

PCR Plastics

Compatibility and stability of Armadillo PCR Strip Plates

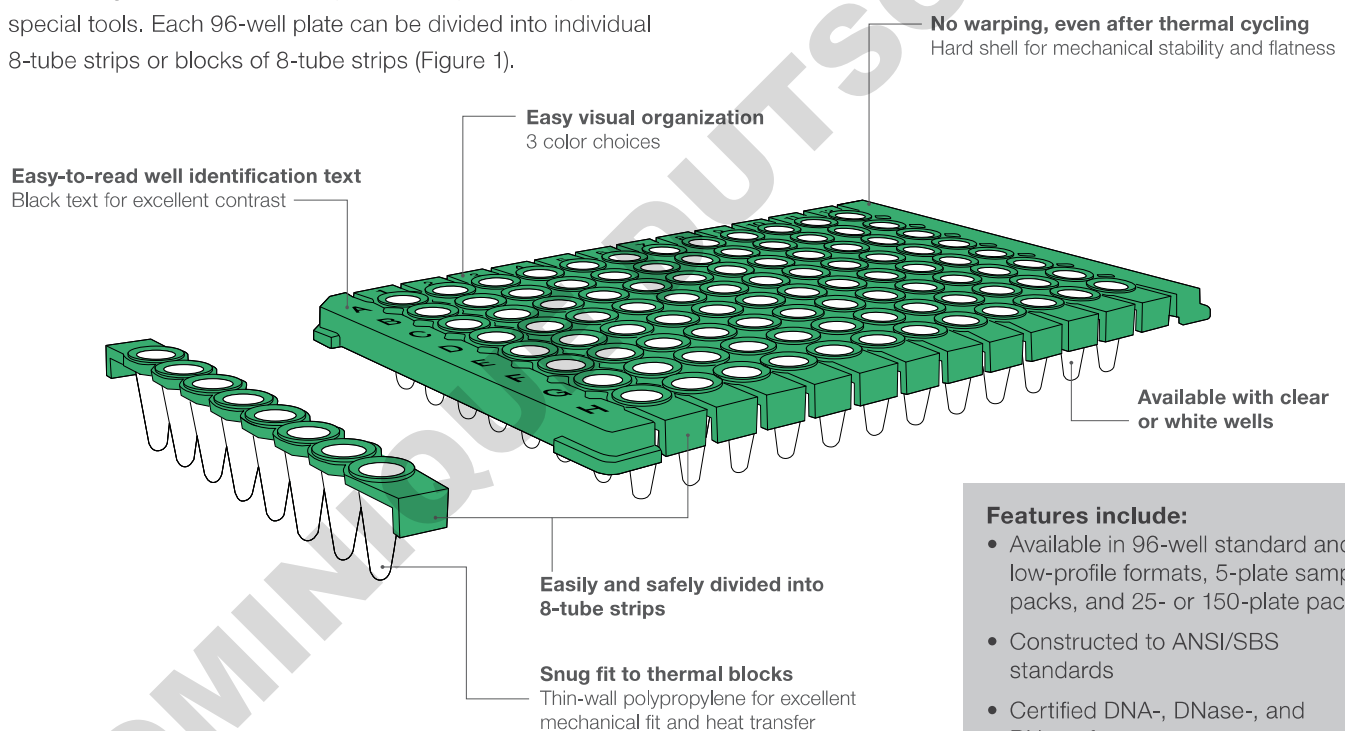
Summary

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.



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

Figure 1. Features of Armadillo PCR Strip Plates.

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.

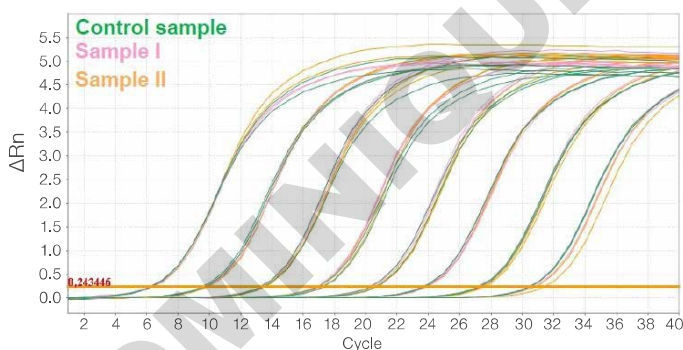


Figure 2. Amplification plots before (control sample) and after (samples I and II) lyophilization of lyo-ready SuperScript III RT.

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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