see similar files of the whole serie: http://farbe.li.tu-berlin.de/hebs.htm
technical information: http://farbe.li.tu-berlin.de or http://color.li.tu-berlin.de

L* CIELAB lightness

$L^* = 116\ (Y/Y_n)^{1/3} - 16$ ($Y_n=100$, $1 \le Y \le 100$) [1a]

$\log(L^*/L^*_n)=1.69$, $m_n=-0.43$
$L^*_n=50$, $Y_n=18$

100,0
8,9
0,1

application range

CIELAB lightness
L* normalized to the background lightness L*_n

$L^* = 116\ (Y/Y_n)^{1/3} - 16$ ($Y_n=100$, $1 \le Y \le 100$) [1b]

2,000
0,179
application range

L* CIELAB lightness

$L^* = 116\ (Y/Y_n)^{1/3} - 16$ ($Y_n=100$, $1 \le Y \le 100$) [1a]

$\log(L^*/L^*_n)=1.69$, $m_n=-0.43$
$L^*_n=50$, $Y_n=18$

100,0
8,9
0,1

ΔY CIE tristimulus value difference ΔY

$\Delta Y\ L^* = 116\ (Y/Y_n)^{1/3} - 16$ ($Y_n=100$, $1 \le Y \le 100$) [1c]
$dY = (3/116)\cdot (Y/Y_n)^{-2/3}$ [2c]
$dY = a\cdot (Y/Y_n)^{2/3}$ [3c]
$dY = b\cdot (Y/Y_n)^{2/3}$ [5c]
$a = 0.557$ $b = 3.826$

$Y_n=18$, $dY_n=0.83$, $(dY/Y_n)=0.045$
$\log dY=-0.08$, $m_n=-0.66$

2,586
0,120

application range

ΔY CIE tristimulus value difference ΔY

$\Delta Y\ L^* = 116\ (Y/Y_n)^{1/3} - 16$ ($Y_n=100$, $1 \le Y \le 100$) [1c]
$dY = (3/116)\cdot (Y/Y_n)^{-2/3}$ [2c]
$dY = a\cdot (Y/Y_n)^{2/3}$ [3c]
$dY = b\cdot (Y/Y_n)^{2/3}$ [5c]
$a = 0.557$ $b = 3.826$

$Y_n=18$, $dY_n=0.83$, $(dY/Y_n)=0.045$
$\log dY=-0.08$, $m_n=-0.66$

2,586
0,120

ΔY/Δy_u CIE tristimulus value difference ΔY normalized to Δy_u

$\Delta Y/y_u\ L^* = 116\ (Y/Y_n)^{1/3} - 16$ ($Y_n=100$, $1 \le Y \le 100$) [1d]
$dY = (3/116)\cdot (Y/Y_n)^{-2/3}$ [2d]
$dY = a\cdot (Y/Y_n)^{2/3}$ [3d]
$dY = b\cdot (Y/Y_n)^{2/3}$ [5d]
$a = 0.557$ $b = 3.826$

$Y_n=18$, $dY_n=0.83$, $(dY/Y_n)=0.045$
$\log[(dY/Y_u)/y_u]=0$, $m_n=0.34$

3,089
0,143

application range

ΔY/Y CIE Y sensitivity

$S_Y=\Delta Y/Y$
$L^* = 116\ (Y/Y_n)^{1/3} - 16$ ($Y_n=100$, $1 \le Y \le 100$) [1e]
$dY = (3/116)\cdot Y_n^{-1/3}\cdot Y^{-2/3}$ [2e]
$dY/Y = c\cdot Y^{-1/3}$ [3e]
$dY/Y = d\cdot (Y/Y_n)^{-1/3}$ [4e]
$c = 0.120$ $d = 0.824$

$dY/Y=0.04$, $m_n=-0.33$
$Y_n=18$, $dY_n=0.83$, $(dY/Y_n)=0.045$

0,120
0,025

application range

Y/ΔY CIE Y-based contrast

$C_Y=Y/\Delta Y$
$L^* = 116\ (Y/Y_n)^{1/3} - 16$ ($Y_n=100$, $1 \le Y \le 100$) [1g]
$Y/dY = (3/116)\cdot Y_n^{1/3}\cdot Y^{2/3}$ [2g]
$Y/dY = e\cdot Y^{1/3}$ [3g]
$Y/dY = f\cdot (Y/Y_n)^{1/3}$ [4g]
$e = 833.048$ $f = 5721.613$

$L^*_n=50$, $Y_n=18$, $dY_n=0.83$, $(Y/dY_n)=22$
$\log (Y/dY)_n=1.33$, $m_n=0.33$

38,6
8,3

application range

ΔY/Y CIE Y sensitivity

$S_Y=\Delta Y/Y$
$L^* = 116\ (Y/Y_n)^{1/3} - 16$ ($Y_n=100$, $1 \le Y \le 100$) [1e]
$dY = (3/116)\cdot Y_n^{-1/3}\cdot Y^{-2/3}$ [2e]
$dY/Y = c\cdot Y^{-1/3}$ [3e]
$dY/Y = d\cdot (Y/Y_n)^{-1/3}$ [4e]
$c = 0.120$ $d = 0.824$

$dY/Y=0.04$, $m_n=-0.33$
$Y_n=18$, $dY_n=0.83$, $(dY/Y_n)=0.045$

0,120
0,025

application range

ΔY/Y / (ΔY/Y)_u CIE Y sensitivity normalized to ΔY_u/Y_u

$S_Y/S_{Yu}=(\Delta Y/Y)/(\Delta Y/Y)_u$
$L^* = 116\ (Y/Y_n)^{1/3} - 16$ ($Y_n=100$, $1 \le Y \le 100$) [1f]
$dY = (3/116)\cdot Y_n^{-1/3}\cdot Y^{-2/3}$ [2f]
$dY/Y = c\cdot Y^{-1/3}$ [3f]
$dY/Y = d\cdot (Y/Y_n)^{-1/3}$ [4f]
$c = 0.120$ $d = 0.824$

$dY/Y=0.04$, $m_n=-0.33$
$Y_n=18$, $dY_n=0.83$, $(dY/Y_n)=0.045$

2,640
0,568

application range

CIELAB lightness L* normalized to the background lightness L*_n

$L^* = 116\ (Y/Y_n)^{1/3} - 16$ ($Y_n=100$, $1 \le Y \le 100$) [1b]

2,000
0,179

application range

ΔY/Δy_u CIE tristimulus value difference ΔY normalized to Δy_u

$\Delta Y/y_u\ L^* = 116\ (Y/Y_n)^{1/3} - 16$ ($Y_n=100$, $1 \le Y \le 100$) [1d]
$dY = (3/116)\cdot (Y/Y_n)^{-2/3}$ [2d]
$dY = a\cdot (Y/Y_n)^{2/3}$ [3d]
$dY = b\cdot (Y/Y_n)^{2/3}$ [5d]
$a = 0.557$ $b = 3.826$

$Y_n=18$, $dY_n=0.83$, $(dY/Y_n)=0.045$
$\log[(dY/Y_u)/y_u]=0$, $m_n=-0.66$

3,089
0,143

application range

Y/ΔY CIE Y-based contrast

$C_Y=Y/\Delta Y$
$L^* = 116\ (Y/Y_n)^{1/3} - 16$ ($Y_n=100$, $1 \le Y \le 100$) [1g]
$Y/dY = (3/116)\cdot Y_n^{1/3}\cdot Y^{2/3}$ [2g]
$Y/dY = e\cdot Y^{1/3}$ [3g]
$Y/dY = f\cdot (Y/Y_n)^{1/3}$ [4g]
$e = 833.048$ $f = 5721.613$

$L^*_n=50$, $Y_n=18$, $dY_n=0.83$, $(Y/dY_n)=22$
$\log (Y/dY)_n=1.33$, $m_n=0.33$

38,6
8,3

application range

(Y/ΔY) / (Y/ΔY)_u CIE Y-based contrast normalized to Y_u/ΔY_u

$C_Y/C_{Yu}=(Y/\Delta Y)/(Y/\Delta Y)_u$
$L^* = 116\ (Y/Y_n)^{1/3} - 16$ ($Y_n=100$, $1 \le Y \le 100$) [1h]
$Y/dY = (3/116)\cdot Y_n^{1/3}\cdot Y^{2/3}$ [2h]
$Y/dY = e\cdot Y^{1/3}$ [3h]
$Y/dY = f\cdot (Y/Y_n)^{1/3}$ [4h]
$e = 833.048$ $f = 5721.613$

$L^*_n=50$, $Y_n=18$, $dY_n=0.83$, $(Y/dY_n)=22$
$\log[Y/dY/(Y/dY)_n]=0$, $m_n=0.33$

1,757
0,378

application range

(Y/ΔY) / (Y/ΔY)_u CIE Y-based contrast normalized to Y_u/ΔY_u

$C_Y/C_{Yu}=(Y/\Delta Y)/(Y/\Delta Y)_u$
$L^* = 116\ (Y/Y_n)^{1/3} - 16$ ($Y_n=100$, $1 \le Y \le 100$) [1h]
$Y/dY = (3/116)\cdot Y_n^{1/3}\cdot Y^{2/3}$ [2h]
$Y/dY = e\cdot Y^{1/3}$ [3h]
$Y/dY = f\cdot (Y/Y_n)^{1/3}$ [4h]
$e = 833.048$ $f = 5721.613$

$L^*_n=50$, $Y_n=18$, $dY_n=0.83$, $(Y/dY_n)=22$
$\log[Y/dY/(Y/dY)_n]=0$, $m_n=0.33$

1,757
0,378

application range

TUB-test chart heb9; Calculated for the LABJND colour-difference formula, see CIE 230:2019
linear[lightness L^*, threshold ΔY, sensitivity $\Delta Y / Y$, contrast $Y / \Delta Y$, unnormalized and normalized]