# The atveryend package

Heiko Oberdiek*
<heiko.oberdiek at googlemail.com>

2016/05/16 v1.9

**Abstract**

This LaTeX package provides two hooks for \end{document} that are executed after the hook of \AtEndDocument. \AfterLastShipout can be used for code that is to be executed right after the last \clearpage before the .aux file is closed. \AtVeryEndDocument is used for code after closing and final reading of the .aux file.

## Contents

**1 Documentation** **2**
1.1 Related work . . . 3

**2 Implementation** **3**
2.1 Tools . . . 4
2.2 Hooks . . . 4
2.3 Redefining \enddocument . . . 6
2.3.1 LaTeX kernel . . . 6
2.3.2 LaTeX kernel 2011/06/27 . . . 7
2.3.3 Package booklet, file 2up.tex . . . 9
2.3.4 Class dinbrief . . . 9
2.3.5 Class combine . . . 10
2.3.6 Class jpsj2 . . . 11
2.3.7 Testing and redefining . . . 12
2.4 Hack into \enddocument . . . 13
2.5 Using hooks of other packages . . . 14
2.5.1 Package scrlfile . . . 14
2.5.2 Package etoolbox . . . 14
2.6 Class letter . . . 14

**3 Test** **16**
3.1 Catcode checks for loading . . . 16

**4 Installation** **17**
4.1 Download . . . 17
4.2 Bundle installation . . . 18
4.3 Package installation . . . 18
4.4 Refresh file name databases . . . 18
4.5 Some details for the interested . . . 18

**5 Catalogue** **19**

**6 Acknowledgement** **19**

*Please report any issues at https://github.com/ho-tex/oberdiek/issues

**7 References** **19**

**8 History** **20**
[2009/12/06 v1.0] . . . . . 20
[2009/12/07 v1.1] . . . . . 20
[2009/12/09 v1.2] . . . . . 20
[2009/12/11 v1.3] . . . . . 20
[2010/01/25 v1.4] . . . . . 20
[2010/03/24 v1.5] . . . . . 20
[2011/04/15 v1.6] . . . . . 20
[2011/04/23 v1.7] . . . . . 20
[2011/06/30 v1.8] . . . . . 21
[2016/05/16 v1.9] . . . . . 21

**9 Index** **21**

# 1 Documentation

There are packages (e.g. hyperref [4], lastpage [6]) that want to call code after the typesetting is done, for example to remember the last page number. LaTeX provides the hook `\AtEndDocument` (clsguide [1]). There are packages that use this hook to do their job for typesetting pages (e.g. endfloat emits the floats here [2]). Also a user might provide additional code in `\AtEndDocument`. Therefore packages have to call `\clearpage` in `\AtEndDocument` to get after the last shipout page. But this is not too reliable, because the right timing is important between packages that want or have to do things before the last page is output and packages that only work properly if they can reach the point after the last shipout.

Therefore the task of this package is to provide additional hooks for `\end{document}`. All hooks are called after the hook of `\AtEndDocument`.

`\BeforeClearDocument {`⟨*code*⟩`}`

The code is called before the final `\clearpage` in `\enddocument`. However it is unknown, whether the last page is already shipped out or if this will be triggered by the final `\clearpage`.

`\AfterLastShipout {`⟨*code*⟩`}`

The code is called after the final `\clearpage` of `\enddocument` before the main `.aux` file is closed. This is the right place to remember the last page in the `.aux` file, for instance.

`\AtVeryEndDocument {`⟨*code*⟩`}`

The code is called after the `.aux` file is closed and read in again. It is the place for final checks, rerun hints, final messages.

`\AtEndAfterFileList {`⟨*code*⟩`}`

After the `.aux` file closing and reading LaTeX prints the file list if requested by `\listfiles`. Then this hook is executed.

`\AtVeryVeryEnd {`⟨*code*⟩`}`

This code is called right before the final `\@@end`.

### 1.1 Related work

**Package scrfile:** Markus Kohm has written package scrlfile (part of KOMA-Script [5]) that provides hooks \BeforeClosingMainAux and after \AfterReading-MainAux. They have the same function as the hooks of this package. In fact this package uses them, if they are available.

**Class revtex4-1:** This class calls \clear@document in \enddocument that wraps the final call of \clearpage. Thus it can be used as hook to call stuff after that \clearpage. This is also done by this package.

**Package etoolbox:** It provides \AfterEndDocument, a hook right before \deadcycles or \@@end [3].

This package tries to combine as many approaches as possible:

- It looks for a known \enddocument and redefines it.
- Hooks that are provided by others are used (package scrlfile or class revtex4-1.
- It redefines \@checkend and \@dofilelist to insert the hooks similar to package scrlfile.
- The hook execution is wrapped in a macro that is redefined by its first call to prevent calling the hook more than once.

## 2 Implementation

```
1 ⟨*package⟩
2 \begingroup\catcode61\catcode48\catcode32=10\relax%
3   \catcode13=5 % ^^M
4   \endlinechar=13 %
5   \catcode123=1 % {
6   \catcode125=2 % }
7   \catcode64=11 % @
8   \def\x{\endgroup
9     \expandafter\edef\csname AtVeryEnd@AtEnd\endcsname{%
10      \endlinechar=\the\endlinechar\relax
11      \catcode13=\the\catcode13\relax
12      \catcode32=\the\catcode32\relax
13      \catcode35=\the\catcode35\relax
14      \catcode61=\the\catcode61\relax
15      \catcode64=\the\catcode64\relax
16      \catcode123=\the\catcode123\relax
17      \catcode125=\the\catcode125\relax
18    }%
19  }%
20 \x\catcode61\catcode48\catcode32=10\relax%
21 \catcode13=5 % ^^M
22 \endlinechar=13 %
23 \catcode35=6 % #
24 \catcode64=11 % @
25 \catcode123=1 % {
26 \catcode125=2 % }
27 \def\TMP@EnsureCode#1#2{%
28   \edef\AtVeryEnd@AtEnd{%
29     \AtVeryEnd@AtEnd
30     \catcode#1=\the\catcode#1\relax
31   }%
32   \catcode#1=#2\relax
33 }
34 \TMP@EnsureCode{9}{10}% (tab)
```

```
\TMP@EnsureCode{39}{12}% '
\TMP@EnsureCode{40}{12}% (
\TMP@EnsureCode{41}{12}% )
\TMP@EnsureCode{42}{12}% *
\TMP@EnsureCode{45}{12}% -
\TMP@EnsureCode{46}{12}% .
\TMP@EnsureCode{47}{12}% /
\TMP@EnsureCode{62}{12}% >
\TMP@EnsureCode{91}{12}% [
\TMP@EnsureCode{93}{12}% ]
\TMP@EnsureCode{96}{12}% `
\edef\AtVeryEnd@AtEnd{\AtVeryEnd@AtEnd\noexpand\endinput}
```

Package identification.

```
\NeedsTeXFormat{LaTeX2e}
\ProvidesPackage{atveryend}%
  [2016/05/16 v1.9 Hooks at the very end of document (HO)]
```

## 2.1 Tools

\AtVeryEnd@ifundefined

```
\def\AtVeryEnd@ifundefined#1{%
  \begingroup\expandafter\expandafter\expandafter\endgroup
  \expandafter\ifx\csname #1\endcsname\relax
    \expandafter\@firstoftwo
  \else
    \expandafter\@secondoftwo
  \fi
}
```

## 2.2 Hooks

yEnd@BeforeClearDocumentHook

```
\let\AtVeryEnd@BeforeClearDocumentHook\@empty
```

tVeryEnd@AfterLastShipoutHook

```
\let\AtVeryEnd@AfterLastShipoutHook\@empty
```

yEnd@AtVeryEndDocumentHook

```
\let\AtVeryEnd@AtVeryEndDocumentHook\@empty
```

eryEnd@AtEndAfterFileListHook

```
\let\AtVeryEnd@AtEndAfterFileListHook\@empty
```

AtVeryEnd@AtVeryVeryEndHook

```
\let\AtVeryEnd@AtVeryVeryEndHook\@empty
```

\BeforeClearDocument

```
\newcommand*{\BeforeClearDocument}{%
  \g@addto@macro\AtVeryEnd@BeforeClearDocumentHook
}
```

\AfterLastShipout

```
\newcommand*{\AfterLastShipout}{%
  \g@addto@macro\AtVeryEnd@AfterLastShipoutHook
}
```

\AtVeryEndDocument

```
\newcommand*{\AtVeryEndDocument}{%
  \g@addto@macro\AtVeryEnd@AtVeryEndDocumentHook
}
```

\AtEndAfterFileList

```
\newcommand*{\AtEndAfterFileList}{%
  \g@addto@macro\AtVeryEnd@AtEndAfterFileListHook
}
```

\AtVeryVeryEnd

```
\newcommand*{\AtVeryVeryEnd}{%
  \g@addto@macro\AtVeryEnd@AtVeryVeryEndHook
}
```

\Call@BeforeClearDocument

```
\newcommand*{\Call@BeforeClearDocument}{%
  \let\BeforeClearDocument\@firstofone
  \ifx\AtVeryEnd@BeforeClearDocumentHook\@empty
    \PackageInfo{atveryend}{Empty hook `BeforeClearDocument'}%
  \else
    \PackageInfo{atveryend}{Executing hook `BeforeClearDocument'}%
    \AtVeryEnd@BeforeClearDocumentHook
  \fi
  \global\let\AtVeryEnd@BeforeClearDocumentHook\@undefined
  \global\let\Call@BeforeClearDocument\relax
}
```

\Call@AfterLastShipout

```
\newcommand*{\Call@AfterLastShipout}{%
  \let\AfterLastShipout\@firstofone
  \ifx\AtVeryEnd@AfterLastShipoutHook\@empty
    \PackageInfo{atveryend}{Empty hook `AfterLastShipout'}%
  \else
    \PackageInfo{atveryend}{Executing hook `AfterLastShipout'}%
    \AtVeryEnd@AfterLastShipoutHook
  \fi
  \global\let\AtVeryEnd@AfterLastShipoutHook\@undefined
  \global\let\Call@AfterLastShipout\relax
}
```

\Call@AtVeryEndDocument

```
\newcommand*{\Call@AtVeryEndDocument}{%
  \let\AtVeryEndDocument\@firstofone
  \ifx\AtVeryEnd@AtVeryEndDocumentHook\@empty
    \PackageInfo{atveryend}{Empty hook `AtVeryEndDocument'}%
  \else
    \PackageInfo{atveryend}{Executing hook `AtVeryEndDocument'}%
    \AtVeryEnd@AtVeryEndDocumentHook
  \fi
  \global\let\AtVeryEnd@AtVeryEndDocumentHook\@undefined
  \global\let\Call@AtVeryEndDocument\relax
}
```

\Call@AtEndAfterFileList

```
\newcommand*{\Call@AtEndAfterFileList}{%
  \Call@AtVeryEndDocument
  \let\AtEndAfterFileList\@firstofone
  \ifx\AtVeryEnd@AtEndAfterFileListHook\@empty
    \PackageInfo{atveryend}{Empty hook `AtEndAfterFileList'}%
  \else
    \PackageInfo{atveryend}{Executing hook `AtEndAfterFileList'}%
    \AtVeryEnd@AtEndAfterFileListHook
  \fi
  \global\let\AtVeryEnd@AtEndAfterFileListHook\@undefined
  \global\let\Call@AtEndAfterFileList\relax
}
```

\Call@AtVeryVeryEnd

```
\newcommand*{\Call@AtVeryVeryEnd}{%
  \Call@AtEndAfterFileList
  \let\AtVeryVeryEnd\@firstofone
  \ifx\AtVeryEnd@AtVeryVeryEndHook\@empty
    \PackageInfo{atveryend}{Empty hook 'AtVeryVeryEnd'}%
  \else
    \PackageInfo{atveryend}{Executing hook 'AtVeryVeryEnd'}%
    \AtVeryEnd@AtVeryVeryEndHook
  \fi
  \global\let\AtVeryEnd@AtVeryVeryEndHook\@undefined
  \global\let\Call@AtVeryVeryEnd\relax
}
```

## 2.3 Redefining \enddocument

This approach looks for known versions of \enddocument and redefines it. Class seminar and package slidesec are not checked, because there would be too much combinations to check.

### 2.3.1 LaTeX kernel

\AtVeryEnd@test@standard

```
\def\AtVeryEnd@test@standard{%
  \let\AtEndDocument\@firstofone
  \@enddocumenthook
  \@checkend{document}%
  \clearpage
  \begingroup
    \if@filesw
      \immediate\closeout\@mainaux
      \let\@setckpt\@gobbletwo
      \let\@newl@bel\@testdef
      \@tempswafalse
      \makeatletter
      \input\jobname.aux %
    \fi
    \@dofilelist
    \ifdim \font@submax >\fontsubfuzz\relax
      \@font@warning{Size substitutions with differences\MessageBreak
                up to \font@submax\space have occurred.\@gobbletwo}%
    \fi
    \@defaultsubs
    \@refundefined
    \if@filesw
      \ifx \@multiplelabels \relax
        \if@tempswa
          \@latex@warning@no@line{Label(s) may have changed. %
              Rerun to get cross-references right}%
        \fi
      \else
        \@multiplelabels
      \fi
    \fi
  \endgroup
  \deadcycles\z@
  \@@end
}
```

VeryEnd@enddocument@standard

```
\def\AtVeryEnd@enddocument@standard{%
  \let\AtEndDocument\@firstofone
```

```
\@enddocumenthook
\@checkend{document}%
\Call@BeforeClearDocument
\clearpage
\Call@AfterLastShipout
\begingroup
  \if@filesw
    \immediate\closeout\@mainaux
    \let\@setckpt\@gobbletwo
    \let\@newl@bel\@testdef
    \@tempswafalse
    \makeatletter
    \input\jobname.aux %
  \fi
  \Call@AtVeryEndDocument
  \@dofilelist
  \Call@AtEndAfterFileList
  \ifdim \font@submax >\fontsubfuzz\relax
    \@font@warning{Size substitutions with differences\MessageBreak
            up to \font@submax\space have occurred.\@gobbletwo}%
  \fi
  \@defaultsubs
  \@refundefined
  \if@filesw
    \ifx \@multiplelabels \relax
      \if@tempswa
        \@latex@warning@no@line{Label(s) may have changed. %
          Rerun to get cross-references right}%
      \fi
    \else
      \@multiplelabels
    \fi
  \fi
\endgroup
\deadcycles\z@
\Call@AtVeryVeryEnd
\@@end
}
```

### 2.3.2 LaTeX kernel 2011/06/27

The LaTeX $2_\varepsilon$ release 2011/06/27 has changed `\enddocument` (`\input` is replaced by `\@@input`).

VeryEnd@test@standard20110627

```
\expandafter\def\csname AtVeryEnd@test@standard20110627\endcsname{%
  \let\AtEndDocument\@firstofone
  \@enddocumenthook
  \@checkend{document}%
  \clearpage
  \begingroup
    \if@filesw
      \immediate\closeout\@mainaux
      \let\@setckpt\@gobbletwo
      \let\@newl@bel\@testdef
      \@tempswafalse
      \makeatletter
      \@@input\jobname.aux %
    \fi
    \@dofilelist
    \ifdim \font@submax >\fontsubfuzz\relax
      \@font@warning{Size substitutions with differences\MessageBreak
            up to \font@submax\space have occurred.\@gobbletwo}%
```

```
    \fi
    \@defaultsubs
    \@refundefined
    \if@filesw
      \ifx \@multiplelabels \relax
        \if@tempswa
          \@latex@warning@no@line{Label(s) may have changed. %
              Rerun to get cross-references right}%
        \fi
      \else
        \@multiplelabels
      \fi
    \fi
  \endgroup
  \deadcycles\z@
  \@@end
}
```

@enddocument@standard20110627

```
\expandafter\def\csname AtVeryEnd@enddocument@standard20110627\endcsname{%
  \let\AtEndDocument\@firstofone
  \@enddocumenthook
  \@checkend{document}%
  \Call@BeforeClearDocument
  \clearpage
  \Call@AfterLastShipout
  \begingroup
    \if@filesw
      \immediate\closeout\@mainaux
      \let\@setckpt\@gobbletwo
      \let\@newl@bel\@testdef
      \@tempswafalse
      \makeatletter
      \@@input\jobname.aux %
    \fi
    \Call@AtVeryEndDocument
    \@dofilelist
    \Call@AtEndAfterFileList
    \ifdim \font@submax >\fontsubfuzz\relax
      \@font@warning{Size substitutions with differences\MessageBreak
              up to \font@submax\space have occurred.\@gobbletwo}%
    \fi
    \@defaultsubs
    \@refundefined
    \if@filesw
      \ifx \@multiplelabels \relax
        \if@tempswa
          \@latex@warning@no@line{Label(s) may have changed. %
              Rerun to get cross-references right}%
        \fi
      \else
        \@multiplelabels
      \fi
    \fi
  \endgroup
  \deadcycles\z@
  \Call@AtVeryVeryEnd
  \@@end
}
```

### 2.3.3 Package **booklet**, file **2up.tex**

\AtVeryEnd@test@booklet

```
\expandafter\def\expandafter\AtVeryEnd@test@booklet\expandafter{%
  \expandafter\twoupclearpage
  \AtVeryEnd@test@standard
}
```

tVeryEnd@enddocument@booklet

```
\expandafter\def\expandafter\AtVeryEnd@enddocument@booklet\expandafter{%
  \expandafter\twoclearpage
  \AtVeryEnd@enddocument@standard
}
```

### 2.3.4 Class **dinbrief**

\AtVeryEnd@test@dinbrief

```
\def\AtVeryEnd@test@dinbrief{%
  \@checkend{document} %
  \newpage
  \begingroup
    \if@filesw
      \ifnum\c@labelgen>0 %
        \immediate\closeout\@mainlbl
        \makeatletter
        \input \jobname@lbl\relax
        \clearpage
      \fi
      \immediate\closeout\@mainaux
    \fi
  \endgroup
  \deadcycles\z@
  \@@end
}
```

tVeryEnd@enddocument@dinbrief

```
\def\AtVeryEnd@enddocument@dinbrief{%
  \@checkend{document}%
  \Call@BeforeClearDocument
  \newpage
  \Call@AfterLastShipout
  \begingroup
    \if@filesw
      \ifnum\c@labelgen>\z@
        \immediate\closeout\@mainlbl
        \makeatletter
        \input \jobname@lbl\relax
        \clearpage
      \fi
      \immediate\closeout\@mainaux
    \fi
    \Call@AtVeryEndDocument
    \csname @dofilelist\endcsname
    \Call@AtEndAfterFileList
  \endgroup
  \deadcycles\z@
  \Call@AtVeryVeryEnd
  \@@end
}
```

### 2.3.5 Class **combine**

\AtVeryEnd@test@combine

```
\def\AtVeryEnd@test@combine{%
  \@enddocumenthook
  \@checkend{document}%
  \clearpage
  \begingroup
    \if@filesw
      \immediate\closeout\@mainaux
      \immediate\closeout\@partaux
      \let\@setckpt\@gobbletwo
      \let\@newl@bel\@testdef
      \@tempswafalse
      \makeatletter \input\c@lmainauxfile  %% change here
    \fi
    \c@lenddoca                          %% a replacement
    \@refundefined
  \endgroup
  \deadcycles\z@
  \@@end
}
```

VeryEnd@enddocument@combine

```
\def\AtVeryEnd@enddocument@combine{%
  \@enddocumenthook
  \@checkend{document}%
  \Call@BeforeClearDocument
  \clearpage
  \Call@AfterLastShipout
  \begingroup
    \if@filesw
      \immediate\closeout\@mainaux
      \immediate\closeout\@partaux
      \let\@setckpt\@gobbletwo
      \let\@newl@bel\@testdef
      \@tempswafalse
      \makeatletter \input\c@lmainauxfile  %% change here
    \fi
    \Call@AtVeryEndDocument
    \c@lenddoca                          %% a replacement
    \@refundefined
  \endgroup
  \deadcycles\z@
  \Call@AtVeryVeryEnd
  \@@end
}
```

\AtVeryEnd@test@c@lenddoca

```
\long\def\AtVeryEnd@test@c@lenddoca{%
  \@dofilelist
  \ifdim\font@submax>\fontsubfuzz\relax
    \@font@warning{%
      Size substitutions with differences\MessageBreak
      up to \font@submax\space have occured.\@gobbletwo
    }%
  \fi
  \@defaultsubs
  \if@filesw
    \ifx\@multiplelabels\relax
      \if@tempswa
        \@latex@warning@no@line{%
          Label(s) may have changed. %
```

```
        Rerun to get cross-references right%
      }%
    \fi
  \else
    \@multiplelabels
  \fi
 \fi
}
```

\c@lenddoca

```
\ifx\AtVeryEnd@c@lenddoca\c@lenddoca
 \def\c@lenddoca{%
  \@dofilelist
  \Call@AtEndAfterFileList
  \ifdim\font@submax>\fontsubfuzz\relax
    \@font@warning{%
      Size substitutions with differences\MessageBreak
      up to \font@submax\space have occured.\@gobbletwo
    }%
  \fi
  \@defaultsubs
  \if@filesw
    \ifx\@multiplelabels\relax
      \if@tempswa
        \@latex@warning@no@line{%
          Label(s) may have changed. %
          Rerun to get cross-references right%
        }%
      \fi
    \else
      \@multiplelabels
    \fi
  \fi
 }%
\fi
```

### 2.3.6 Class jpsj2

\AtVeryEnd@test@jpsj

```
\def\AtVeryEnd@test@jpsj{%
 \if@lastpagebalancing
  \global\let\@outputdblcol=\balancing@outputdblcol
 \fi
 \@checkend{document}%
 \clearpage
 \begingroup
  \if@filesw
    \immediate\closeout\@mainaux
    \def\global\@namedef##1##2{}%
    \def\newlabel{\@testdef r}%
    \def\bibcite{\@testdef b}%
    \@tempswafalse
    \makeatletter
    \input \jobname.aux %
    \if@tempswa
      \@warning{%
        Label(s) may have changed. %
        Rerun to get cross-references right%
      }%
    \fi
  \fi
 \endgroup
```

```
  \deadcycles\z@
  \@@end
}
```

\AtVeryEnd@enddocument@jpsj

```
\def\AtVeryEnd@enddocument@jpsj{%
  \if@lastpagebalancing
    \global\let\@outputdblcol=\balancing@outputdblcol
  \fi
  \@checkend{document}%
  \Call@BeforeClearDocument
  \clearpage
  \Call@AfterLastShipout
  \begingroup
    \if@filesw
      \immediate\closeout\@mainaux
      \def\global\@namedef##1##2{}%
      \def\newlabel{\@testdef r}%
      \def\bibcite{\@testdef b}%
      \@tempswafalse
      \makeatletter
      \input \jobname.aux %
      \if@tempswa
        \@warning{%
          Label(s) may have changed. %
          Rerun to get cross-references right%
        }%
      \fi
    \fi
    \Call@AtVeryEndDocument
    \csname @dofilelist\endcsname
    \Call@AtEndAfterFileList
  \endgroup
  \deadcycles\z@
  \Call@AtVeryVeryEnd
  \@@end
}
```

### 2.3.7 Testing and redefining

\AtVeryEnd@Test

```
\def\AtVeryEnd@Test#1#2{%
  \expandafter\ifx\csname AtVeryEnd@test@#2\endcsname#1%
    \expandafter\let\expandafter#1%
    \csname AtVeryEnd@enddocument@#2\endcsname
    \begingroup
      \let\on@line\@empty
      \PackageInfo{atveryend}{%
        \string#1 detected (#2)%
      }%
    \endgroup
    \expandafter\AtVeryEnd@SkipToNil
  \fi
}
```

\AtVeryEnd@SkipToNil

```
\def\AtVeryEnd@SkipToNil#1\@nil{}
```

\AtVeryEnd@RedefEndDocument

```
\def\AtVeryEnd@RedefEndDocument#1{%
  \ifx#1\@undefined
  \else
```

```
    \AtVeryEnd@Test#1{standard20110627}%
    \AtVeryEnd@Test#1{standard}%
    \AtVeryEnd@Test#1{booklet}%
    \AtVeryEnd@Test#1{dinbrief}%
    \AtVeryEnd@Test#1{combine}%
    \AtVeryEnd@Test#1{jpsj}%
    \AtVeryEnd@SkipToNil
    \@nil
  \fi
}
\AtVeryEnd@RedefEndDocument\enddocument
\AtVeryEnd@RedefEndDocument\AP@enddocument % afterpage.sty
\AtVeryEnd@RedefEndDocument\hyper@back@cite@enddocument % htx-bc.sty
\AtVeryEnd@RedefEndDocument\hyper@enddocument % hyper.sty
\AtVeryEnd@RedefEndDocument\hyper@fn@enddocument % hyper.sty
\AtVeryEnd@RedefEndDocument\cweb@save@enddocument % cweb.cls
\AtVeryEnd@RedefEndDocument\prev@enddocument % flushend.sty
\AtVeryEnd@RedefEndDocument\endorigdocument % gaceta.cls
\AtVeryEnd@RedefEndDocument\keependdoc % aguplus.sty
\AtVeryEnd@RedefEndDocument\EMenddocument % t-angles.sty
\AtVeryEnd@RedefEndDocument\docmute@enddocument % docmute.sty
\AtVeryEnd@RedefEndDocument\a@enddocument % alatex.sty
\AtVeryEnd@RedefEndDocument\enddocumentasusual % frenchle.sty
\AtVeryEnd@RedefEndDocument\old@enddocument % uwthesis.cls
```

## 2.4 Hack into \enddocument

```
\def\AtVeryEnd@document{document}%
\def\AtVeryEnd@RedefCheckEnd{%
  \expandafter\def\expandafter\@checkend
  \expandafter##\expandafter1\expandafter{%
    \@checkend{##1}%
    \def\AtVeryEnd@temp{##1}%
    \ifx\AtVeryEnd@temp\AtVeryEnd@document
      \let\AtVeryEnd@OrgClearpage\clearpage
      \def\clearpage{%
        \let\clearpage\AtVeryEnd@OrgClearpage
        \Call@BeforeClearDocument
        \clearpage
        \Call@AfterLastShipout
      }%
    \fi
  }%
  \aftergroup\AtVeryEnd@RedefCheckEnd
}%
\AtBeginDocument{%
  \AtEndDocument{%
    \AtVeryEnd@RedefCheckEnd
  }%
}
\AtEndDocument{%
  \@ifundefined{@dofilelist}{%
    \gdef\@dofilelist{%
      \Call@AtVeryEndDocument
      \Call@AtEndAfterFileList
    }%
  }{%
    \begingroup
      \toks@\expandafter{\@dofilelist}%
      \xdef\@dofilelist{%
        \noexpand\Call@AtVeryEndDocument
```

```
      \the\toks@
      \noexpand\Call@AtEndAfterFileList
    }%
  \endgroup
 }%
}
```

## 2.5 Using hooks of other packages

### 2.5.1 Package scrlfile

```
\AtBeginDocument{%
 \@ifpackageloaded{scrlfile}{%
  \AtVeryEnd@ifundefined{BeforeClosingMainAux}{}{%
   \BeforeClosingMainAux{\Call@AfterLastShipout}%
  }%
  \AtVeryEnd@ifundefined{AfterReadingMainAux}{}{%
   \AfterReadingMainAux{\Call@AtVeryEndDocument}%
  }%
 }{}%
```

### 2.5.2 Package etoolbox

```
 \@ifpackageloaded{etoolbox}{%
  \AtVeryEnd@ifundefined{AfterEndDocument}{}{%
   \AfterEndDocument{\Call@AtVeryEndDocument}%
  }%
 }{}%
}
```

## 2.6 Class letter

The class letter and some similar classes insert material (\@startlabels) at the end of the document. However, this method violates a precondition of this package that the \clearpage in \enddocument is the final call with no material at later times. Therefore we move the label making from the .aux file to \AtEndDocument.

```
\def\AtVeryEnd@temp{%
 \AtBeginDocument{%
  \let\@startlabels\startlabels
  \let\@mlabel\mlabel
  \if@filesw
   \immediate\write\@mainaux{\string\@startlabels}%
  \fi
 }%
 \AtEndDocument{%
  \if@filesw
   \immediate\write\@mainaux{\string\clearpage}%
  \fi
 }%
}
\ifx\makelabels\AtVeryEnd@temp
\else
 \expandafter\AtVeryEnd@AtEnd
\fi%
\let\AtVeryEnd@PatchLetter=N%
\begingroup\expandafter\expandafter\expandafter\endgroup
\expandafter\ifx\csname endletter\endcsname\relax
\else
 \long\def\AtVeryEnd@TestEndLetter#1\@auxout#2#3\AtVeryEnd@Nil{%
  \def\AtVeryEnd@temp{#2}%
  \ifx\AtVeryEnd@temp\@empty
  \else
   \@onelevel@sanitize\AtVeryEnd@temp
   \edef\AtVeryEnd@StringMlabel{%
```

```
      \string\string
      \string\@mlabel
      \expandafter\@gobble\string\{%
    }%
    \def\AtVeryEnd@CatchFirst##1##2##3##4##5##6##7##8{%
      ##1##2##3##4##5##6##7##8\AtVeryEnd@CatchSecond
    }%
  \def\AtVeryEnd@CatchSecond##1##2##3##4##5##6##7##8##9\@nil{%
      ##1##2##3##4##5##6##7##8%
    }%
    \edef\AtVeryEnd@temp{%
      \expandafter\AtVeryEnd@CatchFirst\AtVeryEnd@temp
      {}{}{}{}{}{}{}{}%
      {}{}{}{}{}{}{}{}%
      \@nil
    }%
    \ifx\AtVeryEnd@temp\AtVeryEnd@StringMlabel
      \expandafter\def\expandafter\endletter\expandafter{%
        \endletter
        \begingroup
          \let\\=\relax
          \let\protect\@unexpandable@protect
          \let\@mlabel=\relax
          \edef\x{\endgroup
            \noexpand\AtEndDocument{%
              \@gobble#2%
            }%
          }%
        \x
      }%
      \let\AtVeryEnd@PatchLetter=Y%
    \fi
  \fi
 }%
 \expandafter\AtVeryEnd@TestEndLetter\endletter
  \@auxout{}\AtVeryEnd@Nil
\fi
\ifx\AtVeryEnd@PatchLetter Y%
  \begingroup
    \let\on@line\@empty
    \PackageInfo{atveryend}{%
      \@backslashchar makelabels detected. %
      Moving labels\MessageBreak
      from '.aux' file to \@backslashchar AtEndDocument%
    }%
  \endgroup
  \def\makelabels{%
    \AtBeginDocument{%
      \let\@startlabels\startlabels
      \let\@mlabel\mlabel
    }%
  }%
  \AtEndDocument{%
    \AtVeryEnd@ifundefined{@startlabels}{%
    }{%
      \clearpage
      \@startlabels
    }%
  }%
  \AfterLastShipout{%
    \let\@startlabels\relax
    \let\@mlabel\@gobbletwo
```

```
  }%
\else
  \PackageWarningNoLine{atveryend}{%
    \@backslashchar makelabels detected, but labels cannot\MessageBreak
    be moved to \@backslashchar AtEndDocument, because\MessageBreak
    \@backslashchar endletter is not in expected form%
  }%
\fi
\AtVeryEnd@AtEnd%
⟨/package⟩
```

# 3 Test

## 3.1 Catcode checks for loading

```
⟨*test1⟩
\catcode`\{=1 %
\catcode`\}=2 %
\catcode`\#=6 %
\catcode`\@=11 %
\expandafter\ifx\csname count@\endcsname\relax
  \countdef\count@=255 %
\fi
\expandafter\ifx\csname @gobble\endcsname\relax
  \long\def\@gobble#1{}%
\fi
\expandafter\ifx\csname @firstofone\endcsname\relax
  \long\def\@firstofone#1{#1}%
\fi
\expandafter\ifx\csname loop\endcsname\relax
  \expandafter\@firstofone
\else
  \expandafter\@gobble
\fi
{%
  \def\loop#1\repeat{%
    \def\body{#1}%
    \iterate
  }%
  \def\iterate{%
    \body
      \let\next\iterate
    \else
      \let\next\relax
    \fi
    \next
  }%
  \let\repeat=\fi
}%
\def\RestoreCatcodes{}
\count@=0 %
\loop
  \edef\RestoreCatcodes{%
    \RestoreCatcodes
    \catcode\the\count@=\the\catcode\count@\relax
  }%
\ifnum\count@<255 %
  \advance\count@ 1 %
\repeat

\def\RangeCatcodeInvalid#1#2{%
```

```
  \count@=#1\relax
  \loop
    \catcode\count@=15 %
  \ifnum\count@<#2\relax
    \advance\count@ 1 %
  \repeat
}
\def\RangeCatcodeCheck#1#2#3{%
  \count@=#1\relax
  \loop
    \ifnum#3=\catcode\count@
    \else
      \errmessage{%
        Character \the\count@\space
        with wrong catcode \the\catcode\count@\space
        instead of \number#3%
      }%
    \fi
  \ifnum\count@<#2\relax
    \advance\count@ 1 %
  \repeat
}
\def\space{ }
\expandafter\ifx\csname LoadCommand\endcsname\relax
  \def\LoadCommand{\input atveryend.sty\relax}%
\fi
\def\Test{%
  \RangeCatcodeInvalid{0}{47}%
  \RangeCatcodeInvalid{58}{64}%
  \RangeCatcodeInvalid{91}{96}%
  \RangeCatcodeInvalid{123}{255}%
  \catcode`\@=12 %
  \catcode`\\=0 %
  \catcode`\%=14 %
  \LoadCommand
  \RangeCatcodeCheck{0}{36}{15}%
  \RangeCatcodeCheck{37}{37}{14}%
  \RangeCatcodeCheck{38}{47}{15}%
  \RangeCatcodeCheck{48}{57}{12}%
  \RangeCatcodeCheck{58}{63}{15}%
  \RangeCatcodeCheck{64}{64}{12}%
  \RangeCatcodeCheck{65}{90}{11}%
  \RangeCatcodeCheck{91}{91}{15}%
  \RangeCatcodeCheck{92}{92}{0}%
  \RangeCatcodeCheck{93}{96}{15}%
  \RangeCatcodeCheck{97}{122}{11}%
  \RangeCatcodeCheck{123}{255}{15}%
  \RestoreCatcodes
}
\Test
\csname @@end\endcsname
\end
```

⟨/test1⟩

# 4 Installation

## 4.1 Download

**Package.** This package is available on CTAN[1]:

**CTAN:macros/latex/contrib/oberdiek/atveryend.dtx** The source file.

[1] http://ctan.org/pkg/atveryend

CTAN:macros/latex/contrib/oberdiek/atveryend.pdf Documentation.

**Bundle.** All the packages of the bundle 'oberdiek' are also available in a TDS compliant ZIP archive. There the packages are already unpacked and the documentation files are generated. The files and directories obey the TDS standard.

CTAN:install/macros/latex/contrib/oberdiek.tds.zip

*TDS* refers to the standard "A Directory Structure for TEX Files" (CTAN:tds/tds.pdf). Directories with texmf in their name are usually organized this way.

## 4.2 Bundle installation

**Unpacking.** Unpack the oberdiek.tds.zip in the TDS tree (also known as texmf tree) of your choice. Example (linux):

```
unzip oberdiek.tds.zip -d ~/texmf
```

**Script installation.** Check the directory TDS:scripts/oberdiek/ for scripts that need further installation steps. Package attachfile2 comes with the Perl script pdfatfi.pl that should be installed in such a way that it can be called as pdfatfi. Example (linux):

```
chmod +x scripts/oberdiek/pdfatfi.pl
cp scripts/oberdiek/pdfatfi.pl /usr/local/bin/
```

## 4.3 Package installation

**Unpacking.** The .dtx file is a self-extracting docstrip archive. The files are extracted by running the .dtx through plain TEX:

```
tex atveryend.dtx
```

**TDS.** Now the different files must be moved into the different directories in your installation TDS tree (also known as texmf tree):

```
atveryend.sty             → tex/latex/oberdiek/atveryend.sty
atveryend.pdf             → doc/latex/oberdiek/atveryend.pdf
test/atveryend-test1.tex → doc/latex/oberdiek/test/atveryend-test1.tex
atveryend.dtx             → source/latex/oberdiek/atveryend.dtx
```

If you have a docstrip.cfg that configures and enables docstrip's TDS installing feature, then some files can already be in the right place, see the documentation of docstrip.

## 4.4 Refresh file name databases

If your TEX distribution (teTEX, mikTEX, ...) relies on file name databases, you must refresh these. For example, teTEX users run texhash or mktexlsr.

## 4.5 Some details for the interested

**Unpacking with LATEX.** The .dtx chooses its action depending on the format:

**plain TEX:** Run docstrip and extract the files.

**LATEX:** Generate the documentation.

If you insist on using LATEX for docstrip (really, docstrip does not need LATEX), then inform the autodetect routine about your intention:

```
latex \let\install=y\input{atveryend.dtx}
```

Do not forget to quote the argument according to the demands of your shell.

**Generating the documentation.** You can use both the .dtx or the .drv to generate the documentation. The process can be configured by the configuration file ltxdoc.cfg. For instance, put this line into this file, if you want to have A4 as paper format:

```
\PassOptionsToClass{a4paper}{article}
```

An example follows how to generate the documentation with pdfLaTeX:

```
pdflatex atveryend.dtx
makeindex -s gind.ist atveryend.idx
pdflatex atveryend.dtx
makeindex -s gind.ist atveryend.idx
pdflatex atveryend.dtx
```

# 5 Catalogue

The following XML file can be used as source for the TeX Catalogue. The elements caption and description are imported from the original XML file from the Catalogue. The name of the XML file in the Catalogue is atveryend.xml.

```
⟨*catalogue⟩
<?xml version='1.0' encoding='us-ascii'?>
<!DOCTYPE entry SYSTEM 'catalogue.dtd'>
<entry datestamp='$Date$' modifier='$Author$' id='atveryend'>
  <name>atveryend</name>
  <caption>Hooks at the very end of a document.</caption>
  <authorref id='auth:oberdiek'/>
  <copyright owner='Heiko Oberdiek' year='2009-2011'/>
  <license type='lppl1.3'/>
  <version number='1.9'/>
  <description>
    This LaTeX packages provides two hooks for <tt>\end{document}</tt>
    that are executed after the hook of <tt>\AtEndDocument</tt>:
    <tt>\AfterLastShipout</tt> can be used for code that is to be executed
    right after the last <tt>\clearpage</tt> before the '<tt>.aux</tt>' file
    is closed. <tt>\AtVeryEndDocument</tt> is used for code after closing
    and final reading of the '<tt>.aux</tt>' file.
    <p/>
    The package is part of the <xref refid='oberdiek'>oberdiek</xref> bundle.
  </description>
  <documentation details='Package documentation'
      href='ctan:/macros/latex/contrib/oberdiek/atveryend.pdf'/>
  <ctan file='true' path='/macros/latex/contrib/oberdiek/atveryend.dtx'/>
  <miktex location='oberdiek'/>
  <texlive location='oberdiek'/>
  <install path='/macros/latex/contrib/oberdiek/oberdiek.tds.zip'/>
</entry>
⟨/catalogue⟩
```

# 6 Acknowledgement

**Arthur Ogawa:** He proposed the new API with \AfterLastShipout and gave me much feedback, comprehensive class/package lists, many suggestions and comments.

# 7 References

[1] The LaTeX3 Project: *LaTeX2e for class and package writers* 2006/02/15; CTAN:macros/latex/doc/clsguide.pdf.

[2] James Darrell McCauley, Jeff Goldberg: *The endfloat package*; 1995/10/11 v2.4i; CTAN:macros/latex/contrib/endfloat/endfloat.pdf.

[3] Philipp Lehmann: *The etoolbox package*; 2009/08/06 v1.8; CTAN:macros/latex/contrib/etoolbox/etoolbox.pdf.

[4] Sebastian Rahtz, Heiko Oberdiek: *The hyperref package*; 2009/12/05 v6.79l; CTAN:macros/latex/contrib/hyperref/.

[5] Markus Kohm: *KOMA-Script*; 2009/07/24 v3.04a; http://www.komascript.de/.

[6] Jeff Goldberg: *The lastpage package*; 1994/07/20 v0.1b; CTAN:macros/latex/contrib/lastpage/lastpage.pdf.

[7] APS, AIP, Arthur Orgawa; ReVTeX 4.1; 2009/10/13 v4.1; http://authors.aps.org/revtex4/.

# 8 History

## [2009/12/06 v1.0]

- The first version.

## [2009/12/07 v1.1]

- Bug fixes.

## [2009/12/09 v1.2]

- Additional support of classes and packages.

## [2009/12/11 v1.3]

- Patch for letter like classes that puts label into the '.aux' file.
- Hook `\BeforeClearDocument` added (request from Arthur Ogawa).
- Patch of `\clear@document` removed (Arthur Ogawa).
- A nested `\AtBeginDocument` removed.

## [2010/01/25 v1.4]

- Moved from `TDS:*/generic/*` to `TDS:*/latex/*`.

## [2010/03/24 v1.5]

- `\Call@BeforeClearDocument` fixed (Ahmed Musa).

## [2011/04/15 v1.6]

- `\Call@AtEndAfterFileList` and `\Call@AtVeryVeryEnd` added.

## [2011/04/23 v1.7]

- Some fix for `\AtVeryEnd@RedefCheckEnd` to avoid error because of undefined control sequence in some circumstances (thanks to D.P. Story for bug report).

### [2011/06/30 v1.8]

- Support of changed \enddocument of LaTeX 2$_\varepsilon$ 2011/06/27.

### [2016/05/16 v1.9]

- Documentation updates.

# 9 Index

Numbers written in italic refer to the page where the corresponding entry is described; numbers underlined refer to the code line of the definition; plain numbers refer to the code lines where the entry is used.


**Symbols**

\# . . . . . 679
\% . . . . . 755
\@ . . . . . 680, 753
\@@end . . . . . 168, 208, 243, 283, 308, 331, 350, 373, 446, 478
\@@input . . . . . 222, 259
\@auxout . . . . . 598, 639
\@backslashchar 645, 647, 669, 670, 671
\@checkend . 138, 173, 213, 248, 294, 311, 335, 354, 426, 452, 523, 525
\@defaultsubs 154, 193, 229, 268, 383, 407
\@dofilelist . . . . . 149, 187, 224, 262, 376, 399, 546, 552, 553
\@empty . . . . . 58, 59, 60, 61, 62, 80, 91, 102, 114, 126, 485, 600, 643
\@enddocumenthook . . . . . 137, 172, 212, 247, 334, 353
\@firstofone . . . . . 79, 90, 101, 113, 125, 136, 171, 211, 246, 688, 691
\@firstoftwo . . . . . 53
\@font@warning . . . . . 151, 190, 226, 265, 378, 402
\@gobble . . . . . 606, 629, 685, 693
\@gobbletwo . . . . . 143, 152, 180, 191, 218, 227, 255, 266, 341, 362, 380, 404, 665
\@ifpackageloaded . . . . . 562, 570
\@ifundefined . . . . . 545
\@latex@warning@no@line . . . . . 159, 198, 234, 273, 387, 411
\@mainaux . 142, 179, 217, 254, 304, 323, 339, 360, 430, 458, 581, 586
\@mainlbl . . . . . 299, 318
\@mlabel . . . . . 579, 605, 626, 653, 665
\@multiplelabels . . . . . 157, 163, 196, 202, 232, 238, 271, 277, 385, 393, 409, 417
\@namedef . . . . . 431, 459
\@newl@bel 144, 181, 219, 256, 342, 363
\@nil . . . . . 493, 504, 611, 618
\@onelevel@sanitize . . . . . 602
\@outputdblcol . . . . . 424, 450
\@partaux . . . . . 340, 361
\@refundefined . . . . . 155, 194, 230, 269, 347, 369
\@secondoftwo . . . . . 55
\@setckpt . 143, 180, 218, 255, 341, 362
\@startlabels . . . 578, 581, 652, 660, 664
\@tempswafalse . . . . . 145, 182, 220, 257, 343, 364, 434, 462
\@testdef . . . . . 144, 181, 219, 256, 342, 363, 432, 433, 460, 461
\@undefined . . 86, 97, 108, 120, 132, 495
\@unexpandable@protect . . . . . 625
\@warning . . . . . 438, 466
\\ . . . . . 624, 754
\{ . . . . . 606, 677
\} . . . . . 678

**A**

\a@enddocument . . . . . 518
\advance . . . . . 718, 726, 741
\AfterEndDocument . . . . . 572
\aftergroup . . . . . 537
\AfterLastShipout . . *2*, 66, 90, 663, 788
\AfterReadingMainAux . . . . . 567
\AP@enddocument . . . . . 508
\AtBeginDocument . 539, 561, 577, 651
\AtEndAfterFileList . . . . . *2*, 72, 113
\AtEndDocument . . . 136, 171, 211, 246, 540, 544, 584, 628, 656, 787
\AtVeryEnd@AfterLastShipoutHook . . . . . 59, 67, 91, 95, 97
\AtVeryEnd@AtEnd 28, 29, 46, 592, 674
\AtVeryEnd@AtEndAfterFileListHook . . . . . 61, 73, 114, 118, 120
\AtVeryEnd@AtVeryEndDocumentHook . 60, 70, 102, 106, 108
\AtVeryEnd@AtVeryVeryEndHook . . . . . 62, 76, 126, 130, 132
\AtVeryEnd@BeforeClearDocumentHook . . . . 58, 64, 80, 84, 86
\AtVeryEnd@c@lenddoca . . . . . 397
\AtVeryEnd@CatchFirst . . . . . 608, 615
\AtVeryEnd@CatchSecond . . . . 609, 611
\AtVeryEnd@document . . . . . 521, 527
\AtVeryEnd@enddocument@booklet 289
\AtVeryEnd@enddocument@combine 352
\AtVeryEnd@enddocument@dinbrief 310
\AtVeryEnd@enddocument@jpsj . . 448
\AtVeryEnd@enddocument@standard . . . . . 170, 291

\AtVeryEnd@enddocument@standard20110627 . . . . . 245
\AtVeryEnd@ifundefined . . . . . 50, 563, 566, 571, 657
\AtVeryEnd@Nil . . . . . 598, 639
\AtVeryEnd@OrgClearpage . . . 528, 530
\AtVeryEnd@PatchLetter 594, 634, 641
\AtVeryEnd@RedefCheckEnd . . . . . 522, 537, 541
\AtVeryEnd@RedefEndDocument . . . . . 494, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520
\AtVeryEnd@SkipToNil . . 490, 493, 503
\AtVeryEnd@StringMlabel . . . . 603, 620
\AtVeryEnd@temp . . 526, 527, 576, 590, 599, 600, 602, 614, 615, 620
\AtVeryEnd@Test . . . . . 480, 497, 498, 499, 500, 501, 502
\AtVeryEnd@test@booklet . . . . . 285
\AtVeryEnd@test@c@lenddoca . . . . 375
\AtVeryEnd@test@combine . . . . . 333
\AtVeryEnd@test@dinbrief . . . . . 293
\AtVeryEnd@test@jpsj . . . . . 422
\AtVeryEnd@test@standard . . . 135, 287
\AtVeryEnd@test@standard20110627 210
\AtVeryEnd@TestEndLetter . . 598, 638
\AtVeryEndDocument . . 2, 69, 101, 790
\AtVeryVeryEnd . . . . . 2, 75, 125

## B

\balancing@outputdblcol . . . . . 424, 450
\BeforeClearDocument . . . . . 2, 63, 79
\BeforeClosingMainAux . . . . . 564
\bibcite . . . . . 433, 461
\body . . . . . 697, 701

## C

\c@labelgen . . . . . 298, 317
\c@lenddoca . . . . . 346, 368, 397
\c@lmainauxfile . . . . . 344, 365
\Call@AfterLastShipout . . . . . 89, 176, 251, 314, 357, 455, 533, 564
\Call@AtEndAfterFileList 111, 124, 188, 263, 327, 400, 474, 548, 556
\Call@AtVeryEndDocument . . . . . 100, 112, 186, 261, 325, 367, 472, 547, 554, 567, 572
\Call@AtVeryVeryEnd . . . . . 123, 207, 282, 330, 372, 477
\Call@BeforeClearDocument . . . . . 78, 174, 249, 312, 355, 453, 531
\catcode 2, 3, 5, 6, 7, 11, 12, 13, 14, 15, 16, 17, 20, 21, 23, 24, 25, 26, 30, 32, 677, 678, 679, 680, 715, 724, 732, 736, 753, 754, 755
\clearpage . . . . . 139, 175, 214, 250, 302, 321, 336, 356, 427, 454, 528, 529, 530, 532, 586, 659, 789
\closeout . . . . . 142, 179, 217, 254, 299, 304, 318, 323, 339, 340, 360, 361, 430, 458
\count@ . . . . . 682, 711, 715, 717, 718, 722, 724, 725, 726, 730, 732, 735, 736, 740, 741
\countdef . . . . . 682
\csname . . . . . 9, 52, 210, 245, 326, 473, 481, 483, 596, 681, 684, 687, 690, 745, 772
\cweb@save@enddocument . . . . . 512

## D

\deadcycles . . . . . 167, 206, 242, 281, 307, 329, 349, 371, 445, 476
\docmute@enddocument . . . . . 517

## E

\EMenddocument . . . . . 516
\end . . . . . 773, 786
\endcsname . . . . . 9, 52, 210, 245, 326, 473, 481, 483, 596, 681, 684, 687, 690, 745, 772
\enddocument . . . . . 507
\enddocumentasusual . . . . . 519
\endinput . . . . . 46
\endletter . . . . . 621, 622, 638
\endlinechar . . . . . 4, 10, 22
\endorigdocument . . . . . 514
\errmessage . . . . . 734

## F

\font@submax 150, 152, 189, 191, 225, 227, 264, 266, 377, 380, 401, 404
\fontsubfuzz 150, 189, 225, 264, 377, 401

## G

\g@addto@macro . . . . 64, 67, 70, 73, 76
\gdef . . . . . 546

## H

\hyper@back@cite@enddocument . . 509
\hyper@enddocument . . . . . 510
\hyper@fn@enddocument . . . . . 511

## I

\if@filesw . . . 141, 156, 178, 195, 216, 231, 253, 270, 297, 316, 338, 359, 384, 408, 429, 457, 580, 585
\if@lastpagebalancing . . . . . 423, 449
\if@tempswa . . . . . 158, 197, 233, 272, 386, 410, 437, 465
\ifdim . . . . 150, 189, 225, 264, 377, 401
\ifnum . . . . 298, 317, 717, 725, 732, 740
\ifx . . 52, 80, 91, 102, 114, 126, 157, 196, 232, 271, 385, 397, 409, 481, 495, 527, 590, 596, 600, 620, 641, 681, 684, 687, 690, 745
\immediate . . . . . 142, 179, 217, 254, 299, 304, 318, 323, 339, 340, 360, 361, 430, 458, 581, 586
\input . . . . . 147, 184, 301, 320, 344, 365, 436, 464, 746
\iterate . . . . . 698, 700, 702

## J

\jobname . . 147, 184, 222, 259, 436, 464
\jobname@lbl . . . . . 301, 320

**K**

\keependdoc . . . . . 515

**L**

\LoadCommand . . . . . 746, 756
\loop . . . . . 696, 712, 723, 731

**M**

\makeatletter . . . . . 146, 183, 221, 258, 300, 319, 344, 365, 435, 463
\makelabels . . . . . 590, 650
\MessageBreak . . . . . 151, 190, 226, 265, 379, 403, 646, 669, 670
\mlabel . . . . . 579, 653

**N**

\NeedsTeXFormat . . . . . 47
\newcommand . . . . . 63, 66, 69, 72, 75, 78, 89, 100, 111, 123
\newlabel . . . . . 432, 460
\newpage . . . . . 295, 313
\next . . . . . 702, 704, 706
\number . . . . . 737

**O**

\old@enddocument . . . . . 520
\on@line . . . . . 485, 643

**P**

\PackageInfo . . . 81, 83, 92, 94, 103, 105, 115, 117, 127, 129, 486, 644
\PackageWarningNoLine . . . . . 668
\prev@enddocument . . . . . 513
\protect . . . . . 625
\ProvidesPackage . . . . . 48

**R**

\RangeCatcodeCheck . . . . . 729, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768
\RangeCatcodeInvalid . . . . . 721, 749, 750, 751, 752
\repeat . . . . . 696, 708, 719, 727, 742
\RestoreCatcodes . . 710, 713, 714, 769

**S**

\space . . . . . 152, 191, 227, 266, 380, 404, 735, 736, 744
\startlabels . . . . . 578, 652

**T**

\Test . . . . . 748, 771
\the . . . . . 10, 11, 12, 13, 14, 15, 16, 17, 30, 555, 715, 735, 736
\TMP@EnsureCode . . . . 27, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45
\toks@ . . . . . 552, 555
\twoclearpage . . . . . 290
\twoupclearpage . . . . . 286

**W**

\write . . . . . 581, 586

**X**

\x . . . . . 8, 20, 627, 632

**Z**

\z@ . . . . . 167, 206, 242, 281, 307, 317, 329, 349, 371, 445, 476