

65005

HOCKWELL STANDARD CORPORATION
NEW CASTLE, PENNSYLVANIA

SUBJECT: A study of the durability and peening intensity produced by CW-41 Cut Steel Wire Shot as compared to Amasteel Cast Steel Shot.

CONCLUSION: S-390 Amasteel Cast Steel Shot will produce arc heights in the production peening operation that will equal or exceed those produced by CW-41 Cut Steel Wire Shot, at any exposure time.

S-390 Amasteel Cast Steel Shot will peen more economically provided the cost of CW-41 Cut Wire Shot is more than \$233.00 per ton.

Reported By:

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INTRODUCTION:

A sample of new CW-41 Cut Steel wire Shot, C-41 Cut Steel wire Shot operating mix, CW-41 Cut Steel Wire Shot separator discharge and an Almen C Test Strip peened in the production machine, were received from Rockwell Standard Corporation in New Castle, Pennsylvania. The information obtained from the above samples was to be used in conjunction with information derived from Ervin Test Machine results to determine a size of cast steel shot that would be more economical than the CW-41 Cut Steel Wire Shot presently used for peening leaf springs.

PROCEDURE AND RESULTS: First, the arc height and approximate coverage of the Almen C Test Strip were determined. The arc height was .008 inches, at the low limit of the specification of .008-.011 inches. The coverage appeared to be 100% or higher upon microscopic examination. It is impossible to determine coverage exceeding 100%.

Next, the operating mix and separator discharge were screened to determine the approximate separator take out size. These two samples screened as follows:

Sieve Opening- Inches	Operating Mix- % Retained	Separator Discharge- % Retained
.0469	.0	.0
.0394	52.6	.2
.0331	11.7	.3
.0278	14.2	.4
.0234	11.7	1.9
.0197	6.5	3.6
.0165	2.5	5.6
.0139	.6	6.4
.0117	.2	7.3
.0070		51.6
.0049		19.8
.0029		2.9
Pan	.0	Trace
TOTAL	100.0	100.0

It was decided to use an .0165 inch opening take out screen for laboratory testing, since this is very close to their operating mix take out size and there is a large amount of data available on cast steel shot using an .0165 inch opening take out screen.

The new CW-41 Cut Steel Wire Shot was then screened to determine its size distribution which is shown on the test report, page 8 . It was also checked against the SAE Recommended Practice for Cut Steel Wire Shot-SAE J-441 with the following results:

SAE J441	OBSERVED	
Carbon-%	0.45-0.75	0.56
Manganese-%	0.60-1.20	0.80
Phosphorous-%	0.045% Max.	0.013
Sulfur-%	0.050% Max.	0.028
Silicon-%	0.10-0.30%	0.11
Hardness	42 R/C Min.	42.5-48.0
Diameter	0.041 \pm .002 inches	0.0398
Length of 10 pcs.	0.410 \pm 0.040 in.	0.410
Weight of 50 pcs.	0.31-0.39 Grams	0.35

This CW-41 Cut Steel Wire Shot conforms very well to SAE J-441.

Next, a 100% breakdown test was run in the Ervin Test Machine on the CW-41 Cut Steel Wire Shot, S-330 Amasteel Shot and S-390 Amasteel Shot. The durability of the CW-41 Cut Wire Shot was 4061 passes compared to 2870 passes for S-390 Amasteel Shot and 2822 passes for S-330 Amasteel Shot. The durability test data, hardness data, and screen size distribution for both the new material and the test machine operating mix is shown on pages 8 and 9.

Fifty grams of the operating mix from the last test machine run of the durability test were then used topeen two Almen A Test Strips at each of various exposure times. The arc heights were

measured and the average height of the two strips at each exposure time tabulated below:

Exposure Time- Machine Passes	Almen A-2 Arc Height-Inches		
	390 Amasteel Shot	CW-41 Cut Steel Wire Shot	330 Amasteel Shot
1	.0028	.0025	.0030
2	.0038	.0040	.0040
5	.0068	.0062	.0062
10	.0088	.0090	.0090
20	.0115	.0118	.0118
40	.0152	.0145	.0135
80	.0180	.0165	.0150

These results are plotted on page 10

Polished Almen A Test Strips were peened at 5 passes and examined microscopically to determine coverage. The coverage data was then used to project coverage at 40 and 80 machine passes according to the method described in the section entitled Shot Peening in the Eighth Edition of the Metals Handbook, Volume 2, Heat Treating Cleaning and Finishing published by the American Society for Metals. The coverage for all three samples was 50% at 5 passes which calculates to 76% at 10 passes, 94% at 20 passes, 100%+ at 40 passes, and 100%+ at 80 passes.

DISCUSSION:

Almen A Strips were used in this test procedure rather than Almen C Test Strips, because the A Strip is more sensitive than the C strip and the peening intensities in the test machine are somewhat lower than those in the production machine. Another indication of the lower intensities in the test machine is the somewhat higher average size of the test machine operating mix compared to the operating mix from the production machine. However, this is of no real concern since the ratio of the durability and arc heights produced by .041 Cut Steel Wire Shot and S-390 and S-330 Amasteel Shot is constant over a wide range of peening intensities.

The graph of Almen A-2 Arc Heights versus Exposure Time shown on page 10, indicates that all three samples produce equal arc heights to 20 machine passes or 90% coverage. At exposure times greater than 20 passes, S-390 Amasteel Shot produces the highest arc heights, S-330 Amasteel Shot produces the lowest arc heights, and .041 Cut Steel Wire Shot produces arc heights half way between. Since the Almen C Test Strip peened in the production machine with CW-41 Cut Steel Wire Shot had an arc height of .008 inches, the lower limit of the specification, which calls for .008-.011 inches, S-330 Amasteel Shot will obviously not do

the job. S-390 Amasteel Shot will produce higher arc heights than CW-41 Cut Steel Wire Shot at the 100% or better coverage required.

Based on a durability of 2870 passes and a cost of \$165.00 a ton for S-390 Amasteel Shot, and a durability of 4061 passes for CW-41 Cut Steel Wire Shot, the CW-41 Cut Wire Shot is worth only \$233.00 per ton.

CONCLUSION:

Based on durability and arc height, S-390 Amasteel Shot will do a better job of peening than CW-41 Cut Steel Wire Shot, and will do it more economically if the cost of the CW-41 Cut Steel Wire Shot is greater than \$233.00 per ton.

TEST REPORT

COMPANY Rockwell Standard Corporation

ADDRESS New Castle, Pa.

DATE _____ MACHINE NO. TM 6

COPIES TO: M. . Smith

MATERIAL	TYPE OF TEST	Throw Out Screen Size	Amount Tested
<u>SAB 011 Cut Wire</u>	<u>100% Breakdown</u>	<u>.0165</u>	<u>100 Gra</u>
<u>SAB S-390 Amasteel</u>	" "	" "	" "

MATERIAL 011 Cut Wire

MATERIAL S-390 Amasteel

THIS BREAKDOWN TEST IS MADE BY MEASURING THE LOSS AFTER EVERY 500 PASSES.

Passes	% Remaining	% Loss	Accumulative Loss %
500	89.0	11.0	11.0
1000	91.0	9.0	16.0
1500	90.5	9.5	25.5
2000	90.5	9.5	35.0
2500	89.5	10.5	45.5
3000	89.5	10.5	60.0
3500	82.0	18.0	78.0
4000	17.5	20.5	90.5
4500			
5000	98.5	2.5	100.0

THIS BREAKDOWN TEST IS MADE BY MEASURING THE LOSS AFTER EVERY 500 PASSES.

Passes	% Remaining	% Loss	Accumulative Loss %
500	94.5	5.5	5.5
1000	83.0	17.0	22.5
1500	76.0	24.0	46.5
2000	77.3	22.7	69.2
2500	81.0	19.0	88.2
3000	83.8	16.2	104.4
3500			
4000			
4500			
5000	88.2	11.8	100.0

SCREENING

CHEMISTRY

BEFORE	AFTER TEST
.0	.0
.0	.0
.0	.0
.0	.0
.0	.0
1.5	1.5
TOT. 100.0	TOT. 100.0

BEFORE	AFTER TEST
.0	.0
.0	.0
.0	.0
.0	.0
.0	.0
1.5	1.5
TOT. 100.0	TOT. 100.0

CARB. _____
 MANG. _____
 SR. _____
 PHOS. _____
 SULP. _____

ROCKWELL HARDNESS 41.9 R/C

SCREENING

CHEMISTRY

BEFORE	AFTER TEST
.0555	.0555
.0169	.0169
.0394	.0394
.0331	.0331
Pan .0	.0270
TOT. 100.0	.0234
	.0197
	.0165
	TOT. 100.0

BEFORE	AFTER TEST
.0555	.0555
.0169	.0169
.0394	.0394
.0331	.0331
Pan .0	.0270
TOT. 100.0	.0234
	.0197
	.0165
	TOT. 100.0

CARB. _____
 MANG. _____
 SR. _____
 PHOS. _____
 SULP. _____

ROCKWELL HARDNESS 45.5 R/C

SUMMARY: (42.5-48.0)

(43.0-47.0)

ALLOY METAL ABRASIVE CO., ANN ARBOR, MICHIGAN

TEST RUN BY _____ SIGNED _____

QUALITY CONTROL SUPERVISOR

ARC HEIGHT VS EXPOSURE TIME ON #1 CUT FUEL WIRE MACH. 350 V 1-370 ANISOTROPIC CAST STEEL BEFOR



350 V
1-370
ANISOTROPIC
CAST STEEL

0.0141 Jul 5 1961
Handwritten

30
Handwritten

.008" C = .0275" A

EXPOSURE TIME-MACHINE PASSES