IDVMAC-01

EQUIPMENT FOR STRESS - RELIEVING BY CONTROLLED MECHANICAL VIBRATIONS, WITH AC MOTOR AND MICROCONTROLLER

The dimensional stabilization by vibrations consists in the utilization of the controlled vibrations for reducing the residual stresses in metallic parts or structures. This method is not a total replacement of the process of voltage removal by climatic cycle, but is an efficient alternative to dimensional stabilization and stress relieving of the parts in any manufacturing stage, without structural changes and without influencing the mechanical characteristics and fatigue strength of the material.

The method consists in applying mechanical energy as vibrations to the parts with high residual stresses, before being worked.

The application of energy as vibrating waves leads to the change of the position of unstable atoms which are moving on very short distances for stabilizing each crystal and, at the same time, the entire structure. The decrease of stress using the vibrations has as result a much more stable structure, with low microscopic residual stresses.

This treatment can be applied both to ferrous and non-ferrous parts; it can be applied also during welding, for avoiding cracks generation.

Actually, the method imposes no limit to the weight of the treated part.

RESEARCH, DEVELOPMENT AND TESTING NATIONAL INSTITUTE FOR ELECTRICAL ENGINEERING

ICMET CRAIOVA

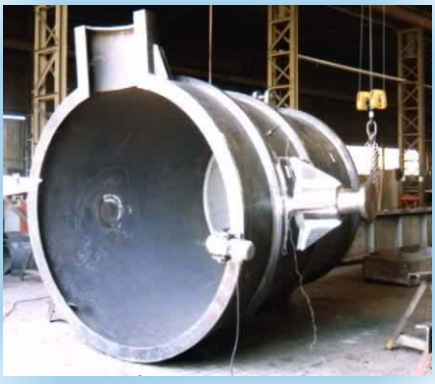
Calea Bucureşti 144, 200515 CRAIOVA

Tel: +40 351 404 888; +40 351 404 889; Fax: +40 351 404 890; +40 251 415 482;

www.icmet.ro; E-mail: market@icmet.ro; testing_services@icmet.ro

IDVMAC-01

The equipment for dimensional stabilization by vibrations is a portable one and can be used for parts having any size, shape or weight resulted after welding or casting and for other structures. The small parts can be treated by fixing them on a shaker.
This method is ideal for the applications involving large parts with critical dimensions, requiring very large furnaces for their thermal stress relieving.



RESEARCH, DEVELOPMENT AND TESTING NATIONAL INSTITUTE FOR ELECTRICAL ENGINEERING

ICMET CRAIOVA

Calea Bucureşti 144, 200515 CRAIOVA
Tel: +40 351 404 888; +40 351 404 889; Fax: +40 351 404 890; +40 251 415 482;
www.icmet.ro; E-mail: market@icmet.ro; testing_services@icmet.ro

IDVMAC-01

The procedure may be used for:

Stress relief of the metallic welded structures:

- It reduces the distortion (resulting less rigid welding seam) and the cracking at the special steel welding.
- It reduces thermal distortions
- It reduces macroscopic stress at the materials highly resistant to traction.

Deformation decrease during and after the mechanical treatment

Homogenization of metallic structures during welding and avoidance of micro-defects appearance:

- Knocking-out of cast pieces;
- Molding with self-hardening mixture;
- Vibration during mold casting.

Materials at which the dimensional stabilization can be applied:

- cast iron, cast steel, non-allied, low allied and high allied steel
- normalized structures
- steel non treated thermally, fixed by coherent precipitation from particles
- martensitic, ferrite, austenitic steel

Materials at which the dimensional stabilization can be only partially applied:

- cold-work hardened or hot hardened nickel, aluminum
- materials hardened by incoherent precipitation

Materials at which the dimensional stabilization cannot be done:

- materials cold-rolled, drawn or deformed with rough distortion of the lattice

RESEARCH, DEVELOPMENT AND TESTING NATIONAL INSTITUTE FOR ELECTRICAL ENGINEERING

ICMET CRAIOVA

Calea Bucureşti 144, 200515 CRAIOVA
Tel: +40 351 404 888; +40 351 404 889; Fax: +40 351 404 890; +40 251 415 482;
www.icmet.ro; E-mail: market@icmet.ro; testing_services@icmet.ro

IDVMAC-01

TECHNICAL CHARACTERISTICS

- Supply voltage: ..... 230 V; 50 Hz ÷ 10%
- Vibration frequency range: ..... V1= 8.3 ÷ 83 Hz
- Stress - relief cycle duration: ..... 30 min.
- Maximum power absorbed from the mains:.....2,5 kVA
- Speed range: .....500 ÷ 5000 rpm
- Possibility to work under two duties: standard duty
  automatic duty
- Three - phase asynchronous motor drive is carried out by inverter supplied at 230V AC
- Capability of auto-diagnosing and detecting the faulty blocks:
  - not-connected printer
  - not-supplied printer
  - lack of paper or jammed paper
  - improperly mounted supply cable
  - hardware fault

OPERATING MODE

The metal structures stabilization shall be done in three steps:

1. Resonance peaks identification

The speed of vibrator motor is smoothly and constantly increased, watching continuously the indicating instruments A [%] - T [min], recording the speed and absorbed current at the appearance of each maximum on the accelerometer A [%]

2. Selection of the speed corresponding to the resonance peaks

After finalizing the sweep and recording the resonance peaks, 3 -5 speeds, for which resonance peaks have been found, should be selected. For covering the entire range (500 -5000 rpm), one resonance peak with the highest amplitude will be selected on an interval of 900 rpm. The vibration for dimensional stabilization will take place at these speeds.

3. Dimensional Stabilization

The vibrator speed is set on the selected peak, according to the highest speed, and the vibrator is let to work, watching the alphanumerical apparatus indications, the stabilization at this speed being ended when the value of the current is stabilized.

The other peaks are identically treated. After passing through all these peaks, the part is dimensionally stabilized.

ICMET

RESEARCH, DEVELOPMENT AND TESTING NATIONAL INSTITUTE FOR ELECTRICAL ENGINEERING

ICMET CRAIOVA

Calea Bucureşti 144, 200515 CRAIOVA

Tel: +40 351 404 888; +40 351 404 889; Fax: +40 351 404 890; +40 251 415 482;

www.icmet.ro; E-mail: market@icmet.ro; testing_services@icmet.ro

IDVMAC-01

The vibratory stress relief equipment with microcontroller, in its variant with maximal fitting out, comprises the following elements:

- Control and adjustment unit, equipped with micro controller (UCR - μP) = 1 piece.

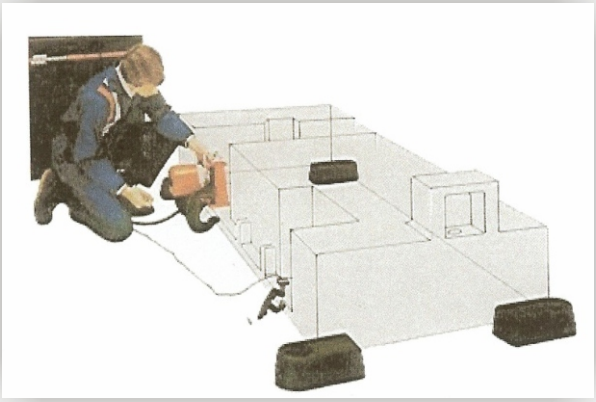
- Vibrator V1 (for parts from 0.05 t to 12 t) with three-phase asynchronous driving motor, power 1.1 kW and movement transmission by flexible shaft = 1 piece

- Acceleration transducer = 1 piece

- Pliers for fixing the vibrator = 2 pieces

- Rubber buffers for V1 = 4 pieces

- Printer = 1 piece



RESEARCH, DEVELOPMENT AND TESTING NATIONAL INSTITUTE FOR ELECTRICAL ENGINEERING

ICMET CRAIOVA

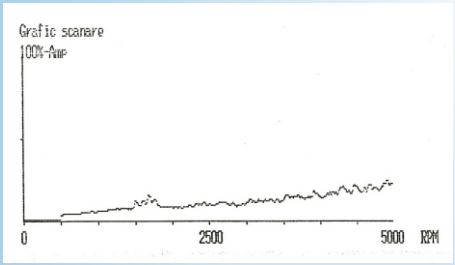
Calea Bucureşti 144, 200515 CRAIOVA
Tel: +40 351 404 888; +40 351 404 889; Fax: +40 351 404 890; +40 251 415 482;
www.icmet.ro; E-mail: market@icmet.ro; testing_services@icmet.ro

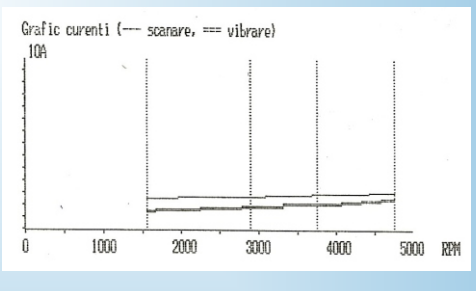
IDVMAC-01

UCR - µP is controlled by a micro controller which, on the basis of a dedicated software, allows:

- vibrator speed change, consequently mechanical vibration frequency change ;
- amplification and processing of the electrical signal given by the acceleration transducer ;
- data presentation of the vibrator speed and current absorbed by the motor, on alphanumeric display, with LCD ;
- identification of the resonance peaks ;
- control of the equipment operation, from the keyboard.

Based on a dedicated software, the equipment allows to print the test reports specific to the technological process of vibratory stabilization, using the printer.





ADVANTAGES

•It reduces distortions during and after mechanical processing and it is applied to a wide range of metals

• It reduces the risk of cracking during welding

• It does not affect the mechanical properties

• It can treat many workpieces at the same time

• It consumes only a fraction of the fuel required by the thermal procedure

• The treatment can be applied where the mechanical processing is performed

• Has no side effect, such as oxidation or dimensional change

• Is a non-polluting procedure

RESEARCH, DEVELOPMENT AND TESTING NATIONAL INSTITUTE FOR ELECTRICAL ENGINEERING

ICMET CRAIOVA

Calea Bucureşti 144, 200515 CRAIOVA
Tel: +40 351 404 888; +40 351 404 889; Fax: +40 351 404 890; +40 251 415 482;
www.icmet.ro; E-mail: market@icmet.ro; testing_services@icmet.ro