

COMPARISON OF INK CARTRIDGES

Yield and Reliability

Black Point BPH 21 and BPH 22
vs.
Hewlett-Packard HP 21 and HP 22
(Order No. 280709)

**Summary of
testing results**

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SUMMARY

In this test the page yields of the cartridges HP 21, HP 22, Black Point BPH 21 and Black Point BPH 22 were determined according to the ISO/IEC 24711 using the test page suite defined in ISO/IEC 24712.

Three printers HP Deskjet D1460 were used parallel. 18 cartridges of each cartridge type and brand were used in the page yield calculations.

The page yields of the Black Point cartridges are considerably higher. The yields of the black cartridges are 642 pages (BPH 21) compared with 200 pages (HP 21), which means that the page yield of the BPH 21 is 221% higher. For the colour cartridges the yields are 341 pages (BPH 22) and 153 pages (HP 22), which means that the page yield of the BPH 22 is 122% higher.

None of the cartridges tested had a reliability problem, all worked failure-free to their end of lifetime.

1. INTRODUCTION

By commission of Black Point the yield of ink cartridges should be determined according to ISO/IEC 24711 (method for testing and calculation of average cartridge yield) and ISO/IEC 24712 (test page suite) by Innovationstechnik. The comparison covered the cartridge types 21 (black) and 22 (colour).

The testing took place in July 2008 with original manufacturer cartridges from HP and refilled cartridges from Black Point. Three HP Deskjet D1460 printers were used in the test. With each printer 6 black and 6 colour cartridges of each brand were tested, so altogether 18 cartridges of each type and brand were tested and used in the yield calculation.

The declared yield results are, according to the ISO/IEC 24711, the calculated 90% lower confidence bound values.

Furthermore the reliability was checked and evaluated.

2. PROCUREMENT

The procurement of the cartridges and printers were done by Black Point. The procurement of the paper was done by Innovationstechnik.

3. CARTRIDGES

The types of cartridges used in the test are the black and colour cartridges for the printer type HP Deskjet D1460. The black cartridge of HP is the HP 21 (C9351AE) and the colour cartridge the HP 22 (C9352AE). The cartridges of Black Point are the BPH 21 (black) and the BPH 22 (colour).

All cartridges both of HP and Black Point are packaged multiple times. The outer package is made of paper, the inner one is a plastic foil. The nozzles are covered with a plastic strip. Additionally the cartridges of Black Point have got a clip over the nozzles.

On the reverse side of the HP packages and also on the cartridges information of the land of production and end of warranty can be found.

For a HP cartridge type the data for all cartridges were identical on the package: Malaysia, April 2010 (HP 21) and Singapore, May 2010 (HP 22). Also the data on the cartridge bodies were identical: 2010/04/21 Y (HP 21) and 2010/05/04 S (HP 22).

The Black Point packages had no information about an expiry date. The dates on the cartridges varied between 2008/05 and 2009/09 (BPH 21) and 2007/12 and 2009/10 (BPH 22).

4. PRINTERS

The type of the printers used in the test is HP Deskjet D1460. The only cartridges permitted are the HP 21 (black) and HP 22 (colour).

The three printers in the test were new and originally packed. They were delivered with a set of introductory cartridges.

5. TEST REALIZATION

The test was done using the test page suite defined in ISO/IEC 24712 (see Appendix E).

For acclimation all material was brought some days before the start of the test into the test room and remained there for the entire test duration.

For the test three identical computers were used. The operating system and Adobe Reader were newly installed. The page scaling was set to none. Also the newest printer driver was installed. The print quality was normal, the paper type plain paper.

Each of the three printers were unpacked, the set-up done according to the installation guide and connected to its own computer via USB cable. During the set-up the introductory cartridges were installed and the print head alignment done according to the messages.

Standard test page suites were printed until fade occurred, then these cartridges were removed.

Every new cartridge was unpacked just before it was used in the test. All relevant data, e.g. serial number, weight, and date and time of the start of the test were written down. Also a visual inspection was done to check e.g. contamination of a cartridge.

The testing was started with the brand HP, so a set of new cartridges HP 21 and HP 22 was installed.

After the installation of a new cartridge a window opened which asked for a print head alignment procedure. It was done according to the messages. Then test page suites were printed.

The printing was done continuously. Only at the end of working days the printers were idle but not powered down.

Each diagnostic page (5th page of the test page suite) was checked if fade or streaks or other faults were recognizable. If streaks occurred on three consecutive pages a streak removal operation had to be executed. The test page suites were printed until fade occurred on the diagnostic page. After that the corresponding cartridge was taken out of the printer and weighed. The number of valid suites was noted down. E.g. suites with fade on the diagnostic pages were not counted. Then a new cartridge was installed in the way described before.

After the 18 colour cartridges which were used in the calculation were depleted additional colour cartridges were taken until the 18 black cartridges were depleted also.

In the same way the cartridges Black Point BPH 21 and BPH 22 were tested.

The average testing room temperature and the maximum and minimum running average temperatures were determined. According to ISO/IEC 24711 the testing room average has to be between 21°C and 25°C and the running averages between 20°C and 26°C.

These conditions were kept during the test.

The declared page yield values are the calculated 90% lower confidence bounds of each cartridge type and brand.

6. RESULTS

6.1 Page Yield

The declared page yields are the calculated 90% lower confidence bounds according to the ISO/IEC 24711. Each calculation uses the results of 18 tested cartridges.

The yield of the cartridge HP 21 is 200 pages, of the cartridge HP 22 153 pages. The yield of the Black Point cartridge BPH 21 is 642 pages, of the Black Point cartridge BPH 22 it is 341 pages. So the yields of the Black Point cartridges are about 221% higher for the black cartridge type and about 122% higher for the colour cartridge type.

Cartridge type	HP Page Yield (pages)	Black Point Page Yield (pages)	Yield Ratio Black Point / HP	Higher Yield of Black Point (%)
21	200	642	3.21	221
22	153	341	2.22	122

6.2 Reliability

None of the cartridges tested had a reliability problem. All cartridges worked without problems until the end of their lifetime.

None of the cartridges had a significant lower yield than the average of that type. All cartridges of a type used a similar amount of ink. The average ink consumption of the HP 21 is 6.94 grams, of the HP 22 5.59 grams. The values for the Black Point cartridges are: 20.31 grams (BPH 21) and 12.81 grams (BPH 22).

APPENDIX

- A** Test Reports Cartridges
 - A.1** Test Report HP Cartridges
 - A.2** Test Report Black Point Cartridges
- B** Test Equipment
- C** Tables Test Results
 - C.1** Yield Results HP 21
 - C.2** Yield Results HP 22
 - C.3** Yield Results Black Point BPH 21
 - C.4** Yield Results Black Point BPH 22
- D** Pictures
- E** ISO/IEC 24712 Test Page Suite

A TEST REPORTS CARTRIDGES

A.1 HP Cartridges

Declaration of Yield: Average Black Cartridge Yield 200 Standard Pages
Average CMY Cartridge Yield 153 Standard Pages

Values obtained by continuous printing
Declared yield values are based on the 90% lower confidence bound in accordance with ISO/IEC24711

Date Tested: 2008/07/17 - 2008/07/22

Printer Model Used: HP Deskjet D1460

Black Cartridge Model: HP 21 (C9351AE)

Colour Cartridge Model: HP 22 (C9352AE)

Type of Colour Cartridge: Combined CMY

Number of Cartridges
Used in Testing: K=18, C=24

Number of Cartridges
Used in Calculations: K=18, C=18

Print Mode: Continuous

Number of Printers Used: 3

Media Used: Xerox Business 80 g/m²,
Laser, Copier, Inkjet

Paper Size: A4

Paper Feed Orientation: Short edge feed

Computer Model: Fujitsu Siemens Scaleo J

CPU: Pentium 4, 3.06 GHz

Memory Size: 512 MB

Interface: USB 2.0

Operating System: Windows XP SP2

Application Software: Adobe Reader Version 8.1.2

Printer Driver: HP Deskjet D1400 series (61.71.246.0)

Test Suite Version: Version 2

Power (off/on) Everyday: No

Cartridge Testing Data: See tables C.1 und C.2

A.2 Black Point Cartridges

Declaration of Yield: Average Black Cartridge Yield 642 Standard Pages
Average CMY Cartridge Yield 341 Standard Pages

Values obtained by continuous printing
Declared yield values are based on the 90% lower confidence bound in accordance with ISO/IEC24711

Date Tested: 2008/07/22 - 2008/07/31

Printer Model Used: HP Deskjet D1460

Black Cartridge Model: Black Point BPH 21
Colour Cartridge Model: Black Point BPH 22
Type of Colour Cartridge: Combined CMY

Number of Cartridges
Used in Testing: K=18, C=35

Number of Cartridges
Used in Calculations: K=18, C=18

Print Mode: Continuous

Number of Printers Used: 3

Media Used: Xerox Business 80 g/m²,
Laser, Copier, Inkjet

Paper Size: A4
Paper Feed Orientation: Short edge feed

Computer Model: Fujitsu Siemens Scaleo J
CPU: Pentium 4, 3.06 GHz
Memory Size: 512 MB
Interface: USB 2.0
Operating System: Windows XP SP2

Application Software: Adobe Reader Version 8.1.2

Printer Driver: HP Deskjet D1400 series (61.71.246.0)

Test Suite Version: Version 2

Power (off/on) Everyday: No

Cartridge Testing Data: See Tables C.3 und C.4

B TEST EQUIPMENT**B.1 Printer**

Manufacturer: Hewlett-Packard
Type: Deskjet D1460
Serial numbers: TH7BL326ZD (Printer 1)
TH7B6330JN (Printer 2)
TH7BL326ZX (Printer 3)
Printer Driver: HP Deskjet D1400 series (61.71.246.0)

B.2 Computer

Manufacturer: Fujitsu Siemens
Type: Scaleo J
Pentium 4, 3.06 GHz, 512 MB RAM
Serial numbers: YSDN069103 (Computer 1 / test system 36)
YSDN069095 (Computer 2 / test system 37)
YSDN069092 (Computer 3 / test system 38)
Operating System: Windows XP SP2
Application Software: Adobe Reader Version 8.1.2
ISO/IEC 24712 Test Suite Version 2

B.3 Scales

Manufacturer: ACCULAB
Type: VICON VIC-303 d=0.001 g
Serial number: 19255098

B.4 Media

Manufacturer: XEROX
Type: Business 80 g/m² A4 for Laser, Copier, Inkjet

C TABLES TEST RESULTS

C.1 Results HP 21

Cartridge Number	Printer Number	Serial Number	Information on Cartridge Body	Date Printed	Temperature			Cartridge Yield (Suites)	Cartridge Yield (Pages)	Ink Used [g]
					Average	Min.	Max.			
1	1	1488581043016848	2010/04/21 Y	07/17-18	23,8	23,0	24,0	39	195	6,89
2	2	1488581043016231	2010/04/21 Y	07/17-18	23,8	23,0	24,0	40	200	6,95
3	3	1488581043016258	2010/04/21 Y	07/17-18	23,8	23,1	24,0	39	195	6,84
4	1	1488581043016270	2010/04/21 Y	07/18	23,6	23,2	23,8	42	210	6,95
5	2	1488581043016179	2010/04/21 Y	07/18	23,6	23,3	23,8	40	200	6,89
6	3	1488581043016176	2010/04/21 Y	07/18	23,6	23,2	23,8	39	195	6,87
7	1	1488581043016282	2010/04/21 Y	07/18-21	22,2	21,1	23,9	39	195	6,71
8	2	1488581043016285	2010/04/21 Y	07/18-21	22,1	21,1	23,9	40	200	6,72
9	3	1488581043016132	2010/04/21 Y	07/18-21	22,1	21,1	23,9	44	220	7,36
10	1	1488581043016827	2010/04/21 Y	07/21	22,6	22,3	22,7	40	200	6,83
11	2	1488581043016124	2010/04/21 Y	07/21	22,6	22,4	22,7	47	235	7,63
12	3	1488581043016126	2010/04/21 Y	07/21	22,6	22,4	22,7	42	210	6,88
13	1	1488581043016141	2010/04/21 Y	07/21-22	22,3	21,5	22,8	41	205	6,87
14	2	1488581043016342	2010/04/21 Y	07/21-22	22,3	21,5	22,8	39	195	6,80
15	3	1488581043016184	2010/04/21 Y	07/21-22	22,4	21,5	22,8	40	200	6,92
16	1	1488581043016209	2010/04/21 Y	07/22	22,5	22,2	22,8	42	210	6,98
17	2	1488581043016110	2010/04/21 Y	07/22	22,5	22,2	22,8	43	215	6,97
18	3	1488581043016152	2010/04/21 Y	07/22	22,4	22,0	22,7	42	210	6,89

Average Ink Used [g]	6,94
Average Page Yield	205,0
Standard Deviation	10,7
90% Lower Confidence Bound	200

C.2 Results HP 22

Cartridge Number	Printer Number	Serial Number	Information on Cartridge Body	Date Printed	Temperature			Cartridge Yield (Suites)	Cartridge Yield (Pages)	Ink Used [g]
					Average	Min.	Max.			
1	1	44839031	2010/05/04 S	07/17	23,9	23,6	24,0	34	170	5,66
2	2	44838955	2010/05/04 S	07/17	23,9	23,7	24,0	32	160	5,78
3	3	44835205	2010/05/04 S	07/17	23,9	23,7	24,0	30	150	5,90
4	1	44834291	2010/05/04 S	07/18	23,4	23,0	23,6	31	155	5,53
5	2	44838997	2010/05/04 S	07/18	23,4	23,0	23,6	33	165	5,50
6	3	44839302	2010/05/04 S	07/18	23,5	23,0	23,6	31	155	5,54
7	1	44835014	2010/05/04 S	07/18-21	23,1	21,1	23,9	30	150	5,54
8	2	44838930	2010/05/04 S	07/18-21	22,8	21,1	23,9	32	160	5,56
9	3	44839073	2010/05/04 S	07/18-21	22,7	21,1	23,9	34	170	5,66
10	1	44835421	2010/05/04 S	07/21	22,1	21,6	22,4	30	150	5,45
11	2	44836215	2010/05/04 S	07/21	22,2	21,8	22,4	30	150	5,50
12	3	44834294	2010/05/04 S	07/21	22,2	21,8	22,4	31	155	5,55
13	1	44835419	2010/05/04 S	07/21	22,6	22,4	22,7	31	155	5,62
14	2	44839283	2010/05/04 S	07/21	22,7	22,4	22,7	29	145	5,64
15	3	44838977	2010/05/04 S	07/21	22,7	22,5	22,7	33	165	5,53
16	1	44838156	2010/05/04 S	07/21	22,7	22,7	22,8	32	160	5,50
17	2	44835019	2010/05/04 S	07/21	22,7	22,7	22,8	30	150	5,60
18	3	44839009	2010/05/04 S	07/21	22,7	22,7	22,8	32	160	5,55

Average Ink Used [g]	5,59
Average Page Yield	156,9
Standard Deviation	7,3
90% Lower Confidence Bound	153

C.3 Results Black Point BPH 21

Cartridge Number	Printer Number	Serial Number	Information on Cartridge Body	Date Printed	Temperature			Cartridge Yield (Suites)	Cartridge Yield (Pages)	Ink Used [g]
					Average	Min.	Max.			
1	1	2169ON131014068	2009/08/03 Y	07/22-23	22,8	21,7	23,4	131	655	20,38
2	2	2110ON136914068	2009/08/04 Y	07/22-23	22,8	21,7	23,4	130	650	20,20
3	3	2169ON131014068	2009/09/17 L	07/22-23	22,8	21,7	23,4	142	710	21,76
4	1	2110ON136914068	2009/04/19 L	07/23-24	22,9	21,7	23,6	129	645	20,10
5	2	2169ON131014068	2009/08/23 Y	07/23-24	22,9	21,7	23,6	124	620	18,70
6	3	2110ON136914068	2009/08/04 Y	07/23-24	22,9	21,7	23,6	127	635	19,92
7	1	2169ON131014068	2008/12/21 M	07/24-25	22,8	21,6	23,6	130	650	20,12
8	2	2169ON131014068	2009/07/30 Y	07/24-25	22,8	21,6	23,6	128	640	19,87
9	3	2110ON136914068	2009/01/08 M	07/24-25	22,8	21,6	23,6	127	635	19,70
10	1	2169ON131014068	2008/12/29 M	07/25-28	24,5	23,3	25,8	120	600	20,23
11	2	2110ON136914068	2009/01/17 M	07/25-28	24,4	22,9	25,8	133	665	20,03
12	3	2169ON131014068	2008/05/27 L	07/25-28	24,6	23,4	25,8	141	705	21,14
13	1	2110ON136914068	2009/01/17 M	07/29-30	22,0	21,4	22,6	123	615	20,35
14	2	2169ON131014068	2009/09/17 L	07/29-30	22,1	21,4	22,9	135	675	19,99
15	3	2110ON136914068	2008/12/17 M	07/29-30	22,1	21,4	22,9	135	675	21,11
16	1	2110ON136914068	2009/08/03 Y	07/30-31	23,3	22,5	23,9	138	690	21,00
17	2	2169ON131014068	2009/03/30 L	07/30-31	23,3	22,5	23,9	139	695	21,59
18	3	2110ON136914068	2008/12/17 M	07/30-31	23,3	22,5	23,9	127	635	19,31

Average Ink Used [g]	20,31
Average Page Yield	655,3
Standard Deviation	31,3
90% Lower Confidence Bound	642

C.4 Results Black Point BPH 22

Cartridge Number	Printer Number	Serial Number	Information on Cartridge Body	Date Printed	Temperature			Cartridge Yield (Suites)	Cartridge Yield (Pages)	Ink Used [g]
					Average	Min.	Max.			
1	1	2126ON/1348137068	2008/11/07 S	07/22-23	22,9	21,7	23,4	71	355	12,86
2	2	1326FN/1348137068	2008/06/22 S	07/22-23	22,9	21,7	23,4	70	350	12,67
3	3	1310FN/1369175068	2008/10/18 S	07/22-23	22,9	21,7	23,4	69	345	12,77
4	1	1310FN/1369175068	2009/03/12 S	07/23	22,7	22,1	23,0	72	360	13,38
5	2	2126ON/1348137068	2009/10/28 S	07/23	22,7	22,0	23,1	74	370	14,11
6	3	1310FN/1369175068	2008/06/27 S	07/23	22,7	22,1	23,1	73	365	12,91
7	1	1310FN/1369175068	2009/05/19 S	07/23-24	22,9	21,7	23,6	72	360	12,93
8	2	1310FN/1369175068	2009/01/26 S	07/23-24	22,9	21,7	23,6	69	345	12,54
9	3	1310FN/1369175068	2009/02/15 S	07/23-24	23,0	21,7	23,6	64	320	12,19
10	1	1326FN/1348137068	2008/03/03 S	07/24	23,1	22,5	23,4	68	340	12,92
11	2	1310FN/1369175068	2008/08/02 S	07/24	23,1	22,5	23,5	73	365	12,75
12	3	6910FN/1369167068	2008/08/25 S	07/24	23,0	22,3	23,3	68	340	12,09
13	1	6910FN/1369167068	2009/06/13 S	07/24-25	22,5	21,6	23,6	70	350	12,45
14	2	1310FN/1369175068	2008/07/13 S	07/24-25	22,5	21,6	23,6	70	350	12,90
15	3	6910FN/1369167068	2009/01/22 S	07/24-25	22,8	21,6	23,6	65	325	12,58
16	1	6910FN/1369167068	2008/08/07 S	07/25	23,3	22,3	24,1	67	335	12,63
17	2	1310FN/1369175068	2009/06/07 S	07/25	23,4	22,4	24,2	71	355	12,98
18	3	2126ON/1348137068	2007/12/24 S	07/25	22,6	21,8	23,3	65	325	12,84

Average Ink Used [g]	12,81
Average Page Yield	347,5
Standard Deviation	14,6
90% Lower Confidence Bound	341

D PICTURES



Tested cartridges (18 cartridges of each type)

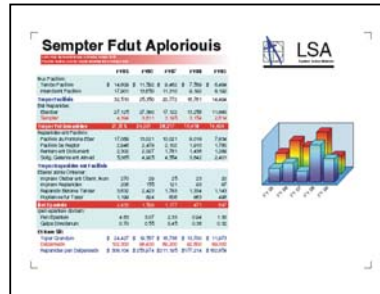


Working station

E ISO / IEC 24712 Test Page Suite



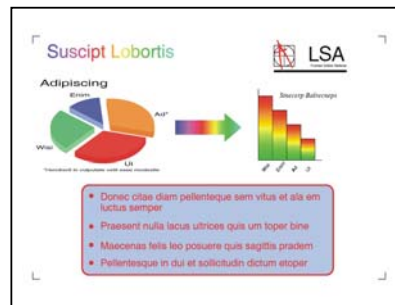
Test suite page 1



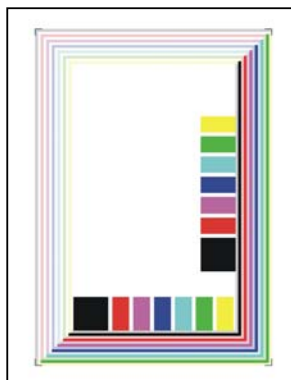
Test suite page 2



Test suite page 3



Test suite page 4



Test suite page 5
Diagnostic page