Northern Ireland Ambulance Service
Health and Social Care Trust

NIAS Guidance: Use of a Powered Air Purifying Respirator (PAPR) System

Title:	NIAS Guidance: Powered Air Purifying Respirator (PAPR) System	**Issue Date:** 15th April 2020
Author:	NIAS Emergency Planning Department	**Review Date**: 6th April 2021

Version Control			
Date	Version	Comments	Author
8th April 2020	1.0	Document Created	S Graham
9th April 2020	1.1	Decontamination Guidance Updated	S Graham
15th April 2020	1.2	Information on Post Use Checks, Decontamination & Filter Change updated	S Graham

Contents

1. Aim

The aim of this document is to provide guidance to Northern Ireland Ambulance Service (NIAS) staff responding to and managing incidents where the use of a Powered Air Purifying Respirator (PAPR) system is required and appropriate in undertaking patient care/treatment/transportation.

2. Scope

This guidance applies to all NIAS staff who may be required to use a Powered Air Purifying Respirator (PAPR) System. This guidance also serves as a point of reference for Line Managers of staff may be required to use Powered Air Purifying Respirator (PAPR) Systems.

This guidance outlines the correct procedure for the use of Powered Air Purifying Respirator (PAPR) Systems in use within NIAS. These are currently the 3M Jupiter Turbo System and the 3M Versaflo Assembly TR300, both together using the 3M Versaflo S-133 Head Cover (Respirator Hood). This guidance uses the term 'Powered Hood System' throughout to refer to the complete assembled unit.

3. Responsibility

It is the responsibility of all NIAS staff to adhere to this guidance. All staff have a duty under health and safety legislation to correctly use any personal protective equipment (PPE) provided.

4. Background

NIAS staff are required to have direct contact with patients who may have airborne infections. A range of respiratory PPE is therefore provided, which includes surgical masks, FFP3 masks and where required and appropriate, Powered Air Purifying Respirator (PAPR) Systems.

The outbreak of COVID-19 increased the frequency of incidents where respiratory protection would be required. In response, NIAS have invested in Powered Air Purifying Respirator (PAPR) Systems for staff who have been unable to successfully complete FFP3 mask fit testing.

5. Indications for use

The use of a Powered Hood System for staff who have been unable to successfully complete FFP3 mask fit testing is indicated when Level 3 PPE is required.

In the context of COVID-19, this is detailed within the National COVID-19 Guidance for Ambulance Trusts and current NIAS Operational Guidance for incidents involving Coronavirus (COVID-19).

The Level 3 PPE requirement indicates that Aerosol Generating Procedures (AGPs) are being undertaken and that the PPE required includes either an FFP3 mask or Powered Hood System is required.

It should be noted that Powered Hood Systems do not provide protection against toxic gases, vapours or low oxygen environments and should not be used in these circumstances.

The equipment provided works by filtering the surrounding air and removing particles only. **The equipment will not filter gas or vapour and is not an air supply**.

6. Equipment

6.1 Components

Both of the Powered Hood Systems are supplied with the following components;

- Respirator Hood
- Main unit - 3M Jupiter Turbo System **or** 3M Versaflo Assembly TR300
- Belt
- Battery pack and charger
- Self-adjusting breathing tube
- Filter(s)
- Airflow indicator
- Calibration Tube (3M Jupiter Turbo System)

3M Jupiter Turbo System

3M Versaflo Assembly TR300

6.2 Storage

The Powered Hood System should be stored in a safe, dry location that minimises the risk of damage to the system or any of the component parts.

7. Using the Powered Hood

7.1 Assembly

Upon first receiving the Powered Hood System it should be assembled and prepared for use.

Instruction on assembly can be found by viewing the following videos. These can either be accessed by following the links below (due to IT restrictions they cannot be accessed on Trust devices) or by contacting the NIAS Emergency Planning Department who can share copies of the video via WhatsApp etc.

3M Jupiter Turbo System

https://www.youtube.com/watch?v=Su0Er5QLDfk

3M Versaflo Assembly TR300

https://www.youtube.com/watch?v=rUXEAiLQt04

7.2 Checking

On a monthly basis or prior to use (whichever is sooner), the following must be checked;

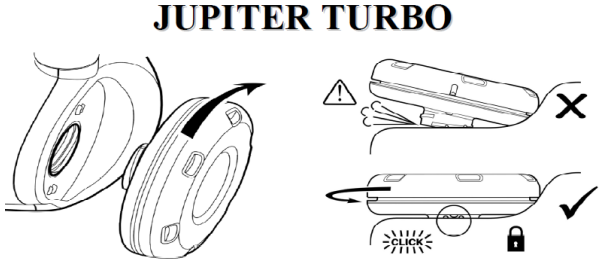
- All of the component parts listed above are present
- Ensure Battery is fully charged
    - **NOTE: It is the responsibility of the person who has been individually issued the Powered Hood System to ensure the battery is charged.**
- Ensure Powered Hood system and its component parts are undamaged
- Ensure main unit is correctly secured to its belt
- Ensure Filter(s) are correctly fitted
- Perform airflow check – insert Airflow Indicator Tube (white ball) into the outlet, switch on, ensure ball rises above the line. If the ball does not rise above the line check the battery status and recheck. If ball continues not to rise replace the filter(s).

7.3 Pre-use Guidance for 3M Jupiter Turbo System

Step 1 – Install the battery and check the battery securely fitted to the unit. You will hear an audible click to confirm. Do not force the battery into place, as this may damage it. **NOTE: it is the responsibility of the person who has been individually issued the Powered Hood System to ensure the battery is charged.**

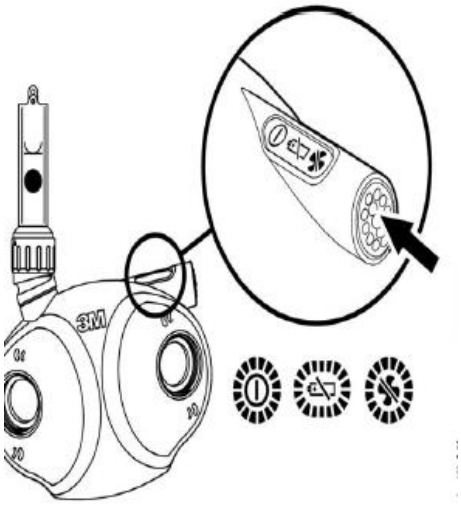
Step 2 – Ensure that the filters are fitted correctly (for COVID-19 the pre-filters will not be required).

Install Pre-filters as shown (if required)



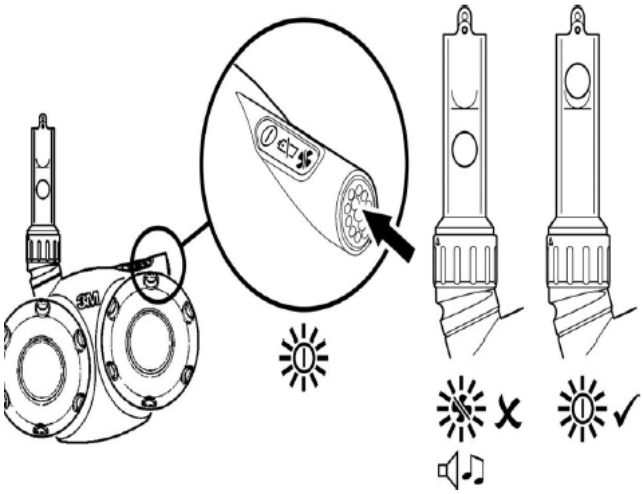
**Attach filters to turbo -
Ensure threads are not crossed.**

Step 3 - Turn on unit by pressing the blue power button (short press and release). Confirm green light is on and that alarm light is off. (Note; pressing and holding the button will result in the unit switching off)



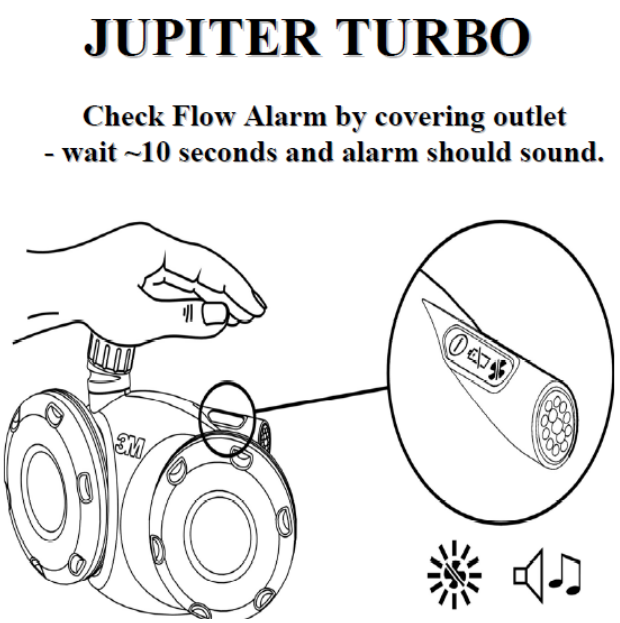
Step 4 - Perform an airflow check using the airflow indicator tube. If the ball floats to the top (above the black line) this is considered a pass. If the ball does not rise above the line check the battery status and recheck. If ball continues not to rise replace the filter(s). If the ball continues not to rise, do not use, report the unit as faulty through normal mechanisms and return through Line Manager to the Emergency Planning Department.

JUPITER TURBO - Airflow Check



Check before each use:
- **Leave filters attached**
- **Insert Airflow Indicator Tube (White Ball)**
- **Turn Turbo on - keep tube vertical**
- **Check position of ball in tube**
- **It should be above mark**
- **If not, check battery, filters.**

Step 5 - Perform the alarm check by placing your hand over the outlet, the alarm will sound; this is confirmation the unit is working.



Step 6 - Examine the breathing tube for tears, holes or cracks. Bend the breathing tube to verify that it is flexible and ensure that the O-rings located at both ends of the breathing tube are present and intact.

7.4 Pre-use Guidance for 3M Versaflo Assembly TR300

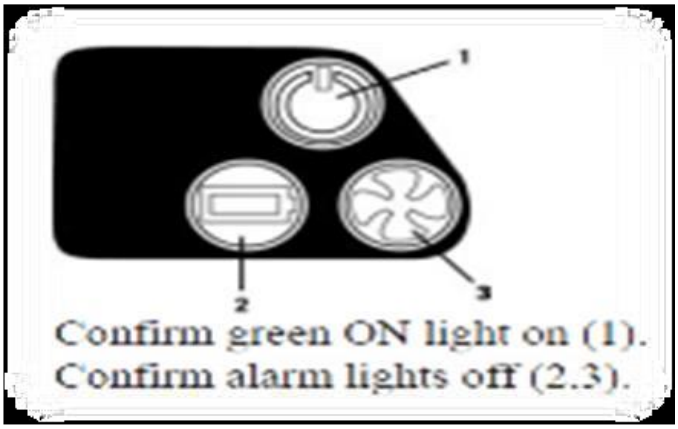
As a general guide ‘anything blue is for you’. When assembling the unit, or removing parts, the blue tabs or clips are an indicator to where you are able to clip/unclip the components.

Step 1 - Check the status of the battery by pressing the ‘Test’ button. The battery will last for approximately 9-12 hours on standard flow and 9-10 hours on high flow. Battery chargers are provided with each unit. **NOTE: it is the responsibility of the person who has been individually issued the Powered Hood System to ensure the battery is charged.**

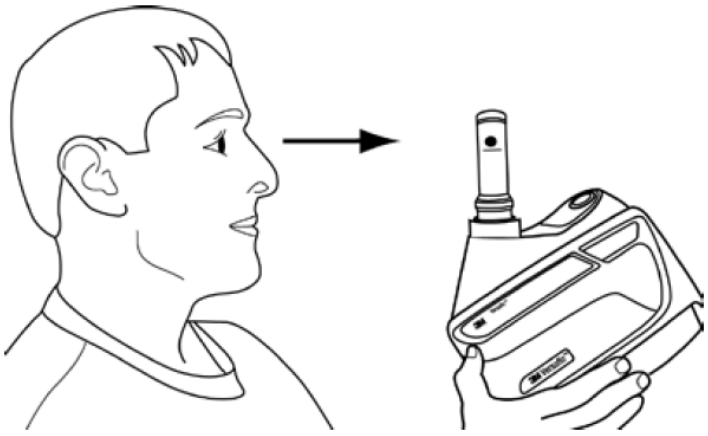
Step 2 - Check that the battery is securely fitted to the unit. If replacing the battery, the non-blue end must be placed in first and then closed next to where the blue clip is. You will hear an audible click to confirm. Do not force the battery into place, as this may damage the blue clip.

Step 3 - Ensure that the filter is fitted correctly.

Step 4 - Turn on unit by pressing the blue power button. Confirm green light is on, alarm light is off.



Step 5 - Perform an airflow check using the airflow indicator tube. If the ball floats to the top (above the black line) this is considered a pass. If the ball does not float to the top change filter and recheck. If the ball continues not to rise, do not use, report the unit as faulty through normal mechanisms and return to the Emergency Planning Department.


Confirm airflow is sufficient. Bottom of the ball above airflow indicator zone flow level.

Step 6 - Perform the alarm check by placing your hand over the outlet, the alarm will sound; this is confirmation the unit is working.

Step 7 - Examine the breathing tube for tears, holes or cracks. Bend the breathing tube to verify that it is flexible and ensure that the O-rings located at both ends of the breathing tube are present and intact.

7.5 Donning

Complete the pre-checks detailed above.

In a time critical situation, it is accepted that only the step of switching the unit on and ensuring a green light is present may be feasible to conduct prior to donning the Powered Hood system.

The following steps are applicable to both types of device in use with NIAS;

- Insert the end of the breathing tube with the two small prongs (bayonet style fitting) into the slot in the main unit/battery pack air outlet. Twist the breathing tube a quarter turn to the right to lock.
- Adjust belt to fit to waist.
- Fasten belt, with unit in the small of your back.
- Inspect hood for any signs of damage. Attach the breathing tube to the hood by pushing the end of the breathing tube (end with the blue pinch clip) onto the air inlet of the hood/head cover.
- Adjust hood head band to fit.
- Slide the hood over your head, using the tab at the front to pull the front seal over your chin. Ensure that air is being blown in the hood, to create a positive pressure.

A guide to resolving common faults is provided in Appendix 1 (Jupiter System) and Appendix 2 (Versaflo System).

7.6 Using with other PPE

Where level 3 PPE is indicated (i.e. for an Aerosol Generating Procedure), the Respirator Hood must be used in conjunction with other specified PPE, which must be donned in the correct order – please refer to current NIAS Operational Guidance for incidents involving Coronavirus (COVID-19), but this is summarised as;

1. Hand Hygiene extended to include the forearms
2. Inner Pair of gloves
3. Fluid repellent coverall or gown
4. Powered Hood system
5. Outer pair of gloves

7.7 Doffing

It is important that PPE is removed in an order that minimises the potential for cross-contamination.

When doffing PPE, follow the order as summarised below with the support and observation of your crewmate (where possible) to ensure the risk of cross-contamination are minimized – please refer to current NIAS Operational Guidance for incidents involving Coronavirus (COVID-19).

Hand hygiene should be practiced and extended to the forearms to help prevent the spread of infection - use alcohol hand rub between removing items of PPE.

1. Outer Pair of gloves
2. Powered Hood system
3. Fluid repellent coverall or gown
4. Inner pair of gloves
5. Hand Hygiene extended to include the forearms

8. Post Use Checks, Decontamination & Filter Change

8.1 Decontamination Principles

Decontamination of the Powered Hood System will be required after each use and prior to the Powered Hood System being stored for future use.

When used in the treatment and/or transportation of a patient with a suspected respiratory pathogen, such as a COVID-19, the Powered Hood System (Main Unit, Air Hose & Hood) should be decontaminated using an **Actichlor Plus solution of 1 tablet in 1 Litre of water to achieve 1,000 parts per million chlorine solution**.

This should be done methodically using wipes in an "S" shape pattern and ensuring all of the surfaces have been decontaminated

Appropriate PPE must be worn when undertaking decontamination of the Powered Hood System.

8.2 Initial Steps and Inspection

- It is important to follow the inspection procedures for the Powered Hood System to identify any damage, excessive wear, or deterioration of components and replace them as necessary. Namely;
    - Examine the condition of the fabric, head suspension, visor and outer shroud. Check that there are no cracks, rips, dents, holes, tears, or other damage.
    - Look closely at the stitching. Ensure stitching is intact and there is no unravelling or gaps in the seams. There should be no tears or holes that could permit contaminated air to enter the hood.
    - Look for scratches or other visual distortions that could make it difficult to see through the visor.
    - Examine the head suspension for cracks or other damage.
    - Examine the entire breathing tube. Look for tears, holes, cracks, distortions, or any other sign of wear or damage. Bend the tube to verify that it is flexible. Ensure the gasket located at the end connecting to headgear is present and not damaged. The breathing tube should fit firmly into the air source connection.
- Detach the belt from the motor/blower and the hood from the breathing tube. Remove belt clips (if possible) from the belt.
- Remove the filter from the PAPR blower assembly. If a filter change is needed – see the filter change section below.

8.3 Decontamination

All elements of the Powered Hood System (Main Unit, Air Hose & Hood) should be decontaminated using an **Actichlor Plus solution of 1 tablet in 1 Litre of water to achieve 1,000 parts per million chlorine solution**.

This should be done methodically using wipes in an "S" shape pattern and ensuring all of the surfaces have been decontaminated

Appropriate PPE must be worn when undertaking decontamination of the Powered Hood System.

The Respirator Hood must be allowed to air dry, or dried with a paper towel before being stored.

Prior to storage, fold the clear plastic hose portal on the hood so that it is facing away from the visor, in order to prevent the visor from becoming damaged.

The Respirator Hood should be only be disposed of in one of the following circumstances;

- Identification of damage, excessive wear, or deterioration of the respirator Hood, or
- Respirator hood has been used for transportation of a patient with a suspected category four pathogen, such as a Viral Haemorrhagic Disease, or
- Respirator Hood is contaminated beyond your ability to clean it

Disposal of the Respirator Hood must be reported to the user's line manager and the NIAS Emergency Planning Department at the earliest opportunity. Used Respirator Hoods requiring disposal must be disposed of in the appropriate Clinical Waste stream.

8.4 Changing the filter

A filter(s) change is required for the Powered Hood System in the following circumstances;

- Powered Hood System was used in the environment where Aerosol Generating Procedures were being performed (COVID-19), or
- When air flow is checked, the ball does not raise to the required level, or
- Filter(s) are cracked or damaged, or
- Filter(s) are discoloured (this is unlikely to be an issue in non-industrial settings).

If the Powered Hood system was donned in anticipation of Aerosol Generating Procedures being performed and the wearer subsequently did not enter the AGP environment or AGPs were not performed, then the filter does <u>not</u> need to be changed.

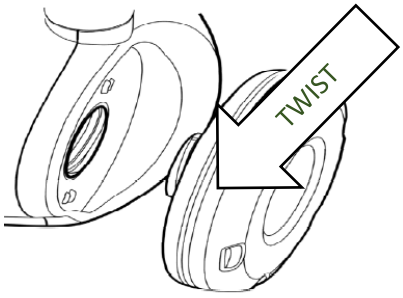
In such circumstances, the exterior of the filter(s) should be decontaminated along with other elements of the Powered Hood System.

Replacement filter(s) should be requested through the users' line manager.

Instruction on changing filter(s) can also be found by viewing the videos mentioned previously.

Used filters are to be disposed of in the appropriate clinical waste stream.

3M Jupiter Turbo System



3M Versaflo Assembly TR300

Press the blue button on the side of the Versalo unit to release the front cover.

Remove and discard of the expired filter.

Place a new filter into the empty carriage.

Replace the front cover until a click is heard. Ensure the white '3M' strip is visible in the window pane.

9. Documentation

All operational use of the Powered Hood system must be documented on the Patient Report Form and reported to the user's Line Manager at the earliest opportunity.

The Line Manager will then contact the NIAS Emergency Planning Department to allow for replacement Respirator Hood or filters to be issued for the relevant Powered Hood System (if required).

Staff have a duty under health and safety legislation to correctly use any personal protective equipment (PPE) provided by the Trust.

Staff must report any faults/breakages are reported and recorded as appropriate through DATIX.

10. Additional Information

NARU and AACE have produced a supporting video for the donning and doffing of PPE for the management of COVID-19 with Aerosol Generating Procedures (AGPs) i.e. when Level 3 PPE is required.

This can be accessed by a number of means;

- On NIAS SharePoint – http://nias-sp/covid-19/SitePages/Videos.aspx
    - Please note that usual NIAS IT restrictions apply regarding viewing videos i.e. that sound may not be available on some NIAS computers
- On the internet by following the link – https://vimeo.com/393639039/53b9a9f0ce
    - please note that you will be unable to follow this link if you are logged onto your profile on a NIAS computer, but it can be accessed on any internet enabled device
- Alternatively, the Emergency Planning Department can share the videos via WhatsApp

This video is in line with guidance currently in use within NIAS and any variations regarding specific equipment do not alter the procedures or levels of protection provided.

This video also shows the donning and doffing procedures for Powered Hood systems.

Instruction on assembly of the Powered Hood systems can be found by viewing the following videos. These either be accessed by following the links below (due to IT restrictions they cannot be accessed on Trust devices) or by contacting the NIAS Emergency Planning Department who can share copies of the video via WhatsApp etc.

3M Jupiter Turbo System

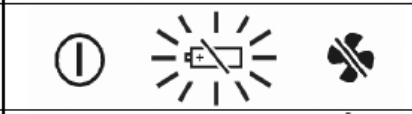
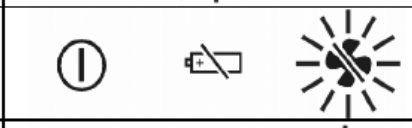
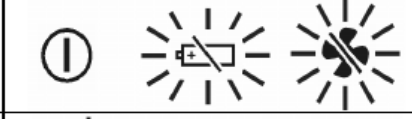
https://www.youtube.com/watch?v=Su0Er5QLDfk

3M Versaflo Assembly TR300

https://www.youtube.com/watch?v=rUXEAiLQt04

Appendix 1 Resolving faults - 3M Jupiter Turbo System

JUPITER TURBO
- Warning Lights

WARNINGS	DISPLAY	SOUND	COMMENTS
LOW BATTERY			Charge battery
LOW FLOW			• Hose blocked – Clear • Filters blocked – replace • Calibration needed
LOW FLOW & BATTERY			See "Low Flow" and 'Low Battery' above
FLOW RECOVERY			Normal Operation

 = Slow Flash

 = One Short Beep

 = Long Intermittent Beep

Appendix 2 Resolving faults - 3M Versaflo Assembly TR300

Fault	Possible Cause(s)	Possible Solution(s)
All LEDs flash and alarm	1. System software malfunction	1. To clear the alarm, power down motor/ blower unit and remove the battery pack. Allow unit to sit for several minutes before reconnecting battery pack and turning the unit back on. If unit does not reset, contact 3M Technical Service.
Low airflow alarm (audible and/or LED flashing)	1. Breathing tube is blocked 2. Air inlet is covered 3. Filter is fully loaded with particles	1. Check & remove blockage or obstruction 2. Check air filter & remove obstruction 3. Change HE filter and prefilter or spark arrestor/prefilter
Bottom bar of battery pack indicator flashes; battery alarm sounds	1. Low battery voltage 2. Battery pack not properly installed 3. Battery pack past service life 4. Battery pack temperature too hot > 140°F (> 60°C)	1. Recharge the battery pack 2. Remove and reinstall battery pack 3. Install a new, fully-charged TR-300 battery pack 4. Bring to cool environment, allow battery pack to cool
No airflow, no alarm(s)	1. Battery pack contact on battery pack is damaged 2. Battery pack is completely discharged (no charge) 3. Damaged circuit board 4. Damaged motor	1. Check that the battery pack contact is not bent or broken 2. Fully charge the battery pack 3. Contact 3M Technical Service 4. Contact 3M Technical Service
Low airflow as indicated by flow meter but no alarm(s)	1. Damaged circuit board 2. Damaged motor 3. Flow indicator not held in vertical position	1. Contact 3M Technical Service 2. Contact 3M Technical Service 3. Ensure flow indicator is held in vertical position during inspection
User detects odor or taste of contaminants or feels eye or throat irritation	1. Incorrect respirator for application and/or environment	1. Consult on-site industrial hygienist or safety director
Battery pack's charge lasts less than expected	1. Inadequate charging 2. HE filter is loaded with particles, making the motor run harder 3. Battery pack reaching end of service life	1. Ensure battery pack is fully charged 2. Check the low flow indicator. Replace the HE filter & prefilter or clean the spark arrestor. 3. Replace battery pack
The motor runs "faster than normal"	1. The HE filter is loaded with particles	1. Check the low flow indicator. Replace the HE filter & prefilter and clean the spark arrestor. 2. Let the unit run for 2 minutes so it can automatically adjust to the new filter or changes to the filter configuration