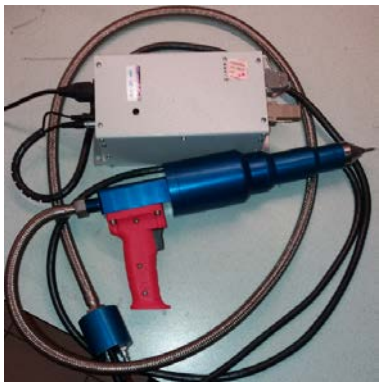
High Power Ultrasonic Impact Treatment

Is a cold working process that uses high frequency and high-velocity impact of a hard metal tool tip to plastically deform a material in order to introduce beneficial compressive residual stresses. These residual compressive stresses are produced by work hardening with the intent to replace residual tensile stresses in metal surfaces and welded joints. In weld joints, one significant objective is to improve the fatigue strength of welds that may be subject to dynamic stress conditions and susceptible to stress cracking.

High Power Ultrasonic Impact Treatment

The High Power Multi-frequency, Multimode, Modulated Sonic & Ultrasonic system (MMM) generates multimode mechanical oscillations through the peening tool which enables high efficiency and effective stress release.



Onshore and Offshore Applications

- Wind Turbine Towers
- Transport Pipelines
- Bridges
- Ship & Floating Vessels
- Platform Support Structure
- Civil Structures
- Aerospace Drive Shaft and Critical Parts
- Storage Tanks
- Pressure Vessels
- High Speed Rail Components

Ultrasonic peening is recommended as a preventative treatment of weld sections expected to be under high stress.

MPI has developed redesigned and delivered its ultrasonic peening equipment globally for over 10 years. The unique MPI ultrasonic impact peening system includes an ultrasonic generator power supply (MMM) connected by a cable hose to the tool housing that contains an ultrasonic transducer assembly and the impact pin(s). The tool-housing tip, holding the impact pin(s), is replaceable and can be designed in a wide range of options to allow for one or many pins of various arrangements to address the many different applications. The tool housing can be for hand-held operation or mounting to a robotic arm for automated applications.
The MPI design team can provide custom pins and pin holders for most any application. We offer standard tool designs working at 20 kHz and 35 kHz. Other custom frequency system are available on demand.

The Advantage

The power supply equipment is the heart of the UP system and is based on proprietary MMM Technology, which produces high efficiency active power in wide-band sonic and ultrasonic vibrations. The peening tool is enabled to produce proprietary “single-piston” peening action, and every other peening tool known from other sources (from competitors) is based on double-piston action. In essence, by utilizing the proprietary peening action, a much deeper metal penetration (up to factor 2) is achieved. Our design team can provide custom pins and pin holders for almost any application. We offer standard tool designs working at 20 kHz and 35 kHz. Enhance low and high cycle fatigue and has been documented to provide increases of up to ten times greater than non-treated ultrasonically peened.

HPUIT Specification

System:

- Power Options: 400W, 1000W, or 1500W
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- System Output Frequency: 20 kHz

Hand Tool:

- Length 420 mm
- Weight approx. 2.8 kg
- Includes single pin working head, two or three pins in line working head, and multi-striker
- Combined air and electrical inlet allow use of single hose line to power and air supply station.
- Sliding outer housing with spring shock absorber to reduce vibration for reduced operator fatigue.
- Non-Corrosive materials

The Problem

Example: Weld joints on offshore rigs are subject to constant stress and strain due to rough sea conditions. The same is true for Floating Production Storage and Offloading (FPSO) vessels that are additionally subjected to the stresses of the cyclical loading, especially in fatigue prone areas. As the rig and vessel welds approach the end of their known fatigue life our clients are faced with the challenge of repairing and maintaining failing weld joints. Normal repairs to these high stress joints are often temporary and not sufficient for long term operation.

HPUIT Generator Specification

Ultrasonic Power Generator:

- Dimensions: 260 x 85 x 370 mm
- Weight: 4 kg
- Electronic protection measures:

  - Overload
  - Short circuit
  - Over temperature

System Requirements:

Mains Supply:	210 - 250 VAC, 50 - 60Hz
Current Consumption:	max. 7 A
Temperature Range:	-10 to +40°C
Compressed Air (filtered) to hand tool for tool tip cooling	

The Solution

By using our Ultrasonic Peening technology to dress repaired welds and also treat undamaged welds in high stress areas our clients can reset the fatigue life and add up to fifteen years of additional service life.

HPUIT System Advantages and Specs

ADVANTAGES

- MPI peening tool has 2 times higher, initial oscillating amplitude of ultrasonic transducer, compared to any other peening tool produced worldwide (meaning hammering, penetration impact depth can be very high and strong). It also has and stronger pulsing momentum (at least two times), than anybody else.
- MPI's peening operating regime is frequency-modulated what has advantages regarding faster and stronger stress relief (compared to competitors).
- MPI peening presents Single-piston peening concept based on several patents and patent application:
- MPI Peening generator keeps frequency and power control during peening in heavy-duty conditions what is very difficult for standard ultrasonic generators.
- Operating life: almost unlimited. Apparatus is very robust and almost indestructible, compared to competitors. Applicable in very long continuous operating regimes (it has forced air-cooling for very long and heavy-duty operations).
- Modular design concept, with easy replaceable hammering pins, and handy for manual operations.
- Can be applied with robotic arm.

GENERAL SPECS

- Rated watt consumption 400-600W.
- Operation ultrasonic frequency 20 kHz (higher frequencies also available).
- Bias current 7A.
- Oscillation amplitude of wave guide edge 25-30 μm.
- Treatment speed in manual mode 0,3 - 0,7 m/min.

HPUIT Treatment for Improvement of Fatigue

High Power Ultrasonic Impact Treatment for Fatigue Life Extension

High Power Ultrasonic Impact Treatment is a valuable technique for the improvement of fatigue life through the cold working of weld toe and weld face. This technique improves the fatigue strength of any full penetration weld configuration well over four times.

High Power Ultrasonic Impact Treatment is normally targeted at areas of structural integrity concern. Therefore, the fatigue life extension of these specific welds will result in an overall life extension of the structure through maintained structural integrity. This treatment can be used to avoid / prevent fatigue cracks in high stressed weld connections in all types of metal structures either civil, industrial, onshore or offshore

HPUIT Means, Less Down-Time & Costs

High Power Ultrasonic Impact Treatment Save Time and Money

Through the preventative technique of High Power Ultrasonic Impact Treatment, high investments in maintenance and repair will be negated. Through the treatment of either known critical structural areas or through predetermination of stress concentrations through NDT inspection, a preventative method against fatigue failure is enabled.

HPUIT Offers Improved Integrity Management

High Power Ultrasonic Impact Treatment Avoids Fatigue Cracking

When High Power Ultrasonic Impact Treatment is used in areas of stress concern, or in areas identified as having residual stresses, then fatigue and fatigue cracking can be prolonged or completely avoided. The treatment is so effective that it could extend the service life of any full penetration weld configuration by at least four times.

If, for example, High Power Ultrasonic Impact Treatment is carried out during a scheduled pipeline, tank or structure inspection it will then be a preferred way to prevent any fatigue crack developing since there is no influence on production and hard to access areas are no more limited. The treatment is relatively fast so it can be applied in addition to standard shutdown or inspection procedures.

High Power Ultrasonic Impact Treatment offers asset owners / operators a pro-active solution for fatigue related structural integrity issues. By using High Power Ultrasonic Impact Treatment, the structural integrity engineer will be able to eliminate frequent shutdowns for repairs.