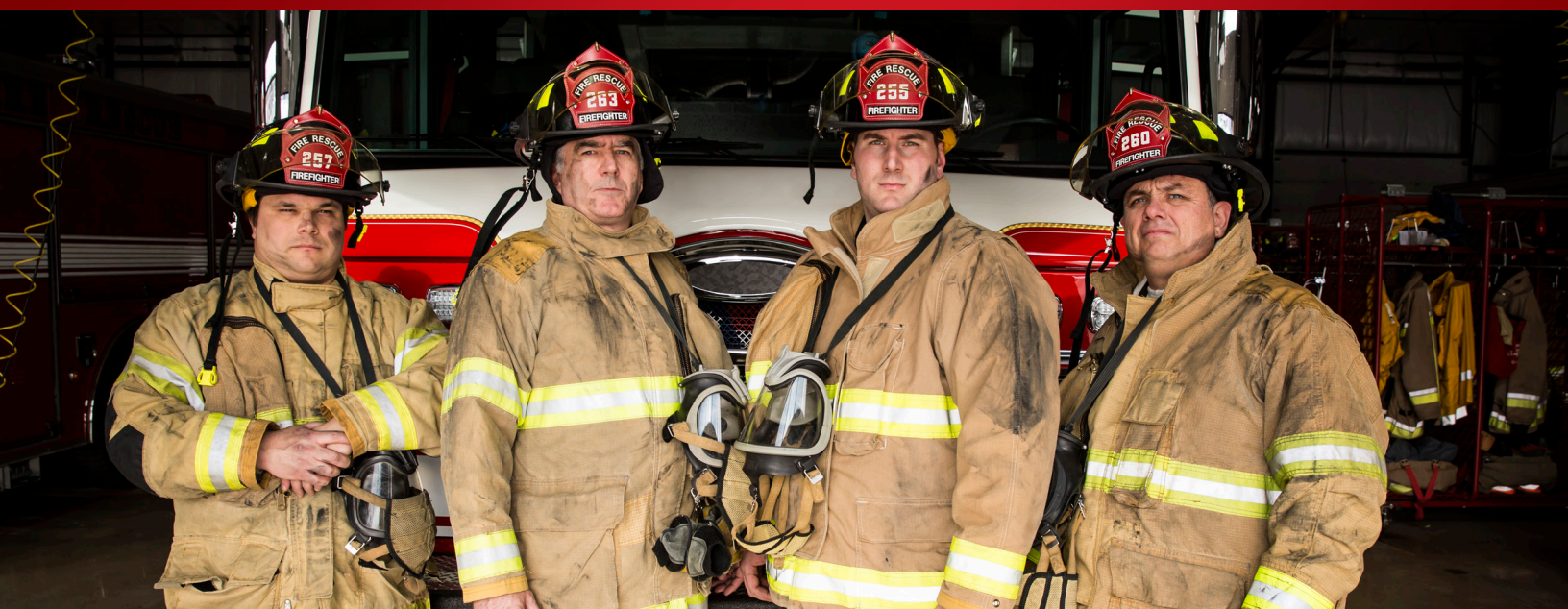
PREPARE, PROTECT & PREVENT:

THE GUIDE TO PROPER PPE CLEANING



THE LAUNDRY EXPERTS.

It's no secret that firefighters put their own safety on the line every day to protect their communities. I've been a firefighter for 28 years and like me, many firefighters have dreamed about this job since a young age. We would do anything to protect the community we serve, as well as our fellow firefighters, but it's important that we also take the necessary steps to protect ourselves.

In the last decade there have been many studies published on the health risks associated with wearing contaminated personal protective equipment (PPE). In fact, according to the Firefighter Cancer Support Network, firefighters are significantly more likely to develop cancer due to their exposure to carcinogens. As a result, the industry is focused on researching these harmful toxins in order to develop a standard protocol that will require frequent and thorough cleaning of PPE to prevent long-term exposure to contamination following a fire or major incident.

In addition to serving as Captain of the Berlin Fire Department in Wisconsin, I have worked for UniMac® laundry manufacturer, the world's leading provider of on-premises laundry (OPL) equipment, and an Alliance Laundry Systems brand for more than 25 years. UniMac has been dedicated to providing equipment that meets the specific needs of the fire industry for more than 60 years. I'm grateful for the opportunity to work with fire departments across the country to provide them with equipment, but both the fire and laundry industries have more work to do to increase awareness of the cleaning techniques needed to properly decontaminate PPE, as well as the importance of regular cleaning.

In this eBook we will examine the current National Fire Protection Association (NFPA) cleaning guidelines, review the current research that will inform the next generation of cleaning guidelines, provide an overview of the specific equipment needed to wash PPE and share best practices for cleaning and maintaining your protective gear. If your fire department wants to continue the conversation to ensure you're taking the right steps to protect your firefighters and prevent long-term exposure to harmful carcinogens, we are here to help. Find a knowledgeable distributor online or give us a call at 1-800-587-5458.

Bill Brooks
UniMac North American Sales Manager

CHAPTER ONE:

CHANGING THE CONVERSATION

Historically, PPE that smelled like smoke or had visible signs of use brought a sense of pride. It represented a badge of honor and the dirtier the gear, the more a firefighter was regarded. However, in recent years, this perception and the conversations around cleaning PPE are changing.

The number of cancer incidences in firefighters has significantly increased over the last 20 years, making it the leading cause of line-of-duty death. As a result, the fire industry, as well as national and local health organizations, have been conducting research to learn more about the carcinogens firefighters are exposed to on the job in an effort to identify what can be done to better protect them. Over the last ten years, there have been multiple studies published detailing of dangers of prolonged exposure to contaminated PPE, which is driving a change in the industry to better understand these risks, educate firefighters on the importance of regularly cleaning PPE and provide training to properly do so.

THE RISKS

Exposure to persistent harmful contaminants in PPE is a serious problem. Firefighters come into contact with the contaminants on the fire ground due to highly toxic substances and a variety of carcinogens. They also risk exposure to an increasing range of infectious pathogens when responding to an emergency medical operation.

Today's households and businesses have more metals, plastics and synthetics, increasing the likelihood of exposure to toxins. Many of these contaminants are related to the number of electronics found in today's households. These harmful chemicals and smoke easily contaminate turnout gear and promptly attach to the fabric of the PPE. Furthermore, these contaminants absorb into firefighters' skin and as temperatures increase, so does the permeability of the skin, making it more absorbent.

The best way to protect firefighters and minimize the risk of toxins absorbing into their skin is by properly wearing the gear during the incident and then decontaminating gear immediately after the incident so that a firefighter does not need to put soiled PPE back on his or her body following a fire or emergency response.

NFPA REGULATIONS

Currently the NFPA requires protective gear to go through an advanced cleaning and inspection once a year. However, the organization recommends that fire departments clean gear as soon as possible after exposure to a fire, body fluids or hazardous materials to preserve the protective qualities of the gear.

To address the health risks and concerns associated with contaminated and soiled gear, the Fire Protection Research Foundation is working on a project to evaluate the current PPE cleaning processes and technologies to determine "How Clean is Clean." As part of this project, the organization is conducting research to understand the levels of chemical and biological contamination, and validate the cleaning procedures required to properly clean them. These findings will help evolve the NFPA requirements and develop industry standards to properly clean and decontaminate PPE.

There is no official industry criteria to reliably show that clothing is being adequately cleaned. The Fire Protection Research Foundation's project aims to establish clear and definitive guidelines for cleaning and decontamination procedures to effectively remove both chemical and biological contaminants. The overall goal of this project is to develop standards that can be implemented in all fire departments across the country to improve firefighter safety and health by reducing the long-term danger of continued exposure to harmful contaminants in unclean or inadequately cleaned PPE.

While this research is underway, firefighters can be proactive by learning more about the proper equipment and processing requirements to thoroughly clean PPE, and by implementing a regular cleaning program within their departments.

The best way to protect firefighters is by properly decontaminating gear after an incident, so that a firefighter does not put soiled PPE back on their body following a fire or emergency response.

CHAPTER TWO:

THE RIGHT EQUIPMENT

CHAPTER TWO: The Right Equipment

Due to the recent studies that outline the health risks for firefighters, many departments and firehouses are taking steps to ensure they have the right equipment and resources to clean their gear.

The most common challenge for laundering PPE is getting the gear clean without compromising the safety properties of the high-tech fibers. If you are considering purchasing equipment for your firehouse or department, it's important to get the right machines that will properly and efficiently wash gear without causing any damage. UniMac® laundry manufacturer's complete line of equipment employs a variety of methods to effectively clean the gear without compromising safety.

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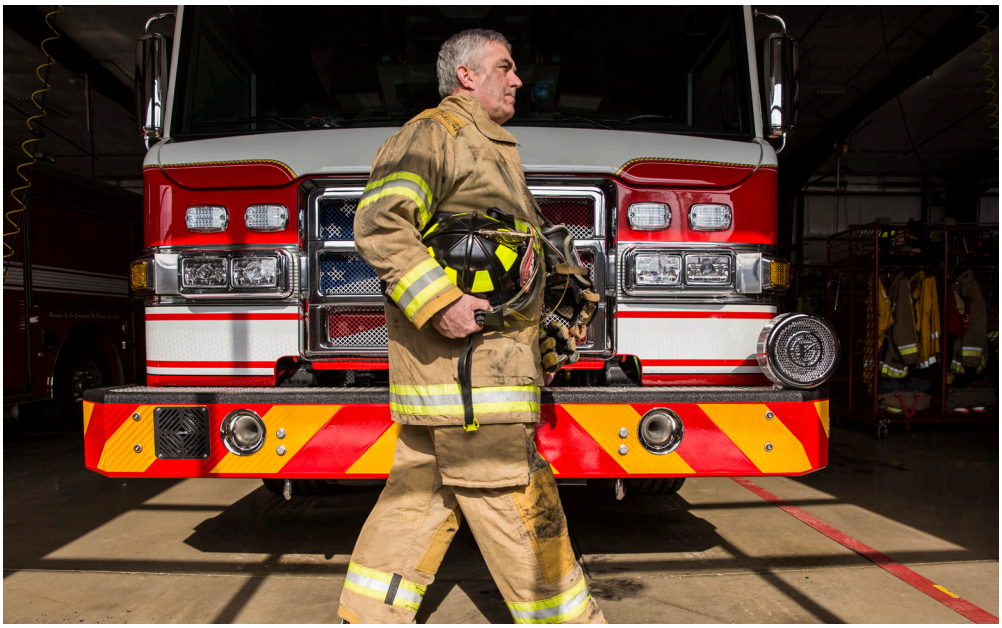


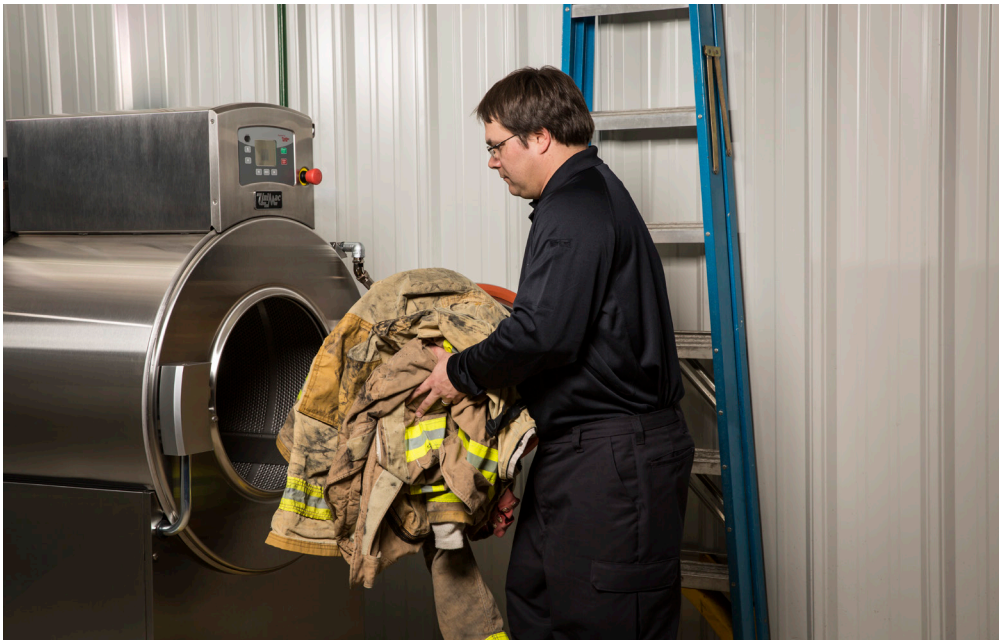
WASHER-EXTRACTORS

The NFPA has a number of requirements and recommendations to thoroughly wash turnout gear. These include:

- **Front Load Washer-Extractor:** The NFPA recommends a front load washing machine for cleaning PPE. A top load machine may reduce the service life of the protective garments due to damage caused by mechanical agitation. Additionally, the NFPA advises against cleaning gear in a home or public laundry to prevent contaminating others.
- **Water Temperature:** The NFPA recommends a maximum water temperature of 105 degrees Fahrenheit. If a temperature exceeds 105 degrees during the wash cycle, the gear may be damaged.
- **G-Force:** G-Force is the machine's extraction speed that is responsible for removing moisture. The higher the G-Force, the more water is removed, helping the load dry more quickly. A high G-Force may be a priority when laundering everyday clothes or linens, but due to the materials in the turnout gear, a low extraction speed is best and the NFPA requires a maximum of 100 G-Force. The turnout gear is made up of three layers – the heat resistant fabric, moisture barrier and thermal layer. The moisture barrier provides protection from chemicals and blood-borne pathogens and if the gear is put in a machine with anything more than 100 G-Force, there is a chance that water will push through the moisture barrier which could ruin the material, making it unable to meet safety standards.

- **Programmable Equipment:** Turnout gear is a specialty item, and therefore requires specialty wash programs. It's not as simple as throwing towels in a washing machine and pressing start. The cycle and rinse time need to be set to properly clean the gear and the cycle settings will change depending on the item being washed or the level of contamination. For example, there is a cycle specifically for gear that has been exposed to blood-borne pathogens. Additionally, advanced equipment with pre-programmed cycles eliminates any potential for human error of selecting the wrong cycle setting, resulting in a seamless wash. Your equipment distributor is an expert on the equipment and cleaning PPE, and can be a great resource if you have questions on your machine or washing your gear.

- **Chemical Injector:** Just as there are specialty wash cycles required for the turnout gear, there are also specific chemicals needed. PPE requires a pH neutral cleaner and using the wrong cleaning solution would decrease the safety properties of the PPE. Today's industry-leading equipment has a chemical injector, which will insert the exact amount of cleaning chemicals at the right temperature and time in the wash process. Additionally, the technology will inject laundry chemicals below the water line to ensure proper dilution and keep gear safe. A representative from the chemical company can help with the chemical injector programming, but your distributor is also available to share expertise on cleaning to ensure the PPE is thoroughly washed before it is returned to service.



Now that you know what type of washing machine and features are best for cleaning PPE, you'll need to determine the best size washer-extractor that will meet your firehouse's needs. Common washer-extractor capacities in firehouses range from 30 to 60 pounds because they can wash multiple people's gear at once.

The size of a washer-extractor's basket is an easy way to know how many pieces of gear will fit in one wash load and can be used to help you determine what your firehouse's equipment capacity needs may be. One cubic foot of a washer-extractor basket can accommodate one piece of gear. For example, a 30 pound washer-extractor has a basket of 4.1 cubic feet and can therefore accommodate four pieces in a proper wash cycle. A 45 pound washer-extractor has a basket of 7.3 cubic feet and can accommodate seven pieces of gear. A 60 pound washer-extractor has basket of 9.7 cubic feet and

can accommodate 10 pieces. It's important to note that each "piece" is not the PPE in its entirety. The lining and shell need to be separated for a proper wash, and therefore a piece is either the lining or a shell. So a 45 pound machine that can accommodate seven pieces of gear would typically be used to wash two people's equipment at a time.

A laundry equipment distributor can be a very knowledgeable resource to help you determine the equipment that will best meet your needs.

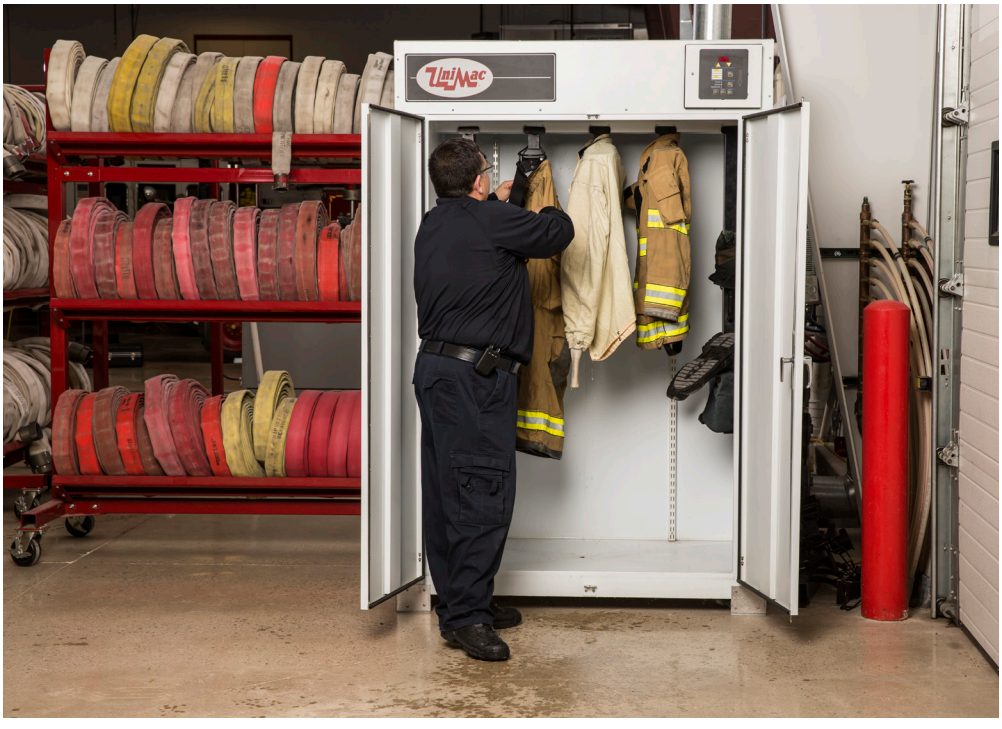
DRYING CABINETS

Once the gear has gone through the proper wash cycle, next will come drying. Drying can also be a challenge for some firehouses, as dryers run the risk of subjecting gear to too much heat or abrasion in order to get it back into service in a timely fashion.

Some firehouses will hang-dry their gear, but this can take a day or more for PPE to fully dry and the drying can sometimes be inconsistent. If hang-drying, it is best to keep clothing out of the direct sunlight, as the UV radiation can break down some of the fibers in the turnout gear. It is also critical that it fully dries before returning it to duty, as wearing damp gear can create steam burns if worn in a fire.

Another option that will expedite dry time and get gear back in service as quickly as possible is a drying cabinet. UniMac laundry manufacturer has been providing drying cabinets to the fire industry for more than half a century, and the newest model of the UniMac PPE Drying Cabinet offers preset programs ranging from 1.5 to 3 hours with very simple to operate controls. With a dual-sided airflow process, the dryer sends heated air around and inside the turnout gear for thorough drying at maximum speed and efficiency. The PPE Drying Cabinet also includes rack attachments to effectively dry boots, gloves and other items. Operating the equipment is as simple as selecting one of the five default pre-programmed settings and pressing start.

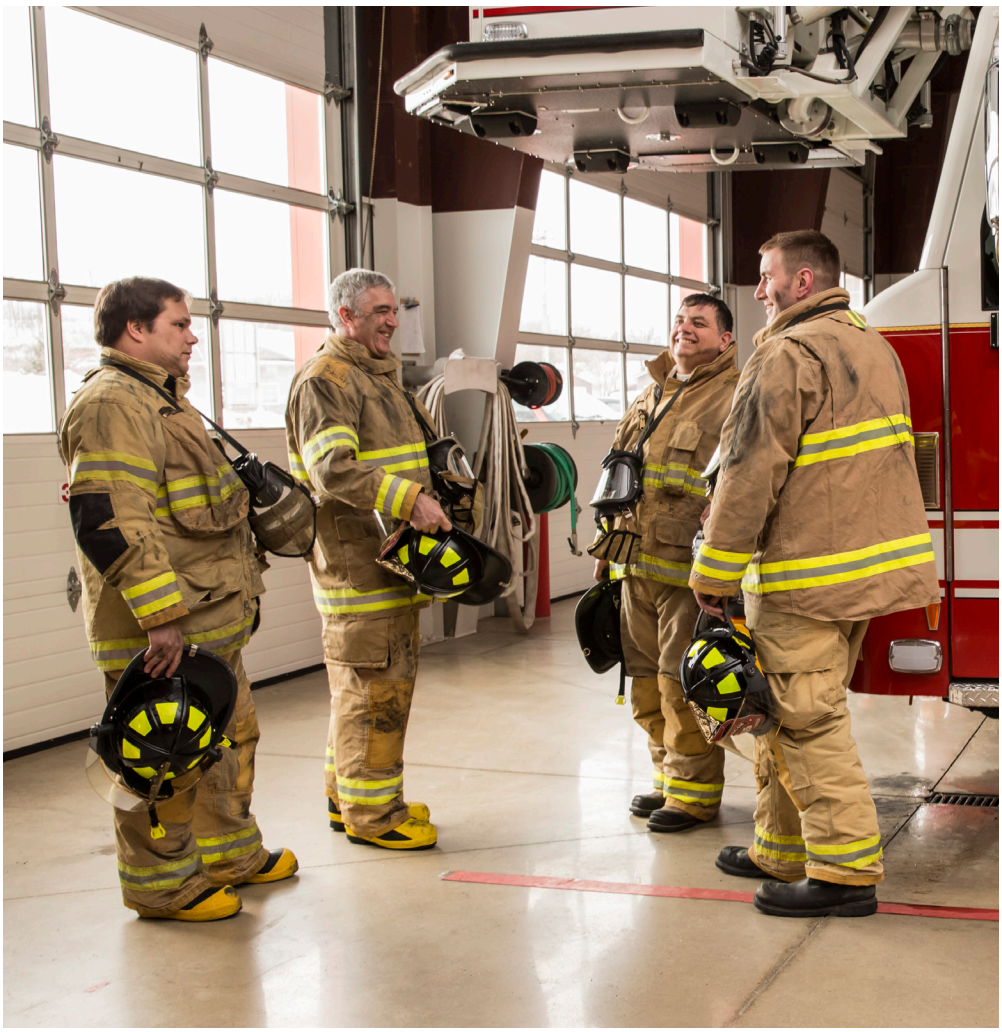
Having equipment on site is one of the best and quickest ways to ensure that PPE is properly cleaned and ready for service. When there is a washer and drying cabinet on site, the gear can be decontaminated and dried within five to six hours. However, when firehouses do not have access to equipment on site, there are resources available to clean and return gear in a timely matter. To help with this, many departments will turn to true industry experts to help – Independent Service Providers (ISPs).



INDEPENDENT SERVICE PROVIDERS

ISPs will provide an advanced and thorough cleaning of PPE and will return gear as quickly as possible. ISPs have industry-leading equipment on site to wash protective clothing, as well as processes and technologies for laundering specialty items like boots and helmets.

Once the gear is cleaned, it will also go through a special inspection. ISPs will examine everything from head to toe – from the helmet to the jacket to the pants to the boots – in order to identify any damage or issues with the gear, so that ISPs are returning equipment that meets the requirements of the gear manufacturer.



EQUIPMENT TRAINING

Fire departments aren't alone when it comes learning how to properly program and use their equipment. Most UniMac distributors have been in the laundry industry for decades and have successfully worked with departments of all sizes to install equipment and help them establish standard cleaning procedures and processes to ensure that gear is properly and promptly cleaned after a major fire or incident. Additionally, once the equipment is installed, UniMac distributors and certified technicians are a valuable resource and there to support firehouses with any of their equipment needs following the installation.

In addition to the UniMac distributor network, leading ISPs also support fire departments with implementing a NFPA 1851 care and maintenance program. Similar to distributors, they will visit fire stations to provide education on how to inspect gear, use equipment and establish cleaning standards. The ultimate goal is to provide firefighters with resources and tools to implement comprehensive cleaning programs.

CHAPTER THREE:

THE PROPER PROCESS

CHAPTER THREE: The Proper Process

The processing techniques for washing PPE are very important. Firefighters need to follow all of the required steps in order to properly clean gear and ensure that nothing is damaged during the wash process.

Using the right equipment and following the required laundering processes will also help extend the life of the gear, which can be around $2,000, as well as ensure that there is no loss of protection due to soiled gear. For example, dirty gear that has not undergone cleaning following service will not reflect heat as well and it will also affect light reflection visibility. The visibility of the reflective tape on the turnout gear is especially important when a firefighter is responding to an accident or incident near traffic.

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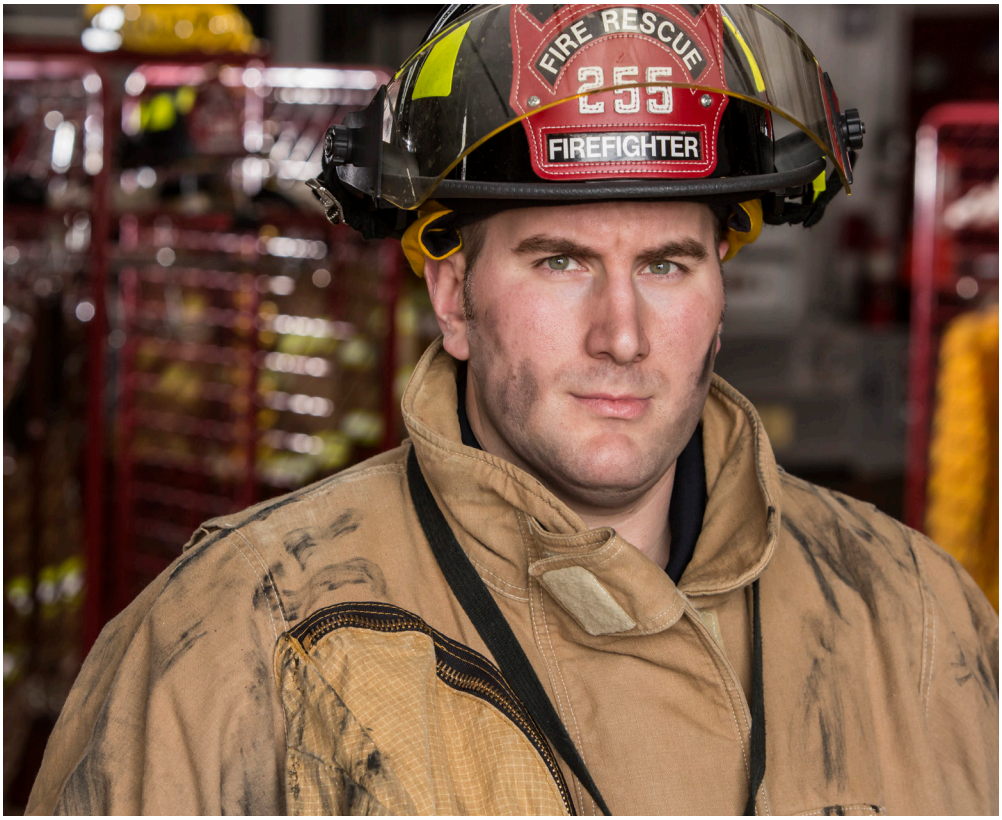


LAUNDERING TIPS

Refer to these tips and processes each time you wash your gear:

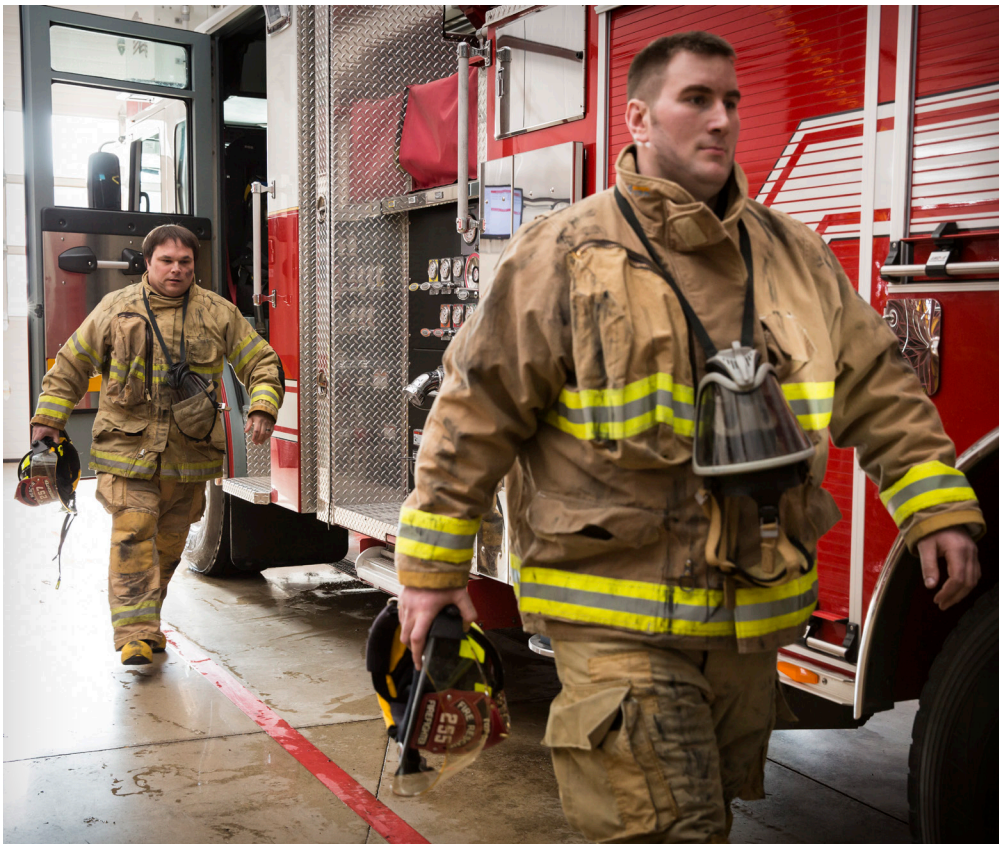
- **Separate the Lining:** Just as it's recommended to separate lights and darks, it's important that you separate the outer shell of the turnout jacket from the lining. Outer shells should be washed together and the inner linings should be laundered together. There are different wash cycles to accommodate these different materials, as the outer shell will need to go through a heavier wash cycle. There are also specific procedures for washing each of these materials:

  - Outer Lining
    - Prior to washing the outer shell, pre-spot anything that is very dirty.
    - Soak outer shells if necessary prior to washing. Consult with a chemical supplier for recommendations on proper ratios and procedures for soaking PPE.
    - Securely close all buttons, snaps and Velcro prior to putting the outer layer in the washer-extractor.

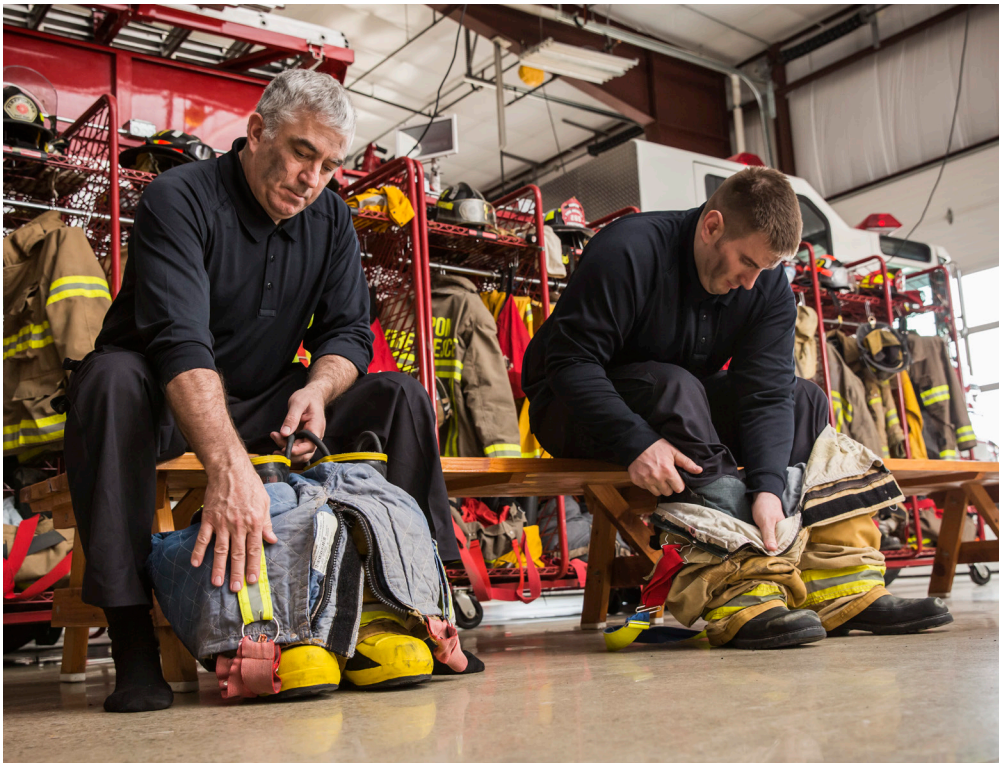
  - Inner Lining
    - Turn the inner lining inside out to protect the moisture barrier prior to putting it in the washer-extractor.

CHAPTER THREE: The Proper Process

- **Cleaning Solutions:** The pH range for cleaning PPE should be 6.0 to 10.5. The detergents should also be safe for PPE and show effectiveness of removing soils and contaminants. Bleach and other chlorinated solvents should not be used. Fire departments should be cautious of chemical suppliers who offer several different products to perform the cleaning process; more chemicals are not always better.
- **Protective Gloves & Glasses:** When washing contaminated PPE and handling the wash chemicals, it's important to wear protective gloves and glasses to protect yourself from any splashing.
- **Wash Cycles:** At a minimum, PPE should go through one complete cycle with at least two rinses. If gear is heavily soiled it should go through a pre-wash setting to remove excess contaminants. Once PPE has completed the wash cycle, inspect the gear and rewash if necessary.



- **Specialty Items:** There are other items that firefighters wear into a fire that should also be cleaned after use. Cleaning processes for these items include:
  - Hoods: Hoods should be washed with the lining of the PPE.
  - Helmets: Helmets should be disassembled for cleaning. The helmet earflaps can be washed in a cycle with the outer shells. The helmet shell should be hand washed with a rag and mild detergent.
  - Gloves: Gloves should be pre-treated and hand washed. When washing, gloves should be filled with a mild detergent.
  - Boots: Boots should be pre-treated and hand washed. You can use a brush and mild detergent to gently scrub the boots. The boots should then be rinsed and hung upside down for drying.



ISOLATE AND CONTAIN

Before the laundering process officially begins, there are steps firefighters can take to remove excess debris or soot from PPE, as well as prevent continued exposure to carcinogens or chemicals on the turnout gear. This can be done through on-scene cleaning, a light washing of the PPE that takes place at the scene of the fire or incident to remove excess debris, soot or particles. On-scene cleaning includes brushing off dry particles, spot-cleaning with a wet rag or rinsing off debris with a low pressure hose.

Additionally, following the on-scene cleaning, firefighters should isolate and contain their contaminated gear. Current guidelines require firefighters to bag their gear if they have come into contact with blood or body fluids. This tactic is now being suggested for everyday cleaning procedures to reduce contaminating vehicles and other common areas following an incident. This helps contain harmful substances, as well as reduce the risk of contaminants absorbing into the firefighter's skin because he or she will promptly remove and bag the gear on the scene to isolate and contain it.

PEACE OF MIND

Having the right equipment and processes in place, whether the laundry is handled internally or outsourced, will provide a peace of mind and ensure that you and your department are doing everything possible to protect one another.

In addition to laundering PPE, there are steps all firefighters should take following a fire or incident that will help prevent and reduce health risks:

- Use a wet towel to remove as much soot as possible
- Change clothes and wash them immediately
- Thoroughly shower after a fire
- Avoid storing gear in the car, your home or living quarters before it is cleaned
- Attend an annual physical examination with a doctor and encourage others to do the same

CONCLUSION

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The ultimate goal of developing and adhering to regular cleaning policies and procedures is that no firefighter will ever need to put contaminated gear back on his or her body.

As the Fire Protection Research Foundation continues its research and works with industry leaders, local governments and equipment manufacturers to develop guidelines and cleaning protocols, it's important for fire departments to stay up to date on the latest research and implement cleaning programs at their stations. As a result of the recent research, access to equipment grants and local funding opportunities are increasing, and the cost of the laundry equipment will seem minimal when you compare it to the health benefits it provides. Additionally, many equipment manufacturers, including UniMac®, offer financing programs specifically tailored to meet the unique needs of the fire industry to make paying for your equipment as easy as possible.

To learn more about the NFPA, visit www.nfpa.org. Additionally, a UniMac distributor is a valued expert when it comes to PPE cleaning and maintenance. To find a distributor near you visit www.UniMac.com.

The ultimate goal of regular cleaning policies and procedures is that no firefighter will ever need to put contaminated gear back on their body.

FIRE AND LAUNDRY EXPERTS

The firefighters pictured in this eBook are real firemen and Alliance Laundry Systems employees. They are true laundry experts and are dedicated to educating the fire industry about the importance of regular and proper cleaning of PPE.

Bill Brooks
UniMac Sales Manager, North America

Kyle Boeck
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