

# Instructions For Use

Version: 4.1 Ref: IFU-BRD3

Revision date: 2023-06-23

---

## **BrilliantDye<sup>®</sup> Terminator v3.1 Cycle Sequencing Kit**

---



**NimaGen.**

Innovators in  
DNA Sequencing  
Technologies



## Product and Company Information

### BrilliantDye™ Terminator v3.1 Cycle Sequencing Kit










BRD3-024, BRD3-100, BRD3-1000, BRD3-5000, BRD3-25K

Research Use Only



NimaGen B.V.  
Hogelandseweg 88  
6545 AB Nijmegen  
The Netherlands  
Tel: +31 (0)24 820 02 41  
Email: [info@nimagen.com](mailto:info@nimagen.com)

## Symbols Used on Product Labels and in Instructions For Use

| Symbol   | Description   |
|--|---|
|   | Manufacturer  |
|   | Use-by date   |
|   | Lot number  |
|   | Reference number  |
|   | Temperature limit for storage   |
|   | Contains sufficient for <n> tests                                       |
|  | Matrix code containing the reference number, lot number and use-by date |

## Product Description

The BrilliantDye™ Terminator v3.1 Cycle Sequencing Kit is a complete kit, based on the trusted Sanger Chain Termination method using capillary electrophoresis. The kit is delivered as a 2.5x concentrated Ready Reaction (RR) Sequencing Premix, fully optimized to provide a robust and highly flexible chemistry, designed for all kinds of DNA sequencing applications, including de novo and resequencing.

BrilliantDye™ is developed for performing fluorescence-based cycle sequencing reactions on single-stranded or double-stranded DNA templates, including PCR fragments and plasmids. BrilliantDye™ generates data with uniform peak heights and optimized signal balance to produce long, high-quality reads, as well as highly accurate base assignments.

BrilliantDye™ Terminator v3.1 Cycle Sequencing Kits are a drop-in replacement for BigDye® Terminator v3.1 Cycle Sequencing Kits without having to change protocol, volume, or setting. The products can be used with other products in the Sanger sequencing workflow (e.g. NimaPOP™ or POP™ polymers and buffers) on Applied Biosystems® 3130, 3500, 3730 and SeqStudio™ Flex Genetic Analyzers.

## Kit Contents and Storage

BrilliantDye™ Terminator v3.1 Cycle Sequencing Kits include all required reagents for sequencing 24, 100, 1000, 5000, or 25000 single-stranded or double-stranded DNA templates.

Each BrilliantDye™ Kit contains 4 reagents: Ready Reaction (RR) Sequencing Premix, 5x Sequencing Buffer, pGEM Control and -21 M13 Primer:

| Reference | Reactions | RR Seq. Premix | 5x Seq. Buffer | pGEM Control | -21 M13 Primer | Storage  |
|-----------|-----------|----------------|----------------|--------------|----------------|--|
| BRD3-024  | 24        | 1 x 192 µL     | 1 x 0.65 mL    | 10 µL        | 10 µL          | Store kit at -15 °C to -25 °C, protected from light and avoid repeated freeze-thaw cycles. |
| BRD3-100  | 100       | 1 x 800 µL     | 1 x 2.0 mL     | 10 µL        | 10 µL          |  |
| BRD3-1000 | 1000      | 10 x 800 µL    | 8 x 2.0 mL     | 50 µL        | 50 µL          |  |
| BRD3-5000 | 5000      | 2 x 20 mL      | 2 x 28 mL      | 50 µL        | 50 µL          |  |
| BRD3-25K  | 25000     | 10 x 20 mL     | 10 x 28 mL     | 50 µL        | 50 µL          |  |

| Contents       | Reference BRD1-024 | Reference BRD1-100 | Reference BRD1-1000 | Reference BRD1-5000 | Reference BRD1-25K |
|----------------|--------------------|--------------------|---------------------|---------------------|--------------------|
| RR Seq. Premix | BRD3-t024          | BRD3-t100          | 10x BRD3-t100       | 2x BRD3-t2500       | 10x BRD3-t2500     |
| 5x Seq. Buffer | 1x BRB-650         | 1x BRB-2000        | 8x BRB-2000         | 2x BRB-110          | 10x BRB-110        |
| pGEM Control   | 1x PGEM-10         | 1x PGEM-10         | 1x PGEM-50          | 1x PGEM-50          | 1x PGEM-50         |
| -21 M13 Primer | 1x M13F-10         | 1x M13F-10         | 1x M13F-50          | 1x M13F-50          | 1x M13F-50         |

## *General Usage Guidelines*

- Avoid excess freeze-thaw cycles (no more than 10). If needed, aliquot the reagents into smaller amounts.
- Before each use of the kit, allow the frozen stocks to thaw on ice or at room temperature (do not heat).
- Keep thawed materials on ice during use. Do not leave reagents at room temperature for extended periods.
- Protect dyes from light to avoid photobleaching.

## **General Precautions**

Read the Material Safety Data Sheet (MSDS) and follow the handling instructions. Adhere to good laboratory practice and wear protective eyewear, gloves and lab coat when handling the reagents and buffers supplied in this kit. Wash body parts with ample amount of water immediately if they come in contact with the reagents and buffers. Seek medical help if needed.

## **Protocol**

The cycle sequencing workflow comprises four steps: 1) prepare DNA templates, 2) perform cycle sequencing, 3) purify cycle sequencing reactions and 4) perform capillary electrophoresis.

### *Purification of PCR Templates*

For optimum results, purify the PCR product before cycle sequencing by removing dNTPs and primers. We recommend NimaGen's AmpliClean™ Magnetic Bead-based PCR Cleanup Kit (AP-005, AP-050, AP-500) or ExS-Pure™ Enzymatic PCR Cleanup Kit (EXS-100, EXS-500, EXS-5000). AmpliClean™ and ExS-Pure™ are the proven equivalents of respective Beckman AMPure XP and Thermo Fisher ExoSAP-IT™ reagents for PCR purification.

### *Template Quality/Quantity*

A common cause of poor sequencing results is the quality or the quantity of the template used for the sequencing reaction. The template should be as much as possible free from proteins, RNA, chromosomal DNA, PCR primers, dNTPs, enzymes, buffer components, salts, organic chemicals and residual detergents.

The quantity of PCR product is optimized to maximize the number of primer binding sites for the BrilliantDye™ reaction and is dependent upon the length and purity of the PCR product.

For setting up the cycle sequencing reaction, use the following guidelines for template quantity:

| DNA Template          | Quantity     |
|-----------------------|--------------|
| PCR 100–200 bp        | 3 – 10 ng    |
| PCR 500–1000 bp       | 5 – 20 ng    |
| PCR 1000–2000 bp      | 10 – 40 ng   |
| >2000 bp              | 20 – 50 ng   |
| Plasmid DNA           | 150 – 300 ng |
| Bacterial genomic DNA | 2 – 3 µg     |

Too low template results in weak signals and elevated signal-to-noise (S/N) ratios; too much template may result in short reads with overloaded signals.

### *Primer Quality/Quantity*

Always use high quality primers for cycle sequencing, as well as for generating PCR templates. The most common cause of primer issues is the so-called N-1 artifact, caused by primer solutions that contain partially non full-length product, causing the typical “n-1 stutter peaks”. We recommend to store sequencing primers in a concentration of 3.2 - 5 µM (pmol/µL) at -20 °C and avoid excess freeze-thaw cycles. Use 3 - 5 pmol sequencing primer per reaction.

### *Diluting and Reaction Setup*

Some cycle sequence reactions may be optimized using diluted 2.5x BrilliantDye™ RR Sequencing Premix. The 5x Sequencing Buffer has been optimized for use with the RR Premix and should be used for any reaction optimization. When diluting, always make sure that the final end reaction concentration is 1x. NOTE: Premix has an intrinsic buffer concentration of 2.5x, i.e. a standard reaction should contain 8 µL of the Premix in an end volume of 20 µL.

However, we do not recommend to use full reactions, in order to prevent overloaded signals and to save material. General rule for using the 5x Sequencing Buffer in combination with the 2.5x BrilliantDye™ RR Sequencing Premix:

$$V_B = (V_T/2.5 - V_M)/2$$

$V_B$  = Volume of 5x Sequencing Buffer in the reaction

$V_T$  = Total sequencing reaction volume

$V_M$  = Volume of BrilliantDye v3.1 RR Sequencing Premix in the reaction

Example of reaction setup:

|   |
|---|
| 1 $\mu$ L 2.5x BrilliantDye™ RR Sequencing Premix ( $V_M$ ) |
| 1.5 $\mu$ L 5x Sequencing Buffer ( $V_B$ )                  |
| 1 $\mu$ L DNA Template                                      |
| 1 $\mu$ L Primer (3.2 - 5 pmol)                             |
| 5.5 $\mu$ L H <sub>2</sub> O                                |
| <hr/>   |
| 10 $\mu$ L ( $V_T$ )  |

### *Perform Cycle Sequencing*

For the cycle sequencing reaction we recommend any brand of high-quality thermal cycler (e.g. Applied Biosystems, Bio-Rad) with the following features:

- 96-well (0.2 mL standard format) or 384-well
  - Heated lid (105 °C)
  - Thermal ramp of approx. 1 °C / sec
  - Ability to cool down to 4 °C at the end of the program
1. Place the tubes or plate(s) in a thermal cycler and set the correct volume:
    - a. 20  $\mu$ L for 96-well reaction plates
    - b. 10  $\mu$ L for 384-well reaction plates
  2. Perform cycle sequencing, using the following thermal protocol

|                      |                              |       |          |
|----------------------|------------------------------|-------|----------|
| Initial denaturation |                              | 96 °C | 45 sec   |
|                      | Denature                     | 96 °C | 10 sec   |
| 25x cycle            | Anneal                       | 50 °C | 5 sec    |
|                      | Extend                       | 60 °C | 4 min    |
|                      | Hold (until ready to purify) | 4 °C  | $\infty$ |

### *Purification of Cycle Sequencing Products*

Prior to capillary electrophoresis, the cycle sequencing products need to be purified, removing unincorporated dye terminators (fluorescent ddNTPs) and salts. We recommend using NimaGen's D-Pure™ DyeTerminator Magnetic Cleanup Kit (DP-005, DP-050, DP-500) as a cost-effective, high-quality cycle sequencing product purification method, in combination with an Alpaqua® 96-well Magnet Plate, also available from NimaGen.



Alternatively, iX-Pure™ DyeTerminator Cleanup Kit (IXP-100, IXP-1000, IXP-2500), the BigDye Xterminator™ equivalent, can be used to effectively remove unincorporated dye terminators, free salts from the post-sequencing reaction and stabilize the post-purification reactions.

### *Capillary Electrophoresis Instrument Compatibility*

The purified extension products can be analyzed by capillary electrophoresis on the following platforms:

- Applied Biosystems® 310 DNA Sequencer
- Applied Biosystems® 3100 (Avant) Genetic Analyzer
- Applied Biosystems® 3130/3100XL Genetic Analyzer
- Applied Biosystems® 3500/3500xL Genetic Analyzer
- Applied Biosystems® 3730/3730xl DNA Analyzer
- Applied Biosystems® SeqStudio™ (Flex) Genetic Analyzer

### *Dye Set / Matrix File / Spectral Calibration*

The BrilliantDye™ Terminator v3.1 Cycle Sequencing Kits are optimized to run with Filterset Z for BigDye® Terminator v3.1. Refer to your instrument manual how to calibrate with this Dye Set. Calibration can be performed using the pGEM Control and -21 M13 Primer included in the kit.

### *Data Analysis*

For primary base calling, the easiest option is to use sequencing analysis software provided with the automated sequencer. We recommend to use the KB Base Caller, in combination with a DyeSet/Primer file, suitable for BigDye® v3.1.

For improved basecalling with longer read lengths, NimaGen recommends PeakTrace (<https://www.nucleics.com/peaktrace/>).

### *Controls*

All BrilliantDye™ Terminator Cycle Sequencing Kits contain pGEM Control and -21 M13 Primer. Use 1 µL of this template and 1 µL of the primer in a cycle sequencing reaction, to verify the performance of your total workflow and troubleshoot issues, correlated to your templates and/or primer.

The sequence of the first part of the pGEM Control:

TGTA AACGACGGCCAGT (-21 M13 primer) -

GAATTGTAATACGACTCACTATAGGGCGAATTCGAGCTCGGTACCCGGGATCCTCTAGAGTCGACCTGCAGGCA  
TGCAAGCTTGAGTATTCTATAGTGTACCTAAATAGCTTGGCGTAATCATGGTCATAGCTGTTTCTGTGTGAAA  
TTGTTATCCGCTCACAATTCACACAACATACGAGCCGGAAGCATAAAGTGTAAGCCTGGGGTGCCTAATGAGT  
GAGCTAACTCACATTAATTGCGTTGCGCTCACTGCCCCTTTCCAGTCGGGAAACCTGTCGTGCCAGCTGCATTA  
ATGAATCGGCCAACGCGCGGGGAGAGGCGGTTTTCGCTATTGGGCGCTCTTCCGCTTCTCGCTCACTGACTCGCT  
GCGCTCGGTTCGCTGCGGCGAGCGGTATCAGCTCAAAAGGCGGTAATACGGTTATCCACAGAATCAGG  
GGATAACGCAGGAAAGAACATGTGAGCAAAAGGCCAGCAAAAGGCCAGGAACCGTAAAAAGGCCGCTTGCTGGC  
GTTTTTCCATAGGCTCCGCCCCCTGACGAGCATCACAAAAATCGACGCTCAAGTCAGAGGTGGCGAAACCCGAC  
AGGACTATAAAGATAACCAGGCGTTTCCCCCTGGAAGCTCCCTCGTGCGCTCTCCTGTTCCGACCCTGCCGCTTAC  
CGGATACCTGTCCGCTTTTCTCCCTTCGGGAAGCGTGGCGCTTTTCTCATAGCTCACGCTGTAGGTATCTCAGTTC  
GGTGTAGGTCGTTTCGCTCCAAGCTGGGCTGTGTGCACGAACCCCCGTTTCAGCCGACCCTGCGCCTTATCCGG  
TAACTATCGTCTTGAGTCCAACCCGGTAAGACACGACTTATCGCCACTGGCAGCAGCCACTGGTAACAGGATTAG  
CAGAGCGAGGTATGTAGGCGGTGCTACAGAGTTCTTGAAGTGGTGGCCTAACTACGGCTACACTAGAAGGACAGT  
ATTTGGTATCTGCGCTCTGCTGAAG

## Customer Support

For technical assistance, please contact us at [techsupport@nimagen.com](mailto:techsupport@nimagen.com).

## Revision History

| Section | Summary of changes   | Version | Date       |
|---------|--|---------|------------|
| All     | Not applicable. New document.  | 4.0     | 2019-05-29 |
| All     | New layout. New introduction (Product Description). Kit Contents and Storage. General Precautions. | 4.1     | 2023-06-23 |

## Legal Notice

BrilliantDye and NimaPOP are (registered) trademarks of NimaGen B.V.; all other product names and trademarks are the property of their respective owners.

## Disclaimer

Although the information in this document is presented in good faith and believed to be correct at the time of printing, NimaGen makes no representations or warranties as to its completeness or accuracy. NimaGen has no liability for any errors or omissions in this document, including your use of it.

## Published by

NimaGen B.V.  
Hogelandseweg 88  
6545 AB Nijmegen  
The Netherlands  
[www.nimagen.com](http://www.nimagen.com)

© 2023 NimaGen  
All rights reserved.