coupling of two pipe systems. Pipe systems that ended with one of them (male or female) could connect with each other system with same quick-coupling end (male or female). H₂ will be vent during discoupling.

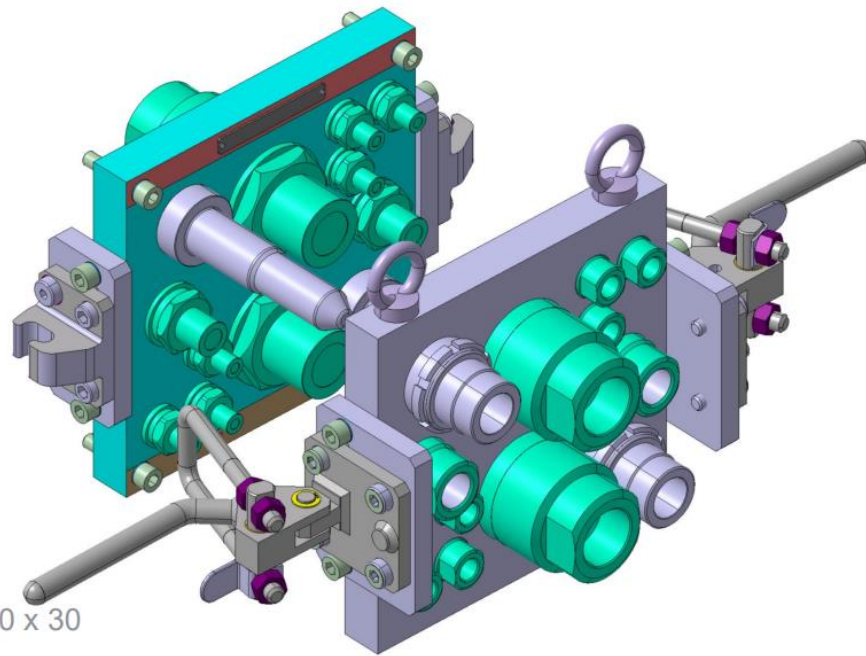


Options:

- Venting Version with DN 30 with 3/2 way valve with needle valve
- Customised solutions

Q _{max} :	8 g/s [28 kg/h] @ 15 °C, P ₁ = 35 bar, 16g/sec, or special
Inlet pressure P ₁ :	0...630 bar
Inlet pressure min:	20 bar
Nominal size:	DN 10, DN 15, DN 25, DN 30
Fluid temperature:	-40 °C...+85 °C
Valve housing material:	1.4404 (X2CrNiMo17-12-2)
Sealing material:	FKM
Internal leakage:	< 10 ppm
External leakage:	< 10 ppm
Weight:	~1,60 kg
Deadroom:	~600 mm ³
Connection:	2x G3/4" female / IG

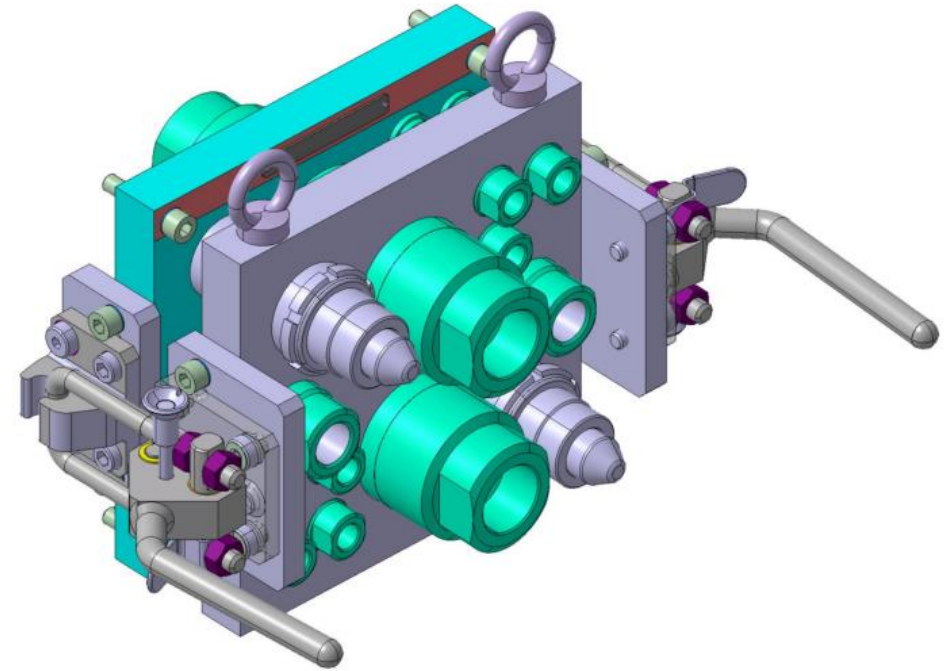
Multiconnector



Dimensions :

Mobile plate : 245 x 240 x 30
Weight : 27 Kg

Fixed plate : 245 x 240 x 30
Weight : 24 Kg



Standardisation document : physical interface

Multiconnector and 1 quick coupling combined on 1 tanktainer

- Multiconnector
 - Chosen as preferable option due to fool proof necessity
 - Backward compatibility should be possible
 - 300 bar : 2 conical pins
 - 500 bar : 3 conical pins
 - 700 bar : 4 conical pins
 - Weight should be lowered
- For inland navigation
 - Multiconnector with 4 connections = preferred option. (Main H₂, Vent line, two air pressure lines)
- For land based applications
 - Only 1 connector needed (H₂ supply)
 - Quick coupling = preferred option
- Multi-use should be possible !
 - Higher turnaround of tanktainers : will lower the cost
 - Use for inland navigation and land based applications should be combined

Standardisation document : data communication

- Required data (available at all times, foreseen in a digital way) :
 - Pressure in each section
 - Temperature in each section
 - Identification of design pressure

Each section has an own Pressure Relief Valve and an own thermal pressure relief device.

- Optional data :
 - Number of filling cycles
 - Acceleration data (occurred G-forces)
 - GPS position
 - Safety check
 - ...

Standardisation document : communication protocol

Communication protocol J2799

