REF DFA2-ASY-0019

BIOFIRE® SHIELD™ Control Kit

for the BioFire® Global Fever Special Pathogens Panel Instructions for Use

For use with the BioFire Global Fever Special Pathogens Panel

IVD

CONTROL

℞ Only

The Symbols Glossary is provided on Page 16 of this booklet.

For In Vitro Diagnostic Use

Manufactured by
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INTENDED USE

The BIOFIRE® SHIELD™ Control Kit for the BioFire® Global Fever Special Pathogens Panel contains Positive and Negative External Controls intended for use as assayed quality controls to monitor the performance of *in vitro* diagnostic laboratory nucleic acid testing procedures for the qualitative detection of *Bacillus anthracis*, chikungunya virus, Crimean-Congo hemorrhagic fever virus, dengue virus (serotypes 1, 2, 3, and 4), *Ebolavirus* spp., *Francisella tularensis*, Lassa virus, *Leishmania* spp., Leptospira spp., *Marburgvirus*, *Plasmodium* spp. (including species differentiation of *Plasmodium falciparum* and *Plasmodium vivax/ovale*), West Nile virus, yellow fever virus, and *Yersinia pestis* when using the BioFire® Global Fever Special Pathogens Panel on BioFire® FilmArray® 2.0 and BioFire® FilmArray® Torch Systems. The BIOFIRE SHIELD Control Kit for the BioFire Global Fever Special Pathogens Panel is designed for and intended to be used solely with the BioFire Global Fever Special Pathogens Panel. This product does not replace manufacturer internal controls provided as part of the BioFire Global Fever Special Pathogens Panel.

Both the Positive and Negative External Controls are provided in a FilmArray Control Injection Vial format. The Positive Control Injection Vial contains dried synthetic DNA segments in buffer and stabilizer to assess the presence of each individual assay on the BioFire Global Fever Special Pathogens Panel. The Negative Control Injection Vial contains no DNA and is non-reactive with the BioFire Global Fever Special Pathogens Panel assays.

For In Vitro Diagnostic Use.

PRODUCT SUMMARY AND PRINCIPLE

The BIOFIRE SHIELD Control Kit for the BioFire Global Fever Special Pathogens (GF SP) Panel is a surrogate control to monitor performance of the BioFire GF SP Panel assays. The BIOFIRE SHIELD Control Kit for the BioFire GF SP Panel is designed to mitigate the risk of control contamination or misuse when evaluating clinical specimens on BioFire FilmArray Systems. Good laboratory practice recommends running positive and negative external controls regularly. Evaluation of external controls is recommended prior to using a new shipment or new lot of BioFire Global Fever Special Pathogens (GF SP) Panel kits, when there is a new operator, and following replacement or repair of a BioFire FilmArray System. It is the responsibility of each laboratory to determine the frequency of external control testing with the BioFire GF SP Panel as part of the laboratory's Quality Control program. Quality control materials should be used in accordance with local, state, federal regulations and accreditation requirements.

COMPOSITION

The BIOFIRE SHIELD Positive External Control for the BioFire GF SP Panel is a surrogate external assayed quality control material composed of a pool of synthetic target DNA sequences in buffer and stabilizer that each produce a signature melting temperature (Tm) value that is distinct from that produced by the corresponding pathogen to reduce the risk of false positive results. The dried synthetic DNA is supplied in a FilmArray Control Injection Vial that is used directly with the BioFire GF SP Panel. The DNA assesses the presence of each individual assay in the BioFire GF SP Panel. No synthetic target DNA sequences are present in the BIOFIRE SHIELD Negative External Control for the BioFire GF SP Panel. The BioFire SHIELD Control kit contains no biological hazards and is 100% non-infectious.

STORAGE AND STABILITY

- Store the BIOFIRE SHIELD Control Kit for the BioFire GF SP Panel at room temperature (18-30°C). **DO NOT REFRIGERATE**.
- Avoid storage of any materials near heating or cooling vents, or in direct sunlight.
- Once the BIOFIRE SHIELD External Control vacuum-sealed packaging bag has been opened, the control should be loaded as soon as possible (within approximately 30 minutes).

MATERIALS PROVIDED

Each BIOFIRE SHIELD Control Kit for the BioFire Global Fever Special Pathogens Panel contains sufficient reagents for six positive external control runs and six negative external control runs (Part No. DFA2-ASY-0019). Materials include:

- Six individually packaged Positive External Control Injection Vials
- Six individually packaged Negative External Control Injection Vials
- Instructions available online at: www.biofiredefense.com/gfspecialpathogens/
    - BIOFIRE® SHIELD™ Control Kit for the BioFire Global Fever Special Pathogens Panel – Instructions for Use
    - BIOFIRE® SHIELD™ Control Kit for the BioFire Global Fever Special Pathogens Panel – Quick Guide

NOTE: *Additional documentation is available online at www.biofiredefense.com*

MATERIALS REQUIRED BUT NOT PROVIDED

- BioFire® FilmArray® Systems including:
  - BioFire® FilmArray® 2.0 or BioFire® FilmArray® Torch Instrument System and accompanying software
  - BioFire® FilmArray® Pouch Loading Station
  - BioFire Global Fever Special Pathogens Panel Pouch Module Software is required to run the BioFire GF SP Panel and is available by request if not already installed on the instrument system.
- 10% bleach solution or a similar disinfectant
- BioFire® Global Fever Special Pathogens Panel (Part No. DFA2-ASY-0018) and accompanying software

WARNINGS AND PRECAUTIONS

1. The BIOFIRE SHIELD Control Kit for the BioFire GF SP Panel is designed only for use with the BioFire GF SP Panel and should not be used with any other test.
2. Only trained laboratory personnel should perform and interpret this test.
3. The BIOFIRE SHIELD Positive and Negative External Control Protocols should only be used to test External Controls as described in the procedure section below. The Positive and Negative External Control Protocols are only for use with the BIOFIRE SHIELD Control Kit. Do not use External Control Protocols to test human specimens or other control materials.
4. Always check the expiration date on the control kits. Do not use controls after the expiration date.
5. Although rare, the synthetic DNA in the BIOFIRE SHIELD Positive External Controls can contaminate the work area and may cause a failed Negative External Control result. For accurate test results:
   - Follow the instructions in the BIOFIRE SHIELD Control Kit for the BioFire Global Fever Special Pathogens Panel – Quick Guide exactly.
   - Wear appropriate personal protective equipment (PPE), including (but not limited to) lab coats and disposable, powder-free gloves. Change gloves often when handling External Controls.
   - Decontaminate the work area with 10% bleach or a similar disinfectant followed by water after every use of an External Control.
6. Bleach introduced in an External Control may damage nucleic acids, which may lead to a failed Positive External Control result.
7. Dispose of materials used in this test, including reagents and used buffer vials according to federal, state, and local regulations.

PROCEDURE

Use clean gloves and other Personal Protective Equipment (PPE) when handling pouches and BIOFIRE SHIELD Controls. Only prepare one BioFire GF SP Panel pouch at a time and change gloves between handling of External Controls and pouches. Refer to the *BIOFIRE SHIELD Control Kit for the BioFire Global Fever Special Pathogens Panel – Quick Guide* for detailed instructions on how to load the BIOFIRE SHIELD Controls. Once an External Control is loaded into the pouch, promptly transfer the pouch to the appropriate instrument to start the run. Dispose of the used controls and pouch in a biohazard container.

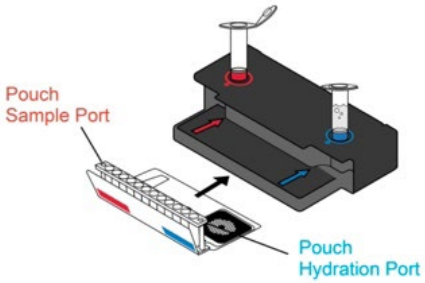
NOTE: *Two additional protocols are provided for use with the BIOFIRE SHIELD Control Kit for the BioFire Global Fever Special Pathogens Panel. It is necessary to select the appropriate protocol prior to running the test. The Positive External Control and the Negative External Control protocols are only for use with the BIOFIRE SHIELD Control Kit for the BioFire Global Fever Special Pathogens Panel and should not be used to test clinical specimens or other types of controls.*

Step 1: Prepare Pouch

a. Insert pouch into Pouch Loading Station.

b. Remove cap from either Positive or Negative Control Injection Vial and place into red well.

c. Place Hydration Injection Vial into blue well.



Step 2: Hydrate Pouch

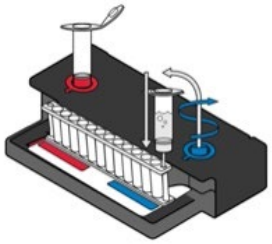
a. Unscrew Hydration Injection Vial from cover.

b. Remove Hydration Injection Vial, leaving blue cover in Pouch Loading Station.

c. Insert Hydration Injection Vial into Hydration port.

d. Push down to puncture seal and wait as Hydration Solution is drawn into the pouch.

NOTE: *Verify the pouch has been hydrated.*



Step 3: Prepare External Control

a. Hold the Sample Buffer Tube with the tip facing up and firmly pinch at textured plastic tab on side of tube until the seal snaps.

NOTE: *Do not touch the tip of the tube.*

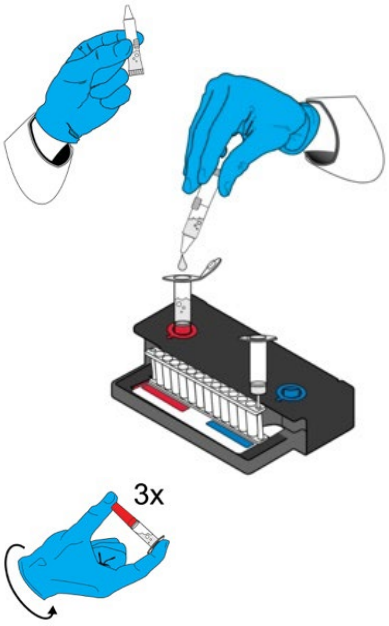
b. Dispense Sample Buffer into Control Injection Vial using a slow, forceful squeeze, followed by a 2nd squeeze.

NOTE: *Avoid generating excessive foam*.

c. Tightly close lid and invert the Control Injection Vial 3 times.

d. Return Control Injection Vial to red well of Pouch Loading Station.

WARNING: Sample Buffer is harmful if swallowed and can cause serious eye damage and/or skin irritation.



Step 4: Loading External Control

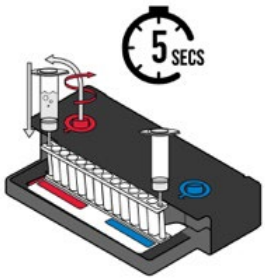
a. Unscrew Control Injection Vial from red cover.

b. Wait for 5 second, then remove Control Injection Vial, leaving red cover in Pouch Loading Station.

NOTE: *Waiting 5 seconds decreases the contamination risk.*

c. Insert Control Injection Vial into pouch sample port.

d. Push down to puncture seal, then wait as control material is drawn into the pouch.



Step 5: Run Pouch

a. Screw vials back into covers in Pouch Loading Station before disposing of them in a biohazard container.

b. Remove pouch from Pouch Loading Station and load into the instrument.

c. Follow instructions on screen for starting a test.

NOTE: *Either Positive External Control or Negative External Control protocol.*

INTERPRETATION OF RESULTS

The External Control Report is automatically displayed upon completion of a run and can be printed or saved as a PDF file.

The Run Information section of the report provides the Sample ID, time and date of the run, and the Internal Controls results. Refer to the *BioFire Global Fever Special Pathogens Panel Instructions for Use* for more information about Internal Controls results. The Run information section also includes pouch information (type, lot number, and serial number), run status (Completed, Aborted, Instrument Error, or Software Error), the protocol used to perform the test, the identity of the operator who performed the test, and the instrument used to perform the test. The External Control interpretations are described in the section below.

External Control Report

When running the BIOFIRE SHIELD Control Kit on the BioFire GF SP Panel, the results are listed in the Result Banner as Passed (**Figures 1** and **3**), Failed (**Figures 2** and **4)** or Invalid (not shown). The report also contains a Result Summary listing the result for each target as either Detected or Not Detected. In the case of a run error, all target results display as Invalid.

BIOFIRE® SHIELD™ Positive External Control
GF Special Pathogens Panel

BIOFIRE

www.BioFireDefense.com

Run Information			
Sample ID	JW43822	Run Date	07 Apr 2023 12:00 AM
Protocol	Positive External Control v3.1	Serial No.	01234567
Pouch Type	GF SP Panel v1.0	Lot No.	012345
Internal Controls	Passed	Operator	Anonymous
Run Status	Completed	Instrument	FA0001

Passed

Report the Results

Result Summary	
Detected	Not Detected
Bacillus anthracis Chikungunya virus Crimean-Congo hemorrhagic fever virus Dengue virus *Ebolavirus* *Francisella tularensis* Lassa virus *Leishmania* spp. *Leptospira* spp. *Marburgvirus* *Plasmodium* spp. *Plasmodium falciparum* *Plasmodium vivax/ovale* West Nile virus Yellow fever virus *Yersinia pestis*	

Figure 1. External Control Report for a Passed Positive External Control

BIOFIRE® SHIELD™ Positive External Control
GF Special Pathogens Panel

BIOFIRE

www.BioFireDefense.com

Run Information			
Sample ID	JW43822	Run Date	07 Apr 2023 12:00 AM
Protocol	Positive External Control v3.1	Serial No.	01234567
Pouch Type	GF SP Panel v1.0	Lot No.	012345
Internal Controls	Passed	Operator	Anonymous
Run Status	Completed	Instrument	FA0001

Failed

Retest a New Positive External Control ONCE (Refer to Instructions For Use)

Result Summary

Detected	Not Detected
Chikungunya virus Crimean-Congo hemorrhagic fever virus Dengue virus *Ebolavirus* *Francisella tularensis* Lassa virus *Leishmania* spp. *Leptospira* spp. *Marburgvirus* *Plasmodium* spp. *Plasmodium falciparum* *Plasmodium vivax/ovale* West Nile virus Yellow fever virus *Yersinia pestis*	*Bacillus anthracis*

Figure 2. External Control Report for a Failed Positive External Control

BIOFIRE® SHIELD™ Negative External Control
GF Special Pathogens Panel

BIOFIRE

www.BioFireDefense.com

Run Information			
Sample ID	JW43822	Run Date	07 Apr 2023 12:00 AM
Protocol	Negative External Control v3.1	Serial No.	01234567
Pouch Type	GF SP Panel v1.0	Lot No.	012345
Internal Controls	Passed	Operator	Anonymous
Run Status	Completed	Instrument	FA0001

Passed

Report the Results

Result Summary	
Detected	Not Detected
	Bacillus anthracis Chikungunya virus Crimean-Congo hemorrhagic fever virus Dengue virus *Ebolavirus* *Francisella tularensis* Lassa virus *Leishmania* spp. *Leptospira* spp. *Marburgvirus* *Plasmodium* spp. *Plasmodium falciparum* *Plasmodium vivax/ovale* West Nile virus Yellow fever virus *Yersinia pestis*

Figure 3. External Control Report for a Passed Negative External Control

BIOFIRE® SHIELD™ Negative External Control
GF Special Pathogens Panel

BIOFIRE

www.BioFireDefense.com

Run Information			
Sample ID	JW43822	Run Date	07 Apr 2023 12:00 AM
Protocol	Negative External Control v3.1	Serial No.	01234567
Pouch Type	GF SP Panel v1.0	Lot No.	012345
Internal Controls	Passed	Operator	Anonymous
Run Status	Completed	Instrument	FA0001

Failed

Unexpected Detection

Decontaminate the Area and Retest (Refer to Instructions For Use)

Result Summary	
Detected	Not Detected
Bacillus anthracis	Chikungunya virus Crimean-Congo hemorrhagic fever virus Dengue virus *Ebolavirus* *Francisella tularensis* Lassa virus *Leishmania* spp. *Leptospira* spp. *Marburgvirus* *Plasmodium* spp. *Plasmodium falciparum* *Plasmodium vivax/ovale* West Nile virus Yellow fever virus *Yersinia pestis*

Figure 4. External Control Report for a Failed Negative External Control

BIOFIRE SHIELD Control Kit Result Explanations

The Positive External Controls produce a signature melting temperature (Tm) value that is distinct from that produced by the corresponding pathogen to reduce the risk of false positive results. The Positive External Control passes when the software detects amplification within the control melting temperature window for all assays. The Negative External Control passes when the software detects no amplification within both the control melting temperature window and the pathogen melting temperature window for all assays. See **Table 1** for an explanation of how the Positive External Control results are analyzed, possible results, and required actions. See **Table 2** for an explanation of how the Negative External Controls are analyzed, possible results, explanations, and required actions.

If any error persists, contact BioFire Defense Technical Support for further instruction.

Table 1. Positive External Control Results Explanation and Required Actions

Positive External Control Result	Explanation	Action Required
Passed	The run was successfully completed AND All Positive External Control targets were Detected.	Follow the instructions provided in the Result Banner.
Failed	The run was successfully completed BUT One or more of the Positive External Control targets were Not Detected.	Repeat the test once using a new pouch and new Positive External Control. If the error persists, call BioFire Defense Technical Support for further instructions.
Invalid	The result is invalid because the run did not complete. OR One or more of the pouch internal controls failed.	Note any error codes displayed by the software during the run. Refer to the appropriate BioFire FilmArray Operator's Manual or call BioFire Defense Technical Support for further instruction. If the error can be resolved, repeat the test using a new pouch.

Table 2. Negative External Control Results Explanation and Required Actions

Negative External Control Result	Explanation	Action Required
Passed	The run was successfully completed AND No pathogen targets were Detected AND No Positive External Control targets were Detected.	Follow the instructions provided in the Result Banner.
Failed	The run was successfully completed BUT One or more pathogen targets were Detected OR One or more Positive External Control targets were Detected.	Decontaminate the area and repeat the test once using a new pouch and new Negative External Control. If the error persists, call BioFire Defense Technical Support for further instructions.[1]
Invalid	The result is invalid because the run did not complete. OR One or more of the pouch internal controls failed.	Note any error codes displayed by the software during the run. Refer to the appropriate BioFire FilmArray Operator's Manual or call BioFire Defense Technical Support for further instruction. If the error can be resolved, repeat the test using a new pouch.

[1] It is possible to determine whether contamination is from amplified pathogen or amplified external control material. Contact BioFire Defense Technical Support for further information.

LIMITATIONS

1. This product is only for use with the BioFire Global Fever Special Pathogens Panel.
2. This product does not contain the full genome of target analytes. The Positive External Control pouch protocol may only be used with the BIOFIRE SHIELD Control Kit for the BioFire GF SP Panel. Do not use this protocol to run other types of controls or patient specimens.
3. This product is not intended to replace the internal controls contained in the BioFire GF SP Panel.
4. The proper function of the External Controls is dependent upon proper storage, handling, and preparation of External Controls. Failure to observe proper procedures in any one of these steps can lead to incorrect results.
5. Quality control materials should be used in accordance with local, state, and federal regulations and accreditation requirements.

PERFORMANCE CHARACTERISTICS

Reproducibility

The following are reproducibility data for the BIOFIRE SHIELD Control Kit for the BioFire GF SP Panel.

Separate reproducibility studies were performed for FilmArray 2.0 and FilmArray Torch Systems. Results for the multi-site reproducibility evaluation performed with the FilmArray 2.0 platform are shown in Table 3. Results for the FilmArray Torch are shown in Table 4; the site variable was simulated by using three different FilmArray Torch Systems.

Table 3. Reproducibility of the BIOFIRE SHIELD Control Kit for the BioFire GF SP Panel on FilmArray 2.0 Systems

SHIELD Control Type	Expected Result	Observed/Expected (Percent Agreement) [95% Confidence Interval]			
		Site 1	Site 2	Site 3	All Sites
Positive	Passed	42/45 (93.3%)	45/45 (100%)	45/45 (100%)	**132/135 (97.8%)** [93.7-99.2%]
Negative	Passed	45/45 (100%)	44/45[a] (97.8%)	44/45[a] (97.8%)	**133/135 (98.5%)** [94.8-99.6%]
Overall Agreement with Expected Result		**265/270 / (98.1%)** [95.7-99.2%]			

[a] Unexpected detection of pathogen amplicon.

Table 4. Reproducibility of the BIOFIRE SHIELD Control Kit for the BioFire GF SP Panel on FilmArray Torch Systems

SHIELD Control Type	Expected Result	Observed/Expected (Percent Agreement) [95% Confidence Interval]			
		System 1	System 2	System 3	All Systems
Positive	Passed	43/45 (95.6%)	43/45 (95.6%)	44/45 (97.8%)	**130/135 (96.3%)** [91.6-98.4%]
Negative	Passed	43/45 (95.6%)	45/45 (100%)	45/45 (100%)	**133/135 (98.5%)** [94.8-99.6%]
Overall Agreement with Expected Result		**263/270 / (97.4%)** [94.7-98.7%]			

Clinical Evaluation

Six clinical sites evaluated the BIOFIRE SHIELD Control Kit by testing a Positive or Negative External Control each day prior to testing clinical specimens. Results for the BioFire GF SP Panel on FilmArray 2.0 Systems are shown in **Table 5**.

Table 5. Performance of the BIOFIRE SHIELD Control Kit for the BioFire GF SP Panel

SHIELD Control Type	Completed with Passed Result	Total Completed	Percent Passed (%)
Positive	158 [a]	160	98.8%
Negative	157 [a]	159	98.7%
Overall	**315**	**319**	**98.7%**

[a] The test site tested a Positive and a Negative External Control on the same day. Controls were likely unintentionally swapped as the Negative External Control failed because all External Control targets were detected, and the Positive External Control failed because all External Control targets were not detected.

APPENDIX

Symbols Glossary

The following symbols can be found on labeling for the BIOFIRE SHIELD Control Kit for the BioFire GF SP Panel kits, kit components, and throughout accompanying packaging.

ISO 15223-1 Medical devices – Symbols to be used with information to be supplied by the manufacturer – Part 1: General requirements					
5.1.1 	Manufacturer	5.1.4 	Use-By date (YYYY-MM-DD)	5.1.5 	Batch Code (Lot Number)
5.1.6 	Catalog Number	5.1.7 	Serial Number	5.2.8 	Do Not Use if Package Is Damaged
5.5.2 	Control	5.5.3 	Negative Control	5.5.4 	Positive Control
5.3.2 	Keep Away from Sunlight	5.3.7 	Temperature Limit	5.4.2 	Do not re-use
5.4.3 	Consult Instructions for Use	5.5.1 	*In vitro* Diagnostic Medical Device	5.5.5 	Contains sufficient for <n> tests
81 FR 38911					
	CAUTION: Federal law restricts this device to sale by or on the order of a licensed healthcare practitioner.				
Manufacturer Symbols (BioFire Defense, LLC)					
	BioFire Defense Logo				BioFire® Global Fever Special Pathogens Panel Symbol

Contact and Legal Information

Customer and Technical Support	
Contact Us on the Web http://www.BioFireDefense.com **Contact Us by Mail** 79 West 4500 South, Suite 14 Salt Lake City, Utah 84107, USA	**Contact Us by E-mail** support@BioFireDefense.com **Contact Us by Phone** 1-801-262-3592 – US and Canada 1-801-262-3592 – International **Contact Us by Fax** 1-801-447-6907

Revision History

Version	Revision Date	Description of Revision(s)
01	July 2023	Initial Release

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For additional information regarding our products and applications, contact BioFire Defense Customer Support.