



ACD-200 BOBCAT DRY FILTER AIR SAMPLER

USER'S GUIDE



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1 PRODUCT OVERVIEW

This section contains a product description of the InnovaPrep ACD-200 Bobcat™ Dry Filter Air Sampler and a brief look at its applications.

1.1 PRODUCT DESCRIPTION

The InnovaPrep ACD-200 Bobcat, shown in Figure 1.1, is a lightweight, portable, dry filter air sampler with a unique patented rapid filter elution system. The Bobcat aerosol collector takes up little more than one-quarter of a cubic foot, has an internal battery, built-in tripod, and can run continuously at 200 liters per minute for up to 12 hours. The system has a built-in, omni-directional aerosol inlet, easy to read status display, and a built-in handle. The system is equipped with a mass flow sensor that allows for consistent sampling rates throughout the collection cycle. It can be operated in four programmable run modes that allow the user to balance collection rate with battery life. The system is easy to use and operators can be trained in a little as 10 minutes. Installation of the filter cassettes and the controls can be manipulated with gloved hands, while wearing personal protective equipment such as military-style nuclear/biological/chemical (NBC) protective suits.



FIGURE 1.1 ACD-200 BOBCAT

Following aerosol collection, the user snaps the Sample Cup onto the Filter to remove it from the Collector, then snaps the Elutor onto the Filter. To extract the captured particles from the Filter, a canister containing the Elution fluid is pressed into the Elutor. The Elution Fluid is released from the canister and turns to foam as it flushes the Filter. The wet foam passes through the interstitial spaces of the Filter to efficiently extract captured particles. Sample elution takes approximately 5 seconds and produces 6 to 7 milliliters of liquid sample. The foam quickly collapses back to a liquid in the Sample Cup, making it available for sample processing and analysis.

1.2 APPLICATIONS

The InnovaPrep ACD-200 Bobcat is ideally suited for the collection of bioaerosols and particulate matter; including sub-micron sized particles, airborne molecular contamination, and particulates. This system has been developed to address a broad range of air sampling requirements. The Filter and Elution Kit are single-use, therefore there is no requirement for decontamination between samples. Since no liquids are used in the collector, the system can be operated at temperatures ranging from -20° C to +60° C in non-condensing environments.

1.3 MATERIALS PROVIDED

Inspect each component when unpacking. If damage is observed, do not use the instrument, and contact InnovaPrep immediately. Remove any protective packaging that may be present around the instrument. Examine the packaging material to be sure that materials that have been provided (see the list below) are removed. Please keep the custom foam packaging insert for use in the event that a return shipment is necessary.

Component	InnovaPrep P/N	Quantity
InnovaPrep ACD-200 Bobcat	ACD-200	1
External Power Supply	AC01057	1
Power Cord	HC03019	1
Power/Trigger Cable Assembly	AC01129	1

1.4 MATERIALS REQUIRED BUT NOT PROVIDED

A Rapid Filter Elution Kit is required for sampling. Users have a choice of two kits with different fluid types.

- Rapid Filter Elution Kit with TRIS - Item AC00201-T
- Rapid Filter Elution Kit with PBS - Item AC00201-P

Each Filter Elution Kit includes:

1. Filter
2. Sample Cup
3. Sample Cup Lid
4. Elutor
5. Elution Fluid Canister

These are available for purchase on the InnovaPrep website.



To operate the unit in “Trigger” mode you will need to purchase the Trigger Accessory.

1.5 BATTERY POWER

Battery is not included. Two rechargeable battery options are available for the ACD-200 Bobcat.

- 7.5 Ah Lithium Ion – Recommended for holding the longest charge (up to 12 hours on continuous mode). Item AC01054
- 4.8 Ah Nickel Metal Hydride – Holds charge up to 7 hours on continuous mode. Item AC09006

2 ACD-200 BOBCAT METHOD OF OPERATION

The InnovaPrep ACD-200 Bobcat uses an electret filter to capture particles onto the surface of polymer fibers in the filter. A novel Wet Foam Elution™ process is then employed to wash the particles off of the fiber surfaces into very small liquid volumes.

2.1 SAMPLE COLLECTION ON AN ELECTRET FILTER

The system uses a dry 52 mm electret filter as the collection media. Electret filters are made with a combination of positively charged and negatively charged fibers. This substantially increases the collection efficiency of the filter and allows for the use of lower pressure drop filters, which, in turn, allows for higher sampling rates for extended periods using battery power. Additional advantages include low consumable costs, ease of use, and high durability. It has the ability to operate below 0°C — a limitation for most collectors.

2.2 WET FOAM ELUTION

The single-use kit comes with everything you need to recover a fluid sample, including the Filter, a Sample Cup with Lid, an Elutor, and a canister of Elution Fluid. The patented Wet Foam Elution process (US Patent 8,100,112; 8,958,623; 9,738,918) is much more efficient than liquid rinsing for the following reasons:

- Volume Expansion
When rinsing a filter with liquid, most of the liquid volume is used to fill the dead space inside the filter housing; only a small portion of the fluid is actually in contact with the filter surface. This can be minimized to an extent by

reducing the cross-sectional area of the fluid path across the filter, but a large portion of the liquid is still underutilized. However, foam is 80-90% gas, which fills the empty space without contributing to the final sample volume.

- Increased Viscosity

Liquid has a tendency toward “channeling” when flowing through a filter, that is, there is an area of high flow in the center of the fluid path while the portion of flow in contact with the filter surface is much slower. The higher viscosity of foam prevents channeling and creates a more uniform flow through the interstitial spaces of the filter.

- Bubble Dynamics

The micro-bubbles in the foam behave as deformable solids. As they travel through the filter they move as a rigid body with a narrow lubricating layer, effectively squeegeeing the particles off of the surfaces of the filter fibers.

- Exfoliating Action

As the micro-bubbles in the foam impact against each other and burst, the turbulence and energy produced helps to lift particles that are adhering to the filter fibers.

- Buffered Elution

The buffered elution fluid is conductive and breaks down the electrostatic charges holding the particles to the electret filter, effectively releasing them in the liquid sample.

2.3 FOAM GENERATION

The Wet Foam Elution process uses a very specific high-quality foam to elute the filter. The elution fluid is composed of water, a low concentration surfactant (0.075% Tween 20), and a pH buffer (Tris or PBS). This solution is carbonated at 130 psi, which dissolves significant amount of CO₂ into the fluid. During the elution process, the valve opens as the elution canister is pushed into the Elutor that is fitted onto the Filter, forcing the elution fluid through the pressure orifice, through the filter and into the Sample Cup. As the fluid passes from the high-pressure environment on one side of the orifice, to the low-pressure environment on the other side, the dissolved CO₂ expands, comes out of the solution to form micro-bubbles. These micro-bubbles increase the volume of the fluid six-fold or more as it passes through the filter. The foam immediately collapses back into a liquid and is ready for sample processing and analysis.

3 COMPONENTS OF THE ACD-200 BOBCAT

The following section describes the components of the InnovaPrep ACD-200 Bobcat air sampler.



FIGURE 3.1 COMPONENTS OF THE ACD-200 BOBCAT

3.1 DESCRIPTION OF COMPONENTS

Description of the InnovaPrep ACD-200 Bobcat components listed in Figure 3.1, clockwise from top:

- Lid Release – Used to open the ACD-200 for loading or recovering a filter cartridge.
- Power and Trigger Port - Inlet for the included Power and for the optional Trigger Connector.
- Leg Hinges with Locking Push Pins – Releasing the push pins allows the user to fold the legs up against the unit for compact storage and convenient transportation.
- Telescoping Tripod Legs – Each of the three legs consist of three segments that allow the user to raise and lower the unit to the desired height.
- Leg Latches – Each leg has three leg latches that allow the user to telescope the legs to the desired length.

- Battery Cover – Located on the bottom of the unit, the battery cover holds the battery in place during operation.
- Check Status Button – Used to verify the status of the system.
- Status Lights – Green LED indicates the system is okay, red LEDs indicate if the lid is open, a filter is needed, the flow rate is below desired level, or the battery power is low.
- Mode Selection Knob – Rotary knob for selecting the operating mode and turning the unit off.
- Inlet Cap – Protect from water ingress and is designed as part of the omni-directional inlet.

3.2 CHECK STATUS BUTTON AND ASSOCIATED LEDs

The ACD-200 is equipped with five LEDs that communicate the status of the unit to the user. The appropriate LEDs are illuminated when the Check Status button is pushed. The red Check Lid LED is illuminated when the lid is open. The red Check Filter LED is illuminated if there is not a filter cassette present in the sampler. The Flowrate LED is illuminated when the internal mass flow sensor is measuring a flow rate less than what has been selected. This may be due to an overloaded filter or a blockage at the exhaust vents located on the bottom of the unit. The Battery LED is illuminated when the battery needs to be recharged.



FIGURE 3.2 CHECK STATUS BUTTON AND LEDs

4 PROCEDURES

This chapter includes some of the basic procedures used while operating the Bobcat.

4.1 SETTING UP THE ACD-200 BOBCAT FOR COLLECTION

Select the desired area for sample collection. For each leg, push the locking push pin located on the leg hinge at the base of the Bobcat as shown in Figure 4.1 and 4.2. It should be noted that the Bobcat cannot be operated with the legs in the upright position since the exhaust vents are located on the bottom of the unit and the Inlet can't be opened.



FIGURE 4.1 LOCKING PUSH PIN LOCATION AT LEG HINGE



FIGURE 4.2 UNLOCKING AND UNFOLDING LEG

Unfold the leg until the push pin pops out and locks the leg into place as shown in Figure 4.3. Open the leg latches, as shown in Figure 4.4, and telescope the legs out to the desired height.



FIGURE 4.3 LEG PUSH PIN LOCKED IN PLACE



FIGURE 4.4 OPENING LEG LATCH FOR ADJUSTMENT

Supporting the back of the unit with one hand, push the 10-Pin Connector (see Figure 4.5) on the Power and Trigger Connector into the Power and Trigger Port on the front of the unit. It will automatically lock into place. Push the barrel

plug on the external power supply (see Figure 4.6) into the barrel jack on the Power and Trigger Connector. Plug one end of the AC Power Cord (Figure 4.7) into the External Power Supply and plug the other end into an appropriate wall outlet.



FIGURE 4.5
POWER AND TRIGGER CONNECTOR



FIGURE 4.6 EXTERNAL POWER SUPPLY
WITH BARREL PLUG



FIGURE 4.7 AC POWER CORD

4.2 OPTIONAL BATTERY OPERATION

The ACD-200 has a rechargeable battery for operating the unit in the field. Instructions for using the battery are as follows. The battery door is located on the bottom of the unit.

The Battery Cover is removed by pinching the retaining clips on both sides, as shown in Figure 4.9, and pulling the cover straight out of the bottom of the unit, as shown in Figure 4.10.

The battery is installed into the unit with the battery socket towards the front of the unit as shown in Figure 4.11. Reinstall the Battery Cover by pushing it into the bottom of the unit until both clips click into place.



FIGURE 4.9 PINCHING CLIPS ON
BATTERY COVER



FIGURE 4.10 REMOVING
BATTERY COVER



FIGURE Battery Socket

FIGURE 4.11 INSTALLING
BATTERY

4.3 INSTALLING THE FILTER

Open the ACD-200 by putting one hand on top of the Inlet and while grasping it, press the Release Button. The top will open on its hinge. Insert the Filter into the top of the Collector as shown in Figure 4.12. The Filter housing is designed to only fit in one way. Close the Inlet lid and hold it down to lock it in place, as shown in Figures 4.13 and 4.14.



FIGURE 4.12 INSTALLING FILTER CASSETTE



FIGURE 4.13 CLOSING LID



FIGURE 4.14 RELEASE BUTTON

4.4 COLLECTING A SAMPLE

The unit is controlled with a single rotary switch as shown in Figure 4.15. The selections are Power OFF, Triggered, Continuous, and three run modes:

- Continuous mode
- 1 minute on, 1 minute off—sample collection at 200 Lpm.
- 5 minutes on, 15 minutes off—sample collection at 200 Lpm.
- Extended Run—this selection samples for 1 minute on and 5 minutes off with sample collection at 100 Lpm.

Five status lights are used to signal the system’s status and to alert the user to errors. A check status push-button switch can be used to turn the status lights on momentarily so the device is not readily seen in dark conditions (i.e. under “light discipline” conditions).



FIGURE 4.15 MODE SELECTION KNOB

A Trigger accessory is required to operate the Bobcat in the “Triggered” mode. The Trigger (Item # AC08078) is a 22ft cabled switch available for models purchased after February 2018. For models purchased prior to February 2018, please contact InnovaPrep for more information.

4.5 RECOVERY OF THE SAMPLE

When the run is completed, recover the Filter sample by unlatching the Inlet, and pressing the Sample Cup into the top of the Filter as shown in Figure 4.16 and pressing firmly until it clicks all the way around the cup. The Filter and Sample Cup are then lifted out of the collector, flipped over, and capped with the Elutor as shown in Figure 4.17 (make sure the Filter and Elutor are fully seated) then seal in a zip-type bag for transporting dry as shown in Figure 4.18. Alternatively, the Filter can be eluted into the Sample Cup, as shown in Figure 4.19, while in the field then capped with the Sample Cup Lid.



FIGURE 4.16 SAMPLE CUP SNAPPED INTO THE FILTER



FIGURE 4.17 ELUTOR SNAPPED ONTO THE FILTER



FIGURE 4.18 ASSEMBLY IS BAGGED AND READY FOR TRANSPORT TO THE LABORATORY

4.6 ELUTING A FILTER SAMPLE

To extract the captured particles from the filter contained, follow the procedures below:

1. Place the Sample Cup, Filter, and Elutor assembly, as shown in Figure 4.19, on a stable surface.
2. Firmly press the Elution Canister into the Elutor, also shown in Figure 4.19. The elution foam is released from the Elution Canister through the Filter when the canister valve is pressed down. Hold the canister down until all the foam is released. The foam quickly collapses back to a liquid in the sample cup, making it available for sample processing and analysis.

4.7 CLEANING THE SYSTEM

For periodic cleaning and when the instrument is placed in or removed from storage common off-the-shelf alcohol or bleach wipes can be used for cleaning and disinfection.

Using gloved hands, remove the sampler from the work area, hot zone, or contaminated area to an area where the cleaning can be safely performed, if applicable, and disconnect the AC power converter and/or remove the battery.

Wipe down the exterior surface of the inlet as shown in Figure 4.20. To clean under the inlet, use a swab to get the wipe under the inlet cap and wipe down the interior surfaces of the sampler as shown in Figure 4.21.



FIGURE 4.20 CLEANING EXTERIOR SURFACES



FIGURE 4.21 CLEANING INTERIOR SURFACES

4.8 BATTERY CHARGING

The battery charger consists of two parts, the battery cap and a “wall wart” style AC power adapter, permanently connected by a flexible cable. The AC power adapter is supplied with a standard North American AC plug installed. Other AC plugs are available for International use; contact InnovaPrep for more information. Plug the AC power adapter into any available AC mains socket. The LED on the power supply will illuminate, and the battery cap indicator will indicate the Stand-by state (see below). Make sure that the connector and contact pads on the battery are clean and free of foreign matter, and push the battery cap all the way into the battery connector. The charge cycle for the attached battery will start automatically.

Indicator Light	State of Charging Process
Slow Blinking Yellow	Stand-by – Prequalification
Fast Blinking Yellow	Precharge
Steady Yellow	Normal Charge
Steady Green	Full Charge
Red	Battery or Charger Fault

Note: Maximum storage temperature for the battery is 40°C and charging temperature maximum is 37°C

Please contact InnovaPrep or an official InnovaPrep distributor for technical assistance and troubleshooting.

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Revision	Date	Author
1	November 12, 2013	P. Murowchick
2	February 24, 2015	P. Murowchick
3	August 8, 2017	A. Packingham
4	March 8, 2018	A. Packingham
5	April 20, 2018	D. Alburty
6	August 28, 2018	A. Packingham
7	September 11, 2018	A. Packingham
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