

# Technical Data Sheet

3M™ Organic Vapor Service Life Indicator Cartridges 6000i Series



## Description

Introducing 3M™ Organic Vapor Cartridges with 3M™ Service Life Indicator technology. Unique to 3M, these innovative and easy-to-use cartridges help users determine when to change their cartridge in appropriate environments.\*



## Features and Benefits

In appropriate environments,\* the 3M™ Service Life Indicator can help:

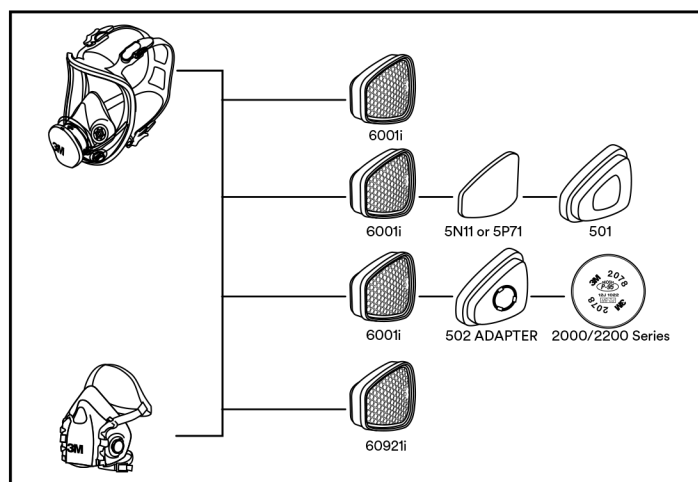
- **Engage your workforce in safety.**  
The simple indicator bar design gives users an easy, visual tool to help determine when to change their cartridges.
- **Optimize cartridge use.**  
Designed to indicate service life based on individual exposure and respiratory use patterns.
- **Provide confidence in protection.**  
The 3M™ Service Life Indicator can help provide added peace of mind and can help increase compliance with your company's respirator policy and industry regulatory requirements.



3M™ Multi Gas/Vapor Cartridges shown with 3M™ Full Facepiece 6000 Series and 3M™ Organic Vapor Monitor 3510.

## Approvals

The 6001i and 60921i cartridges are only NIOSH approved for respiratory protection against certain contaminants when used with the 3M™ Facepiece series 6000, 7000 and FF-400.



## How does an organic vapor cartridge work?

Respirator cartridges are filled with a material called “activated carbon.” During the manufacturing process it is “activated” by heating the material in nitrogen or steam. The resulting material has a significant number of micropores that help adsorb various organic vapors. When organic vapors are drawn through the cartridge, the air is filtered as vapors condense into the carbon pores. The effective service life is the time until vapors begin to exit the cartridge. Unlike particle filters, the service life of an organic vapor cartridge is not indicated by a change in breathing resistance, but by breakthrough, at which point the user will start to be exposed to the hazard.

## Ordering Information

	Product Number	Description	Quantity
	6006	Multi gas/vapor cartridge	60/case
	60926	Multi gas/vapor—P100 cartridge	60/case
3M™ Multi gas/vapor Cartridges are approved for use with the 3M™ 6000, 7000 and Ultimate FX FF-400 Series Facepieces.			



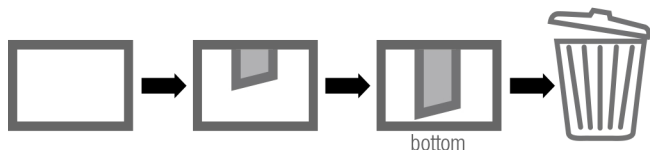
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# How does the 3M™ Service Life Indicator work?



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The 3M™ Service Life Indicator helps customers in appropriate environments know when they should change their organic vapor cartridges.\* The indicator is adhered to the cartridge wall, in contact with the carbon bed. As the organic vapors are adsorbed onto the carbon, they are also adsorbed onto the service life indicator. As this happens, the indicator changes color, visually marking the course of the organic vapors through the carbon bed.



## Do I have an “appropriate” environment?\*

The 6000i Series provides the same organic vapor protection as the standard 6000 series. However, it's important to know if you have an appropriate environment for using the 3M™ Service Life Indicator to help determine your change schedules. Like any indicator, the 3M™ Organic Vapor Service Life Indicator has a minimum “limit of detection.” This is because the human eye also has a limit of detection. To discriminate between two colors, there needs to be a big enough difference in the colors, or “wavelength shift.” Visibility of the indicator bar will depend on the specific organic vapor and exposure concentration. The vapor concentration that causes a noticeable color change is called the “minimum indication level” (MIL). The MIL is different for different compounds. **See the MIL table at the end of this data sheet, or refer to the 6000i User Instructions or 3M™ Select and Service Life Software — [3M.com/servicelifesoftware](http://3M.com/servicelifesoftware).**



The key is knowing the exposure levels at your site, and this relies upon monitoring. 3M™ Organic Vapor Monitors 3500/3510/3520/3530 could be used for sampling many organic vapors. Monitoring results can then be entered into the 3M™ Select and Service Life Software — [3M.com/servicelifesoftware](http://3M.com/servicelifesoftware). The software is used to give information on whether the End-of-Service-Life Indicator (ESLI) is applicable, as well as an estimate of service life to know how often to check the ESLI in use.

The 3M™ Service Life Indicator can be used to complement cartridge change schedules and, in some cases, replace them. To rely on the ESLI in your workplace environment,

1. Assess organic vapors and exposure levels.
2. Organic vapor cartridges must be appropriate (no chemicals where other types of cartridges or supplied air is required).
3. If a mixture of organic vapors is present, consider the organic vapor with the shortest cartridge service life:
  - Worker exposure levels  $\geq$  MIL (exposure concentration is high enough to cause noticeable change in indicator), AND
  - $MIL \leq$  occupational exposure limit (OEL) (indicator bar will develop before vapor concentration moving through cartridge reaches exposure limit)

If your workplace environment doesn't meet the MIL and OEL criteria, then the ESLI can still be used to complement an existing change-out schedule. The indicator cannot be relied upon to indicate when cartridge change is needed, but, in certain scenarios, for example in a temporary period of higher exposure, the ESLI may indicate that a cartridge change is required before the existing change-out schedule.

## FAQs

Concern	Solution
Cannot see portion of cartridge where ESLI is located	<ul style="list-style-type: none"><li>• Use a mirror to observe the ESLI.</li><li>• Rely on a co-worker who can see the ESLI.</li><li>• Go to a clean area, remove the respirator and view the ESLI.</li></ul>
Cannot see indicator bar	<ul style="list-style-type: none"><li>• Re-evaluate the selection process (exposure may be less than MIL).</li><li>• If in a hot environment, move to a cooler environment to see if appearance changes (rare for most workplaces).</li><li>• Go to an area with a broader light spectrum (e.g., standard fluorescent or incandescent lighting or outdoors).</li><li>• If red-green color-blind, see below.</li></ul>
Poor lighting	<ul style="list-style-type: none"><li>• Go to an area with adequate lighting to view the ESLI.</li><li>• Do not use a light pointed directly at the ESLI, as this may affect the ESLI appearance.</li></ul>
Red-green color deficiency or color blindness	<ul style="list-style-type: none"><li>• Rely on a co-worker who can see the ESLI.</li></ul>
Tinted eyewear and difficult to see progression of indicator bar	<ul style="list-style-type: none"><li>• Go to an area where it is safe to remove eyewear to view the ESLI.</li><li>• Rely on a co-worker who can see the ESLI.</li></ul>
Glare	<ul style="list-style-type: none"><li>• Go to an area where there is less glare to view the ESLI.</li></ul>

\*Please see the 6001i and 60921i User Instructions or the 3M™ Select and Service Life Software ([3M.com/servicelifesoftware](http://3M.com/servicelifesoftware)) to determine if these cartridges are appropriate for your work environment.





Description	Primary Materials
Filter media	Activated carbon
Body/Base	Polystyrene
Lid	Polystyrene
Retainer	Polypropylene
Optical film sensor	Polymer, acrylate adhesive, speciality polymer
Optical sensor over label	Paper, adhesive

Approximate Mass:

6001i = 100 g each

6092i = 125 g each

This product does not contain components made from natural rubber latex.

## Storage and Transportation

3M™ Organic Vapor Cartridges should be stored in the packaging provided in dry, clean conditions away from direct sunlight, sources of high temperature and solvent vapors. Store in accordance with manufacturer's instructions found in the packaging. Average conditions may exceed 86F (30C) / 80% RH for limited periods. They can reach an average of 104F (40C) / 85% RH, provided that this is for no longer than one month. Before initial use, always check that the product is within the stated three-year shelf life (or use-by date).

## Disposal

Dispose in accordance with local regulations.

**CAUTION:** Failure to properly dispose of used cartridges contaminated by hazardous materials can result in personal exposures as well as environmental harm.

## ⚠ Warnings and Use Limitations

**Before use, wearer must read and follow all User Instructions.**

**Misuse may result in sickness or death.**

- Always be sure that the complete product (i.e., facepiece and cartridge) is:
  - Suitable for the application.
  - Fitted correctly (i.e., workers undergo fit test and conduct user seal check).
  - Worn during all periods of exposure.
  - Replaced when necessary.
- Use this respirator system strictly in accordance with all instructions:
  - Do not submerge the cartridges in liquid.
  - Do not use in atmospheres containing less than 19.5% oxygen. (3M definition. Individual countries may apply their own limits on oxygen deficiency. Seek advice if in doubt).
  - Do not use these products in oxygen or oxygen-enriched atmospheres.
  - Do not use for respiratory protection against atmospheric contaminants/concentrations that are unknown or immediately dangerous to life and health (IDLH) or against contaminants/concentrations that generate high heats of reaction with chemical cartridges.

- Leave the contaminated area immediately if:
  - Any part of the system becomes damaged.
  - Airflow to the facepiece decreases or stops.
  - Breathing becomes difficult, or increased breathing resistance occurs.
  - Dizziness or other distress occurs.
  - You smell or taste contaminants, or irritation occurs.
  - If any part of the indicator bar reaches the end-of-service line (denoted by trash bin icon on cartridge label).
- Never alter, modify or repair this device.
- The End-of-Service-Life Indicator (ESLI) is not appropriate for all organic vapors and exposure levels.\*
- The employer must determine whether or not the ESLI is appropriate for their workplace.\*
- If you have red-green color blindness or color deficiency, rely on a colleague who can see the progression of the ESLI indicator bar.
- Regardless of ESLI status, the user must exit exposure area and change both cartridges if contaminant odor, taste or irritation is detected.
- If organic vapor concentrations are too low, they will not be detected by the ESLI. For minimum indication levels (MIL) per compound, please see the MIL table that follows or User Instructions. A list of common organic vapors and their minimum indication levels are shown. If you can't find a specific organic vapor, please contact 3M Technical Service in the U.S. at 1-800-243-4630 and in Canada at 1-800-267-4414. It is recommended that you search this table by CAS number.
- To use the ESLI properly, it is critical that the user or safety manager:
  - Determines whether or not the ESLI is appropriate for the organic vapors in their environment.\*
  - Is able to read and interpret the ESLI.
  - Checks the ESLI regularly.
  - Replaces the cartridges as necessary.
- If no part of the indicator bar has appeared after an extensive period (e.g., within a month), the ESLI should not be used as a primary change-out schedule.
- To earn NIOSH certification, an ESLI must reliably indicate depletion at less than or equal to 90% of service life. After extensive laboratory testing under rigorous conditions, the ESLI on the 6000i Series Cartridges reliably indicated sorbent depletion when there was at least 10% service life remaining. With certain organic vapor(s) and environmental conditions, there could be significantly more remaining service life. Nonetheless, the cartridge should be discarded as soon as the ESLI end line is reached to ensure worker safety.

# Organic Vapors and Minimum Indication Level (MIL)

## Common Organic Vapors and Minimum Indication Level (MIL)

**NOTE:** This is NOT a list of what the 6001i and 60921i may be used for. See right for a list of common organic vapors and their associated MILs. In order to rely on the 3M™ Service Life Indicator as a primary method for determining when to change cartridges, both of the following conditions must be met:

Worker exposure levels  $\geq$  MIL, AND MIL  $\leq$  occupational exposure limit.



### WARNING

This respirator helps reduce exposures to certain airborne contaminants. Before use, the wearer must read and understand the User Instructions provided as a part of the product packaging. Follow all local regulations. In the U.S., a written respiratory protection program must be implemented meeting all the requirements of OSHA 1910.134, including training, fit testing and medical evaluation. In Canada, CSA standard Z94.4 requirements must be met and/or requirements of the applicable jurisdiction, as appropriate. Misuse may result in sickness or death. For proper use, see package instructions, supervisor, or call 3M PSD Technical Service in USA at 1-800-243-4630 and in Canada at 1-800-267-4414.

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Compound	CAS #	MIL in parts per million (ppm)
Ethylbenzene	100-41-4	2
Styrene	100-42-5	1
Propyl bromide	106-94-5	147
1,2-Dichloroethane	107-06-2	145
Methyl propyl ketone	107-87-9	23
Propyleneglycol methylether	107-98-2	24
Methyl isobutyl ketone	108-10-1	5
Isopropyl acetate	108-21-4	30
Methoxypropyl acetate (propylene glycol monomethyl ether acetate)	108-65-6	3
Diisobutyl ketone	108-83-8	10
Toluene	108-88-3	8
4-methyl pyridine	108-89-4	2
Chlorobenzene	108-90-7	4
Cyclohexanone	108-94-1	11
3-methyl pyridine	108-99-6	2
n-Propyl acetate	109-60-4	25
2-Methoxyethanol	109-86-4	59
Tetrahydrofuran	109-99-9	280
Isobutyl acetate	110-19-0	5
Methyl amyl ketone	110-43-0	3
n-Hexane	110-54-3	93
2-Ethoxyethanol	110-80-5	20
Ethoxyethyl acetate	111-15-9	2
n-Octane	111-65-9	2
2-Butoxyethanol	111-76-2	1
n-Nonane	111-84-2	1
Isoamyl alcohol	123-51-3	5
n-Butyl acetate	123-86-4	2
1,4-Dioxane	123-91-1	60
Isoamyl acetate	123-92-2	2
Tetrachloroethylene	127-18-4	20
Xylenes	1330-20-7	2
Limonene (d-)	138-86-3	2
Ethyl acetate	141-78-6	161
n-Heptane	142-82-5	12
Trimethylbenzene (mixture)	25551-13-7	2
3-methyl 2-butanone	563-80-4	46
Propionic acid n-butyl ester	590-01-2	3
2-Hexanone	591-78-6	3
1-Hexene	592-41-6	92
n-Pentyl acetate	628-63-7	3
Isopropanol	67-63-0	650
1-Propanol	71-23-8	300
n-Butyl alcohol	71-36-3	34
Benzene	71-43-2	65
Isobutanol	78-83-1	64
sec-Butyl alcohol	78-92-2	83
Methyl ethyl ketone	78-93-3	175
Trichloroethylene	79-01-6	66
Methyl acetate	79-20-9	950
Stoddard solvent	8052-41-3	1
Methyl methacrylate	80-62-6	16
Diethyl ketone	96-22-0	26
Methyl acrylate	96-33-3	104
Chlorobenzotrifluoride (4-)	98-56-6	5
Isopropyl benzene (cumene)	98-82-8	3



# How an Organic Vapor Respirator Cartridge Works

3M makes organic vapor respirator cartridges to help reduce user exposure to many different organic vapors.

To achieve this objective, respirator cartridges are filled with a material called activated carbon. Activated carbon is typically made from coal or renewable resources like wood or coconut shells.

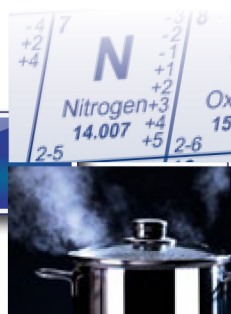
It is "activated" by heating the material in nitrogen or steam at approximate temperatures of 800 – 900 °C. The resulting material has a significant number of micropores that help adsorb various organic vapors. These micropores can be measured and optimized for specific product needs and performance.



Coal or renewable resources, such as coconut shells



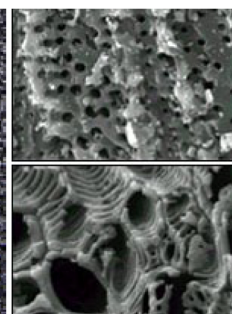
Coal or renewable resources are heated without oxygen



High-temperature steam or nitrogen activation



High-grade activated carbon



Electron micrographs of activated carbon pores

When organic vapors are drawn through an organic vapor cartridge, the air is filtered as vapors condense into the carbon pores. Vapors move through the cartridge from one pore to the next. This occurs more quickly for small volatile vapors with lower boiling points (e.g., acetone). Some migration of organic vapors can even occur during storage, so care must be taken before reusing the cartridge. The effective service life is the time until vapors begin to exit the cartridge.

Unlike particle filters, service life is not indicated by change in breathing resistance. Instead, cartridges must be changed according to local regulations; end-of-service-life indicator; taste, smell, or irritation from the contaminant; or according to 3M™ Service Life Software calculation, whichever comes first.

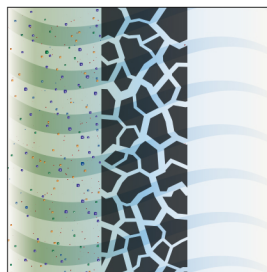
Activated carbon by itself cannot adsorb other types of gases or vapors such as acid gases, ammonia, formaldehyde, etc. In some cases, additional metals and salts are added to the carbon to selectively remove these compounds. For this reason, 3M offers a variety of cartridges and facepieces to help protect workers in different environments and satisfy personal preferences.

3M is committed to develop quality safety products to help protect workers. For more information about 3M organic vapor cartridges, please read Technical Data Bulletin #142 "Reuse of Organic Vapor Chemical Cartridges" at [www.3M.com/PPESafetySolutions](http://www.3M.com/PPESafetySolutions).

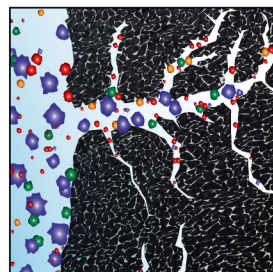
To establish a cartridge change schedule, visit [www.3M.com/SLSWeb/index.html](http://www.3M.com/SLSWeb/index.html).

## Factors that influence service life:

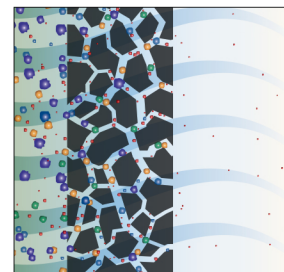
- Exposure concentration
- Temperature
- Humidity (water vapor takes up space in carbon pores)
- Breathing rate



Unfiltered organic vapors are drawn into the cartridge.



Activated carbon adsorbs organic vapors on molecular level.



Service life continues until vapors begin to escape the cartridge.



### WARNING

These respirators help protect against certain airborne contaminants. Before use, the wearer must read and understand the User Instructions provided as a part of the product packaging. A written respiratory protection program must be implemented meeting all the requirements of OSHA 1910.134 including training, fit testing and medical evaluation. In Canada, CSA standards Z94.4 requirements must be met and/or requirements of the applicable jurisdiction, as appropriate. **Misuse may result in sickness or death.** For proper use, see packaging instructions, supervisor, or call 3M OH&ESD Technical Service in USA at 1-800-243-4630 and in Canada at 1-800-267-4414.



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