



# Introduction of robotics to material testing laboratories

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**WHITE PAPER**

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## ARC Specialties Introduces Robotics to Material Testing Laboratory for Improved Consistency and Productivity

Welding Consultants LLC (WC LLC), based in Columbus, Ohio, is a material testing laboratory specializing in the weldment testing. WC LLC's parent company, ARC Specialties, Inc. (ARC), is a premier robotic and automation integrator, specializing in custom automated welding, cutting and machining systems. Its President, Dan Allford, is an automation visionary who excels in identifying potential automation applications, regardless of how unconventional they may appear. From the time ARC purchased WC LLC, he was looking for potential uses for a robot to improve throughput and separate WC LLC from its competitors. Below is a description of the welding and cutting robot ARC designed and integrated into the WC LLC infrastructure.

In addition to routine welding procedure and welder performance qualification testing, two key areas of concentration for the WC LLC operation are welding filler metal qualification and line pipe mechanical testing in support of pipeline failure and performance analyses.

In the case of welding filler metal qualification testing, welding of the test coupon is critical and requires careful control so the resulting filler metal mechanical properties are representative of the product being tested. Limits on amperage, voltage and travel speed are well defined by the applicable filler metal specification. However, other variables such as electrode extension [stickout], travel angle, work angle, bead width, and bead placement are also critical control factors, as they too affect the resulting mechanical properties. With the implementation of this welding robot with WC LLC's existing fixturing, all of these variables can be accurately controlled in a repeatable manner. In order to repeat the same weld on each new test plate, the only required programming is to establish the start and stop points.

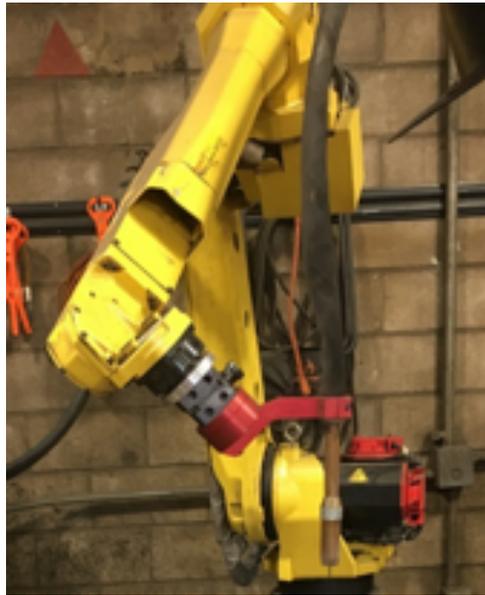


FIG. 1 - ARC Robot with welding gun



FIG. 2 - Typical filler metal qualification test plate

By introducing robotics for this application, WC LLC is able to consistently weld these test coupons to guarantee repeatable and accurate test results. In cases where the customer requests testing of multiple heats of the same product, the ability to consistently weld test coupons becomes even more critical. WC LLC anticipates that the introduction of this robot to their filler metal testing capabilities will eventually increase its market share in this important business segment.

Another important part of WC LLC's business is the mechanical testing of pipeline samples being studied to determine causes of either failure or performance deficiencies. The samples range from diameters measured in fractions to multiples of feet, with thicknesses typically 1 inch or less. Per customer requirements, sections are removed from the pipe body and then machined to facilitate bend, tensile and Charpy impact testing. Prior to the introduction of the ARC cutting robot, this involved thermal cutting by hand, saw-cutting to consistent sizes and shapes, and finally, machining to produce the finished test specimens.

With the advent of the ARC cutting robot, utilizing a plasma arc cutting (PAC) torch, samples can be accurately removed from precise locations at specified orientations. The cut accuracy is sufficient to allow for elimination of the sawing operation, so samples can go directly to final machining. Jim Walker, ARC's welding technologist and robotic programmer has developed a menu of cut shapes, so the robotic operator needs only pull up the desired specimen shape, make adjustments for pipe diameter and wall thickness, and initiate the cutting operation. Images of the cutting robot and examples of cuts appear below.

This case study is an excellent example of ARC's ability to develop a robotic system for an unconventional, low volume application to result in increased productivity, along with improved consistency and quality.



FIG. 3 - ARC cutting robot with PAC torch



FIG.4 - Pipe section with tensile and Charpy blanks removed



FIG. 5 - Example of excellent cut quality