

# Cylinder Valves for Automotive Hydrogen Applications



**CAVAGNA group**

Wherever gas is used, we are there

## HP1 - 350 bar Hydrogen REMOTE TPRD



**IN/VENT ports:**  
9/16" - 18 UNF-2B

**High-flow TPRD:**  
vented, glass bulb T=110±5°C

**Certifications:**  
ECE R134

## HP1 - 350 bar Hydrogen END PLUG TPRD



**Tank connection:**  
2" - 12 UN or  
1 1/8" - 12 UNF

**Vent Port:**  
9/16" - 18 UNF-2B

**High-flow TPRD:**  
vented, glass bulb T=110±5°C

**Certifications:**  
ECE R134

# HS1 - Solenoid Hydrogen Valve

Pa - H<sub>2</sub>



## Lightweight aluminum High-flow valve:

CV: 0.86  
Fast-filling: full flow at ultra low tank pressure  
See graph for flow vs valve dP

## High-flow excess flow valve:

No impact on filling flow  
Easily calibrated  
Auto reset

## High-flow TPRD:

vented, glass bulb T=110±5°C

## Pressure sensor port option:

SAE/ORB

## Low-torque/high-flow bleed valve:

Drive vehicle or drain tank  
Life > 100 cycles

## Live port: for remote PRD:

For optional remote PRD or sensor  
IFS format (ø 6 mm or ø 8 mm)

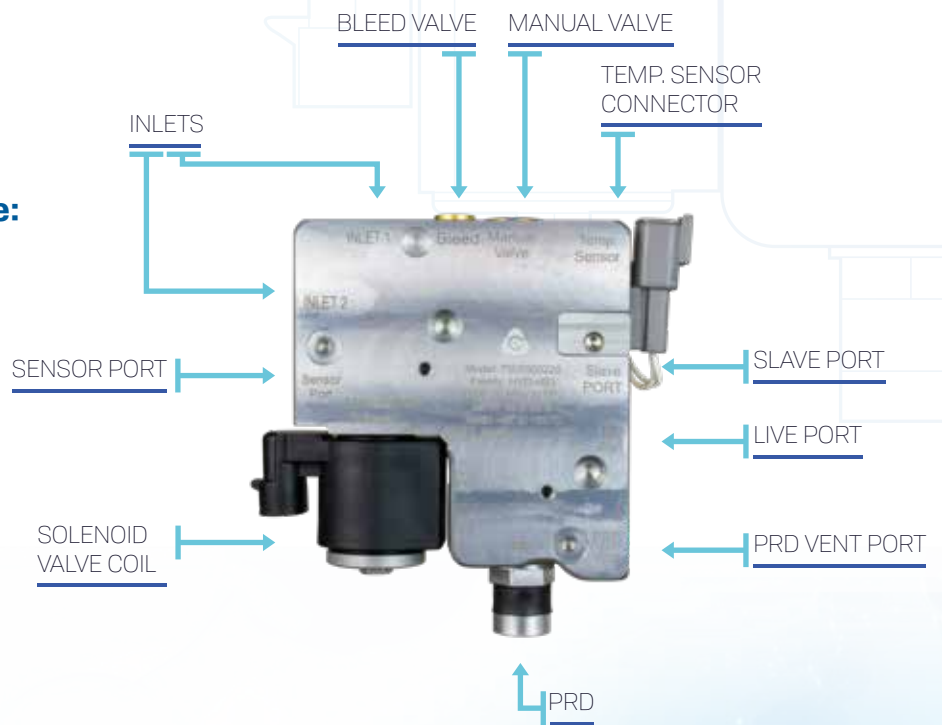
## Temperature sensor

## Total Mass:

1072g

## Certifications:

ECE R134

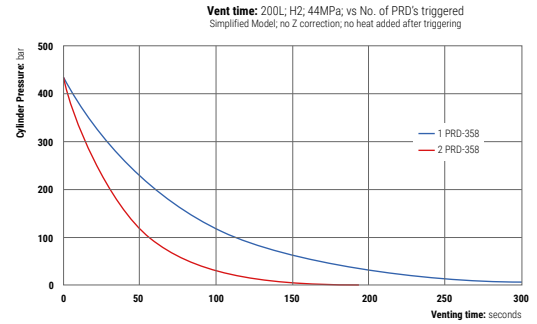




# HS1 - Solenoid Hydrogen Valve

## PRD vent time model

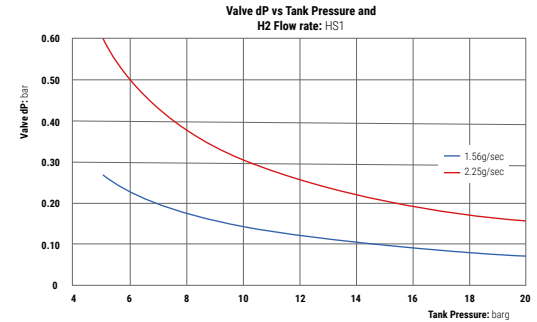
- Vent time directly related to number of PRD's triggered
- PRD meets hypothetical 5 minute goal on 200L tank



## Low-pressure valve performance

### Valve has capacity for full power performance at ultra-low pressures

- Avoids limp-home modes in low-fuel "emergencies"
- No flow loss at 5 barg (tank pressure)
- Valve has extra capacity in case higher demand fuel cells considered for future ECEV's



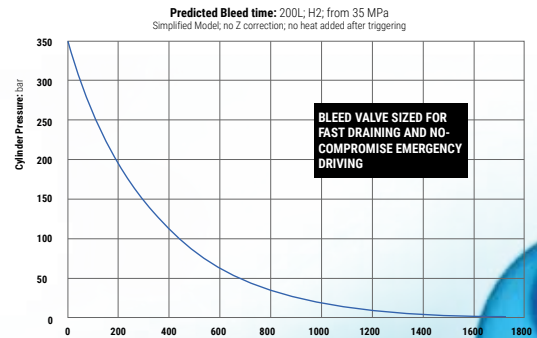
## Bleed-valve performance model

### Vent mode

- Fastest possible vent time (35 to 0.15 MPa) is 28.8 minutes if valve kept at full flow and outlet is unrestricted

### Driving mode

- Solenoid by-passed
- 1.4g/sec available at very low tank pressure (no limp-home mode needed)



Bleed Valve dP at 1.4 g/sec	
P <sub>tank</sub> (barg)	dP (bar)
5	1.63
10	0.69
15	0.46
20	0.34