

Vibration Stress Relief at Its Best-

**Meta-Lax® Technology is the "World's Most Successful"
Vibration stress relief and weld conditioning process
*based on Effectiveness AND Consistency***

One Patented Technology - Three Great Products



Save Time, Save Money, Improve Quality

Meta-Lax® Technology - A Proven Alternative Stress Relief Process

Meta-Lax: 1. A patented process by Bonal Technologies that relieves thermal stress within metal components by using nondestructive sub-harmonic vibrations. **2. Meta relaxation.**

The Meta-Lax sub-harmonic vibratory stress relief process was developed in a planer-mill machine



Improved Quality Over Thermal Stress Relief.

Northrop -Grumman

does not work for stress relief.

The benchmark we used for comparison was thermal stress relief. It may be helpful to relate Meta-Lax to the “thermal stress relief process”, in that both induce internal accelerated motion in the metal to cause stress relief.

In order for Meta-Lax stress relief to be considered “successful” we insisted that Meta-Lax treated parts had to meet or exceed the performance of thermal stress relieved parts in distortion control following machining and fatigue life, and do it on a consistent basis.

Initially we tried using the harmonic peak energy level for stress relieving thinking that we needed to pound the stress out of the metal part. Some people refer to this as the “resonant-vsr” or “at peak” method. However, we found that this at peak approach did not produce consistent results so we kept researching. Finally we began to use an energy level that was before the harmonic

peak (hence “sub-harmonic”). When we applied sub-harmonic energy we witnessed that the metal responded extremely well, achieving excellent distortion control consistently.

In developing the Meta-Lax step-by-step process we also discovered that we could determine when stress relief is complete. **This eliminated guessing and assured consistently effective results.**

The patented Meta-Lax technology is unique in the vibratory stress relief industry in that **Meta-Lax is the ONLY vsr process that can produce “consistently” effective results. It also is the only vsr process that uses sub-harmonic energy, certifies when stress relief is complete, and is used during welding for beneficial gain.**

Patented Meta-Lax Technology is based on two sound principles:

Principle #1: Sub-harmonic vibrational energy must be used for the stress relieving frequency. “The amount of energy being dissipated by vibration determines the amount of “backoff” from [the harmonic peak] to be at the most efficient stress relieve range.” Richard Skinner, PE, Lockheed Missiles & Aerospace



Batch Processing Small Parts Saves Time.

Edel Brown

Principle #2: Thermal stressed workpieces will have harmonic curves in a false frequency location. Meta-Lax certification sheet shows that the harmonic curve relocates from the first to second scan indicating stress removal, then stabilizes in the third scan signifying stress relief is complete. Verified by University of California - Berkeley

Customers Say It Best In Every Industry

Aerospace

"Since using Meta-Lax, we hold dimensional tolerances on weldments and machined parts as never before."

NASA



Automotive

"We produced 680 autobody carrier trucks with excellent results in the stability of the frames."

General Motors



Defense

"We saw our scrap rate go from 50% to 0 and stay there."

U.S. Army



Die Casting

"I fully expect to triple the life from this die."

Airtex



High Performance

"The Meta-Lax system has made our engines perform more consistent and longer than ever before."

Automotive Specialists



Machining

"We've cut the 8-12 hours processing time for several grindings down to a single operation taking only 6-8 hours."

Toyoda Machinery USA



Mining

"Since using Meta-Lax, we eliminated cracking in the last 600-700 cross tubes we made. That's unheard of in our industry."

Corrosion Engineering



Mold Making

"For us using Meta-Lax guarantees satisfied customers and a high quality product."

Beiter Moldmaking



Power Generation

"By using the Meta-Lax system for thermal stress relief, cost reduction and quality improvements have been great."

Kanawha Mfg.



Welding & Fab

"With PPAW we do less straightening and involve less labor. We know weld quality is much better with less effort."

Peninsula Metal Fab



This is just a sampling of the applications and industries that Meta-Lax technology has been used on.

How Meta-Lax® Technology Works

All metal structures exhibit harmonic and non-harmonic behavior (1st Scan). A metal structure that contains thermal stress (i.e. stress that has been caused from a thermal shock) displays its harmonic curve at a frequency that is out of phase from its natural frequency location. The Meta-Lax process vibrates the metal workpiece at its sub-harmonic energy level (see 1st Scan).



*Eliminated Thermal Stress
Relief Costs.*
Overhead Conveyor

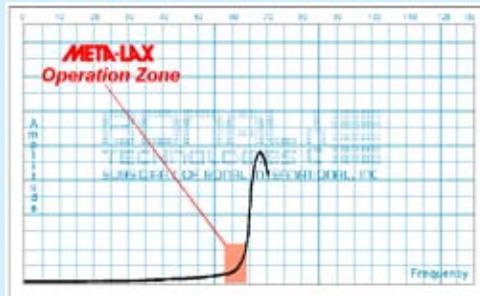
The sub-harmonic zone is optimum energy level when using vibrational energy to stress relieve metal, as verified by R.D. Skinner of Lockheed Missiles. Sub-harmonic energy is defined as the leading portion of the harmonic curve.

The exact height within the sub-harmonic zone will vary depending on the metal alloy of the parts being treated. By applying sub-harmonic energy for a period of between 15 and 60 minutes, pockets of high stress are redistributed, thereby reducing the effects of thermal stress.

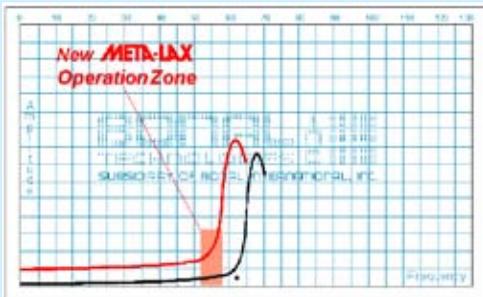
Graphically, the harmonic curve shifts over slightly as thermal stress is being neutralized during the process (2nd Scan). Upon further Meta-Lax treatment in the sub-harmonic zone

there will come a time when the harmonic curve will no longer shift, but rather begins to repeat. When the harmonic curve repeats its previous scan stress relief is COMPLETE (3rd Scan).

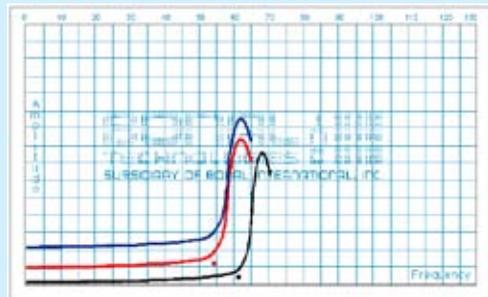
Certification: A Meta-Lax® Technology Exclusive



1st Scan: Represents initial response of workpiece.



2nd Scan: Represents change due to reduction of thermal stress.



3rd Scan: Repeats prior scan certifying that stress relief is complete. **Eliminates Guessing!**

Meta-Lax® Technology - As Used During Welding - “Weld Conditioning”

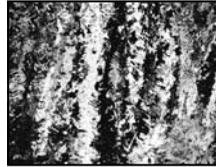
Meta-Lax weld conditioning involves inducing the weldment to very mild “sub-harmonic” vibrations during welding. The mild vibrations keep the weld metal “liquid” a few seconds longer which allows the weld metal to solidify more uniformly from the root gradually out to the face. Two immediate benefits result.

First, there will be less weld distortion since the contraction that will occur on the face will not have as good a chance to distort the weldment because much of the solidification below the face will have already taken place. Second, more centers of freezing will occur at the exact same time when the freezing temperature is reached. This results in refined weld grains which are crack resistant. Ductility and impact values, in particular, are increased up to 400% and 75% respectively.

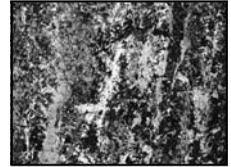
Furthermore, the welder can reduce weld amps 3-15% to prevent even more weld distortion, or

increase weld amps 3-15% to achieve the highest quality weld possible and the fastest travel speed compared to non-treated weldments.

A36 Photomicrographs Comparison



Normal Weld



Sub-harmonic Weld
Conditioned Weld

Other Weld Conditioning Benefits

In addition, using Meta-Lax technology often leads to other benefits. These benefits include welding faster (up to 25%), reducing rework, reducing pre-heat temperature (up to 300-F), and reducing porosity.

Benefits of Using Meta-Lax® Technology

- Meets or Exceeds Thermal Stress Relief
- Certifiable Stress Relief
- No Treatment Distortion
- 90% Less Processing Costs
- 98% Less Processing Time
- 41% Less Machining Time
- 500% Fatigue Life Improvement
- 90% Less Distortion
- 90% Less Weld Cracking
- 25% Faster Weld Speed
- 66% Less Preheat
- Less Weld Porosity
- No Size or Weight Limitations
- Consistently Effective
- Scientifically and Academically Verified

Materials Meta-Lax® Can be Used On

- Low Carbon- HOT ROLLED- 1018, 1020, A36, 4620, 8620
- Medium Carbon- 1045, 1060, 4140, 4340, H13, P20
- Tool Steel- A2, D2, M1, M2, M3, M4, S7, HY80, HY100
- Aluminum- 356, 2000, 5000, 6000, 7000
- Stainless Steel- 304, 316, 410, 416
- Cast Iron- Gray, Nodular, Meehanite
- Exotic Metal- Gold, Titanium, Magnesium, Inconel, Monel, Bronze, Waspalloy, Hastelloy, Stellite
- Weldments • Forgings • Castings
- Hardened • And others

Meta-Lax® Product Line

META-LAX®

Stress Relief & Weld Conditioning

Benefits - Stress Relief

- Certifiable Stress Relief
- No Treatment Distortion
- No Size or Weight Limits
- 41% Less Machining Time
- 98% Less Processing Time
- 95% Less Processing Cost
- Consistently Effective
- 9 Month ROI

Benefits - Weld Conditioning

- 90% Less Weld Distortion
- 90% Less Weld Cracking
- Less Weld Porosity
- 25% Faster Weld Speed
- 400% Greater Ductility
- Improve Weld Quality

Meta-Lax processing is the world's most successful vibratory stress relief treatment for metal structures. This success has been spearheaded by the Meta-Lax product line. In addition, Meta-Lax can be used during welding, "weld conditioning" to prevent weld distortion, weld cracking, and other weld defects.

In stress relieving, Meta-Lax equipment "certifies" stress relief in one of three ways; computerized, graphic, or manual. Meta-Lax stress relief certification is considered the standard in the vibration stress relief industry.

The portability and ease of operation make all Meta-Lax equipment suitable for in-plant or on-site applications.



2700 Console with Computer Certification



1701 Console with DataGraph Certification



701 Console Manual Certification

Force Inducer & Weight Capacity



IF

60-500 lbs.



IFD

120-10,000 lbs.



V8

100-20,000 lbs.



2A

150-40,000 lbs.



3A

5,000 lbs. - over

Pulse Puddle Arc Welding® Product Line



Pulse Puddle Arc Welding (PPAW) utilizes Bonal's patented process during welding to pulsate the weld puddle while the weld metal is being deposited.

PPAW Equipment is engineered to be integrated into the welding station as well as in field operations.

Benefits:

- 90% Less Weld Distortion
- 90% Less Weld Cracking
- Less Weld Porosity
- 25% Faster Weld Speed
- 400% Greater Ductility
- Improve Weld Quality

PPAW Console & Wand



Pulsator & Weight Capacity



P1

60-500 lbs.



P2

120-10,000 lbs.



P3

5,000-40,000 lbs.



P4

100-20,000 lbs.



P5

150-40,000 lbs.

Black Magic for Distortion Control® Product Line



Black Magic - The Ultimate Distortion Controller utilizes Bonal's patented process to induce a mild energy into the treated part. It helps to control distortion on those smaller metal parts up to 300 lbs. A perfect addition to any machine shop to prevent anticipated distortion.

Benefits:

- Reduce Machining Distortion
- Reduce Grinding Distortion
- Reduce Heat Treat Distortion
- No Operator Training

Three Sizes:

- 12"x18" - 50 lbs. capacity
- 15"x30" - 150 lbs. capacity
- 18"x 36" - 300 lbs. capacity



1300 North Campbell Road
Royal Oak, MI 48067
Phone: 248 582-0900
Toll Free: 800 638-2529
Fax: 248 582-0901
info@bonal.com
www.bonal.com

Frequently Asked Questions

How long does Meta-Lax stress relief take?

For most parts Meta-Lax stress relief is completed between 20 minutes to two hours.

How big and heavy of parts can Meta-Lax technology treat?

Size and weight, large or small, are NOT limitations since large and heavy parts require treating a section of the part at a time whereas small parts simply are attached to a vibration platform. A series of large bulkheads for a lock and dam facility required over 80 different force inducer placements taking three days of processing each. Meta-Lax has been used to treat several heavy parts that weighed over 1,000,000 lbs. each without problem. An example of tiny parts secured to a table would be of pacemaker valves where about a year's supply were Meta-Lax treated at one time.

Do you have an independent survey that rated "customer satisfaction"?

YES, and it's impressive. Our customers indicated a 95% satisfaction with their results and 100% were satisfied with working with the Bonal staff.

Who endorses Meta-Lax technology?

Meta-Lax technology has been verified by over seven major organizations including U.S. Department of Energy, and there have been over 165 articles published in trade magazines of which over 125 of these included pre-approved stories of Bonal customers including NASA, U.S. Army, and General Motors. Additionally, Bonal has received Special Awards from National Science Foundation, U.S. Department of Energy, GSA, and Entrepreneur of the Year.



*Meta-Lax Stress Relief -
The New Standard.*

J & J Burning

How much does this equipment cost?

Meta-Lax equipment ranges from \$10-30k.
Pulse Puddle Arc Welding equipment ranges from \$8-13k.
Black Magic equipment ranges from \$4.7-7k.