



## DRIVING FUEL CELL INDUSTRY CHANGE

At Gore, we're contributing to a clean energy future by developing innovative, high-powered and reliable fuel cell components that optimize the cost of ownership in motive and stationery power generation applications.

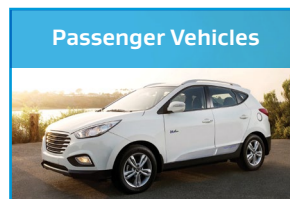
Our path to today's clean-energy technologies began in 1969, when Bob Gore discovered expanded polytetrafluoroethylene, known as ePTFE. This versatile polymer has been advancing fuel cell technology since 1994, when we introduced our innovative ePTFE-reinforced GORE-SELECT® Membrane. Today, you'll find GORE-SELECT® Membranes at the heart of vehicle fuel cells from leading OEMs, and in other transportation, portable and stationery power applications worldwide.

### Empowering the Future, Together

Decades of market experience and advanced materials expertise have enabled us to continue to advance our fuel cell industry offerings. By incorporating new-generation technologies, we've created fuel cell Proton Exchange Membranes that are more durable and higher performing.

Our proprietary technologies allow us to tailor the structure of ePTFE, creating a thinner membrane that delivers superior uniformity, high power density and greater chemical and mechanical durability. With GORE-SELECT® Membranes, our fuel cell customers enjoy a competitive advantage: they can meet their engineering targets, reduce total cost of ownership, and produce higher-performing fuel cell systems.

### Gore Fuel Cell Applications



Remarkable journeys with zero carbon footprint



Powering businesses with sustainable industrial energy



Connecting cities with sustainable energy



Voyage globally with cleaner energy



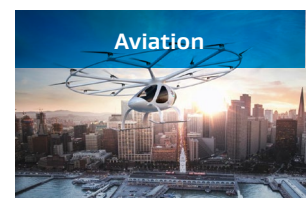
Clean, scalable solutions for mobility and logistics



Increasing energy efficiency for a greener lifestyle



Future-proof, reliable and clean energy reserves



Powering the skies with zero pollution

## GORE-SELECT® Membranes: Core Portfolio

Membrane Name	M735.18	M740.18	M775.15	M788.12	M765.08
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### Physical Characteristics

Membrane color	Black	Black	Black	Clear	Clear
Orientation for use (Side not attached to backer to be used as the cathode side)	Yes	Yes	Yes	No	No
Nominal thickness (μm) <sup>1</sup>	18	18	15.5	12	8.5
Proton resistance (mohm*cm <sup>2</sup> ) <sup>2</sup> 80 °C, 30% relative humidity (RH)	< 150	< 150	< 80	< 120	< 80
Hydrogen crossover (mA/cm <sup>2</sup> /MPa) <sup>3</sup> 80 °C, 50% relative humidity (RH)	20	20	30	30	40
Tensile strength (MPa) <sup>1</sup> Machine Direction (MD)	51	50	38	71	91
Tensile strength (MPa) <sup>1</sup> Transverse Direction (TD)	54	52	39	76	96
Swelling ratio area change (%) <sup>4</sup>	< 5	< 5	< 5	< 5	< 5
Peel strength btw. GSM and backer (mN/cm) <sup>1</sup>	50	50	60	50	70

### Performance Durability

Mechanical durability Relative humidity (RH) cycle test <sup>5</sup> (normalized to M775.15)	1.8	1.8	1.0	1.3	1.1
Chemical durability OCV hold test (30% RH, 95 °C), Fluorine release rate <sup>6</sup> Typical Fe contamination (ppm)	σ <sup>7</sup> < 1	+++ < 1	++ < 1	+ < 1	+ < 1

### Roll Properties

Standard roll widths (mm)	340 220	340 220	340 220	360 490 294 240	360 490 294 240
Standard length, Nominal at mass production (m)	200	200	200	400	400
Standard length, Nominal for sample roll (m) Standard A Standard B	– –	– –	10 50	10 50	10 50
Orientation	Product in roll form is shipped with the membrane facing outwards				
Max. # membrane-to-membrane splices	1	1	1	2	2
Trailer length (m)	–	–	3.5	20	20
Clean room standard (ISO14644-1)	Class 7 (Class 10,000)				
Visual inspection for defects	100%				

**For additional information, including product handling guidelines and safety data, please contact your local Gore representative.**

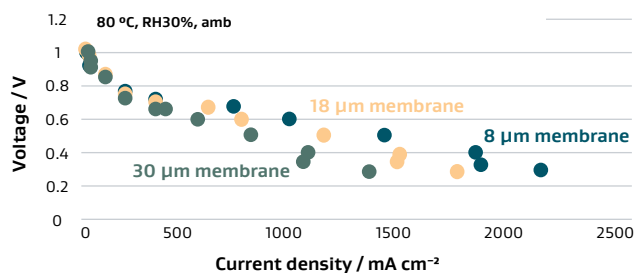
1. Measurements taken with membrane conditioned to 23 °C, 50 % relative humidity (RH).
2. Proton resistance measurements taken by high frequency resistance method. Membrane impedance taken at zero imaginary impedance.
3. Hydrogen crossover measurements taken by cyclic voltammetry (CV).
4. Swelling ratio calculated by dimension change from membrane conditioned to 23 °C, 50% RH to water soaked at 100 °C for 10 min.
5. Gore original method.
6. Electrode and GDL for evaluation are Gore's experimental standard.
7. Without Ce in the electrode.

## GORE-SELECT® Membrane Meets Fuel Cell OEM Needs

The GORE-SELECT Membrane is a proprietary Proton Exchange Membrane (PEM) that leverages our expertise in ePTFE-reinforced composite membrane technology. It enables fuel cell performance that meets OEM needs for superior uniformity, higher power density and improved chemical and mechanical durability.

## High Proton Conductance & High Power Density

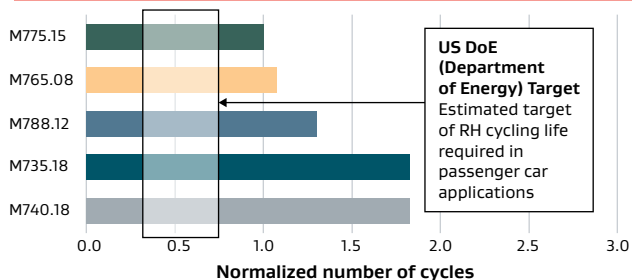
### High Current Density Output



Thin films and superior water transport in GORE-SELECT® Membranes enable low proton resistance and therefore high power density, which offers design flexibility for the fuel cell system and stack.

## Enhanced Mechanical Durability

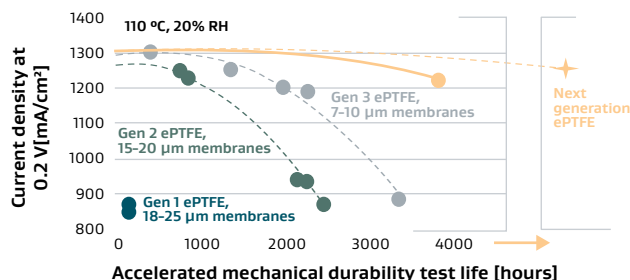
### Gore RH (Relative Humidity) Cycling Test



Our GORE-SELECT® Membrane has X-Y dimensional stability and high durability after repeated wet-dry cycles. These ePTFE-reinforced membranes far exceed the U.S. DoE performance standard for accelerated stress tests.

## Balancing Performance & Durability

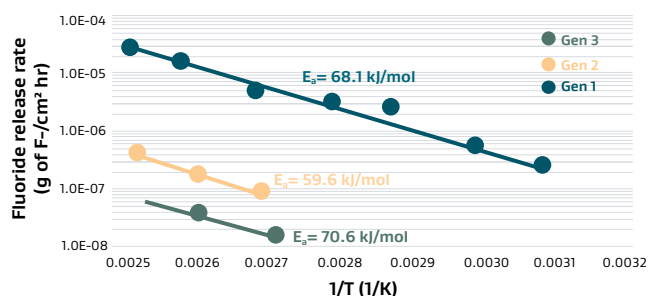
### High Performance and Mechanical Durability



Successive generations of GORE-SELECT® Membranes have continuously improved the balance of power density and durability. This has enabled our customers to increase stack power and lifetime.

## Improved Chemical Durability

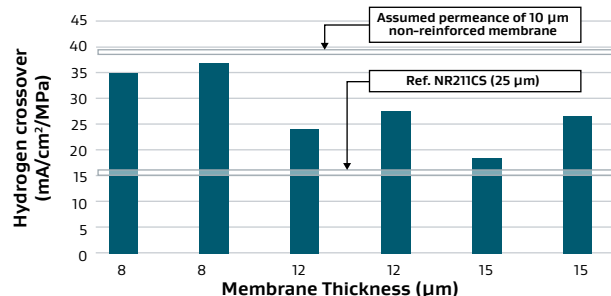
### Fluoride release rate in 70% RH OCV (Open Circuit Voltage) hold



Our advanced additive technology enables a long service life in harsh operating conditions. With this enhanced level of durability, engineers have the potential to push the limits of the hydrogen fuel stack design and operation even further.

## Low Gas Permeance

### Hydrogen Permeability



Our innovations allow us to control the composition of our reinforced membrane, leading to a thinner design with a lower gas permeation rate than thicker, non-reinforced membranes.

# GORE-SELECT® Membranes: Applications and Attributes

## For automotive applications

**M735.18** Durable and low gas permeance

## For stationary power generation and chemically-demanding automotive applications

**M740.18** High chemical durability and low gas permeance

## For commercial vehicles and other heavy-duty applications

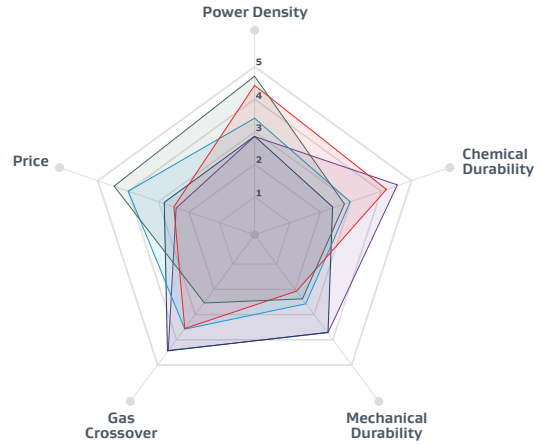
**M775.15** High chemical durability and high power density

## For backup power, range extenders, forklifts and portable applications

**M788.12** High chemical durability and low gas permeance

## For passenger vehicle applications

**M765.08** High power density under dry condition



For information about GORE-SELECT® Membranes M665.12 and M665.15 for stationary power generation applications, please contact your local Gore representative.

## Gore's Sustainability Commitment

Gore develops high-performing products of high societal value while meeting or exceeding applicable environmental and safety standards. As we advance our technologies and conduct our global operations, we strive to be good stewards of air, water and energy resources, and in our management of waste, through:

- Manufacturing processes that are guided by the ISO 14001 standard.
- Manufacturing processes that do not use PFOS and PFOA.
- Products that do not emit PFOS and PFOA in use.
- Products that comply with REACH Regulation (No. 1907/2006) for chemicals.
- Voluntary compliance with limit-value standards for hazardous substances under RoHS (EU Directive 2011/65/EU).
- Responsible waste management that includes precious-metals recovery, ePTFE recycling, and multiple waste-reduction streams and processes.

For more information: [gore.com/about/the-gore-story/responsibility-environmental](https://www.gore.com/about/the-gore-story/responsibility-environmental)

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