

Product Information

JumpStart™ REDTaq™ ReadyMix™ PCR Reaction Mix

Product Code **P 0982**

Technical Bulletin Code MB-780

TECHNICAL BULLETIN

Product Description

JumpStart™ REDTaq™ ReadyMix™ combines the performance and convenience benefits of Sigma's REDTaq Genomic DNA polymerase and the advantages of JumpStart Taq Antibody for hot start¹ PCR[†] in an easy-to-use reaction mixture. This is the ideal solution for performing high-throughput PCR, combining quick setup time with the ability to load samples immediately after PCR onto agarose gels. This ready-to-use mixture of JumpStart REDTaq Genomic DNA polymerase, 99% pure deoxynucleotides and reaction buffer is provided in a 2× concentrate for ease-of-use. Add 25 µl of the 2× mix, DNA template, primers and water. At room temperature, the JumpStart Taq antibody inactivates the REDTaq Genomic DNA polymerase. When the temperature is raised above 70 °C in the first denaturation step of the cycling process, the complex dissociates and the polymerase becomes fully active. After amplification, the sample is loaded directly onto an agarose gel. The unique inert red dye acts as a tracer, migrating slightly faster than bromophenol blue. There are no special preparations or protocol changes required. JumpStart REDTaq DNA polymerase offers the same high quality performance as regular Taq DNA polymerase.

- The ideal ReadyMix for high throughput and/or multiplex PCR applications.
- For a typical PCR reaction, mix 25 µl of JumpStart REDTaq ReadyMix with 25 µl of a mixture containing template DNA, primers, and water. Reaction volume can be scaled if desired.
- A hot start mechanism using JumpStart Taq antibody, which prevents non-specific product formation, allows assembled PCR reactions to be placed at room temperature for up to 2 hours without compromising the performance.

- When performing a large number of PCR reactions, JumpStart REDTaq ReadyMix can save a significant amount of preparation time, reduce the risk of contamination from multiple pipetting steps, and provide consistent batch-to-batch and reaction-to-reaction performance.
- The red tracer means quick recognition of reactions to which enzyme has been added as well as visual confirmation of complete mixing.
- The enzyme formulation allows aliquots (5-10 µl) from the PCR to be directly loaded onto an agarose gel without addition of loading buffers.
- The red tracer serves as a tracking dye comigrating with a 125 bp fragment in a 1% agarose gel.

Because the red tracer has no effect on the amplification process, a sample can be easily re-amplified as in "nested PCR". The presence of the dye also has no effect on automated DNA sequencing, ligation, exonucleolytic PCR product digestion, and transformation. Although exceptions may exist, the dye is generally inert in restriction enzyme digestions. If necessary, the dye can be removed from the amplicon by routine purification methods.

Unit Definition: One unit incorporates 10 nmol of total deoxyribonucleoside-triphosphates into acid precipitable DNA in 30 min at 74 °C.

Reagents

- JumpStart REDTaq ReadyMix, Product Code P 0982, 20 mM Tris-HCl, pH 8.3, 100 mM KCl, 4 mM MgCl₂, 0.002% gelatin, 0.4 mM each dNTP (dATP, dCTP, dGTP, TTP), inert dye, stabilizers, 0.06 unit/µl Taq DNA Polymerase, JumpStart Taq antibody. Provided as 20 and 100 reactions.

Storage/Stability

JumpStart REDTaq ReadyMix can be stored at 2-8 °C up to 6 months so there is no waiting for the reaction components to thaw. It can also be stored at -20 °C, long term. There was no detectable loss of performance after 10 freeze-thaw cycles.

Materials and Reagents Required but not Provided

- PCR Reagent water, Product Code W 1754
- Primers
- DNA template
- Thermal cycler
- 0.2 and 0.5 ml PCR microcentrifuge tubes, thin-walled, Product Codes P 3114 and P 3364
- Mineral Oil, Product Code M 8662 (optional)
- Betaine, Product Code B 0300 (optional)
- DMSO, Product Code D 8418 (optional)

Precautions and Disclaimer

Sigma's JumpStart REDTaq ReadyMix is for R&D use only. Not for drug, household or other uses. Refer to the Material Safety Data Sheet (MSDS).

Procedure

Optimal concentrations of template DNA, MgCl₂, KCl and PCR adjuncts as well as pH are often target specific. If further optimization is needed for specific template and primers, additional components (MgCl₂, dNTPs, KCl, betaine, etc.) can be added to the template/primer mixture, although this is not required for most applications. The following procedure serves as a reference.

Note: DMSO up to 5% (v/v) is compatible with the system and does not interfere with PCR. However, other cosolvents, solutes (e.g., salts), and extremes in pH, or other reaction conditions may reduce the affinity of the JumpStart Taq antibody for the Taq polymerase and thereby compromise its effectiveness.

1. Add the following reagents to a 0.2 ml or 0.5 ml thin-walled microcentrifuge tube.

Volume	Reagent	Final Concentration
25 µl	2×JumpStart REDTaq ReadyMix	1×
---	Forward primer (20 µM)	0.4 µM
---	Reverse primer (20 µM)	0.4 µM
---	Template DNA	1-200 ng
q.s.	Water	
50 µl	Total volume	

Note: A template-primer mix is recommended when performing multiple reactions.

2. Mix gently by vortexing and briefly centrifuge to collect all components at the bottom of the tube.
3. Add 50 µl of mineral oil to the top of each tube to prevent evaporation (optional, depending on model of thermal cycler).
4. Optimum cycling parameters vary with PCR composition and thermal cycler. It may be necessary to optimize the cycling parameters to achieve maximum product yield and/or quality.

Typical cycling parameters for 0.2–2 kb fragments:

Initial denaturation	94 °C	2 min
30-35 cycles:		
Denaturation	94 °C	30 sec
Annealing	55 °C to 68 °C	30 sec
Extension	72 °C	2 min
Final extension	72 °C	5 min
Hold	4 °C	

5. The amplified DNA can be evaluated by loading 5-10 µl of the PCR reaction directly onto an agarose gel. It is not necessary to add a separate loading buffer/tracking dye.

†The PCR process is covered by patents owned by Hoffman-LaRoche, Inc.

References

1. Dieffenbach, C., and Dveksler, G., (Eds.), *PCR Primer: A Laboratory Manual*, Cold Spring Harbor Laboratory Press, Cold Spring Harbor, NY, 1995. (Product Code Z36,411-8).
2. Rees, W. A., et al., *Biochemistry*, **32**, 137-144 (1993).
3. Don, R. H., et al., *Nucleic Acids Res.*, **19**, 4008 (1991).
4. Huang, L. M., and Jeang, K.-T., *Biotechniques*, **16**, 242-246 (1994).
5. Kwok, S., and Higuchi, R., *Nature*, **339**:237-238 (1989).

JumpStart REDTaq ReadyMix Troubleshooting Guide

Problem	Possible Cause	Solution
No PCR product is observed	A PCR component is missing or degraded.	A positive control should always be run to insure components are functioning. A checklist is also recommended when assembling reactions.
	Too few cycles were performed.	Increase the number of cycles (3-5 additional cycles at a time).
	The annealing temperature is too high.	Decrease the annealing temperature in 2-4 °C increments.
	The primers are not designed optimally.	Confirm the accuracy of the sequence information. If the primers are less than 27 nucleotides long, try to lengthen the primer to 27-33 nucleotides. If the primer has a GC content of less than 45%, try to redesign the primer with a GC content of 45-60%.
	There is not enough template.	After increasing the number of cycles has shown no success, repeat the reaction with a higher concentration of template.
	The template is of poor quality.	Evaluate the template integrity by gel electrophoresis. It may be necessary to repurify template using methods that minimize shearing and nicking.
	The denaturation temperature is too high or too low.	Optimize the denaturation temperature by increasing or decreasing the temperature in 1 °C increments.
	The denaturation time is too long or too short.	Optimize the denaturation time by increasing or decreasing it in 10 second increments.
	The extension time is too short.	Increase the extension time in 2 minute increments.
	Target template is complex.	In most cases, inherently complex targets are due to unusually high GC content and/or secondary structure. Betaine has been reported to help amplification of high GC content templates at a concentration of 0.8-1.3 M. ²
There are multiple or smeared products	The annealing temperature is too low.	Increase the annealing temperature in increments of 2-3 °C.
	The primers are not designed optimally.	Confirm the accuracy of the sequence information. If the primers are less than 27 nucleotides long, try to lengthen the primers to 27-33 nucleotides. If the primer has a GC content of less than 45%, try to redesign the primers with a GC content of 45-60%.
	Touchdown PCR may be required.	“Touchdown” PCR significantly improves the specificity of many PCR reactions in various applications. Touchdown PCR involves using an annealing/extension temperature that is higher than the T_M of the primers during the initial PCR cycles. The annealing/extension temperature is then reduced to the primer T_M for the remaining PCR cycles. The change can be performed in a single step or in increments over several cycles. ³

JumpStart REDTaq ReadyMix Troubleshooting Guide (continued)

Problem	Possible Cause	Solution
There are multiple or smeared products (continued)	Too many cycles were performed.	The nonspecific bands may be eliminated by reducing the number of cycles.
	The template concentration is too high.	Reduce the concentration of the template in the PCR reaction.
	The template concentration is too low.	Add additional template in 50 ng increments for genomic DNA or 1-2 ng for viral DNA.
There is no reduction of nonspecific PCR bands when using the JumpStart enzyme.	The antibody affinity may be reduced by reaction components or conditions.	Some cosolvents, solutes (e.g., salts) and pH extremes may reduce the affinity of the JumpStart Taq antibody for the polymerase and thereby compromise its effectiveness. Check your reaction mixture and conditions and/or check your system with a manual hot start method.
	Primers were not designed appropriately.	Check your system with a manual hot start method. If the results are similar, raise the annealing temperature in 2-3 °C increments to improve the specificity of binding. If raising the temperature reduces the yield of the specific product with only a small reduction of side reaction products, it may be necessary to redesign the primers. ⁴
	There was crossover contamination of specific and/or nonspecific PCR products.	Take special precautions to avoid crossover contamination of PCR reactions, including primer-dimer artifacts. ⁵
The yield of specific product is low.	Too few cycles were performed.	Increase the cycle number in 3-5 cycle increments.
	A co-solvent is required.	Add dimethyl sulfoxide (5%) or 0.8-1.3 M betaine final concentration.
	PCR priming opportunities may be low due to reaction conditions or primer design.	Modify the reaction conditions by increasing the denaturation temperature to 95 °C, increase extension times in 2 minute increments, increase MgCl ₂ and dNTP concentrations, etc. Redesign PCR primers.
The finished PCR reaction does not sink in the well of the agarose gel.	There is too little REDTaq in the reaction mix; the mix was diluted.	Add loading buffer to the reaction aliquot.

Related Products

Reagents and Kits

- Lambda Hind III DNA Marker, Product Code D 9780
- Enhanced Avian HS RT-PCR kits, Product Codes HSRT-20 (20 reactions) and HSRT-100 (100 reactions). The RT-PCR kit combines two powerful techniques to convert mRNA into cDNA and subsequently to amplify the cDNA. The enhanced avian reverse transcriptase has an enhanced ability to transcribe through difficult secondary structure at elevated temperatures (up to 65 °C). Includes JumpStart AccuTaq LA for hot start PCR.
- BlueView™ Nucleic Acid Stain, Product Codes T 8935 and T 9060. When added to agarose for gel manufacture and as running buffer, BlueView instantly stains nucleic acids

Techware

- PCR Multiwell Plates, 96-well, Product Code Z37,490-3
- PCR Multiwell Plates, 384-well, Product Code Z37,491-1
- PCR Microtubes, 0.2 ml with attached caps, Product Code Z37,487-3
- PCR Microtubes, 0.2 ml strip tubes with strip caps, Product Code Z37,496-2
- Sealing accessory for PCR vessels, Micro Mats, Product Code Z37,493-8, molded to fit standard 96-well plates
- Sealing accessory for PCR vessels, Pierceable cap strips, Product Code Z37,495-4, caps in strips of eight, the center of each can be pierced with a hypodermic needle for quick sample removal without generating aerosols or other sources of cross-contamination. Caps can be used with 0.2 ml PCR strip and 96-well plates. Pkg of 120 strips (960 caps).
- PCR Workstation, 120V, Product Code Z37,621-3
- PCR Workstation, 240V, Product Code Z37,622-1

PCR Books

- *PCR: Essential Data Series*, C. R. Newton, Ed., John Wiley and Sons, Inc., New York, NY, 1995, Product Code Z36,491-6
- *PCR: A Practical Approach*, M. J. McPherson, P. Quirke, and G. R. Taylor, Eds., IRL Press, Oxford, England, 1991, Product Code P7186
- *PCR 3: PCR In Situ Hybridization*, C.S. Herrington and J. J. O'Leary, Eds., IRL Press at Oxford University Press, Inc., Oxford, England, 1997, Product Code Z37,839-9
- *PCR Cloning Protocols: Methods in Molecular Biology*, Vol. 67, B. White, Ed., Humana Press, Totowa, NJ, 1996, Product Code Z37,422-9
- *PCR In Bioanalysis: Methods in Molecular Biology*, Vol. 92, S. J. Smeltzer, Ed., Humana Press, Totowa, NJ, 1998, Product Code Z37,960-3
- *PCR Primer: A Laboratory Manual*, C. Dieffenbach and G. S. Dvekster, Eds., Cold Spring Harbor Laboratory, Cold Spring Harbor, NY, 1995, Product Code Z36,411-8
- *PCR Protocols: A Guide to Methods and Applications*, M. A. Innis, et al., Eds., Academic Press, San Diego, CA, 1990, Product Code P 8177
- *PCR Protocols for Emerging Infectious Diseases*, D. H. Persing, Ed., American Society for Microbiology, Washington, DC, 1996, Product Code Z36,991-8
- *PCR Sequencing Protocols*, R. Rapley, Humana Press, Totowa, NJ, 1996, Product Code Z37,381-8
- *PCR Strategies*, Michael A. Innis, David H. Gelfand, and John J. Sninsky, Eds., Academic Press, San Diego, CA, 1995, Product Code Z36,445-2
- *PCR Technology, Current Innovations*, H. G. Griffin and A. M. Griffin, Eds., CRC Press, Boca Raton, FL, 1994, Product Code Z35,749-9
- *Quantitation of mRNA by Polymerase Chain Reaction*, T. Kohler, et al., Springer-Verlag, Berlin, 1995, Product Code Z37,194-7

NOTICE TO PURCHASER: LIMITED LICENSE

A license under US Patents 4,683,202, 4,683,195, 4,965,188, and 5,075,216 or their foreign counterparts, owned by Roche Molecular Systems and F. Hoffmann-La Roche Ltd ("Roche"), has an up-front fee component and a running-royalty component. The purchase price of this product includes limited, nontransferable rights under the running-royalty component to use only this amount of the product to practice the Polymerase Chain Reaction ("PCR") and related processes described in said patents solely for the research and development activities of the purchaser when this product is used in conjunction with a thermal cycler whose use is covered by the up-front fee component. Rights to the up-front fee component must be obtained by the end user in order to have a complete license to use this product in the PCR process.

These rights under the up-front fee component may be purchased from Applied Biosystems or obtained by purchasing an Authorized Thermal Cycler. No right to perform or offer commercial services of any kind using PCR, including without limitation reporting the results of purchaser's activities for a fee or other commercial consideration, is hereby granted by implication or estoppel. Further information on purchasing licenses to practice the PCR Process may be obtained by contacting the Director of Licensing at Applied Biosystems, 850 Lincoln Centre Drive, Foster City, California 94404 or the Licensing Department at Roche Molecular Systems, Inc., 1145 Atlantic Avenue, Alameda, California 94501.

JumpStart and JumpStart Taq Antibody are licensed under U.S. Patent No. 5,338,671 and 5,587,287 and corresponding patents in other countries.

JumpStart, REDTaq, and ReadyMix are trade marks of Sigma-Aldrich Biotechnology LP.

6/2002