

# **RESPIRATORY PROTECTION IN CONSTRUCTION**

PRESENTED BY:  
VICTOR D'AMATO, CIH, CSP



11495 Sunset Hills Road  
Suite 210  
Reston, Virginia 20190  
Phone: 703-689-9482  
Fax: 703-689-3998  
WWW.ATRIUMEHS.COM

## **OVERVIEW**

- Regulations and Requirements
- Airborne Hazards and Respirators
- Respirator Selection
- Medical Surveillance
- Fit Testing
- Use, Care and Maintenance
- Voluntary Use
- Silica in Construction

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## REGULATORY REQUIREMENTS

- OSHA Respiratory Protection Standard
  - 29 CFR 1910.134-Respiratory protection requirements
- National Institute For Occupational Safety and Health (NIOSH)
  - 42 CFR Part 84
  - Approve respirator **systems**

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## REGULATORY REQUIREMENTS

### OSHA Requires:

- Written Respiratory Protection Program (RPP)
  - Designation of RPP Administrator
  - Respirator Selection
- Medical Surveillance
- Fit Testing
- Training

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## WHAT TYPE OF HAZARDS EXIST



Respirators protect us from hazardous atmospheres

- Oxygen-deficient
- Hazardous
  - Gases
  - Aerosols
  - Vapors

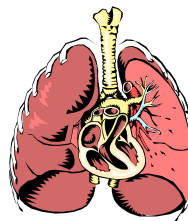


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## HOW RESPIRATORS PROTECT YOU

- When used properly, respirators prevent the inhalation of chemicals and dust in the air and protect the lungs.
- Two basic types of respirators:
  - Air purifying
  - Air supplying



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## AIR PURIFYING RESPIRATORS

Clean the air you breathe

- Negative Pressure - When you inhale, air is pulled through a filter cartridge, where air contaminants are trapped.



- Powered Air – powered fan pulls air through filter cartridge



**AIR PURIFYING RESPIRATORS DO NOT PROVIDE OXYGEN AND ARE NOT APPROPRIATE FOR UNKNOWN ATMOSPHERES**

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## SUPPLIED AIR RESPIRATORS

Provides clean, breathable air to the wearer

- Airline – Clean air is delivered from a clean air source to the wearer via hose.
- Self-contained – Clean air is provided by integrated tank



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## Tight-Fitting Coverings



**Quarter Mask**



**Half Mask**



**Full Facepiece**



**Mouthpiece/Nose Clamp**  
(no fit test required)

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## Loose-Fitting Coverings



**Hood**



**Helmet**



**Loose-Fitting  
Facepiece**



**Full Body Suit**

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## RESPIRATOR SELECTION

- General use conditions;
- Oxygen concentration or expected oxygen concentration;
- Physical, chemical, and toxicological properties of the contaminants present;
- Occupational exposure limit (OEL) of contaminants present;
- Expected concentration of those contaminants;
- Immediately dangerous to life or health (IDLH) concentration;
- Eye irritation potential; and
- Environmental factors, such as presence of oil aerosols

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## RESPIRATOR SELECTION

- **Physical Stresses**
  - Using respirators increases cardiovascular work and heat stress
  - Sign and symptoms
    - Shortness of breath
    - Extreme fatigue
    - Chest pain
    - Light headedness
    - Confusion
  - Prevention
    - Keep hydrated
    - Know your limitations (work rate consumption)
    - Quit before there is a problem

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## RESPIRATOR SELECTION

- “IDLH” means “immediately dangerous to life or health”.
- Hazards in IDLH Atmospheres
  - Diminished Oxygen (<19.5%)
  - Toxic gases
    - CO
    - Hydrogen cyanide
  - Air purifying respirators are not approved for IDLH atmospheres.
- The only alternative is a approved supplied air respirator.

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## RESPIRATOR SELECTION

- MUST BE NIOSH APPROVED SYSTEM
  - NIOSH reviews respirator approval applications, which contain technical specifications, drawings, and other related information.
  - NIOSH also inspects, examines and tests the respirators to determine that the applicable requirements are met for individual, completely assembled respirators.

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**TABLE 1 – ASSIGNED PROTECTION FACTORS<sup>5</sup>**

<sup>2</sup> Respirator Type <sup>1</sup>	Quarter Mask	Half Mask	Full Face	Helmet/Hood	Loose-Fitting
Air Purifying	5	<sup>3</sup> 10	50	-----	-----
PAPR	-----	50	1,000	<sup>4</sup> 25/1,000	25
SAR					
• Demand	-----	10	50	-----	-----
• Continuous Flow	-----	50	1,000	<sup>4</sup> 25/1,000	25
• Pressure Demand/ other (+) pressure	-----	50	1,000	-----	-----
SCBA					
• Demand	-----	10	50	50	-----
• Pressure Demand/ other (+) pressure	-----	-----	10,000	10,000	-----

<sup>1</sup>May use respirators assigned for higher concentrations in lower concentrations or when required use is independent of concentration.  
<sup>2</sup>These APF's are only effective when employer has a continuing, effective respirator program per 1910.134.  
<sup>3</sup>This APF category includes filtering facepieces and elastomeric facepieces.  
<sup>4</sup>Must have manufacturer test evidence to support an APF of 1,000 or else these respirators receive an APF of 25.  
<sup>5</sup>These APFs do not apply to escape-only respirators. Escape respirators must conform to 1910.134(d)(2)(ii) or OSHA's substance specific standards, if used with those substances.

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## MAXIMUM USE CONCENTRATION (MUC)

- The maximum atmospheric concentration of a hazardous substance from which an employee can be expected to be protected when wearing a respirator, and is determined by the **assigned protection factor** of the respirator or class of respirators and the **exposure limit** of the hazardous substance

$$**MUC = APF \times OSHA Exposure Limit<sup>1</sup>**$$

<sup>1</sup> When no OSHA exposure limit is available for a hazardous substance, the employer must determine an MUC on the basis of relevant available information and informed professional judgment.

# RESPIRATOR SELECTION

## Air Purifying Cartridges

- Selection and use based on the airborne contaminant:
  - Gas
  - Vapor
- Color-coded
- Change-out schedule required
- Same cartridge on both sides, use same manufacturer



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# RESPIRATOR SELECTION

## Air Purifying Filters



- Only for particulates, dusts, fibers
- NIOSH Classifications
- Includes FFPDs, such as the N95
- Change-out schedule required
- Combination filter & cartridge options

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# NIOSH FILTER CLASSIFICATIONS

Class	Description
<b>N95</b>	Filters at least 95% of airborne particles. <b>Not resistant to oil.</b>
<b>N99</b>	Filters at least 99% of airborne particles. <b>Not resistant to oil.</b>
<b>N100</b>	Filters at least 99.97% of airborne particles. <b>Not resistant to oil.</b>
<b>R95</b>	Filters at least 95% of airborne particles. <b>Somewhat resistant to oil.</b>
<b>P95</b>	Filters at least 95% of airborne particles. Strongly resistant to oil.
<b>P99</b>	Filters at least 99% of airborne particles. Strongly resistant to oil.
<b>P100</b>	Filters at least 99.97% of airborne particles. Strongly resistant to oil.

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### AIR-PURIFYING RESPIRATORS

#### Advantage Respirator Cartridges

The Advantage line of particulate, chemical and combination cartridges is NIOSH-approved (to 42 CFR Part 84) and provides lightweight, low-profile performance. Cartridges fit both 200 LS Half-Mask and 3000 Full-Facepiece Advantage Respirators.

MSA Cartridge Description	Re-Order Part Number	Color Coding													See Note and page with this filter		
		OV	CL	SD	HC	HO*	AM	MA	FM	HF	NV	P100	495	N95			
GMA	815355																2.3
GMA with N95 Prefilter	815355 with 815394 or 816357																2.3
GMA with R95 Prefilter	815355 with 815397																2.3
GMA P100	815362																2,3,4
GMB	815356																2
GMB with N95 Prefilter	815356 with 815394 or 816357																2
GMB with R95 Prefilter	815356 with 815397																2
GMB P100	815363																2,4
GMC	815357																2,3
GMC with N95 Prefilter	815357 with 815394 or 816357																2,3
GMC with R95 Prefilter	815357 with 815397																2,3
GMC P100	815364																2,3,4
GMD	815358																2,3
GMD with N95 Prefilter	815358 with 815394 or 816357																2,3
GMD with R95 Prefilter	815358 with 815397																2,3
GMD P100	815365																2,3,4
GME	815359																2,3
GME with N95 Prefilter	815359 with 815394 or 816357																2,3
GME with R95 Prefilter	815359 with 815397																2,3
GME P100	815366																2,3,4
GMI P100**	815641																2,4
Mersorb	815361																2,4
Mersorb with N95 Prefilter	815361 with 815394 or 816357																2,4
Mersorb with R95 Prefilter	815361 with 815397																2,4
Mersorb P100	815368																2,4
Low-Profile P100	815369																2,4
N95 Snap-On Prefilter and Cover	815394 Pack of 30 816357 Pack of 50 815392 Reusable Snap-On Cover, 2 in a Package																1,4
R95 Snap-On Prefilter and Cover	815397 Pack of 20 815411 Reusable Snap-On Cover, 2 in a Package																

**WARNING**

An appropriate cartridge change-out schedule must be developed by a qualified professional, unless the cartridge carrier contains an end-of-service-life indicator. The change-out schedule must take into account all factors that may influence respiratory protection including specific work practices and other conditions unique to the worker's environment. If using against substances having poor warning properties, there is no secondary means of knowing when to replace the cartridge/ canister. In such cases, take appropriate additional precautions to prevent overexposure, which may include a more conservative change-out schedule or using an air-supplied respirator or SCBA. Failure to follow this warning can result in serious personal injury or death. As a reference, below is a partial list of substances having poor warning properties.

Acidosis	Hydrogen cyanide	Nitric acid	Phosphorus trichloride
Aniline	Hydrogen sulfide	Nitro compounds	Silicene
Azane	Methanol	Nitrogen oxides	Sulfur chloride
Boron	Methyl bromide	Nitrogen	Urethane or other
Carbon monoxide	Methyl chloride	Nitromethane	disocyanate
Diocyanates	Methylene chloride	Phosgene	containing paints
Dimethyl sulfide	Nitrol carbonyl	Phosphine	Vinyl chloride

\*Escape only. \*\* Effective against, but not NIOSH approved for Iodine Vapor.

\*\*\* Definitions  
**N95-Particulate Filter (95% filter efficiency level)** effective against particulate aerosols; free of oil; time use restrictions may apply.  
**R95-Particulate Filter (95% filter efficiency level)** effective against all particulate aerosols; time use restrictions may apply.  
**P100-Particulate Filter (99.97% filter efficiency level)** effective against all particulate aerosols.

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## Medical Clearance

- Determines your physical ability to wear respirator
- Questionnaire
- Medical Examination



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## TRAINING AND INFORMATION

- Once a year
- New respirator
- Changes in workplace
- Inadequacies in employee knowledge or use



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## TRAINING AND INFORMATION

- Why the respirator is necessary and how improper fit, use, or maintenance can compromise its protective effect
- Limitations and capabilities of the respirator
- Effective use in emergency situations
- How to inspect, put on and remove, use and check the seals
- Maintenance and storage
- Recognition of medical signs and symptoms that may limit or prevent effective use
- General requirements of the OSHA standard

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## FIT TESTING



- Evaluating the fit of a respirator on an individual
- Required for tight-fitting facepieces and N95
- May not be required for voluntary use situations

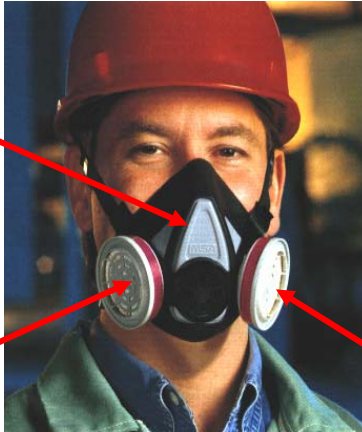
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## HOW NEGATIVE PRESSURE APRs WORK

### INHALATION

Vacuum – or  
Negative Pressure  
– created in mask



Air enters  
through filters -  
*purified*

Air enters  
through filters -  
*purified*

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## HOW NEGATIVE PRESSURE APRs WORK

### EXHALATION

Positive pressure  
created in mask



Air expelled out

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# IF IT DOESN'T FIT RIGHT

## INHALATION

Vacuum – or  
Negative Pressure  
– created in mask



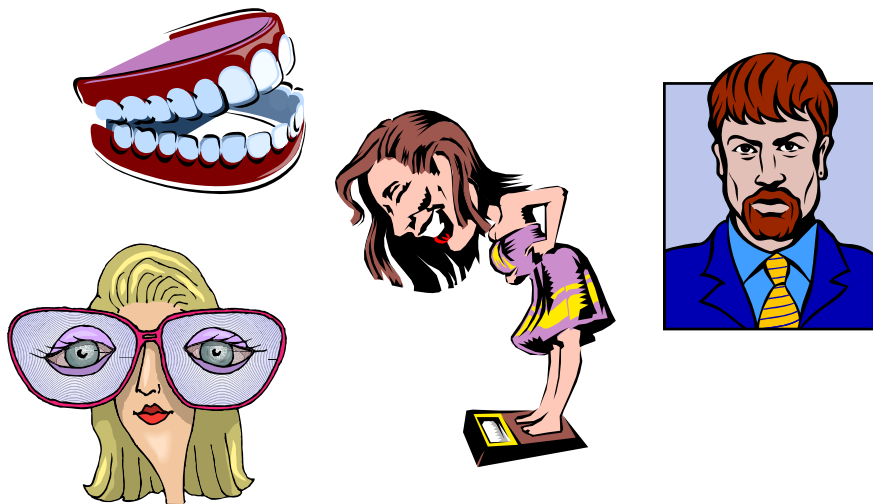
Air enters  
through leaks  
in mask seal

Air enters  
through leaks  
in mask seal

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# FACTORS AFFECTING FIT



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## QUANTITATIVE FIT TEST

- Numerical measure of fit
- PortaCount
- Fit factor value



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## QUALITATIVE FIT TEST



- PASS/FAIL using test agent
- Depends on user response

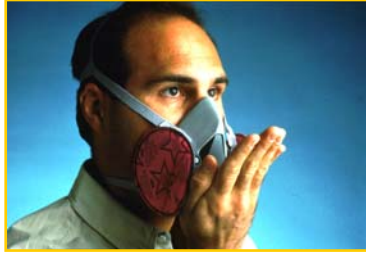
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## RESPIRATOR USE Before Each Use



- Negative pressure check



- Positive pressure check

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## RESPIRATOR USE



- Don PRIOR to entering contaminated atmosphere
- Do not remove until out of contaminated atmosphere

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A respirator is only as  
effective as its USER!



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## RESPIRATOR CARE

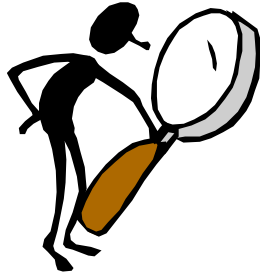
- Inspect before and after use
- Clean as needed
- Store appropriately always



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## INSPECTION POINTS



- Headbands
- Facepiece
- Inhalation/exhalation valves
- Cartridge holders
- Cartridges/filters

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## CLEANING

- Disassemble
- Wash in mild detergent
- Rinse thoroughly
- Disinfect (if needed)
- Drain or wipe-dry



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## STORAGE

- Protect from damaging agents
- Rest in normal position



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## VOLUNTARY USE

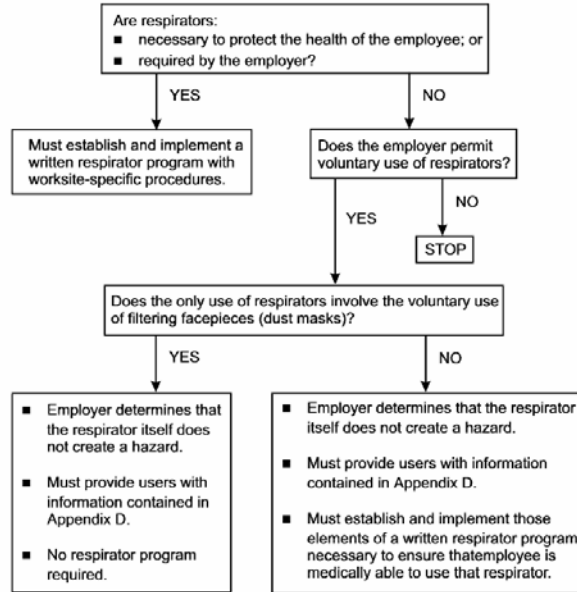
OSHA requirements for voluntary use of respirators are as follows:

- Exposures to airborne hazardous substances < PEL
- Employer must allow voluntary use.
- Employers must provide the information included in Appendix D of the OSHA respiratory protection standard

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### Respirator-Use Requirements Flow Chart 29 CFR 1910.134(c)



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## **SILICA EXPOSURES IN CONSTRUCTION**

- Silica is an indispensable part of both the natural and the industrial worlds.
- Silica is a chemical compound that can be found in crystalline and non-crystalline (amorphous) forms.
- Building materials, such as concrete and dimension stone (sandstone, granite, and limestone are examples) contain crystalline silica in the form of quartz.
  - Sandpaper and grinding wheels have been made from quartz.
  - Quartz was the primary abrasive used in sandblasting operations.
  - Quartz is used as functional filler in plastics, rubber, and paint.

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## ***SILICA EXPOSURES IN CONSTRUCTION***

- Prolonged and excessive exposure to crystalline silica dust can cause silicosis, a noncancerous lung disease.
- 1980s - Studies suggested that crystalline silica was a carcinogen
- 1987 - IARC labeled crystalline silica as a probable human carcinogen
- 2008 - OSHA implemented a National Emphasis Program (NEP) to identify, reduce, and eliminate the health hazards associated with occupational exposure to crystalline silica.

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## ***SILICA FACTS***

- Silicon (Si)
  - Element
  - 2<sup>nd</sup> most common element of Earth's crust
- Silica (SiO<sub>2</sub>)
  - Chemical compound
  - Crystalline and amorphous
- Silicone
  - Synthetic
  - Liquids, greases, waxes, resins and solids

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## **CRYSTALLINE SILICA**

- Also known as “free silica”
- Significantly more hazardous than amorphous silica
- 3 mineralogical forms
  - Quartz (most common)
  - Cristobalite
  - Tridymite



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## **HEALTH EFFECTS OF CRYSTALLINE SILICA**

- Silicosis
  - Chronic, accelerated, acute
  - Respirable silica (<10 $\mu$ m)
- Lung cancer
- Tuberculosis
- Chronic obstructive pulmonary disorder
- Other
  - Immunologic disorders and autoimmune diseases
  - Renal disease
  - Stomach and other cancers



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# SIGNS AND SYMPTOMS OF CHRONIC SILICOSIS

*NOTE: There may be no symptoms in the early stages.*

- As the disease progresses
  - Cough
  - Breathlessness
  - Weakness
- Significant X-ray changes after 15-20 years of exposure



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# RESPIRATORY PROTECTION

Photo 1	Photo 2	Photo 3	Photo 4	Photo 5	Photo 6	Photo 7
<p>Covering your face with a cloth such as a bandana or T-shirt <b>WILL NOT</b> protect you.</p>	<p>These are filtering facemask respirators.</p> <ul style="list-style-type: none"> <li>• Disposable</li> <li>• N-95 Type or higher</li> <li>• Provide minimal protection</li> </ul>	<p>Model Advantage 200 Photo courtesy of MSA.</p> <p>Half-face mask air-purifying respirator with replaceable N-95 (or higher) filters.</p>	<p>Model Advantage 1000 Photo courtesy of MSA.</p> <p>Full-face mask air-purifying respirator with replaceable N-95 (or higher) filters.</p>	<p>Model M22K Photo courtesy of MSA.</p> <p>Powered air-purifying respirator (PAPR) equipped with:</p> <ul style="list-style-type: none"> <li>• Full facemask</li> <li>• High efficiency particulate filters</li> </ul> <p>NOTE: Uses battery-powered motor to filter the air.</p>	<p>Supplied-air respirator (SAR) equipped with:</p> <ul style="list-style-type: none"> <li>• Full facemask</li> <li>• Pressure-demand or other positive pressure mode.</li> </ul>	<p>Type CE abrasive blasting respirator (SAR), operated in a pressure-demand or other positive pressure mode.</p> <p>NOTE: A tight-fitting mask is worn under the blasting hood.</p> <p>This is the only respirator that can be used for abrasive blasting.</p>
No Protection	Least Protection	More Protection	Most Protection			

Source: NIOSH Publication No. 2004-108: Silicosis: Learn the Facts!

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Questions?



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