



**PRESSURE TECH**



# White Paper:

Delivering the Hydrogen Economy with Safe and Reliable Hydrogen Refuelling.

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# Introduction

For some time now, the hydrogen economy has faced a classic conundrum often referred to as the age-old question of the chicken and the egg: which comes first, is it the infrastructure or is it the demand?



## SECURING INVESTMENT

It has been difficult to justify the investment needed to deliver hydrogen production and refuelling stations when the demand that will create a return on investment doesn't really exist at the scale required. On the flip-side, end users are reluctant to purchase hydrogen vehicles when there isn't the network needed to efficiently support them.

## A GLIMMER OF LIGHT?

We have started to recognise a shift and acceptance that the infrastructure must come first and be ready to

support the growing demand of a hydrogen economy, that is beginning to be delivered with thanks to government investment and legislations such as the Alternative Fuel Infrastructure Regulation, or AFIR.

The aim of AFIR is to accelerate and standardise the development of both the electric charging and hydrogen refuelling infrastructure across the EU. For hydrogen, a publicly accessible hydrogen refuelling station, or HRS, must be constructed with a maximum distance of 200km between them along the TEN-T core network by the end of 2030.

## What is the TEN-T?

The Trans-European Transport Network (TEN-T) is a planned EU-wide network of railways, inland waterways, short-sea shipping routes, and roads linking ports, airports, and railway terminals across the EU.

With less than **6 years** to meet **AFIR**, we all have our part to play in ensuring this important objective is met.

# Key Piece of the Puzzle

## SAFETY FIRST

A key consideration in the establishment of a growing hydrogen refuelling infrastructure is safety.

To refuel a vehicle safely, it is crucial the high-pressure compressed and stored hydrogen gas is delivered into the vehicle's hydrogen cylinders in a controlled way. The control is achieved using pressure ramp rates, where the high-pressure hydrogen from the HRS is reduced to as little as 20 bar and then gradually increased to either 350 bar or 700 bar, depending on the vehicles storage system.



## SAE J2601

To facilitate this pressure control – reducing stored high-pressure to low-pressure and then increasing again – a pressure regulator is required. The pressure regulator must be remotely controllable to allow for the gradual pressure ramp-up to fill the vehicle safely and in accordance with industry standards, such as SAE J2601.

### What is SAE J2601?

The SAE J2601 standard sets out protocols and process limits for the hydrogen fueling of light duty vehicles. It covers things such as the fuel temperature, maximum flow rate, rate of pressure increase and final pressure.

The importance of adhering to this standard cannot be over stated. At such high pressures — and particularly at 700 bar pressure — it is critical all components within the HRS are designed with the utmost care and consideration.

## PRESSURE REGULATORS

The dynamic nature of the hydrogen refuelling process, coupled with the unique characteristics of hydrogen gas, necessitates specific criteria that regulators must adhere to. These criteria ensure efficiency, safety, and reliability throughout the refuelling process.

Material selection plays a pivotal role in ensuring the regulator's reliability and safety, where both internal and external material properties must be compatible with hydrogen to prevent hydrogen embrittlement. Additionally, they must withstand extreme high pressures associated with hydrogen refuelling and operate across a wide temperature range, from as low as -40°C to +80°C or more.

For optimal performance, the regulator must also be able to facilitate the flow of hydrogen at high rates – up to 120 grams per second, enabling fast and efficient refuelling

This is what Pressure Tech's RF1034 regulator was designed to do and is already being widely used by our customers who are at the forefront of delivering the hydrogen economy with their hydrogen refuelling stations.

# RF1034

## THE SOLUTION?

The RF1034 is a piston-sensed regulator designed and manufactured by Pressure Tech. Every aspect of its construction has been considered with hydrogen refuelling in mind.

Balanced main valve design for accurate pressure control.

Cv 0.5 or 1.0 refuelling times comply with SAE J2601.

1,034 bar max. working pressure easily caters for 350 bar and 700 bar applications.

High-quality materials, including a stainless steel body, offer reliability, longevity and performance.

Designed to industry standards like ISO 19880-3 ensures compatibility with new and existing HRS.

Pneumatic and electronic control options allow for flexibility in system design and enable pressure ramp-up in line with industry standards.



## SUMMARY

Initiatives such as the Alternative Fuel Infrastructure Regulation give confidence to private companies, such as Pressure Tech, to make significant time and monetary investments to develop and launch the products required to establish the Trans-European Transport Network, and more generally, to grow the hydrogen economy as a whole.

By prioritising infrastructure development and incorporating regulators like the RF1034, Pressure Tech and our partners are paving the way for a more sustainable future through the adoption of hydrogen as a clean energy solution.

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