MARCEL DASSAULT AIRCRAFT
BREGUET AVIATION

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BOULOGNE PLANT

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BF/HX-SECRET.OA/JT

# MACHINING TESTS OF TOOLS

# TREATED WITH

# MICROLON

# MICROLON TEST BATTERY

## I - DRILLING

- Test no. 1 - 30 NCD16 Steel
- Test no. 2 - 30 NCD16 Steel
- Test no. 3 - Light Alloy A7U4SG + 30 NCD16 Steel
- Test no. 4 - 15 CDV6 Steel
- Test no. 5 - 15 CDV6 Steel

## II - REAMING

- Test no. 6 - 15 CDV6 Steel
- Test no. 7 - 15 CDV6 Steel
- Test no. 8 - Light Alloy A7U4SG (boring-milling)
- Test no. 9 - Light Alloy A7U4SG (boring-milling)

## III - TAPPING

- Test no. 10 - 15 CDV6 Steel

## IV - MILLING

- Test no. 11 - Light Alloy AU4G1
- Test no. 12 - 15 CDV6 Steel
- Test no. 13 - 15 CDV6 Steel

## V - MECHANICAL STAMPING

- Test no. 14 - Light Alloy AU4G1
- Test no. 15 - Light Alloy AU4G1

## VI - CONCLUSIONS

1 - Drilling: - Steels
- Light Alloys

2 - Reaming: - Steels
- Light Alloys

3 - Tapping: - Steels
- Titanium
- Light Alloys

4 - Milling: - Steels
- Light Alloys

5 - Stamping: - Light Alloys

6 - General Conclusions

# I - DRILLING

## TEST No. 1

Dormer 4mm drill bit, speed 450 rpm, feed per revolution: 0.18mm
material: 30 NCD16, tensile strength = 108/123kg, thickness: 15mm.
cutting speed: 5.6 m/min.

| Without Microlon | With Microlon |
|---|---|
| 84 holes, resharpening every 30 holes | 84 holes, resharpening every 36 holes |
| | (bit treated with spraycan) |
| | RESULT: 20% gain |

## TEST No. 2

Dormer 24.5mm drill bit, speed 224 rpm, feed per revolution: 0.18mm
material: 30 NCD16, tensile strength = 108/123kg, thickness: 15mm.
cutting speed: 17 m/min.

| Without Microlon | With Microlon |
|---|---|
| 24 holes, resharpening every 9 holes | 24 holes, resharpening every 11 holes |
| | (bit treated with spraycan) |
| | RESULT: 20% gain |

## TEST No. 3

Dormer 5.8mm drill bit, speed 360 rpm, feed per revolution: 0.18mm
material: A7U4SG + 35NC6 + A7U4SG, thickness:
cutting speed: 6.68 m/min.

| Without Microlon | With Microlon |
|---|---|
| 24 holes, no resharpening | 24 holes, no resharpening |
| | (bit treated with spraycan) |

RESULT:

This test wasn't pushed far enough, but the use of Microlon produces superior quality holes.

## TEST No. 4

Dormer 10.5mm drill bit, standard sharpening, speed 224 rpm (treated with spraycan)
material: 15 CDV6, tensile strength = 90kg, thickness: 35mm.

| Without Microlon | With Microlon |
|---|---|
| 85 holes,<br>peripheral scratching<br>bit breakage | 135 holes,<br>voluntary cessation<br>Appearance of holes impeccable;<br>bit still in perfect condition. |
| | RESULT:<br>approx. 50% gain in quantity<br>gain in quality |

## TEST No. 5

Dormer 6.7mm drill bit, standard sharpening, speed 450 rpm (treated with spraycan), feed per revolution 0.18mm
material: 15 CDV6, tensile strength = 90kg, thickness: 35mm.

| Without Microlon | With Microlon |
|---|---|
| 98 holes,<br>Stopped; bit marked around the periphery (margin). | 222 holes,<br>voluntary cessation<br>appearance of holes still quite clean; bit still in good shape. |
| | RESULT:<br>gain 100% or more<br>gain in quality |

# II - REAMING

## TEST No. 6

26mm H8 carbide reamer with follower guide, speed 80 rpm
material: 15 CDV6, tensile strength = 90kg, thickness: 80mm.

| Without Microlon | With Microlon |
|---|---|
| 3 holes - appearance dull | 6 holes - appearance shiny |
| | bit treated |
| | RESULT:<br>gain in quantity and quality |

TEST No. 7

material: sandwich: TAV6, 16mm + 30 NCD 16, 78mm + TA6V, 16mm

| | |
|---|---|
| 16.5mm drill bit | speed 160 rpm, feed 0.09 mm/min |
| 17.5mm high-speed steel reaming bit | speed 160 rpm, feed 0.09 mm/min |
| 17.8mm carbide reaming bit | speed 112 rpm, feed 0.09 mm/min |
| 18.7mm carbide reaming bit | speed 112 rpm, feed 0.09 mm/min |

Results over 12 holes made

| Without Microlon | With Microlon |
|---|---|
| bit and h/s steel reamers sharpening every 3 holes | bit and h/s steel reamers 12 holes without sharpening |
| carbide reaming bits sharpening every 2 holes | carbide reaming bits sharpening every 6 holes |

RESULT:

Large gain in longevity of Microlon-treated tools and in resharpening time.

NOTE: If the test of longevity of the Microlon-treated tools had been continued over a greater number of pieces, the results would have been more representative.

TEST No. 8

Reaming tests on Syderic drill press with 6mm H8 Florimond & Chabardes Record 200-grade American reamers, AU4SG test piece, treated and BF4-protected, thickness: 12mm, spindle speed: 1300 rpm, cutting speed: 24 m/min, lubricant: Alumicut, manual feed: 5.7mm hole before reaming.

| Series reamer without Microlon treatment | Series reamer with Microlon treatment |
|---|---|
| Results: 5800 calibrated holes voluntary cessation of test condition of reamer: intact surface condition of last holes: still clean still within tolerance | Results: 10,250 calibrated holes voluntary cessation of test condition of reamer: intact 0.005mm hole shrinkage but still within tolerance, surface clean |

RESULT:

While nothing indicated that the untreated reamer would not have gone considerably beyond 5800 holes, the treated reamer went to 10,250 holes without problem and would have gone beyond.

In both cases, the tests were stopped voluntarily owing to their length, but there is every reason to suppose that the Microlon-treated reamer would have allowed the reaming of many more holes within diameter and surface condition tolerances.

TEST No. 9

Simultaneous reaming/countersinking test on Spacematic 62
F8 5mm Ø and F8 6mm Ø at 60°

spindle speed: 2800 rpm, feed per revolution: 0.05mm, lubricant: Alumicut, average thickness on panels and ribs: EA1M 10 m/min, material: AU4SG, treated (T 851 tempered) and "BF4"-protected, tests conducted with Microlon-treated and untreated countersink/reaming bits, supplier: Recoules

Test with 5mm F8 bit at 60°
un-treated series tool

Results: The per-tool average was 5 1/2 wings,
that is . . . . . 1925 holes.

Test with 5mm F8 bit at 60°
Microlon-treated series tool

Results: Test stopped at the end of 3 1/2 wings,
that is . . . . . 1225 holes.

Test with 6mm F8 bit at 60°
un-treated series tool

Results . . . . . 1200 holes

Test with 6mm F8 bit at 60°
Microlon-treated series tool

Results . . . . . 900 holes

CONCLUSION

The results show negative for Microlon-treated bits.

Technically, it is hard to explain why unless it's that the overheating generated by the very high pressure of high-speed penetration destroys the Microlon. We shall run these tests again.

## III - TAPPING

TEST No. 10

8mm 125 pitch Armor tap, through holes, speed: 224 rpm
material: 15 CDV6, tensile strength = 90 kg/mm$^2$, thickness: 33mm

- Without Microlon: 80 holes — Stopped, holes no longer within tolerance.
- With Microlon: 320 holes — Voluntary cessation, still within tolerance.

(hardened tap)

CONCLUSION: Spectacular gain in quantity and quality.

## IV - MILLING

### TEST No. 11

Surfacing test with 80mm bell-face 2-step AVYAC SK8 "Light Alloy" milling cutter, material: AU4G 1, machine: Graffenstaden, cutting speed: 48 meters, spindle speed: 200 rpm, feed: 220 mm/min, feed per tooth: 0.015 mm , depth of cut: 5mm, width of cut: 80mm, liberal flow of Wynn 009 cutting oil

| Test with untreated standard cutter | Test with Microlon-treated standard cutter |
|---|---|
| total length machined: 45m | total length machined: 69.300m |
| Test stopped as soon as the surface appeared torn. | Test stopped in same conditions as with untreated cutter. |

CONCLUSION:

The test with the Microlon-treated 2-step cutter showed a gain of 55% over that with the untreated 2-step cutter.

### TEST No. 12

Surfacing test with 60mm Record 200 2-step milling cutter,
mfgr: Florimond & Chabardes,
material: 15 CDV6 R 70 Hb steel,
number of teeth: 8 "steel" cutter,
pass depth: 5mm, pass width: 62mm,
spindle speed: 80 rpm, cutting speed: 14 m/min,
feed: 36 mm/min
liberal flow of Wynn 009 soluble cutting oil

| Test with untreated standard cutter | Test with Microlon-treated standard cutter |
|---|---|
| total length machined: 4.25m | total length machined: 4.25m |

CONCLUSION:

The two tests yielded equivalent results, the Microlon apparently having no beneficial effect on cutting.

TEST No. 13

Milling tests in roughed out slots with 30mm roughing cutters (new)
mfgr: AVYAC, ref: SK8, grade P200
milling machine: Graffenstaden
material: 15 CDV6 R 70 Hb steel
slotting over 3/4 of tool length or 30mm
width of cut: 25mm, feed: 48 mm/min
spindle speed: 320 rpm, cutting speed: 30 m/min
liberal flow of Wynn 009 soluble cutting oil

| Test with untreated standard cutter | Test with Microlon-treated standard cutter |
|---|---|
| total length machined: 5.3m | total length machined: 3.3m |

CONCLUSION:

The test with the Microlon-treated cutter showed negative compared with the untreated cutter.

NOTE: It appears that tests in both cases were run with excessive feed which ought not to have exceeded 32 mm/min. The advance was 50% above manufacturer's recommendation. We shall run the test over.

## V - STAMPING

TEST No. 14

Mechanical Stamping

forming U-ribs from 1.6mm thick AU4G1 blanks

| Without Microlon | With Microlon |
|---|---|
| The tool marks the radii and there is a slight tearing perpendicular to the bend. | The tool still marks the radii but there is no longer any tearing perpendicular to the bend. |

TEST No. 15

forming corrugations in 2mm thick AU4G1 on a bending press

| Without Microlon | With Microlon |
| --- | --- |
| The tool leaves marks on and slighty tears the metal. | The tool neither marks nor tears. |

CONCLUSION:

The Microlon film is more resistant to high pressure than all the stamping oils. The Microlon film doesn't break as oil films do.

# C O N C L U S I O N S

## I - DRILLING

a) in steel:

Use of Microlon yields a gain of 20-100% in bit life and improves the condition of the surface in every instance.

b) in light alloys:

Use of Microlon improves the condition of the surface.

## II - REAMING and SIMULTANEOUS REAMING/COUNTERSINKING

a) in steel:

Reaming

Gain of 50-100% in number of holes before resharpening; improved quality of holes (appearance)

b) in light alloys:

Reaming

Gain of 50-100% in number of holes before resharpening; improved surface condition.

Simultaneous reaming-countersinking

No improvement. Our tests were rather negative. The reasons for this must be sought because the results do not make sense. We are going to rerun these tests.

## III - TAPPING

a) in steel:

It's here that the gain is the most spectacular: 100 to 300% in the number of holes.

b) in titanium:

The same order of gain in quantity and quality of holes as with steel.

c) in light alloys:

We have not made systematic tests as we have little tapping to do in light alloys, but the tests should yield similar results.

IV - MILLING

a) steels:

Tests were not conclusive, rather negative. It seems that the very high milling pressure coupled with heating destroys the Microlon film. We shall run these tests again.

b) light alloys:

Tests show a 50% gain in tool life.

V - STAMPING

We do no steel stamping.

For light alloys, Microlon acts as an excellent lubricant, highly resistant to high pressures.

By reducing friction, it improves the condition of the stamped surface.

VI - GENERAL CONCLUSIONS

Light alloy reaming/countersinking with the Spacematic and steel milling apart, Microlon

- prolongs useful tool life,
- improves surface appearance.

Wherever friction is significant (tapping and stamping, e.g.) treatment with Microlon yields spectacular gains in quantity and quality, provided temperatures are not excessive. But since it should not be used at high temperatures owing to risk of toxic fumes, it is a product that we ought to employ as an aid in solving most of our machining problems (with one small proviso: cleaning of tools prior to application).

/s/ illegible