

# PfuUltra High-Fidelity DNA Polymerase AD

Catalog #600385, 600387, and 600389  
600385-12, Revision E0

## Laboratory Reagent.

## MATERIALS PROVIDED

Materials provided	Quantity		
	Catalog #600385	Catalog #600387	Catalog #600389
PfuUltra High-Fidelity DNA Polymerase AD	100 U	500 U	1000 U
10× PfuUltra HF Reaction Buffer AD	1 ml	2 × 1 ml	4 × 1 ml

**Storage:** Store at –20°C upon receipt.

## Technical Services

**US and Canada:** Call (800) 227-9770 (option 3, 4, 3).  
Or send an e-mail to [genomics@agilent.com](mailto:genomics@agilent.com)

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## INTRODUCTION

PfuUltra High-Fidelity DNA Polymerase AD features a reformulated buffer system for increased economy with the same high performance as the original PfuUltra DNA polymerase for robust, ultra-high-fidelity PCR. As with the original PfuUltra DNA polymerase, PfuUltra high-fidelity DNA polymerase AD is a mixture of a genetically-engineered higher-fidelity mutant of Pfu DNA polymerase and the exclusive thermostable ArchaeMaxx polymerase-enhancing factor,<sup>1</sup> which enhances PCR product yields and increases target length capability. PfuUltra high-fidelity DNA polymerase AD is an ideal choice for PCR cloning and other applications that require the highest-accuracy amplification. PfuUltra DNA polymerase AD exhibits an extremely low error rate of only 1 error per 2,500,000 bases, while Pfu DNA polymerase produces approximately 1 error per 770,000 bases and Taq DNA polymerase produces approximately 1 error every 125,000 bases.

## OPTIMIZATION PARAMETERS (50 µL REACTION VOLUME)

Parameter	Genomic DNA Targets ≤6 kb or Vector DNA Targets ≤10 kb	Genomic DNA Targets >6 kb or Vector DNA Targets >10 kb	cDNA Targets
Extension time	1 minute per kb	2 minutes per kb	2 minutes per kb
PfuUltra High-Fidelity DNA polymerase AD	2.5 U	5.0 U	5.0 U
Input template	50–100 ng genomic DNA; 100 pg–30 ng vector DNA	200–250 ng genomic DNA; 100 pg–30 ng vector DNA	1–2 µl cDNA (from cDNA synthesis reaction)
Primers (each)	100–200 ng (0.2–0.5 µM)	200 ng (0.5 µM)	100–200 ng (0.2–0.5 µM)
dNTP concentration	200–250 µM each dNTP	500 µM each dNTP	200–250 µM each dNTP
Final reaction buffer conc.	1.0×	1.5× for genomic DNA or 1.0× for vector DNA	1.0× (supplemented with 1 mM MgSO <sub>4</sub> )
Denaturing temperature	95°C	92°C	95°C
Extension temperature	72°C	68°C	68°C

## PCR PROTOCOL

The reaction conditions given here are for amplification of a typical single-copy chromosomal target of ≤6 kb. See the *Optimization Parameters* section for guidelines on amplifying longer targets, vector DNA targets, or cDNA targets. The reaction conditions are for one reaction and must be adjusted for multiple samples. The final volume of each reaction is 50 µl.

1. Add the components *in order* into sterile thin-walled PCR tubes while mixing gently.

### Reaction Mixture for a Typical Single-Copy Chromosomal Locus PCR Amplification (≤6 kb)

Component	Amount per reaction
Distilled water (dH <sub>2</sub> O)	40.6 µl
10× PfuUltra HF Reaction Buffer AD <sup>a</sup>	5.0 µl
dNTP mix (25 mM each dNTP)	0.4 µl
DNA template (100 ng/µl)	1.0 µl
Primer #1 (100 ng/µl)	1.0 µl <sup>b</sup>
Primer #2 (100 ng/µl)	1.0 µl <sup>b</sup>
PfuUltra High-Fidelity DNA Polymerase AD (2.5 U/µl)	1.0 µl <sup>c</sup>
Total reaction volume	50 µl

<sup>a</sup> The 10× buffer provides a final 1× Mg<sup>2+</sup> concentration of 2 mM. When amplifying cDNA, add Mg<sup>2+</sup> to a final 1× concentration of 3 mM. (For example, Mg<sup>2+</sup> concentration may be adjusted to 3 mM in the final 50-µl reaction volume by adding 2 µl of a PCR-grade 25 mM MgSO<sub>4</sub> solution and reducing the amount of dH<sub>2</sub>O to 38.6 µl.)

<sup>b</sup> The recommended primer concentration of 0.2–0.5 µM corresponds to 100–200 ng for a typical 18- to 25-mer oligonucleotide primer in a 50-µl reaction volume.

<sup>c</sup> The amount of PfuUltra DNA polymerase AD varies depending on the length of the PCR target. The standard amount for vector targets up to 10 kb and genomic targets up to 6 kb in length is 1 µl (2.5 U).

- If the extension time is >30 minutes, overlay each reaction with ~50 µl of DNase-, RNase-, and protease-free mineral oil (Sigma, St. Louis, Missouri).
- Perform PCR using optimized cycling conditions. Suggested cycling parameters for *PfuUltra* high-fidelity DNA polymerase AD-based PCR are provided below. (Optimized cycling parameters are not necessarily transferable between thermal cyclers. Consult the instrument manufacturer's recommendations if further optimization of cycling parameters is required.) Analyze the PCR amplification products on a 0.7–1.0% (w/v) agarose gel.

#### Genomic DNA Targets ≤6 kb and Vector DNA Targets ≤10 kb

Segment	Number of cycles	Temperature	Duration
1	1	95°C <sup>a</sup>	1 minute
2	30	95°C	30 seconds
		Primer $T_m - 5^\circ\text{C}$	30 seconds
		72°C	1 minute per kb
3	1	72°C	10 minutes

#### Genomic DNA Targets >6 kb, Vector DNA Targets >10 kb, and cDNA Targets

Segment	Number of cycles	Temperature	Duration
1	1	92°C <sup>b</sup>	2 minutes
2	10	92°C <sup>b</sup>	10 seconds
		Primer $T_m - 5^\circ\text{C}$	30 seconds
		68°C	2 minutes per kb
3	20	92°C	10 seconds
		Primer $T_m - 5^\circ\text{C}$	30 seconds
		68°C	2 minutes per kb plus 10 seconds per cycle

<sup>a</sup> Denaturing temperatures above 95°C are recommended only for GC-rich templates.

<sup>b</sup> For cDNA targets, use a denaturation temperature of 95°C.

## TROUBLESHOOTING AND APPLICATION NOTES

- Low yield:** If PCR product yields are lower than expected, optimize the extension time, amount of DNA template (excess DNA can inhibit PCR), and amount of *PfuUltra* high-fidelity DNA polymerase AD. Optimize the PCR program denaturation time (typically 30–60 seconds at 95°C is sufficient; prolonged denaturation steps may damage the template DNA) and the annealing temperature. Extraneous salts contributed by primer or template DNA solutions may inhibit the PCR reaction. Use high-quality, gel purified primers and highly-purified template DNA.
- Multiple bands:** The annealing temperature may require optimization. Typically annealing temperatures will range between 55°C and 72°C. Try adding Agilent Perfect Match PCR Enhancer to improve specificity. Redesign primers.
- PCR adjuncts and cosolvents:** Including a cosolvent, such as 1–10% (v/v) DMSO or 5–20% glycerol, or an adjunct, such as 1.25–10% formamide or 0.01–1 U of Agilent Perfect Match PCR Enhancer, in the PCR reaction may increase performance for some targets/cycling programs.
- PCR cloning:** If generating PCR fragments for cloning applications, use the StrataClone Blunt PCR Cloning Kit (Catalog #240207) or another blunt PCR cloning strategy. *PfuUltra* high-fidelity DNA polymerase AD does **not** exhibit terminal deoxynucleotidyltransferase (TdT) activity, which is characterized by the addition of nontemplate-directed nucleotide(s) at the 3' end of PCR-generated fragments.

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## REFERENCES

- Hogrefe, H. H., Hansen, C. J., Scott, B. R. and Nielson, K. B. (2002) *Proc Natl Acad Sci U S A* 99(2):596–601.
- Cline, J., Braman, J. C. and Hogrefe, H. H. (1996) *Nucleic Acids Res* 24(18):3546–51.

## MSDS INFORMATION

Material Safety Data Sheets (MSDSs) are provided online at [www.agilent.com](http://www.agilent.com). MSDS documents are not included with product shipments.