The Shot Peening Operator's Checklist

Part one of two-part series

In the current manufacturing world where quality *assurance* carries more value than quality *control*, it's important that you, the shot peening operator, apply this concept to your shot peening processes.

In this article, I'll review four key "quality assurance" equipment inspections that every shot (and glass bead) peening operator should conduct on a regular basis. The underlying assumption is that we are shot peening, not blast cleaning. To refresh, the purpose of cleaning is to remove contaminants like rust, scale, or sand from the surface of a metallic part, or to impart a profile (roughness) on the surface to facilitate better coating adhesion. Peening, on the other hand, induces compressive stress into the surface of the component. Induced compressive stresses counter the tensile or working stresses during the component's work life, neutralize the detrimental effect and prevent failure.

The degree of cleanliness is subjective. In comparison, peening results are objective and measurable. Peening performance is assessed by monitoring the intensity and coverage. Further, monitoring process variables, such as blast media size and shape, media velocity, media flow rate, etc., determine the repeatability and consistency of the peening operation.

Centrifugal wheel-style media propulsion systems and compressed air nozzles are typical shot peening machines. Our discussion will start with a very common exercise that should be routine for every operator. I'll then offer common inspection points for both types of shot peening machines.

#1 CONDUCT GENERAL MACHINE INSPECTIONS

As mundane and obvious as this sounds, general machine inspections will help you identify issues before they can negatively affect the peening process. This exercise won't take more than 10 to 15 minutes, and it should be carried out at the start of every shift. Listed below are some of the conditions that are identifiable during inspection, and their possible causes and effects.

Oil leakage: Leakage of oil from a gearbox that's part of the media reclaim system could indicate future motor and gearbox failure, thereby disrupting machine operation. Needless to say, oil leakage is a safety hazard.

Media leakage: Assuming that the general housekeeping of your work area is acceptable, any media spillage that's above the routine must be investigated. In addition to being a slip hazard, a media leak indicates several things waiting to go wrong. Most of the time the location of the media leak will point you towards the source. However, sometimes the source of the leak isn't obvious, especially in a wheelblast machine with a leak on the ground below the storage hopper. In this case, the source of leak could be one of the flow control valves, a worn hose, or a leak from the blast cabinet being deflected by a machine component onto the floor below the hopper. The fix for each of these is based on the source.

PEENING TIP

If the leakage isn't significant, it may not be visually noticeable. However, your intensity values and saturation curve will tell the true story. In an airblast machine, after the media flow is registered by your flow control valve to be 10 lbs/minute (for example), but not all of the media is propelled onto the part due to the leak, your results will start straying. Coverage will not be complete for the same cycle time as before.

Damage to hoses in an airblast machine: Kinks in an airblast hose will lead to premature wear of the hose and potential leakage of shot. Premature wear not only happens on the outside of the blast cabinet, but could also take place inside the cabinet when the moving carriage rubs the hose against the cabinet wall.

Access panels: Open access panels, without safety interlocks, are safety hazards and invite

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the entry of contaminants that could result in foreign object damage.

Limit switches: Loose limit switches could indicate the incorrect position of a nozzle carriage, risking damage to the workpiece.

Work handling equipment: If you have an inline machine with conveyor rollers, verify that the rollers are turning properly and in the right direction. Slippage in roller movement could leave a light part stranded inside the blast cabinet and damage it due to the continuous intense blast.

I suggest that you run a dry cycle (without blast media) for a few minutes after your inspection, before running your Almen test strips for the shift. Running a dry cycle will help you find problems before an expensive landing gear or engine component is loaded into the machine for processing.

PEENING TIP

Degree of wear on the blast hose is usually seen in the form of a 'soft spot' on the hose and, in some cases, the damage is clearly visible. A hose wearing on the inside may gradually disintegrate and small pieces of rubber contaminants plug the blast nozzle. The effect of a plugged nozzle on intensity and coverage needs no elaboration. Therefore, the first sign of such contaminants inside your hose should be an indicator to check the hose condition.

#2 WATCH FOR WEAR ON FIXTURES AND MOUNTING BLOCKS

Your peening test fixture is blasted more often than the actual part and subject to more wear than any other component of the machine. First and foremost, manufacture the fixture from wear-resistant material. The cost of faulty and incomplete peening results due to fixture wear can be very high.

The condition of Almen blocks, their position on the fixture and holding screws for the Almen strips should be regularly inspected.

PEENING TIP

If, at the beginning of your shift, you have an insufficiently covered strip, drastically different intensity values, or an absence of coverage, check the position and condition of the Almen blocks.

#3 RESPECT YOUR MEDIA CLASSIFICATION SYSTEM

The media classification unit in your peening machine is an important part of the process. Proper consideration should be given to the media type before selecting the classifier unit. For example, glass bead has a tendency to plug the holes due to their shape. In such cases, a ball tray or other self-cleaning mechanism should be installed with the classifier unit. Classifier units are built sturdy enough for peening applications. Common issues with the classifier almost always involve the screen itself. Three such situations are:

1) Your peening machine is discharging a lot of good media into the trash container, robbing the system of useable media. This translates to frequent machine shut-downs due to lack of media. A possible cause is the top screen (in a two-deck classifier) is plugged (holes blinded), preventing media drainage and classification at the next level.

2) Your intensity values fluctuate drastically, prohibiting the plotting of a saturation curve. A possible cause is the blinding of the bottom screen preventing proper media classification. Right-sized media, along with fines, make their way to the blast tank, resulting in incorrect results.

3) The top screen develops a tear or a hole. Replace the screen before large contaminants reach your blast tank, plug the tank opening, or reach the blast nozzle. This situation could result in serious foreign object damage.

Respect your classifier and inspect it at least once a week if it's in a continuous production environment.

PEENING TIP

Use your ears. A good operator is conditioned to recognize unusual sounds. This could be the noise from a loose component in a blast wheel, a plugged nozzle, a rattling bucket in the bucket elevator, etc. These irregularities will have a detrimental effect on your peening results and lead to part damage.

#4 LOOK FOR CABINET WEAR

Though not a common occurrence in an airblast machine, wheelblast machines used for peening undergo gradual wear. Typically, these machine cabinets are fabricated from wear-resistant alloys such as manganese steel and lined with wear-resistant material. However, the travel path of blast media inside the cabinet is not predictable and a single piece of shot could find a gap through a worn liner and start eroding the cabinet wall, eventually leaking out of the machine. Cap nuts used to fasten liner plates on to the cabinet wall also wear and sometimes get dislodged. A loose cap nut, if not captured by one of the reclaim system components, could reach the blast wheel with disastrous results. Also, inspect the cabinet wear plates that are directly in line with the blast nozzles as these areas experience greater wear. Internal parts of the blast cabinet should be inspected on a regular basis, at least once a week.

Watch for more operator tips in the next issue of *The Shot Peener*.