Q: What is the difference between the 600 and the 620 Electrolyzer Test Systems? Can both be used for PEM and AEM water electrolysis using high purity water or KOH as the feed stock?

A: The primary difference between the 600 and the 620 ETS is the plumbing. The 600 ETS has a single tank and pump for the liquid feed stock that is dedicated for the Positive (Anode, O_2) side. As such, the 600 ETS is intended for Proton Exchange Membrane (PEM) water electrolysis with high purity water as the feed stock.

As shown below, water is consumed at the Anode in a PEM electrolysis cell. In contrast, in an AEM cell, four (4) water molecules are consumed at the Cathode and two (2) produced at the Anode for every O_2 molecule produced during water electrolysis. In both cases, there is a net consumption of two water for every two H_2 and one O_2 molecule generated.

		PEM	AEM
Anode	Positive	$2H_2O \rightarrow O_2 + 4H^+ + 4e^-$	$4OH^- \rightarrow 2H_2O + O_2 + 4e^-$
Cathode	Negative	$4H^+ + 4e^- \rightarrow 2H_2$	$4\ H_2O + 4e^- \rightarrow 4OH^- + 2H_2$
Overall		$2H_2O \rightarrow O_2 + 2H_2$	$2H_2O \rightarrow O_2 + 2H_2$

As such, in AEM water electrolysis, it is common to feed water, or KOH solution, to the Negative side, to the Positive side or to both sides. For this reason, the 620 ETS has two tanks and two pumps to facilitate controlled feed of liquid to either or both sides of the cell. The 620 ETS also uses KOH-compatible pumps by default. The figure below shows the plumbing and other significant components of the 620 ETS.

Because the 620 ETS has two tanks and may be used with feed stock other than DI water (*e.g.*, KOH solution), two Electrolyte Maintenance Activities may be required:

1. Negative and Positive Feed Tank Solution Level Adjustment – Water consumption and net transfer within the cell is complex and can lead to one tank gaining solution over time and the other tank level dropping over time. As such, periodic Solution Level Balancing is required and consists of manually flipping a single switch that opens a solenoid valve that effectively connects to the Positive and Negative Tanks and permits the solution levels to balance out under gravity feed. Small pressure differences will cause the solution levels to not balance properly.

2. Solution Concentration Balancing – In an AEM cell, water is consumed at the Cathode (H_2) and produced at the Anode (O_2). This, combined with water

transfer with the cell, can lead to changes in the KOH concentration over time, with the Negative side solution getting more concentrated and the Positive side solution getting less concentrated (this is our experience, different water transfer rates within the cell could lead to the other outcomes). Solution Concentration Balancing is a periodic maintenance activity the involves manually flipping a single switch that opens two normally-closed solenoid valves and turning on a dedicated Recirculating Pump that forces solution from one tank to the other while allowing gravity to balance out the tank solution levels.

The 620 ETS is therefore more suited to AEM water electrolysis than the 600 ETS.

Please note that at this time, the 620 ETS does **not** include KOH concentration monitoring capability. That is something that the end-user provides if they think it is necessary.

620 ELECTROLYSIS TEST SYSTEM – FOR PEM & AEM