

Cutlery and Allied Trades Research Association



Research and Development
Consultancy Services

Special Purpose Machines
Quality Testing

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Our Reference: PS/988867

24 September 2019
Clint

USA

For the Attention of Mr Clint

CATRA Test Report-



Report Compiled by:

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Test Programme Completed by:

Stephen Beverley

CATRA Test Report # 988615

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1. Executive Summary

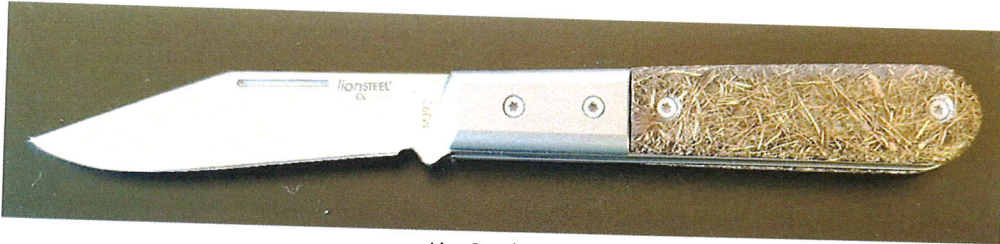
1.1 Clint [redacted] provided CATRA with 4 folding knives for Vickers Hardness Testing & Cutting Performance Testing on the Automatic Edge Tester (AET) to ISO 8442:5.

1.2 Blade (1) had previously been sharpened and Blades (2), (3) & (4) were all new. All the blades were to be sharpened using the CATRASHARP to an angle of approximately 32 degrees. Blades (1), (2) & (4) were manufactured from M390 and blade (3) from S30V. Vickers Hardness tests were carried out on the blades near the pivot point as the material has uniform geometry. An approximate HRc is provided for reference. HRc's were in the range of 60 – 63. Rockwell Hardness Tests were also undertaken, which were approximately 1 unit lower than the Vickers to Rockwell conversion.

1.3 All 4 knives performed well on the ICP & durability tests. The HRc values are consistent with datasheets for Bohler's M390 & Hudson Tool Steel Corp for S30V with heat treatments for optimum durability.

2. Samples /Products Tested

2.1 The knife blades under test are pictured below.



LionSteel M390
Figure 2a



Material M390
Figure 2b



Material CPM S30V
Figure 2c



Material M390
Figure 2d

2.2 BÖHLER M390 – Properties & Applications:

Composition

C	Si	Mn	Cr	Mo	V	W
1.90%	0.70%	0.30%	20.00%	1.00%	4.00%	0.60%

M390, as described by Bohler, is an excellent corrosion resistance Martensitic ISOMATRIX PM Chromium Stainless Steel produced by the powder metallurgical process. Gives homogeneous structure with a high volume of small, finely dispersed chromium and vanadium carbides. It is hardenable in vacuum to give 60-62 HRc.

2.3 CPM S30V – Properties

Composition

C	Cr	V	Mo
1.45%	14.00%	4.00%	2.00%

As described by Hudson Tool Steel Corp '*CPM® S30V® is a martensitic stainless steel designed to offer the best combination of toughness, wear resistance and corrosion resistance. Its chemistry has been specially balanced to promote the formation of vanadium carbides which are harder and more effective than chromium carbides in providing wear resistance. CPM® S30V® offers substantial improvement in toughness over other high hardness steels such as 440C and D2, and its corrosion resistance is equal to or better than 440C in various environments.*

The target HRc range is between 58- 61.

3. Performance Tests & Methods

3.1 The Automatic Edge Tester is configured to evaluate knives in accordance with *BS EN ISO 8442-5: 2004 - Materials and articles in contact with foodstuffs - cutlery and holloware - Part 5: Specification for sharpness and edge retention test of cutlery.*

3.2 The test comprises of the knife cutting into a weighted (50N) stack of card that has been impregnated with Silica to accelerate wear. The knife is clamped in an inverted position on a travelling bed that is programmed to repeat a 25mm cutting stroke for 60 cycles. The normal test is for the blade to be assessed over a 40mm cutting stroke; however, due to the size of the blade this was reduced to 25mm and the results factored to

give an equivalent performance result. Factoring is based on a test data obtained from a single straight blade where we are able to obtain data for 25 & 40mm cycles on the same edge.

3.3 The Initial Cutting Performance (ICP) is the sum of the card cut over the first 3 cutting strokes. The Total Card Cut (TCC) is a measure of the durability of the edge over the 60 cycles. Figure 2 shows the assessment criteria used on the test.

3.4 The table below shows the criteria for the assessment of the blades, both to the ISO standard and CATRAS enhanced performance analysis.

		Sharpness ICP mm	Life TCC mm
ISO limit mm		50	150
ISO Pass/ fail		Pass	Pass
CATRA Comments			
Key			
Sharpness ICP mm		Life TCC mm	
1-50	Poor	1-150	Poor
51-80	Average	151-280	Average
81-100	Good	281-370	Good
101-110	Very Good	371-500	Very Good
>111	Excellent	>501	Excellent

Assessment Criteria

Figure 2

Vickers Hardness tests were then carried out on the blades

4. Results

4.1 The table below shows the results for the ICP & TCC of the 4 knives.

Blade description	Test No	ICP mm	TCC mm	Blade Angle	Material
Pocket Knife	32783	100.5	626.0	31.5	M390
Kershaw	32781	119.7	707.7	32	M390
SpyerCo Black	32779	109.8	641.9	30	S30V
SpyerCo Red	32777	104.5	784.7	32	M390

Table 1

All 4 blades were prepared in a similar manner, using 5 strokes on the CATRAHONE, producing an angle of approximately 32 degrees. It should be noted that, all the knives would have had slightly different starting geometry's prior to sharpening and there would also be some variances in the geometry of each knife on test. Notwithstanding this, all the knives had VERY GOOD ICP, with the Kershaw being EXCELLENT. All the knives were EXCELLENT for TCC. Each knife was tested only once. For statistical purposes samples sizes of greater than 5 are required to determine a Mean and Standard Deviation for the sharpening and ICP/TCC testing process.

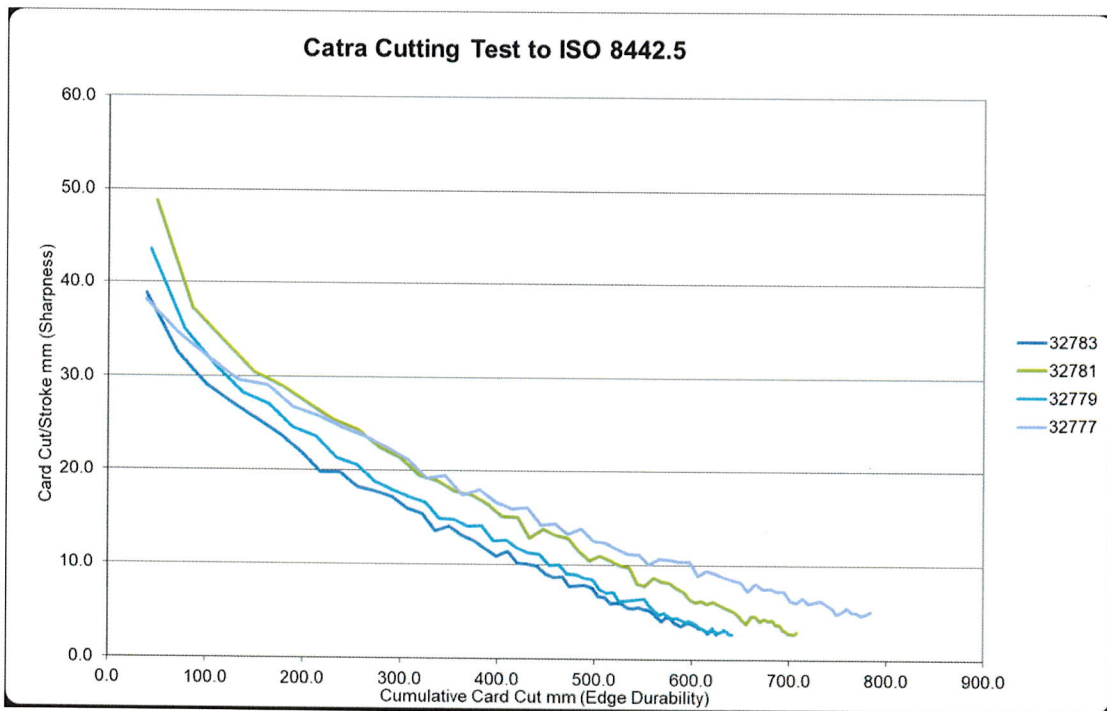
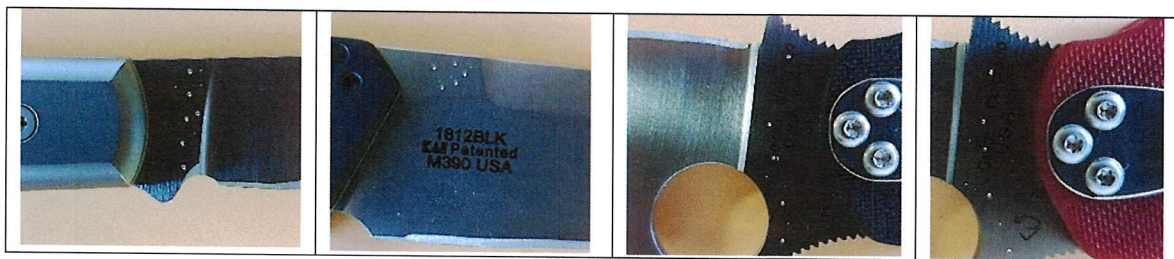


Figure 3

The hardness of the blades was measured using a Vickers Hardness test machine (30Kg load). The hardness was measured at the blade root which is >2.5mm thick and has parallel sides. This is then converted to an approximate Rockwell Hardness. This was followed by a Rockwell test averaged over 4 further locations.



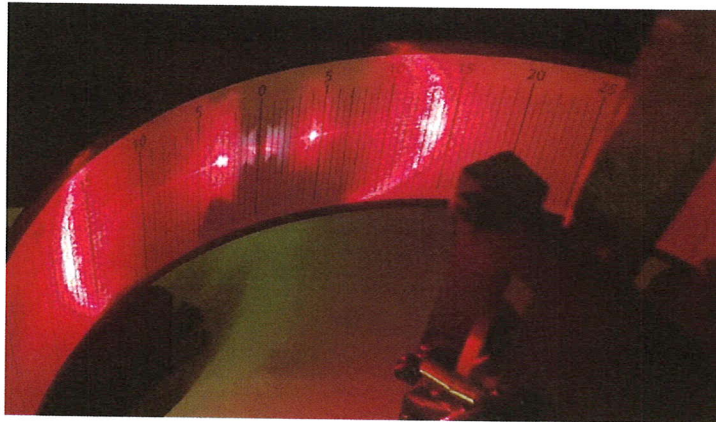
Vickers Hardness Test – Indentation Locations

Figure 4

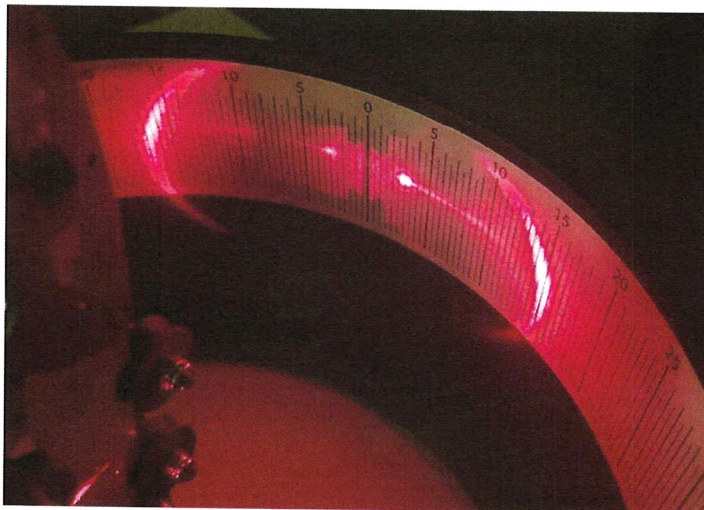
Sample	Hardness (Vickers)				Hv - HRC Conversion					HRC
				Average						
Folding Blade - LionSteel M390	690	695	700	695	60.0	58.5	58.5	58.5	58	58.5
Kershaw M390	786	786	775	782	63.0	62	62	62	61	62
Spyderco Black M390	752	758	758	756	62.0	60.5	61	60.5	61.5	61
Spyderco Red M390	752	741	752	748	62.0	60.5	60	59.5	60.5	60

Blade Angles/ Goniometer Images (+/- 1°)

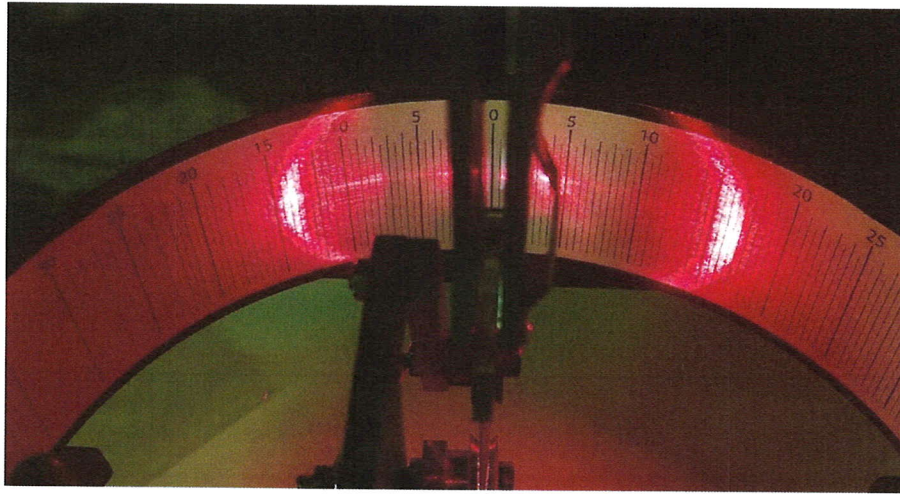
Folding Blade – 31.5



Kershaw - 32 Degrees



SpyderCo Black – 30 degrees



SpyderCo Red – 32 Degrees

