Interface Definition Document (IDD)

Nanoracks Mixstix

Nanoracks

Doc No: NR-NANOLAB-S0004

Revision: A

List of Revisions

Revision	Revision Date	Revised By	Revision Description
-	2/8/2021	Maggie Ahern	Initial Release
A	6/6/22	Steven Stenzel	General Updates

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1 Introduction

1.1 Purpose

This Interface Definition Document (IDD) defines the environments, components, and processes relevant to the design and assembly of Nanoracks' Mixstix. This IDD also includes the minimum requirements each of the Mixstix must meet in order to receive program approval to fly aboard the International Space Station (ISS). Nanoracks verifies experiment compliance on behalf of payload developers (PDs).

1.2 Scope

The requirements defined in this document apply to payload experiment design and assembly and are included to ensure payload and crew safety while on orbit. A Nanoracks Mission Manager will assist PDs to ensure a successful mission.

2 Acronyms, Definitions and Applicable Documents

Table 2-1: Acronyms

Acronym	Definition
BSL	Biosafety Level
CMC	Cargo Missions Contract
IDD	Interface Definition Document
ISS	International Space Station
NASA	National Aeronautics and Space Administration
PD	Payload Developer
SDS	Safety Data Sheet

Table 2-2: Applicable Documents

Doc No.	Rev	Title
NR-NANOLAB-S0004	-	Nanoracks Mini-Laboratory (Mixstix) IDD

3 Responsibilities

3.1 Nanoracks Responsibilities

The Nanoracks Mission Manager shall provide PD with the necessary forms to describe the experiment to be performed. In addition, Nanoracks shall provide the Mixstix kit for experiment design and assembly. Nanoracks shall support a video conference to assist in the assembly of the Mixstix as requested.

3.2 PD Responsibilities

PD agrees to provide Nanoracks timely notification of any changes to the experiment. Generally, this means no less than 3 months prior to flight. PD shall ship the Mixstix to the Nanoracks Houston facility, unless other arrangements are approved by PD and Nanoracks. In most cases, Mixstix experiments must arrive at Nanoracks' Houston facility ten (10) business days prior to scheduled launch.

4 Mixstix Overview

Mixstix are simple to assemble, self-contained kits that allow for one to three volumes of fluids/solids to be mixed in orbit. Each of the Mixstix is a silicone tube coated in paralyene which can hold approximately 10 cubic centimeters. Mixstix can be stowed cold (approximately +4 C) or ambient (approximately +25 C) during pre-operations, ascent, and after landing. All Mixstix will be stored in ambient conditions after arrival on station and during descent. The operations for each Mixstix are independently determined, offering the PD more flexibility in to determine the following:

1. The types of fluids, materials, chemicals, and biological substances being tested
2. Which of the five available interaction timeframe(s) the experiment is activated by a crew member
3. Type of experiment operations to be performed at each opportunity

Based upon the contract, the PD will generally be sent a Mixstix kit that will be used to assemble the experiment. The kit includes materials for five Mixstix – one for flight, one for ground control, one as a flight back-up, and two for testing. In this section, the materials included in the kit and the quantity supplied are listed in **Table 4-1.** In addition, the required materials and other recommended materials that are not included in the kit are also listed in **Table 4-2** so the PD can prepare for a successful assembly of the experiment.

Table 4-1 - Materials included in the Mixstix Kit:

Item	Quantity
Silicone tubes	5
Nylon end caps (solid)	5
Nylon end caps (with screw holes)	5
Blunt tip needle	1
Polycarbonate screws	5
O-ring	5
Sharpie markers	2 (1 blue, 1 green)
Zip ties	10
Clamps	10

Table 4-2 - Materials not included in the Mixstix Kit:

Required Items	Suggested Items
Safety equipment (Gloves, goggles)	Syringe
Phillips screwdriver	Long cotton swab
Wire crimper or scissors appropriate for trimming nylon zip tie	Compressed gas keyboard cleaner

4.1 Mixstix Sterilization

The materials provided in the Mixstix kits are not sterilized prior to shipping to the PD. Nanoracks does not require sterilization. For experiments requiring sterilization, review the operating temperature ranges and recommendations provided below to prevent damage to the kit materials which may result in the experiment leaking. Heat sterilization is not recommended. All recommendations must be adhered to unless the PD is given an explicit waiver by Nanoracks.

Item	Temperate Range	Nanoracks Recommendation
Silicone tubes	-68 to 125 C[1]	Heat sterilization is not recommended, however, if the PD receives approval from Nanoracks, then they may sterilize by means of boiling, Ethylene Oxide gas, gamma irradiation, or autoclaving at 121 C for 15 minutes at 15psi.[2]
Nylon end caps	-52 to 93 C	Heat sterilization is not allowed.
Blunt tip needle	N/A	Heat sterilization is not allowed.
Polycarbonate screws	-40 to 98 C	Heat sterilization is not allowed.
O-rings	-18 to 204 C	PD may sterilize by means of boiling, Ethylene Oxide gas, gamma irradiation, or autoclaving at 121 C for 15 minutes at 15 psi
Clamps	2 to 93 C	Heat sterilization is not recommended, however, if the PD chooses they may sterilize by means of boiling, Ethylene Oxide gas, gamma irradiation, or autoclaving at 121 C for 15 minutes at 15 psi [3]

[1] Temperature range for silicone tubes (182 C) reduced to reflect the maximum operating temperature for the Parylene coating (125 C)

[2] An approval will only be received if the contents of the experiment pass a compatibility check ensuring a Parylene coating is not needed to consider the tube a level of containment

[3] Clamps may not function properly after being sterilized

4.2 Mixstix Assembly

There are three different types of assembly for the Mixstix kit: Type I, Type II, and Type III (**Figure 4.2-1**). The various assembly options enable the PD to have flexibility in the types of experiments that can be performed using the Mixstix kit.

Figure 4.2-1 - Type I, II and III shown from left to right.

The Type I assembly is comprised of one chamber with no clamps. The Type II assembly is comprised of two chambers and one clamp. Finally, the Type III assembly is comprised of three chambers and two clamps. Each assembly type is outlined, respectively, in Appendix A, B, and C.

5 Experiment Considerations

When reporting the contents of the Mixstix experiment, the PD must consider the content, quantity, concentration, and pH of each volume's materials, chemicals, biology, etc. This information enables the ISS program to review any potential hazards or other safety concerns that may result from the volumes being combined. A Safety Data Sheet (SDS) shall be provided for each volume that contains a non-edible substance. SDSs must be in the newer SDS format rather than the retired Material Safety Data Sheet (MSDS) format and must have a publication or review date less than five years prior to the launch date.

The PD shall define the thermal control needed for the experiment at each of the following stages: shipping to Nanoracks, handover to NASA, ascent, and return to PD. The thermal control options for Mixstix include refrigerated (~+4C) or ambient (~+25C). On-orbit and descent are required to be at ambient.

Finally, the PD will need to determine the on-orbit operations, such as, when the experiment requires crew interaction and how long the volumes need to be agitated.

6 Shipping

The PD shall ship the Mixstix to Nanoracks' Houston facility. Consider customs and duties if shipping from outside of the United States. Provide tracking information to the Mission Manager. All shipping costs, arrangements, paperwork, and related shipping activities are the customer's responsibility unless otherwise agreed to in the contract. Note that Nanoracks will not receive bacteria in-house if it is above a biosafety level (BSL) of 1. Coordinate with your Mission Manager if any of the volumes' contents have a BSL greater than 1.

6.1 Shipping Ambient

If the experiment is shipping ambient, ensure the tube is secure so it does not move during shipping and cause the clamp to open. Nanoracks recommends PD tape the Mixstix directly to the box or uses a cushioning material such as foam, packing peanuts, or bubble wrap to prevent damage to the Mixstix while in transit.

6.2 Shipping Cold

If experiment is to be shipped cold, ensure the Mixstix stays cold during shipping to Houston. Nanoracks recommends using a foam container shown in **Figure 6.2-1**, or other properly insulated container. In addition, an outer cardboard box is highly recommended. Ship overnight if the Mixstix needs to remain cold. Ensure the packing is secure so neither the tube nor ice packs are able to move during shipping and cause the clamp(s) to open.

These kinds of boxes are sometimes found at shipping stores or medical supply chains (like here: https://us.vwr.com/store/catalog/product.jsp?product_id=4677606).

Figure 6.2-1 Foam Shipping Container

Use as many pre-chilled cold packs, such as those made by Coleman or Igloo, needed to surround the experiment. Sending only cold packs in a cardboard box will NOT keep the Mixstix cold.

Figure 6.2-2 shows the recommended arrangement taken from a FedEx 'How to Pack' manual (http://images.fedex.com/us/services/pdf/How_To_Pack.pdf):

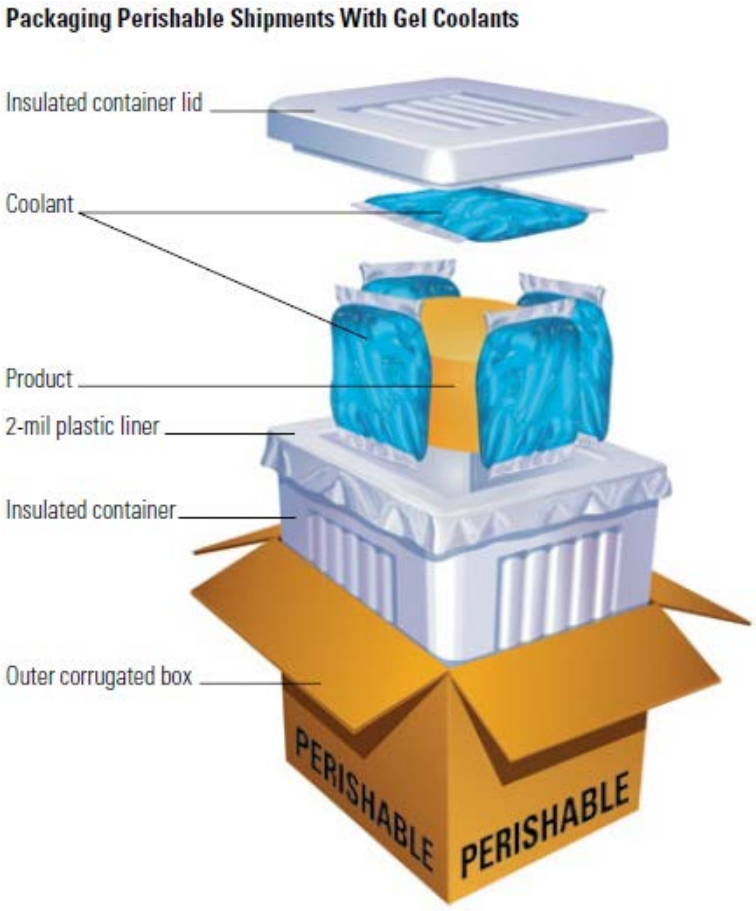
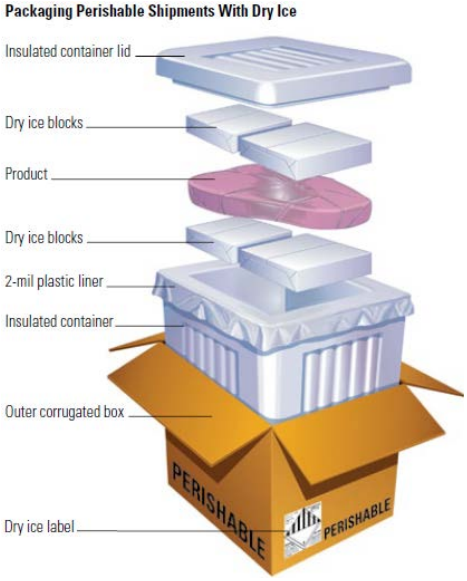


Figure 6.2-2 Cold Pack Shipping Container

6.3 Shipping with Dry Ice

If there are special concerns about the Mixstix remaining cool during shipping, consider using dry ice. Use caution as dry ice can cause the Mixstix to freeze (which is not an acceptable use of the equipment) and damage experiment samples. Dry ice can often be found at grocery stores and are sold in bricks. Always buy more than the estimated need. If the dry ice bricks do not fit into the package, gently break it up by hitting the brick with a rubber mallet or dropping it on the floor. Always use gloves or a towel when handling. Ensure the packing is secure so neither the tube nor the dry ice are able to move during shipping and cause the clamp(s) to open.

Figure 6.3-1 shows the FedEx recommended dry ice configuration for shipping along with a guide for how much and how long dry ice may last. Always ship overnight, but pack enough dry ice to last an extra day because of un-expected delays. Shipping companies do not always provide timely updates about any delays.



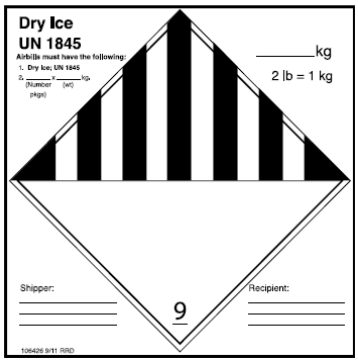
Weight of Frozen Food	Time In Transit			
	4 Hours	12 Hours	24 Hours	2 Days
2 LB	2 LB Dry Ice	3 LB Dry Ice	5 LB Dry Ice	10 LB Dry Ice
5 LB	3 LB Dry Ice	4 LB Dry Ice	8 LB Dry Ice	15 LB Dry Ice
10 LB	4 LB Dry Ice	5 LB Dry Ice	10 LB Dry Ice	20 LB Dry Ice
20 LB	5 LB Dry Ice	8 LB Dry Ice	15 LB Dry Ice	25 LB Dry Ice
50 LB	10 LB Dry Ice	15 LB Dry Ice	20 LB Dry Ice	30 LB Dry Ice
For each additional day add 8 to 15 pounds.				

Figure 6.3-1 Dry Ice Shipping

Do not seal the foam or cardboard box completely since as the dry ice turns into a gas, pressure can build up and rupture the container.

Be sure to know approximately how much dry ice used (in kilograms) in the container and mark it on the shipping label. They will also require a completed dry ice label (see below) to be placed on the exterior of the box. They will supply the label. Finally, label the exterior of the box with “perishable.”

FedEx Dry Ice Label



Appendix A: Experiment Details Form

Table A-1: Basics

Experiment Name	
School/Organization Name	Name: Contact: Phone: Email:
Study Question	
Hypothesis	
Part Number	This will be assigned by Nanoracks and provided to you before experiment finalization.

Table A-2: Experiment

What will be in each section of the experiment and how much? Please use detail. For example, if you are using bacteria, which strain? If you are using a chemical, what is the concentration?

Content + Quantity + Concentration	
Volume 1	
Volume 2	
Volume 3	
Products of chemical reactions after chamber(s) is/areopened	

pH	
Volume 1	
Volume 2	
Volume 3	

Would you like your experiment refrigerated (4°C) or ambient (25°C)? Temperatures listed are nominal.

Thermal Control	
Shipping to Nanoracks in TX (Note that shipping accommodations are the responsibility of the PD)	
At Nanoracks before Handover to NASA	
Handover to NASA through arrival at ISS	
Onboard ISS	25°C - Required
From ISS through arrival at Nanoracks	25°C - Required
At Nanoracks through Return Shipping	
Return Shipping (Note that return shipping accommodations are the responsibility of the PD)	

Table A-3: Operations

When does the experiment need crew interaction? Which clamp(s) should open? Does it need to be shaken and for how long? Experiments can be shaken gently or vigorously. Time limit for an individual day's interaction is 120 seconds. There are five opportunities for crew interaction during the experiment's stay onboard the ISS. Please provide information or "none" for each opportunity below.

Arrival on ISS: A = 0	
Action	
Duration	
Remarks	
During First Week: A+2	
Action	
Duration	
Remarks	
2 Weeks Prior to Departure: D-14	
Action	
Duration	
Remarks	
Week Prior to Departure: D-5	
Action	
Duration	
Remarks	
Days Prior to Departure: D-2	
Action	
Duration	
Remarks	

Appendix B: Assembly Type I

This document includes directions for assembly of a Type I Mixstix with one chamber (no clamps). Your kit includes materials for five Mixstix – one for flight, one for ground control, one as a flight back-up, and two for testing. A Mixstix can be assembled many ways. You should read thorough all instructions and make a good plan for your specific experiment before you begin.

B-1: Parts List

Items you will need:

- Experiment materials
- Philips head screwdriver
- Wire crimpers or cutters

Optional items we recommend:

- Paper towels
- Long cotton tipped swabs
- Compressed air (such as for electronics cleaning)
- Gloves and other protective equipment
- Cellophane tape
- 10 mL syringe
- Pipette
- Weigh papers or funnel

Included in your kit:

- 5 Mixstix tubes
- 5 solid endcaps
- 5 end caps with a threaded hole
- 5 polycarbonate screws with O-rings attached
- 10 clamps
- 1 blunt industrial needle
- 1 blue Sharpie
- 1 green Sharpie
- 10 zip-ties

B-2: Before You Begin Assembly

Ensure all experiment materials are added as described on your Experiment Details From. If you need to add less of something, this is okay, but you cannot add any new materials, add more materials, or materials of a higher concentration than described in your form. Note that reducing water or another solvent could result in an increased concentration of other experiment materials. Consult your mission manager if you have questions.

Observe all safety precautions needed to work with your materials. The Mixstix alone do not require any safety equipment, but if your experiment requires gloves, goggles, apron, or other safety equipment, please utilize as appropriate.

B-3: Assembly Procedure

Gather all materials. Put on safety equipment (as needed based on the materials' handling recommendations). Premeasure samples if it is practical.

Insert solid end cap into one end of tube. It should be fully seated into the tube.

Install zip tie. The simplest way is generally to begin with the zip tie away from the tube. Insert the tip into the clasp just enough that it begins to click. Then place the loop over the Mixstix and tighten. Place the zip tie between the flange of the endcap and the flared tip. It should be tight enough that the zip tie will not rotate around the tube. Reference **Figure B-3-1**.

Figure B-3-1 Mixstix Assembly

Insert the endcap with a taped hole.[4] Endcap should be all the way seated. Install zip tie as before. Remember to tighten it as much as possible so it cannot rotate around the tube. Using wire crimpers or cutters, snip the excess length of the zip ties as shown **Figure B-3-2**.

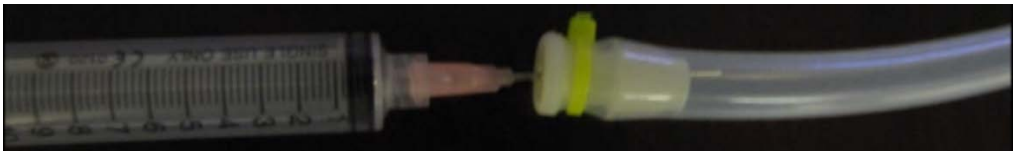


Figure B-3-2 Mixstix Zip Tie

[4] If the sample you are loading in this section is not a liquid, you can do the last endcap a little differently

Using a syringe and provided blunt tipped needle, insert sample into chamber. Hold the tube at a shallow angel to ensure proper fill without spilling any of your sample as shown in **Figure B-3-3**.

Record the final measurements of all materials inserted into the Mixstix on your Experiment Details Form.

Figure B-3-3 Mixstix Filling

Use your hand to start the small clear screw with black O-ring. Use a Phillips head screwdriver to finish tightening the screw. Tighten until the O-ring is lightly compressed. Take care to tighten enough to prevent liquid from escaping, but do not over tighten. See **Figure B-3-3**.

Figure B-3-3 Mixstix Filling Screw

If you are not loading a liquid into your Mixstix or you do not need to utilize as much volume as possible, you can use this alternative method for installing the second endcap:

First, install the screw into the cap. Set cap with screw installed aside. Add your experiment samples. Now insert cap into the mixture tube. Install zip tie.

To prepare with for shipping, insert finished tube into a plastic zip top bag. Roll excess bag around the tube and secure with cellophane tape.

Congratulations! You have successfully assembled the Mixstix!

Appendix C: Assembly Type II

This document includes directions for assembly of a Type II Mixstix with two chambers (one clamp). Your kit includes materials for five Mixstix – one for flight, one for ground control, one as a flight back-up, and two for testing. A Mixstix can be assembled many ways. You should read through all instructions and make a good plan for your specific experiment before you begin.

C-1: Parts List

Items you will need:

- Experiment materials
- Philips head screwdriver
- Wire crimpers or cutters

Optional items we recommend:

- Paper towels
- Long cotton tipped swabs
- Compressed air (such as for electronics cleaning)
- Gloves and other protective equipment
- Cellophane tape
- 10 mL syringe
- Pipette
- Weigh papers or funnel

Included in your kit:

- 5 Mixstix tubes
- 5 solid endcaps
- 5 end caps with a threaded hole
- 5 polycarbonate screws with O-rings attached
- 10 clamps
- 1 blunt industrial needle
- 1 blue Sharpie
- 1 green Sharpie
- 10 zip-ties

C-2: Before you begin Assembly

Ensure all experiment materials are added as described on your Experiment Details Form. If you need to add less of something, this is okay, but you cannot add any new materials, add more materials, or materials of a higher concentration than described in your form. Note that reducing water or another solvent could result in an increased concentration of other experiment materials. Consult your mission manager if you have questions.

Observe all safety precautions needed to work with your materials. The Mixstix alone does not require any safety equipment, but if your experiment requires gloves, goggles, apron, or other safety equipment, please utilize as appropriate.

C-3: Getting Started

Gather all materials. Put on safety equipment (as needed based on the materials handling recommendations). Premeasure samples if it is practical.

Insert solid end cap into one end of tube. It should be fully seated into the tube.

Install zip tie. The simplest way is generally to begin with the zip tie away from the tube. Insert the tip into the clasp just enough that it begins to click. Test the loop to ensure it will not come apart. If it does, you may need to reverse your zip tie. Then place the loop over the Mixstix and tighten. Place the zip tie between the flange of the endcap and the flared tip. It should be tight enough that the zip tie will not rotate around the tube. Refer to **Figure C-3-1**.

Figure C-3-1 Mixstix Assembly

C-4: Filling the Mixstix

Insert the tube into the clamp. (The direction of the clamp does not matter for a Type II Mixstix.) The clamp can be pulled apart slightly to make it easier to slide the clamp down the tube. Move the clamp down the tube to make the chamber the correct size.

Note that it may be easier to install the clamp before adding your sample if your sample is a liquid. Take care to keep the tube up right so no sample is spilled. Close the clamp tightly. You will hear and feel a series of clicks indicating the clamp is closing. Keep pressing until the clamp cannot be tightened further.

Record the final measurements of all materials inserted into the Mixstix on your Experiment Details Form.

Clean or dry the empty chamber of the Mixstix. Required cleaning procedure will vary with the types of samples being use, but compressed air can be used to spray out liquid or solids. Hold the tube so that it is angled down slightly and insert the small nozzle into the tube to allow sample to escape. See **Figure C-4-1**.

Additionally, or alternatively, use long cotton swaps to dry the sides of the tube.

Figure C-4-1 Mixstix Cleaning

C-5: Finishing Assembly

Insert the endcap with a taped hole. Endcap should be all the way seated. Install zip tie as before. Remember to tighten it as much as possible so it cannot rotate around the tube. Using wire crimpers or cutters, snip the excess length of the zip ties as shown in **Figure C-5-1**.

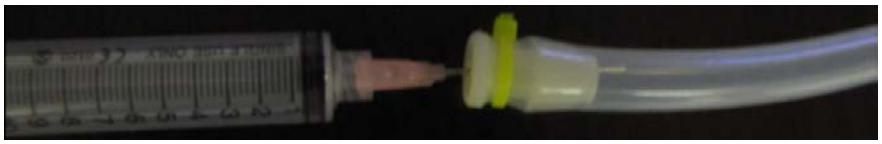


Figure C-5-1 Mixstix Zip Tie

Using a syringe and provided blunt tipped needle, insert sample into chamber. Hold the tube at a shallow angel to ensure proper fill without spilling any of your sample as shown in **Figure C-5-2**. Record the final measurements of all materials inserted into the Mixstix on your Experiment Details Form.

Figure C-5-2 Mixstix Filling

Use your hand to start the small clear screw with black O-ring. Use a Phillips head screwdriver to finish tightening the screw. Tighten until the O-ring is lightly compressed. Take care to tighten enough to prevent liquid from escaping, but do not over tighten. See **Figure C-5-3** for refrence.

Figure C-5-3 Mixstix End Screw

If you are not loading a liquid into your Mixstix or you do not need to utilize as much volume as possible, you can use this alternative method for installing the second endcap:

First, install the screw into the cap separate from the mixture tube. Set cap with screw installed aside. Add your experiment samples. Now insert cap into the mixture tube. Install zip tie. To prepare with for shipping, insert finished tube into a plastic zip top bag. Roll excess bag around the tube and secure with cellophane tape.

Congratulations! You've successful assembled the Mixstix!

Appendix D: Assembly Type III

This document includes directions for assembly a Type III Mixstix with three chambers and two clamps. Your kit includes materials for five Mixstix – one for flight, one for ground control, one as a flight back-up, and two for testing. A Mixstix can be assembled many ways. You should read thorough all instructions and make a good plan for your specific experiment before you begin.

D-1: Parts List

Items you will need:

- Experiment materials
- Philips head screwdriver
- Wire crimpers or cutters

Optional items we recommend:

- Paper towels
- Long cotton tipped swabs
- Compressed air (such as for electronics cleaning)
- Gloves and other protective equipment
- Cellophane tape
- 10 mL syringe
- Pipette
- Weigh papers or funnel

Included in your kit:

- 5 Mixstix tubes
- 5 solid endcaps
- 5 end caps with a threaded hole
- 5 polycarbonate screws with O-rings attached
- 10 clamps
- 1 blunt industrial needle
- 1 blue Sharpie
- 1 green Sharpie
- 10 zip-ties

D-2: Before You Begin Assembly

Ensure all experiment materials are added as described on your Experiment Details Form. If you need to add less of something, this is okay, but you cannot add any new

materials, add more materials, or materials of a higher concentration than described in your form. Note that reducing water or another solvent could result in an increased concentration of other experiment materials. Consult your mission manager if you have questions.

Observe all safety precautions needed to work with your materials. The Mixstix alone do not require any safety equipment, but if your experiment requires gloves, goggles, apron, or other safety equipment, please utilize as appropriate.

D-3: Getting Started

Gather all materials. Put on safety equipment (as needed based on the materials handling recommendations). Premeasure samples if it is practical.

Insert solid end cap into one end of tube. It should be fully seated into the tube.

Install zip tie. The simplest way is generally to begin with the zip tie away from the tube. Insert the tip into the clasp just enough that it begins to click. Test the loop to ensure it will not come apart. If it does, you may need to reverse your zip tie. Then place the loop over the Mixstix and tighten. Place the zip tie between the flange of the endcap and the flared tip. It should be tight enough that the zip tie will not rotate around the tube. Refer to the **Figure D-3-1**.

Figure D-3-1 Mixstix Assembly

D-4: Filling the Mixstix

- **First Chamber**

Insert your first experiment material. A funnel or weighing paper may help get all the sample into the mixture tube.

Insert the tube into the clamp starting on the end of the clamp with the tab. The clamp can be pulled apart slightly to make it easier to slide the clamp down the tube. Move the clamp down the tube to make the first chamber the correct size.

Note that it may be easier to install the clamp before adding your sample if your sample is a liquid. Take care to keep the tube up right so no sample is spilled. Close the clamp tightly. You will hear and feel a series of clicks indicating the clamp is closing. Keep pressing until the clamp cannot be tightened further. Record the final measurements of all materials inserted into the Mixstix on your Experiment Details Form.

Clean or dry the empty chamber of the Mixstix. Required cleaning procedure will vary with the types of samples you use, but compressed air can be used to spray out liquid or solids. Hold the tube so that it is angled down slightly and insert the small nozzle into the tube to allow sample to escape. See **Figure D-4-1**. Additionally, or alternatively, use long cotton swaps to dry the sides of the tube.

Figure D-4-1 Mixstix Cleaning

If the clamp you just placed will be the FIRST clamp opened by the crew member, use green the green sharpie to signify activation.

If the clamp you just placed will be the SECOND clamp opened by the crew member, use the blue sharpie to signify deactivation.

Whichever color you need, the sharpies provided in your kit to color the entire textured square on the clamp.

- **Second Chamber**

Make sure the first clamp is tight, then insert the second sample. This should be done the same as the first sample. Use funnel or weight paper if necessary. Take care not to spill the sample. Record the final measurements of all materials inserted into the Mixstix on your Experiment Details Form.

Insert the tube with into the second clamp starting at the end AWAY from the tab. The two clamps will be facing opposite directions. Slide the second clamp down the tube so that the middle chamber is the correct size. Before you close the clamp, align the tab with the tab on the first clamp. See **Figure D-4-2** for reference. As with the first clamp, it might be easier to install the clamp before adding the sample if the sample is liquid.

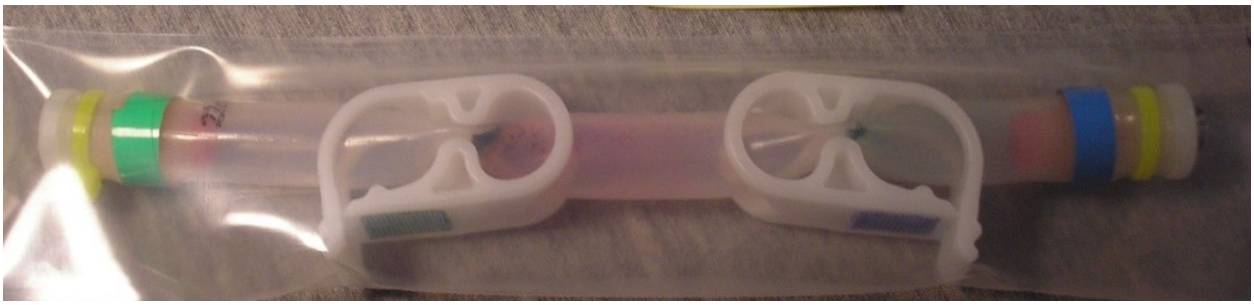


Figure D-4-2 Mixstix Clamps

Clean the remaining empty chamber.

If the clamp you just placed will be the FIRST clamp opened by the crew member, use green the green sharpie to signify activation.

If the clamp you just placed will be the SECOND clamp opened by the crew member, use the blue sharpie to signify deactivation.

Whichever color you need, the sharpies provided in your kit to color the second textured square on the clamp.

D-5: Finishing Assembly

Insert the endcap with a taped hole. Endcap should be all the way seated. Install zip tie as before. Remember to tighten it as much as possible so it cannot rotate around the tube. Using wire crimpers or cutters, snip the excess length of the zip ties as shown in photo below.

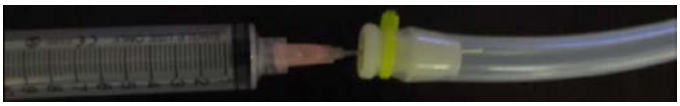


Figure D-5-1 Mixstix Zip Tie

Using a syringe and provided blunt tipped needle, insert sample into chamber. Hold the tube at a shallow angel to ensure proper fill without spilling any of your sample as shown in **Figure D-5-2**. Record the final measurements of all materials inserted into the Mixstix on your Experiment Details Form.

Figure D-5-2 Mixstix Filling

Use your hand to start the small clear screw with black O-ring. Use a Phillips head screwdriver to finish tightening the screw. Tighten until the O-ring is lightly compressed. Take care to tighten enough to prevent liquid from escaping, but do not over tighten. See **Figure D-5-3** for refrence.

Figure D-5-3 Mixstix End Screw

If you are not loading a liquid into your Mixstix or you do not need to utilize as much volume as possible, you can use this alternative method for installing the second endcap:

First, install the screw into the cap separate from the mixture tube. Set cap with screw installed aside. Add your experiment samples. Now insert cap into the mixture tube. Install zip tie. To prepare with for shipping, insert finished tube into a plastic zip top bag. Roll excess bag around the tube and secure with cellophane tape.

Congratulations! You've successful assembled the Mixstix!