Technical Information Bulletin 93-01

NAFION® Hydrogen-Form Membrane Expansion

Many NAFION perfluorinated membranes* are produced in the hydrogen ionic form (H+) to meet specific customer needs.

Prior to using these membranes, it is necessary to expand them before installation so that during operation, the membranes will shrink slightly and remain wrinkle-free. Because there are many different applications and electrolyzers that these membranes are used in, we recommend that membrane expansion be discussed with your equipment supplier or your representative.

Special Expansion Considerations

• Membranes expand more in deionized (DI) water when they are in the hydrogen ionic form (H+) than they do when they are in the sodium ionic form (Na+) or potassium ionic form (K+). Consequently, many applications processing dilute electrolytes require that membranes be pre-expanded in DI water.

• Membranes expand more when the expansion bath is heated. Consequently, some applications may require elevated bath temperatures to prevent wrinkling during USC.

• The hydrogen-form membranes are relatively free of other cations. In special cases where purity is essential, such as fuel cell applications, the membrane is typically expanded in high purity HNO3 or HCI followed by a DI water rinse.

• Hydrogen-form membranes expanded in DI water will be slightly acidic (pH 2 to 7). This may cause corrosion of certain types of electrodes before start-up. Corrosion of some electrodes (activated nickel, for example) could result in nickel absorption in the membranes and subsequent high voltage during normal operation. If this is the case, alkaline expansion is recommended as detailed next. If in doubt about possible corrosion of your electrodes, contact your hardware supplier for specific recommendations.

• If alkalinity is required to protect the electrodes, or if there is uncertainty about your electrodes, we recommend that the membrane be converted to the sodium form as described in our technical information bulletin 91-04, "Potassium-Form Membrane Expansion," except that only NaOH should be used for the conversion. If NaHC03 were used, CO2 gas would be generated and the bubbles would coat the membrane and inhibit wetting.

• Some electrode types are not affected by slight acidity, and water expansion is a convenient way to expand membranes. When expanding the hydrogen-form membranes in DI water, follow the guidelines presented below.

*NAFION 117 perfluorinated membrane (abbreviated N117), N1035, N115, N324, N424 and N438 are some of the hydrogen-form membranes available.
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Procedure: Expanding Hydrogen-Form Membranes in DI Water

1. Use only DI water to prevent contamination of the membrane with undesirable elements or compounds that can affect performance later.
2. Because DI water pH is usually 6 to 7 and the treatment bath will probably tum slightly acidic (pH 6 or less), the construction materials of the bath must be carefully chosen. PVC is commonly used.
3. For expansion, membrane sheets may be suspended vertically or laid horizontally with or without mesh separators.
4. Completely cover the membranes with DI water and change the bath periodically to remove any impurities and debris that may have accumulated. Arbitrarily, we recommend changing the bath after treating 1 m² per 5 liters of water.
5. Soak the membranes in DI water a minimum of 4 hours at a temperature of 18°C to 30°C.