



BekkTech Membrane & Single-Cell Test Systems

The BekkTech Membrane & Single-Cell Test Systems allow you to measure several parameters for comparison to targets set by the organizations funding & monitoring membrane research, including the following:

A Few Of The Current Targets Set By Funding & Monitoring Organizations		
Organization	Test	Target
U.S. Department of Energy HTMWG	In-Plane Conductivity Test at 30C	70 mS/cm at 80% RH
U.S. Department of Energy HTMWG	In-Plane Conductivity Test at 120C	100 mS/cm at 50% RH
U.S. Freedom Car	Hydrogen Crossover Testing	2 mA/cm ²
U.S. Freedom Car	Open Circuit Testing	500 hours

BekkTech Systems Are Designed For The Following Tests				
Membrane & Single Cell Test Capabilities	BT-512	BT-512MX	BT-552	BT-552MX
In-Plane Membrane Conductivity Testing (40°C to 120°C) Obtain quick bulk conductivity measurements on your pure membrane sample at a range of relative humidities and temperatures. The variables introduced by MEA components are eliminated.	✓	✓	✓	✓
In-Plane Membrane Conductivity Testing (30°C to 40°C)		✓		✓
Through-Plane Conductivity Testing (40°C to 120°C) Assemble your membrane into an MEA for through-plane conductivity testing.	✓	✓	✓	✓
Activation Energy / Transition Temperature Testing Test at a given relative humidity and changing temperatures. Use this test to determine the Activation Energy of your sample. This test also gives evidence of the material transitions associated with temperature and relative humidity.	✓	✓	✓	✓
Hydrogen Crossover / Permeability Testing Compare the hydrogen crossover rate of your membrane with the goals set by funding and monitoring organizations.			✓	✓
Open Circuit Testing Demonstrates the stability of your membrane.			✓	✓
Polarization Curves Using voltage holds or current holds.			✓	✓
Cyclic Voltammograms Using your potentiostat.			✓	✓

System Characteristics (All BekkTech Systems)
Low Thermal Mass Saturators Allow for prompt reaction to temperature changes. Significantly reduces the amount of time required for your sample to achieve equilibrium.
Saturators Accurate at Varying Gas Compositions and Pressure BekkTech Saturators provide true dew point control.
Separation of Gas / Water Components from Electrical Components Enhanced safety by separating arcing / sparking components from electrical components.
System Modifications Hardware and software are designed with the researcher in mind. Gas panel allows for easy access to components to facilitate modifications & troubleshooting. Software can be modified to address the specific testing needs of your organization.



BekkTech Membrane and Single Cell Test Systems (Software & Components)	BT-512	BT-512MX	BT-552	BT-552MX
Automated Control and Data Acquisition				
<i>BekkTech Testing Software in LabView</i>				
In-Plane Conductivity Testing with Gas-Mixing (for operating conditions below 40C)		✓		✓
In-Plane Conductivity Testing without Gas-Mixing (for operating conditions from 40C to 120C)	✓	✓	✓	✓
Through-Plane Conductivity Testing	✓	✓	✓	✓
Activation Energy / Transition Testing	✓	✓	✓	✓
Hydrogen Crossover / Permeability Testing			✓	✓
Open Circuit Testing			✓	✓
Polarization Curves using Voltage Holds			✓	✓
Polarization Curves using Current Holds			✓	✓
Observe the performance of the sample in real-time graphs of results	✓	✓	✓	✓
<i>BekkTech Data Analysis Software in MS Excel</i>				
Excel Spreadsheet for data filtering and analysis	✓	✓	✓	✓
Generates graphs of pertinent data	✓	✓	✓	✓
NRE 212 data is included for comparison to your data	✓	✓	✓	✓
Computer and USB Director				
One Dell computer & monitor with LabView Basic & Microsoft Office Basic installed	✓	✓	✓	✓
One USB Director with RS-232 & RS-485 connections for communication to temperature controllers and mass flow controller	✓	✓	✓	✓
System Hardware				
Gas Delivery components are assembled on a panel for easy access. Place on your desktop or under a ventilation hood.	✓	✓	✓	✓
Wetted gas components are brass and 316 stainless steel upstream of the Mass Flow Controllers and 316 stainless steel and Teflon downstream of the Mass Flow Controllers.	✓	✓	✓	✓
One (1) Hydrogen/Nitrogen Mass Flow Controllers – 1000 SCCM	✓	✓	✓	✓
Additional Hydrogen/Nitrogen Mass Flow Controller – 1000 SCCM (Allows for wet / dry gas mixing for low-temperature conductivity testing)		✓		✓
Cathode gas line with one (1) Air/Nitrogen Mass Flow Controller – 1000 SCCM			✓	✓
Hydrogen flashback arrestor	✓	✓	✓	✓
Dry gas valve – Allows for gas mixing when testing at temperatures below 40C		✓		✓
Back pressure regulator(s) – 0-50 psig	✓	✓	✓	✓
Dew Point / Relative Humidity Control				
Electronics are separated from gas delivery and water delivery for safety	✓	✓	✓	✓
Five 2 Amp Temperature Controllers and five Type T thermocouples for measurement & control of test equipment (120 VAC, 60 Hz)	✓	✓	✓	✓
Ability to interlock to your external safety system for emergency shutdown	✓	✓	✓	✓
One BekkTech Saturator	✓	✓	✓	✓
Additional BekkTech Saturator (one for anode line, one for cathode line)			✓	✓
Heated Gas Lines (120VAC)	✓	✓	✓	✓
Test Hardware				
One set of Fuel Cell Technologies 5 cm ² cell hardware for testing to 120C	✓	✓	✓	✓
One BekkTech Conductivity Cell for testing to 120C	✓	✓	✓	✓
Voltage and Current Control				
One Keithley 2400 SourceMeter (used for DC Voltage Sweeps for Conductivity Testing) – 120 to 240 VAC, 50 to 60 Hz	✓	✓	✓	✓
One Agilent 6060B Electronic Load Box, 0-6 Amp or 0-60 Amp Ranges (used for Voltage & Current Holds for Single-Cell Testing), 120 VAC, 60 Hz or 220 - 240 VAC, 50 Hz			✓	✓
<i>BekkTech Pressurized Deionized (DI) Water System (Water Supply to Two Saturators)</i>				
Assembled on a stand-alone panel	✓	✓	✓	✓
Water Reservoir, DI Water Filter, Diaphragm Pump(s), 120VAC	✓	✓	✓	✓

Additional Components & Services (Optional):

Step-Down Isolation Transformer

Converts 220-240VAC to 120VAC for our international customers

Membrane Sample Preparation & Measurement Kit

- One Mitutoyo Thickness Measurement Gauge (Rated accuracy of +/- 3 microns)
- One 9x Magnifier with +/- 0.1 mm scale (for width measurements)
- One Sample Punch (cuts samples for testing to a size of 5mm x 25mm)

On-Site Installation & Training

Systems include a comprehensive manual with information on installing the system. Instructions for performing a membrane conductivity test & voltage / current holds (BT-552 & BT-552MX) are also included. On-site installation & training is optional. It includes the following:

- Install the system
- Leak test the system
- Instruct the operator(s) on the various system components and troubleshooting
- Demonstrate how to perform a membrane conductivity test on pure membrane.
- Demonstrate how to perform voltage/current holds on MEAs (BT-552 and BT-552MX)
- The BekkTech Engineer is on-site for a half day to install and a full day for training

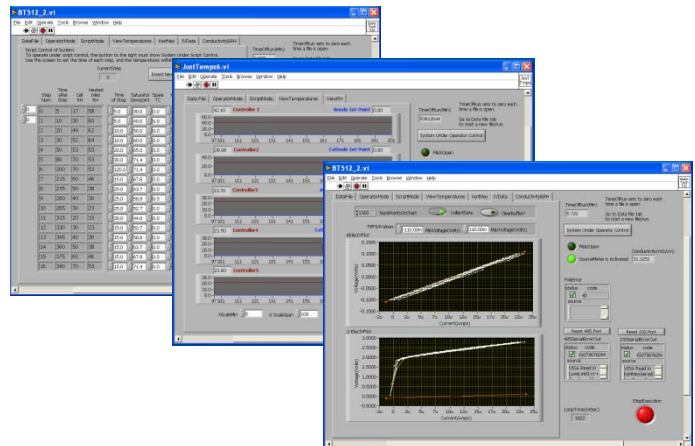
E-mail and Phone Support:

Prompt e-mail support on any questions regarding your BekkTech equipment is always included with your purchase. In addition, Skype Internet Phone Software and a webcam will be installed on your system computer, if you choose. This will give you the opportunity to participate in video discussions with our engineers for any questions/issues you may have when using your BekkTech equipment.

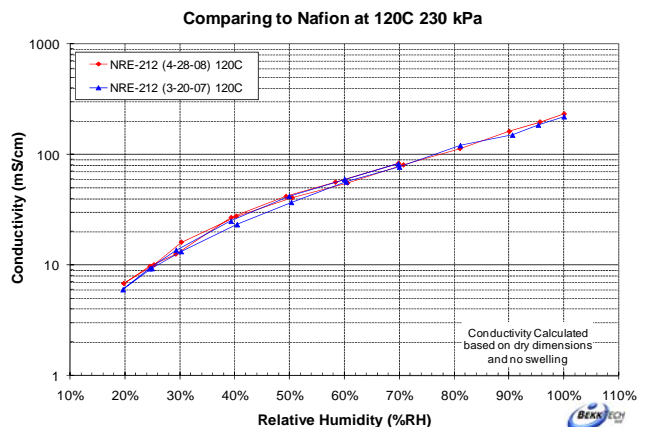
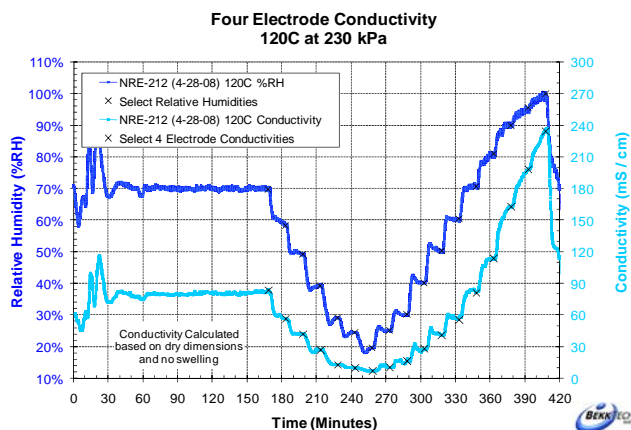
Photo Summary of Equipment and Software



BT-552 Membrane & Single-Cell Test System



BekkTech Testing Software in LabView



BekkTech Data Analysis Software in Microsoft Excel