

detected at this stage would have to be eliminated by cutting and would represent a loss of material.

While leak testing by the manufacturer is done continuously on roll goods, a need exists for the end user to check individual sheets for leaks. For instance, in a stack or electrolyzer consisting of several individual cells, a leak may have developed requiring disassembly of the stack and determining which membrane is leaking and where. Quiver Ltd. in Milan, Italy, has developed equipment for this purpose (Fig. 3.4). The membrane is placed on a vacuum table and an arm equipped with sensors traverses the sheet at a rate of 1 m/min (Fig. 3.5, steps 1–3). When one of the sensors detects a leak, the arm stops, an alarm sounds and the sensor that had detected the leak is indicated by a light. The exact location of the leak can then be determined by a manual probe (step 4). Pinholes as small as 0.1 mm can be detected by this method. The test tables are available in four different sizes, all 131 cm wide and with a length of 82, 157, 246 and 300 cm. Quiver also offers equipment to repair leaks by fusing a patch of Nafion 324 over the affected area. The patch must be placed with its anode side against the anode side of the membrane for proper bonding.

The equipment works by thermal impulse, which means that the patch is assembled under the heat sealer at room temperature, pressure is applied by a pneumatic piston and a burst of electric heat raises the temperature of the repair area to the bonding temperature and then allows for rapid cooling (see Chapter 10).

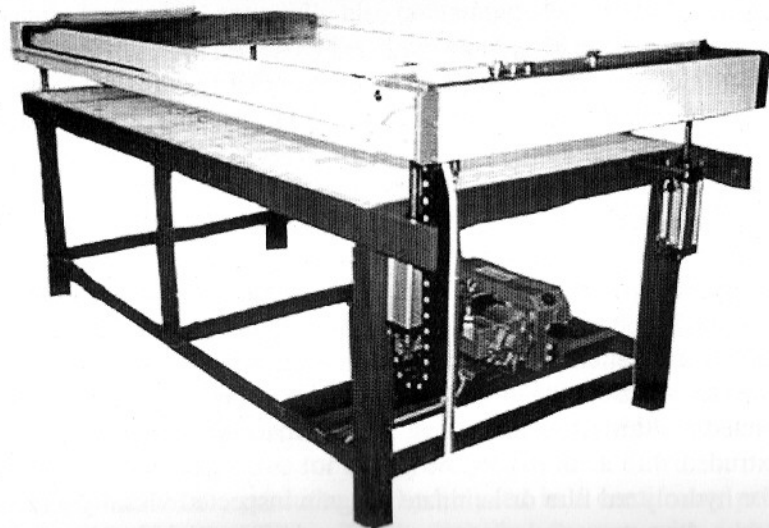
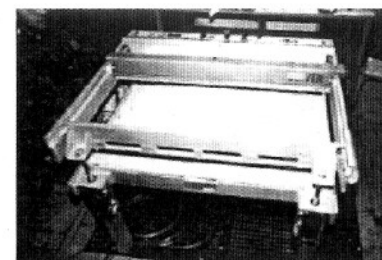


Figure 3.4 Leak test table [25].



STEP-1



STEP-2



STEP-3



STEP-4

Figure 3.5 Leak testing [25].

3.7 Liquid Compositions

Some fluorinated ionomers dissolve in polar organic solvent or mixtures of such solvents with water under atmospheric conditions. Such polymers include partially fluorinated ionomers based on sulfonated poly trifluoro styrene as well as perfluorinated ionomers of very low EW. Using methanol or ethanol at their atmospheric b.p., the maximum EW for solubility is about 900 for polymers of the Nafion structure and about 750 for the DOW polymer. Perfluorinated ionomers of the more typical EW of 1000–1100 require higher temperatures for dissolution, about 240°C for 1100 EW Nafion [26]. The resulting products are often referred to as “solutions”, although they may not necessarily be true solutions of individual polymer molecules but rather agglomerations of several molecules in a micelle containing a hydrophobic core of mostly fluoro polymer backbone surrounded by a hydrophilic shell of ionic groups.

Such a micelle is stabilized by negative charges similar to a soap micelle (see Section 4.3). The addition of a fluoro oxy alkylene oligomer of an MW of 350–500 not only reduces the temperature necessary for dissolution, but also results in smaller micelles [27].