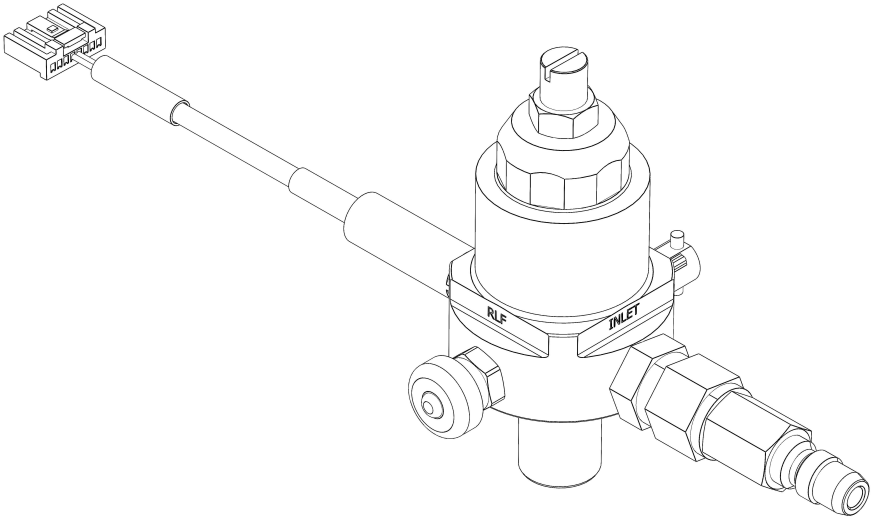




IE-SOAR™



Lightweight Hydrogen Regulator

User Manual

Users must read all instructions provided and retain the manual for future reference

Document No: 10010368

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The Lightweight regulator is constructed using a Pressure Tech LW351 regulator with fuel-cell specific modifications, for more information on the LW351 please refer to the Pressure Tech service manual at bit.ly/3lgDeOx

Intelligent Energy's Lightweight Pressure Regulator (LPR) has been designed in accordance with sound engineering practice of the United Kingdom. The LPR complies with the provisions of article 4, paragraph 3 of the Pressure Equipment Directive (PED 2014/68/EU).



The CE label shows that the product complies with the basic requirements of the applicable directives. For the declaration of conformity contact the manufacturer at servicing@intelligent-energy.com



- Only qualified technicians trained in high pressure flammable gases must carry out fitting of regulators and filling of cylinders, and do so in accordance with local laws and Health and Safety (H&S) regulations.
- The customer is responsible for ensuring all technicians and pilots are suitably trained, accredited and in compliance with local laws and H&S regulations.
- The customer is responsible for ensuring the safe operation of the Lightweight Hydrogen Regulator.
- Do not open or dismantle the Lightweight Hydrogen Regulator.
- Do not remove any external covers or cowlings.
- Pressurised hydrogen present. Highly flammable!
- Do not use the Lightweight Hydrogen Regulator if the unit is damaged.
- The Lightweight Hydrogen Regulator should be inspected for damage and leak checked prior to use.



When shipping or transporting your Unmanned Aerial Vehicle and Fuel Cell Power Module (FCPM), the FCPM must always be disconnected from the hydrogen source.

When transporting pressurised gas check for relevant local regulations.

This user manual is intended as a general guidance only and does not purport to address the specific situations that could potentially arise from the use of the Lightweight Hydrogen Regulator with pressurised hydrogen systems and their usage in connection with UAVs. The recipient is responsible for ensuring that all personnel have read and understood this User Manual before being allowed to handle, operate, install and store any equipment supplied by Intelligent Energy.

The recipient must ensure that any personnel responsible for handling the Lightweight Hydrogen Regulator with hydrogen cylinders and operating UAVs are suitably trained and certified in compliance with any applicable local, state and federal laws and regulations and good industry practice. The recipient is responsible for complying with any relevant health and safety policies and procedures that may apply to the operation of UAVs and use and storage of hydrogen on any sites.

Intelligent Energy warrants to the recipient and it will repair and replace any defective equipment resulting from the authorised use of the equipment provided, in accordance with the warranty terms. Notwithstanding the above, Intelligent Energy, to the fullest extent permitted by law, accepts no liability (including liability in respect of any error or defects in the Lightweight Hydrogen Regulator) for any damage caused as a result of Recipient's unauthorised use of the equipment provided. The recipient acknowledges that the manner in which the equipment is stored, used or operated is not under the control of Intelligent Energy Limited.

Intelligent Energy has made every effort to ensure that this User Manual is accurate and disclaims liability for any inaccuracies or omissions that may have occurred.

2 Lightweight Hydrogen Regulator

2.1 Product Overview

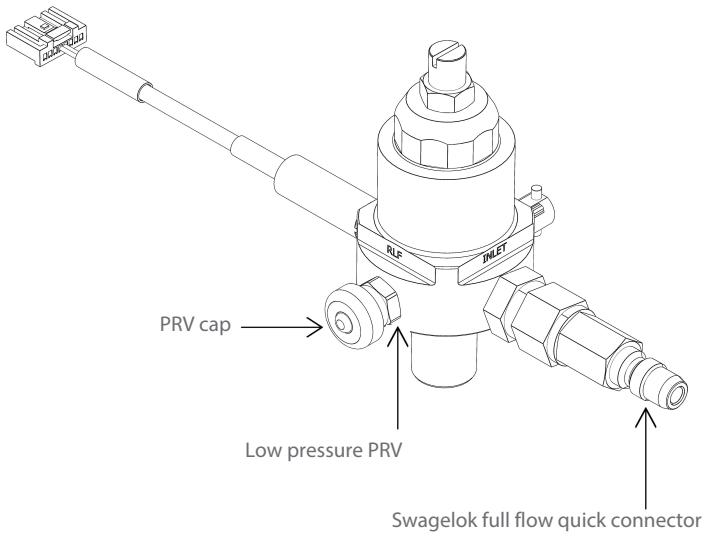
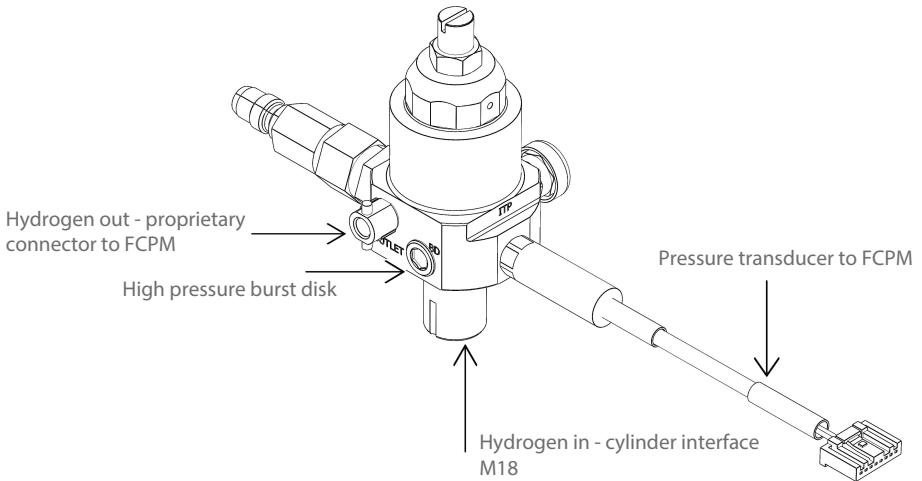
The Lightweight Hydrogen Regulator has been designed for use with the Intelligent Energy IE-SOAR FCPMs. It is intended to provide the necessary pressure regulation and safety features required to operate an IE-SOAR FCPM. The Regulator has been designed to meet relevant safety standards. It is designed to operate with compressed gaseous hydrogen.

2.2 Product specification

Hydrogen Regulator	Mass	315g
	Maximum regulator (cylinder) pressure	300 or 350 Bar/4350 or 5075 PSI*
	Output pressure	0.9 Bar \pm 0.1 Bar/13 PSI \pm 1.5 PSI
	PRV set pressure	2 Bar/29 PSI
	Burst disc set pressure	427 or 491 Bar/6190 or 7120 PSI*
	Cylinder interface	M18 \times 1.5
	Maximum cylinder mass	10kg

* Configuration dependent on maximum cylinder operating pressure.

2.2 Main components



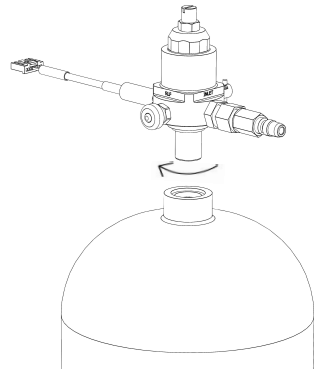
3 Assembly and connection

3.1 Assembly of regulator to cylinder

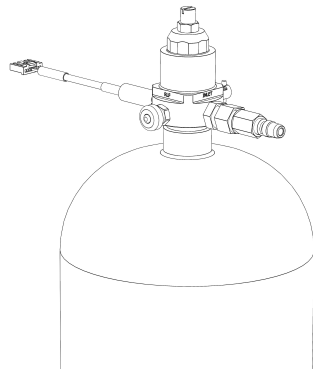


- Take the cylinder and regulator and inspect for physical damage or debris, reject if visible to the eye.
- Inspect the mating threads for damage or debris, reject if visible to the eye.

- 1 By hand, carefully thread the regulator assembly into the cylinder.



- 2 Tighten the regulator until it is mated flush to the neck of the cylinder.



- 3 Once the regulator is flush, apply a maximum torque of 58Nm (42.8ft.lb).
- 4 Always conduct a leak check on the completed assembly.



- 5 **Prior to operation the cylinder will need to be purged to remove air impurities. Contact Intelligent Energy for further information.**

3.2 Filling of cylinder

Only qualified technicians trained in high pressure and flammable gases can carry out fitting of regulators and filling of cylinders, and do so in accordance with local laws and Health and Safety (H&S) regulations.

A leak check must be conducted after filling the cylinder.

The female swagelok part number is SS-QF4-B-4PF. This part must be a constituent of the equipment used to fill the HFLW regulator.

Consult local H&S / facilities management for guidance on storage of cylinders and advisable safety equipment.

3.3 Hydrogen fuel

When installing and operating hydrogen systems, hydrogen general safety guidance should be considered, for more detailed information see:

ISO/TR 15916 – Basic considerations for the safety of hydrogen systems

Hydrogen purity is an important consideration for fuel cell performance, it should comply with the specification in the table below for best performance:

Fuel Characteristics	Fuel Requirements
Hydrogen concentration	> 99.90 %
Nitrogen, Helium, Argon	< 0.10%
Oxygen	< 50 ppm
Carbon Dioxide	< 2 ppm
Carbon Monoxide	< 0.2 ppm
Ammonia	< 0.1 ppm
Sulphur containing compounds	< 4 ppb
Max particle concentration	< 1 mg/kg
Max particle diameter	< 75 µm

For more details about hydrogen quality see the user manual for your FCPM or contact Intelligent Energy Product Support, see Section 6

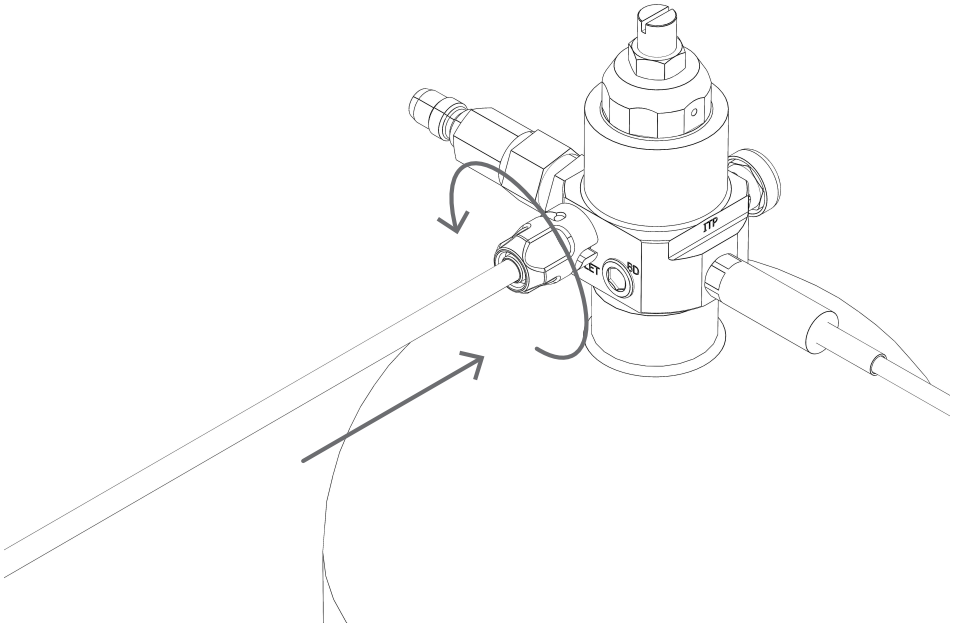
3 Assembly and connection

3.4 Hydrogen connection

The Lightweight Hydrogen Regulator is designed to be connected to an Intelligent Energy FCPM, please refer to the FCPM user manual for details of how to make the hydrogen connection to that unit.

Ensure the hydrogen cylinder and FCPM are securely mounted before proceeding.

- 1 Verify that the connector O-rings are in place and free from damage or debris.
- 2 Align the hose connector path with the regulator pins.
- 3 Push the hose connector and twist anti-clockwise. It will click when located.



There are multiple ways to fill cylinders and Intelligent Energy has application notes available for some fill options. Contact Intelligent Energy Product Support at servicing@intelligent-energy.com for details.

5 Troubleshooting

Symptom	Reason(s)	Action
High H ₂ pressure fault	Gas pressure regulation fault	Contact Intelligent Energy Product Support
Low H ₂ pressure fault	No hydrogen supplied from cylinder Cylinder is empty Gas pressure regulation fault	<ol style="list-style-type: none"> 1. Check cylinder pressure, refill if needed 2. Inspect the pressure transducer cable Replace if damaged <p>If the steps above do not resolve the issue, contact Intelligent Energy Product Support, see Section 6</p>
Loss of cylinder pressure	Leak between cylinder and regulator Leak from the regulator	<ol style="list-style-type: none"> 1. Place cylinder and regulator in a well-ventilated space, preferably outdoors 2. Purge the gas from the cylinder by lifting the cap of the PRV, see diagram in section 2.2 3. When the cylinder is empty. A person trained in the use of pressurised gas should remove the regulator from the cylinder and inspect the sealing o-ring. Replace if damaged 4. Reassemble and refill the cylinder 5. Check for leaks <p>If the steps above do not resolve the issue, contact Intelligent Energy Product Support,</p>

6 Contacting Intelligent Energy Product Support

For all other issues and questions please contact your local Intelligent Energy representative or the Product Support team by email servicing@intelligent-energy.com

7 End of life treatment and disposal



When the Lightweight Hydrogen Regulator or cylinder reaches end of life please contact Intelligent Energy for support with reconditioning or disposal at servicing@intelligent-energy.com



T +441509 271 271 **E** servicing@intelligent-energy.com

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Published by: Intelligent Energy Ltd, Charnwood Building, Holywell Park, Ashby Road, Loughborough LE11 3GB. Tel: +44 (0) 1509 271 271

Document No: 10010368

(Registered in England with company number: 03958217).