WeldComputer
The Technology Leader in Resistance Welding

Case Study

Manufacturer of **Safety-Related Devices** for Automobiles Uses **WeldView Monitor** to **Eliminate Destructive Testing,** Saving Half Their Welds

The company was destructively testing 50% of its production components due to inconsistent weld performance but was unable to identify the root cause or solve the issues until they consulted WeldComputer's experts. With the WeldView Monitor, this company was able to significantly decrease rework and scrap costs, as well as improve efficiency. The result was an impressive return on their investment in just a few months.

THE COMPANY

WeldComputer engaged with an Ohio-based automotive parts manufacturer responsible for welding critical components for Autoliv, the largest airbag inflator manufacturer.

THE CHALLENGE

The company sought assistance from WeldComputer Corporation to address the issue of inconsistent weld performance of its production components. To test quality, the manufacturer began destructive testing; however, after previous attempts to resolve the problem by replacing parts on their welding machine, they were never able to achieve a consistent welding performance. This led to the manufacturer increasing their destructive testing frequency, to the point where they were destroying every other weld to evaluate the quality.

With half of the production yield destroyed, the manufacturer's ability to continue operating became at risk. It was at this point that the manufacturer contacted WeldComputer to uncover the root cause of the problem, receive recommendations on rectifying it, and prevent faulty welds from going unnoticed during production.

When WeldComputer arrived at the facility, it became clear the manufacturer needed to monitor their welds to identify the issues with their machine and process, essentially removing the guesswork from their resistance welding. Additionally, it would be beneficial for the team to understand the physics of the issues, to educate their operators on what was happening to cause each issue, and to troubleshoot the challenges, without needing to completely halt production or reduce their production output.

The WeldComputer team connected a portable WeldView Monitor to their projection welding machine to gather data on the welding process. The variables monitored included: combination workpiece thickness, projection set-down profile, cylinder pressure, transformer secondary voltage, conductance, power, and current.

To gather a baseline for the welding issues, the manufacturer produced eight welds utilizing the current production welding parameters: 1000 pounds electrode force (set by a mechanical force gauge placed under the electrode), 84% heat applied for a duration of 7 cycles. After each weld was produced, the Welding Engineer destructively tested the weld and reported if it was acceptable or failed. There were several issues observed with the current machine and process.

ISSUE 1: PRESSURE VARIATION

The first weld was destructively tested to assess quality and revealed it was unacceptable. The monitor data supported this. It was clear that 68.25 milliseconds after the beginning of the weld the cylinder pressure rapidly dropped from 43.8 PSI to less than 20 PSI, as depicted on the following chart (Fig. 1).

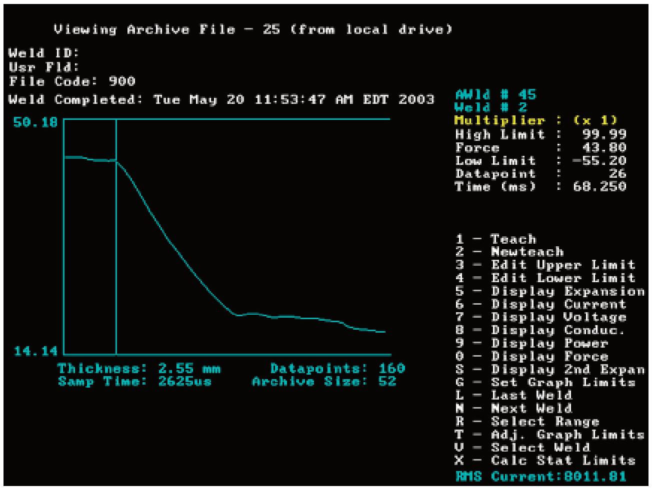

Figure 1. Initial Weld (#2) displaying 20+ PSI decrease

A second weld was produced with similar results; the monitor reported that 86.6 milliseconds after the beginning of the weld, the cylinder pressure rapidly dropped from 44.3 PSI to 21.75 PSI. Six additional welds were made and monitored with similarly inconsistent pressure observed from weld to weld.

What was the cause? A pneumatic valve was actuating during the weld sequence and was contributing to the cylinder pressure variations. Once this issue was corrected, a nominal pressure of 45.85 PSI was established to weld the part. Figure 2 shows the upper and lower limits of acceptability that were set with the monitor to report any further abnormal pressure variations.

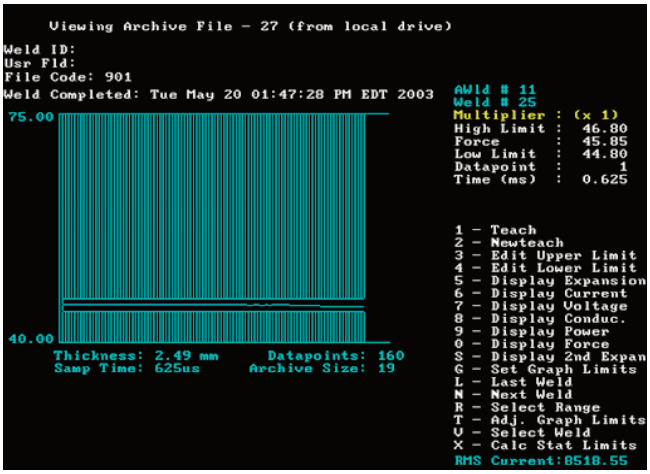

Figure 2. Pressure trace with acceptability limits set to detect pressure variation.

As the team continued to test the welding performance, the monitor caught a weld taking place with a cylinder pressure that was now far outside of the acceptability limits. The actual pressure trace from the monitor (shown below in Figure 3) reported that the pressure was now 71.27 PSI.

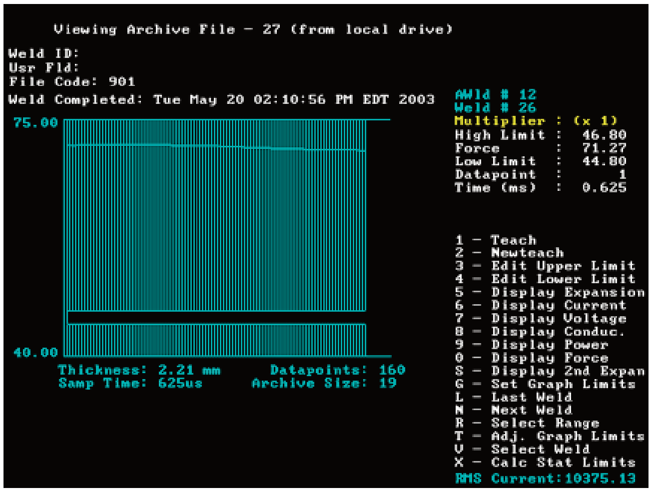

Figure 3. Pressure trace indicating cylinder pressure outside acceptable limits

The issue was traced to a bad regulator, which once replaced, fixed the pressure variation problem.

The resulting welds led to another issue discovery.

ISSUE 2:
INCORRECT HEAT AND TIME SETTINGS

After the regulator was replaced, the team found another issue. The monitor readings showed that the heat was being applied for 5 cycles (approximately 83 milliseconds), double the duration than what would be considered optimum for this process . This was determined from the following trace (Fig. 4), documenting that the projection fully collapsed within 2 cycles (approximately 31.5 milliseconds). The additional cycles contributed nothing to the size of the weld. Visually, the part also had burnt surfaces and there was noticeable electrode degradation.

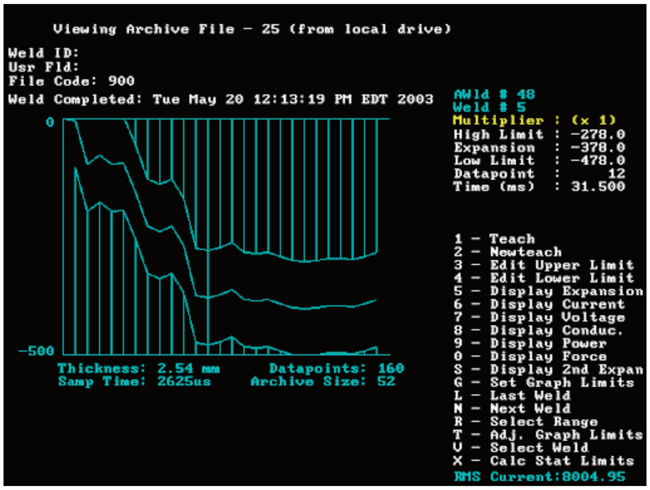

Figure 4. Trace of projection collapse profile

This prompted the decision to reduce the duration to 3 cycles, based on the data presented by the monitor. The resulting parts now had a superior cosmetic appearance as there were no longer signs of the burnt surfaces that previously existed on each completed assembly.

THE SOLUTION

After witnessing data from monitoring the process, it became immediately evident that installing a dedicated WeldView monitor onto the machine would allow the manufacturer to:

- Monitor each welding process, removing any guesswork from resistance welding,
- Verify production welding parameters and immediately detect an incorrect pressure setting or heat setting that would result in faulty welds,
- Confirm proper machine performance, saving time and money by avoiding unnecessary maintenance procedures and by knowing immediately when maintenance is needed,
- Validate the quality of every production weld and improve the quality assurance of their production output by preventing sporadic bad welds from being shipped to customers, and
- Eliminate destructive testing, which increases productivity while saving money.

The previously inconsistent and out-of-tolerance welds were now eliminated, leading to a significant decrease in rework and scrap costs. By eliminating guesswork and reducing dependence on destructive testing, the company was able to see a return on their investment in just a few months.

IMPROVED CONSISTENCY

After replacing the pressure regulator, 14 welds were produced and monitored. The new welds – with updated settings of 48.2 PSI cylinder pressure, 3 cycles at 75% heat – now had superior cosmetic appearances as there were no signs of burnt surfaces or excessive surface discoloration that previously existed on each completed assembly. The following day the manufacturer reported that production proceeded throughout the night with every 16th part being destructively tested, and that all of the destructive tests passed.

REDUCED POWER CONSUMPTION AND POWER BILL SAVINGS

Based on the reduction in weld time, the manufacturer also can expect more than a 60% reduction in the power bill to operate this machine.

ELIMINATION OF DESTRUCTIVE TESTING

While destructive testing did not contribute to the issues presented with the welding machine and process, this method of quality assurance testing was costing the business significant money. By using a monitor to evaluate weld quality, the manufacturer could dramatically reduce the cost of the destructive testing, since they were no longer destroying 50% of their production products.

Overall, destructive testing is seen as an antiquated method because it provides no information about any weld other than the one that is destroyed. The only way to effectively prove and evaluate the quality of each weld that's not destroyed is to monitor each weld as it's being formed. This is because multiple variables can compromise weld quality, from electrical factors like voltage, current, resistance, and power, to mechanical factors such as electrode force, workpiece thickness, and workpiece thermal expansion.

When using a monitor, such as a WeldView Monitor or an Integrated WeldComputer Control with Monitoring, the operator will know of errors in the welding process that lead to poor quality parts and inconsistent welds so that those welds will never leave the factory. Utilizing a monitoring system for quality assurance would offer manufacturers substantial long-term cost savings by substituting expensive destructive testing with a more reliable and precise quality assurance analysis system.