

Age-corrected MAC¹

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© Nickalls RWD, Dales S and Nice A (2002–2009).
An open source anaesthesia workstation (Linux)
revision: 2009 α

¹<http://www.nickalls.org/dick/papers/xenon/hand-macage01.pdf>

Chapter 6

Age-corrected MAC

6.1 Introduction

The first implementation of the real-time age-corrected MAC output on the anaesthesia workstation was towards the end of 1996, soon after reading Mappleson's MAC paper (Mapleson 1996). The workstation program at that time was an MS-DOS application (written in QuickBasic 4.5) running in the thoracic theatre at the City Hospital.

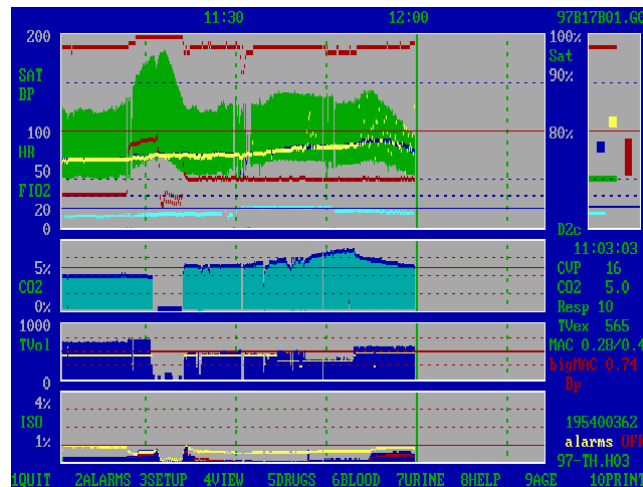


Figure 6.1: Screenshot (November 1997) of the MS-DOS anaesthesia workstation program (version D2c), showing the age-corrected MAC (“bigMAC”) value in a red-alert state (only 0.74) on the lower RHS of the screen. Other ‘red-alert’ states also indicated are for Bp (blood pressure—too low), and alarm sound OFF.

In practice this application was greatly facilitated by the excellent serial-port data stream output by the Datex Cardiocap and Capnomac Ultima series of anaesthesia monitors we then used (detailed in: Nickalls and Ramasubramanian 1995), since the data included agent name and inspired and expired vapour concentrations. Consequently, a practical real-time age-corrected MAC output display was straightforward and simple to implement, since all that was necessary was to write a small subroutine to calculate the value and display the numeric value continuously, and arrange for the value to be displayed in red and also trigger an audible alarm) when less than

a critical value (initially I chose the value 0.86—see the program below).

A significant problem regarding the administration of anaesthesia at that time was the fact that no less than four inhalational anaesthetic vapours were in common use (halothane, isoflurane, desflurane, sevoflurane), it was essentially impossible for *anyone* to remember the appropriate settings for each combination of agent and age. Consequently the prospect of inadvertent awareness was ever present, and anaesthetists generally tended to learn how to use one or two agents for most things even though particular agents may well be more suitable in certain circumstances (eg desflurane with obesity etc).

In view of this problem, the display of age-corrected MAC was particularly since one could now use any agent for any patient irrespective of age, quite safely simply by administering the agent in terms of MAC, and with the great benefit of essentially eliminating the possibility of inadvertent awareness simply by ensuring the age-corrected MAC was greater than a certain critical value—now taken to be 1 MAC (Hardman JG and Aitkenhead AR 2005). In fact we now had a working practical way of giving anaesthetics in terms of MAC units, as originally foreseen by Mapleson many years earlier in his insightful Clover lecture (Mapleson 1979). Our system of displaying real-time age-corrected MAC was at that time almost certainly the only such system in the UK, and possibly in the world.

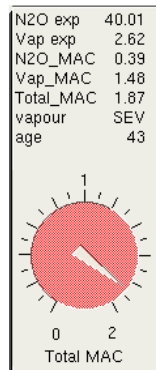


Figure 6.2:

Example of the new real-time age-corrected MAC-widget displayed by the anaesthesia workstation Linux software (© Nickalls RWD and Dales S (1996–2009)) interfaced to the Datex S/5 monitor. If the corrected MAC is too low or too high (as shown in this case—total MAC 1.87) then, in addition to sounding an audible alarm, the dial of the MAC-widget turns red.

The theatre program was later rewritten for the Linux operating system using the new Datex-Ohmeda AS3 monitors, having a much better data-stream (detailed in the Datex chapter). This allowed a nice widget design and hence a much better age-corrected MAC screen display as shown in Figures 6.2, 6.3. This display was intuitive, easy to read and well liked.

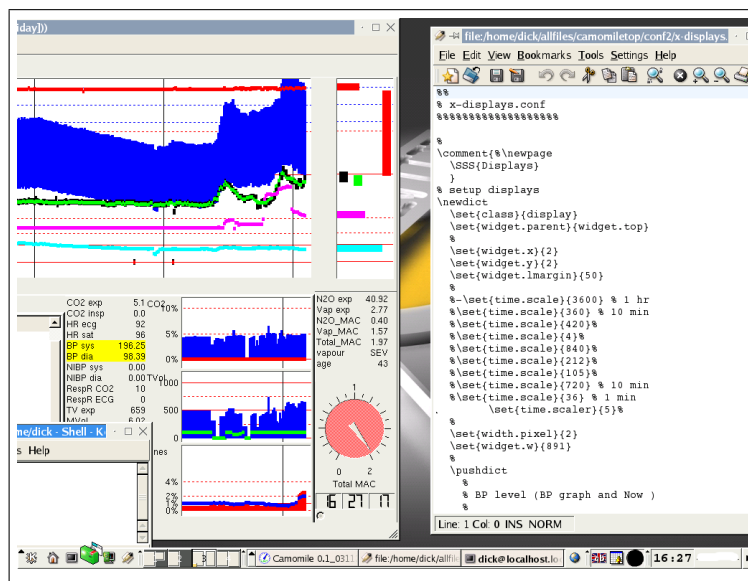


Figure 6.3: Screenshot showing the Linux MAC widget in a red-alert state. Note that the main display screen (pushed to the LHS) is designed so that all the important minute-to-minute data and alarm data is positioned on the RHS of the main display screen, and so allows the main display screen to be moved towards the left in order to view other data, files, or images as required. In this example a file is opened on the RHS of the PC screen.

6.1.1 MAC subroutine (MS-DOS)

The agent name and the end-tidal concentration (output by the Datex monitor) were used as inputs for the calculation, the $MAC_{age=40}$ values for each agent being stored in simple look-up table in the following subroutine (written in QuickBASIC 4.5).

```

REM MS-DOS program
REM 1996 QuickBASIC 4.5
SUB mac (n2opercent, vapourname$, etvapour,
    ageofpatient%, bmac)
REM
REM Determines the current value of MAC
REM using the recent paper by Mapleson (BJA, 1996, vol
    76, p 179-185)
REM Effect of age on MAC in humans: a meta-analysis
REM
REM new MAC sub using etn2o
REM returns the value of BIGMAC (bmac)
REM this is the newMAC which works correctly
REM
IF etvapour < 0 THEN etvapour = .001
n2o = n2opercent
v$ = vapourname$
vap = etvapour
A% = ageofpatient%
deltaage% = A% - 40

```

```

BB = -.00269
REM -----
REM this MAC sub is called from the end of PLOTVAPOUR
sub
REM vapour is on Datex Ultima BOO and C04 (13,3) data
strings
REM vapourcode$= ISO, HAL etc = " " when not
selected
IF v$ = "" THEN mac40 = 0
IF v$ = "HAL" THEN mac40 = .75
IF v$ = "ISO" THEN mac40 = 1.17
IF v$ = "ENF" THEN mac40 = 1.63
IF v$ = "SEV" THEN mac40 = 1.8
IF v$ = "DES" THEN mac40 = 6.6
REM mac40 for N2O = 104
REM -----
REM do N2O calculation first
REM restrict n2o to zero or above
IF n2o < 0 THEN n2o = 0
REM eqn mac=(mac40)*10^(-0.00269* deltaage%)
macn2o = 104 * 10 ^ (BB * deltaage%)
IF macn2o <= 0 THEN
    Fmacn2o = .01: REM changed from 0 to .01 check
ELSE
    Fmacn2o = n2o / macn2o
END IF
REM -----
REM do VAPOUR calc next
REM eqn mac=(mac40)*10^(-0.00269* deltaage%)
macvapour = mac40 * 10 ^ (BB * deltaage%)
IF macvapour <= 0 THEN
    totalFmac = Fmacn2o
ELSE
    Fmacvapour = (vap / macvapour)
    totalFmac = Fmacvapour + Fmacn2o
END IF
REM -----
REM do not print to screen if printing last 20 mins
fast data
IF pl20mf$ = "on" THEN GOTO MAClastline
REM -----
A = Fmacn2o
B = Fmacvapour
c = totalFmac
REM -----
COLOR green , screenbackcolour
REM cannot print digits with PRINT USING and
REM strings in same PRINT statement , so therefore
REM we have to print them separately (red if vap mac=0)
LOCATE 18, 68: PRINT SPACES(11)
LOCATE 18, 68: PRINT "MAC ";
IF B <= 0 THEN
    COLOR red , screenbackcolour
    PRINT USING "#.##"; B;

```

```

        COLOR green , screenbackcolour
    ELSE
        PRINT USING "#.##"; B;
    END IF
    PRINT "/";
    PRINT USING "#.##"; A
    REM — print in red if bigmac less than .86
    IF c < 0.86 THEN
        COLOR red , screenbackcolour
    ELSE
        COLOR green , screenbackcolour
    END IF
    LOCATE 19, 68: PRINT SPACES(10)
    LOCATE 19, 68: PRINT "bigMAC ";
    PRINT USING "#.##"; c
    REM _____
    REM now return to normal screen colours
    COLOR screenforecolour , screenbackcolour
    MAClastline:
    bmac = c
    END SUB
    $%

```

6.2 Age corrected MAC charts

Sometime during the next couple of years I started wondering how I could create a paper nomogram-type chart for determining age-corrected MAC for use when I did lists at the QMC, since (a) I was unable then to use my computer program (based in the thoracic theatre at the City Hospital), and (b) it was impossible to use the data presented in the Mapleson 1996 paper in a clinical setting to guide at all accurately the appropriate choice of end-tidal agent concentration for a particular patient.

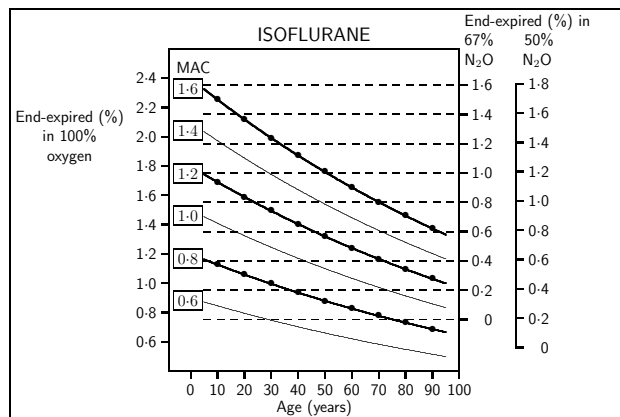


Figure 6.4: One of the first age-corrected iso-MAC charts, drawn using mathsPIC.

The main problem was figuring out how best to incorporate the optional and flexible use of nitrous oxide, since the charts would not be particularly useful clinically unless they easily allowed for the effect of nitrous oxide. The design of such a chart was not straightforward, and it was quite a long time before I formulated a suitable design which allowed nitrous-oxide use (see Figure 6.4). The solution lay in the generally held view that MAC-multiples were additive, and hence the nitrous oxide scale could simply be shifted by an agent-specific amount. Eventually a single chart for each inhalational agent was generated using Perl and mathsPIC (Nickalls 1999, 2000; Syropoulos and Nickalls 2000), and this was then tested clinically over a period of time.

Encouraged by colleagues who tested these charts (one for each of the three main inhalational agents), a paper was submitted to the *British Journal of Anaesthesia* in November 2001. A revised version was submitted in February 2003 and was published later that year (Nickalls and Mapleson 2003). The article was also the subject of an editorial (White, 2003). Since then the these age-corrected iso-MAC charts have been included in the *Oxford handbook of anaesthesia* (Allman and Wilson 2006).

6.3 Generating the charts

The charts were generated using QuickBasic 4.5 (MS-DOS), Perl and mathsPIC. I originally used a QuickBasic program (e.g. iso-mac.dat; see below) to generate the agent-specific data-files (for isoflurane, sevoflurane, desflurane) containing the data points for each of the iso-MAC curve (i.e. for the curves associated with the MAC values 0.6, 0.8, 1.0, 1.2, 1.4, 1.6). These data-files were coded with the letters *j, k, m, n, p, q*. For example the following program iso-mac.bas generated the isoflurane data-file isoqdata.dat (i.e. the data-file for the 'q' (iso-MAC 1.6) curve for isoflurane). In order to generate all the different data-files (a total of 3×6 different data-files) the program was run many times, each run having different values enabled for agent and MAC etc.

```

REM new iso-mac.bas
COLOR 15, 1
CLS
REM IF ageofpatient% < 1 THEN ageofpatient% = 1
REM -----
REM this MAC sub is called from the end of PLOTVAPOUR
  sub
REM vapour is on BOO and C04 (13,3) data strings
REM vapourcode$= ISO, HAL etc = " " when not
  selected
REM IF v$ = " " THEN mac40 = 0
REM IF v$ = "HAL" THEN mac40 = .75
REM IF v$ = "ISO" THEN mac40 = 1.17
REM IF v$ = "ENF" THEN mac40 = 1.63
REM IF v$ = "SEV" THEN mac40 = 1.8
REM IF v$ = "DES" THEN mac40 = 6.6
REM mac40 for N2O = 104
REM -----
REM etn2o = 100 - (eto2 + etco2 + etvap)
REM -----
REM do N2O calculation first
REM restrict n2o to zero or above
REM IF n2o < 0 THEN n2o = 0
REM eqn mac=(mac40)*10^(-0.00269* deltaage%)
REM -----

```

```

REM q = 1.6 mac = 1.17
REM p = 1.4 mac = 1.17
REM n = 1.2 mac = 1.17
REM m = 1 mac = 1.17
REM k = 0.8 mac = 1.17
REM j = 0.6 mac = 1.17

OPEN "isoqdata.dat" FOR OUTPUT AS #1
n = 1.6
code$ = "q"

mac40 = 1.17: REM isoflurane

REM -----
PRINT #1, "%% " + code$ + "= mac40(iso) * "; n
FOR j = 5 TO 95 STEP 5
REM j = age
deltaage = j - 40
BB = -.00269
mac = (n * mac40) * 10 ^ (BB * deltaage)
PRINT j, mac
PRINT #1, "point(" + code$; j; "){"; j; ", "; mac; "}"
s$ = s$ + code$ + STR$(j) + SPACES(1)
NEXT j

PRINT #1,
PRINT #1, "drawline(" + s$ + ")"
REM $-----

```

6.3.1 A data file for a single iso-MAC curve

The following output data-file (`isoqdata.dat`) was generated by the above program. This data-file contained the mathsPIC code for drawing the iso-MAC 1-6 curve ('q') for the agent isoflurane. This file was then one of the input files for another mathsPIC program which drew the whole graph.

```

%% isoqdata.dat
%% q= mac40(iso) * 1.6
point(q 5 ){ 5 , 2.325176} %% manual
point(q 10 ){ 10 , 2.25427 }
point(q 15 ){ 15 , 2.185525 }
point(q 20 ){ 20 , 2.118877 }
point(q 25 ){ 25 , 2.054262 }
point(q 30 ){ 30 , 1.991617 }
point(q 35 ){ 35 , 1.930882 }
point(q 40 ){ 40 , 1.872 }
point(q 45 ){ 45 , 1.814913 }
point(q 50 ){ 50 , 1.759567 }
point(q 55 ){ 55 , 1.705909 }
point(q 60 ){ 60 , 1.653887 }
point(q 65 ){ 65 , 1.603451 }
point(q 70 ){ 70 , 1.554554 }
point(q 75 ){ 75 , 1.507148 }

```

```

point(q 80 ){ 80 , 1.461187 }
point(q 85 ){ 85 , 1.416628 }
point(q 90 ){ 90 , 1.373428 }
point(q 95 ){ 95 , 1.331545 }

drawline(q 5 q 10 q 15 q 20 q 25 q 30 q 35 q 40 q 45 q
50 q 55 q 60 q 65 q 70 q 75 q 80 q 85 q 90 q 95 )
drawpoint(q 10 q 20 q 30 q 40 q 50 q 60 q 70 q
80 q 90 )

```

6.3.2 mathsPIC script for drawing the whole graph

Once having generated all the different data-files (above), a mathsPIC script was written to draw the axes, and to draw the graph by inputting all the relevant data-files. For example, the following mathsPIC script (`mac-iso7.m`) inputs each of the various data-files (one for each iso-MAC curve) and draws the complete isoflurane graph, outputting the \LaTeX form of the graph.

For those not familiar with \TeX and \LaTeX the complete process to be run through is roughly as follows: we first process the mathsPIC script via the mathsPIC program (a Perl program) to generate the \TeX (`.mt`) output file, and then we \LaTeX this file to generate the (`.dvi`) output file. Next we generate a PostScript version (using the `dvips` utility, and then define the Bounding Box (BB) (using GhostScript) and form the EPS version (i.e. by including the BB coordinates and then renaming the file). Finally we generate the associated (`.pdf`) files using the `epstopdf` utility.

Note that the particular mathsPIC program used at that time was actually an early β version of the final mathsPIC program (Syropoulos A and Nickalls RWD 2005), so that the following mathsPIC script contains instances of the old `\variable(){}{}` commands which were still being used (eventually changed to the Perl-like format `\var(){}{}`).

```

%% mac-iso7.m (modified from mac-iso5.m)
%% Feb 1st 2003
%% final graph/chart for the bja
%% wih decimals ( $\cdot$ ) and \fbox{}
%% new curves for anaesthesia
% mathsPIC

\documentclass[a4paper,12pt]{article}
\usepackage{pictexwd}
\begin{document}
\thispagestyle{empty}%% to avoid page nos
\oddsidemargin=-17mm
%\framebox{}
\beginpicture
%-----

%% use sf font for figures for BJA
\fontfamily{cmss}\selectfont\normalsize
\linethickness=0.9pt %% = normalsize (my manual p 23)

%% structure copied from mac-des.m
%%-----
%% ISOflurane Delta for N2O = 0.75 = (66.6666/104)*1.17
pointnumber(200)
%% y units = 12cm/2.2 = 5.454545

```

```

%paper{units(mm,5.454545cm) xrange(-5,100)
  yrange(0.4,2.6) axes(L) ticks(10,0.2)}
paper{units(0.7mm,3.818181cm) xrange(-8,100)
  yrange(0.4,2.6) axes(T)}

%-----
%% want to print only some of the L axis scale
  (0.6-2.4), so do it manually
\axis left
\  ticks withvalues 0{\cdot$}6 0{\cdot$}8
  1{\cdot$}0 1{\cdot$}2 1{\cdot$}4
  1{\cdot$}6
\  1{\cdot$}8 2{\cdot$}0 2{\cdot$}2
  2{\cdot$}4 /
\  at 0.60 0.80 1.00 1.20 1.40
\  1.60 1.80 2.00 2.20 2.40 / /
%-----
\axis bottom
\  ticks withvalues 0 10 20 30 40 50 60 70 80
  90 100 /
\  at 0 10 20 30 40 50 60 70 80
  90 100 / /
%-----
\axis right
%%{ {using N2O 67%}} shift = 0.7523
\  ticks withvalues 0 0{\cdot$}2 0{\cdot$}4
  0{\cdot$}6
\  0{\cdot$}8 1{\cdot$}0
  1{\cdot$}2 1{\cdot$}4
\  1{\cdot$}6 /
\  at 0.7523 0.9523 1.1523 1.3523 1.5523
  1.7523 1.9523 2.1523
\  2.3523 / /
%-----
%% extra 50% right axis shift = 0.5614
%% since this axis is off the graph then need new paper
  command
%% but do not use axis() option
paper{units(0.7mm,3.818181cm) xrange(-8,121)
  yrange(0.5614,2.3614) }
\axis right %% seconds right axis for 50% oxygen
  shift = 0.5614
\  ticks withvalues 0 0{\cdot$}2
  0{\cdot$}4 0{\cdot$}6 0{\cdot$}8
\  1{\cdot$}0 1{\cdot$}2 1{\cdot$}4
  1{\cdot$}6 1{\cdot$}8 /
\  at 0.5614 0.7614 0.9614 1.1614
  1.3614
\  1.5614 1.7614 1.9614 2.1614 2.3614 / /
%-----
%%beginSKIP
\newcommand{\thickline}{\setplotsymbol({\Large .})}%

```

```

\newcommand{\thinline}{\setplotsymbol({\tiny .})}%

\thickline%
inputfile(isoqdata.dat) %1.6
\thinline%
inputfile(isopdata.dat) %1.4
\thickline%
inputfile(isondata.dat) % 1.2
\thinline%
inputfile(isomdata.dat) % 1
\thickline%
inputfile(isokdata.dat) % 0.8
\thinline%
inputfile(isojdata.dat) %0.6
%%endSKIP
%-----
%%from mac-des.m
variable(x){-1}
variable(x2){x, advance(2)}
point(h){x2,2.475}
text(MAC){h}
%% vertical diff = 0.29 units %% 0.28
variable(d){0.29}

variable(h6){0.88} %0.9
text(\fbox{$0{\cdot}6$}){x,h6}

variable(h8){h6, advance(d)}
text(\fbox{$0{\cdot}8$}){x,h8}

variable(h10){h8, advance(d)}
text(\fbox{$1{\cdot}0$}){x,h10}

variable(h12){h10, advance(d)}
text(\fbox{$1{\cdot}2$}){x,h12}

variable(h14){h12, advance(d)}
text(\fbox{$1{\cdot}4$}){x,h14}

variable(h16){h14, advance(d)}
text(\fbox{$1{\cdot}6$}){x,h16}

%-----
\newcommand{\myleft}{%
%\framebox{
\begin{minipage}{29mm}\centering%
\End-expired(\%)\%
\ in 100\% \\\%
\ oxygen\\
\end{minipage}%
%\ }%
\ }%

text(\myleft){-45, 2.0}

```

```

%-----
\newcommand{\myrightb}{%
  %\fbox{%
  \begin{minipage}{4cm}%
  \End-expired (\%) in \\
  67%\hspace{8mm}50%\ \\
  N$_2$O\hspace{7.5mm}N$_2$O
  \end{minipage}
% }%
\}% end of newcommand
text(\myrightb){102, 2.657}[1] %% was 2.6
%-----

\newcommand{\mybottom}{Age (years)}%
text(\mybottom){46, 0.15}

%%text(\copyright\ RWD Nickalls\ 2001){22,0.5}

text(\large ISOFLURANE){46, 2.7} %% 80

%-----
% draw horizontal dashed lines
%%\linethickness=0.4pt %% equivalent to {\tiny .}
\linethickness=0.6pt %% half way between tiny and
normalsize
\setdashes
variable(x5){5} %% Left X value
variable(x6){100} %% Right X value
variable(y16){2.3523}
variable(y14){2.1523}
variable(y12){1.9523}
variable(y10){1.7523}
variable(y08){1.5523}
variable(y06){1.3523}
variable(y04){1.1523}
variable(y02){0.9523} %% = 0.7523 + 0.2
variable(y00){0.7523} %% = 0.7523

point(L16){x5, y16}
point(R16){x6, y16}

point(L14){x5, y14}
point(R14){x6, y14}

point(L12){x5, y12}
point(R12){x6, y12}

point(L10){x5, y10}
point(R10){x6, y10}

point(L08){x5, y08}
point(R08){x6, y08}

```

```

point(L06){x5, y06}
point(R06){x6, y06}

point(L04){x5, y04}
point(R04){x6, y04}

point(L02){x5, y02}
point(R02){x6, y02}

point(L00){x5, y00}
point(R00){x6, y00}

%% draw the dashes from Left to Right
%% (so have small gap at right axis)
drawline(L16R16, L14R14, L12R12, L10R10, L08R08, L06R06,
         L04R04, L02R02, L00R00)

\endpicture
%\ } %framebox
\end{document}

```

The following example is the \TeX code output by the above mathsPIC program.

```

%* -----
%* mathsPIC 2.1g1
%* Copyright (c) RWD Nickalls 1999–2002
%* Email: dicknickalls@compuserve.com
%* Date (m/d/y) : 02–02–2003 16:22:19
%* Command Line: /b/s MAC-ISO7.M
%* Input Filename: MAC-ISO7.M
%* Output Filename: MAC-ISO7.MT
%* -----
%% mac-iso7.m (modified from mac-iso5.m)
%% Feb 1st 2003
%% final graph/chart for the bja
%% wih decimals ( $\cdot$ ) and \fbox{}
%% new curves for anaesthesia
% mathsPIC
\documentclass[a4paper,12pt]{article}
\usepackage{pictexwd}
\begin{document}
\thispagestyle{empty}%% to avoid page nos
\oddsidemargin=-17mm
\framebox{%
\beginpicture
%-----
%% use sf font for figures for BJA
\fontfamily{cmss}\selectfont\normalsize
\linethickness=0.9pt %% = normalsize (my manual p 23)
%% structure copied from mac-des.m
%%-----
%% ISOflurane Delta for N2O = 0.75 = (66.6666/104)*1.17
%% pointnumber(200)
%% y units = 12cm/2.2 = 5.454545

```

```

%paper{units (mm,5.454545cm) xrange(-5,100)
  yrange(0.4,2.6) axes(L) ticks(10,0.2)}
%%
paper{units (0.7mm,3.818181cm)xrange(-8,100)yrange(0.4,2.6) axes(T)}
\setcoordinatesystem units < .7mm, 3.818181cm>
%% ... note: xunits & yunits are different
\setplotarea x from -8 to 100, y from .4 to 2.6
\axis top /
%-----
%% want to print only some of the L axis scale
(0.6-2.4), so do it manually
\axis left
  ticks withvalues 0{ $\cdot$ }6 0{ $\cdot$ }8
1{ $\cdot$ }0 1{ $\cdot$ }2 1{ $\cdot$ }4
1{ $\cdot$ }6
1{ $\cdot$ }8 2{ $\cdot$ }0 2{ $\cdot$ }2
2{ $\cdot$ }4 /
  at 0.60 0.80 1.00 1.20 1.40
1.60 1.80 2.00 2.20 2.40 / /
%-----
\axis bottom
  ticks withvalues 0 10 20 30 40 50 60 70 80
90 100 /
  at 0 10 20 30 40 50 60 70 80
90 100 / /
%-----
\axis right
%%/%% {using N2O 67%}} shift = 0.7523
  ticks withvalues 0 0{ $\cdot$ }2 0{ $\cdot$ }4
0{ $\cdot$ }6
0{ $\cdot$ }8 1{ $\cdot$ }0
1{ $\cdot$ }2 1{ $\cdot$ }4
1{ $\cdot$ }6 /
  at 0.7523 0.9523 1.1523 1.3523 1.5523
1.7523 1.9523 2.1523
2.3523 / /
%-----
%% extra 50% right axis shift = 0.5614
%% since this axis is off the graph then need new paper
command
%% but do not use axis() option
%%
paper{units (0.7mm,3.818181cm)xrange(-8,121)yrange(0.5614,2.3614)}
\setcoordinatesystem units < .7mm, 3.818181cm>
%% ... note: xunits & yunits are different
\setplotarea x from -8 to 121, y from .5614 to
2.3614
\axis right %% seconds right axis for 50% oxygen
shift = 0.5614
  ticks withvalues 0 0{ $\cdot$ }2
0{ $\cdot$ }4 0{ $\cdot$ }6 0{ $\cdot$ }8
1{ $\cdot$ }0 1{ $\cdot$ }2 1{ $\cdot$ }4
1{ $\cdot$ }6 1{ $\cdot$ }8 /
  at 0.5614 0.7614 0.9614 1.1614

```

```

                                1.3614
                                1.5614 1.7614 1.9614 2.1614 2.3614 / /
%-----
%%beginSKIP
\newcommand{\thickline}{\setplotsymbol({\Large .})}%
\newcommand{\thinline}{\setplotsymbol({\tiny .})}%
\thickline%
%% inputfile(isoqdata.dat) %1.6
%% ... start of file <isoqdata.dat>
%% q= mac40(iso) * 1.6
%% point(q5){5,2.325176} ( 5 , 2.325176 ) %% manual
%% point(q10){10,2.25427} ( 10 , 2.25427 )
%% point(q15){15,2.185525} ( 15 , 2.185525 )
%% point(q20){20,2.118877} ( 20 , 2.118877 )
%% point(q25){25,2.054262} ( 25 , 2.054262 )
%% point(q30){30,1.991617} ( 30 , 1.991617 )
%% point(q35){35,1.930882} ( 35 , 1.930882 )
%% point(q40){40,1.872} ( 40 , 1.872 )
%% point(q45){45,1.814913} ( 45 , 1.814913 )
%% point(q50){50,1.759567} ( 50 , 1.759567 )
%% point(q55){55,1.705909} ( 55 , 1.705909 )
%% point(q60){60,1.653887} ( 60 , 1.653887 )
%% point(q65){65,1.603451} ( 65 , 1.603451 )
%% point(q70){70,1.554554} ( 70 , 1.554554 )
%% point(q75){75,1.507148} ( 75 , 1.507148 )
%% point(q80){80,1.461187} ( 80 , 1.461187 )
%% point(q85){85,1.416628} ( 85 , 1.416628 )
%% point(q90){90,1.373428} ( 90 , 1.373428 )
%% point(q95){95,1.331545} ( 95 , 1.331545 )
%%
%% drawline(q5q10q15q20q25q30q35q40q45q50q55q60q65q70q75q80q85q90q95)
\plot 5 2.325176 10 2.25427 / %% q5q10
\plot 10 2.25427 15 2.185525 / %% q10q15
\plot 15 2.185525 20 2.118877 / %% q15q20
\plot 20 2.118877 25 2.054262 / %% q20q25
\plot 25 2.054262 30 1.991617 / %% q25q30
\plot 30 1.991617 35 1.930882 / %% q30q35
\plot 35 1.930882 40 1.872 / %% q35q40
\plot 40 1.872 45 1.814913 / %% q40q45
\plot 45 1.814913 50 1.759567 / %% q45q50
\plot 50 1.759567 55 1.705909 / %% q50q55
\plot 55 1.705909 60 1.653887 / %% q55q60
\plot 60 1.653887 65 1.603451 / %% q60q65
\plot 65 1.603451 70 1.554554 / %% q65q70
\plot 70 1.554554 75 1.507148 / %% q70q75
\plot 75 1.507148 80 1.461187 / %% q75q80
\plot 80 1.461187 85 1.416628 / %% q80q85
\plot 85 1.416628 90 1.373428 / %% q85q90
\plot 90 1.373428 95 1.331545 / %% q90q95
%% drawpoint(q10q20q30q40q50q60q70q80q90)
\put {$\bullet$} at 10 2.25427 %% q10
\put {$\bullet$} at 20 2.118877 %% q20
\put {$\bullet$} at 30 1.991617 %% q30
\put {$\bullet$} at 40 1.872 %% q40

```

```

\put {$\bullet$} at 50 1.759567 %% q50
\put {$\bullet$} at 60 1.653887 %% q60
\put {$\bullet$} at 70 1.554554 %% q70
\put {$\bullet$} at 80 1.461187 %% q80
\put {$\bullet$} at 90 1.373428 %% q90
%% ... end of file <isoqdata.dat>
\thinline%
%% inputfile(isopdata.dat) %1.4
%% ... start of file <isopdata.dat>
%% p= mac40(iso) * 1.4
%% point(p5){5,2.034529} ( 5 , 2.034529 ) %% manual
%% point(p10){10,1.972486} ( 10 , 1.972486 )
%% point(p15){15,1.912335} ( 15 , 1.912335 )
%% point(p20){20,1.854018} ( 20 , 1.854018 )
%% point(p25){25,1.797479} ( 25 , 1.797479 )
%% point(p30){30,1.742665} ( 30 , 1.742665 )
%% point(p35){35,1.689522} ( 35 , 1.689522 )
%% point(p40){40,1.638} ( 40 , 1.638 )
%% point(p45){45,1.588049} ( 45 , 1.588049 )
%% point(p50){50,1.539621} ( 50 , 1.539621 )
%% point(p55){55,1.49267} ( 55 , 1.49267 )
%% point(p60){60,1.447151} ( 60 , 1.447151 )
%% point(p65){65,1.40302} ( 65 , 1.40302 )
%% point(p70){70,1.360235} ( 70 , 1.360235 )
%% point(p75){75,1.318754} ( 75 , 1.318754 )
%% point(p80){80,1.278539} ( 80 , 1.278539 )
%% point(p85){85,1.23955} ( 85 , 1.23955 )
%% point(p90){90,1.201749} ( 90 , 1.201749 )
%% point(p95){95,1.165102} ( 95 , 1.165102 )
%%
%% drawline (p5p10p15p20p25p30p35p40p45p50p55p60p65p70p75p80p85p90p95)
\plot 5 2.034529 10 1.972486 / %% p5p10
\plot 10 1.972486 15 1.912335 / %% p10p15
\plot 15 1.912335 20 1.854018 / %% p15p20
\plot 20 1.854018 25 1.797479 / %% p20p25
\plot 25 1.797479 30 1.742665 / %% p25p30
\plot 30 1.742665 35 1.689522 / %% p30p35
\plot 35 1.689522 40 1.638 / %% p35p40
\plot 40 1.638 45 1.588049 / %% p40p45
\plot 45 1.588049 50 1.539621 / %% p45p50
\plot 50 1.539621 55 1.49267 / %% p50p55
\plot 55 1.49267 60 1.447151 / %% p55p60
\plot 60 1.447151 65 1.40302 / %% p60p65
\plot 65 1.40302 70 1.360235 / %% p65p70
\plot 70 1.360235 75 1.318754 / %% p70p75
\plot 75 1.318754 80 1.278539 / %% p75p80
\plot 80 1.278539 85 1.23955 / %% p80p85
\plot 85 1.23955 90 1.201749 / %% p85p90
\plot 90 1.201749 95 1.165102 / %% p90p95
%% ... end of file <isopdata.dat>
\thickline%
%% inputfile(isondata.dat) % 1.2
%% ... start of file <isondata.dat>
%% n= mac40(iso) * 1.2

```

```

%% point(n5){5,1.743882} ( 5 , 1.743882 ) %% manual
%% point(n10){10,1.690702} ( 10 , 1.690702 )
%% point(n15){15,1.639144} ( 15 , 1.639144 )
%% point(n20){20,1.589158} ( 20 , 1.589158 )
%% point(n25){25,1.540697} ( 25 , 1.540697 )
%% point(n30){30,1.493713} ( 30 , 1.493713 )
%% point(n35){35,1.448162} ( 35 , 1.448162 )
%% point(n40){40,1.404} ( 40 , 1.404 )
%% point(n45){45,1.361185} ( 45 , 1.361185 )
%% point(n50){50,1.319675} ( 50 , 1.319675 )
%% point(n55){55,1.279432} ( 55 , 1.279432 )
%% point(n60){60,1.240415} ( 60 , 1.240415 )
%% point(n65){65,1.202589} ( 65 , 1.202589 )
%% point(n70){70,1.165916} ( 70 , 1.165916 )
%% point(n75){75,1.130361} ( 75 , 1.130361 )
%% point(n80){80,1.09589} ( 80 , 1.09589 )
%% point(n85){85,1.062471} ( 85 , 1.062471 )
%% point(n90){90,1.030071} ( 90 , 1.030071 )
%% point(n95){95,.9986587} ( 95 , .9986587 )
%%
drawline (n5n10n15n20n25n30n35n40n45n50n55n60n65n70n75n80n85n90n95)
\plot 5 1.743882 10 1.690702 / %% n5n10
\plot 10 1.690702 15 1.639144 / %% n10n15
\plot 15 1.639144 20 1.589158 / %% n15n20
\plot 20 1.589158 25 1.540697 / %% n20n25
\plot 25 1.540697 30 1.493713 / %% n25n30
\plot 30 1.493713 35 1.448162 / %% n30n35
\plot 35 1.448162 40 1.404 / %% n35n40
\plot 40 1.404 45 1.361185 / %% n40n45
\plot 45 1.361185 50 1.319675 / %% n45n50
\plot 50 1.319675 55 1.279432 / %% n50n55
\plot 55 1.279432 60 1.240415 / %% n55n60
\plot 60 1.240415 65 1.202589 / %% n60n65
\plot 65 1.202589 70 1.165916 / %% n65n70
\plot 70 1.165916 75 1.130361 / %% n70n75
\plot 75 1.130361 80 1.09589 / %% n75n80
\plot 80 1.09589 85 1.062471 / %% n80n85
\plot 85 1.062471 90 1.030071 / %% n85n90
\plot 90 1.030071 95 .9986587 / %% n90n95
%% drawpoint (n10n20n30n40n50n60n70n80n90)
\put {$\bullet$} at 10 1.690702 %% n10
\put {$\bullet$} at 20 1.589158 %% n20
\put {$\bullet$} at 30 1.493713 %% n30
\put {$\bullet$} at 40 1.404 %% n40
\put {$\bullet$} at 50 1.319675 %% n50
\put {$\bullet$} at 60 1.240415 %% n60
\put {$\bullet$} at 70 1.165916 %% n70
\put {$\bullet$} at 80 1.09589 %% n80
\put {$\bullet$} at 90 1.030071 %% n90
%% ... end of file <isomdata.dat>
\thinline%
%% inputfile(isomdata.dat) % 1
%% ... start of file <isomdata.dat>
%% m= mac40(iso) * 1

```

```

%% point(m5){5,1.453235} ( 5 , 1.453235 )
%% point(m10){10,1.408918} ( 10 , 1.408918 )
%% point(m15){15,1.365953} ( 15 , 1.365953 )
%% point(m20){20,1.324298} ( 20 , 1.324298 )
%% point(m25){25,1.283914} ( 25 , 1.283914 )
%% point(m30){30,1.244761} ( 30 , 1.244761 )
%% point(m35){35,1.206802} ( 35 , 1.206802 )
%% point(m40){40,1.17} ( 40 , 1.17 )
%% point(m45){45,1.134321} ( 45 , 1.134321 )
%% point(m50){50,1.099729} ( 50 , 1.099729 )
%% point(m55){55,1.066193} ( 55 , 1.066193 )
%% point(m60){60,1.033679} ( 60 , 1.033679 )
%% point(m65){65,1.002157} ( 65 , 1.002157 )
%% point(m70){70,.9715963} ( 70 , .9715963 )
%% point(m75){75,.9419674} ( 75 , .9419674 )
%% point(m80){80,.9132419} ( 80 , .9132419 )
%% point(m85){85,.8853925} ( 85 , .8853925 )
%% point(m90){90,.8583924} ( 90 , .8583924 )
%% point(m95){95,.8322156} ( 95 , .8322156 )
%%
drawline (m5m10m15m20m25m30m35m40m45m50m55m60m65m70m75m80m85m90m95)
\plot 5 1.453235 10 1.408918 / %% m5m10
\plot 10 1.408918 15 1.365953 / %% m10m15
\plot 15 1.365953 20 1.324298 / %% m15m20
\plot 20 1.324298 25 1.283914 / %% m20m25
\plot 25 1.283914 30 1.244761 / %% m25m30
\plot 30 1.244761 35 1.206802 / %% m30m35
\plot 35 1.206802 40 1.17 / %% m35m40
\plot 40 1.17 45 1.134321 / %% m40m45
\plot 45 1.134321 50 1.099729 / %% m45m50
\plot 50 1.099729 55 1.066193 / %% m50m55
\plot 55 1.066193 60 1.033679 / %% m55m60
\plot 60 1.033679 65 1.002157 / %% m60m65
\plot 65 1.002157 70 .9715963 / %% m65m70
\plot 70 .9715963 75 .9419674 / %% m70m75
\plot 75 .9419674 80 .9132419 / %% m75m80
\plot 80 .9132419 85 .8853925 / %% m80m85
\plot 85 .8853925 90 .8583924 / %% m85m90
\plot 90 .8583924 95 .8322156 / %% m90m95
%% ... end of file <isomdata.dat>
\thickline%
%% inputfile(isokdata.dat) % 0.8
%% ... start of file <isokdata.dat>
%% k= mac40(iso) * .8
%% point(k5){5,1.162588} ( 5 , 1.162588 ) %% manual
%% point(k10){10,1.127135} ( 10 , 1.127135 )
%% point(k15){15,1.092763} ( 15 , 1.092763 )
%% point(k20){20,1.059439} ( 20 , 1.059439 )
%% point(k25){25,1.027131} ( 25 , 1.027131 )
%% point(k30){30,.9958085} ( 30 , .9958085 )
%% point(k35){35,.9654412} ( 35 , .9654412 )
%% point(k40){40,.936} ( 40 , .936 )
%% point(k45){45,.9074566} ( 45 , .9074566 )
%% point(k50){50,.8797836} ( 50 , .8797836 )

```

```

%% point(k55){55,.8529544} ( 55 , .8529544 )
%% point(k60){60,.8269435} ( 60 , .8269435 )
%% point(k65){65,.8017257} ( 65 , .8017257 )
%% point(k70){70,.7772771} ( 70 , .7772771 )
%% point(k75){75,.7535739} ( 75 , .7535739 )
%% point(k80){80,.7305936} ( 80 , .7305936 )
%% point(k85){85,.708314} ( 85 , .708314 )
%% point(k90){90,.6867139} ( 90 , .6867139 )
%% point(k95){95,.6657725} ( 95 , .6657725 )
%%
drawline (k5k10k15k20k25k30k35k40k45k50k55k60k65k70k75k80k85k90k95)
\plot 5 1.162588 10 1.127135 / %% k5k10
\plot 10 1.127135 15 1.092763 / %% k10k15
\plot 15 1.092763 20 1.059439 / %% k15k20
\plot 20 1.059439 25 1.027131 / %% k20k25
\plot 25 1.027131 30 .9958085 / %% k25k30
\plot 30 .9958085 35 .9654412 / %% k30k35
\plot 35 .9654412 40 .936 / %% k35k40
\plot 40 .936 45 .9074566 / %% k40k45
\plot 45 .9074566 50 .8797836 / %% k45k50
\plot 50 .8797836 55 .8529544 / %% k50k55
\plot 55 .8529544 60 .8269435 / %% k55k60
\plot 60 .8269435 65 .8017257 / %% k60k65
\plot 65 .8017257 70 .7772771 / %% k65k70
\plot 70 .7772771 75 .7535739 / %% k70k75
\plot 75 .7535739 80 .7305936 / %% k75k80
\plot 80 .7305936 85 .708314 / %% k80k85
\plot 85 .708314 90 .6867139 / %% k85k90
\plot 90 .6867139 95 .6657725 / %% k90k95
%% drawpoint(k10k20k30k40k50k60k70k80k90)
\put {$\bullet$} at 10 1.127135 %% k10
\put {$\bullet$} at 20 1.059439 %% k20
\put {$\bullet$} at 30 .9958085 %% k30
\put {$\bullet$} at 40 .936 %% k40
\put {$\bullet$} at 50 .8797836 %% k50
\put {$\bullet$} at 60 .8269435 %% k60
\put {$\bullet$} at 70 .7772771 %% k70
\put {$\bullet$} at 80 .7305936 %% k80
\put {$\bullet$} at 90 .6867139 %% k90
%% ... end of file <isokdata.dat>
\thinline%
%% inputfile(isojdata.dat) %0.6
%% ... start of file <isojdata.dat>
%% j= mac40(iso) * .6
%% point(j5){5,.871941} ( 5 , .871941 ) %% manual
%% point(j10){10,.8453511} ( 10 , .8453511 )
%% point(j15){15,.819572} ( 15 , .819572 )
%% point(j20){20,.794579} ( 20 , .794579 )
%% point(j25){25,.7703483} ( 25 , .7703483 )
%% point(j30){30,.7468564} ( 30 , .7468564 )
%% point(j35){35,.7240809} ( 35 , .7240809 )
%% point(j40){40,.702} ( 40 , .702 )
%% point(j45){45,.6805924} ( 45 , .6805924 )
%% point(j50){50,.6598377} ( 50 , .6598377 )

```

```

%% point(j55){55,.6397159} ( 55 , .6397159 )
%% point(j60){60,.6202077} ( 60 , .6202077 )
%% point(j65){65,.6012943} ( 65 , .6012943 )
%% point(j70){70,.5829578} ( 70 , .5829578 )
%% point(j75){75,.5651804} ( 75 , .5651804 )
%% point(j80){80,.5479452} ( 80 , .5479452 )
%% point(j85){85,.5312355} ( 85 , .5312355 )
%% point(j90){90,.5150355} ( 90 , .5150355 )
%% point(j95){95,.4993294} ( 95 , .4993294 )
%%
drawline (j5j10j15j20j25j30j35j40j45j50j55j60j65j70j75j80j85j90j95 )
\plot 5 .871941 10 .8453511 / %% j5j10
\plot 10 .8453511 15 .819572 / %% j10j15
\plot 15 .819572 20 .794579 / %% j15j20
\plot 20 .794579 25 .7703483 / %% j20j25
\plot 25 .7703483 30 .7468564 / %% j25j30
\plot 30 .7468564 35 .7240809 / %% j30j35
\plot 35 .7240809 40 .702 / %% j35j40
\plot 40 .702 45 .6805924 / %% j40j45
\plot 45 .6805924 50 .6598377 / %% j45j50
\plot 50 .6598377 55 .6397159 / %% j50j55
\plot 55 .6397159 60 .6202077 / %% j55j60
\plot 60 .6202077 65 .6012943 / %% j60j65
\plot 65 .6012943 70 .5829578 / %% j65j70
\plot 70 .5829578 75 .5651804 / %% j70j75
\plot 75 .5651804 80 .5479452 / %% j75j80
\plot 80 .5479452 85 .5312355 / %% j80j85
\plot 85 .5312355 90 .5150355 / %% j85j90
\plot 90 .5150355 95 .4993294 / %% j90j95
%% ... end of file <isojdata.dat>
%%endSKIP
%-----
%%from mac-des.m
%% variable(x){-1} (-1 )
%% variable(x2){x,advance(2)} ( 1 )
%% point(h){x2,2.475} ( 1 , 2.475 )
%% text(MAC){h}
\put {MAC} at 1 2.475
%% vertical diff = 0.29 units %% 0.28
%% variable(d){0.29} ( .29 )
%% variable(h6){0.88} ( .88 ) %0.9
%% text(\fbox{$0{\cdot}6$}){x,h6}
\put {\fbox{$0{\cdot}6$}} at -1 .88
%% variable(h8){h6,advance(d)} ( 1.17 )
%% text(\fbox{$0{\cdot}8$}){x,h8}
\put {\fbox{$0{\cdot}8$}} at -1 1.17
%% variable(h10){h8,advance(d)} ( 1.46 )
%% text(\fbox{$1{\cdot}0$}){x,h10}
\put {\fbox{$1{\cdot}0$}} at -1 1.46
%% variable(h12){h10,advance(d)} ( 1.75 )
%% text(\fbox{$1{\cdot}2$}){x,h12}
\put {\fbox{$1{\cdot}2$}} at -1 1.75
%% variable(h14){h12,advance(d)} ( 2.04 )
%% text(\fbox{$1{\cdot}4$}){x,h14}

```

```

\put {\fbox{$1{\cdot}4$}} at -1 2.04
%% variable(h16){h14,advance(d)} ( 2.33 )
%% text(\fbox{$1{\cdot}6$}){x,h16}
\put {\fbox{$1{\cdot}6$}} at -1 2.33
%-----
\newcommand{\myleft}{%
%\framebox{
\begin{minipage}{29mm}\centering%
  End-expired (\%)\%
  in 100\% \\\%
  oxygen \\\%
\end{minipage}%
%\ }%
}%
%% text(\myleft){-45, 2.0}
\put {\myleft} at -45 2
%-----
\newcommand{\myrightb}{%
%\fbox{%
\begin{minipage}{4cm}%
  End-expired (\%) in \\\%
  67\% \hspace{8mm}50\% \\\%
  N$_2$O \hspace{7.5mm}N$_2$O
\end{minipage}
% }%
}% end of newcommand
%% text(\myrightb){102, 2.657}[1] %% was 2.6
\put {\myrightb} [1] at 102 2.657
%-----
\newcommand{\mybottom}{Age (years)}%
%% text(\mybottom){46, 0.15}
\put {\mybottom} at 46 .15
%%text(\copyright\RWD Nickalls\ 2001){22,0.5}
%% text(\large ISOFLURANE){46, 2.7} %% 80
\put {\large ISOFLURANE} at 46 2.7
%-----
% draw horizontal dashed lines
%%\linethickness=0.4pt %% equivalent to {\tiny .}
\linethickness=0.6pt %% half way between tiny and
normalsize
\setdashes
%% variable(x5){5} ( 5 ) %% Left X value
%% variable(x6){100} ( 100 ) %% Right X value
%% variable(y16){2.3523} ( 2.3523 )
%% variable(y14){2.1523} ( 2.1523 )
%% variable(y12){1.9523} ( 1.9523 )
%% variable(y10){1.7523} ( 1.7523 )
%% variable(y08){1.5523} ( 1.5523 )
%% variable(y06){1.3523} ( 1.3523 )
%% variable(y04){1.1523} ( 1.1523 )
%% variable(y02){0.9523} ( .9523 ) %% = 0.7523 + 0.2
%% variable(y00){0.7523} ( .7523 ) %% = 0.7523
%% point(L16){x5,y16} ( 5 , 2.3523 )
%% point(R16){x6,y16} ( 100 , 2.3523 )

```

```

%% point(L14){x5,y14} ( 5 , 2.1523 )
%% point(R14){x6,y14} ( 100 , 2.1523 )
%% point(L12){x5,y12} ( 5 , 1.9523 )
%% point(R12){x6,y12} ( 100 , 1.9523 )
%% point(L10){x5,y10} ( 5 , 1.7523 )
%% point(R10){x6,y10} ( 100 , 1.7523 )
%% point(L08){x5,y08} ( 5 , 1.5523 )
%% point(R08){x6,y08} ( 100 , 1.5523 )
%% point(L06){x5,y06} ( 5 , 1.3523 )
%% point(R06){x6,y06} ( 100 , 1.3523 )
%% point(L04){x5,y04} ( 5 , 1.1523 )
%% point(R04){x6,y04} ( 100 , 1.1523 )
%% point(L02){x5,y02} ( 5 , .9523 )
%% point(R02){x6,y02} ( 100 , .9523 )
%% point(L00){x5,y00} ( 5 , .7523 )
%% point(R00){x6,y00} ( 100 , .7523 )
%% draw the dashes from Left to Right
%% (so have small gap at right axis)
%%
%% drawline(L16R16,L14R14,L12R12,L10R10,L08R08,L06R06,L04R04,L02R02,L00R00)
\putrule from 5 2.3523 to 100 2.3523 %% L16R16
\putrule from 5 2.1523 to 100 2.1523 %% L14R14
\putrule from 5 1.9523 to 100 1.9523 %% L12R12
\putrule from 5 1.7523 to 100 1.7523 %% L10R10
\putrule from 5 1.5523 to 100 1.5523 %% L08R08
\putrule from 5 1.3523 to 100 1.3523 %% L06R06
\putrule from 5 1.1523 to 100 1.1523 %% L04R04
\putrule from 5 .9523 to 100 .9523 %% L02R02
\putrule from 5 .7523 to 100 .7523 %% L00R00
\endpicture
\ } %framebox
\end{document}
%*
%* _____
%* PointNumber = 200
%* Number of points/variables used = 153
%* _____

```

6.3.3 Final mathsPIC program for making the charts

This version of the mathsPIC program (`mac-iso8t.m`) incorporated axis legend rotation (using \LaTeX and PostScript), and generated the version used by the *Oxford handbook of anaesthesia*.

```

%% mac-iso8T.m (TEST version modified from mac-iso8.m)
%% Jan 10, 2006
%% mathsPICperl version
%% final graph/chart for the bja
%% wih decimals ( $\cdot$ ) and \fbox{}
%% new curves for anaesthesia
% mathsPIC

%% to test rotation legend on axes
%% _____

```

```

%% \\$--> $
%% \\% --\% for percent
%% enter the Y2 Y1 values in ET units
%% adjust \oddsidemargin
%% ? adjust linethickness
%% adjust minipage-->3.6cm
%% adjust possn of MAC
%% remove isoflurane word from ylegend
%% push Isoflutane title up
%% push age down

%%-----
\documentclass[a4paper,12pt]{article}
\usepackage{mathspic}
\usepackage{decimal,rotating}

\begin{document}
% \oddsidemargin=-17mm
%%\framebox{%
\beginpicture
%-----

%% use sf font for figures for BJA
\fontfamily{cmss}\selectfont\normalsize
\linethickness=1.1pt %% = normalsize (was 0.9 for
    BJA) (my manual p 23)

    %% structure copied from mac-des.m
%%-----
%% ISOflurane Delta for N2O = 0.75 = (66.6666/104)*1.17
%% y units = 12cm/2.2 = 5.454545
%paper{units(mm,5.454545cm) xrange(-5,100)
    yrange(0.4,2.6) axes(L) ticks(10,0.2)}
paper{units(0.7mm,3.818181cm) xrange(-8,100)
    yrange(0.4,2.6)}

%-----
%% want to print only some of the L axis scale
    (0.6-2.4), so do it manually
\axis left
\    ticks withvalues    0{\cdot$}6    0{\cdot$}8
    1{\cdot$}0    1{\cdot$}2    1{\cdot$}4
    1{\cdot$}6
\    1{\cdot$}8    2{\cdot$}0    2{\cdot$}2
    2{\cdot$}4 /
\    at    0.60    0.80    1.00    1.20    1.40
\    1.60    1.80    2.00    2.20    2.40    / /
%-----
\axis bottom
\    ticks withvalues    0    10    20    30    40    50    60    70    80
    90    100 /
\    at    0    10    20    30    40    50    60    70    80
    90    100 / /
%-----

```

```

\axis right
%%% {using N2O 67%}} shift = 0.7523
\  ticks withvalues 0 0{\cdot}2 0{\cdot}4
  0{\cdot}6
\
  0{\cdot}8 1{\cdot}0
1{\cdot}2 1{\cdot}4
\
  1{\cdot}6 /
\
  at 0.7523 0.9523 1.1523 1.3523 1.5523
  1.7523 1.9523 2.1523
\
  2.3523 / /

%-----
%% extra 50% right axis shift = 0.5614
%% since this axis is off the graph then need new paper
  command
%% but do not use axis() option
paper{units(0.7mm,3.818181cm) xrange(-8,121)
  yrange(0.5614,2.3614) }
\axis right %% seconds right axis for 50% oxygen
  shift = 0.5614
\  ticks withvalues 0 0{\cdot}2
  0{\cdot}4 0{\cdot}6 0{\cdot}8
\
  1{\cdot}0 1{\cdot}2 1{\cdot}4
  1{\cdot}6 1{\cdot}8 /
\
  at 0.5614 0.7614 0.9614 1.1614
  1.3614
\
  1.5614 1.7614 1.9614 2.1614 2.3614 / /

%-----

%%beginSKIP
\newcommand{\thickline}{\setplotsymbol({\Large .})}%
%\newcommand{\thinline}{\setplotsymbol({\tiny .})}% =
  BJA graphs
%% make thin line a bit thicker for the OUP graphs
\newcommand{\thinline}{\setplotsymbol({\large .})}%

\thickline%
inputfile(isoqdata8.dat) %1.6
\thinline%
inputfile(isopdata8.dat) %1.4
\thickline%
inputfile(isondata8.dat) % 1.2
\thinline%
inputfile(isomdata8.dat) % 1
\thickline%
inputfile(isokdata8.dat) % 0.8
\thinline%
inputfile(isojdata8.dat) %0.6
%%endSKIP

%-----
%%from mac-des.m
var x=-1
var x2=x + 2
point(h){x2,2.55}% 2.475

```

```

text(MAC){h}
%% vertical diff = 0.29 units %% 0.28
var d=0.29

var h6=0.88
text(\fbox{$0{\cdot}6$}){x,h6}

var h8=h6+d
text(\fbox{$0{\cdot}8$}){x,h8}

var h10=h8 + d
text(\fbox{$1{\cdot}0$}){x,h10}

var h12=h10 + d
text(\fbox{$1{\cdot}2$}){x,h12}

var h14 = h12+d
text(\fbox{$1{\cdot}4$}){x,h14}

var h16=h14 + d
text(\fbox{$1{\cdot}6$}){x,h16}

%%=====new rotated legends from
      macATdes2.pl=====
var y2=2.6
var y1=0.4

%-----
\newcommand{\ylegend}{\sf End-tidal (\%) in 100\,\%
  oxygen/air}%
%-----determine string length --> Yunits etc-----
\newlength{\ylength}%
\settowidth{\ylength}{\ylegend}%
%%%%text(answer ylength = \number\ylength){37,-0.4}
%% halflength/3.818=0.777 y units %%
text(\turnbox{90}{\ylegend}){-25, y1+((y2-y1)/2) -
  0.777}
%-----

beginSKIP
%-----
\newcommand{\rightylegend}{\sf End-tidal (\%) in
  N$.2$O}\%
\newlength{\rylength}%
\settowidth{\rylength}{\rightylegend}%
text(answer rylength = \number\rylength){37,-1.0}
%% halflength/3.818=0.7188 y units %%
text(\turnbox{270}{\rightylegend}){140, y1+((y2-y1)/2)
  + 0.7188}
%
endSKIP
%%=====
beginSKIP
%-----

```

```

\newcommand{\myleft}{%
%\framebox{
\begin{minipage}{29mm}\centering%
\End-expired (\%)\%
\ in 100\% \\\%
\ oxygen\\
\end{minipage}%
%\ }%
\ }%

text(\myleft){-45, 2.0}
endSKIP
%-----
\newcommand{\myrightb}{%
%\fbox{%
\ \begin{minipage}{3.5cm}% 3.8cm
\ \End-expired (\%) in\\
\ \hspace*{9mm}67\%\hspace{8mm}50\%\%
\ \hspace*{9mm}N$.2$O\hspace{7.5mm}N$.2$O
\ \end{minipage}
%\ }%
\ }% end of newcommand
text(\myrightb){89.143, 2.657}[1]
%-----

%%%\ End-expired (\%) in\\
%%%\ 67\%\hspace{8mm}50\%\%
%%%\ N$.2$O\hspace{7.5mm}N$.2$O

%%=====

\newcommand{\mybottom}{Age (years)}%
text(\mybottom){46, 0.12} % 0.15

text({\footnotesize\copyright\ RWD Nickalls\
2003}){19,0.5}

text(\large ISOFLURANE){46, 2.8} %% 80

%-----
% draw horizontal dashed lines
%%%\linethickness=0.4pt %% equivalent to {\tiny .}
%\linethickness=0.6pt %% half way between tiny and
normalsize
\setdashes
var x5=5 %% Left X value
var x6=100 %% Right X value
var y16=2.3523
var y14=2.1523
var y12=1.9523
var y10=1.7523
var y08=1.5523

```

```

var y06=1.3523
var y04=1.1523
var y02=0.9523 %% = 0.7523 + 0.2
var y00=0.7523 %% = 0.7523

point(L16){x5, y16}
point(R16){x6, y16}

point(L14){x5, y14}
point(R14){x6, y14}

point(L12){x5, y12}
point(R12){x6, y12}

point(L10){x5, y10}
point(R10){x6, y10}

point(L08){x5, y08}
point(R08){x6, y08}

point(L06){x5, y06}
point(R06){x6, y06}

point(L04){x5, y04}
point(R04){x6, y04}

point(L02){x5, y02}
point(R02){x6, y02}

point(L00){x5, y00}
point(R00){x6, y00}

%% draw the dashes from Left to Right
%% (so have small gap at right axis)
drawline(L16R16, L14R14, L12R12, L10R10, L08R08, L06R06,
         L04R04, L02R02, L00R00)

\endpicture
%%\ } %framebox
\end{document}

```

6.3.4 Output `mac-iso8t.mt` code from the previous `mathsPIC` program

```

%* -----
%* mathspic (Perl version 1.00 Feb 14, 2005)
%* A filter program for use with PiCTeX
%* Copyright (c) 2005 A Syropoulos & RWD Nickalls
%* Command line: /usr/local/bin/mpic100.pl mac-iso8t.m
%* Input filename : mac-iso8t.m
%* Output filename: mac-iso8t.mt

```

```

%* Date & time: 2006/01/13    09:19:33
%* -----
%% mac-iso8T.m (TEST version modified from mac-iso8.m)
%% Jan 10, 2006
%% mathsPICperl version
%% final graph/chart for the bja
%% wih decimals ( $\cdot$ ) and  $\fbox{\}$ 
%% new curves for anaesthesia
% mathsPIC
%% to test rotation legend on axes
%% -----
%%  $\rightarrow$  $
%%  $\%$   $\rightarrow$   $\%$  for percent
%% enter the Y2 Y1 values in ET units
%% adjust  $\oddsidemargin$ 
%% ? adjust linethickness
%% adjust minipage  $\rightarrow$  3.6cm
%% adjust possn of MAC
%% remove isoflurane word from ylegend
%% push Isoflutane title up
%% push age down
%% -----
\documentclass[a4paper,12pt]{article}
\usepackage{mathspic}
\usepackage{decimal,rotating}
\begin{document}
% \oddsidemargin=-17mm
%%\framebox{%
\beginpicture
% -----
%% use sf font for figures for BJA
\fontfamily{cmss}\selectfont\normalsize
\linethickness=1.1pt %% = normalsize (was 0.9 for
  BJA) (my manual p 23)
  %% structure copied from mac-des.m
%% -----
%% ISOflurane Delta for N2O = 0.75 = (66.6666/104)*1.17
%% y units = 12cm/2.2 = 5.454545
%paper{units(mm,5.454545cm) xrange(-5,100)
  yrange(0.4,2.6) axes(L) ticks(10,0.2)}
%% paper{units(0.7mm,3.818181cm) xrange(-8,100)
  yrange(0.4,2.6)}
\setcoordinatesystem units <0.7mm,3.818181cm>
\setplotarea x from -8.00000 to 100.00000, y from
  0.40000 to 2.60000
% -----
%% want to print only some of the L axis scale
  (0.6-2.4), so do it manually
\axis left
  ticks withvalues 0 $\cdot$ 6 0 $\cdot$ 8
    1 $\cdot$ 0 1 $\cdot$ 2 1 $\cdot$ 4
    1 $\cdot$ 6
      1 $\cdot$ 8 2 $\cdot$ 0 2 $\cdot$ 2
        2 $\cdot$ 4 /

```

```

          at 0.60 0.80 1.00 1.20 1.40
          1.60 1.80 2.00 2.20 2.40 / /
%-----
\axis bottom
  ticks withvalues 0 10 20 30 40 50 60 70 80
    90 100 /
  at
    90 100 / /
%-----
\axis right
%%% {using N2O 67%}} shift = 0.7523
  ticks withvalues 0 0{\cdot$}2 0{\cdot$}4
    0{\cdot$}6
                0{\cdot$}8 1{\cdot$}0
                  1{\cdot$}2 1{\cdot$}4
                    1{\cdot$}6 /
  at 0.7523 0.9523 1.1523 1.3523 1.5523
    1.7523 1.9523 2.1523
    2.3523 / /
%-----
%%% extra 50% right axis shift = 0.5614
%%% since this axis is off the graph then need new paper
%%% command
%%% but do not use axis() option
%%% paper{units(0.7mm,3.818181cm) xrange(-8,121)
%%%   yrange(0.5614,2.3614) }
\setcoordinatesystem units <0.7mm,3.818181cm>
\setplotarea x from -8.00000 to 121.00000, y from
  0.56140 to 2.36140
\axis right %%% seconds right axis for 50% oxygen
  shift = 0.5614
  ticks withvalues 0 0{\cdot$}2
    0{\cdot$}4 0{\cdot$}6 0{\cdot$}8
  1{\cdot$}0 1{\cdot$}2 1{\cdot$}4
    1{\cdot$}6 1{\cdot$}8 /
  at 0.5614 0.7614 0.9614 1.1614
    1.3614
    1.5614 1.7614 1.9614 2.1614 2.3614 / /
%-----
%%%beginSKIP
\newcommand{\thickline}{\setplotsymbol({\Large .})}%
\newcommand{\thinline}{\setplotsymbol({\tiny .})}% =
  BJA graphs
%%% make thin line a bit thicker for the OUP graphs
\newcommand{\thinline}{\setplotsymbol({\large .})}%
\thickline%
%%% inputfile(isoqdata8.dat) %1.6
%%% ... start of file <isoqdata8.dat> loop [1]
%%%% Iteration number: 1
%%% q= mac40(iso) * 1.6
%%% point(q5){5,2.325176} %%% manual q5 = (5.00000,
  2.32518)
%%% point(q10){10,2.25427} q10 = (10.00000,
  2.25427)

```

```

%% point(q15){15,2.185525} q15 = (15.00000,
2.18553)
%% point(q20){20,2.118877} q20 = (20.00000,
2.11888)
%% point(q25){25,2.054262} q25 = (25.00000,
2.05426)
%% point(q30){30,1.991617} q30 = (30.00000,
1.99162)
%% point(q35){35,1.930882} q35 = (35.00000,
1.93088)
%% point(q40){40,1.872} q40 = (40.00000,
1.87200)
%% point(q45){45,1.814913} q45 = (45.00000,
1.81491)
%% point(q50){50,1.759567} q50 = (50.00000,
1.75957)
%% point(q55){55,1.705909} q55 = (55.00000,
1.70591)
%% point(q60){60,1.653887} q60 = (60.00000,
1.65389)
%% point(q65){65,1.603451} q65 = (65.00000,
1.60345)
%% point(q70){70,1.554554} q70 = (70.00000,
1.55455)
%% point(q75){75,1.507148} q75 = (75.00000,
1.50715)
%% point(q80){80,1.461187} q80 = (80.00000,
1.46119)
%% point(q85){85,1.416628} q85 = (85.00000,
1.41663)
%% point(q90){90,1.373428} q90 = (90.00000,
1.37343)
%% point(q95){95,1.331545} q95 = (95.00000,
1.33154)
%% drawline(q5 q10 q15 q20 q25 q30 q35 q40 q45 q50 q55
q60 q65 q70 q75 q80 q85 q90 q95)
\plot 5.00000 2.32518 10.00000 2.25427 / %% q5q10
\plot 10.00000 2.25427 15.00000 2.18553 / %% q10q15
\plot 15.00000 2.18553 20.00000 2.11888 / %% q15q20
\plot 20.00000 2.11888 25.00000 2.05426 / %% q20q25
\plot 25.00000 2.05426 30.00000 1.99162 / %% q25q30
\plot 30.00000 1.99162 35.00000 1.93088 / %% q30q35
\plot 35.00000 1.93088 40.00000 1.87200 / %% q35q40
\plot 40.00000 1.87200 45.00000 1.81491 / %% q40q45
\plot 45.00000 1.81491 50.00000 1.75957 / %% q45q50
\plot 50.00000 1.75957 55.00000 1.70591 / %% q50q55
\plot 55.00000 1.70591 60.00000 1.65389 / %% q55q60
\plot 60.00000 1.65389 65.00000 1.60345 / %% q60q65
\plot 65.00000 1.60345 70.00000 1.55455 / %% q65q70
\plot 70.00000 1.55455 75.00000 1.50715 / %% q70q75
\plot 75.00000 1.50715 80.00000 1.46119 / %% q75q80
\plot 80.00000 1.46119 85.00000 1.41663 / %% q80q85
\plot 85.00000 1.41663 90.00000 1.37343 / %% q85q90
\plot 90.00000 1.37343 95.00000 1.33154 / %% q90q95

```

```

%% drawpoint(q10 q20 q30 q40 q50 q60 q70 q80
q90)
\put {$\bullet$} at 10.00000 2.25427 %% q10
\put {$\bullet$} at 20.00000 2.11888 %% q20
\put {$\bullet$} at 30.00000 1.99162 %% q30
\put {$\bullet$} at 40.00000 1.87200 %% q40
\put {$\bullet$} at 50.00000 1.75957 %% q50
\put {$\bullet$} at 60.00000 1.65389 %% q60
\put {$\bullet$} at 70.00000 1.55455 %% q70
\put {$\bullet$} at 80.00000 1.46119 %% q80
\put {$\bullet$} at 90.00000 1.37343 %% q90
%% ... end of file <isoqdata8.dat> loop [1]
\thinline%
%% inputfile(isopdata8.dat) %1.4
%% ... start of file <isopdata8.dat> loop [1]
%% Iteration number: 1
%% p= mac40(iso) * 1.4
%% point(p5){5,2.034529} %% manual p5 = (5.00000,
2.03453)
%% point(p10){10,1.972486} p10 = (10.00000,
1.97249)
%% point(p15){15,1.912335} p15 = (15.00000,
1.91233)
%% point(p20){20,1.854018} p20 = (20.00000,
1.85402)
%% point(p25){25,1.797479} p25 = (25.00000,
1.79748)
%% point(p30){30,1.742665} p30 = (30.00000,
1.74266)
%% point(p35){35,1.689522} p35 = (35.00000,
1.68952)
%% point(p40){40,1.638} p40 = (40.00000,
1.63800)
%% point(p45){45,1.588049} p45 = (45.00000,
1.58805)
%% point(p50){50,1.539621} p50 = (50.00000,
1.53962)
%% point(p55){55,1.49267} p55 = (55.00000,
1.49267)
%% point(p60){60,1.447151} p60 = (60.00000,
1.44715)
%% point(p65){65,1.40302} p65 = (65.00000,
1.40302)
%% point(p70){70,1.360235} p70 = (70.00000,
1.36024)
%% point(p75){75,1.318754} p75 = (75.00000,
1.31875)
%% point(p80){80,1.278539} p80 = (80.00000,
1.27854)
%% point(p85){85,1.23955} p85 = (85.00000,
1.23955)
%% point(p90){90,1.201749} p90 = (90.00000,
1.20175)

```

```

%% point(p95){95,1.165102}      p95 = (95.00000,
    1.16510)
%% drawline(p5 p10 p15 p20 p25 p30 p35 p40 p45 p50 p55
    p60 p65 p70 p75 p80 p85 p90 p95)
\plot 5.00000 2.03453 10.00000 1.97249 / %% p5p10
\plot 10.00000 1.97249 15.00000 1.91233 / %% p10p15
\plot 15.00000 1.91233 20.00000 1.85402 / %% p15p20
\plot 20.00000 1.85402 25.00000 1.79748 / %% p20p25
\plot 25.00000 1.79748 30.00000 1.74266 / %% p25p30
\plot 30.00000 1.74266 35.00000 1.68952 / %% p30p35
\plot 35.00000 1.68952 40.00000 1.63800 / %% p35p40
\plot 40.00000 1.63800 45.00000 1.58805 / %% p40p45
\plot 45.00000 1.58805 50.00000 1.53962 / %% p45p50
\plot 50.00000 1.53962 55.00000 1.49267 / %% p50p55
\plot 55.00000 1.49267 60.00000 1.44715 / %% p55p60
\plot 60.00000 1.44715 65.00000 1.40302 / %% p60p65
\plot 65.00000 1.40302 70.00000 1.36024 / %% p65p70
\plot 70.00000 1.36024 75.00000 1.31875 / %% p70p75
\plot 75.00000 1.31875 80.00000 1.27854 / %% p75p80
\plot 80.00000 1.27854 85.00000 1.23955 / %% p80p85
\plot 85.00000 1.23955 90.00000 1.20175 / %% p85p90
\plot 90.00000 1.20175 95.00000 1.16510 / %% p90p95
%% ... end of file <isopdata8.dat> loop [1]
\thickline%
%% inputfile(isopdata8.dat) % 1.2
%% ... start of file <isopdata8.dat> loop [1]
%% Iteration number: 1
%% n= mac40(iso) * 1.2
%% point(n5){5,1.743882} %% manual      n5 = (5.00000,
    1.74388)
%% point(n10){10,1.690702}      n10 = (10.00000,
    1.69070)
%% point(n15){15,1.639144}      n15 = (15.00000,
    1.63914)
%% point(n20){20,1.589158}      n20 = (20.00000,
    1.58916)
%% point(n25){25,1.540697}      n25 = (25.00000,
    1.54070)
%% point(n30){30,1.493713}      n30 = (30.00000,
    1.49371)
%% point(n35){35,1.448162}      n35 = (35.00000,
    1.44816)
%% point(n40){40,1.404}         n40 = (40.00000,
    1.40400)
%% point(n45){45,1.361185}      n45 = (45.00000,
    1.36119)
%% point(n50){50,1.319675}      n50 = (50.00000,
    1.31967)
%% point(n55){55,1.279432}      n55 = (55.00000,
    1.27943)
%% point(n60){60,1.240415}      n60 = (60.00000,
    1.24042)
%% point(n65){65,1.202589}      n65 = (65.00000,
    1.20259)

```

```

%% point(n70){70,1.165916}      n70 = (70.00000,
    1.16592)
%% point(n75){75,1.130361}      n75 = (75.00000,
    1.13036)
%% point(n80){80,1.09589}       n80 = (80.00000,
    1.09589)
%% point(n85){85,1.062471}      n85 = (85.00000,
    1.06247)
%% point(n90){90,1.030071}      n90 = (90.00000,
    1.03007)
%% point(n95){95,0.9986587}     n95 = (95.00000,
    0.99866)
%% drawline(n5 n10 n15 n20 n25 n30 n35 n40 n45 n50 n55
    n60 n65 n70 n75 n80 n85 n90 n95)
\plot 5.00000 1.74388 10.00000 1.69070 / %% n5n10
\plot 10.00000 1.69070 15.00000 1.63914 / %% n10n15
\plot 15.00000 1.63914 20.00000 1.58916 / %% n15n20
\plot 20.00000 1.58916 25.00000 1.54070 / %% n20n25
\plot 25.00000 1.54070 30.00000 1.49371 / %% n25n30
\plot 30.00000 1.49371 35.00000 1.44816 / %% n30n35
\plot 35.00000 1.44816 40.00000 1.40400 / %% n35n40
\plot 40.00000 1.40400 45.00000 1.36119 / %% n40n45
\plot 45.00000 1.36119 50.00000 1.31967 / %% n45n50
\plot 50.00000 1.31967 55.00000 1.27943 / %% n50n55
\plot 55.00000 1.27943 60.00000 1.24042 / %% n55n60
\plot 60.00000 1.24042 65.00000 1.20259 / %% n60n65
\plot 65.00000 1.20259 70.00000 1.16592 / %% n65n70
\plot 70.00000 1.16592 75.00000 1.13036 / %% n70n75
\plot 75.00000 1.13036 80.00000 1.09589 / %% n75n80
\plot 80.00000 1.09589 85.00000 1.06247 / %% n80n85
\plot 85.00000 1.06247 90.00000 1.03007 / %% n85n90
\plot 90.00000 1.03007 95.00000 0.99866 / %% n90n95
%% drawpoint(n10 n20 n30 n40 n50 n60 n70 n80 n90)
\put {$\bullet$} at 10.00000 1.69070 %% n10
\put {$\bullet$} at 20.00000 1.58916 %% n20
\put {$\bullet$} at 30.00000 1.49371 %% n30
\put {$\bullet$} at 40.00000 1.40400 %% n40
\put {$\bullet$} at 50.00000 1.31967 %% n50
\put {$\bullet$} at 60.00000 1.24042 %% n60
\put {$\bullet$} at 70.00000 1.16592 %% n70
\put {$\bullet$} at 80.00000 1.09589 %% n80
\put {$\bullet$} at 90.00000 1.03007 %% n90
%% ... end of file <isomdata8.dat> loop [1]
\thinline%
%% inputfile(isomdata8.dat) % 1
%% ... start of file <isomdata8.dat> loop [1]
%% Iteration number: 1
%% m= mac40(iso) * 1
%% point(m5){5, 1.453235}      m5 = (5.00000, 1.45324)
%% point(m10){10,1.408918}     m10 = (10.00000,
    1.40892)
%% point(m15){15,1.365953}     m15 = (15.00000,
    1.36595)

```

```

%% point(m20){20,1.324298}      m20 = (20.00000,
    1.32430)
%% point(m25){25,1.283914}      m25 = (25.00000,
    1.28391)
%% point(m30){30,1.244761}      m30 = (30.00000,
    1.24476)
%% point(m35){35,1.206802}      m35 = (35.00000,
    1.20680)
%% point(m40){40,1.17}          m40 = (40.00000, 1.17000)
%% point(m45){45,1.134321}      m45 = (45.00000,
    1.13432)
%% point(m50){50,1.099729}      m50 = (50.00000,
    1.09973)
%% point(m55){55,1.066193}      m55 = (55.00000,
    1.06619)
%% point(m60){60,1.033679}      m60 = (60.00000,
    1.03368)
%% point(m65){65,1.002157}      m65 = (65.00000,
    1.00216)
%% point(m70){70,0.9715963}     m70 = (70.00000,
    0.97160)
%% point(m75){75,0.9419674}     m75 = (75.00000,
    0.94197)
%% point(m80){80,0.9132419}     m80 = (80.00000,
    0.91324)
%% point(m85){85,0.8853925}     m85 = (85.00000,
    0.88539)
%% point(m90){90,0.8583924}     m90 = (90.00000,
    0.85839)
%% point(m95){95,0.8322156}     m95 = (95.00000,
    0.83222)
%% drawline(m5 m10 m15 m20 m25 m30 m35 m40 m45 m50 m55
    m60 m65 m70 m75 m80 m85 m90 m95)
\plot 5.00000 1.45324 10.00000 1.40892 / %% m5m10
\plot 10.00000 1.40892 15.00000 1.36595 / %% m10m15
\plot 15.00000 1.36595 20.00000 1.32430 / %% m15m20
\plot 20.00000 1.32430 25.00000 1.28391 / %% m20m25
\plot 25.00000 1.28391 30.00000 1.24476 / %% m25m30
\plot 30.00000 1.24476 35.00000 1.20680 / %% m30m35
\plot 35.00000 1.20680 40.00000 1.17000 / %% m35m40
\plot 40.00000 1.17000 45.00000 1.13432 / %% m40m45
\plot 45.00000 1.13432 50.00000 1.09973 / %% m45m50
\plot 50.00000 1.09973 55.00000 1.06619 / %% m50m55
\plot 55.00000 1.06619 60.00000 1.03368 / %% m55m60
\plot 60.00000 1.03368 65.00000 1.00216 / %% m60m65
\plot 65.00000 1.00216 70.00000 0.97160 / %% m65m70
\plot 70.00000 0.97160 75.00000 0.94197 / %% m70m75
\plot 75.00000 0.94197 80.00000 0.91324 / %% m75m80
\plot 80.00000 0.91324 85.00000 0.88539 / %% m80m85
\plot 85.00000 0.88539 90.00000 0.85839 / %% m85m90
\plot 90.00000 0.85839 95.00000 0.83222 / %% m90m95
%% ... end of file <isomdata8.dat> loop [1]
\thickline%
%% inputfile(isokdata8.dat) % 0.8

```

```

%% ... start of file <isokdata8.dat> loop [1]
%% Iteration number: 1
%% k= mac40(iso) * .8
%% point(k5){5,1.162588} %% manual      k5 = (5.00000,
    1.16259)
%% point(k10){10,1.127135}      k10 = (10.00000,
    1.12713)
%% point(k15){15,1.092763}      k15 = (15.00000,
    1.09276)
%% point(k20){20,1.059439}      k20 = (20.00000,
    1.05944)
%% point(k25){25,1.027131}      k25 = (25.00000,
    1.02713)
%% point(k30){30,0.9958085}     k30 = (30.00000,
    0.99581)
%% point(k35){35,0.9654412}     k35 = (35.00000,
    0.96544)
%% point(k40){40,0.936}         k40 = (40.00000,
    0.93600)
%% point(k45){45,0.9074566}     k45 = (45.00000,
    0.90746)
%% point(k50){50,0.8797836}     k50 = (50.00000,
    0.87978)
%% point(k55){55,0.8529544}     k55 = (55.00000,
    0.85295)
%% point(k60){60,0.8269435}     k60 = (60.00000,
    0.82694)
%% point(k65){65,0.8017257}     k65 = (65.00000,
    0.80173)
%% point(k70){70,0.7772771}     k70 = (70.00000,
    0.77728)
%% point(k75){75,0.7535739}     k75 = (75.00000,
    0.75357)
%% point(k80){80,0.7305936}     k80 = (80.00000,
    0.73059)
%% point(k85){85,0.708314}      k85 = (85.00000,
    0.70831)
%% point(k90){90,0.6867139}     k90 = (90.00000,
    0.68671)
%% point(k95){95,0.6657725}     k95 = (95.00000,
    0.66577)
%% drawline(k5 k10 k15 k20 k25 k30 k35 k40 k45 k50 k55
    k60 k65 k70 k75 k80 k85 k90 k95)
\plot 5.00000 1.16259 10.00000 1.12713 / %% k5k10
\plot 10.00000 1.12713 15.00000 1.09276 / %% k10k15
\plot 15.00000 1.09276 20.00000 1.05944 / %% k15k20
\plot 20.00000 1.05944 25.00000 1.02713 / %% k20k25
\plot 25.00000 1.02713 30.00000 0.99581 / %% k25k30
\plot 30.00000 0.99581 35.00000 0.96544 / %% k30k35
\plot 35.00000 0.96544 40.00000 0.93600 / %% k35k40
\plot 40.00000 0.93600 45.00000 0.90746 / %% k40k45
\plot 45.00000 0.90746 50.00000 0.87978 / %% k45k50
\plot 50.00000 0.87978 55.00000 0.85295 / %% k50k55
\plot 55.00000 0.85295 60.00000 0.82694 / %% k55k60

```

```

\plot 60.00000 0.82694 65.00000 0.80173 / %% k60k65
\plot 65.00000 0.80173 70.00000 0.77728 / %% k65k70
\plot 70.00000 0.77728 75.00000 0.75357 / %% k70k75
\plot 75.00000 0.75357 80.00000 0.73059 / %% k75k80
\plot 80.00000 0.73059 85.00000 0.70831 / %% k80k85
\plot 85.00000 0.70831 90.00000 0.68671 / %% k85k90
\plot 90.00000 0.68671 95.00000 0.66577 / %% k90k95
%% drawpoint(k10 k20 k30 k40 k50 k60 k70 k80 k90)
\put {$\bullet$} at 10.00000 1.12713 %% k10
\put {$\bullet$} at 20.00000 1.05944 %% k20
\put {$\bullet$} at 30.00000 0.99581 %% k30
\put {$\bullet$} at 40.00000 0.93600 %% k40
\put {$\bullet$} at 50.00000 0.87978 %% k50
\put {$\bullet$} at 60.00000 0.82694 %% k60
\put {$\bullet$} at 70.00000 0.77728 %% k70
\put {$\bullet$} at 80.00000 0.73059 %% k80
\put {$\bullet$} at 90.00000 0.68671 %% k90
%% ... end of file <isokdata8.dat> loop [1]
\thinline%
%% inputfile(isojdata8.dat) %0.6
%% ... start of file <isojdata8.dat> loop [1]
%% Iteration number: 1
%% j= mac40(iso) * .6
%% point(j5){5,0.871941} %% manual j5 = (5.00000,
0.87194)
%% point(j10){10,0.8453511} j10 = (10.00000,
0.84535)
%% point(j15){15,0.819572} j15 = (15.00000,
0.81957)
%% point(j20){20,0.794579} j20 = (20.00000,
0.79458)
%% point(j25){25,0.7703483} j25 = (25.00000,
0.77035)
%% point(j30){30,0.7468564} j30 = (30.00000,
0.74686)
%% point(j35){35,0.7240809} j35 = (35.00000,
0.72408)
%% point(j40){40,0.702} j40 = (40.00000,
0.70200)
%% point(j45){45,0.6805924} j45 = (45.00000,
0.68059)
%% point(j50){50,0.6598377} j50 = (50.00000,
0.65984)
%% point(j55){55,0.6397159} j55 = (55.00000,
0.63972)
%% point(j60){60,0.6202077} j60 = (60.00000,
0.62021)
%% point(j65){65,0.6012943} j65 = (65.00000,
0.60129)
%% point(j70){70,0.5829578} j70 = (70.00000,
0.58296)
%% point(j75){75,0.5651804} j75 = (75.00000,
0.56518)

```

```

%% point(j80){80,0.5479452}      j80 = (80.00000,
    0.54795)
%% point(j85){85,0.5312355}      j85 = (85.00000,
    0.53124)
%% point(j90){90,0.5150355}      j90 = (90.00000,
    0.51504)
%% point(j95){95,0.4993294}      j95 = (95.00000,
    0.49933)
%% drawline(j5 j10 j15 j20 j25 j30 j35 j40 j45 j50 j55
    j60 j65 j70 j75 j80 j85 j90 j95)
\plot 5.00000 0.87194 10.00000 0.84535 / %% j5j10
\plot 10.00000 0.84535 15.00000 0.81957 / %% j10j15
\plot 15.00000 0.81957 20.00000 0.79458 / %% j15j20
\plot 20.00000 0.79458 25.00000 0.77035 / %% j20j25
\plot 25.00000 0.77035 30.00000 0.74686 / %% j25j30
\plot 30.00000 0.74686 35.00000 0.72408 / %% j30j35
\plot 35.00000 0.72408 40.00000 0.70200 / %% j35j40
\plot 40.00000 0.70200 45.00000 0.68059 / %% j40j45
\plot 45.00000 0.68059 50.00000 0.65984 / %% j45j50
\plot 50.00000 0.65984 55.00000 0.63972 / %% j50j55
\plot 55.00000 0.63972 60.00000 0.62021 / %% j55j60
\plot 60.00000 0.62021 65.00000 0.60129 / %% j60j65
\plot 65.00000 0.60129 70.00000 0.58296 / %% j65j70
\plot 70.00000 0.58296 75.00000 0.56518 / %% j70j75
\plot 75.00000 0.56518 80.00000 0.54795 / %% j75j80
\plot 80.00000 0.54795 85.00000 0.53124 / %% j80j85
\plot 85.00000 0.53124 90.00000 0.51504 / %% j85j90
\plot 90.00000 0.51504 95.00000 0.49933 / %% j90j95
%% ... end of file <isojdata8.dat> loop [1]
%%endSKIP
%-----
%%from mac-des.m
%% var x=-1
%% x = -1
%% var x2=x + 2
%% x2 = 1
%% point(h){x2,2.55}% 2.475 h = (1.00000, 2.55000)
%% text(MAC){h}
\put {MAC} at 1.000000 2.550000
%% vertical diff = 0.29 units %% 0.28
%% var d=0.29
%% d = 0.29
%% var h6=0.88
%% h6 = 0.88
%% text(\fbox{$0{\cdot}6$}){x,h6}
\put {\fbox{$0{\cdot}6$}} at -1.000000 0.880000
%% var h8=h6+d
%% h8 = 1.17
%% text(\fbox{$0{\cdot}8$}){x,h8}
\put {\fbox{$0{\cdot}8$}} at -1.000000 1.170000
%% var h10=h8 + d
%% h10 = 1.46
%% text(\fbox{$1{\cdot}0$}){x,h10}
\put {\fbox{$1{\cdot}0$}} at -1.000000 1.460000

```

```

%% var h12=h10 +d
%% h12 = 1.75
%% text(\fbox{$1{\cdot}2$}){x,h12}
\put {\fbox{$1{\cdot}2$}} at -1.000000 1.750000
%% var h14 = h12+d
%% h14 = 2.04
%% text(\fbox{$1{\cdot}4$}){x,h14}
\put {\fbox{$1{\cdot}4$}} at -1.000000 2.040000
%% var h16=h14 +d
%% h16 = 2.33
%% text(\fbox{$1{\cdot}6$}){x,h16}
\put {\fbox{$1{\cdot}6$}} at -1.000000 2.330000
%%=====new rotated legends from
      macATdes2.pl=====
%% var y2=2.6
%% y2 = 2.6
%% var y1=0.4
%% y1 = 0.4
%-----
\newcommand{\ylegend}{\sf End-tidal (\%) in 100\,\%
  oxygen / air}%
%-----determine string length ----> Yunits etc-----
\newlength{\ylength}%
\settowidth{\ylength}{\ylegend}%
%%text(answer ylength = \number\ylength){37,-0.4}
%% halflength/3.818=0.777 y units %%
%% text(\turnbox{90}{\ylegend}){-25, y1+((y2-y1)/2) -
  0.777}
\put {\turnbox{90}{\ylegend}} at -25.000000 0.723000
%-----
%%beginSKIP
%%endSKIP
%%=====
%%beginSKIP
%%endSKIP
%-----
\newcommand{\myrightb}{%
  %\fbox{%
    \begin{minipage}{3.5cm}% 3.8cm
    End-expired (\%) in\
    \hspace*{9mm}67\%\hspace{8mm}50\%\
    \hspace*{9mm}N$.2$\hspace{7.5mm}N$.2$O
    \end{minipage}
  }%
}% end of newcommand
%% text(\myrightb){89.143, 2.657}[1]
\put {\myrightb} [1] at 89.143000 2.657000
%-----
%%\ End-expired (\%) in\
%%\ 67\%\hspace{8mm}50\%\
%%\ N$.2$\hspace{7.5mm}N$.2$O
%%=====
\newcommand{\mybottom}{Age (years)}%
%% text(\mybottom){46, 0.12} % 0.15

```

```

\put {\mybottom} at 46.000000 0.120000
%% text({\footnotesize\copyright\ RWD Nickalls\
2003}){19,0.5}
\put {{\footnotesize\copyright\ RWD Nickalls\ 2003}} at
19.000000 0.500000
%% text(\large ISOFLURANE){46, 2.8} %% 80
\put {\large ISOFLURANE} at 46.000000 2.800000
%-----
% draw horizontal dashed lines
%%\linethickness=0.4pt %% equivalent to {\tiny .}
\linethickness=0.6pt %% half way between tiny and
normalsize
\setdashes
%% var x5=5 %% Left X value
%% x5 = 5
%% var x6=100 %% Right X value
%% x6 = 100
%% var y16=2.3523
%% y16 = 2.3523
%% var y14=2.1523
%% y14 = 2.1523
%% var y12=1.9523
%% y12 = 1.9523
%% var y10=1.7523
%% y10 = 1.7523
%% var y08=1.5523
%% y08 = 1.5523
%% var y06=1.3523
%% y06 = 1.3523
%% var y04=1.1523
%% y04 = 1.1523
%% var y02=0.9523 %% = 0.7523 + 0.2
%% y02 = 0.9523
%% var y00=0.7523 %% = 0.7523
%% y00 = 0.7523
%% point(L16){x5, y16} L16 = (5.00000, 2.35230)
%% point(R16){x6, y16} R16 = (100.00000, 2.35230)
%% point(L14){x5, y14} L14 = (5.00000, 2.15230)
%% point(R14){x6, y14} R14 = (100.00000, 2.15230)
%% point(L12){x5, y12} L12 = (5.00000, 1.95230)
%% point(R12){x6, y12} R12 = (100.00000, 1.95230)
%% point(L10){x5, y10} L10 = (5.00000, 1.75230)
%% point(R10){x6, y10} R10 = (100.00000, 1.75230)
%% point(L08){x5, y08} L08 = (5.00000, 1.55230)
%% point(R08){x6, y08} R08 = (100.00000, 1.55230)
%% point(L06){x5, y06} L06 = (5.00000, 1.35230)
%% point(R06){x6, y06} R06 = (100.00000, 1.35230)
%% point(L04){x5, y04} L04 = (5.00000, 1.15230)
%% point(R04){x6, y04} R04 = (100.00000, 1.15230)
%% point(L02){x5, y02} L02 = (5.00000, 0.95230)
%% point(R02){x6, y02} R02 = (100.00000, 0.95230)
%% point(L00){x5, y00} L00 = (5.00000, 0.75230)
%% point(R00){x6, y00} R00 = (100.00000, 0.75230)
%% draw the dashes from Left to Right

```

```

%% (so have small gap at right axis)
%% drawline(L16R16, L14R14, L12R12, L10R10,L08R08,
    L06R06, L04R04, L02R02, L00R00)
\putrule from 5.00000 2.35230 to 100.00000 2.35230 %%
    L16R16
\putrule from 5.00000 2.15230 to 100.00000 2.15230 %%
    L14R14
\putrule from 5.00000 1.95230 to 100.00000 1.95230 %%
    L12R12
\putrule from 5.00000 1.75230 to 100.00000 1.75230 %%
    L10R10
\putrule from 5.00000 1.55230 to 100.00000 1.55230 %%
    L08R08
\putrule from 5.00000 1.35230 to 100.00000 1.35230 %%
    L06R06
\putrule from 5.00000 1.15230 to 100.00000 1.15230 %%
    L04R04
\putrule from 5.00000 0.95230 to 100.00000 0.95230 %%
    L02R02
\putrule from 5.00000 0.75230 to 100.00000 0.75230 %%
    L00R00
\endpicture
%%\ } %framebox
\end{document}

```

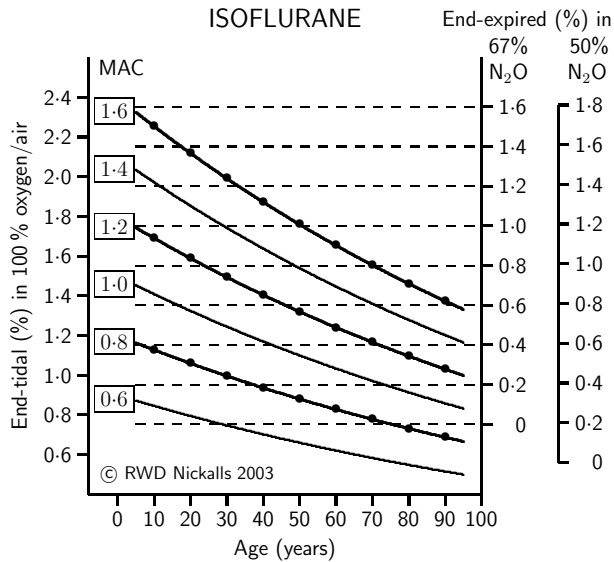


Figure 6.5: The isoflurane version (`mac-iso8t.m`) generated for the *Oxford Handbook of Anaesthesia* with rotated LHS-axis legend.

6.4 References

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