



2× Phanta[®] Max Master Mix

NB-54-0155-01

NB-54-0155-02

NB-54-0155-03

2x Phanta® Max Master Mix

Cat# NB-54-0155-01 size : 1ml

Cat# NB-54-0155-02 size : 5 x 1ml

Cat# NB-54-0155-03 size : 15 x 1ml

01/Product Description

Phanta Max Super-Fidelity DNA Polymerase is a new generation superior enzyme based on Phanta DNA Polymerase for robust PCR with higher fidelity. The unique extension factor, specificity-promoting factors and plateau un-inhibitory factor newly added to Phanta Max greatly improve its long-fragment amplification ability, specificity, and PCR yield. Phanta Max is capable of amplifying long fragments such as 40 kb λ DNA, 40 kb plasmid DNA, 20 kb genomic DNA and 10 kb cDNA. The amplification error rate of Phanta Max is 53-fold lower than that of conventional Taq and 6-fold lower than that of Pfu. In addition, Phanta Max has a good resistance to PCR inhibitors and can be used for direct PCR amplifications of bacteria, fungi, plant tissues, animal tissues, and even whole blood samples. Phanta Max contains two monoclonal antibodies inhibiting the 5'→3' polymerase activity and 3'→5' exonuclease activity at room temperature, which enable Phanta Max to perform hot start PCR with great specificity. This kit contains Phanta Max Super-Fidelity DNA Polymerase, dNTP, and an optimized buffer system. It contains all required reaction components, except primers and templates, thereby simplifying the operation process and improving the detection throughput and repeatability. Protective agents in the 2 × Phanta Max Master Mix enable the resistance to repeated freezing and thawing. Amplification will generate blunt-ended products, which are compatible with ClonExpress and Top Cloning kit (Neo Biotech # NB-54-0002-01 /-02; NB-54-0003-01 /-02; NB-54-0004-01 /-02; NB-54-0009-01 /-02).

02/Components

	NB-54-0155-01	NB-54-0155-02	NB-54-0155-03
2x Phanta® Max Master Mix	1 ml	5x 1ml	15x 1ml

03/Storage

Store at -30 ~ -15°C and transport at ≤0°C.

▲ Avoid repeated freezing and thawing.

04/Applications

This product is suitable for PCR amplification using genomic DNA, cDNA, Plasmid DNA and crude samples as templates.

05/Unit Definition

One unit (U) is defined as the amount of enzyme that incorporates 10 nmol of dNTP into acid-insoluble material in 30 min at 74°C with activated salmon sperm DNA as the template/primer.

06/Notes

1. Please use high quality DNA as templates.
2. Please ensure that the primers and templates do not contain uracil. And do not use dUTP.
3. Phanta Max Super-Fidelity DNA Polymerase has strong proof-reading activity. If TA cloning needs to be performed, please perform purification before dA-tailing.
4. Primer Design
 - It is recommend that the last base at the 3' end of primer should be G or C.
 - Consecutive mismatches should be avoided in the last 8 bases at the 3' end of the primer.
 - Avoid hairpin structures at the 3' end of the primer.
 - Differences in the T_m value of the forward primer and the reverse primer should be no more than 1°C and the T_m value should be adjusted to 55 to 65°C (Primer Premier 5 is recommended to calculate the T_m value).
 - Extra additional primer sequences that are not matched with the template, should not be included when calculating the primer T_m value.
 - Control the GC content of the primer to be 40% - 60%.
 - The overall distribution of A, G, C, and T in the primer should be as even as possible. Avoid using regions with high GC or AT contents.
 - Avoid the presence of complementary sequences of 5 or more bases either within the primer or between two primers and avoid the presence of complementary sequences of 3 or more bases at the 3' end of two primers.
 - Use the NCBI BLAST function to check the specificity of the primer to prevent non-specific amplification.

07/Experiment Process

07-1/For Conventional PCR

Recommended PCR System

Keep all components on ice during the experiment. Thaw, mix and briefly centrifuge each component before use. And put back to -20°C for storage.

Components	Volume
ddH ₂ O	up to 50 µl
2 × Phanta Max Master Mix	25 µl
Primer 1 (10 µM)	2 µl
Primer 2 (10 µM)	2 µl
Template DNA*	x µl

▲ The PCR Enhancer (Neo Biotech # NB-54-0123-01) is recommended for unsuccessful amplification of fragments with GC content >60%.

* Optimal reaction concentration varies in different templates. In a 50 µl system, the recommended template usage is as follows :

Template Type	Input Template DNA
Genomic DNA	50 - 400 ng
Plasmid or Virus DNA	10 pg - 30 ng
cDNA	1 - 5 µl (≤1/10 of the total volume of PCR system)

Recommended PCR Program

Steps	Temperature	Time	Cycles
Initial-denaturation ^a	95°C	30 sec/3 min	1
Denaturation	95°C	15 sec	} 25 - 35
Annealing ^b	56 ~ 72°C	15 sec	
Extension ^c	72°C	30 - 60 sec/kb	
Final Extension	72°C	5 min	1

▲ For initial-denaturation, the recommended temperature is 95°C, and the recommended time is 30 sec for plasmid/virus DNA and 3 min for genomic DNA/cDNA.

▲ Set the annealing temperature according to the T_m value of the primers. If the T_m value of the primers is higher than 72°C, the annealing step can be removed (two-step PCR). If necessary, annealing temperature can be further optimized through setting temperature gradient. In addition, the amplification specificity depends directly on the annealing temperature. Raising annealing temperature is helpful to improve amplification specificity.

▲ Longer extension time is helpful to increase the products yield.

07-2/For Long-fragment PCR

Phanta Max Super-Fidelity DNA Polymerase can extraordinarily perform a long-fragment amplification with high specificity and yields. If the recommended program fails to work, the following Touch Down two-step PCR may be helpful:

Steps	Temperature	Time	Cycles
Initial-denaturation	95°C	3 min	1
Denaturation	95°C	15 sec	} 5
Extension	74°C	60 sec/kb	
Denaturation	95°C	15 sec	} 5
Extension	72°C	60 sec/kb	
Denaturation	95°C	15 sec	} 5
Extension	70°C	60 sec/kb	
Denaturation	95°C	15 sec	} 25
Extension	68°C	60 sec/kb	
Final Extension	68°C	5 min	1

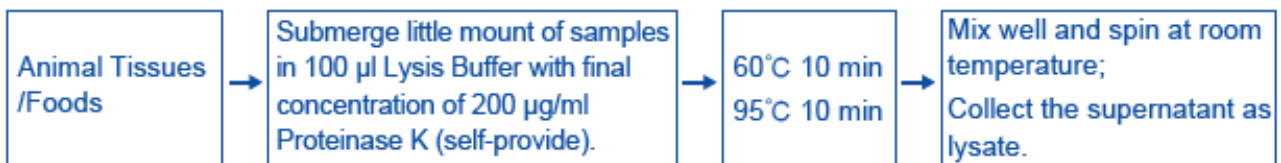
▲ It is recommended to use high-quality templates and long primers. Increasing the input amount of template DNA may be helpful to improve the products yield.

07-3/For PCR Using Crude Sample as Template

Phanta Max Super-Fidelity DNA Polymerase has good resistance to PCR inhibitors and can be used for direct PCR amplifications of bacteria, fungi, plant tissues, animal tissues, and even whole blood samples. Crude samples that have been successfully amplified with Phanta Max Master Mix are as follows :

Sample Type	Amplification Method	Template Recommendation (for a 50 µl PCR system)
Whole Blood	Direct PCR	1 - 5 µl
Dry Serum Filter Paper	Direct PCR	1 - 2 mm ² filter paper
Cultured Cells	Direct PCR	Little amount of cells
Yeast	Direct PCR	A monoclonal or 1 µl suspension
Bacteria	Direct PCR	A monoclonal or 1 µl suspension
Mildew	Direct PCR	Little amount of sample
Sperm	Direct PCR	Little amount of sample
Plankton	Direct PCR	Little amount of sample
Plant Tissue	Direct PCR	1 - 2 mm ² tissue
Mouse Tail	PCR with lysate	1 - 5 µl lysate
Food	PCR with lysate	1 - 5 µl lysate

▲ Lysate Preparation:



Lysis Buffer: 20 mM Tris-HCl, 100 mM EDTA, 0.1% SDS, pH 8.0 (not included in this kit)

08/Examples

08-1/Amplification of Various Long Fragments

Taking human genomic DNA as templates, the target fragments of 0.6 kb, 1.0 kb, 2.6 kb, 3.0 kb, 4.0 kb, 5.1 kb, 6.2 kb, 7.1 kb, 8.5 kb, 10.6 kb, 17.8 kb, 20.3 kb, and 21.4 kb were amplified, respectively. The T_m value of all primers are approximately 60°C (calculated by Primer Premier 5). The reaction system and program are as follows:

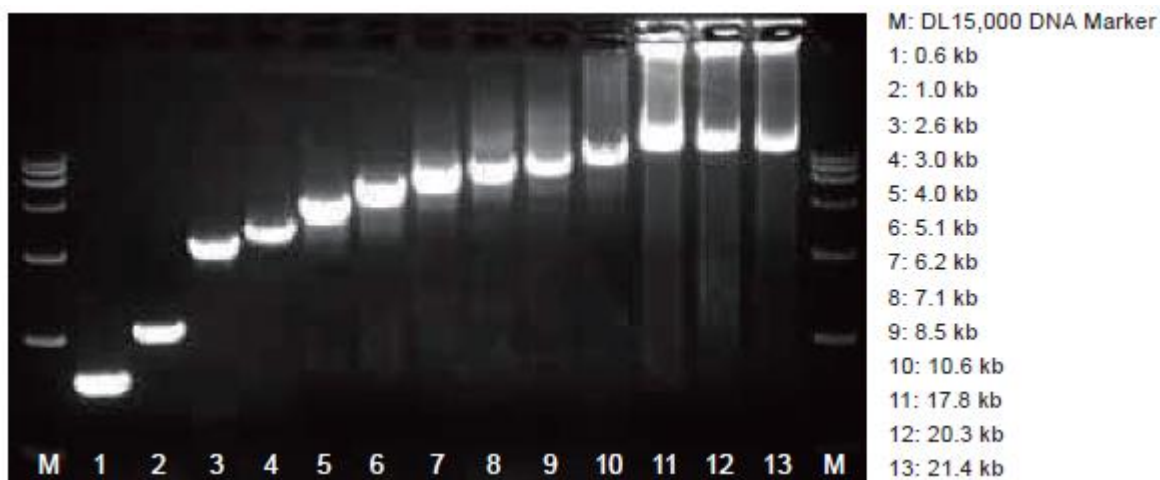
Recommended PCR System

Components	Volume
ddH ₂ O	up to 50 μ l
2 × Phanta Max Master Mix	25 μ l
Primer 1 (10 μ M)	2 μ l
Primer 2 (10 μ M)	2 μ l
Human Genomic DNA (100 ng/ μ l)	1 μ l

Recommended PCR Program

Steps	Temperature	Time	Cycles
Initial-denaturation	95°C	3 min	
Denaturation	95°C	15 sec	} 35
Annealing	60°C	15 sec	
Extension	72°C	30 sec/kb	
Final Extension	72°C	5 min	

Electrophoresis Results of the PCR Products



08-2/Stable Amplification Ability of Crude Samples

1. Taking the **human whole blood** collected with EDTA blood collection tube as template, a target fragment of 1,295 bp was amplified with 2 × Phanta Max Master Mix, a high fidelity DNA polymerase from company A, and a high fidelity DNA polymerase from company B, respectively. In addition, 2 × Phanta Max Master Mix was used to amplify longer fragments (3,276 bp and 8,513 bp). The T_m value of all primers are around 60°C (calculated by Primer Premier 5). The reaction system and program are as follows:

Components	Volume
ddH ₂ O	up to 50 µl
2 × Phanta Max Master Mix	25 µl
Primer 1 (10 µM)	2 µl
Primer 2 (10 µM)	2 µl
Whole Blood*	x µl

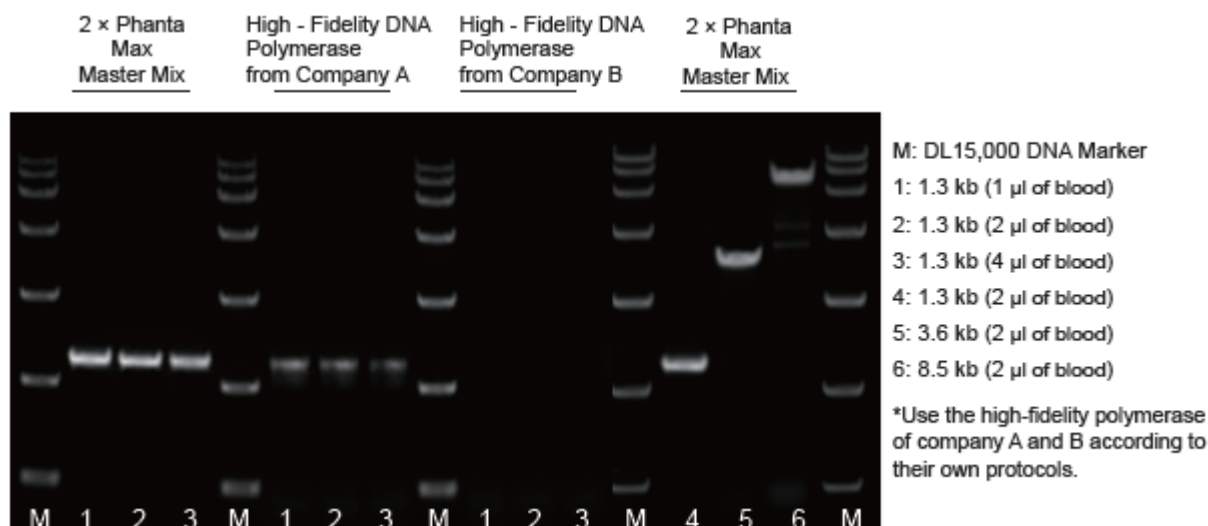
*The input amounts of the whole blood are 1 µl, 2 µl, 4 µl, respectively

Recommended PCR Program

Steps	Temperature	Time	Cycles
Initial-denaturation	95°C	3 min	
Denaturation	95°C	15 sec	} 35
Annealing*	60/63/70°C	15 sec	
Extension	72°C	30 sec/kb	
Final Extension	72°C	5 min	

* The annealing temperatures for 1.3 kb, 3.6 kb and 8.5 kb of target fragments are 60°C, 63°C, and 70°C, respectively.

Electrophoresis Results of the Amplification Products



2. Taking the **tomato leaf, rice leaf, polished rice** as templates, and the purified genomic DNA from rice leaf as positive control, target fragments of 1.3 kb were amplified with 2 × Phanta Max Master Mix, a high fidelity DNA polymerase from company A, and a high fidelity DNA polymerase from company B, respectively. The T_m value of all primers are approximately 60°C (calculated by Primer Premier 5). The reaction system and program are as follows:

Recommended PCR System

Components	Volume
ddH ₂ O	up to 50 µl
2 × Phanta Max Master Mix	25 µl
Primer 1 (10 µM)	2 µl
Primer 2 (10 µM)	2 µl
Plant Tissues*	x µl

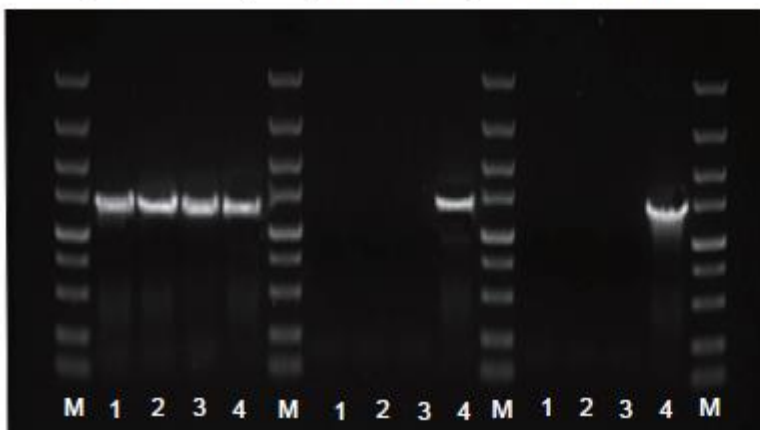
*The recommended diameter of the plant tissues is 0.3 - 3 mm.

Recommended PCR Program

Steps	Temperature	Time	Cycles
Initial-denaturation	95°C	3 min	} 35
Denaturation	95°C	15 sec	
Annealing	60°C	15 sec	
Extension	72°C	30 sec/kb	
Final Extension	72°C	5 min	

Electrophoresis Results of the Amplification Products

2 × Phanta Max Master Mix High - Fidelity DNA Polymerase from Company A High - Fidelity DNA Polymerase from Company B



M: DL 5,000 DNA Marker

1: Tomato leaf

2: Rice leaf

3: Polished rice

4: Purified genomic DNA from rice leaf

*Use the high-fidelity polymerase of company A and B according to their own protocols.

3. Using the lysate of **mouse tails** as templates, a target fragment of 2.5 kb was amplified with 2 × Phanta Max Master Mix from Vazyme, a high fidelity DNA polymerase from company A, and a high fidelity DNA polymerase from company B, respectively. The T_m value of all primers are approximately 60°C (calculated by Primer Premier 5). The reaction system and program are as follows:

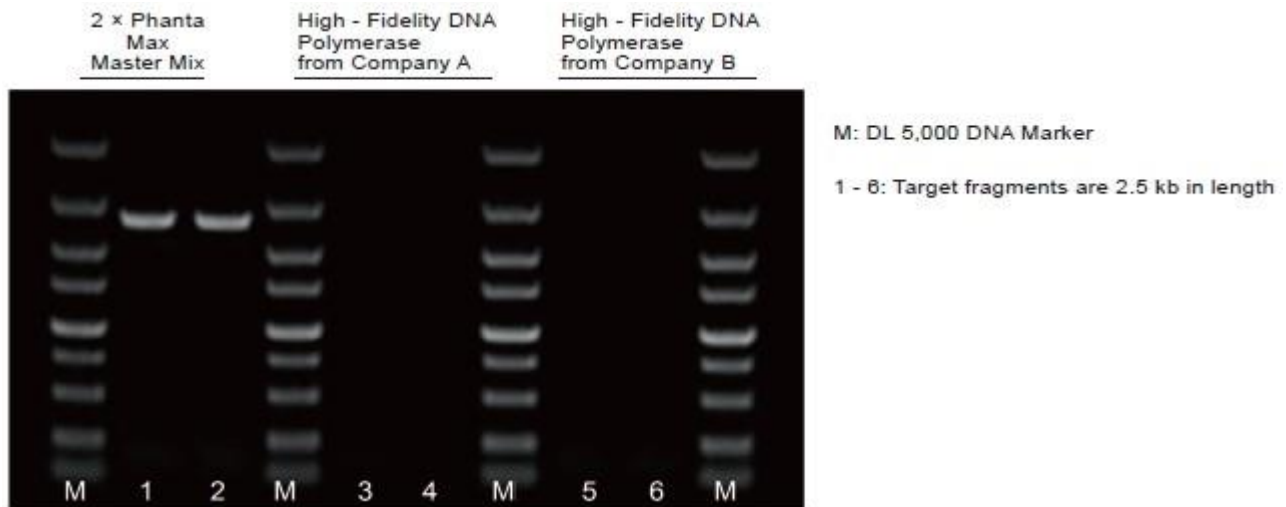
Recommended PCR System

Components	Volume
ddH ₂ O	up to 50 µl
2 × Phanta Max Master Mix	25 µl
Primer 1 (10 µM)	2 µl
Primer 2 (10 µM)	2 µl
Lysate of Mouse Tails	2 µl

Recommended PCR Program

Steps	Temperature	Time	Cycles
Initial-denaturation	95°C	3 min	
Denaturation	95°C	15 sec	} 35
Annealing	60°C	15 sec	
Extension	72°C	30 sec/kb	
Final Extension	72°C	7 min	

Electrophoresis Results of the Amplification Products

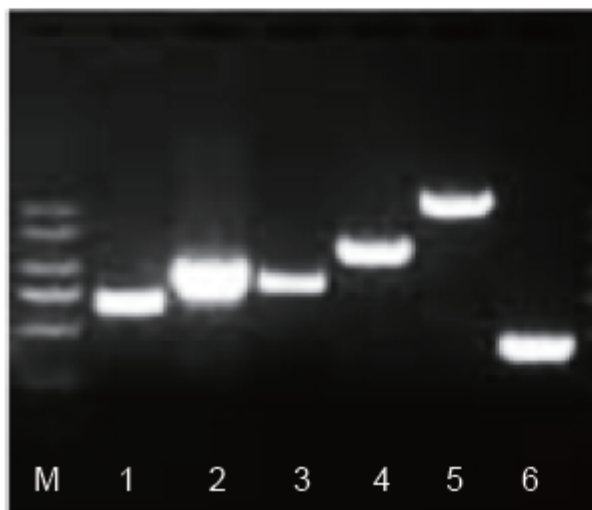


08-3/Excellent Ability of Fragments with High GC Content

2 × Phanta Max Master Mix is capable of amplifying GC-rich fragments that conventional polymerase cannot amplify. Taking human genomic DNA as templates, target fragments of 654 bp, 900 bp, 800 bp, 1,200 bp, 1,400 bp, and 426 bp were amplified, respectively. The GC contents of all these amplicons are higher than 68%. High amplification efficiency is shown in the following figure. The T_m value of all primers are approximately 60°C (calculated by Primer Premier 5). Refer to 07-1 for reaction system preparation, and the PCR program is as follows:

Steps	Temperature	Time	Cycles
Initial-denaturation	95°C	3 min	} 35
Denaturation	95°C	15 sec	
Extension	72°C	45 sec/kb	
Final Extension	72°C	5 min	

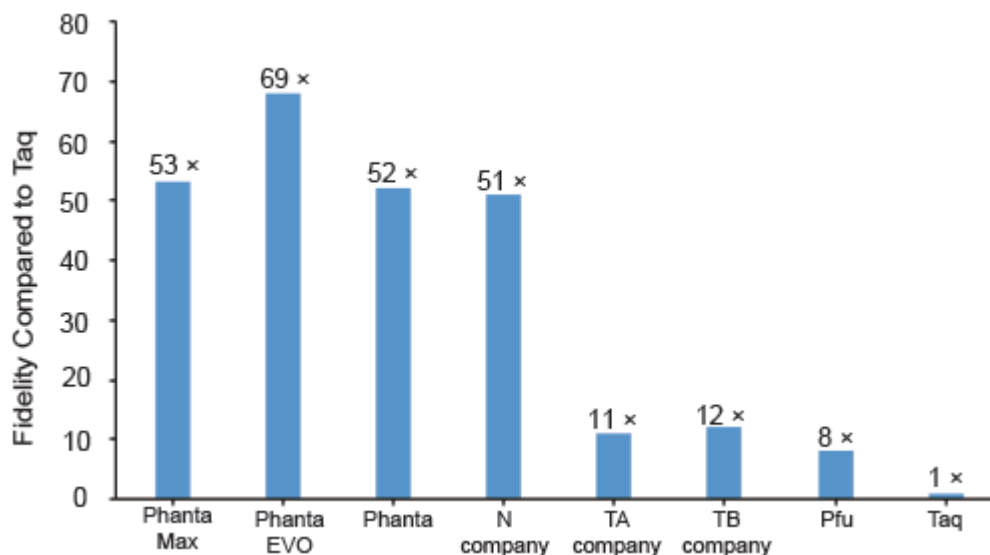
Electrophoresis Results of the Amplification Products



- M: DL 2,000 DNA Marker
- 1: 654 bp, 68.1% GC Content
 - 2: 900 bp, 69.4% GC Content
 - 3: 800 bp, 71.3% GC Content
 - 4: 1,200 bp, 73.5% GC Content
 - 5: 1,400 bp, 74.7% GC Content
 - 6: 426 bp, 76.8% GC Content

08-4/Reliable High Fidelity

The amplification fidelity of Phanta Max Super-Fidelity DNA Polymerase is 53-fold superior than that of Taq DNA Polymerase and 6-fold higher than that of Pfu DNA Polymerase. The following figure shows a comparison of amplification fidelity among various polymerases detected by Lacl Assay (Cline, J. et al. Nucleic Acids Research. 24:3546-3551(1996)).



09/FAQ & Troubleshooting

◇ **No amplification products or low amount of amplification products**

1. Primer: Optimize primer design
2. Annealing temperature: Set temperature gradient and find the optimal annealing temperature
3. Primer concentration: Increase the primer concentration appropriately
4. Extension time: Appropriately increase the extension time
5. Cycles: Increase the cycles to 35 - 40
6. Template purity: Use templates with high purity
7. Input amounts of template: Refer to the recommended amounts and appropriately increase the input amounts

◇ **Unspecific products or smear bands**

1. Primer: Optimize primer design
2. Annealing temperature: Set temperature gradient and increase the annealing temperature
3. Primer concentration: Decrease the final concentration of primer to 0.2 μ M
4. Extension time: Appropriately decrease the extension time when larger unspecific fragments appear
5. Cycles: Decrease the cycles to 25 - 30
6. PCR program: Use two-step method or Touch Down PCR program
7. Template purity: Use templates with high purity
8. Input amounts of template: Refer to the recommended amounts and appropriately decrease the input amounts