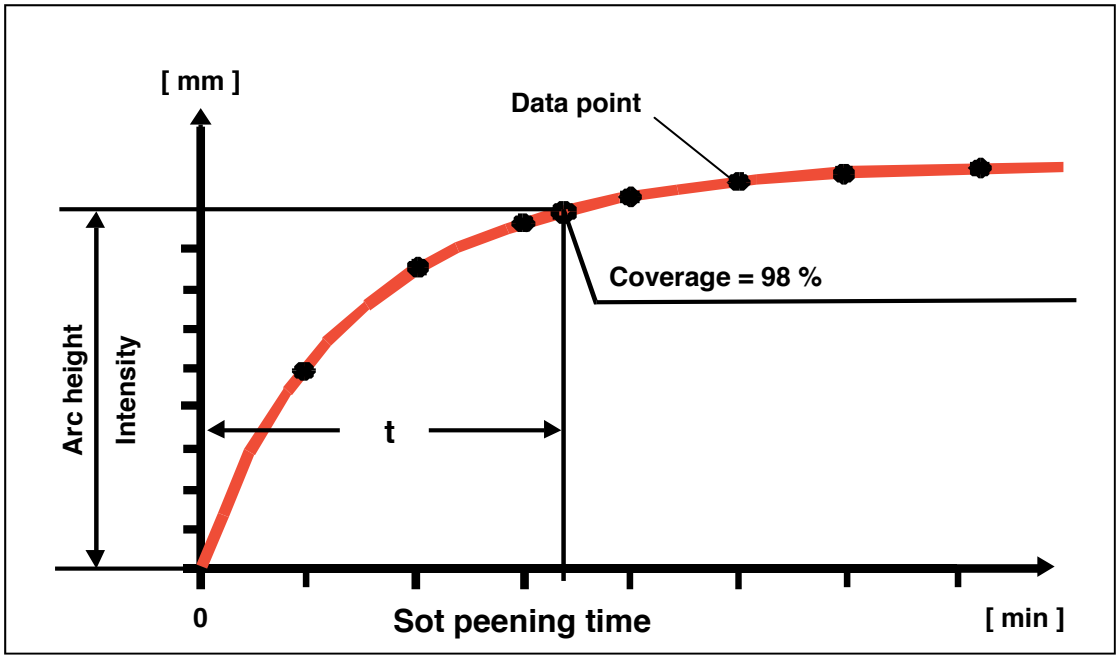
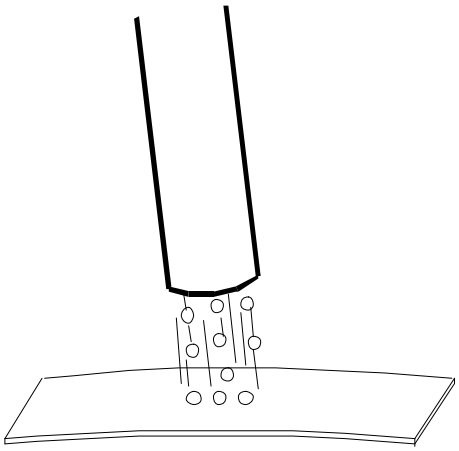
Intensity of shot peening

Shot peening intensity curve



The energy transmitted by shot peening depends: on the mass, on the velocity and angle of impact, on the hardness of the shot peening media, on the number of shot beads and on the surface conditions of part.

If an Almen test strip is shot peened on one side only, it will be curved, more or less, convex on the shot peened side, depending on the energy of the shot peening media stream and the shot peening time.



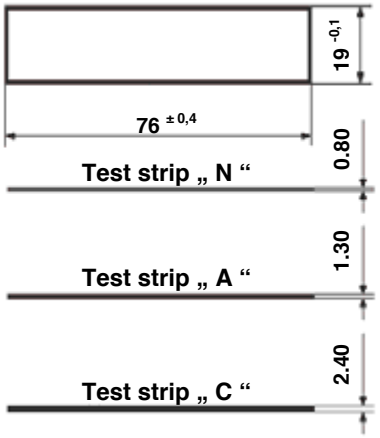
The shot peening intensity is defined as the arc height of an Almen test strip measured at a coverage of 98 % by using an almen gauge.

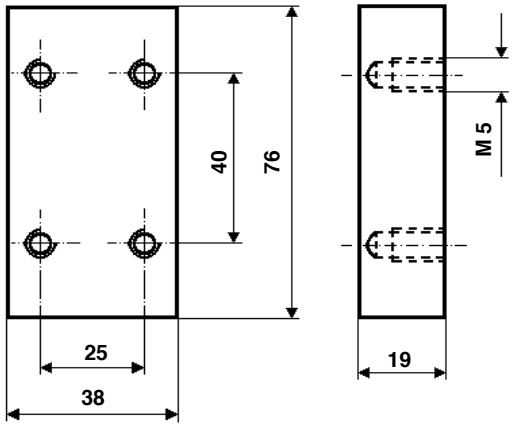
The definition is corresponding with the saturation curve in the Military Specification AMS-S-13165.

To set up a shot peening machine to the specified intensity, several shot peening intensity curves have initially to be recorded with different set ups, with at least 3 data points (recommended are 5). For the use of Almen test strips see page 95.
The shot peening intensity curve, which produces the specified intensity at a coverage of 98 %, measured by using an Almen gauge, will determine the correct set up of the shot peening machine being used.
To achieve the specified coverage on the part see page 97.

Intensity of shot peening

Almen test strip, holding fixture and Almen gauge





Almen test strip

Analysis of stock – C75 S
Cold rolled spring steel
Square edge number one (on 3“ edge)
Finish blue temper (or bright)
Uniformly hardened and tempered to 44 – 50 HRC
Flatness ± 0.04 mm arc height as measured on Almen gauge

Holding fixture

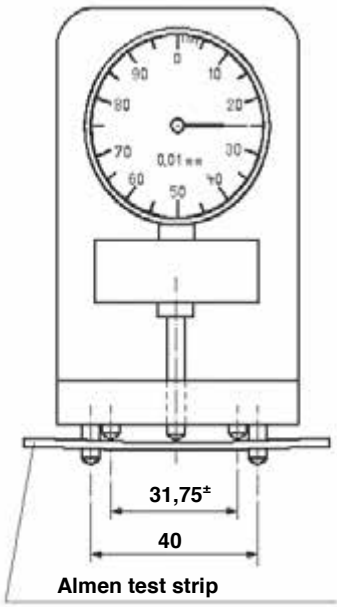
To ensure adequate planar support and sufficient counterweight, the Almen test strip should be mounted on a holding fixture using 4 flat headed screws of size M5 x 10 mm.

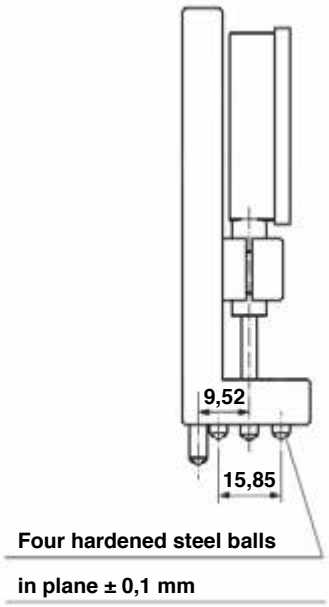
Limits of use:
Almen test strip „A“ = 0.1 – 0.6 mm A
Almen test strip „C“ > 0.6 mm A
Almen test strip „N“ < 0.1 mm A

Almen gauge

The Almen gauge is used to measure the arc height of an Almen test strip fixed onto the Almen gauge at six points.

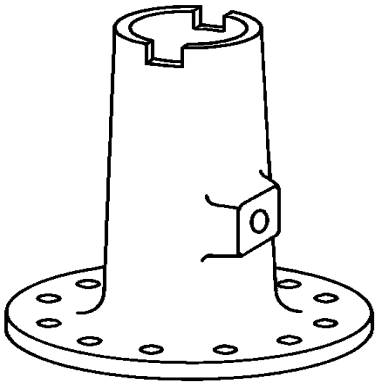
Dial graduation = 0.01 mm



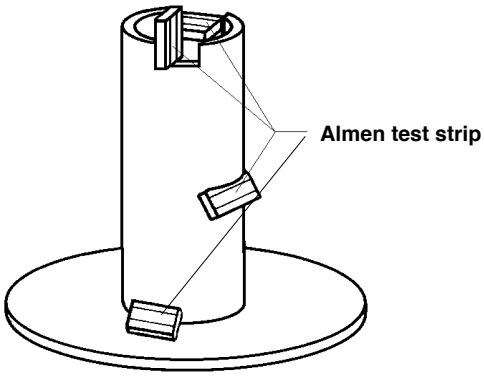


Intensity of shot peening

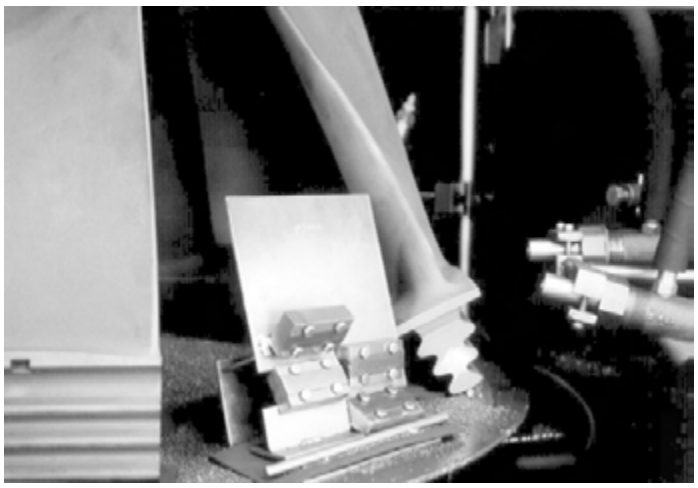
Mock up of part and measuring of intensity



Original of part



Mock up of part



Almen test (determining the shot peening intensity)
Directions for use

1) Choosing the specified Almen test strips „A“, „C“, or „N“ (page 95).
2) Controlling the Almen test strips for flatness with the Almen gauge (page 95).
3) Mounting the Almen test strips on the holding fixture on the mock up.
4) Shot peening the mock up.
5) Measuring the arc height of the Almen test strips.
6) Marking the results in the intensity curves. One intensity curve for each measuring point on the mock up.
7) Repeating step 1) to step 6) 5 times with different shot peening times to be able to draw the intensity curve for each measuring point.
8) The arc height at a coverage of 98 % on each intensity curve can be determined and represents the shot peening intensity at this machine set up (page 94).
9) Repeating step 1) to 8) until the shot peening intensity meets the limits of the specified intensity in every measuring point on the mock up.

Note: Almen test strips should be used only once.

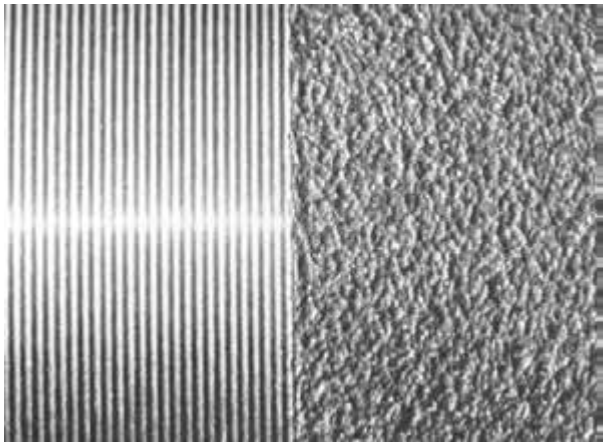
Coverage of shot peening

Definition

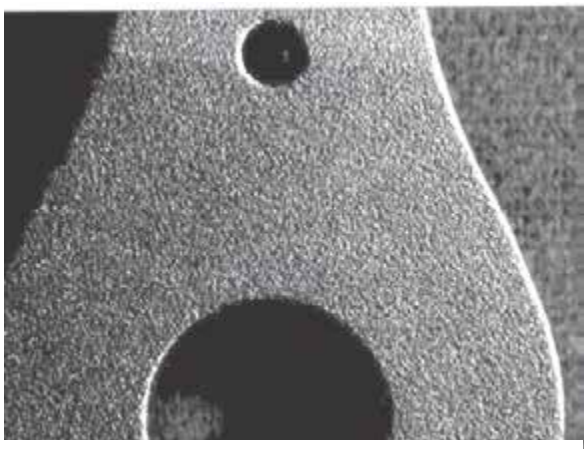
Coverage means the percentage of the surface actually impacted by the shot peening process (dimpled or obliterated surface). A coverage of 100 % is only a theoretical limit and is neither realizable nor mesurable.
In the shot peening process a minimum coverage of 98 % is mandatory.

Coverage factor

Coverage to more than 98 % (the measurable limit) is defined in terms of the multiple of the time taken to achieve a coverage of 98 % (e.g. **1.5** x t 98 %).



Not shot peened **Coverage 98 %**



Coverage 98 %

A coverage of 98 % is the highest measurable limit.
Intensity and coverage are the most important parameters in the shot peening process.
Only complete coverage and the specified intensity lead to the desired distribution of compressive residual stress.
Equal coverage depends on the shot peening time, the exposure to the media stream, the machine set up and the motion of the part or media stream in the shot peening machine.
Many specifications recommend controlling the coverage by visual means such as a magnifying glass or by coating the part with tracer liquid before shot peening. It is extremely difficult, if not impossible, to examine sufficient coverage on hardened parts or holes with a magnifying glass. The tracer liquid coating dampens the shot peening intensity as other liquid films (e.g. oil) and reduces the depth of compressive residual stress until it is completely removed.
OSK-Kiefer GmbH has, in cooperation with the University of Karlsruhe, developed a method which takes into account the ratio between shot peening time of the Almen test strip to the necessary shot peening time of hardened materials up to 63 HRC.

Shot peening time ratio

This shot peening time ratio shows the multiple shot peening time of a tempered or hardened steel up to 63 HRC, compared with the shot peening time of an Almen test strip (44—50 HRC), to a coverage of 98 %.