To: Notes

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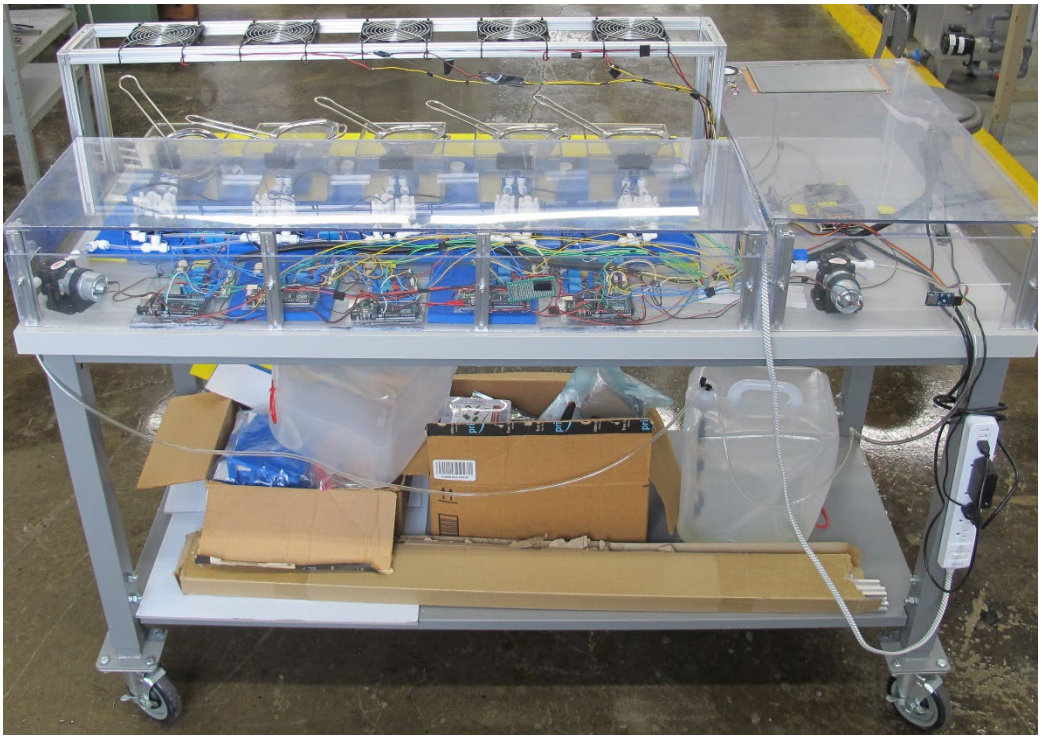
Subject: Passivation Immersion Tester Electronics Retro-fit---Senior Design Project Overview

Background: Bowmar currently has possession of a 5-bay water immersion tester for the purpose of assuring NADCAP compliance on passivated metal components per ASM2700. This tester has 5 individually controlled bays (or dunk tanks) that fill and empty from a master water supply tank as described in operation below. A requirement of NADCAP compliance is data logging the individual test cycles by Job Order, Person Clocking on the Job, and Date/Time. This tester must incorporate this data logging.

The current tester possessed by Bowmar was constructed with the intent of testing operational concepts. The electronics of this tester are currently Arduino based and of prototype quality. Current electronics are not appropriate for use in an industrial Environment.



Bowmar's current 5-bay immersion tester. It is expected that only the cart/bench, (5) individual dunk tanks, fans, and fan mount(s) are to be re-used. All plexiglass covers and electronics to be removed and replaced with components appropriate for an industrial environment.

Senior Design Project Overview: Bowmar's proposed project is the retro-fitting and reworking of the current tester with new electronics appropriate for long-term use in an industrial environment. Although the final design and construction is at the discretion of the students involved, Bowmar would like the electronic system designed and constructed using industry-accepted practices and built with future maintainability in mind. Usage of a PLC based system utilizing DIN-rail mount components and an HMI user interface is encouraged. As is the usage of external relays to control the individual component outputs. There are to be no exposed wires. All wires should be placed in conduit and all electronics/HMI should be in a rugged cabinet. Mechanical aspects of the project are light. Project is expected to be appropriate for a 2 to 3 person group with one member a EE and another with some programming knowledge, CPE/EE.

It is expected that the table, tanks, and fans will be the only items from the existing tester suitable for re-use. All active electronics are expected to be replaced (I.E. clean-sheet design and build in regards to the electronics).

Input List:

5 discrete inputs---Dunk tank(s) full. Level switches on each individual dunk tank that actuate when the tank is full. Can be of float type or non-contact at the discretion of the team.

5 discrete inputs---Dunk tank(s) empty. Level switches on each individual dunk tank that actuate when the tank is empty. Can be of float type or non-contact at the discretion of the team.

1 discrete input---Master tank full. Level switch on master tank to indicate when the master tank is full. Can be of float type or non-contact at the discretion of the team. The 5 individual dunk tanks pull their water from a master tank and NOT directly from the building water supply. This arrangement is preferred as NADCAP compliance requires testing on the water supplied to the dunk tanks. Using a master tank supply allows that water testing to be performed in a single, central location. Without using a central water tank, water testing would be requirement on all (5) individual dunk tanks.

1 discrete input----Master tank empty. Level switch present on master tank to indicate when the master tank is empty. Can be of float type or non-contact at the discretion of the team.

HMI inputs---User interface. Details provided below.

Output list:

5 discrete outputs low voltage DC (recommend 12VDC)----Individual dunk tank fill pumps

5 discrete outputs low voltage DC (recommend 12VDC) ----Individual dunk tank empty pumps. Water pumped from the individual dunk tanks is to building floor drain/evaporation system.

1 discrete output low voltage DC (recommend 12VDC) ---Master tank fill valve solenoid. Master tank is filled from building water supply. Any solenoid should be power 'on' and no power 'off' to prevent undesired valve-on conditions.

5 discrete outputs 12VDC---Dunk tank fans

HMI outputs---User interface. Details provided below.

Operational Requirements:

NADCAP compliance requires that the tested components go through a 24 hour test cycle. That cycle requires the test components be immersed for 1 hour, then exposed to air for the next hour. Then immersed for another hour and then exposed for another. This water immersion/air exposure on an hourly basis is to repeat 12 times in a 24 hour period to complete the test. Test parameters are:

*Complete 24 hour cycle can vary up +/-20 minutes in length

*Each individual fill/empty cycle can vary up to +/-1 minute in length

*Overall test cycles must be electronically logged to Job Order number, Person starting/ending the test, date/time, # of cycles, and component part number. Data logging to be transferrable to other equipment for download via thumb drive (ideally) or data card. It is not desired that the tester be hard-wired to Bowmar's internal data network. Ideally, the exported data is to be presented in the form of an EXCEL spreadsheet.

*Fill and empty time of (5) individual test tanks to be a maximum of 45 seconds. Test tanks are approximately 1 quart in size.

*The (5) test tanks are to be controlled independently with varying start/stop times.

*Electric fans over each dunk tank provide ventilation to the individual tanks. Bowmar guidance on when those fans are to operate will be provided as the project progresses.

*Design should feature basic fault detection, and corresponding test cycle cessation. Faults should include, but are not limited to:

-Excessive time for dunk tank fill (either bad pump or bad full switch)

-Excessive time for dunk tank empty (either bad pump or bad empty switch)

-Excessive time for master tank full (bad solenoid fill valve or bad tank full switch)

-Power outage detection and test cycle cessation if power is out long enough to cause the tester to 'miss' a fill or empty cycle.

HMI requirements

The user interface is to be a touch screen HMI. Bowmar recommends usage of an approximate screen size of 10". Interface software should be created in such a way as to make operation straightforward.

Power Requirements

Tester to be powered from a standard NEMA 5-15 plug. 115VAC, 12 Amps maximum. All outputs and inputs to be low voltage DC. Usage of 12VDC is recommended. Metal components to be earth-grounded.