

PCR Plastics

Compatibility and stability of Armadillo PCR Strip Plates

Summary

Thermo Scientific™ Armadillo™ PCR Strip Plates are compatible with the leading PCR and qPCR instruments on the market, including industrial-grade real-time thermal cyclers. Armadillo PCR Strip Plates are designed to be compatible with automated workflows, heat sealers, and lyophilization processes. They are also suitable for long-term storage at -80°C .

Introduction

Armadillo PCR Strip Plates are automation-friendly plates that can be segmented into smaller pieces easily and safely without special tools. Each 96-well plate can be divided into individual 8-tube strips or blocks of 8-tube strips (Figure 1).

Armadillo PCR Strip Plates are a flexible solution for hybrid workflows that include both automated and manual processes for producing and distributing reagents and assays. The 96-well format is suitable for high-throughput production with automated filling, sealing, and lyophilization. Individual 8-tube strips are convenient for low-throughput downstream applications. In addition to being compatible with the leading PCR and qPCR instruments, Armadillo PCR Strip Plates are suitable for robotic handling.

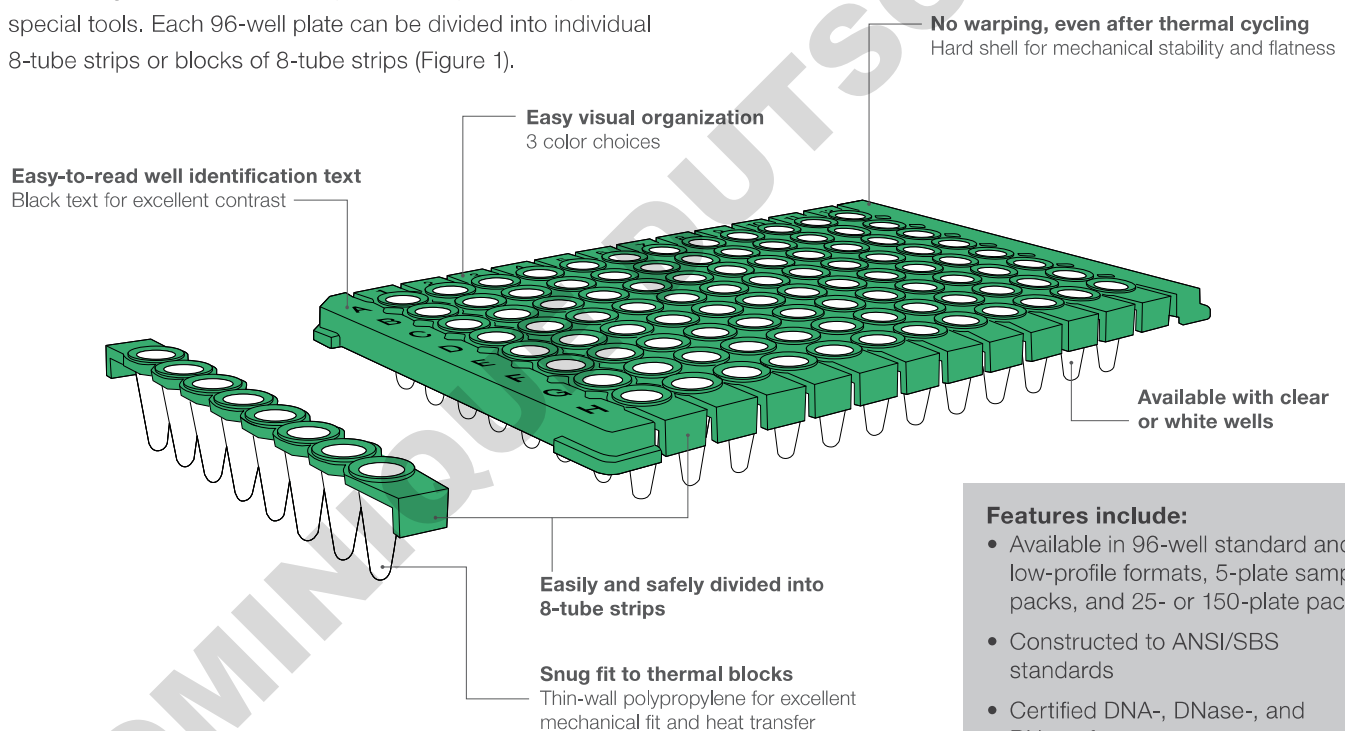


Figure 1. Features of Armadillo PCR Strip Plates.

Features include:

- Available in 96-well standard and low-profile formats, 5-plate sample packs, and 25- or 150-plate packs
- Constructed to ANSI/SBS standards
- Certified DNA-, DNase-, and RNase-free
- Validated with Applied Biosystems™ instruments and compatible with industry-leading instruments

Materials and methods

Visual inspection and verification of thermal cycler and qPCR instrument compatibility

The compatibility of Armadillo PCR Strip Plates was verified by measuring mass loss after thermal cycling (simulated PCR), and by visual inspection. The tested plates were loaded with 10 μ L of bromophenol blue in each well and were weighed on a Sartorius FB06BBE-S scale before and after a standard thermal cycling protocol (Table 1). The criterion to pass the test was mass loss of less than 5%. The plates were visually inspected after the runs for discoloration, bubbles, distortion, and cracking.

Table 1. Thermal cycling protocol used to determine mass loss.

| Stage 1 | Stage 2 | | Stage 3 |
|---------|-----------|--------|--------------|
| 95°C | 95°C | 50°C | 10°C and 4°C |
| 2 min | 20 sec | 10 sec | 30 min |
| 1 cycle | 40 cycles | | 1 cycle |

Verification of heat sealer compatibility

The compatibility of Armadillo PCR Strip Plates was verified by measuring mass lost during thermal cycling after heat sealing. Each well in the tested plates was loaded with 10 μ L of bromophenol blue. The plates were heat sealed on different heat sealing instruments using Thermo Scientific™ Heat Seals (Cat. No. AB3739), then run on the thermal cycling protocol summarized in Table 1. At the end of each run, the mass of each plate was compared to its previous mass. The criterion to pass the test was a mass loss of less than 5%.

Liquid handler compatibility test

Two compatibility tests were performed with Armadillo PCR Strip Plates. Three different plates were gripped and transferred from one deck position to another at least two times, using a robotic arm. One plate was gripped from a stack of 5 plates, then moved to a different deck position, using the robotic arm. The plates were shuffled by hand, and the process was repeated 4 more times. The tests were documented in videos, and the plates were inspected for distortion and cracking.

Lyophilization compatibility test

Three Armadillo PCR Strip Plates were loaded with 20 μ L of lyo-ready Invitrogen™ SuperScript™ III Reverse Transcriptase (RT). Lyophilization was performed using a Telstar™ LyoBeta™ 25 freeze dryer. The chamber was cooled to -60°C and left for 1 hour. Vacuum was then applied, and the temperature was gradually increased from -60°C to $+20^{\circ}\text{C}$ over a 24-hour period. The plates were visually inspected, and the performance of the SuperScript III RT was assessed after reconstitution.

Reverse transcription was performed before and after lyophilization using GAPDH RNA as a control template with 20 μ L of lyo-ready SuperScript III RT. The reverse transcription reaction conditions were 5 min at 25°C , 60 min at 50°C , and 15 min at 70°C . The samples were stored at 4°C until qPCR was run on an Applied Biosystems™ 7500 Fast Real-Time PCR System or an Applied Biosystems™ QuantStudio™ 7 Flex Real-Time PCR System using Applied Biosystems™ SYBR™ Green I dye as a reporter.

Table 2. Thermal cyclers and qPCR instruments that are compatible with Armadillo PCR Strip Plates.

| Instrument | Manufacturer | Cat. No. | Compatibility test result (visual inspection and mass loss) |
|--|--------------------------|------------|---|
| Applied Biosystems™ SimpliAmp™ Thermal Cycler | Thermo Fisher Scientific | A24811 | Pass |
| Applied Biosystems™ Veriti™ 96-Well Fast Thermal Cycler | Thermo Fisher Scientific | 4375305 | Pass |
| Applied Biosystems™ Veriti™ 96-Well Thermal Cycler | Thermo Fisher Scientific | 4375786 | Pass |
| Applied Biosystems™ ProFlex™ 96-Well PCR System | Thermo Fisher Scientific | 4484075 | Pass |
| Applied Biosystems™ 7500 Real-Time PCR System, desktop* | Thermo Fisher Scientific | 4351105 | Pass |
| Applied Biosystems™ 7500 Fast Real-Time PCR System, desktop* | Thermo Fisher Scientific | 4351107 | Pass |
| Applied Biosystems™ StepOnePlus™ Real-Time PCR System | Thermo Fisher Scientific | 4376600 | Pass |
| Applied Biosystems™ QuantStudio™ 5 Real-Time PCR System, 96-well, 0.1 mL, desktop* | Thermo Fisher Scientific | A28573 | Pass |
| Applied Biosystems™ QuantStudio™ 5 Real-Time PCR System, 96-well, 0.2 mL, desktop* | Thermo Fisher Scientific | A28574 | Pass |
| Applied Biosystems™ QuantStudio™ 7 Flex Real-Time PCR System, Fast 96-well block, desktop* | Thermo Fisher Scientific | 4485693 | Pass |
| Applied Biosystems™ QuantStudio™ 7 Flex Real-Time PCR System, 96-well block, desktop* | Thermo Fisher Scientific | 4485690 | Pass |
| Applied Biosystems™ QuantStudio™ 12K Flex Real-Time PCR System, Fast 96-well block, desktop* | Thermo Fisher Scientific | 4471088 | Pass |
| Applied Biosystems™ QuantStudio™ 12K Flex Real-Time PCR System, 96-well block, desktop* | Thermo Fisher Scientific | 4471087 | Pass |
| Applied Biosystems™ ViiA™ 7 Real-Time PCR System with Fast 96-Well Block* | Thermo Fisher Scientific | 4453535 | Pass |
| Applied Biosystems™ ViiA™ 7 Real-Time PCR System with 96-Well Block* | Thermo Fisher Scientific | 4453534 | Pass |
| Applied Biosystems™ Automated Thermal Cycler (ATC), 96-well | Thermo Fisher Scientific | A31489 | Pass |
| Mastercycler™ X50s | Eppendorf | 6311000010 | Pass |
| Prime™ thermal cycler | Techne | 53020-2 | Pass |
| T100 thermal cycler | Bio-Rad | 621BR21950 | Pass |
| PTC-0200 DNA Engine™ Cycler | Bio-Rad | EN033846 | Pass |
| LightCycler™ 480 System | Roche | 20788 | Pass |
| LightCycler™ 480 Instrument II | Roche | 29237 | Pass |
| Cobas™ Z 480 Real-Time PCR Analyzer | Roche | 51317 | Pass |

* Requires a strip plate adaptor for proper fit and performance.

Storage stability

Armadillo PCR Strip Plates were tested by storing them at -80°C for 3 months. A subset of the plates was tested at regular intervals over the 3-month test period by running qPCR on an Applied Biosystems™ QuantStudio™ 5 Real-Time PCR System using SYBR Green I dye as a reporter.

Results

Thermal cycler and qPCR instrument compatibility and visual inspection test

Armadillo plates were tested on 22 leading thermal cyclers and qPCR instruments for compatibility. A mass loss test was performed by comparing the weight of loaded plates before and after each run. Visual inspection was also performed at the end of each run to assess the structural integrity of the plates. The absence of any visible damage and a mass loss of less than 5% were considered a passing result. The results are summarized in Table 2. The tests showed that the Armadillo plates were compatible with leading PCR and qPCR instruments.

Verification of heat sealer compatibility

Armadillo plates were tested on two leading heat sealing instruments for compatibility. A mass loss test was performed by comparing the weight of loaded plates before and after each run. A mass loss of less than 5% was considered a passing result. The results are summarized in Table 3. The tests showed that the Armadillo plates were compatible with leading heat sealing instruments.

Table 3. Heat sealing instruments that are compatible with Armadillo PCR Strip Plates.

| Instrument | Manufacturer | Cat. No. | Compatibility test result (visual inspection and mass loss) |
|---|--------------------------|----------|---|
| Thermo Scientific™ ALPS 3000™ Automated Heat Sealer | Thermo Fisher Scientific | AB3000 | Pass |
| PlateLoc™ Thermal Microplate Sealer | Agilent Technologies | G5585B | Pass |

Liquid handler compatibility test

Armadillo plates were tested on four leading liquid handlers for compatibility. Two visual tests were performed. In the first test, individual plates were moved around a minimum of two times by a robotic arm. In the second test, plates were lifted by a robotic arm from a stack and moved individually. The overall condition of the plates was assessed during handling, and a visual inspection at the end of the test was performed to evaluate structural integrity. The results are summarized in Table 4. The tests showed that Armadillo PCR Strip Plates were compatible with the leading liquid handling systems.

Table 4. Liquid handlers that are compatible with Armadillo PCR Strip Plates.

| Instrument | Manufacturer | Cat. No. | Compatibility test result |
|--|-----------------|------------|---------------------------|
| Biomek™ FX [®] Liquid Handler | Beckman Coulter | A31844 | Pass |
| Freedom EVO™-2 100 Liquid Handler | Tecan | 10641100 | Pass |
| Biomek™ FX Automated Workstation | Beckman Coulter | 717013 | Pass |
| Freedom EVO™ 100 Liquid Handler | Tecan | 1311006746 | Pass |

Lyophilization compatibility test

To test the suitability of Armadillo PCR Strip Plates for lyophilization, the functional performance of lyo-ready SuperScript III RT in qPCR experiments before and after lyophilization was compared. The results are shown in Figure 2. There was no decrease in the performance of the enzyme after lyophilization.

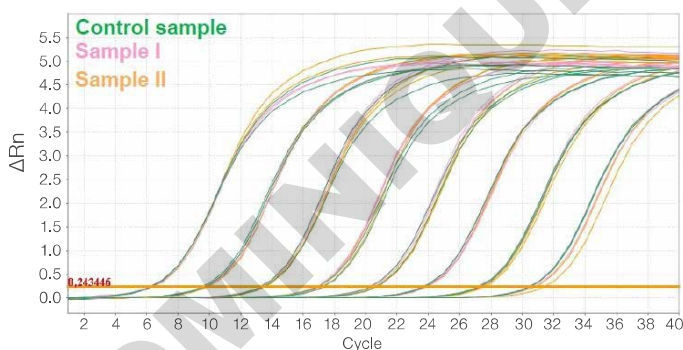


Figure 2. Amplification plots before (control sample) and after (samples I and II) lyophilization of lyo-ready SuperScript III RT.

Storage stability

The storage stability of Armadillo PCR Strip Plates at -80°C was assessed by applying three criteria. They had to pass a visual inspection for cracks and warpage. The ease of breaking away tube strips and performance in a qPCR experiment were also evaluated. The criteria for passing were a Ct standard deviation (SD) of 0.167 or less and a T_m SD of 0.167 or less. The three tests were performed at different time points over a period of 3 months. The results are summarized in Tables 5 and 6. The tests showed that the Armadillo plates were stable during storage at -80°C for 3 months. Visual inspection did not reveal any cracks or warpage, and the plates could be separated into strips.

Table 5. Results of visual inspection and break-away tests after storage at -80°C .

| Test | Week | Results |
|---|------|---------|
| Visual inspection after storage at -80°C | 0 | Pass |
| | 3 | Pass |
| | 6 | Pass |
| | 9 | Pass |
| | 13 | Pass |
| Separation into strips after storage at -80°C | 0 | Pass |
| | 3 | Pass |
| | 6 | Pass |
| | 9 | Pass |
| | 13 | Pass |

Table 6. Results of qPCR tests performed after storage at -80°C .

| Week | C _t SD | T _m SD | Result |
|------|-------------------|-------------------|--------|
| 0 | 0.1449 | 0.1198 | Pass |
| 3 | 0.1303 | 0.0856 | Pass |
| 6 | 0.1222 | 0.0806 | Pass |
| 9 | 0.1363 | 0.1191 | Pass |
| 13 | 0.1369 | 0.0912 | Pass |

Conclusion

Armadillo PCR Strip Plates were compatible with all of the leading PCR and qPCR instruments they were tested with. Liquid handling tests showed the plates to be suitable for robotic applications. Reagents in Armadillo plates retained their functionality after lyophilization and after storage in the plates at -80°C for at least 3 months.

Ordering information

| Product | Format | Plate color | Well color | Quantity | Cat. No. | | |
|---|-------------|-----------------------------------|------------|----------|-----------|---------|-----------|
| Armadillo 96-Well Low-Profile PCR Strip Plate | Low profile | Clear | Clear | 5 | AB2696SMP | | |
| | | | | 25 | AB2696 | | |
| | | | | 150 | AB2696150 | | |
| | | | White | 5 | AB3696SMP | | |
| | | | | 25 | AB3696 | | |
| | | | | 150 | AB3696150 | | |
| | | Blue | Clear | 25 | AB2696B | | |
| | | | White | 25 | AB3696B | | |
| | | Green | Clear | 25 | AB2696G | | |
| | | | White | 25 | AB3696G | | |
| | | Armadillo 96-Well PCR Strip Plate | Standard | Clear | Clear | 5 | AB2796SMP |
| | | | | | | 25 | AB2796 |
| 150 | AB2796150 | | | | | | |
| White | 5 | | | | AB3796SMP | | |
| | 25 | | | | AB3796 | | |
| Blue | Clear | | | | 25 | AB2796B | |
| Green | Clear | | | 25 | AB2796G | | |

Find out more at thermofisher.com/armadillostriplates

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