DESIGN OF AUTOMATED MANUFACTURING CELL USING FLEXIBLE CONTINUOUS WEB

By

Christopher R. Dromms

An Abstract of a Thesis Submitted to the Graduate

Faculty of Rensselaer Polytechnic Institute

in Partial Fulfillment of the

Requirements for the Degree of

MASTER OF SCIENCE

Major Subject: MECHANICAL ENGINEERING

The original of the complete thesis is on file
in the Rensselaer Polytechnic Institute Library

Approved:

Stephen J. Derby, Thesis Adviser

Rensselaer Polytechnic Institute
Troy, New York

July 2010
(For Graduation August 2010)

ABSTRACT

The research presented in this paper focused on the design of Proof Of Principle Model for an automated manufacturing cell that fabricated parts using a flexible continuous web. The POPM was based on a new production system concept that used a flexible web to produce membrane electrode assemblies. A risk analysis showed that a POPM was required to experimentally verify that the concept would be able to hold current finished part tolerances. Additionally testing of ultrasonic bonding systems in an automated process and the ability of this concept to scale to larger part sizes were also central to the POPM. The design of the POPM focused around the tractor drive module that indexed the web through the system. Other integrated systems included the laser cell, ultrasonic bonding system, and overall system layout. The system was fabricated, assembled, and closed loop control performed using C#. In order to quantitatively determine if the concept would meet current finished part tolerances a variety of experiments were performed. The focus of these experiments was to measure the repeatability of each process used to manufacture the MEA. Experiments performed found that many of the processes had a repeatability in the $50\mu m$ range with some being much better than that. Experiments also found that the current implementation of the POPM had mechanical and software issues that resulted in poor quality laser cut features and ultrasonically bonded parts. These issues were the result of the current implementation of the POPM and could likely be improved during future work.