iQ ES Series

SERVO ULTRASONIC PRESS SYSTEMS

Benefits of using the Weld Method

“Force Change”

in Cut-and-Seal Applications

SUMMARY

This document describes the benefits of using the weld method “Force Change” over the traditional method “Position” in cut-and-seal applications. Details are provided of how the Force Change method operates, along with experimental weld data comparing the two methods.

INTRODUCTION

Introduced in the ES Series firmware version 1.14.02 (late 2018), a couple of new weld methods were added for the servo ultrasonic presses: Force Change and Force Rate (US Patent # 10,746,703). The Force Change method has been shown to be beneficial for cut-and-seal applications.

The weld method used to achieve the best repeatability for cut-and-seal applications has traditionally been Position. However, as cycles are run, the stack and horn heat up and elongate due to thermal expansion. This means that even if the weld end position is repeatable, the force at the end of the weld increases over time, because the horn tip gets physically closer to the anvil. Since consistency in the weld force at the end of the weld is key in cut-and-seal repeatability, welding by Position sometimes does not produce consistent results over time. In addition, the increasing weld end force leads to wear of the anvil.

By using “Force Change” instead of “Position” for the weld method, very repeatable results can be obtained regardless of stack temperature Anvil wear is also minimized when using this weld method. The horn and anvil are separated by a very small distance in the final welded position for most cut-and-seal applications. Because welding by Position is incredibly consistent, small changes in the length of the horn due to thermal expansion can cause increased metal-to-metal contact between the horn and anvil. This contact can cause premature wear of both components. Using “Force Change” as the primary weld method helps mitigate this effect.

OPERATION

How does the “Force Change” method work?
When the Force Change method is selected in the setup, a couple of parameters must be programmed as shown in Figure 1: “Distance” and “Change in Force”.

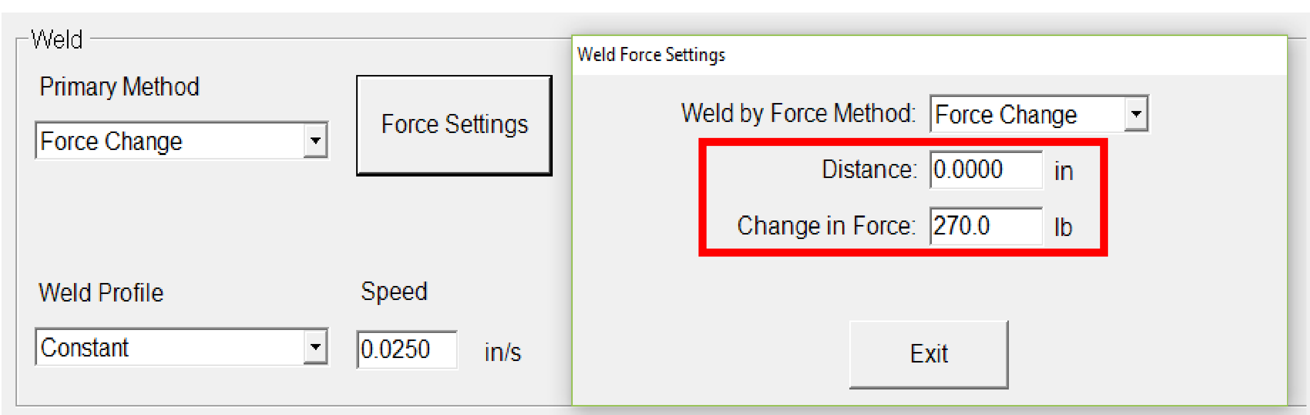

Figure 1

The sequence of this method is described below with reference to Figure 2, which shows a graph of the Force and Distance versus Time for the weld phase of a sample cut-and-seal application.

1. The weld phase starts at Time 0 s.
2. When the press has moved the amount programmed in the “Distance” field (from the start of the weld), the system takes a snapshot of the force and stores this value as a reference. For cut-and-seal applications, this distance is set to 0, which means that the reference force will be equal to the force at the start of the weld. In the graph below, the reference force is 20 lb. (89 N).
3. The weld ends when the current force exceeds the reference force from Step 2 by the amount programmed in the “Change in Force” field. In the example below, the weld ends when the force reaches 290 lb (1290 N), which is an increase of 270 lb from 20 lb.

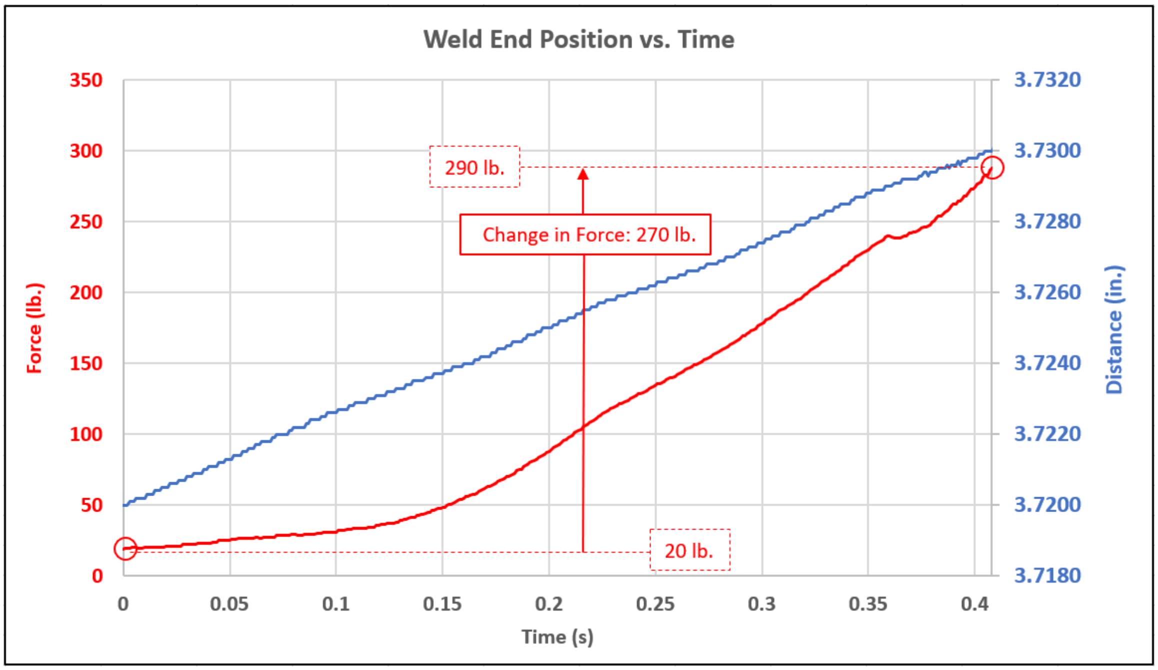

Figure 2

To set up this method for cut-and-seal applications, program the welder as follows:

4. Set up trigger as desired. Using Trigger Method of Force is preferred to maintain consistency of the force at trigger.
5. Set the Weld Primary Method to “Force Change”.
6. Set the “Distance” in the Weld Force Settings window to 0. This means that the reference force will be captured immediately at trigger.
7. Set the “Change in Force” value such that the desired force at the end of the weld is the sum of “Force At Trigger” and “Change in Force”.

EXPERIMENTAL DATA

To illustrate the difference in performance between these weld methods, two layers of a non-woven spunbonded material were welded together as shown in Figure 3.

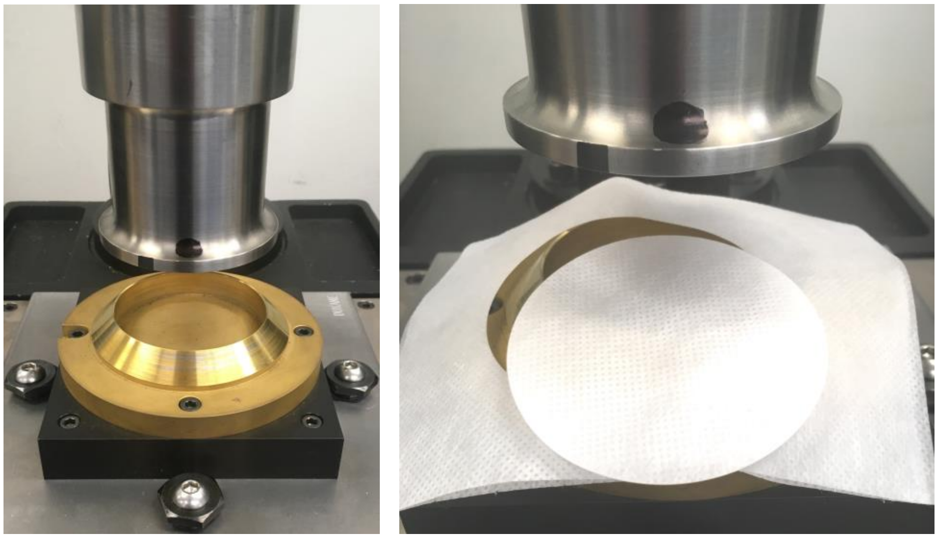

Figure 3

The results are summarized by the graphs in Figures 4 and 5. Figure 4 shows the Weld Peak Force versus cycle number for both weld methods. Using the Position method, the force increases with the number of cycles run as the horn heats up. Had additional cycles been run, this increase would have continued until the horn reached a steady state temperature. Using the Force Change method, the force remains fairly constant, regardless of horn heating.

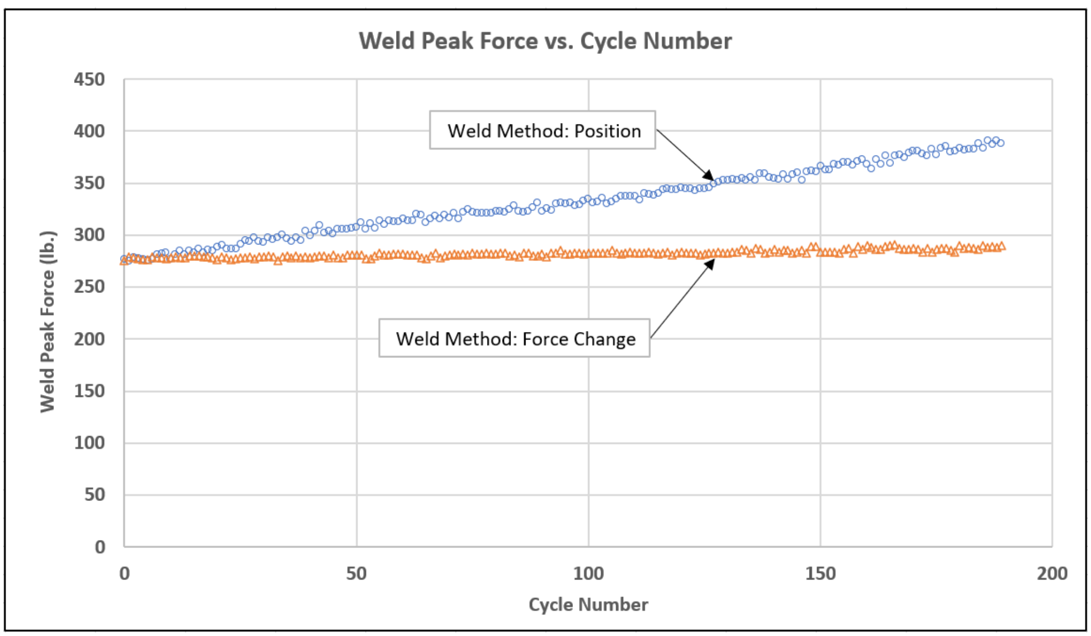

Figure 4

Figure 5 shows the Weld End Position versus cycle number for the same runs as Figure 4. With the Position method, the weld end position remains constant. This is expected, as it is the controlling parameter for terminating the weld. With the Force Change method, however, the weld end position becomes smaller over time. This demonstrates the amount of thermal expansion of the horn and anvil as the tooling warms while operating. The end position varies in this case, asforce is the controlling parameter.

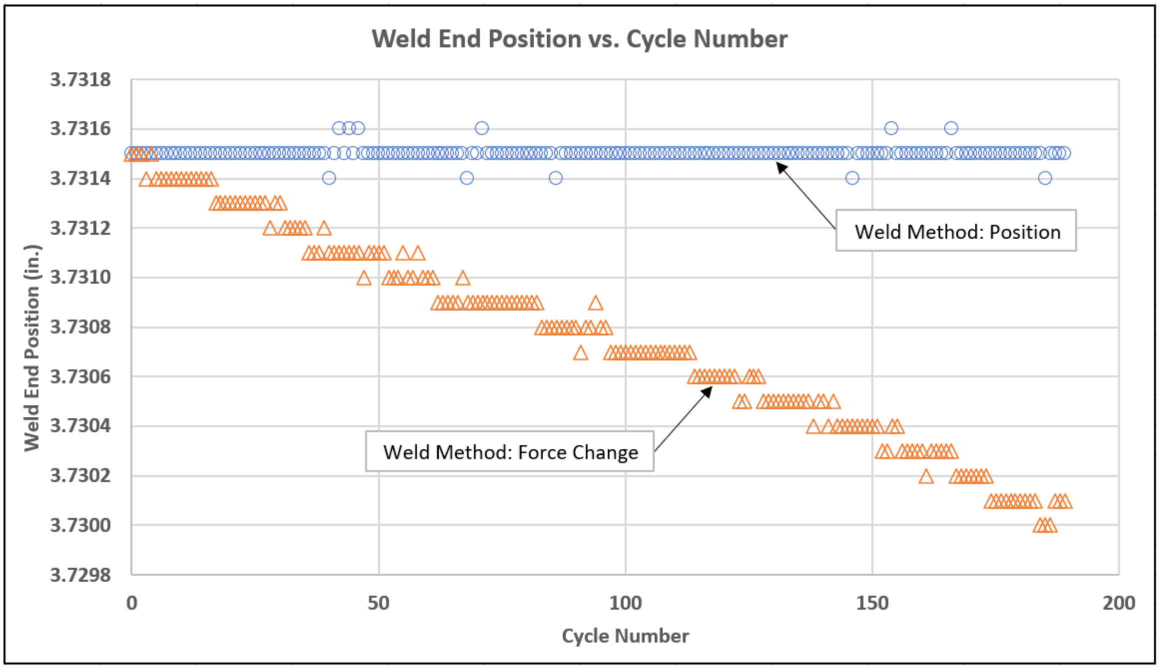

Figure 5

Dukane

2900 Dukane Drive
St. Charles, IL 60174 USA
Tel: (630) 797-4900
Fax: (630) 797-4949
http://www.dukane.com