



Feline Immunodeficiency Virus RT-PCR Detection Kit Product # 44100

Product Insert

Pathogen Information

Feline Immunodeficiency Virus (FIV) is a lentivirus which belongs to the same retrovirus family as the feline leukemia virus (FeLV). FIV infection occurs globally, and 1.5-3.0% of healthy cats are thought to carry the virus. The infection rate could be even higher (as much as 15%) in cats which are sick or at risk. Biting wounds and scratches appear to be the most efficient mode of transmission of the virus, where the infected cat's saliva enters into the other cat's bloodstream. The infection can also be transmitted from an infected mother cat to her kittens, either during labour or when newborn kittens ingest infected milk. Sexual contact does not appear to be a major means of spreading FIV. Cats infected with FIV may appear normal for years, however infection does lead to a state of immunodeficiency which hinders the cat's ability to fight off infections. Several symptoms may be observed: poor coat condition, persistent fever, loss of appetite, or chronic or recurrent infections of the skin, urinary bladder and upper respiratory tract. While serology has been used to diagnose FIV-infected cats, cats with weakened immune response will not be reliably diagnosed as the method depends on the production of antibodies. Molecular detection by PCR overcomes this immune response problem, as it directly detects the pathogen itself rather than the cat's immune response.

Principle of the Test

Norgen's FIV RT-PCR Detection Kit constitutes a ready-to-use system for the isolation and detection of FIV using end-point one-step RT-PCR. The kit first allows for the isolation of FIV RNA from the blood samples using spin-column chromatography based on Norgen's proprietary resin. The FIV RNA is isolated free from inhibitors, and can then be used as the template in a one step RT-PCR reaction for FIV detection using the provided FIV Detection Mastermix. The FIV Detection Mastermix contains reagents and enzymes for the specific amplification of a 318 bp region of the viral genome. In addition, Norgen's FIV RT-PCR Detection Kit contains a second Mastermix, the RT-PCR Control Master Mix, which can be used to identify possible PCR inhibition and/or inadequate isolation via a separate RT-PCR reaction with the use of the provided *PCR control (PCRC)* or *Isolation Control (IsoC)*, respectively. This kit is designed to allow for the testing of 24 samples.

Kit Components:

Component	Contents
Lysis Solution	30 mL
Wash Solution	11 mL
Elution Buffer	2 mL
Mini Spin Columns	24
Collection Tubes	24
Elution tubes (1.7 mL)	24
2x FIV Detection RT-PCR Mastermix	0.35 mL
2x RT-PCR Control Mastermix	0.35 mL
Isolation Control (IsoC)^{*a}	0.3 mL
FIV Positive Control (PosC)^{*b}	0.1 mL
Nuclease Free-Water	1.25 mL
Norgen's RNA Marker	0.1 mL
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* IsoC = Isolation Control ; PosC= Positive Control

^a The isolation control is a cloned RNA transcript.

^b The positive control is FIV RNA transcript

Customer-Supplied Reagents and Equipment

- Benchtop microcentrifuge
- 95-100% ethanol
- Thermocycler and or Real-Time PCR System
- Micropipettes with an accuracy range between 1-10 µL, 10-100 µL and 100-1000 µL
- Laminar flow hood for extractions
- Vortex
- Sterile, nuclease-free aerosol-barrier micropipettor tips
- Microcentrifuge tube rack
- Disposable latex gloves
- β-mercaptoethanol

Storage Conditions and Product Stability

- The Positive Control (**FIV PosC**, red cap) and Isolation Control (**IsoC**, orange cap) should be stored at -70 °C. If needed, make aliquots of the controls according to the volume used in the protocol (10 µL of **FIV PosC** or 10 µL of **IsoC**) prior to freezing.
- The **2X FIV Detection RT-PCR Mastermix** and the **2X RT-PCR Control Mastermix** should be stored at -20 °C upon receipt (-70 °C for long-term). Make appropriate aliquots and store at -20 °C if needed.
- All other kit components may be stored at room temperature
- The **2X FIV Detection RT-PCR Mastermix** and the **2X RT-PCR Control Mastermix**, Positive Control and Isolation Control should not undergo repeated freeze-thaw (a maximum freeze-thaw of three times).
- For RT-PCR:
 - Allow reagents to thaw at room temperature prior to use
 - When thawed, mix the components and centrifuge briefly
 - Work quickly on ice.
 - After addition of RT-PCR Mastermix use within one hour

Quality Control

In accordance with Norgen's ISO 9001 and ISO 13485-certified Quality Management System, each lot of Norgen's FIV RT-PCR Detection Kit, including the 2x FIV Detection RT-PCR Mastermix, 2X RT-PCR Control Mastermix, FIV Isolation Control and FIV Positive Control are tested against predetermined specifications to ensure consistent product quality.

Product Use Limitations

Norgen's FIV RT-PCR Detection Kit is designed for research purposes only.

Product Warranty and Satisfaction Guarantee

NORGEN BIOTEK CORPORATION guarantees the performance of all products in the manner described in our product manual. The customer must determine the suitability of the product for its particular use.

Disclaimers

The **Lysis Solution** contains guanidinium salts, and should be handled with care. Guanidinium salts form highly reactive compounds when combined with bleach, thus care must be taken to properly dispose of any of these solutions.

If liquid containing these buffers is spilt, clean with suitable laboratory detergent and water. If the spilt liquid contains potentially infectious agents, clean the affected area first with laboratory detergent and water, and then with 1% (v/v) sodium hypochlorite.

Safety Information

Ensure that a suitable lab coat, disposable gloves and protective goggles are worn when working with chemicals. For more information, please consult the appropriate Material Safety Data Sheets (MSDSs). These are available as convenient PDF files online at www.norgenbiotek.com.

CAUTION: DO NOT add bleach or acidic solutions directly to the sample-preparation waste.

General Precautions

- Follow universal precautions. All specimens should be considered as potentially infectious and handled accordingly.
- Wear personal protective equipment, including gloves and lab coats when handling kit reagents. Wash hands thoroughly when finished performing the test.
- Dispose of unused kit reagents and specimens according to local, provincial or federal regulations.
- Workflow in the laboratory should proceed in a uni-directional manner, beginning in the pre-amplification area(s) (i.e. specimen collection and RNA extraction) and moving to the amplification / detection area(s) (RT-PCR and gel electrophoresis).
- Do not use supplies and equipment across the dedicated areas of specimen extraction and sample preparation. No cross-movement should be allowed between the different areas.
- Personal protective equipment, such as laboratory coats and disposable gloves, should be area specific.
- Only use the protocol provided in this insert. Alterations to the protocol and deviations from the times and temperatures specified may lead to erroneous results.

Working with RNA

RNases are very stable and robust enzymes that degrade RNA. Autoclaving solutions and glassware is not always sufficient to actively remove these enzymes. The first step when preparing to work with RNA is to create an RNase-free environment. The following precautions are recommended as your best defense against these enzymes.

- The RNA area should be located away from microbiological work stations.
- Clean, disposable gloves should be worn at all times when handling reagents, samples, pipettes, disposable tubes, etc. It is recommended that gloves are changed frequently to avoid contamination.
- There should be designated solutions, tips, tubes, lab coats, pipettes, etc. for RNA only.
- All RNA solutions should be prepared using at least 0.05% DEPC-treated autoclaved water or molecular biology grade nuclease-free water.
- Clean all surfaces with commercially available RNase decontamination solutions.
- When working with purified RNA samples, ensure that they remain on ice during downstream applications.

INSTRUCTIONS FOR USE

Important Notes Prior to Beginning Protocol:

- Blood of all human and animal subjects is considered potentially infectious. All necessary precautions recommended by the appropriate authorities in the country of use should be taken when working with whole blood.
- All centrifugation steps are carried out in a benchtop microcentrifuge at 14,000 x g (~ 14,000 RPM) except where noted. All centrifugation steps are performed at room temperature.
- A variable speed microcentrifuge should be used for maximum kit performance. If a variable speed centrifuge is not available a fixed speed centrifuge can be used, however reduced yields may be observed.

- Ensure that all solutions are at room temperature prior to use.
- Prepare a working concentration of the **Wash Solution** by adding 25 mL of 95 - 100 % ethanol (provided by the user) to the supplied bottle containing the concentrated **Wash Solution**. This will give a final volume of 36 mL. The label on the bottle has a box that may be checked to indicate that the ethanol has been added.
- Add 10 µL of β-mercaptoethanol (provided by the user) to each 1 mL of Lysis Solution required. β-mercaptoethanol is toxic and should be dispensed in a fume hood.
- It is important to work quickly during this procedure.
- **FIV Isolation Control (IsoC)**
 - A FIV Isolation Control (**IsoC**) is supplied. This allows the user to control the RNA isolation procedure. For this assay, add the FIV Isolation Control (**IsoC**) to the lysate during the isolation procedure
 - The FIV Isolation Control (**IsoC**) must not be added to the sample material directly.
 - Do not freeze and thaw the FIV Isolation Control (**IsoC**) more than 2 times.
 - The FIV Isolation Control (**IsoC**) must be kept on ice at all times during the isolation procedure.
- The RT-PCR components of the FIV RT-PCR Detection Kit should remain at -20°C until RNA is extracted and ready for RT-PCR amplification.
- It is recommended that no more than 100 µL of blood or saliva be used in order to prevent clogging of the column.
- We recommend the use of this kit to isolate RNA from non-coagulating fresh blood using EDTA or citrate as the anti-coagulant.
- FIV has a poor survival rate outside the infected body. It is important to add the **Lysis Solution** to the specimen as soon as possible (within 6 hours)
- It is important to work quickly during this procedure.

A. SPECIMEN LYSATE PREPARATION

Blood Lysate Preparation:

1. Add 350 µL of the **Lysis Solution** to an RNase-free microcentrifuge tube.
2. Add up to 100 µL of blood. Vortex for 10 seconds to mix.

Note: FIV has a poor survival rate outside the infected body. It is important to add the **Lysis Solution** to the specimen as soon as possible (within 6 hours). In the presence of the Lysis Solution components, the virus could be stable for hours if stored at room temperature and > 1 month if stored at -70°C.

3. Add 10 µL of the Isolation Control (**IsoC**) to the lysate. Vortex for 10 seconds to mix.
4. Add 200 µL of 95% ethanol to the lysate. Vortex for 10 seconds to mix.
5. Proceed to RNA Isolation (Step B).

B. SPECIMEN RNA PURIFICATION

Following the lysate preparation viral RNA can be extracted from the specimens using the supplied buffers and solutions according to the following protocol:

1. Assemble a column with one of the provided collection tubes.
2. Apply the lysate with ethanol (up to 650 µL) to the column and centrifuge for 1 minute at 14,000 rpm.

Note: Ensure the entire lysate volume has passed through into the collection tube by inspecting the column. If the entire lysate volume has not passed through, spin for an additional minute.

3. Discard the flowthrough and reassemble the spin column with its collection tube.
4. Depending on lysate volume, repeat steps **B2** and **B3**.

5. Apply 400 µL of **Wash solution** and centrifuge for one minute at 14,000 rpm.

Note: Ensure the entire wash solution has passed through into the collection tube by inspecting the column. If the entire wash volume has not passed through, spin for an additional minute.

6. Discard the flowthrough and reassemble the spin column with its collection tube.
7. Repeat steps **B5** and **B6** two more times (for a total of 3 washes).
8. Spin the column for 2 minutes to thoroughly dry the resin at 14,000 rpm. Discard the collection tube.
9. Place the column into a new 1.7 mL Elution tube.
10. Add 50 µL of **Elution Solution** to the column.
11. Centrifuge for 2 minutes at 2,000 rpm followed by a 2 minute spin at 14,000 rpm. Note the volume eluted from the column. If the entire 50 µL has not been eluted, spin the column for an additional minute at 14,000 rpm.
12. The purified RNA sample could be used immediately for RT-PCR as described below. It is recommended that samples be placed at -70°C for long term storage.

C. FIV RT-PCR Assay Preparation

Notes:

- Before use, suitable amounts of all RT-PCR components should be completely thawed at room temperature, vortexed and centrifuged briefly.
 - The amount of **2X FIV Detection RT-PCR Mastermix** and **2X RT-PCR Control Mastermix** provided is enough for up to 32 RT-PCR reactions (24 sample RT-PCR, 4 positive control RT-PCR and 4 no template control RT-PCR) each.
 - For each sample, one RT-PCR reaction using the **2X FIV Detection RT-PCR Mastermix** and one RT-PCR reaction using **2X RT-PCR Control Mastermix** should be set up in order to have a proper interpretation of the result.
 - For every RT-PCR run, one reaction containing FIV Positive Control (**FIV PosC**) and one reaction as no template control must be included for proper interpretation of results.
 - The recommended minimum number of RNA samples tested per RT-PCR run is 6.
 - Using a lower volume from the sample than recommended may affect the sensitivity of FIV Limit of Detection.
1. Prepare the RT-PCR reaction for sample detection (Set #1, using **2X FIV Detection RT-PCR Mastermix**) and the RT-PCR reaction for control detection (Set #2, using **2X RT-PCR Control Mastermix**) as shown in Table 1 below. The recommended amount of sample RNA to be used is 2.5 µL. However, a volume between 1 and 5 µL of sample RNA may be used as template. Ensure that one FIV detection reaction and one control reaction is prepared for each RNA sample. Adjust the final volume of the RT-PCR reaction to 20 µL using the Nuclease-Free Water provided.

Table 1. RT-PCR Assay Preparation

RT-PCR Components	Volume Per RT-PCR Reaction
2X FIV Detection RT-PCR Mastermix Or 2X RT-PCR Control Mastermix	10 µL
Sample RNA	2.5 µL
Nuclease-Free Water	7.5 µL
Total Volume	20 µL

2. For each RT-PCR run, prepare **one** positive control RT-PCR as shown in Table 2 below:

Table 2. RT-PCR Positive Control Preparation

RT-PCR Components	Volume Per RT- PCR Reaction
2X FIV Detection RT-PCR Mastermix Or 2X RT-PCR Control Mastermix	10 µL
<i>FIV Positive Control (PosC)</i>	10 µL
<i>Total Volume</i>	20 µL

3. For each RT-PCR run, prepare **one** no template control RT-PCR as shown in Table 3 below:

Table 3. RT-PCR Negative Control Preparation

RT-PCR Components	Volume Per RT-PCR Reaction
2X FIV Detection RT-PCR Mastermix Or 2X RT-PCR Control Mastermix	10 µL
<i>Nuclease-Free Water</i>	10 µL
<i>Total Volume</i>	20 µL

Therefore, at a minimum, each PCR run will contain 6 separate RT-PCR reactions.

C. One-Step RT-PCR Assay Programming

1. Program the thermocycler according to the program shown in Table 4 below.
2. Run one-step RT-PCR.

Table 4. FIV Assay Program

One Step RT-PCR Cycle	Step	Temperature	Duration
<i>Cycle 1</i>	Step 1	50°C	25 min
<i>Cycle 2</i>	Step 1	95°C	5 min
<i>Cycle 3 (35x)</i>	Step 1	94°C	15 sec
	Step 2	60°C	30 sec
	Step 3	72°C	45 sec
<i>Cycle 4</i>	Step 1	72°C	5 min
<i>Cycle 5</i>	Step 1	4°C	∞

D. FIV One Step RT- PCR Assay Results Interpretation

1. For the analysis of the RT-PCR data, the entire 15-20 μ L RT-PCR Reaction should be loaded on a 1X TAE 1.7% Agarose RNA gel along with 10 μ L of Norgen's RNA Marker (provided). Prepare enough agarose gel for running one set of RT-PCR of FIV detection and one set of RT-PCR for controls detection.
2. The RT-PCR products should be resolved on the 1X TAE 1.7% Agarose gel at 150V for 30 minutes (Gel running time will be vary depending on an electrophoresis apparatus).
3. Sample results are provided below:

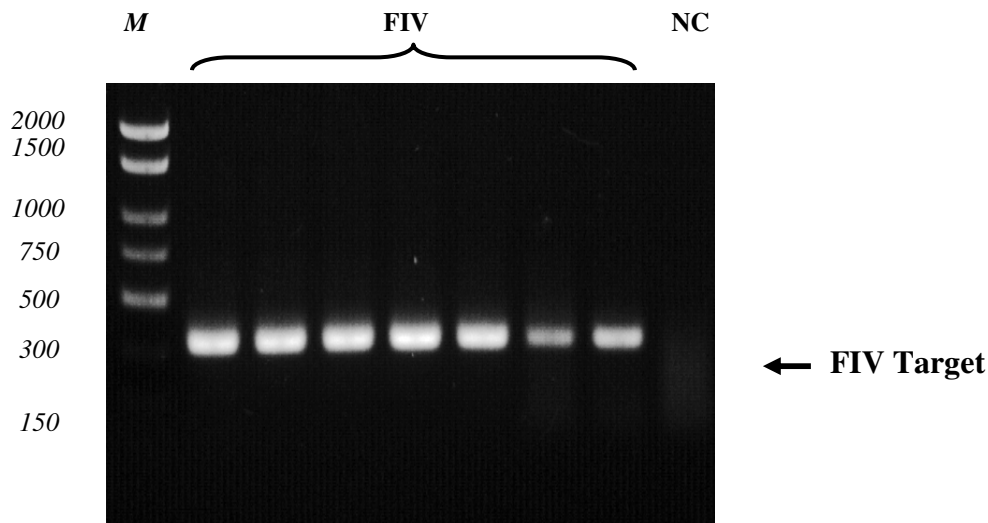


Figure 1: A representative 1X TAE 1.7% agarose gel showing the amplification of FIV under different concentration (FIV Target) using the **2X FIV Detection RT-PCR Mastermix**. The size of the FIV target amplicon corresponds to 318 bp as represented by the provided DNA Marker (M). **NC** = Negative Control.

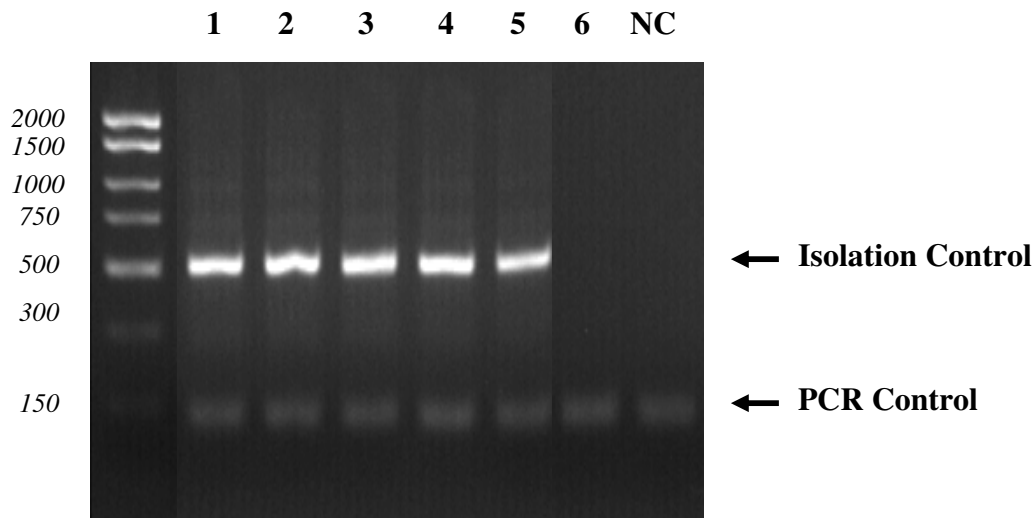


Figure 2: A representative 1X TAE 1.7% agarose gel showing the amplification of **Isolation Control** and **PCR Control** under different conditions using the **2X RT-PCR Control Mastermix**. The size of the Isolation Control amplicon and PCR Control amplicon correspond to 499 bp and 150 bp, respectively, as represented by the provided DNA Marker (M). Lanes 1 to 5 showed detection of both Isolation Control and PCR Control, suggesting that the RNA isolation as well as the RT-PCR reaction was successful. Lane 6 showed only the detection of PCR Control suggesting that while the RT-PCR was successful, the isolation failed to recover even the spiked-in Isolation control. **NC** = Negative Control.

Table 5. Interpretation of One-Step RT-PCR Assay Results

Input Type	Target reaction	Control Reaction		Interpretation
	FIV Target Band (318 bp)	FIV <i>IsoC</i> Band (499 bp)	FIV <i>PCRC</i> Band (171 bp)	
Positive Control	X	X	X	Valid
Negative Control			X	Valid
Sample	X	X	X	Positive
Sample		X	X	Negative
Sample			X	Re-test
Sample				Re-test
Sample		X		Negative
Sample	X		X	Positive
Sample	X	X		Positive
Sample	X			Re-test

** For results obtained that are not covered in Table 5 above, please refer to the Troubleshooting Section.

E. FIV RT-PCR Assay Specificity and Sensitivity

- The specificity of Norgen's FIV RT-PCR Detection Kit is first and foremost ensured by the selection of the FIV specific primers, as well as the selection of stringent reaction conditions. The FIV specific primers were checked for possible homologies to all GenBank published sequences by sequence comparison analysis and published FIV strains.

F. Linear Range

- The linear range of Norgen's FIV RT-PCR Detection Kit was determined by analysing a dilution series of a FIV quantification standards ranging from 100 ag to 1 pg.
- Each dilution has been tested in replicates (n = 4) using Norgen's FIV RT-PCR Detection Kit on a 1X TAE 1.7% agarose gel.
- The linear range of Norgen's FIV RT-PCR Detection Kit has been determined to cover concentrations from 100 ag to 1 ng
- Under the conditions of the Norgen's FIV RNA Isolation procedure, Norgen's FIV RT-PCR Detection Kit covers a linear range from 100 copies to 1 x 10⁶ copies.

Frequently Asked Questions

1. How many samples should be included per RT-PCR run?

- Norgen's FIV RT-PCR Detection Kit is designed to test 24 samples. For every 6 samples, a non-template control (Nuclease Free Water) and a Positive Control must be included. It is preferable to pool and test 6 samples at a time. If not, the provided Positive Control is enough to run 3 samples at a time.

2. How can I interpret my results if neither the FIV RT-PCR control nor the FIV Isolation Control (*IsoC*) amplifies?

- If neither the FIV PCR control nor the FIV Isolation Control (*IsoC*) amplifies, the sample must be re-tested. If the positive control showed amplification, then the problem occurred during the isolation, where as if the Positive control did not amplify, therefore the problem has occurred during the setup of the PCR assay reaction.

3. How should it be interpreted if only the FIV PCR control showed amplification but neither the FIV target nor the FIV Isolation control amplified for a sample?

- This indicates a poor isolation. The isolation procedure must be repeated.

4. How should it be interpreted if only the FIV Isolation Control (*IsoC*) was amplified in a sample?

- The sample tested can be considered as FIV negative.

5. How should it be interpreted if the FIV PCR control and the FIV target showed amplification in a sample?

- The sample tested can be considered positive. It could happen when too much template was added to the reaction.

6. How should it be interpreted if only the FIV target and the FIV PCR control were amplified in a sample?

- The sample tested can be considered as FIV positive.

7. How should it be interpreted if only the FIV target was amplified in a sample?

- It is recommended that the isolation is repeated.

8. How should it be interpreted if only the FIV PCR control and the FIV Isolation control showed amplification in a sample?

- The sample tested can be considered negative

9. What if I forgot to do a dry spin after my third wash?

- Your first RNA elution will be contaminated with the Wash Solution. This may dilute the RNA yield in your first elution and it may interfere with the PCR detection, as ethanol is known to be a PCR inhibitor.

10. What if I forgot to add the FIV Isolation Control (*IsoC*) during the isolation?

- It is recommended that the isolation is repeated.

11. What if I forgot to run the Control RT-PCR for the sample and I only ran the Detection RT-PCR and I obtained a positive result?

- The result can be considered positive. However, any negative result must be verified by running the associated control RT-PCR to ensure that it is a true negative and not a false negative due to problems with the RNA isolation or the RT-PCR reactions.

Related Products	Product #
Total RNA Purification Kit	17200
Feline Leukemia Virus RT-PCR Detection Kit	44000
Feline Calicivirus RT-PCR Detection Kit	43900
Feline Herpes Virus PCR Detection Kit	44300
Feline <i>infectious peritonitis</i> RT-PCR Detection Kit	44400

Technical Assistance

NORGEN's Technical Service Department is staffed by experienced scientists with extensive practical and theoretical expertise in sample and assay technologies and the use of NORGEN products. If you have any questions or experience any difficulties regarding Norgen's FIV RT-PCR Detection Kit or NORGEN products in general, please do not hesitate to contact us.

NORGEN customers are a valuable source of information regarding advanced or specialized uses of our products. This information is helpful to other scientists as well as to the researchers at NORGEN. We therefore encourage you to contact us if you have any suggestions about product performance or new applications and techniques.

For technical assistance and more information, please contact our Technical Support Team between the hours of 8:30 and 5:30 (Eastern Standard Time) at (905) 227-8848 or Toll Free at 1-866-667-4362 or call one of the NORGEN local distributors (www.norgenbiotech.com) or through email at techsupport@norgenbiotech.com.

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