

GE Healthcare

# illustra GenomiPhi V2 DNA Amplification Kit

Product Web Protocol

Codes: 25-6600-30  
25-6600-31  
25-6600-32



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# 1. Legal

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## 1.1. Product use restriction/warranty

The **GenomiPhi V2 DNA Amplification Kit** components have been designed, developed, and sold **for research purposes only**. They are suitable **for *in vitro* use only**. Not recommended or intended for diagnosis of disease in humans or animals. No claim or representation is intended for its use to identify any specific organism or for clinical use (diagnostic, prognostic, therapeutic, or blood banking). Do not use internally or externally in humans or animals.


It is the responsibility of the user to verify the use of the **GenomiPhi V2 DNA Amplification Kit** for a specific application range as the performance characteristic of this kit has not been verified to a specific organism.

# 2. Handling. Safety Warnings and Precautions

## 2.1. Handling, preparation, and storage of starting materials

 **This kit is sensitive to small amounts of DNA. Wear gloves and safety glasses to avoid contamination.**

This product and its components should be handled only by persons trained in laboratory techniques and used in accordance with the principles of good laboratory practice. All chemicals should be considered potentially hazardous; therefore, when handling chemical reagents, it is advisable that suitable protective clothing, such as laboratory overalls, safety glasses and gloves be worn. Care should be taken to avoid contact with skin or eyes. In case of contact with skin or eyes, wash immediately with water. See the appropriate Material Safety Data Sheet for specific recommendations.

 **GenomiPhi™ V2 Amplification Kit is optimized for whole genome amplification from at least 10 ng of high quality genomic DNA template.** Use of less DNA or low quality DNA (such as degraded DNA, or DNA from formalin fixed paraffin embedded samples) can result in amplification bias.

No amplification product is produced in the absence of template DNA up to 1.5 hours amplification. However, if amplification reactions are carried out for more than 1.5 hours, they may produce some artifact DNA synthesis in no-template controls.

 **Wear gloves at all times during the preparation to avoid contamination.**

## 2.2. Storage conditions

Store the kit at -70°C.

The enzyme mix must be stored at -70°C; all other components may be stored at -20°C. Thaw components on ice and maintain at 0°C to 4°C during handling.

## 2.3. Expiry

This product has been designed to deliver high quality results for up to 12 months from the manufacturing date. Please refer to the detail expiration date on the product label.

# 3. Components

## 3.1 Kit Contents

### Genomiphi V2 DNA Amplification Kit

Cat. No.	500 Reactions	100 Reactions	25 Reactions
	25-6600-32	25-6600-31	25-6600-30
Sample Buffer (Green Cap)	5 x 0.9 ml	1 x 0.9 ml	1 x 225 µl
Reaction Buffer (Blue Cap)	5 x 0.9 ml	1 x 0.9 ml	1 x 225 µl
Enzyme Mix (Yellow Cap)	5 x 100 µl	1 x 100 µl	1 x 25 µl
Control DNA (Lambda), 10 ng/µl	1 x 20 µl	1 x 20 µl	1 x 20 µl

## 3.2. Reagents to be supplied by the user

**Liquid-handling supplies** - Vials, pipettes, micro centrifuge, and vacuum centrifuge. Perform all amplification reactions in plastic micro centrifuge tubes (typically 0.5 ml), or in 96-well or 384-well plates suitable for sealing and incubating at 30°C.

**Thermocycler or water baths** - for incubations at 30°C, 65°C and 95°C.

# 4. Product description

## 4.1 The basic principle

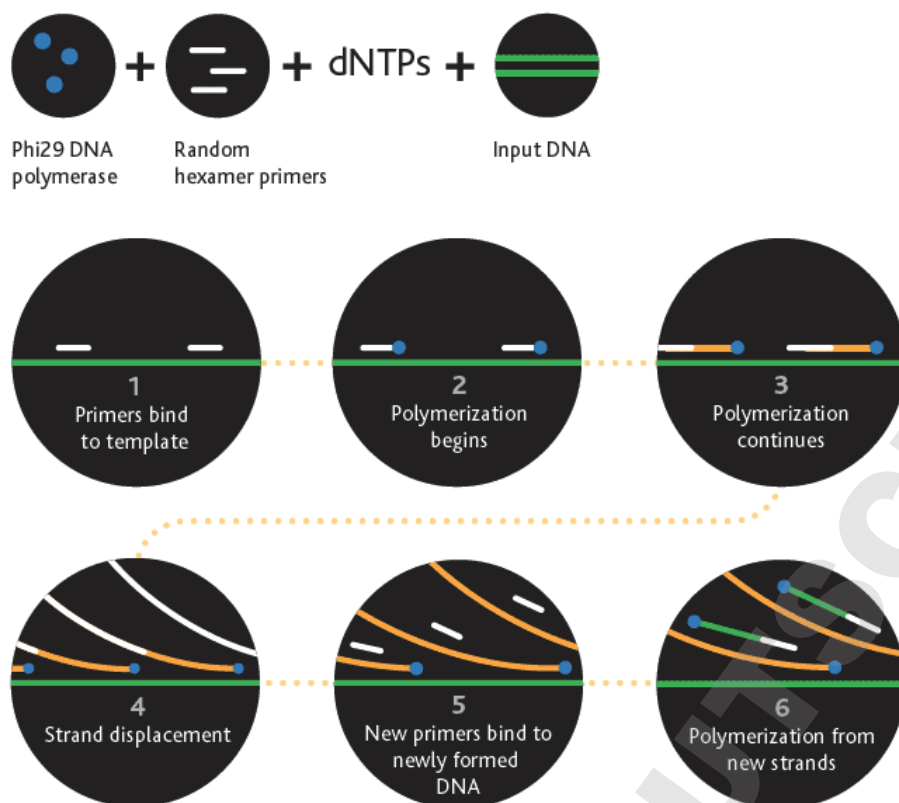
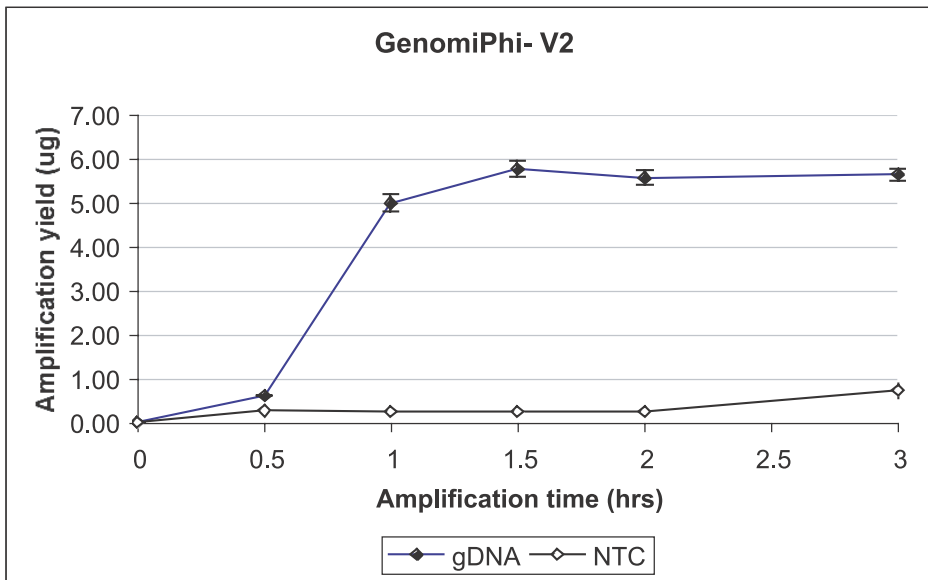


Figure 1 Overview of the **GenomiPhi V2 DNA Amplification Kit** procedure

Figure 1 shows an overview of whole genome amplification by isothermal stand displacement using the **GenomiPhi V2 DNA Amplification Kit**. DNA is briefly heat-denatured then cooled in sample buffer containing random hexamers that non-specifically bind to the DNA. A master-mix containing DNA polymerase, additional random hexamers, nucleotides, salts and buffers is added and isothermal amplification proceeds at 30°C for 1.5 hours. After amplification the enzyme is heat inactivated during 10 minute incubation at 65°C.

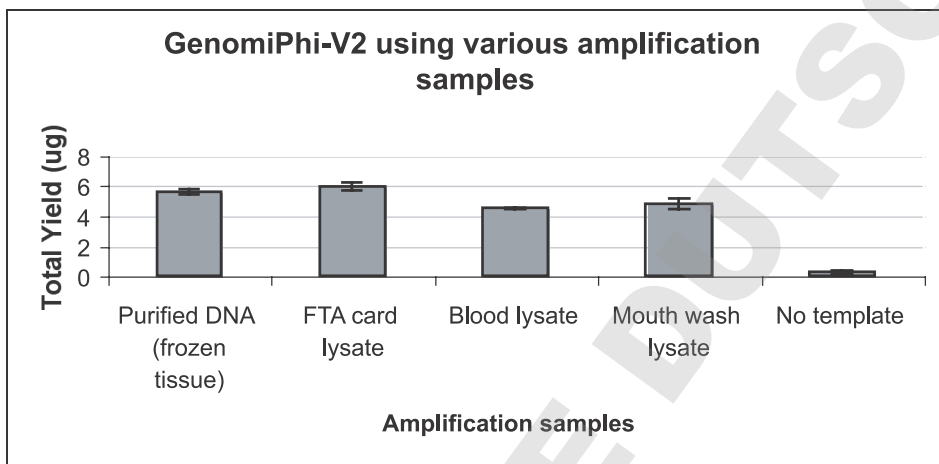
## 4.2 Kit specifications

Typical amplification kinetics with **GenomiPhi V2 DNA Amplification Kit** is shown in Figure 2 below. Microgram quantities of DNA are generated from nanogram amounts of starting material in 1.5 hours. Typical DNA yields from a **GenomiPhi V2 DNA Amplification Kit** reaction are 4–7 µg per 20 µl reaction when starting with 10 ng of purified DNA. Kinetics will vary if crude or un-quantified samples are amplified. Increased reaction times (2 hours) may be helpful for samples such as crude blood or buccal swabs. Reactions containing no DNA do not produce any product during 1.5 h reactions. The average product length is greater than 10 kb. DNA replication is extremely accurate due to the proofreading 3'– 5' exonuclease activity of the DNA polymerase (3, 4).



**Figure 2** Amplification kinetics of a **GenomiPhi V2 Amplification Kit** reaction.

Figure 2 shows the comparison of amplification of 10 ng purified gDNA with no template control (NTC). Most commercial DNA isolation kits and homemade purification procedures produce suitable DNA for the amplification

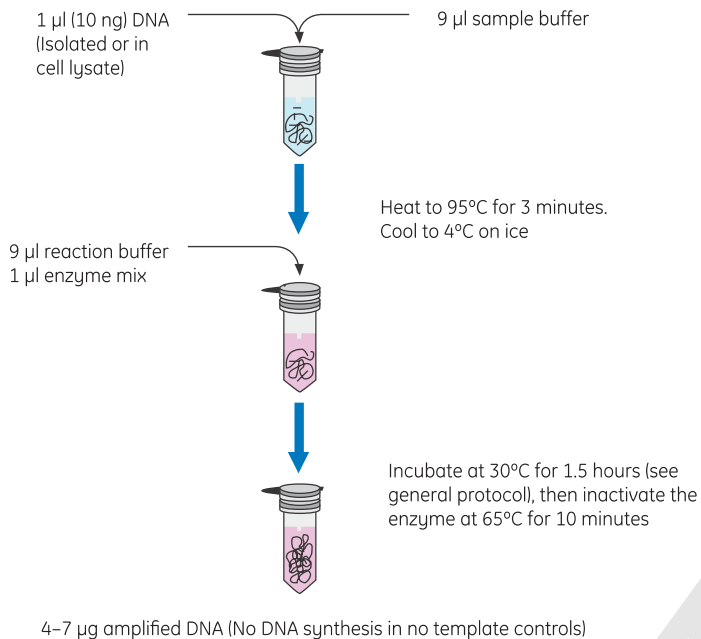


**Figure 3** Amplification of various samples using **GenomiPhi V2 Amplification Kit**.

Figure 3 shows the amplification yields for **GenomiPhi V2 Amplification Kit** using purified DNA (10 ng) or non-purified cell lysates. Amplification protocols are described later in the booklet.

# 5. Protocols

## 5.1. Short Protocol



**Figure 4** Schematic representation of **GenomiPhi V2 Amplification Kit** protocol.

## 5.2 General Protocol

The steps outlined below describe a general protocol for amplifying template DNA. This protocol should be considered a starting point for optimizing the reaction in your laboratory.

### 1. Mix sample buffer with template DNA

Add **9 µl** Sample Buffer to **1 µl** of 10 ng template DNA.      9 µl Sample Buffer



Template DNA should be resuspended in TE or water.

1 µl DNA Template (10 ng)

### 2. Denature template DNA

Heat the samples to **95°C** for **3 minutes** then cool to **4°C** on ice.



Heating the DNA for longer than 3 minutes or at higher temperatures can cause damage to the DNA.

95°C  
for 3 minutes



### 3. Prepare the master mix for each amplification reaction

For each amplification reaction, on ice combine **9 µl** of Reaction Buffer with **1 µl** of Enzyme Mix.      9 µl Reaction Buffer  
1 µl Enzyme Mix





Prepare the master mix only in sufficient quantities and immediately prior to use. Keep the master mix on ice and discard any unused portion. The master mix contains all the components required for DNA amplification and will generate amplification products if exposed to temperatures > 4°C for sufficient time.




<p><b>4. Transfer master mix to cooled sample.</b> Add <b>10 µl</b> of prepared master mix from <b>Step 3</b> to each cooled sample, on ice.</p>	<p>10 µl Master Mix</p>
<p><b>5. Incubate for DNA amplification.</b> Incubate the samples at <b>30°C</b> for <b>1.5 hours</b>.</p>	<p>30°C for 1.5 hours</p>
<p><b>6. Inactivate the Phi29 DNA polymerase enzyme.</b> Heat the samples to <b>65°C</b> for <b>10 minutes</b> then cool to <b>4°C</b>.</p>	<p>65°C for 10 minutes</p>
<p> Heating is required to inactivate the exonuclease activity of the DNA polymerase which may otherwise begin to degrade the amplification product.</p>	
<p><b>7. Storage of amplified material</b> Store amplification reactions at <b>-20°C</b>.</p>	
<p> GenomiPhi DNA V2 amplification products should be stored and treated as genomic DNA.</p>	

## 5.3 Chemical denaturation and amplification of template DNA

The steps outlined below describe a general protocol for amplifying template DNA.

<p><b>1. Prepare denaturation solution and neutralization buffer.</b></p>	
<p><b>Denaturation Solution</b></p>	
<p>400 mM KOH 10 mM EDTA</p>	
<p><b>Neutralization Buffer</b></p>	
<p>400 mM HCl 600 mM Tris-HCl, pH 7.5</p>	
<p><b>2. Denature template DNA</b> Mix <b>1 µl</b> of template (10 ng) with <b>1 µl</b> of Denaturation Solution. Incubate at room temperature for 3 minutes.</p>	<p>1 µl of DNA + 1 µl Denaturation Solution</p>
<p> Mix by pipetting up and down. Do not vortex.</p>	
<p><b>3. Neutralize DNA solution.</b> Add <b>1 µl</b> of Neutralization Buffer and store on ice.</p>	<p>1 µl Neutralization Buffer</p>
<p> Mix by pipetting up and down. Do not vortex.</p>	
<p><b>4. Prepare the master mix for each amplification reaction</b></p>	
<p>For each amplification reaction, on ice combine <b>7 µl</b></p>	


of Sample Buffer and **9 µl** of Reaction Buffer, with **1 µl** of Enzyme Mix.

 Prepare the master mix only in sufficient quantities and immediately prior to use. Keep the master mix on ice and discard any unused portion. The master mix contains all the components required for DNA amplification and will generate amplification products if exposed to temperatures > 4°C for sufficient time.


<b>5. Transfer master mix to cooled sample.</b> Add <b>17 µl</b> of prepared master mix from <b>Step 4</b> to each cooled sample, on ice.	17 µl Master Mix
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<b>6. Incubate for DNA amplification.</b> Incubate the samples at 30°C for <b>1.5 hours</b> .	30°C for 1.5 hours
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<b>7. Phi29 DNA polymerase enzyme.</b> Heat the samples to <b>65°C</b> for <b>10 minutes</b> then cool to <b>4°C</b> .	65°C for 10 minutes
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 Heating is required to inactivate the exonuclease activity of the DNA polymerase which would otherwise begin to degrade the amplification product.

<b>8. Storage of the amplified material</b> Store amplification reactions at <b>-20°C</b> .	
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 GenomiPhi DNA V2 amplification products should be stored and treated as genomic DNA.

## 5.4 DNA amplification from blood cells

**Note:** Components of blood (e.g. heme) can be inhibitory to the GenomiPhi reaction. Amplification is faster and more reproducible when the blood sample contains relatively low blood components prepared by such as dilution. A reaction time of 2 hours is suggested.

<b>1. Prepare cell lysis solution and neutralization buffers.</b>	
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**Cell lysis solution**

400 mM KOH

10 mM EDTA

100 mM DTT

**Neutralization Buffer**

400 mM HCl

600 mM Tris-HCl, pH 7.5

<b>2. Cell lysis</b> Dilute blood 3 times with physiological buffer, e.g., PBS. Add one part of this mixture with one part of cell lysis solution. Mix well with gentle tapping and incubate on ice for 10 minutes.	1 µl of diluted blood cells + 1 µl cell lysis solution 10 minutes on ice
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Mix by pipetting up and down. Do not vortex.

**3. Neutralize cell lysate.**

Add one part of neutralization buffer to the cell lysate, mix well and store on ice.

1  $\mu$ l Neutralization Buffer



Mix by pipetting up and down. Do not vortex.

**4. Prepare the master mix for each amplification reaction**

For each amplification reaction, on ice combine **7  $\mu$ l** of Sample Buffer and **9  $\mu$ l** of Reaction Buffer, with **1  $\mu$ l** of Enzyme Mix.



Prepare the master mix only in sufficient quantities and immediately prior to use. Keep the master mix on ice and discard any unused portion. The master mix contains all the components required for DNA amplification and will generate amplification products if exposed to temperatures  $> 4^{\circ}\text{C}$  for sufficient time.

**5. Transfer master mix to cooled sample.**

Add **17  $\mu$ l** of prepared master mix from **Step 4** to each cooled sample, on ice.

17  $\mu$ l Master Mix

**6. Incubate for DNA amplification.**

Incubate the samples at  $30^{\circ}\text{C}$  for **2 hours**.

$30^{\circ}\text{C}$  for 2 hours

**7. Phi29 DNA polymerase enzyme.**

Heat the samples to  **$65^{\circ}\text{C}$**  for **10 minutes** then cool to  **$4^{\circ}\text{C}$** .

$65^{\circ}\text{C}$  for 10 minutes



Heating is required to inactivate the exonuclease activity of the DNA polymerase which would otherwise begin to degrade the amplification product.

**8. Storage of the amplified material**

Store amplification reactions at  **$-20^{\circ}\text{C}$** .



GenomiPhi DNA V2 amplification products should be stored and treated as genomic DNA.

## 5.5 DNA amplification from cheek cells (mouth wash or buccal swab)

**1. Prepare cell lysis solution and neutralization buffers.**

**Cell lysis solution**

400 mM KOH  
10 mM EDTA  
100 mM DTT

**Neutralization Buffer**

400 mM HCl  
600 mM Tris-HCl, pH 7.5

**2. Cell lysis**

Wash cheek cells (from mouth wash or buccal swab) with PBS and centrifuge. To the cell pallet add enough cell lysis solution (**10 µl**) to submerge the cells completely. Mix well with gentle tapping and incubate on ice for 10 minutes.

Palleted cheek cells  
+  
10 µl cell lysis solution  
10 minutes on ice



Mix by pipetting up and down. Do not vortex.

**3. Neutralize cell lysate.**

Add one part of neutralization buffer (**10 µl**) to the cell lysate, mix well and store on ice.

10 µl Neutralization Buffer



Mix by pipetting up and down. Do not vortex.

**4. Prepare the master mix for each amplification reaction**

For each amplification reaction, on ice combine **9 µl** of Sample Buffer and **9 µl** of Reaction Buffer, with **1 µl** of Enzyme Mix.



Prepare the master mix only in sufficient quantities and immediately prior to use. Keep the master mix on ice and discard any unused portion. The master mix contains all the components required for DNA amplification and will generate amplification products if exposed to temperatures > 4°C for sufficient time.

**5. Transfer master mix to 1 µl of cooled cell lysate.**

Add **19 µl** of prepared master mix from **Step 4** to **1 µl** of neutralized cell lysate on ice.

19 µl  
Master Mix

**6. Incubate for DNA amplification.**

Incubate the samples at **30°C** for **2 hours**.

30°C  
for 2 hours

**7. Phi29 DNA polymerase enzyme.**

Heat the samples to **65°C** for **10 minutes** then cool to **4°C**.

65°C  
for 10 minutes



Heating is required to inactivate the exonuclease activity of the DNA polymerase which would otherwise begin to degrade the amplification product.

**8. Storage of the amplified material** Store amplification reactions at **-20°C**.



GenomiPhi DNA V2 amplification products should be stored and treated as genomic DNA.

## 5.6 DNA amplification from blood or buccal swab-blotted paper (e.g., Whatman's FTA paper or Guthrie card)

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### 1. Prepare cell lysis solution and neutralization buffers.

#### Cell lysis solution

400 mM KOH  
10 mM EDTA  
100 mM DTT

#### Neutralization Buffer

400 mM HCl  
600 mM Tris-HCl, pH 7.5

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### 2. Cell lysis

Cut the blood-blotted FTA paper in small pieces such as 3 mm x 3 mm square or punch out a 3 mm diameter circle from it, and wash the blotted FTA card piece with FTA purification reagent (Whatman catalog number WB120204) in a micro centrifuge tube. Add enough **(10 µl)** cell lysis solution to submerge the paper completely. Mix well with gentle tapping and incubate on ice for **10 minutes**.

Washed FTA card piece blotted with blood or cheek cells + 10 µl cell lysis solution

10 minutes on ice



Mix by pipetting up and down. Do not vortex.

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### 3. Neutralize cell lysate.

Add one part of neutralization buffer **(10 µl)** to the cell lysate, mix well and store on ice.

10 µl Neutralization Buffer



Mix by pipetting up and down. Do not vortex.

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### 4. Prepare the master mix for each amplification reaction

For each amplification reaction, on ice combine **9 µl** of Sample Buffer and **9 µl** of Reaction Buffer, with **1 µl** of Enzyme Mix.



Prepare the master mix only in sufficient quantities and immediately prior to use. Keep the master mix on ice and discard any unused portion. The master mix contains all the components required for DNA amplification and will generate amplification products if exposed to temperatures > 4°C for sufficient time.

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### 5. Transfer master mix to 1 µl cooled cell lysate.

Add **19 µl** of prepared master mix from **Step 4** to **1 µl** of neutralized cell lysate on ice.

19 µl  
Master Mix

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### 6. Incubate for DNA amplification.

Incubate the samples at **30°C** for **2 hours**.

30 °C  
for 2 hours

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### 5. Phi29 DNA polymerase enzyme.

Heat the samples to **65°C** for 10 minutes then cool to **4°C**.



Heating is required to inactivate the exonuclease activity of the DNA polymerase which would otherwise begin to degrade the amplification product.

65°C  
for 10 minutes

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### 6. Storage of the amplified material

Store amplification reactions at **-20°C**.



GenomiPhi DNA V2 amplification products should be stored and treated as genomic DNA.

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## 5.7 Quantification of amplification products

Quantification is generally not required as every reaction will yield approximately the same amount of DNA. **Quant-iT™ PicoGreen® dsDNA quantification reagent** (Invitrogen, P7581) is recommended if accurate quantitation is required.



Quantification of non-purified amplification products by UV absorption will generate inaccurate results due to the presence of unused hexamers in the completed reaction.

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### 1. Prepare TE buffer.

Dilute the concentrated 20 x TE buffer included in the kit to 1 x concentration using water.

Prepare 1 x TE buffer



Use only sterile, distilled, DNase free water when preparing the dilution to ensure accurate quantification.

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### 2. Prepare 1:25 dilution of PicoGreen reagent.

Determine the required volume of a 1:25 dilution of PicoGreen reagent.

- Volume = 100 µl/sample x # of samples

Determine the volume of stock PicoGreen reagent necessary to produce the required volume of a 1:25 dilution

- Volume =  $\frac{\text{volume of required dilution}}{25}$



Reagent adsorbs to glass surfaces. Use plastic ware only. Protect the solution from light at all times.

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### 3. Prepare the λ DNA standard curve. Dilute the λ DNA standard supplied in the Quant-iT PicoGreen® kit to a **10 ng/µl** working solution. Use this working stock to prepare a standard curve (see below).

**Add 100 µl** of each dilution to each well of the assay plate.

---

Standard Number	λ DNA (10ng)	λ DNA (10 ng/μl)	1 x TE
1	600	60 μl	40 μl
2	500	50 μl	50 μl
3	400	40 μl	60 μl
4	200	20 μl	80 μl
5	100	10 μl	90 μl
6	50	5 μl	95 μl
7	25	2.5 μl	97.5 μl
8	0	0 μl	100 μl

**4. Dilute the GenomiPhi V2 amplification products.**

**Dilute** the GenomiPhi V2 amplification products 1:10 by **adding 180 μl** of 1 x TE to each amplification reaction. Due to the viscosity of the amplification product, mix amplification products thoroughly by vortexing heavily.

Dilute 1:10

**5. Add diluted GenomiPhi amplification products to the assay plate.**

Aliquot **90 μl** of 1 x TE into each sample well. **Add 10 μl** of diluted sample for a final volume of **100 μl**.

90 μl of TE  
+  
10 μl of diluted sample



Because the amplification product is diluted **before** the assay, the dilution factor must be taken into consideration when calculating total yields.

**6. Add diluted PicoGreen to sample wells.**

**Add 100 μl** of the 1:25 dilution of PicoGreen to all wells containing standards and samples. Mix contents well by pipetting up and down.

Seal the plate with foil and spin in micro plate centrifuge for 1 minute at < 200 x g to eliminate bubbles.



Protect plate from light at all times. The plate must be read 5-10 minutes after addition of PicoGreen reagent to ensure accurate quantification

**7. Measure the sample fluorescence.**

Place the sample assay plate into a fluorescence micro plate reader.

Set the fluorescence reader at the following parameters:

- Excitation wavelength: **480 nm**
- Emission wavelength: **520 nm**
- Gain: **Optimal**



If it is not possible to set the instrument gain to optimal, find a way to have the instrument read the sample where the highest DNA concentration generates readings that fall within the linear dynamic range of the

instrument.

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**8. Calculate the concentration of the amplification product.**

Generate a standard curve of fluorescence versus DNA concentration. Determine the concentration of GenomiPhi V2 Kit amplified products from the equation of the line derived from the standard curve.

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# 6. Appendix

## 6.1 Troubleshooting

Problem	Possible cause and suggestions
<b>Reduced yield/ no amplification product</b>	<b>Contamination of template DNA</b> <ul style="list-style-type: none"><li>• Excessive contaminants carried over from the starting material can inhibit the DNA polymerase. Dilute or clean-up the DNA and re-amplify.</li><li>• Extending the amplification time will help when inhibitory material is causing reduced yields.</li></ul>
	<b>Inactive Enzyme</b> <ul style="list-style-type: none"><li>• It is critical that the enzyme be stored properly. The <b>Enzyme Mix</b> should be stored at <b>-70°C</b>. If the material will be consumed within <b>2 months</b>, <b>-20°C</b> storage may be used. The freezer must <b>not</b> be a frost-free unit.</li><li>• Perform a control reaction to confirm performance of the enzyme.</li></ul>
	<b>Low quality DNA</b> <ul style="list-style-type: none"><li>• Amplification kinetics strongly favors intact templates. Avoid template preparation steps that can damage DNA.</li></ul>
	<b>Prolonged denaturation</b> <ul style="list-style-type: none"><li>• Heating at <b>95°C</b> for 3 minutes is sufficient to denature template DNA and facilitate primer annealing. Longer denaturing times can nick the template and decrease the amplification efficiency.</li></ul>
<b>Poor performance in downstream applications</b>	<b>Degraded/low amounts of template DNA</b> <ul style="list-style-type: none"><li>• In the absence of input DNA or poor quality of input DNA, there will be no or minimal DNA synthesis in the amplification reactions within 2 hours.</li><li>• Degraded or low amounts of starting DNA template may not amplify consistently or representatively. Increase the amount of starting DNA.</li><li>• Use high quality genomic DNA for amplification.</li></ul>
	<b>Inhibition of optimized downstream conditions</b> <ul style="list-style-type: none"><li>• Starting material components can inhibit amplification reaction. Purify the starting material using a suitable column prior to amplification.</li><li>• For some downstream applications, components of the GenomiPhi V2 reaction will alter previously optimized downstream conditions. Purify the amplification products using a suitable column after amplification.</li></ul>

## 6.2 References

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2. Lizardi, P. *et al.*, *Nat. Genet.* **19**, 225–232 (1998).
3. Estaban, J.A. *et al.*, *J. Biol. Chem.* **268**, 2719–2726 (1993).
4. Nelson, J.R. *et al.*; *BioTechniques* **32**, S44–S47 (2002).

## 6.3 Related Products

### DNA Purification Products

GFX™ Genomic Blood DNA Purification Kit  
Nucleon™ BACC Genomic DNA Extraction Kits  
GFX™ Micro Plasmid Prep Kit  
MicroSpin™ Columns  
GFX™ PCR DNA and Gel Band Purification Kit  
CyScribe™ GFX™ Purification Kit  
ProbeQuant™ G-50 Micro Columns

### PCR Products

PureTaq™ Ready-To-Go™ PCR Beads  
FideliTaq™ PCR Master Mix  
dNTP Set, 100 mM Solution (dATP, dGTP, dCTP, dTTP)  
Exo-SAP IT  
Taq Polymerase™

### Sequencing Products

MegaBACE™ DNA Analysis System  
DYEnamic™ ET Dye Terminator Cycle Sequencing Kit  
Autoseq™ G-50

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