



July 24, 2020

# Enapter Service Bulletin #1

## About this document

The Enapter Service Bulletin is a new activity started by Enapter in July 2020 as part of our scale-up and continuous improvement process. In the Service Bulletin, we will periodically summarise new features and development for existing products, and up-to-date recommendations to achieve the highest levels of operational performance and safety using our hydrogen generation systems and EMS. Service Bulletins will be released to all system integration partners operating relevant Enapter equipment. It will always be released on a dedicated page on the Enapter Handbook, and on occasion may also be distributed by email to all customers when there is a high relevance or safety-critical information. This first Service Bulletin is sent by email to ensure everyone is informed about the existence of the Service Bulletins.

## 1. Production Rate

### Description

Starting from July 2020, all Enapter electrolyser systems will have a minimum production rate of 300 NL/h in steady production mode, regardless of the number of modules used. Each individual module will be able to be dynamically ramped from 60% – 100%. The minimum power consumption during steady operation at the lowest setpoint is approximately 1.4 kW. This change minimises an inherent operational safety risk: There is always a small amount of hydrogen crossing over from the pressurised hydrogen side to the oxygen side, which is at atmospheric pressure. The change further limits the maximum hydrogen concentration in the oxygen vent outlet to always be below 3%. There is no change to the installation instructions – the oxygen vent must still be unobstructed and lead to a dedicated safe area free of any ignition sources.

The modularity of Enapter's AEM electrolyser ensures an extremely high level of flexibility in the production rate. For example, a 10 Nm<sup>3</sup>/h electrolyser system made of 20x EL 2.1 can be ramped dynamically between 0.3 – 10Nm<sup>3</sup>/h, or 3% – 100%.

### Actions required

The change will be rolled out to all EL 2.1 via OTA FW update.

All customers operating EL 2.0 and making use of the variable production rate feature should contact Enapter Support ([support@enapter.com](mailto:support@enapter.com)) to perform a FW update using remote assistance.

## 2. Vent Line Management

### Description

The vent line of the electrolyser allows oxygen gas to freely flow from the EL to a safe area for release into the atmosphere. In systems with multiple EL units connected together, the vent lines are typically simply connected together, bundling the flow of oxygen into a single point of release when all systems are fully operational. Currently, the flow of oxygen is completely unrestricted. Potentially a stream of oxygen from one operating EL module can enter into another EL that is in standby mode (not generating gas). If the passive device does not have its ventilation fan switched on, a potential leak in its vent line or internal process tank may not be diluted. Enapter now requires the installation of a check valve on the vent outlet piping on all existing EL 2.0 and EL 2.1 produced before July 2020 to mitigate this risk.

### Actions required

Enapter will make every effort to reach out to all customers and will provide suitable check valves for every installation that needs them.

This action is required for all systems where the vent line is shared among multiple EL or other devices.

### 3. Clean Water

#### Description

We have studied the occurrence of a sudden deterioration of the output water quality of the Water Purification System (WPS) after some time of operation that was observed in the field and in our factory when directly connected to the EL without a clean water buffer tank. The WPS Enapter is currently using and supplying doesn't have an active output water quality monitoring and flushing system and is prone to failure with frequent start and stops. As is common with water filtration devices, at every startup, it also needs about 10 seconds to reach the optimal stable water conductivity. Therefore, Enapter recommends the use of the WTM to act as a buffer and helps to avoid frequent start and stops, preserving the water quality and the water filtration cartridges. Our data indicates that CO<sub>2</sub> in the refill water can quickly degrade the electrolyte solution in the electrolyser. Depending on the filtering system, the CO<sub>2</sub> is caught by the resin filter initially, but then tends to be released suddenly out of the resin filter as it gets exhausted and catches the stronger ions instead. This can be easy to miss without continuous and careful monitoring. When the electrolyser stack performance suffers, it is too late, and the electrolyte needs to be replaced in addition to the water filters.

#### Actions required

There are no immediate actions required. We recommend our customers to monitor the water quality supplied to the electrolysers carefully, and to consider the installation of a WTM or other clean water tank.

### 4. Power Consumption

#### Description

Enapter has reassessed how we declare the power consumption of our machines. There are several factors that contribute to this. First, in the final release of the EL2.1, we decided to update some internal electronic components that promise to have a longer lifetime and better reliability. Based on electrochemical degradation, we expect a stack lifetime of >30k hours. We chose components of the EL2.1 in order to achieve this target. Second, we prefer to provide realistic values that can be demonstrated in normal on-site conditions, not only in perfect conditions in the lab (air-condition!).

With the current AEM electrolyser we need 4.8 kWh to produce 1 Nm<sup>3</sup> of hydrogen. That means it takes 53.3 kWh to produce 1kg of hydrogen (compressed at 35 bar and with a purity of ~99.9%). 1 kg of hydrogen contains 33.33 kWh / kg (lower heating value), i.e. our electrolyser already has an efficiency of 62.5%. It is important to compare apples with apples: power input, hydrogen production, pressure and purity. These are very different for different manufacturers. System efficiencies (not stack efficiencies) need to be compared.

#### Actions required

No actions need to be taken. Enapter will update all data sheets and product documentation.