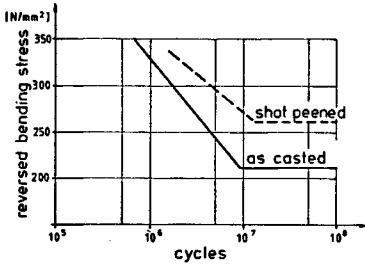


Shot Peening, Special Application and Procedure

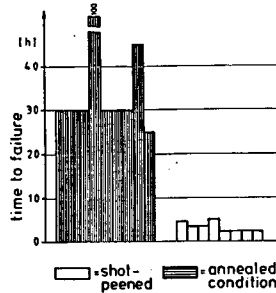
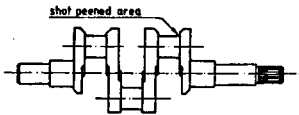
B. Kiefer, OSK-Bernd Kiefer, Oberflächen- & Strahltechnik, 8067 Petershausen, FRG

Application

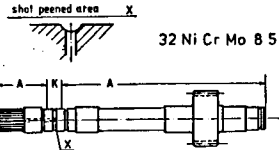
Different parts with different shapes, sizes, materials and natures of loads need different procedures and attention in the different fields of shot peening (1 - 4).



annealed cast iron



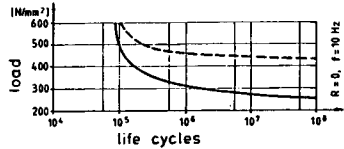
— shot-peened — annealed condition



corrosive environment and reversed bending load

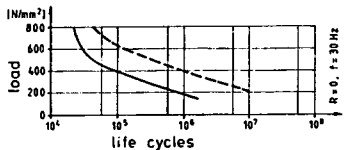
X 3 Cr Mn Ni Mo 26 6 4

in 4N NaCl, PH = 2, 80°C.

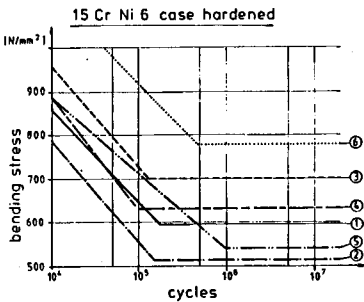


— polished — shot peened

50 Cr V 4
in 3% NaCl



— annealed condition — shot peened



15 Cr Ni 6 case hardened

	radi R (mm)	condition of radi	shot	shot hard- ness (HRC)
①	1	milled	—	—
②	0,6	milled	—	—
③	1	shot peened	cut wire	48
④	0,6	shot peened	cut wire	48
⑤	0,6	sand plas- ted	steel shot	45
⑥	0,6	shot peened	steel shot	55

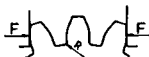


Fig.1 - 4

Selection of Machine and Medium

Shot peening machine

The result of shot peening treatment depends on the intensity, the shot size, shape, hardness and quality, the coverage, the condition and the equipment of the machine used, the qualification of the operator and the quality control system.

The result depends not on the system of acceleration of peening medium, but on the capability of the machine to keep the mentioned parameter constant.

Selection is made according

- to peening medium
- to intensity
- to surface roughness
- to size, shape, material, area to be peened and production stage of parts
- to efficiency

Of course, it will take more attention and effort to keep the peening medium in shape and size, to keep the right angle of impact as well as coverage especially in critical areas by a wheel machine compared with an air blast machine. Similar difficult it will be to use different intensities on the same part as will lead to best results on parts with gradually changing cross sections by a wheel machine.

Peening medium

The material of peening medium is chosen in dependence on

- materials of parts
- necessary intensity
- permissible contamination
- permissible surface roughness
- hardness of parts

The hardness of peening medium should not be less than 10 % below hardness of parts.

The size of peening medium is dependend on

- necessary intensity
- smallest radi of part (the harder the steel, the smaller the size of medium by higher velocity).

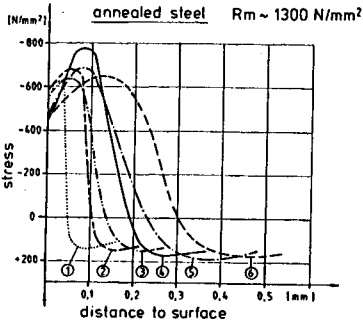
It is an absolute fact that the result of a shot peening treatment will never be better than the condition of the peening medium.

Control of media as well as classifying (screening and separation of broken medium) is mandatory in shot peening operation.

Research and Practical Use

Scientific research and industry have plotted and published a wide family of characteristics of residual stress distributions in shot peened parts and specimens resulting from different shapes, dimensions, materials, peening media, shot size and hardnesses, intensities and coverages (5 - 8).

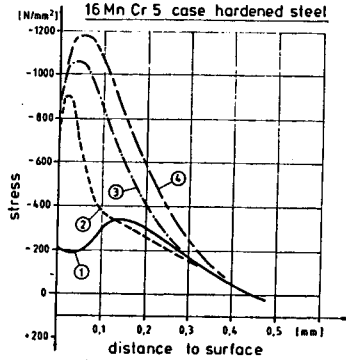
residual stress distribution
after shot peening in a



	intensity [mm A]	shot size [mm Ø]	coverage [%]
①	0,1	0,3	100
②	0,18	0,3	200
③	0,22	0,6	100
④	0,3	0,6	200
⑤	0,38	1,6	100
⑥	0,48	1,6	200

Fig. 5

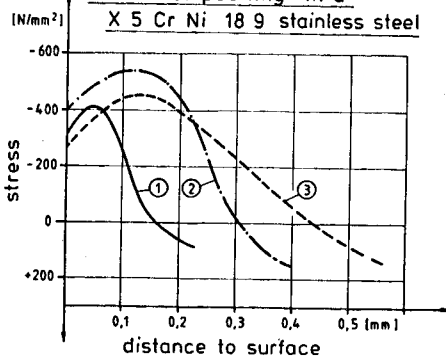
residual stress distribution
after shot peening in a



	intensity [mm A]	coverage [%]	hardness of shot [HRC]
①	---	---	---
②	0,25	98	46 - 51
③	0,55	98	46 - 51
④	0,55	98	53 - 58

Fig. 6

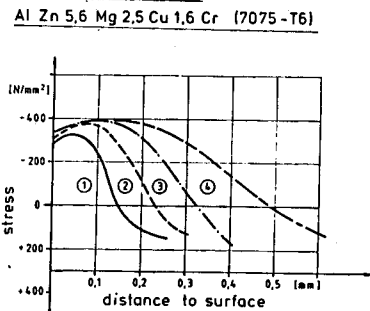
residual stress distribution
after shot peening in a



	shot	shot size [mm Ø]	intensity [mm A]
①	glass beads	0,25	0,15
②	steel shot	0,6	0,3
③	steel shot	1	0,4

Fig. 7

residual stress distribution
after shot peening in



	intensity [mm A]	shot size [mm Ø]	coverage [%]
①	0,18	0,5	100
②	0,28	0,5	100
③	0,35	0,7	100
④	0,9	1,2	100

Fig. 8

By testing them in different nature of loads, it shows best results if a certain ratio that area of residual compressive stress layer bears to area of residual tensile stress.

By plotting intensity, air pressure, shot velocity, shot hardness, and part hardness given from the science in a way shown in the following chapter you will get one of different ways to select intensity, coverage, shot size, shot hardness and material of shot only by knowing the ratio that F1 bears to F2.

Range of Intensity

The characteristic of residual stress induced by shot peening is the controlling factor to select the range of intensity. With the ratio that F1 bears to F2 (Fig. 9) you calculate the thickness of compressive layer induced by shot peening which correlate to a certain intensity (Fig. 10).

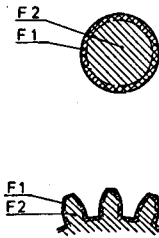


Fig. 9

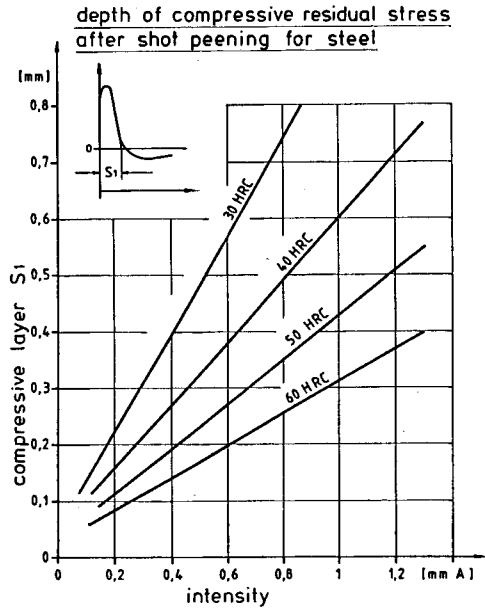


Fig. 10

Corrections may be necessary by

- limit of shot size
- limit of surface roughness
- layer of decarburization

The specified range of intensity can be realized by small shot with high velocity or big shot with low velocity according to (Fig. 11) depending on factors shown in chapter "Peening Medium".

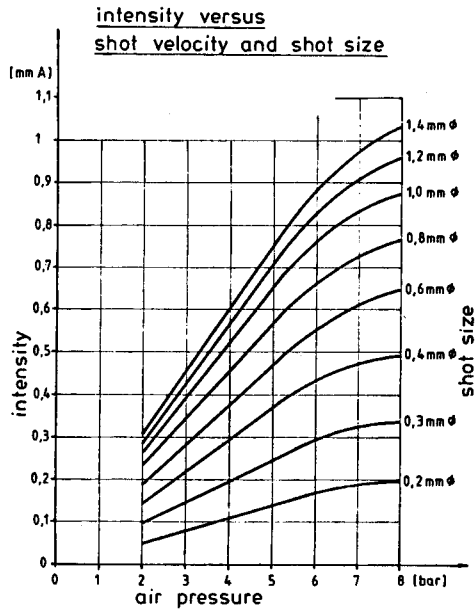


Fig. 11

References

- (1) F. Shaw, Conf. on Advances in Shot Peening and Blast Cleaning 1976
- (2) D. E. Niles, SAE Congr. Detroit Jan. 1967
- (3) Winter, Forschungsstelle f. Getriebe, Ber. Nr. 746
- (4) H. Wohlfahrt, E. Macherauch, P. Starker, R. Schreiber
- (5) H. Wohlfahrt, Betriebsfestigkeit, Juni 1978
- (6) D. Wayne, Univ. of Wisconsin
- (7) R. Clausen, P. Martin, Zwf 74
- (8) P. Striggens, H. Wiegand, Industrieanzeiger 92 (1970)