

Evolution in Applications and Tools for Rotary Flap Peening

ROTARY FLAP PEENING (RFP) has been a well-known and established process in the aviation industry for many decades. Initially RFP was developed for repair peening on military aircraft and helicopter components. The technique can eliminate part disassembly and shipment to a dedicated shot peening facility. Today RFP is widely used in civil aerospace as well. With this smart process in place, excessive shipping time and organizational effort can be eliminated. Many different units, from landing gears and brakes to structure, wing and fuselage bodies to thin-walled components like flaps and wing spars, are flap peened during maintenance, repair and overhaul. Latest applications can be found in OEM aerospace parts production where the process allows for small spot repair of slight surface scratches thus salvaging expensive parts. Other application trends are in manual shape corrections of shot-peened and peen-formed parts.

FLAP PEENING PRINCIPLES

The flexible flap, with its embedded tungsten carbide shots on both sides, is the standardized tool and the basis of all associated specifications, equipment and flap peening methods. The flap is defined in detail in the AS2592 specification. The equipment and the procedure are standardized in AMS 2590. A speed-controlled rotary drive runs a slotted mandrel that clamps the flap on its center line. The flap consists of a synthetic fiber fabric strip soaked in resin and fringe meshes which carry one or two rows of tungsten carbide balls with a fixed diameter of 0.045 inches. The flaps are available in three different sizes: 9/16 x 1, 9/16 x 1 ¼ and 1 x 2 inches. These different sizes allow the user to adapt peening intensity, provide ease of work, and meet the requirements of the application with respect to specifications and accessibility in an appropriate manner.

The RFP method has the same physical basic principles as shot peening. Round shot is propelled onto the component surface in a controlled manner and creates local plastic deformation in the part surface and, as a consequence, creates the desired compressive residual stresses. The benefits of this surface enhancement are the local restoration of the original stress state in previously peened components and the reinforcement of surfaces after grinding and blending.

The main process parameters are as follows:

- **Media hardness, size and shape** are clearly defined by the specifications of the tungsten carbide balls.
- **Peening intensity - impingement angle and intensity.** The impingement angle is close to 90° to the surface as long as the peening area is accessible and the tool is held at an appropriate distance. With this orthogonal impact, the energy transfer into the surface is maximized. The velocity depends on the tool rotation speed.
- **Coverage - impact dent density.** The impact dent size is mainly dependent on the flap speed. The peening time determines the impact dent density.

FLAP PEENING EQUIPMENT

The following parameters provide controllability of the process. The parameters are the tool rotation speed that determines the peening intensity and the peening time that determines the peening coverage. The application of the process can be challenging due to limited accessibility of parts and the areas to be peened, or the required peening time at low intensities. Thus an appropriate flap peening tool should provide two main features:

- proper speed control in all situations during the procedure
- user-friendly tool operation

So it is worthwhile to compare the characteristics of well-known compressed air and electrically driven tools to alternative solutions and to new equipment in the market. Let's explore two systems.

SUHNER ROTOmax 2.0

Users who prefer a simple and very powerful and robust flap peening drive should check out the ROTOmax 2.0 drive from SUHNER. This drive was originally designed for grinding tasks. It has a strong motor with simple dial of speed with membrane keys. The very high motor power and the closed-loop speed control allows for extremely stable rpm



The ROTOmax 2.0 works as a rotary-flap peening tool and a grinder.

even with high friction in the application. The motor rotation is transferred to the handpiece via a flexible shaft. The flap peening mandrels can be fixed in the robust handpiece with the help of collets.

The stability of the strong drive comes with some disadvantages in handling. The drive is very heavy. Even if installed on a trolley, it has limited mobility. The biggest mandrel requires a bigger shaft and quite heavy handpiece. The lack of the shaft's flexibility and the weight of the handpiece is exhausting for the operator. On the other hand, the drive is multifunctional as it can be used for other applications like grinding.

sentenso RotoFlapMaster

The new RotoFlapMaster from sentenso is an innovative development with several unique features. This system consists of a very compact control box with power supply, closed-loop speed control, membrane keys and colour display, a handpiece with brushless DC motor and a flexible connecting cable. The RotoFlapMaster is a compact system which provides specific usability. sentenso implemented the functionality of the RFP process in a user-friendly, cordless, and smart unit. It uses latest drive technology with a dynamic brushless motor with up to 10,000 rpm with very precise 14-bit closed-loop speed control and reversible operation. Under typical loads, this control keeps the rotation speed



The RotoFlapMaster kit

safely within a closed range far below the maximum value of +/-100 rpm required by AMS2590. The handpiece is designed in an ergonomic style so that it is easy to handle even in tight work areas. An angled handpiece is under design.

Advanced Usability

The system controller provides an easy-to-read colour display and predefined speed settings for all flaps and Almen strips, depending on the desired peening intensity. The handpiece has two specific features which help the operator use the tool with just one hand without having to turn his view away from his work. One is the START/STOP button and the other one is the green and red light element that indicates the correct speed.

For ease of use and compact design, the controller functions are reduced to the core features. This was one of the consequences from a survey that sentenso performed with many operators. Only the necessary functions were implemented including:

- Set rotation speed
- Change rotation direction
- Preset of speed
- Preset of intensity with calculation of suggested speed depending on flap size and Almen strip type
- Timer function
- Various settings (flap size, Almen strip type, language, units)

The START/STOP functionality on the handpiece allows the operator to fully control the tool at any time and in any situation and whenever he wants to start or stop his work. This feature is especially helpful in difficult-to-reach areas. Moreover he can use the tool with the controller placed on a table close by but also with a belt around his shoulder or around his waist. With the controller on his body, the operator can work on a hinged step or ladder without the need to step up and down when the peening must be interrupted. In case the speed should be dropped due to extreme friction or blocking, this will be clearly indicated with the light element changing from green to red.

The quality of a rotary flap peening job is generally characterized by intensity and coverage. Some specifications allow just closed-loop speed control as a replacement measure for peening intensity. Most specs and AMS 2590 still demand the intensity determination and verification on a specific magnetic Almen strip holder. The proper full coverage on the peening area is assured by visual inspection. This inspection should gradually be checked by the operator during peening.

For the quality checks, the START/STOP button provides additional assistance. Pressing the button twice starts the system timer. The timer is very helpful when running

saturation curves on Almen strips which need defined peening time cycles. The operator can work on the holder area beside the strip and start the cycle time when he is ready topeen the strip. The START/STOP function also allows interruption of work for intermediate coverage inspections during the peening job.

Fully Mobile Operation

The RotoFlapMaster receives its power from a rechargeable battery pack so fully mobile flap peening becomes available for the first time. With one battery fully charged and under usual working conditions, the tool will run a 9/16 x 1¼ inch flap at a speed of 5,000 rpm for more than four hours. With the second battery, the tool can be used more or less permanently.

The compact and lightweight controller can be carried by the user during operation which provides free and flexible use. The unique system is available separately or in operator-friendly and customizable equipment kits. Each piece of equipment is packed safely in a robust travel case with rollers and an extendable pullbar so it can be easily taken to the work site.

With the high number of user-friendly features, the new RotoFlapMaster represents an evolution in rotary flap peening equipment. ●

For more information on sentenso products, visit www.sentsenso.de, send email to info@sentsenso.de, or call +49 2363 3606988.



The RotoFlapMaster tool in action

Ground-Breaking Ceremony for New USA TOYO SEIKO Facility

ON SEPTEMBER 4, 2020, TOYO SEIKO held a ground-breaking ceremony for their new facility in South Bend, Indiana USA.

The estimated completion date for the new 25,200 square foot building is in April 2021. The location has room for a 10,000 square foot expansion. The company had outgrown their current 16,000 square foot building in South Bend. The TOYO SEIKO facility will have room for offices, manufacturing, warehouse space, and shipping and receiving capabilities. The company will be adding a peening laboratory in the future. “We are very excited to have a facility that meets our specific parameters as opposed to adjusting to meet an existing layout. It’s much more efficient,” said Larry Catanzarite, General Manager with TOYO SEIKO North America. ●



Dr. Watanabe, President and CEO of TOYO SEIKO, was unable to attend the event due to COVID-19 travel restrictions so he participated via a video conference.



The following people took part in the ground-breaking ceremony (from left to right): Jose Delgado, Plant Manager TOYO SEIKO North America Inc.; Tom Brickley, V.P. Electronics Inc.; Joe Leatherman, President Cadet Construction; Jeffrey T. Ballard, Vice President Danch, Harner & Associates Inc.; Larry A. Catanzarite, General Manager TOYO SEIKO North America Inc.; Honorable James Mueller Mayor, South Bend Indiana; Jack Champaigne, President Electronics Inc.; Shota Watanabe, Vice President TOYO SEIKO North America Inc.; Missy Varga, Operations Manager TOYO SEIKO North America Inc.