

## Generic Case Studies

### #1 – Longerons

Description. Longerons for U.S. bombers, which connect the cockpit to the fuselage, were forgings made out of 7075 aluminum and measured 8-inch x 18-inch x 18-feet. The finished product required several extensive machining steps. Forgings started at 1,665 lbs. and finished around 600 lbs. The tolerance over the length was 0.125-inch flatness.



Normal Performance. Normal distortion always exceeded tolerance to the point that special approval was given to accept longerons with an overall distortion that was less than 0.200-inch. Even with the special approval, scrap rate was around 90 percent.

Performance After Meta-Lax Treatment. Meta-Lax stress relief was applied to one longeron (before any machining) as a trial. Longerons were machined to an overall flatness of 0.087-inch (42% better than their previous best).

### #2 – Truck Coil Springs

Description. An aftermarket truck spring manufacturer wanted to apply Meta-Lax stress relief to 12 truck coil springs for a shock absorber. They wanted to see if the springs had stress from manufacturing and, if so, would MLSR improve the performance of the springs. The springs were about 2.5-inch dia. x 15-inch. Normal testing of these truck springs was on a cyclic fatigue testing machine where the springs would be compressed by a certain amount of force followed by a release. The process was repeated until failure.

Normal Performance. Normally 20% of the springs would break within the first 1,000,000 cycles. 100% of the springs would break by 2,000,000 cycles.

Performance After Meta-Lax Treatment. Meta-Lax stress relief found that thermal stress was in the finished product as received and was relieved. In the fatigue test, all MLSR treated springs (12) made it to 1,000,000 cycles. They continued the cyclic fatigue test. All MLSR treated springs made it to 2,000,000 cycles without failure.

### **#3 – Tank Turrets**

Description. The top part of a tank is the turret. This turret has several highly critical weld joints which directly affects the safety of the crew inside. These turrets would be subject to testing by means of applying ballistic hits directly on the welded joints.

Normal Performance. Upon one direct ballistic hit, the weld metal would be severely cracked, but the vehicle would be operational and the crew safe. Upon the second direct ballistic hit the tank would be ruined and the crew in danger.

Performance After Meta-Lax Treatment. Meta-Lax was applied during the welding of the turret (Meta-Lax Weld Conditioning). After the first direct ballistic hit there was no damage to the weld joint. Even after the second direct ballistic hit there were no damage. After the third direct hit there were fine cracks detected in some areas of the weld joint but was considerably less than after the first direct hit of a non-treated turret.

### **#4 – Howitzer Frames**

Description. Welded frames for howitzer weapons.

Normal Performance. After welding, the frame would be flux checked for cracks. When cracks were found they were required to scarf out cracked area, reweld, and retest. Only when the weldment was crack-free was the frame allowed to continue through its manufacturing process. Heat treat stress relief was then applied to the crack-free frames. Following HTSR, the frames were again flux checked for cracks. The procedure was repeated in obtaining crack-free frames. Normal rework involved an average of seven repairs per frame in producing a final howitzer frame.

Performance After Meta-Lax Treatment. Meta-Lax Weld Conditioning was applied during the welding of 3 howitzer frames as part of the test. None of the MLWC treated frames had any cracks throughout the manufacturing except for one which had a weld defect at the end of one weld pass.

## **#5 – Fairwater Planes**

Description. A fairwater plane is the horizontal fin towards the top part of a submarine. The part is made out of HY80 steel and is hollow with tar like material filling the inside. Cracking frequently occurs and requires repair.

Normal Performance. The normal repair procedure required scarfing, preheating, and welding the cracked area. Yet reoccurring cracking within 24 hours would commonly occur. Each repair cycle would normally take 1-2 shifts plus 24 hours for cooldown. Reoccurring cracking ranged between 20 to over 45 times per fairwater plane.



Performance After Meta-Lax Treatment. Meta-Lax was applied during welding (Meta-Lax Weld Conditioning) on two fairwater planes. The first one had already been welded forty times. MLWC was applied during welding and without preheating. After the 24 hour cooldown the fairwater plane was inspected and no cracks were found. MLWC was applied to a second fairwater which had just not yet been repair weld. After the first weld repair using MLWC there was a small crack identified. Following the second weld repair of that fairwater plane no cracks were found.

## **#6 Checking Fixture**

Description. Tubular weldment 16-feet long of 1020 hot rolled steel.

Normal Performance. Distortion from welding averaged 0.375-inch. Straightening was required to a tolerance of 0.100-inch. Distortion from machining averaged 0.010-inch.



Performance Following Meta-Lax Weld Conditioning. Checking fixture was welded using MLWC. Distortion from welding averaged 0.050-inch (80% less than normal). No straightening needed. Distortion following milling was 0.0015-inch (85% less than normal).

### **#7 Hough Bucket**

Description. Bucket consisted of low carbon steel bucket with an abrasion resistant edge.

Normal Performance. Normally the welds that hold a 5-inch edge to the bucket would break well within 2 months of service and need repair.

Performance Following Meta-Lax Treatment.

Meta-Lax was added during welding. The edges would last at least 10 months in service without any breaking. When repair was needed it was due to the edge being worn off instead of breaking off (as shown). They confidently increased the width of the blade to 8-inches to give even more service life.



### **#8 Checking Fixture**

Description. Box style checking fixture was used to check airplane wings. Weldment was 20-in. sq. x 50-ft. length.

Normal Performance. Checking fixture distorted 3-inches over the 50-ft. and was scrapped.

Performance Following Meta-Lax Treatment. Meta-Lax was added during the welding process. Distortion was  $\frac{1}{4}$ -inch over the 50-feet length.

