

HYDROGEN PN1000 (15,000psi / 1,034bar) LEAKAGE-FREE BALL VALVES

H2 FUELING, STORAGE & TRANSPORT



Scope of Webinar

- Hydrogen High Pressure applications
- HABONIM HP H₂ valve range
- Leakage free : TOTAL HERMETIX®
- Fueling type approval : ISO19880-3
- TPED : road, rail, inland water transport
- Case studies / references



HYDROGEN HIGH PRESSURE APPLICATIONS

H2 ball valves up to 1034 barg / 15,000psi

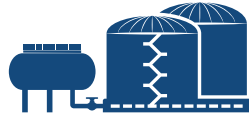




Production

Conventional
(eg. SMR)

Renewable
(eg. electrolyser)



Conditioning

Compression

Liquefaction



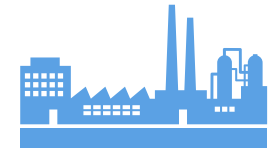
Delivery / Supply

CGH₂ distribution/
storage

LH₂ distribution/
storage

Pipeline
distribution

Onsite
electrolysis



Industrial use

- Desulphurization of fossil fuels
- Metal sintering and annealing
- Ammonia synthesis for fertilizers
- Plastic and solvent production
- Hydrogenation of oils

- Wide range of required volumes
- Typically low to medium pressure (from 1 to 50 bars)



Refuelling / Mobility

Ionic
compressor

350 bar

700 bar

Cryo
pump


300 bar
C_cH₂/LCH₂

300 to 1034 barg
4,000 to 15,000 psi

H₂ COMPRESSION & FIX STORAGE



Cylinder filling :

- Market used to HP globe valves :
 - O₂ adiabatic compression explosion risk avoidance
 - Slow to operate on-off = OPEX cost
 - Expensive
- Ball valves for H₂ : fast on-off & cost effective
- HABONIM's H₂ leakage-free Total Hermetix® 

Compressor output to storage tank :

- Ball valves up to DN50 / 2", welded

Pressures 350, 450, 500, 700, 900 barg
5000, 6000, 7000, 10,000, 13,000 psi



H₂ ROAD TRANSPORTATION




Configuration :

- Compressed 350 barg, trend to 700 barg
5,000psi, trend to 10,000psi
- Cylinder bundles on truck: 5x5, 4x4, 4x3...
- Europe imposes TPED certification -
Transportation Pressure Equipment Directive



Valves:

- Automatic ball valve per cylinder
- Cone & thread connection
- PN500, PN700, PN1000
7,250psi, 10,000psi, 15,000psi
- TPED type approval & "Pi" marking 





H₂ FUELLING

Pressure :

- CH₂ 300-350 bar / 4,500-5,000psi- trucks
- CH₂ 500 bar / 7,250psi – machinery & trucks
- CH₂ 700 bar / 10,000psi – cars
- Cold gas being filled

Fast filling : HP tank to vehicle

Standard filling: compressor to vehicle

Valves:

- Automatic ball valves
- Cone & thread connection
- PN400, PN700, PN1000
6,000psi, 10,000psi, 15,000psi
- ISO19880-3 type approval
- Leakage-free: efficiency & no hazard



Note: market used to stem leaking needle-valves due to past lack of alternative HP H₂ offering !

HYDROGEN HIGH PRESSURE VALVES HABONIM KNOW-HOW

H2 ball valves up to 1034 barg / 15,000psi



H29 – HYDROGEN PN700/PN1000 (10,000psi/15,000psi)



- Up to 15,000psi / 1034 barg
- Total Hermetix® with H2 double stem packing
- ISO15848-1 / API641 – fugitive emission
- TPED & ISO19880 type approvals @ 10,000psi / 700 barg
- Fire-safe



Robust,
proven
& cost
effective!



Total Hermetix™ |
 Port: Standard Port Full Port |
 End Connections: Threaded Cone & Thread

Maximum Working Pressure				
1/4"	3/8"	1/2"	3/4"	1"
1,034 bar (15,000psi)				

Temp.*	Valve Type	Design Type	Series	TH	Port	End Con.
	Ball (Quarter turn)	Threaded Body	H29	<input checked="" type="checkbox"/>	<input type="checkbox"/> <input checked="" type="radio"/>	<input checked="" type="checkbox"/> <input type="checkbox"/>

*Working temperature: -60°C - +260°C (-76°F ÷ +500°F)



H99 – HYDROGEN PN1034 (15,000psi)



- Up to 15,000psi / 1034 barg
- Total Hermetix® with double H2 stem packing
- ISO15848-1 / API641 – fugitive emission
- TPED type approval 15,000psi / 1034 barg
- Fire-safe



Fully certified TPED up to 1034 barg! 15,000psi

*Work in progress

Total Hermetix™ |
 Port: Standard Port Full Port |
 End Connections: Threaded Cone & Thread

Temp.*	Valve Type	Design Type	Series	TH	Port		End Con.		Maximum Working Pressure				
	Ball (Quarter turn)	Threaded Body	H99	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="radio"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1/4"	3/8"	1/2"	3/4"	1"
									1,000bar (15,000psi)				

*Working temperature: -60°C - +260°C (-76°F ÷ +500°F)

*3/4" & 1" size is with limited port



FUGITIVE EMISSIONS ISO 15848 & API 641



H₂: small molecule ; very flammable ;
lighter than air Hazardous prevention:

- Forced ventilation out of system
- Prevention of fugitive emissions
=> Specs on valves

ISO 15848-1 & API 641 are fugitive
emission Type Approvals:

- ISO 15484-1 is tested with He
- Ball valves are Class B: Leakage < 10⁻⁴
mg/second/meter of stem perimeter

ALL HABONIM VALVES ARE ISO 15848-1 & API 641 CERTIFIED

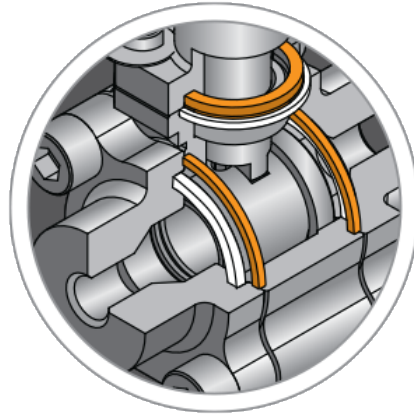


LEAK TIGHTNESS – HABONIM TOTAL HERMETIX®

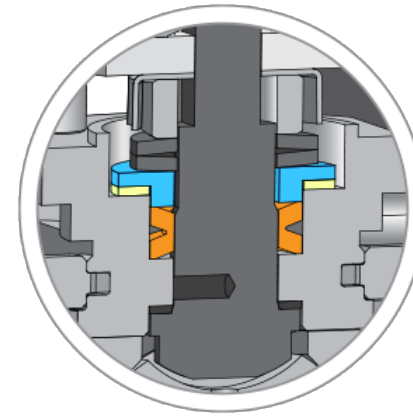


500,000 on-off cycles
w/o refurbishing :
ISO 15848-1 CO5 level

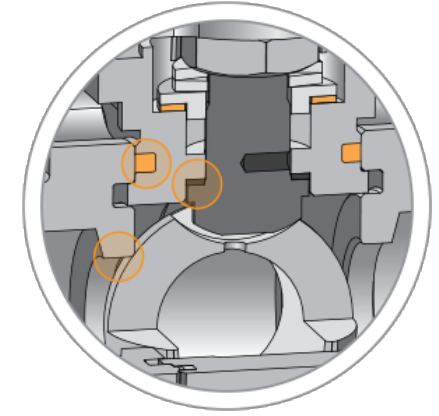
< 10^{-6} mbar x l/s
vacuum He tightness !



Double Body
Sealing



HermetiX Zero
Fugitive Emissions
No Maintenance
Stem Sealing



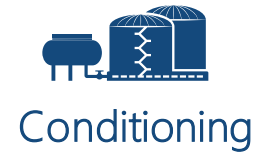
Fire Safe

Inline Superior Sealing

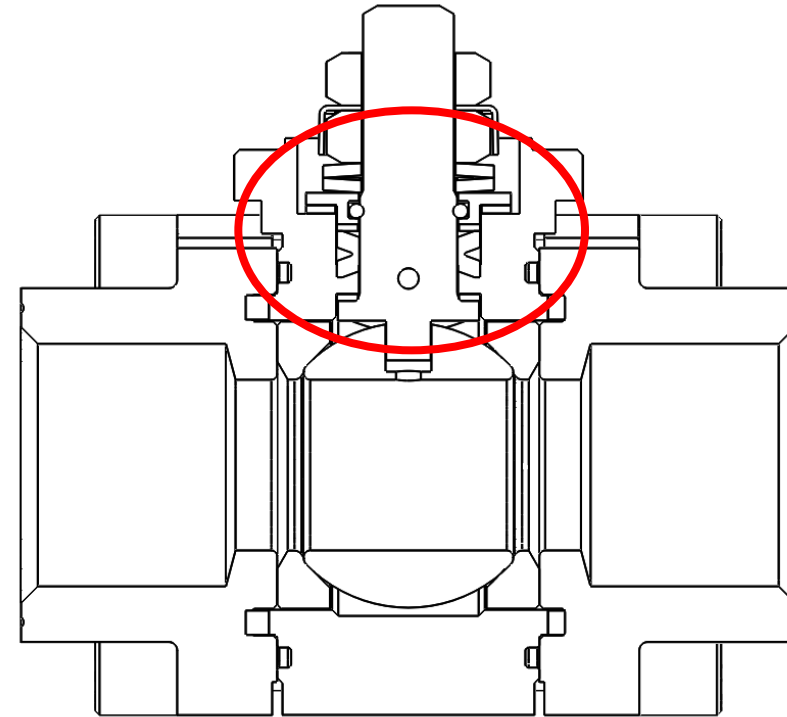
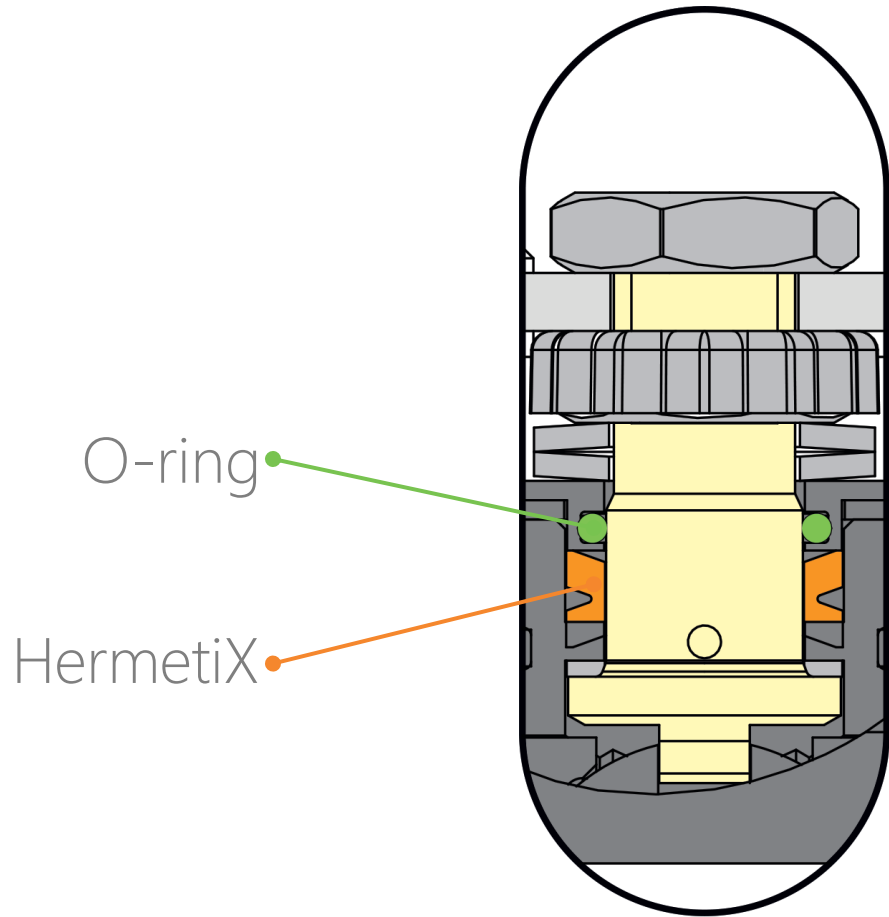
Habonim Quality



HABONIM H₂ DOUBLE STEM PACKING



Double stem sealing



TPED TYPE APPROVAL



TPED – Transportation Pressure Equipment Directive

Applies to road, rail and inland waterways in EU

H29 : TPED 700 bar (10,000psi)

H99 : TPED 1034 bar (15,000psi)



TPED Type Approval Tests :

- Resistance to impact
- Static test: shell, seat leak bi-directional, stem and body gaskets leak test
- Dynamic tests: low & high pneumatic seat tightness both directions x 2 times
- Cycling test
- Dynamic tests: low & high pneumatic seat tightness both directions x 2 times

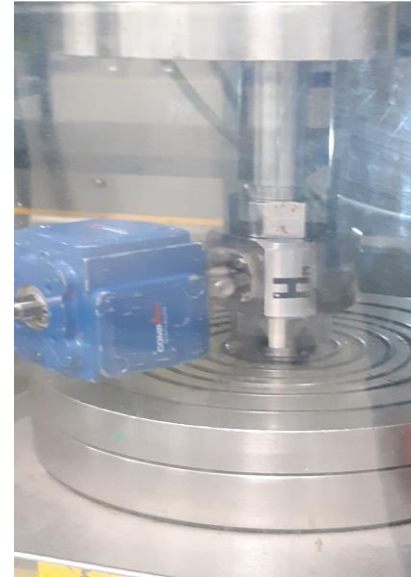


ISO 19880-3 : H₂ GAS, FUELLING STATIONS, VALVES

Extremely strict test regimes...



100,000 Cycles
Under Pressure



Pressure Tests
valve rating x 2

Side loads & more...

Internal tested with ^2He
Helium

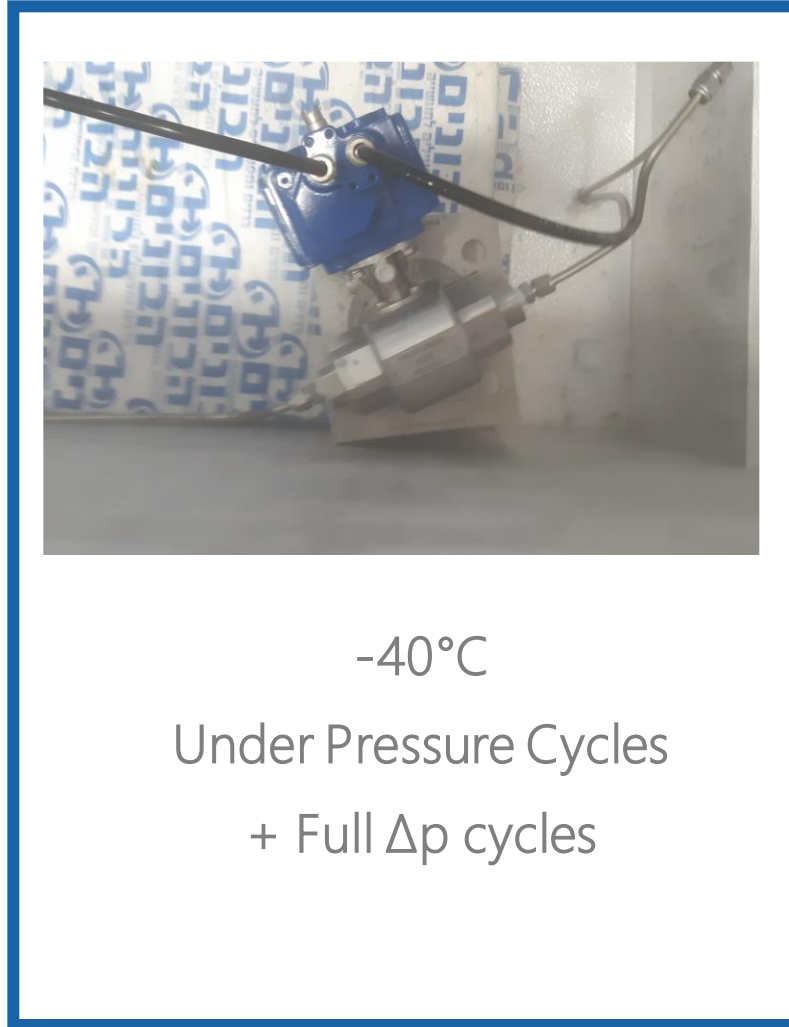
ISO 19880-3 : H₂ GAS, FUELLING STATIONS, VALVES

Extremely strict test regimes...



100,000 Cycles
Under Pressure

Side loads & more...



-40°C
Under Pressure Cycles
+ Full Δp cycles



Pressure Tests
valve rating x 2

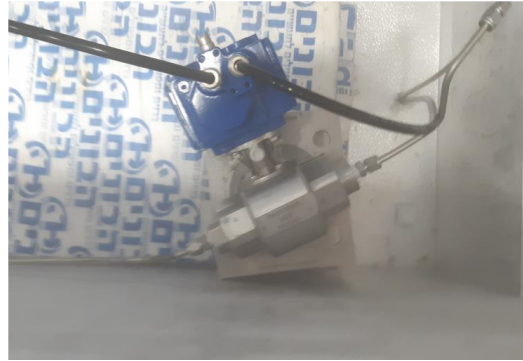
Internal tested with ²He
Helium

ISO 19880-3 : H₂ GAS, FUELLING STATIONS, VALVES

Extremely strict test regimes...



100,000 Cycles
Under Pressure



-40°C
Under Pressure Cycles
+ Full Δp cycles



+80°C
Under Pressure Cycles
+ Full Δp cycles



Pressure Tests
valve rating x 2

Side loads & more...

Internal tested with ²He
Helium

HABONIM VALVE RANGE FOR HP HYDROGEN

Overview



H₂ FULL VALVE RANGE



- H₂ STEM PACKING
- ISO15848 & API 641

Quick Selection Table

Total Hermetix™ | **Port:** Standard Port Full Port Tube Size
 Ordering Code | **End Connections:** Threaded Cone & Thread Flanged Welded

	Category	Ball Valve	Design Type	OC	Series	TH	Port	End Con.	Valve Size (Inches)																MWP (ANSI Class)	TPED Certified	ISO19880				
									1/4	3/8	1/2	9/16	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	6	8	10	12				14	16		
Temperature: -60°C - +260°C (-76 °F ÷ +500 °F)	High Pressure	Trunnion	Threaded body		H99						1,034bar (15,000psi)																900/600/300/150	Yes	In progress		
			3 Piece		H96							2500																900/600/300/150	No	No	
			3 Piece		H95							1500																900/600/300/150	No	No	
		Floating	Threaded body		H29							1,034bar (15,000psi)																900/600/300/150	No	No	
			Threaded body		H24								700bar (10,000psi)																900/600/300/150	Yes	Yes
			3 Piece		See Industrial							500bar (7,250psi) with TPED - Class 2500																900/600/300/150	Yes*	Internal test pass certification to-do	
	Industrial Use	Trunnion	3 Piece		See Industrial							2500 / 1500																900/600/300/150	No	No	
			2 Piece									900/600/300/150																900/600/300/150	No	No	
		Floating	3 Piece										900/600/400/300/150																900/600/300/150	No	No
			2/1 Piece										300/150/PN40/PN16																900/600/300/150	No	No
			DS/DBB										600/300/150/PN16																900/600/300/150	No	No
			Multiport / Diverter										600/300/150																900/600/300/150	No	No
			Control		See Control								900/400/300/150/PN40/PN16																900/600/300/150	No	No

H₂ HP RANGE



- H₂ STEM PACKING
- ISO15848 & API 641

Family	Series	Sizes	Pressure rating	TPED Certified	ISO19880 Type Approved	Connections	Desing
Hydrogen use	H99	¼" – 1"	1,034 bar 15,000 psi	Yes	In progress	Thread & cone Threaded	Trunnion
	H29	¼" – 1"	700 bar 10,000 psi	Yes	Yes	Thread & cone Threaded	Floating soft seated
	H24	¼" – 1½"	500 bar 7,250 psi	Yes Class #2500	In progress	Threaded Compression fitting	Floating soft seated
	H28	¼" – 6"	#2500 420 bar 6,000 psi	No	No	Welded Threaded Custom	Floating hybrid seated

CASE STUDIES & REFERENCES



VALENCIA PORT – H₂ MULTIPRESSURE DISPENSER

- PN1000 design - H29 valves
- Valves control which bottle comes H₂ from and cut input to Coriolis & dispenser
- 300 bar – 500 bar – 1000 bar dispenser
4,300 psi – 7,250 psi – 15,000 psi
- Selectable pressure
- Builder: CALVERA



GERMANY – H₂ INTEGRATED DISPENSER

- PN400 & PN700 - H24/H29 valves
5,800 psi & 10,000 psi
- Valves integrated into H₂ dispenser
- Germany
- Builder: INFASERV (Germany)



GERMANY – PN1000 ACTUATED H₂ VALVES – CYLINDER FILLING



TEYSEN

- Application: filling station
- Service pressure: 1000 bar
15,000 psi
- Valve: 24 (H29) series PN1000
15,000 psi



CASE STUDY – 700 bar (10,000psi) H₂ TRUCKS

- 26 valves H29 per each truck
- PN700 (10,000psi) TPED certified
- 3/8" cone & thread connection
- C30 Compact Habonim high-cycling actuator => 3 million cycles mechanical lifetime!

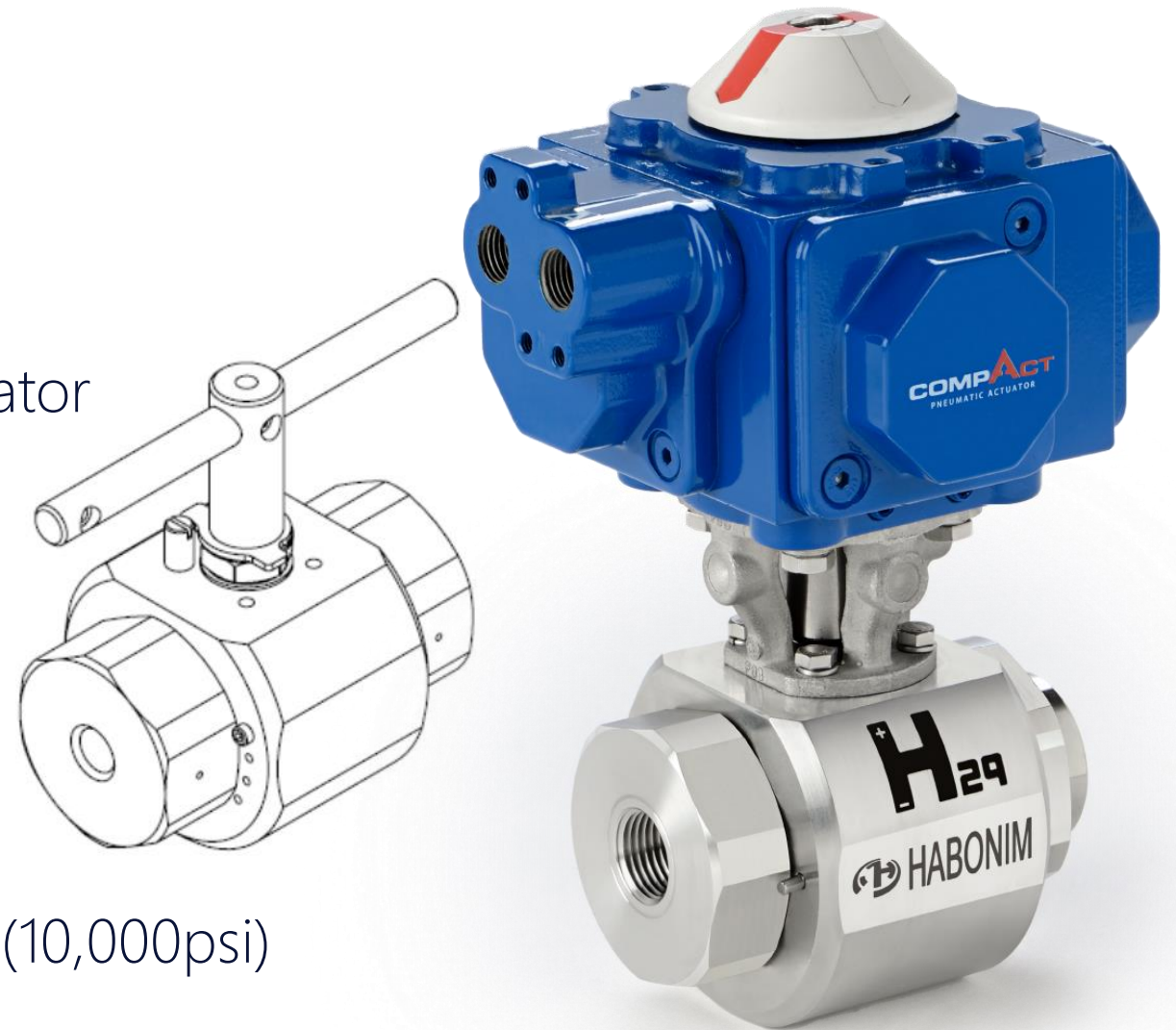
First unit out of 50 under construction

Sorry, project cannot be disclosed!

Why HABONIM?

Unique solution

Several projects with prototype H24 PN700 (10,000psi)



H₂ REFERENCES

nel

MS2
FOR GREAT RESULTS

 **CALVERA**
Hydrogen

 **H**
Centro Nacional del
Hidrógeno

A
AREVA

 **Air Liquide**

H₂PRO

CIMC ENRIC

 **ESI**
Technologies Group
Process Equipment Specialists

HDT
MOTHES
Hochdrucktechnik

 **HYGEAR**

 **infraseriv**
höchst

 **THEISEN**
VERSORGUNGSTECHNIK

And more...



Performing In Demanding Applications

