Miller.

The Power of Blue®

Welding Safety & Health Guide

VOLUME III
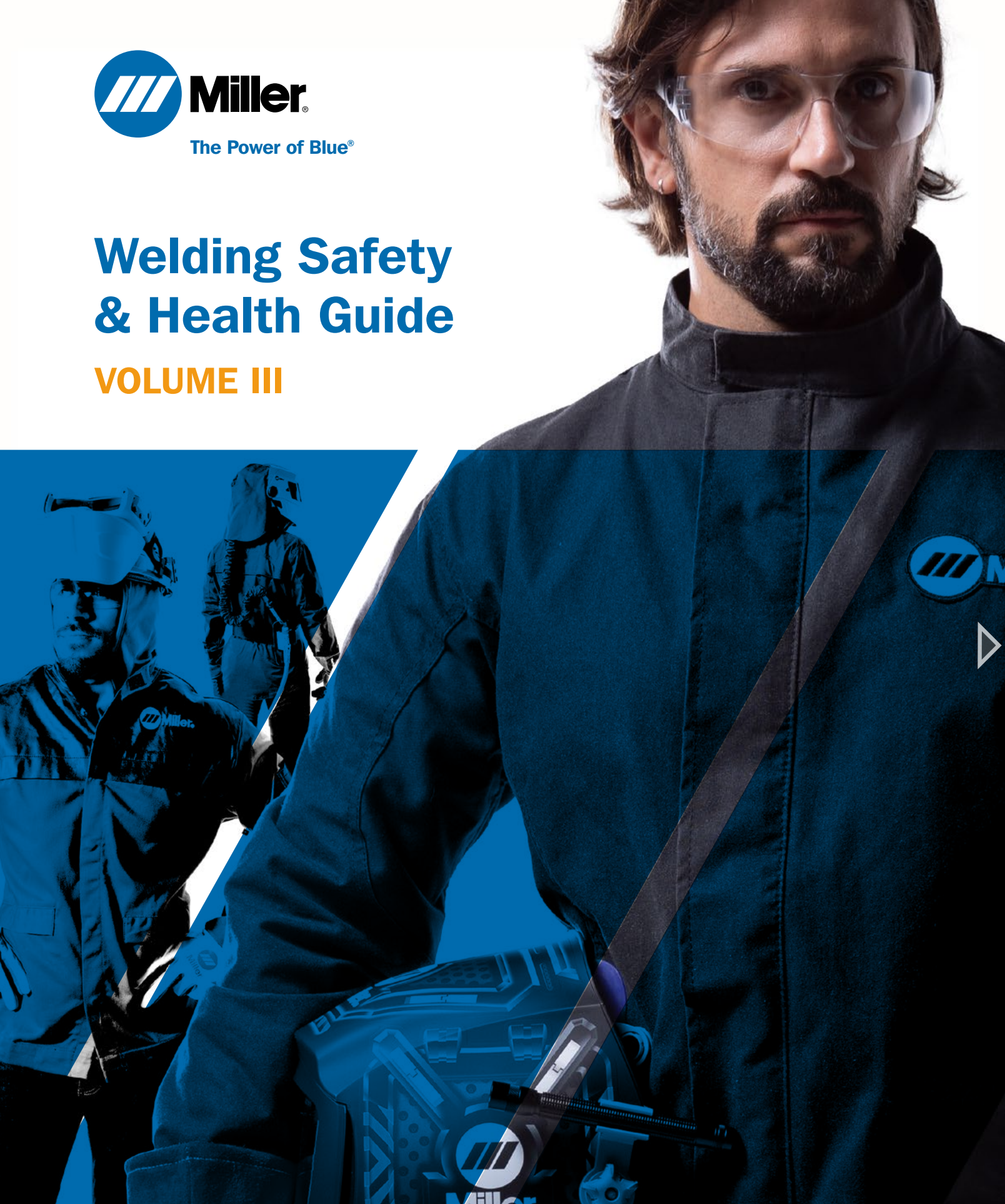
Miller Welding Safety & Health

All of our products are designed and built to protect the welder behind the hood and the environment in which they perform their job – because that's what we know. By listening to welders, safety managers, and industrial hygienists and working with them side-by-side, we understand their needs and have developed products with enhanced technologies that provide protection when working around the clock. The compliance and comfort of your workers and your environment is critical to productivity, performance, and hiring and retaining the best employees.
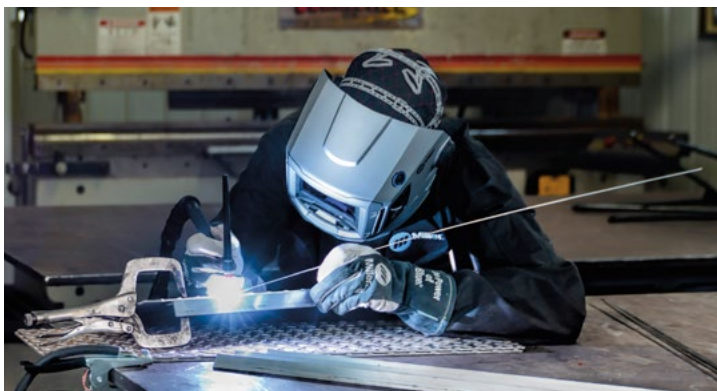
Visit **MillerWelds.com/Safety** to learn more!

⚠ WARNING
READ INSTRUCTIONS.
• Read and follow all labels and the Owner's Manual carefully before installing, operating, or servicing unit. Read the safety information at the beginning of the manual and in each section.

Fume Extraction & Respiratory Protection

Head & Face Protection

Hand & Body Protection

Heat Stress Protection

Fume Extraction & Respiratory Protection

Providing a clean and compliant work environment doesn't need to be complicated. Miller provides multiple solutions for weld fume control that can fufill each tier of OSHA's hierarchy of controls, making it easier to keep your environment in compliance and your workers on the job.

The Talk: Terms and definitions used in this section

OSHA: Occupational Safety & Health Administration; federal agency responsible for setting and enforcing standards, providing training, outreach, education and assistance.

NIOSH: National Institute of Occupational Safety and Health; federal agency that conducts research and makes recommendations to prevent worker injury and illness as well as certifies respirators.

ACGIH®: American Conference of Governmental Industrial Hygienists; a member-based organization that develops recommendations or guidelines to assist in the control of occupational health hazards.

Threshold Limit Value (TLV®): Airborne concentrations of chemical substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed, day after day, over a working lifetime, without adverse health effects.[1]

Ceiling Limit (C): The concentration that should not be exceeded during any part of the working exposure.[1]

EPA: Environmental Protection Agency; federal agency that focuses on protecting human health and the environment by writing and enforcing regulations based on laws passed by Congress.

NESHAP: National Emissions Standards for Hazardous Air Pollutants set by the EPA; regulates what manufacturers emit out of their shops.

Permissible Exposure Limit (PEL): Regulations that establish the acceptable amount or concentration of a substance in the air in the workplace and intended to protect workers from adverse health effects related to hazardous chemical exposure.[2]

Recommended Exposure Limits (REL): Authoritative Federal agency recommendations established according to the legislative mandate for NIOSH to recommend standards to OSHA and are intended to limit exposure to hazardous substances in workplace air to protect worker health.[3]

Time Weighted Average (TWA): Average value of exposure on the basis of a typical 8h/day, 40h/week work schedule.

Statistics & Trends: Fume Extraction & Respiratory Protection

#5-Respiratory Protection

OSHA's 2019 Top Ten Most Cited Violations is 1910.134(c)(1) - Establishing and implementing a written respiratory protection program.[4]

[1] https://www.acgih.org/tlv-bei-guidelines/tlv-chemical-substances-introduction
[2] https://www.osha.gov/chemicalmanagement/index.html
[3] https://www.osha.gov/dsg/annotated-pels/
[4] Report from OSHA and Safety+Health magazine.

Is Your Welding Facility Fume Exposure Compliant?

To maintain a compliant work environment it's necessary to know if exposure to airborne concentrations of chemical substances are exceeding acceptable limits. If exposure levels reach OSHA PELs, or another applicable government occupational exposure limit, there are methods to reduce the exposure and provide a clean, comfortable and compliant workplace.

Get started using the two-step process outlined below – starting with assessing your air quality and then determining a customized action plan.

Determine if Your Facility is Compliant

STEP 1:

Exposure Assessment

Have the air in your facility tested by a certified Industrial Hygienist to determine airborne concentrations of chemical substances, ensuring exposure levels do not exceed limits as outlined in the chart below, or other applicable government occupational exposure limits, whichever is lower.

To contact an Industrial Hygienist, visit www.aiha.org or call 703-849-8888.

Common Substances Related to Welding[1]		Exposure Limits	
Substance	Prevalent In	OSHA - Permissible Exposure Limits (Enforceable)[2]	ACGIH® - Threshold Limit Value (Recommended)
Aluminum	Aluminum Alloys, Steel Additive, Electrode Coatings	5.0 mg/m³ TWA	1.0 mg/m³ TWA
Beryllium	Copper, Magnesium & Aluminum Alloys	0.002 mg/m³ TWA, 0.025 mg/m³ Ceiling	0.00005 mg/m³ TWA
Cadmium	Coatings of Electrodes	0.005 mg/m³ TWA	0.1 mg/m³ TWA
Copper	Copper Metals, Electrodes	0.1 mg/m³ TWA	0.2 mg/m³ TWA
Hexavalent Chromium	Stainless, High Alloy Steels, Some Non-Alloy Sheets	0.005 mg/m³ TWA, 0.1 mg/m³ TWA	0.05 mg/m³ TWA
Iron (Iron Oxide)	Most Welding Fumes	5.0 mg/m³ TWA	5.0 mg/m³ TWA
Lead	Solder, Brass & Bronze Alloys, Steel Coatings	0.05 mg/m³ TWA	0.05 mg/m³ TWA
Manganese	Most Welding Fumes: Electrodes & Steels	5.0 mg/m³ Ceiling[3]	0.02 mg/m³ TWA
Nickel	Stainless, Nickel Alloys	0.5 mg/m³ TWA	0.2 mg/m³ TWA
Zinc (Zinc Oxide)	Galvanized Metal Coatings	5.0 mg/m³ TWA	2.0 mg/m³ TWA

[1] https://www.osha.gov/dsg/annotated-pels/tablez-1.html
[2] More strict regulations may apply. Be sure to understand the relevant regulations in your area.
[3] OSHA limit is 0.2 and only applies to the state of CA.

STEP 2:

Determine an Action Plan

Based on air sampling results, you may need to implement control measures to manage fume exposure within your facility. When determining an action plan, start at the top and work your way down OSHA's Hierarchy of Controls – selecting the controls that are the most feasible, effective and permanent for your workplace. It may be necessary to implement multiple solutions to achieve the desired results.

Follow the steps below to reduce exposure levels and help gain compliance:

1

Process Modification/ Substitution

Eliminates the exposure before it can occur
using low manganese wire, advanced welding processes or equipment

2

Engineering Controls

Requires a physical change in the workplace
such as implementing local exhaust ventilation or fume extraction systems

3

Work Practice Controls

Requires a change in workplace procedures
such as training and education on best practices for weld processes and position

4

Personal Protective Equipment

Requires the worker to wear personal protective equipment
when engineering controls are not feasible, respiratory protection may be required to reduce weld fume exposure

Increasing Effectiveness

This process requires repetitive exposure assessments. Any time there is a change to the worker, process or facility, retesting should be conducted to ensure exposure concentrations have not been affected.

Process Modification/Substitution
Engineering Controls
Work Practice Controls
Personal Protective Equipment

1
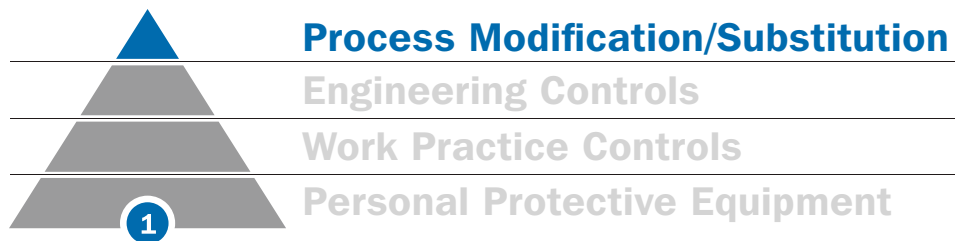
Process Modification/ Substitution

According to OSHA, the first and most effective level in the Hierarchy of Controls physically removes the hazard from the environment or substitutes it with something that does not produce the hazard[1].

Although removing welding from your operations may not be feasible, substituting standard filler metal with low manganese filler metal can help reduce manganese fume emissions.

Depending on parameters, you could also consider using advanced processes such as GMAW-pulse to reduce fume emissions compared to conventional spray transfer.
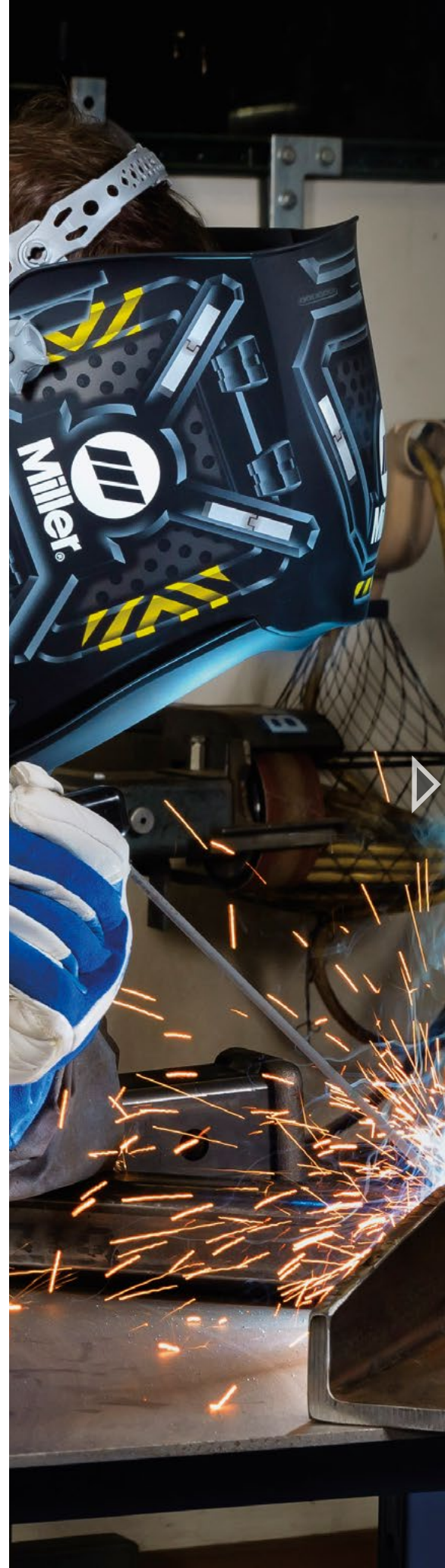
[1] https://www.osha.gov/shpguidelines/hazard-prevention.html

Process Modification/Substitution
Engineering Controls
Work Practice Controls
Personal Protective Equipment

Low Manganese Wire

Low manganese wire is designed to reduce manganese fume emissions in welding. Conversion to low manganese products may result in a 60-90 percent reduction in manganese levels when compared to traditional filler metal fume emissions.

Designed for compliance, low manganese wire can help you meet changing environmental regulations for the manufacturing and fabrication industries.

Process Modification/Substitution
Engineering Controls
Work Practice Controls
Personal Protective Equipment

2

Engineering Controls

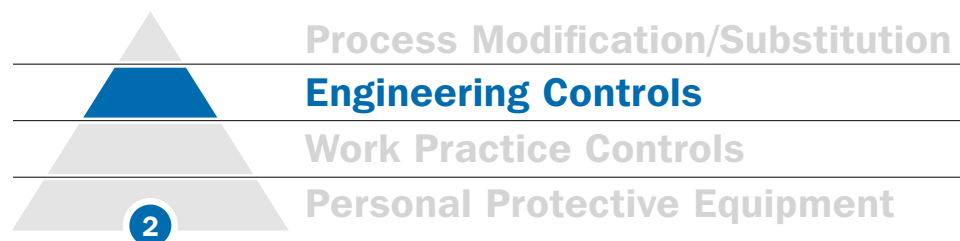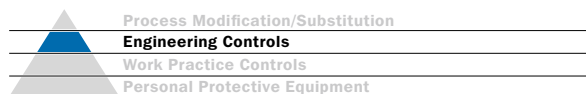The second most effective level of control recommended by OSHA requires placing a barrier between the weld operator and the hazard.[1] Examples of engineering controls include automated welding, which encloses the process and uses an extraction system to the remove weld fume. General ventilation and source capture are two additional methods, with source capture being the preferred method because of its ability to capture and remove fume at the source before it reaches an operator's breathing zone.

New source capture methods like ZoneFlow™ technology create a larger capture area — keeping environments cleaner and improving productivity through fewer arm interactions so weld operators can focus on welding.

The Talk: Terms and definitions used in this section

Accu-Rated™: The true, accurate airflow at the inlet of the collection hood.

ZoneFlow™: Advanced Miller® technology that creates a negative pressure zone, allowing the weld particulate capture distance to be extended up to five feet deep and three feet wide.

MERV (Minimum Efficiency Reporting Value): Value that reports a filter's ability to capture larger particles between 0.3 and 10 microns (μm).[2]

High Vacuum Extraction Systems: Draws air in at a high air transport velocity and high pressure, but a low air volume. Typically used to draw air through smaller, highly restrictive hoses or pipes, allowing the accessories to be mobile and reach restricted spaces more easily.

Low Vacuum Extraction Systems: Moves higher amounts of airflow (cfm) through larger ducts at a relatively low system pressure, providing a further source capture distance.

CFM (Cubic Feet Per Minute): Measurement of velocity at which air flows into or out of a space.

[1] https://www.osha.gov/shpguidelines/hazard-prevention.html
[2] https://www.epa.gov/indoor-air-quality-iaq/what-merv-rating-1

Process Modification/Substitution
Engineering Controls
Work Practice Controls
Personal Protective Equipment
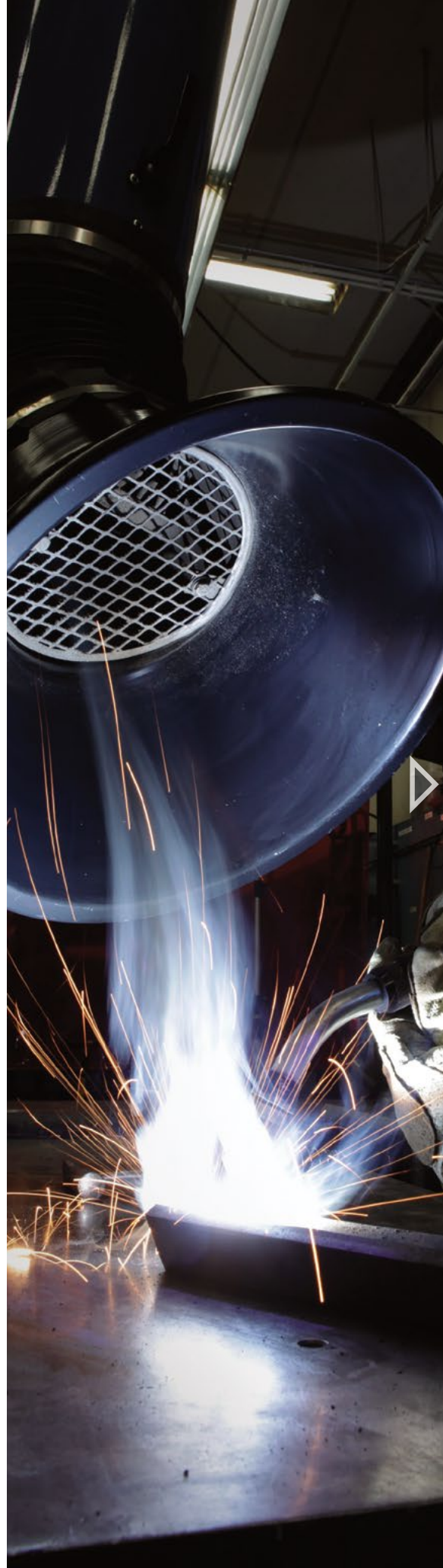
FILTAIR® Fume Extraction

The complete line of Miller® FILTAIR® fume extractors are designed specifically for welding – drawing weld fumes away from the operator's breathing zone and keeping your facility clean. We offer many types of fume extraction equipment to best fit your environment and fume control needs.

ZoneFlow™ Technology

Stay in your zone with exclusive ZoneFlow™ Technology. Experience the benefits of a weld fume capture zone that's up to five feet from the arc compared to traditional systems requiring the hood placed within 18 inches from the arc for effective capture.

What does a capture zone that's three times larger mean to you?

(▶) **Less Arm Movement**
Operators can maintain an effective capture zone without having to constantly adjust the arm so they can focus on welding and stay comfortable without interruptions

(▶) **Increased Productivity**
Weld operators can significantly reduce interactions with the arm, increasing arc-on time – boosting productivity and efficiency

(▶) **Clean Environment**
A larger capture zone makes it easier to effectively capture weld fume and maintain a clean environment, helping to achieve compliance

(▶) **Lower Cleaning and Maintenance Costs**
Your overall facility will stay cleaner, potentially reducing cleaning and maintenance costs

Available on FILTAIR® Capture 5, SWX and Centralized Fume Extraction Systems

ZoneFlow™ Technology creates the largest capture zone in the industry.

5 feet!

Available in 230-volt, single-phase model, making it suitable for use in small shops or rural areas without access to industrial three-phase power.

Process Modification/Substitution
Engineering Controls
Work Practice Controls
Personal Protective Equipment

Weld Fume Control Products

Model	Processes Stick, TIG, MIG, and Flux-Cored	Filter	Filter Media (sq ft)	Input Power
Portable				
FILTAIR® 130	✓	Manual-Cleaning	31	115 V, 1-phase 60 Hz at 11 Amps
Mobile				
FILTAIR® Capture 5	✓	Self-Cleaning	452	208/230 V, 1-phase, 60 Hz 460 V, 3-phase, 60 Hz
FILTAIR® MWX-S	✓	Self-Cleaning	490	115 V, 1-phase, 60 Hz at 11.9 Amps
FILTAIR® MWX-D	✓	Disposable	490	115 V, 1-phase, 60 Hz at 11.9 Amps
Stationary				
FILTAIR® SWX-D	✓	Disposable	490	115 V, 1-phase, 60 Hz at 11.9 Amps
FILTAIR® SWX-S	✓	Self-Cleaning	490	115 V, 1-phase, 60 Hz at 11.9 Amps
Centralized				
FILTAIR® Centralized 4000	✓	Self-Cleaning	588	230, 460 or 575 V, 3-phase, 60 Hz
FILTAIR® Centralized 6000	✓	Self-Cleaning	882	230, 460 or 575 V, 3-phase, 60 Hz
FILTAIR® Centralized 8000	✓	Self-Cleaning	1,176	230, 460 or 575 V, 3-phase, 60 Hz
FILTAIR® Centralized 12000	✓	Self-Cleaning	1,764	230, 460 or 575 V, 3-phase, 60 Hz

ZoneFlow™ Technology	Sound Level (dBA at 5 ft)	Net Weight (lb)
	68.5	46
✓	77	660
	70	300
	70	238
✓	75	130
✓	75	195
✓	72-75	1,600
✓	72-75	2,250
✓	72-75	2,900
✓	72-75	3,900

Process Modification/Substitution
Engineering Controls
Work Practice Controls
Personal Protective Equipment
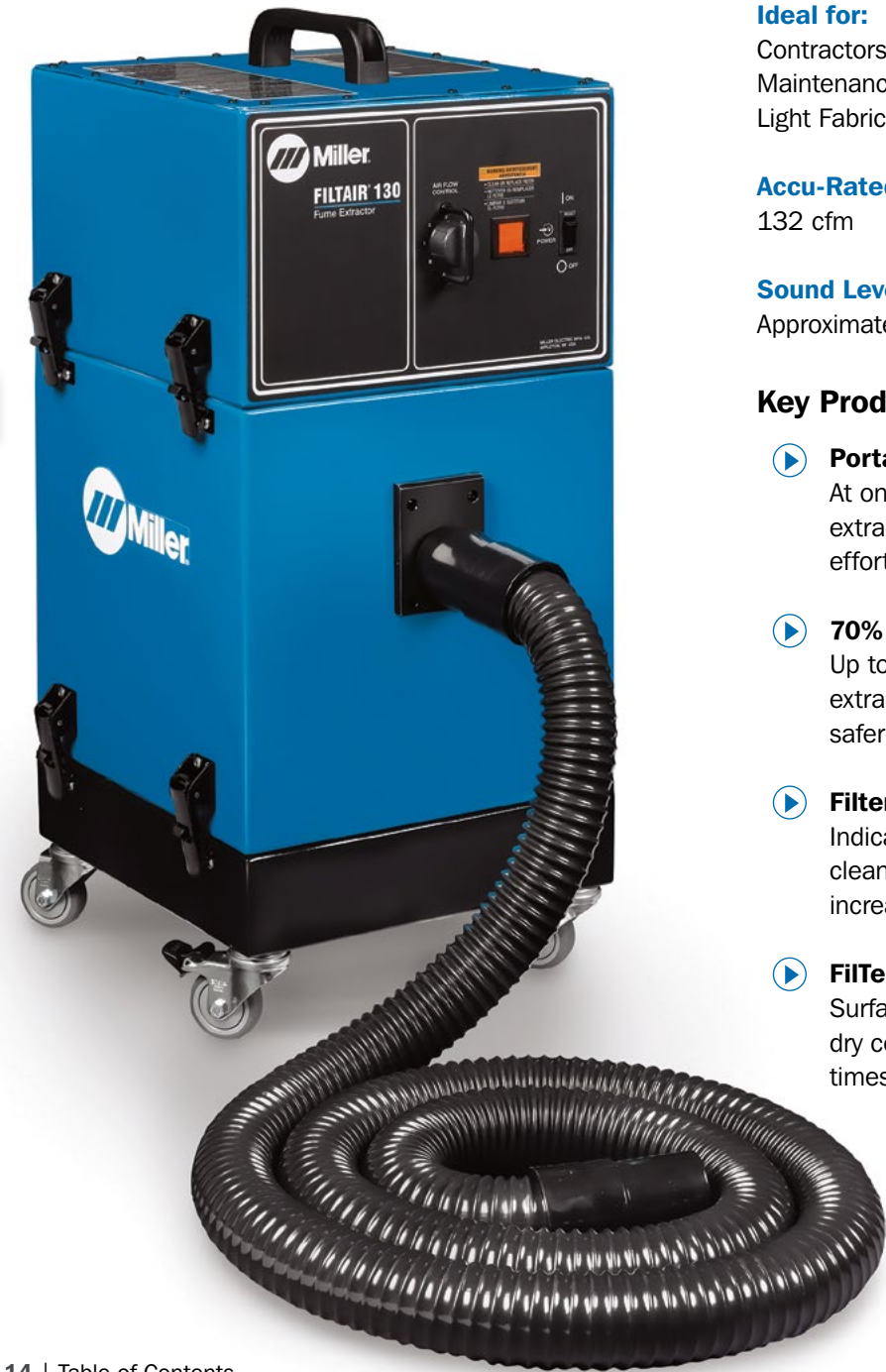
Portable Extractors

FILTAIR® 130

Extremely lightweight and portable high vacuum weld fume extractor ideal for moving with the weld operator and work. Only 46 pounds!

Ideal for:

Contractors
Maintenance & Repair Operations
Light Fabrication

Accu-Rated™ Airflow:

132 cfm

Sound Level:

Approximately 68.5 dBA at 5 ft

Key Product Features:

▶ Portable
At only 46 pounds, the lightweight vertical shaped extraction machine is easy to move around for effortless portability

▶ 70% Quieter
Up to 70 percent quieter than some other fume extractors at only 68.5 dBA per 5-feet provides a safer and more productive work area

▶ Filter Service Indicator
Indicator turns red when the filter needs to be cleaned to maintain extraction performance and increase filter life

▶ FilTek® XL Filter
Surface-loading filter can be manually cleaned with dry compressed air, extending its life up to eight times that of conventional filters

Part #:	Description:
300595	Model 130 - Includes Filter, 8-ft Hose and 20-ft Power Cord
Accessories	See pg. 19

Process Modification/Substitution
Engineering Controls
Work Practice Controls
Personal Protective Equipment

Mobile Extractors

FILTAIR® Capture 5

Extended-capture fume extraction system designed specifically to capture fume in larger weld areas while minimizing interactions with the arm.

Ideal for:

Heavy Equipment Manufacturing
Fabrication
Maintenance and Repair Operations
Training Centers

Accu-Rated™ Airflow: 900 cfm
Sound Level: Approximately 77 dBA at 5 ft

Part #:	Description:
951639	208-230 V with 10-ft Pre-Assembled Extraction Arm
951640	230 V with 12-ft Pre-Assembled Extraction Arm
951574	460 V with 10-ft Pre-Assembled Extraction Arm
951575	460 V with 12-ft Pre-Assembled Extraction Arm

Key Product Features:

▶ **ZoneFlow™ Technology**
Up to three times larger capture zone than traditional extractors reduces arm movements and increases operator productivity

▶ **Easy-to-Operate, Pre-assembled ZoneFlow™ Extraction Arms**
Available in 10- and 12-foot lengths made of aluminum and steel for a more durable, long-lasting performance. External brackets and adjustments allow air to pass through with less resistance giving you stronger cfm (airflow).

▶ **Automatic Filter Cleaning**
Extends filter life. An automatic pulse cleaning cycle cleans the filter from the inside out every time the machine is turned off. Weld fume particulate is removed from the filter and safely deposited in the particulate disposal drawer.

▶ **Filter Pressure Gauge**
Easy-to-read gauge indicates when pressure drop increases/cartridge needs to be replaced.

Process Modification/Substitution
Engineering Controls
Work Practice Controls
Personal Protective Equipment

FILTAIR® MWX

Mobile weld fume extractors designed to easily move with the weld operator and work.

Ideal for:

Manufacturing & Fabrication
Maintenance & Repair Operations
School & Training Facilities

Accu-Rated™ Airflow: 875 cfm
Sound Level: Approximately 70 dBA at 5 ft

Key Product Features:

▶ **Large Hood**
The largest hood in the industry provides 360-degree rotation to obtain the best position over the weld – limiting the amount of weld fume entering the breathing zone.

▶ **Easy-to-Operate Extraction Arms**
External adjustments allow air to pass through with less airflow resistance giving you stronger cfm (airflow). Reliable and accurate positioning across the full range of motion of the arm increases proper use and compliance. Easy maintenance ensures long-lasting operation and increased ROI. Extraction arms are pre-assembled in 7-, 10- and 12-foot lengths.

▶ **Filter Pressure Gauge**
Front panel Filter Pressure Gauge is easy to read with color-coded graphics, indicating when pressure drop increases and the filter needs to be replaced (MWX-D) or cleaned (MWX-S).

Equipment and Options	Part #:	Description:
MWX-D Packages (Includes mobile extractor, high-efficiency filter and arm)	951507	With 7-ft Extraction Arm and Disposable Filter
	951508	With 10-ft Extraction Arm and Disposable Filter
	951509	With 12-ft Extraction Arm and Disposable Filter
MWX-S Packages (Includes mobile extractor, high-efficiency filter and arm)	951510	With 7-ft Extraction Arm and Self-Cleaning Mechanism
	951511	With 10-ft Extraction Arm and Self-Cleaning Mechanism
	951512	With 12-ft Extraction Arm and Self-Cleaning Mechanism

Process Modification/Substitution
Engineering Controls
Work Practice Controls
Personal Protective Equipment

Stationary Extractors

FILTAIR® SWX

Wall or column mounted weld fume extractors designed for environments with weld areas that need filtration but do not have extensive floor space. Features ZoneFlow™ Technology on select models.

Ideal for:

Schools & Training Facilities
Manufacturing & Fabrication
Fixed Welding Cells/Stations

Accu-Rated™ Airflow: 875 cfm
Sound Level: Approximately 80 dBA at 5 ft

Key Product Features:

▶ **Easy-to-Operate, Pre-assembled Standard/ZoneFlow™ Extraction Arms**
Designed to cover larger spaces. Available in 10- and 12-foot lengths. External brackets and adjustments allow air to pass through with less resistance giving you stronger cfm (airflow).

▶ **Telescoping Arms**
Designed to fit small weld booths used in training centers and educational booths. Telescopes from 3 to 4.5 feet with a wide range of motion to cover all positions.

▶ **Filter Pressure Gauge**
Easy-to-read front panel Filter Pressure Gauge indicates when pressure drop increases and the filter needs to be replaced (SWX-D) or cleaned (SWX-S). Note: On self-cleaning model, the filter gauge and cleaning control are mounted on a remote control box for easy access.
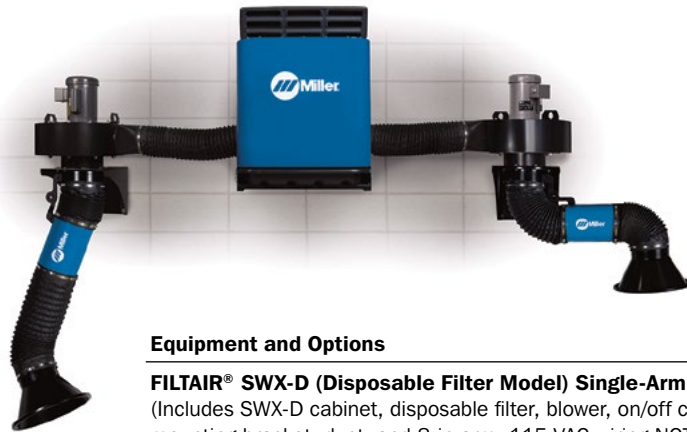
Equipment and Options	Part #:	Description:
FILTAIR® SWX-D (Disposable Filter Model) Single-Arm Packages (Includes SWX-D cabinet, disposable filter, blower, on/off control box, mounting bracket, duct, and 8-in arm. 115 VAC wiring NOT included.)	951619	With 3–4.5-ft Telescoping Extraction Arm
	951513	With 7-ft Standard Extraction Arm
	951514	With 10-ft Standard Extraction Arm
	951515	With 12-ft Standard Extraction Arm
FILTAIR® SWX-S (Self-Cleaning Filter Model) Single-Arm Packages (Includes SWX-S cabinet, self-cleaning control box and filter, blower, on/off control box, mouting bracket, duct, and 8-in arm. 115 VAC wiring NOT included.)	951620	With 3–4.5-ft Telescoping Extraction Arm
	951516	With 7-ft Standard Extraction Arm
	951517	With 10-ft Standard Extraction Arm
	951760	With 10-ft ZoneFlow™ Extraction Arm
	951518	With 12-ft Standard Extraction Arm
	951761	With 12-ft ZoneFlow™ Extraction Arm
FILTAIR® SWX Dual-Arm Add-on Packages (Includes blower, on/off control box, mounting bracket, duct, backdraft dampers, and 8-in arm. 115 VAC wiring NOT included.)	951621	With 3–4.5-ft Telescoping Extraction Arm
	951519	With 7-ft Standard Extraction Arm
	951520	With 10-ft Standard Extraction Arm
	951762	With 10-ft ZoneFlow™ Extraction Arm
	951521	With 12-ft Standard Extraction Arm
	951822	With 12-ft ZoneFlow™ Extraction Arm

Process Modification/Substitution
Engineering Controls
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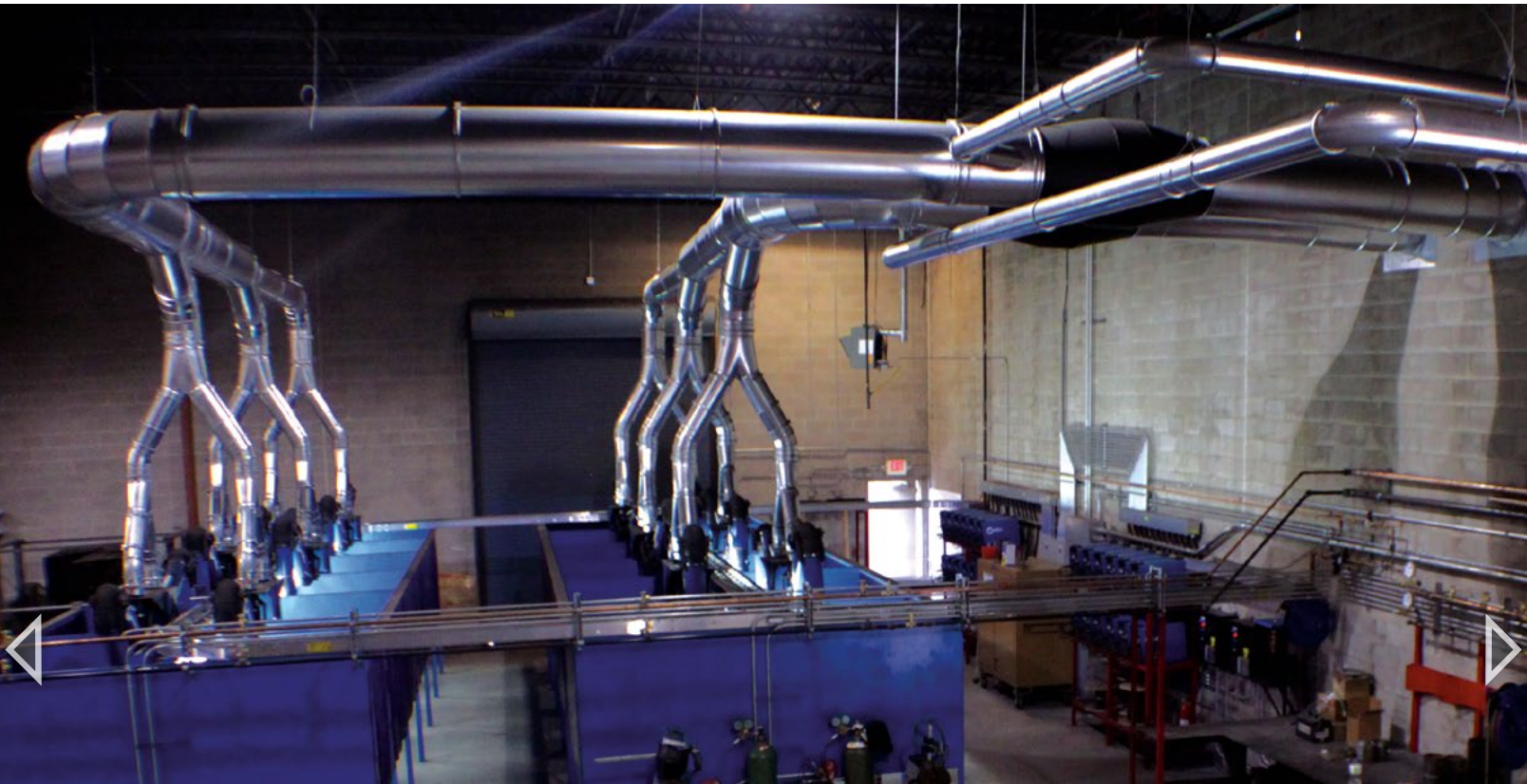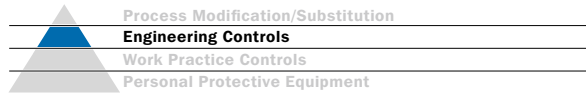
Centralized Extraction Systems

FILTAIR® 4000-12000

Custom engineered industrial centralized solutions designed for multiple capture sources that require ducting and accessories to complete the system.

Ideal for:

Manufacturing Facilities
Automated Welding Cells
Schools & Training Facilities

Accu-Rated™ Airflow: 2,000-10,500 cfm[1]
Sound Level: Approximately 72-75 dBA at 5 ft

Key Product Features:

▶ **Up to 65% Smaller Footprint than most Cartridge Collectors**
Maximizes floor space for more profitable work stations increasing weld time

▶ **Quieter than Traditional Systems**
Motor is located on inside of the unit

▶ **Easier Installation**
Completely packaged, fully assembled and pre-wired system

▶ **ZoneFlow™ Extraction Arms**
Available in 10- and 12-foot lengths made of aluminum and steel for a more durable, long-lasting performance. External brackets and adjustments allow air to pass through with less resistance giving you stronger cfm (airflow).

[1] Dependent on model

FILTAIR® Centralized Extraction Systems Overview

Modular, Expandable Ductwork

- Clamp-together ducting easily integrates with existing ductwork and adapts to future facility needs – reducing the cost of ongoing plant changes

Spark Cooler®

Extend and protect the life of your filters and system

- Cool and suppress sparks before they reach the filter material

- Help prevent dust collector fires

- Minimal pressure drop, no maintenance, simple installation

Sprinkler Inlet
Increase safety and limit damage

- All FILTAIR® Industrial Centralized Systems feature a sprinkler inlet ready for sprinkler head installation

Low-Profile Automation Hoods

- Exclusive technology – capture velocity zone is maximized and distributed over the work area

- Clear, UV-protected polycarbonate ceiling panels allow maximum light into cell

- Modular design for easy size and height change

Arms with External Supports

- Combined with our custom engineered systems, FILTAIR® extraction arms with external supports maintain stronger suction capture velocity to ensure adequate ventilation to pull fume from the breathing zone
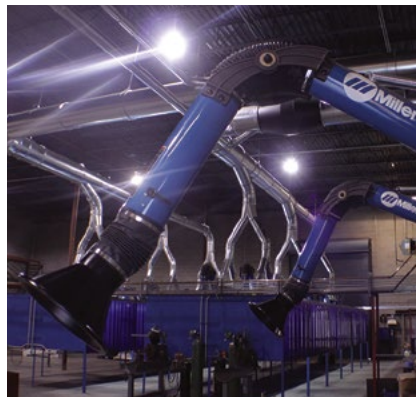
UP TO 65% SMALLER

- Up to 65% smaller footprint than most cartridge collectors

- Maximize valuable floor space for more profitable work stations, increasing weld time

Process Modification/Substitution
Engineering Controls
Work Practice Controls
Personal Protective Equipment

FILTAIR® Accessories

Extraction Arms

Part #:	Description:
301242	Telescoping Arm, 6-in Diameter
300953	Standard Arm, 6-in Diameter, 7-ft Arm
300954	Standard Arm, 6-in Diameter, 10-ft Arm
951810	ZoneFlow™ Arm, 6-in Diameter, 10-ft Arm
300955	Standard Arm, 6-in Diameter, 12-ft Arm
951811	ZoneFlow™ Arm, 6-in Diameter, 12-ft Arm
300952	Arm Mounting Bracket and Ducting Kit, 6-in Diameter
301237	Telescoping Arm, 8-in Diameter
300980	Standard Arm, 8-in Diameter, 7-ft Arm
300981	Standard Arm, 8-in Diameter, 10-ft Arm
951758	ZoneFlow™ Arm, 8-in Diameter, 10-ft Arm
300982	Standard Arm, 8-in Diameter, 12-ft Arm
951759	ZoneFlow™ Arm, 8-in Diameter, 12-ft Arm
300771	Arm Mounting Bracket and Ducting Kit, 8-in Diameter

ZoneFlow™ Arm
• Pre-assembled, easy to operate fume extraction arm
• Designed to be mounted to a wall, pedestal or column
• Connects with FILTAIR® SWX and Centralized systems or competitive equipment

Spark Cooler®
• Available in a variety of sizes
• See representative for part numbers

FILTAIR® Low-Profile Modular Hoods
• Available in one-foot increments from 4 x 4 feet up to 16 x 16 feet
• Corner lift hooks are convenient for installing or hanging over a work area. The hood can also be placed on an existing cell enclosure or supported with 9-, 10-, 12- or 14-foot post assemblies
• See representative for part numbers

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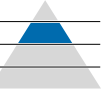
FILTAIR® Accessories

130 and 400 Replacement Filters
301267 130 model
300925 400 model

MWX & SWX Replacement Filters
300540 Self-cleaning filter models
300539 Disposable filter models

Capture 5 Replacement Filter
301106

Centralized FilTek® XL Replacement Filter
300927

Flexible Funnel Magnetic Nozzle
300668

Magnetic Nozzles
300895 12-in (305 mm) width

Collection Hose
300896 17-ft (5.2 m)
300897 34-ft (10.4 m)

Hood Light with Arc Sensor
300689 MWX Series
300763 SWX Series
• Illuminates the welding zone and enables the fume extractor to start automatically when welding begins

Process Modification/Substitution
Engineering Controls
Work Practice Controls
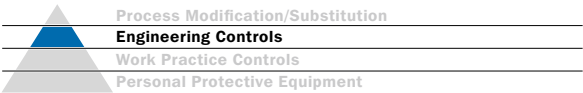Personal Protective Equipment

FilTek® XL Filters

When it comes to selecting a fume extractor, nothing is more important than the filter.

FilTek® XL is an innovative, surface-loading filter that captures particles on the surface of the media (versus depth loading), making maintenance easier and extending the filter life.

Miller® FilTek® XL filters have a high MERV rating – a class-leading MERV 15 – capturing up to 95 percent at .5 μ (micron) of weld fume particulate, including hexavalent chrome. The smaller the particles in the air, the higher the MERV rating required to capture them.

MERV Rating

M = Minimum   **E** = Efficiency   **R** = Reporting   **V** = Value

Filters are rated on a MERV scale, which measure filter efficiency based on particle count. MERV ratings range from 1 to 16, with 16 being the best at filtering small particles – such as those found in weld fumes. Filters in common air filtration systems often have MERV ratings between 7-11. FilTek® XL filters are rated at class-leading MERV 15 to capture up to 95 percent of weld fume particulates.

Applicable Weld Fume MERV Rating Categories[1]	Particle Size Range Efficiency %[2]		
	0.3 to 1 μm	1 to 3 μm	3 to 10 μm
10	Not Rated	50 - 65%	85%
11	Not Rated	65 - 80%	85%
12	Not Rated	80 - 90%	85%
13	<75%	90%	90%
14	75 - 85%	90%	90%
15 Miller® FilTek XL	85 - 95%	90%	90%
Percentage of Weld Fume Particle Size[3]	75 - 95%	15%	10%

Filter Media Performance Summary

FilTek® XL filters have high efficiencies and low pressure drops to capture better, last longer and lower operating costs.

MERV 15 per ASHRAE 52.2	< 95% efficient

Filter Media Type	Weld Fume Capture Efficiency	Pressure Drop
Cellulose	Very Low	Low
Cellulose Blend	Low	Moderate
Spunbond Polyester	Moderate/High	High
Meltblown Composite	High	High
Miller® FilTek® XL	High	Low

Disposable vs. Self-Cleaning Model Filters

XL Filters: Provide excellent surface loading qualities with very low resistance that makes them ideal for weld fume.

Disposable Model Filters: "D" model extractors have disposable filters with lower initial expenditures, but the need to replace the filter is more frequent.

Self-Cleaning Model Filters: "S" model extractors have a self-cleaning mechanism that releases a strong reverse pulse of air to remove the collected fume off the outside of the filter. The self-cleaning models have higher initial expenditures, but require less maintenance and a much longer filter life.

[1] American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Standard 52.2
[2] National Air Filtration Association (NAFA) Guide
[3] Jenkins, Pierce, Edgar, Particle Size Distribution of GMAW and FCAW

45° or 60° neck bend
for maximum feeding
characteristics

Small vacuum chamber
increases visibility and access
to weld joints

(Optional chamber sizes)

Bernard® Clean Air™
Fume Extraction MIG Gun

Vacuum Regulator

Small, lightweight handle improves
maneuverability and operator comfort

Reduce wrist fatigue and improve
flexibility with 360° vacuum hose
swivel on rear of handle

Bernard® FILTAIR® Fume
Extraction Curved Handle

Fume Guns
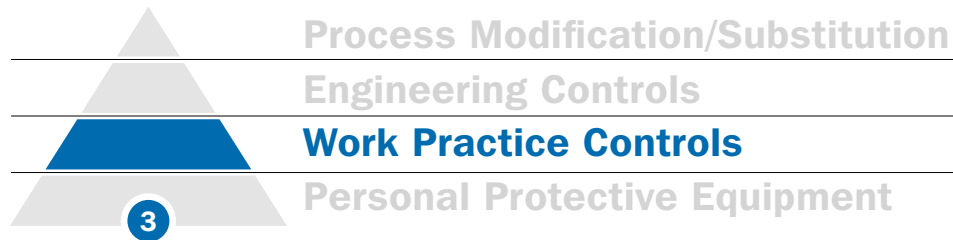
Ideal Fume Extraction Solution
for Large Weldments and Confined Spaces

Bernard® Clean Air™ Fume Extraction MIG Gun

Closely matching the weight, handle size, durability and industrial-grade performance of Bernard BTB Semi-Automatic Air-Cooled MIG Guns, Clean Air Fume Extraction Guns are fully configurable with your choice of curved or straight handles (formerly FILTAIR® Fume Extraction Guns).

Key Product Features:

- Available in 300, 400, 500 and 600 amp models

- Lightweight, comfortable and durable design for industrial grade performance

- Nozzle shroud adjusts to one of four positions for optimized fume capture, gas flow and weld access

- Compatible with vacuum systems from most manufacturers

- Suitable for use with solid and flux core wires

- Durable crush and snag resistant vacuum hose eliminates the need for a bulky vacuum hose cover for most applications

- Small size of vacuum chamber provides good joint access and visibility

- Compatible with Centerfire™, Quik Tip™ or TOUGH LOCK™ Consumables

- Available with Bernard Universal Conventional Liners, QUICK LOAD™ Liners or the QUICK LOAD Liner AutoLength™ System

- Clean Air Straight Handle models feature rubber over-mold on handle for operator comfort and grip and a swivel on the rear of the handle that improves flexibility and reduces wrist fatigue

Process Modification/Substitution

Engineering Controls

Work Practice Controls

Personal Protective Equipment

3

Work Practice Controls

The third level of the OSHA Hierarchy is work practice controls, which does not remove the hazards[1], but includes general workplace and operation-specific rules that limit or prevent exposure. Compliant work practices involve adjustments to how a task is performed, along with regular maintenance and supervision of engineering controls. It is also important that everyone using any type of personal protective equipment knows how to use and maintain their PPE for optimal performance.

Tips for Work Practice Controls Within a Welding Environment

Clean, Dry Work Surface
A good practice to reduce the generation of fumes and gases from paints and primers is to grind or sand the surface to bare metal prior to welding.[2]
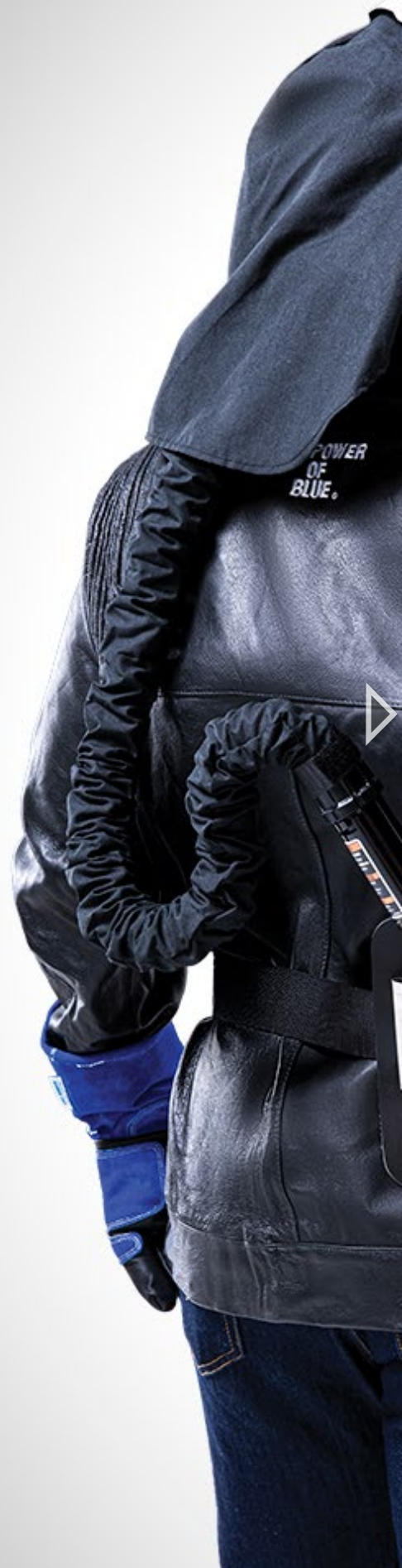
Body Positioning
Avoiding the fume can be done by positioning of the work, the head, or by ventilation which captures or directs the fume away from the face.[2] Using magnification lenses or a helmet with high-definition lens technology can help improve your view for better body and head positioning.

Work Stations
Some factors for determining adequate ventilation include[2]:

• Volume and configuration of the space in which operations occur
• Number and type of operations generating contaminants
• Concentrations of specific toxic or flammable contaminants being generated
• Natural air flow (rate and general atmospheric conditions where work is being done)
• Location of the welder's and other person's breathing zones in relation to the contaminants or sources

[1] https://www.osha.gov/shpguidelines/hazard-prevention.html
[2] https://app.aws.org/technical/AWS_Z49.pdf

		Process Modification/Substitution
		Engineering Controls
		Work Practice Controls
4		**Personal Protective Equipment**
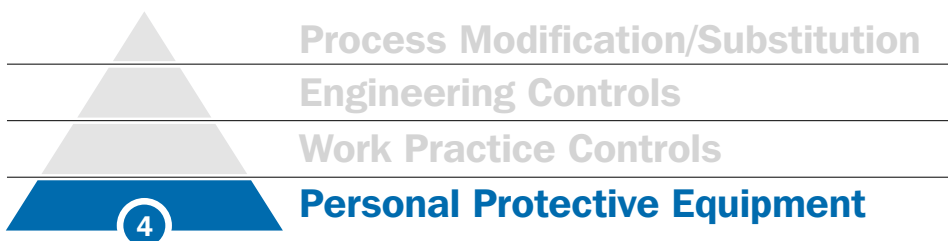
Personal Protective Equipment

When engineering controls are not feasible, while they are being implemented, or when they do not reduce exposure levels enough, respiratory protection should be implemented. Miller respirators are specifically designed for comfort, keeping operators productive and compliant.

Written Respiratory Protection Program:
OSHA requires an employer to develop and implement a Written Respiratory Protection Program with required worksite-specific procedures and elements for both mandatory and voluntary respirator use. For employees voluntarily using respirators, employers must provide those users with a copy of Appendix D to OSHA 1910.134.

The Talk: Terms and definitions used in this section

29 CFR 1910.134: OSHA standard that addresses respirator selection, use, implementation and creating a respiratory protection program.

Assigned Protection Factor (APF): Level of protection that a respirator is intended to provide, when used in conjunction with a written respiratory protection program.

Maximum Use Concentration (MUC): Calculation indicating the maximum atmospheric concentration of a hazardous substance that an employee can be expected to be protected when wearing a respirator.

MUC = APF x OSHA PEL

Process Modification/Substitution
Engineering Controls
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Personal Protective Equipment

Half Mask Respirators

Low-profile design fits comfortably under welding helmets and Weld-Mask™ 2, maximizing the field of vision. The large, non-return exhaust valve eases breathing and reduces user fatigue.

Which Mask Should I Use?

After completing an exposure assessment and understanding your environment, the applications, and users you'll be ready to make the best selection.

Other factors to consider include:
• Fit – Utilize fit testing to select the correct size to ensure a tight seal
• Comfort – Features that allow the user to customize the fit for all-day comfort
• Design – Select a respirator that fits with other PPE, such as welding helmets, without interrupting field of vision

N Not Resistant to Oil   **P** Oil Proof

95 (up to 95% of airborne particles)   100 (up to 99.97% of airborne particles)

NOTE: Only Masks with a P rating can provide ample protection against solid and liquid aerosol particulates that may contain oil.

LPR-100™/OV

LPR-100™

When use is mandatory, the Miller® LPR-100™ and LPR-100™/OV Half Mask Respirators need to be fit tested[1] prior to use and then annually or sooner if a change to the workplace or user occurs. Fit testing can be done either qualitatively or quantitatively to determine whether the mask provides an acceptable fit to the wearer.[2]

▶ **Quantitative:**
Uses measuring instruments to measure facial seal leakage

▶ **Qualitative:**
Relies on a subjective sensation (taste, irritation, smell) of the wearer to a particular test agent

[1] Nuisance level OF relief respirators are designed for use with organic vapor concentrations not exceeding OSHA's PELs or other applicable government occupational exposure limits, whichever is lower.
[2] OSHA accepted fit test protocols and procedures are contained in 29 CFR 1910.134 Appendix A.

Process Modification/Substitution
Engineering Controls
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LPR-100™ Reusable Half Mask Respirators

Low-profile design fits comfortably under T94™, Elite™, and Classic Series Welding Helmets and Weld-Mask™ 2. The large, non-return exhaust valve eases breathing and reduces user fatigue.

P Oil Proof

▶ Ideal for welding applications

NIOSH 42 CFR 84 Certified	APF = 10	OSHA Classification: Tight-Fitting[1] Respirator	FILTER: Up to 99.97% Efficiency

Part #:	Description:
ML00894	LPR-100 Respirator with P100 Filters, Small/Medium
ML00895	LPR-100 Respirator with P100 Filters, Medium/Large
SA00818	Replacement P100 Filters, Pair
ML00994	LPR-100 Respirator with P100 Nuisance Level OV Relief Filters[1], Small/Medium
ML00995	LPR-100 Respirator with P100 Nuisance Level OV Relief Filters[1], Medium/Large
SA00819	Replacement Combination P100/Nuisance Level OV Relief Filters[1], Pair
261086	Quantitative Face-Fit Test Kit
283374	Protective Case

LPR-100™/OV Reusable Half Mask Respirators

Provides maximum field of vision and does not interfere with protective eyewear for an ideal solution for use with a welding helmet. Fits under T94™ and Digital Elite™ Series Welding Helmets and Weld-Mask™ 2.

P Oil Proof

▶ Ideal for welding, paint, weldment cleaning and general metal working clean-up

NIOSH 42 CFR 84 Certified	APF = 10	OSHA Classification: Tight-Fitting[1] Respirator	FILTER: Up to 99.97% Efficiency with Organic Vapor Cartridge

Part #:	Description:
ML00996	LPR-100/OV with P100 Filters, Small/Medium
ML00997	LPR-100/OV with P100 Filters, Medium/Large
SA00820	P100/OV Replacement Filters, Pair
261086	Quantitative Face-Fit Test Kit
285686	Protective Case

[1] Fit testing is necessary for mandatory use. See page 28 for fit testing details.
[2] Nuisance level OV relief respirators are designed for use with organic vapor concentrations not exceeding OSHA's PELs or other applicable government occupational exposure limits, whichever is lower.

Process Modification/Substitution
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LPR-100™ and LPR-100™/OV Reusable Half Mask Respirators

Features OV (organic vapor) cartridges

Wrap-around spark guard protects filters from spatter and other debris

Organic Vapors / P100
40.069.0093

OV / P100
40.069.0080

Oversized exhaust valve eases breathing

Optional Nuisance Level OV (organic vapor) relief filters to remove foul odors

Key Product Features:

▶ P100 filters provide up to 99.97 percent filtration of airborne particles and oil aerosols, including those in the fume regulation chart

▶ Optional combination P100/Nuisance level Organic Vapor respirators feature an added layer of carbon that helps remove nuisance level organic vapor odors[1]

▶ Four-point head strap adjustments with integrated comfort cushion provide a customized and comfortable fit

▶ Odor-free, non-allergenic, latex and silicone free, made from medical grade materials

[1] Nuisance level OV relief respirators are designed for use with organic vapor concentrations not exceeding OSHA's PELs or other applicable government occupational exposure limits, whichever is lower.

Process Modification/Substitution
Engineering Controls
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Half Mask Filters

When should I replace my LPR-100 filter cartridges?[1]

▶ It becomes difficult to breathe comfortably or breathing resistance increases (this will vary from person to person)

▶ The filter becomes visibly dirty or physical damage occurs

▶ For P-Series filters only when used in environments containing oil aerosol:

- Dispose of P-Series filters after 40 hours of use or 30 days, whichever comes first

P100/OV (Organic Vapor) Filter Cartridge (SA00820)

In addition to a P100 filter layer, product features activated carbon with a pore structure selected for maximum absorption efficiency.

P100 Nuisance Level OV Relief Filter (SA00819)

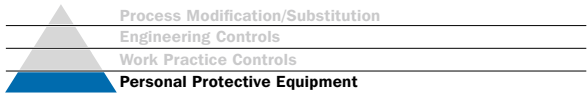Features an added layer of carbon that helps remove nuisance level organic vapor odors.

P100 Filter (SA00818)

Innovative filter media that will not deteriorate in humid conditions, extending filter life.

[1] https://www.osha.gov/sites/default/files/2019-03/respiratoryprotection.pdf

Process Modification/Substitution
Engineering Controls
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T94-R™ Series Respiratory Systems

T94-R™ industrial welding helmets are designed for optimal comfort and visibility so the operator keeps their system on throughout long work days, increasing arc-on time and helping maintain compliance.

T94-R™ Series Welding Helmet Key Features:

- ▶ Well-balanced design reduces torque on neck, increasing all-day wear

- ▶ Patented Dualtec™ manifold system optimizes helmet balance and sound

- ▶ Shade 5.0 side windows maximize peripheral vision, improving sense of surroundings

- ▶ *ClearLight*™ Lens Technology provides a brighter, more natural view of the weld

- ▶ Flame resistant head seal provides additional head protection

- ▶ Matte silver finish reflect ambient heat, keeping the user cool

T94i-R™

T94-R™

Process Modification/Substitution
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Dualtec™ Manifold System

Patent-pending technology optimizes airflow for high-performance output and maximum cooling effect throughout the entire helmet assembly.

Dualtec™ Manifold System Key Features:

▶ Low-profile breathing tube is positioned at the bottom of the neck instead of the top of the head, like many traditional systems, providing 34 percent better balance*

▶ Operators experience 55 percent less neck torque*, reducing strain and fatigue

▶ Tube stays flat against back for easy, unrestricted movement

▶ Six-point air distribution evenly distributes air throughout the helmet for customized cooling and helps reduce dry eyes and nose with adjustable air vents and dual air speeds
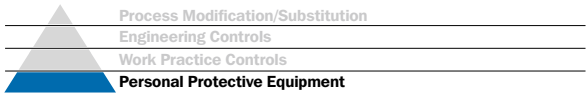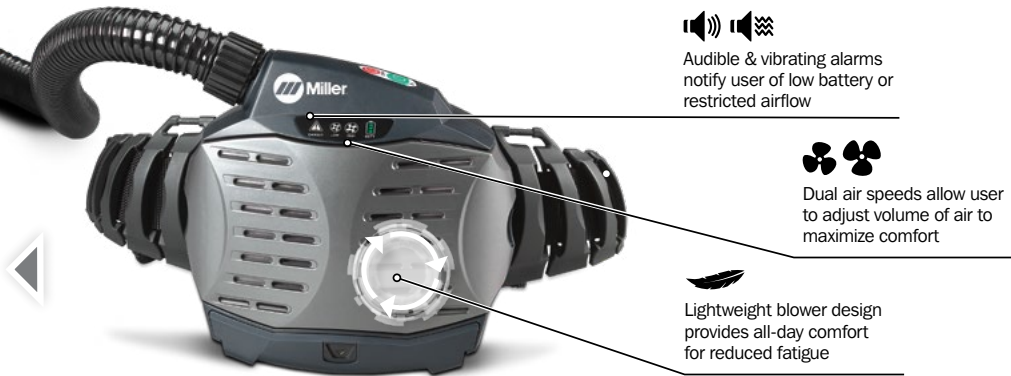
Inside View

Airflow Input

Side Profile View

* With visor raised on the T94i-R™ Helmet

Process Modification/Substitution
Engineering Controls
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Personal Protective Equipment

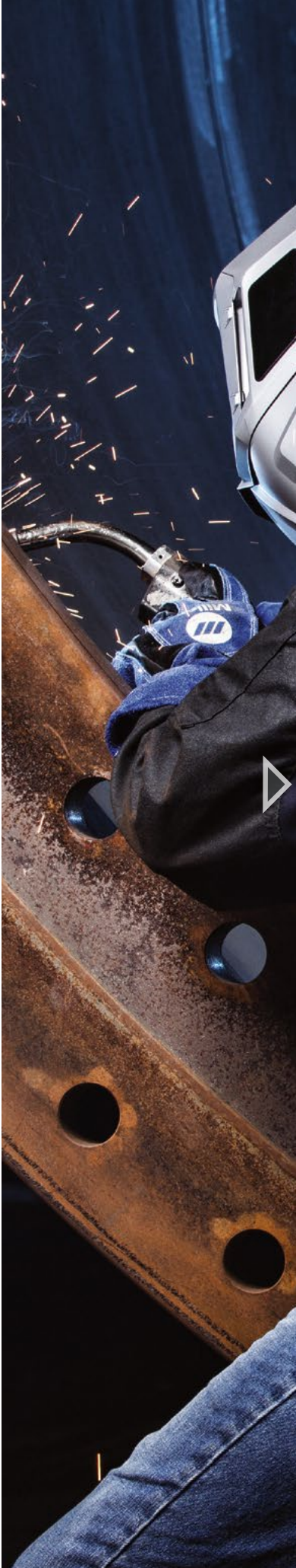# Powered Air Purifying Respirators (PAPRs)

Industrial protection for the most extreme welding applications, our PAPR systems are available with the T94-R™, T94i-R™, and Hard Hat head assemblies.

NIOSH 42 CFR 84 Certified	APF = 25	OSHA Classification: Loose-fitting powered air purifying respiration	Hard Hat Certification: ANSI Z89.2 2009 Certified, Type 1, Class C or G	Helmet Lens Certification: Meets ANSI Z87.1+ and CSA Z94.3 Standards

Audible & vibrating alarms notify user of low battery or restricted airflow

Dual air speeds allow user to adjust volume of air to maximize comfort

Lightweight blower design provides all-day comfort for reduced fatigue

PAPR System Key Features:

- Exclusive Dualtec™ manifold system with 6-point air distribution system maximizes cooling through targeted air placement

- Lightweight low-profile blower assembly with integrated shoulder straps reduces lower back strain and fatigue

- Low-profile breathing-tube attachment eases on/off, and flexible tube material eliminates breathing tube snags in work cell

- HEPA filter is up to 99.97 percent efficient in removing monodisperse particles of 0.3 micrometers, including those on the fume regulations chart

- Quick-release belt for easy, one-handed on/off

- Lightweight lithium ion battery provides up to 8 hours of life with no memory retention from frequent charging

- Two batteries included with each system

| Process Modification/Substitution |
| Engineering Controls |
| Work Practice Controls |
| **Personal Protective Equipment** |

PAPR Systems:

Part #:	Description:
259385	PAPR with Hard Hat with Titanium 9400
261659	PAPR with Hard Hat with Titanium 9400i with Integrated Grind Shield
264573	PAPR with T94-R™
264575	PAPR with T94i-R™

Replacement Parts:

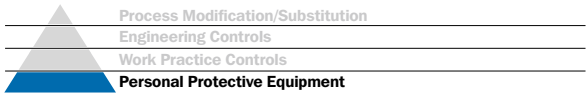| Part #:	Description:
235673-2	Filter, Particulate (HEPA) (2 pack)
235673-6	Filter, Particulate (HEPA) (6 pack)
235673-36	Filter, Particulate (HEPA) (36 pack)
235674	Filter, Prefilter (Foam) (6 pack)
268841	Prefilter, Nuisance Level OV Relief (6 pack)
235676	Spark Guard

Accessories:

Part #:	Description:
244151	Belt Extension (adds 18 inches in length)
264582	Leather Belt

T94i-R™

Process Modification/Substitution
Engineering Controls
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Supplied Air Respirators (SARs)

Industrial protection against weld fume and heat stress, Miller® SAR system is available with the T94i-R™ helmet assembly.

NIOSH 42 CFR 84 Certified	APF = 25	Loose-fitting supplied air purifying respirator	Helmet Lens Certification: Meets ANSI Z87.1+ and CSA Z94.3 Standards

SAR System Key Features:

- ▶ C50 air regulator can provide air as cool as 50 degrees Fahrenheit under the hood

- ▶ C50 air regulator can be positioned horizontally or vertically to naturally align with body movements

C50 Air Regulator
with T94i-R™

BreatheAir™ Filtration System Key Features:

- ▶ BreatheAir™ box uses a 3-stage filtration process to provide Grade D breathing air to SAR users while monitoring for CO during use

- ▶ Filter change indicators clearly notify the operator when filters need to be changed, eliminating guesswork and amplifying unit performance

- ▶ External warning lights and alarms quickly notify the operator of heightened CO levels, reducing user reaction time

- ▶ Both portable and stationary systems are available, supporting up to two or four operators with CO monitors set to either 10 PPM (USA) or 5 PPM (Canada)

BreatheAir™
Filtration System

	Process Modification/Substitution	
	Engineering Controls	
	Work Practice Controls	
	Personal Protective Equipment	

SAR Systems:

Part #:	Description:
264871	SAR with T94i-R™
951800	SAR with T94i-R™ and 25-ft Straight Air Hose
951801	SAR with T94i-R™ and 100-ft Straight Air Hose
951802	SAR with T94i-R™ and 25-ft Coiled Air Hose
951803	SAR with T94i-R™ and 100-ft Coiled Air Hose

Accessories:

Part #:	Description:
270405	Hose, straight, 25-ft with Industrial Interchange Quick Disconnect
270407	Hose, straight, 100-ft with Industrial Interchange Quick Disconnect
270408	Hose, coiled, 25-ft with Industrial Interchange Quick Disconnect
270410	Hose, coiled, 100-ft with Industrial Interchange Quick Disconnect
270412	C50 air regulator
275983	Two Person BreatheAir™ Portable Box (10 PPM CO Monitor) (USA)
275984	Two Person BreatheAir™ Portable Box (5 PPM CO Monitor) (Canada)
275985	Four Person BreatheAir™ Portable Box (10 PPM CO Monitor) (USA)
275986	Four Person BreatheAir™ Portable Box (5 PPM CO Monitor) (Canada)
275961	Two Person BreatheAir™ Panel (10 PPM CO Monitor) (USA)
275970	Four Person BreatheAir™ Panel (10 PPM CO Monitor) (USA)
275963	Two Person BreatheAir™ Panel (5 PPM CO Monitor) (Canada)
275981	Four Person BreatheAir™ Panel (5 PPM CO Monitor) (Canada)
275989	Monitor Calibration Kit (5 PPM CO Monitor) (Canada)
275988	Monitor Calibration Kit (10 PPM CO Monitor (USA)

BreatheAir™ Portable Box

BreatheAir™ Panel

Straight Air Hose

Coiled Air Hose

Head and Face Protection

Ultraviolet (UV) and infrared (IR) radiation can be a significant threat to a weld operator's eyes and face, and even minimal exposure can cause burns. Helmets with protective eyewear help prevent eye injuries and skin burns. Different applications require different PPE, and it is critical to choose the right equipment for the job. Miller's complete line of head and face PPE provides weld operators with the best equipment – designed to protect and perform in demanding welding, cutting, and grinding applications.

Process Modification/Substitution
Engineering Controls
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Personal Protective Equipment

THE TALK: Terms and definitions used in this section

Ultraviolet Radiation (UV): A form of electromagnetic radiation with shorter wavelengths that emit bright light.[1]

Infrared Radiation (IR): A form of electromagnetic radiation with longer wavelengths that produce heat and can be detected as a sensation of warmth on the skin.[2]

Welder's Flash or Arc Flash: A painful inflammation of the cornea caused by exposure to high-intensity ultraviolet light, resulting in pain, sensitivity and visual impairment.

Primary Protection: A device that may be worn alone or in conjunction with a secondary protector (ex. safety glasses), per OSHA.

Secondary Protection: A device that may be worn only in conjunction with a primary protector (ex. welding helmet or grind shield), per OSHA.

ANSI: American National Standard Institute, a nonprofit organization that defines and oversees common standards and assessment systems.

CE: Certification mark that indicates conformity with health, safety and environmental protection standards for products sold within the European Economic Area (EEA).

CSA: Certification mark that shows that a product has been independently tested and certified to meet recognized standards for safety or performance in North America.

STATISTICS & TRENDS: Head & Face
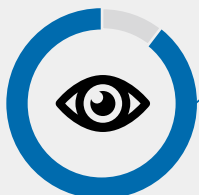
62%
Sixty-two percent of on-the-job eye injuries happen in manufacturing, construction and trade.[3]

$300 Million
Eye injuries alone cost more than $300 million per year in lost production time, medical expenses and worker compensation.[4]

[1] https://www.britannica.com/science/ultraviolet-radiation
[2] https://www.britannica.com/science/infrared-radiation
[3] https://www.bls.gov/opub/mlr/cwc/workplace-injuries-involving-the-eyes-2008.pdf
[4] https://www.occupationalhc.com/2015/03/eye-wellness-and-safety-in-the-workplace/

OSHA Standard 1910.133
Primary eye protection (ex. safety glasses) should always be used with secondary eye/face protection (ex. welding helmet or grind shield).

Process Modification/Substitution
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Choosing The Right Helmet

Choosing the right helmet for your application(s) and overall comfort can increase your weld quality, productivity, safety and long-term health. The most important criteria when choosing a welding helmet are safety, compliance and comfort, but other valuable features to consider include: **lens type, viewing size, filter shade, number of sensors, ease of use, weight and useful technology.**

Lens Types and Shade Coverage

Lens	Passive (Shade 10)	Auto Darkening	
Shade Type	Fixed Shade	Fixed Shade	Variable Shade
Inactive Shade Coverage	#10	#3 or #4	#3 or #4
Active Shade Coverage	#10	Shade Dependent	#5 - #13

▶ Number of Arc Sensors

Number of Arc Sensors	2	3	4
	Traditional or Bench Welding		Fabrication or Out-Of-Position Welding

Low Sensitivity   Medium Sensitivity   High Sensitivity

▶ Passive Lens vs. Auto-Darkening Lens

Passive Lens: Utilizes a UV and IR coated dark-tinted glass, typically with a #10 fixed shade. A passive helmet is worn in the up position until the electrode, gun or torch is positioned. The weld operator then flips the helmet down with a quick nod of the head, just before the arc is struck.

Auto-Darkening Lens: Typically starts with a #3 or #4 shade in its inactive state. Depending on the light source, when an arc or cutting torch is started the lens darkens to shade #5-#13. The helmet stays in position, without the need for head nods – improving weld quality and reducing neck fatigue.

▶ Fixed Shade Lens vs. Variable Shade Lens

Fixed Shade Lens: Senses an arc and darkens to a fixed shade. Ideal when using the same material, thickness and process every time you weld. Fixed shade lenses are available in different shades.

Variable Shade Lens: Adjusts the shade depending on the brightness of the arc. Ideal when using different materials and processes that vary the amperage.

Process Modification/Substitution
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Eye Protection Against Radiant Energy
Choosing the Right Lens

OSHA requires specific eye protection to ensure workers are compliant. As a rule of thumb, start with a shade that is too dark to see the weld zone. Then, go to a lighter shade that gives a sufficient view of the weld without going below the minimum. During oxygen gas welding or cutting, where the torch produces a high yellow light, it is recommended to use a filter lens that absorbs the yellow or sodium line in the visible light (spectrum) of the operation.

What are ANSI Standards for Head and Face Protection?

ANSI Z87.1 ensures that helmets and lenses have passed independent testing to show they can survive high velocity impact from flying objects, provide ultraviolet and infrared filtering regardless of shade setting, and meet advertised switching speeds and darkness shades in temperatures as low as 23 degrees Fahrenheit and high as 131 degrees Fahrenheit.

An ANSI Z87.1+ marking indicates a high-impact rating for cutting and grinding.

All Miller welding helmets and glasses meet the ANSI Z87.1+ standards.

Z89.1-2014
Upon request, accessory manufacturers (welding helmets) are required to prove that their components do not cause the hard hat to fail.

Process Modification/Substitution
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Filter Lenses for Protection During Shielded Metal Arc Welding[1]

Operation	Electrode Size	Arc Current (Amperes)	Minimum Protective Shade Number	ANSI & AWS Shade Number Recommendations
Shielded Metal Arc Welding (SMAW)	Less than 3/32 in (2.4 mm)	Less than 60	7	-
	3/32-5/32 in (2.4-4.0 mm)	60-160	8	10
	More than 5/32-1/4 in (4.0-6.4 mm)	160-250	10	12
	More than 1/4 in (6.4 mm)	250-550	11	14

Filter Lenses for Protection During Other Welding and Cutting Operations[1]

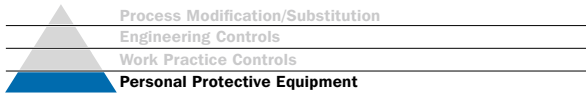| Operation	Arc Current (Amperes)	Minimum Protective Shade Number	ANSI & AWS Shade Number Recommendations
Gas Metal Arc Welding (GMAW) and Flux Cored Arc Welding (FCAW)	Less than 60	7	-
	60-160	10	11
	160-250	10	12
	250-500	10	14
Gas Tungsten Arc Welding (GTAW)	Less than 50	8	10
	50-150	8	12
	150-500	10	14
Air Carbon Arc Cutting (CAC-A) (Light)	Less than 500	10	12
Air Carbon Arc Cutting (CAC-A) (Heavy)	500-1000	11	14
Plasma Arc Welding (PAW)	Less than 20	6	6-8
	20-100	8	10
	100-400	10	12
	400-800	11	14
Plasma Arc Cutting (PAC)	Less than 20	4	4
	20-40	5	5
	40-60	6	6
	60-80	8	8
	80-300	8	9
	300-400	9	12
	400-800	10	14
Torch Brazing (TB)	-	-	3 or 4
Torch Soldering (TS)	-	-	2
Carbon Arc Welding (CAW)	-	-	14

Filter Lenses for Gas Welding and Oxygen Cutting Operations[1]

Operation	Electrode Size	Arc Current (Amperes)	Minimum Protective Shade Number
Gas Welding	Under 1/8 in (3.2mm)	-	4 or 5
	1/8 in to 1/2 in (3.2 to 12.7 mm)	-	5 or 6
	Over 1/2 in (12.7 mm)	-	6 or 8
Oxygen Welding	Under 1 in (25 mm)	-	3 or 4
	1 to 6 in (25-150 mm)	-	4 or 5
	Over 6 in (150 mm)	-	5 or 6

[1] https://app.aws.org/technical/AWS_Z49.pdf

Process Modification/Substitution
Engineering Controls
Work Practice Controls
**Personal Protective Equipment**

Miller® Technologies

We continually strive to develop new technologies that enhance operator skills and improve overall productivity and safety through ongoing innovation.

ClearLight™
Lens Technology

X-Mode™

AutoSense™

InfoTrack™

InfoTrack™ 2.0

ClearLight™ Lens Technology

## High-definition optics for precision arc recognition
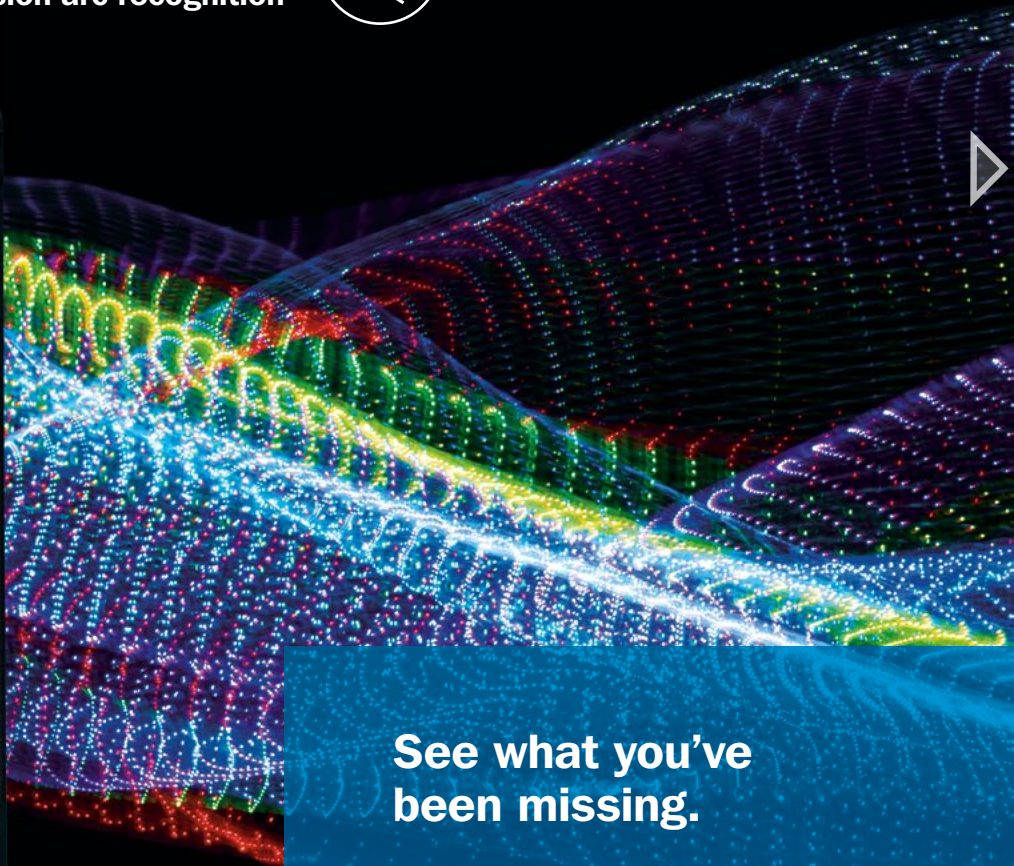
See what you've been missing.

Designed by welders, for welders – *ClearLight*™ Lens Technology is engineered to complement the colors emitted from the welding arc, enhancing clarity and natural color so that you can see more detail. Having confidence in what you see allows you to perform at a higher level, creating better welds with less rework.

Process Modification/Substitution
Engineering Controls
Work Practice Controls
Personal Protective Equipment

MORE CONTRAST & CLARITY

▶ Natural, accurate color tones come through the lens versus traditional lenses that produce artificial blue or yellow tints

▶ Crisp, high-definition view of workpiece with more contrast among objects in viewing area
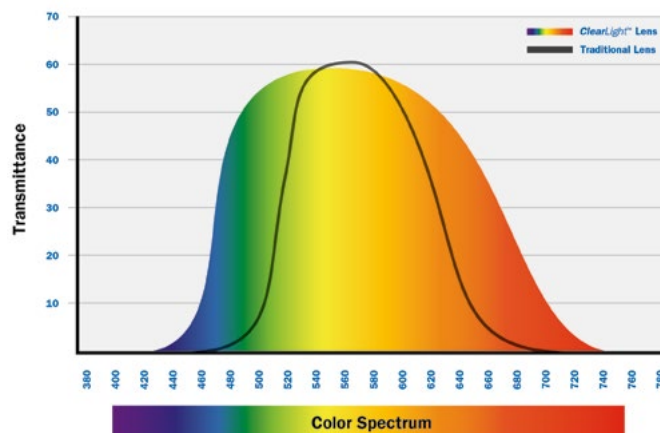
MORE DETAIL

▶ View of surroundings is enhanced and operators can see more detail for better welds with less rework

ClearLight™ **Lens**

3.0 LIGHT STATE

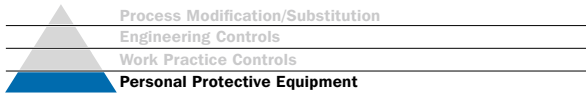▶ 1/1/1/2 optical clarity rating provides a noticeably brighter light state of 3 compared to most traditional lenses that only lighten to 4 – allowing weld operators to keep their hood down in between welds and non-welding tasks within arms reach of the workpiece, improving safety and productivity

Traditional Lens

Available on Classic VS, Digital Performance™, Digital Elite™, Digital Infinity™ and T94™ Series Helmets

Process Modification/Substitution
Engineering Controls
Work Practice Controls
Personal Protective Equipment

Miller® Technologies

Innovative features designed to enhance operator visibility and weld quality, improving safety and productivity.

X-Mode™ Auto-Darkening Technology
Eliminate interference from sunlight and out of position welding angles

Eliminate light sensitivity

A helmet in X-Mode™ won't darken unless a welding arc is present. It electromagnetically senses the weld and can continuously detect the arc even if light sensors are blocked, eliminating sunlight interference.

Optimize out of position welding

Ideal for users welding out of position, in tight spots, or in bright, sunlit environments.

Available on T94™, Digital Infinity™, Digital Elite™ and Classic VSi™ Series Welding Helmets.

Process Modification/Substitution
Engineering Controls
Work Practice Controls
Personal Protective Equipment

AutoSense™

Eliminate issues with setting helmet sensitivity

▶ By simply pushing and holding a button, AutoSense™ Technology automatically sets the helmet sensitivity by sensing your welding environment

▶ Ideal for operators who frequently adjust their settings for changing welding environments

▶ Available on Digital Infinity™ and Digital Elite™ Series Welding Helmets
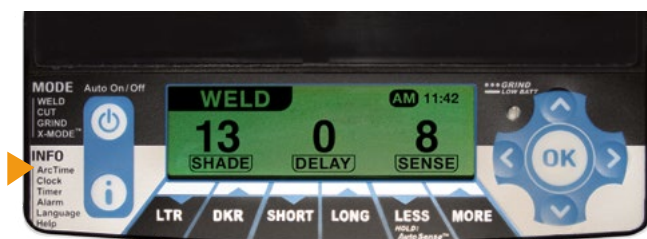
InfoTrack™ (i)

Exclusive arc tracking technology for productive data monitoring

▶ InfoTrack™ features arc time and includes a digital clock display with the ability to set an alarm or timer

▶ InfoTrack™ 2.0 features both arc time and arc count with a digital clock display to plan, track, and increase productivity

InfoTrack™

InfoTrack™ 2.0

Available on Digital Infinity™ Series Welding Helmets

Available on T94™ Series Welding Helmets

Helmet Selection Chart

Choosing a helmet that is best suited for specific application(s) can increase productivity, weld quality, safety and comfort.

	MP-10™	Classic FS#10 Flip-Up	Classic Variable Shade	Classic VSi™
Viewing Area	16 sq in	5.1 sq in	5.2 sq in	5.9 sq in
***ClearLight*™ Lens Technology**	No	No*	Yes	No*
Shades	Weld: 10	Grind: 3 Weld: 10	Grind: 3 Cut: 5-8 Weld: 8-13	Grind: 3 Weld: 8-13
Modes	Weld	Weld/Grind	Weld/Cut/Grind	Weld/Grind/X-Mode
Integrated Grind Shield	No	Yes	No	Yes
Auto-on	No	Yes	Yes	Yes
Sensors	-	2	2	3
TIG Rating	-	20 amps	5 amps/below	5 amps/below
Switching Speed	-	1/3,600	1/23,000	1/20,000
Digital Controls	No	No	Yes	No
Premium Headgear	No	No	No	No
InfoTrack™	No	No	No	No
AutoSense™	No	No	No	No
Weight	18 oz (510 g)	14 oz (396 g)	16 oz (454 g)	23 oz (652 g)

*Coming soon with ***ClearLight*™ Lens Technology

Process Modification/Substitution
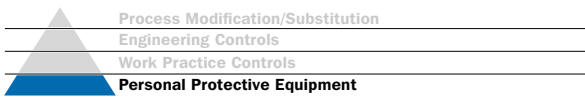Engineering Controls
Work Practice Controls
Personal Protective Equipment

	Digital Performance™ Series	Digital Elite™ Series	Digital Infinity™ Series	T94™ Series	
	7.2 sq in	9.2 sq in	**Largest View** 13.4 sq in	9 sq in	
	Yes	Yes	Yes	Yes	
	Grind: 3 Cut: 5-8 Weld: 8-13	Grind: 3 Cut: 5-8 Weld: 8-13	Grind: 3 Cut: 5-8 Weld: 8-13	Grind: 3 Cut: 5-8 Weld: 8-13	
	Weld/Cut/Grind	Weld/Cut/Grind/X-Mode	Weld/Cut/Grind/X-Mode	Weld/Cut/Grind/X-Mode	
	No	No	No	No (T94) Yes (T94i)	
	Yes	Yes	Yes	Yes	
	3	4	4	4	
	5 amps	5 amps/below	5 amps/below	3 amps/below	
	1/20,000	1/20,000	1/20,000	1/20,000	
	Yes	Yes	Yes	Yes	
	Yes	Yes	Yes	Yes	
	No	No	Yes - 1.0	Yes - 2.0	
	No	Yes	Yes	No	
	17 oz (482 g)	18 oz (510 g)	23 oz (652 g)	**T94** 21.1 oz (598 g)	**T94i** 26 oz (737 g)

Process Modification/Substitution
Engineering Controls
Work Practice Controls
Personal Protective Equipment

MP-10™ Series

Best-in-class traditional passive helmet.

Meets ANSI Z87.1+ and CSA Z94.3 Standards	90 Day Limited Warranty

16

Large
Viewing Area

Viewing Area: 16 sq in

Arc Sensors: N/A

Operating Modes: Weld

Weight: 18 oz

Part #:	Description:
238497	Black (Each)
770246	Replacement Headgear
282013	Helmet Lighting Accessory Kit*

Black

Classic Series FS #10 2x4 Flip-Up

* Accessory sold separately

Process Modification/Substitution
Engineering Controls
Work Practice Controls
Personal Protective Equipment

Black - Variable Shade

Rise™

Metalworks™

Liberty™

NEW!

Metal Matrix™

Black – VSi

Black - FS#10 2x4 Flip-Up

Classic Series

Trusted entry level helmet for the value-minded welder.

Meets ANSI Z87.1+ and CSA Z94.3 Standards	3-Year Warranty

ClearLight™ Lens Technology (VS only)

X-Mode (VSi only)

Helmet Lighting*

Digital Controls (VS only)

3 YEAR WARRANTY
(VSi and FS#10 helmets have a 2-year warranty)

Auto On/Off

Viewing Area: FS #10 - 5.1 sq in
VS - 5.2 sq in | VSi - 5.9 sq in

Arc Sensors: 2 (VSi has 3)

Operating Modes: FS #10 - Weld, Grind
VS - Weld, Cut, Grind
VSi - Weld, Grind, X-Mode

Weight: FS#10 - 14 oz
VS - 16 oz | VSi - 23 oz

Part #:	Description:
287803	Black – Variable Shade
263038	Black – FS#10 2x4 Flip-Up
260938	Black – VSi
287810	Metalworks™
287815	Rise™
287820	Liberty™
288519	Metal Matrix™
770246	Replacement Headgear
282013	Helmet Lighting Accessory Kit*

Coming Soon with
ClearLight™ Lens Technology

287798	Black - FS#10 2x4 Flip-Up
287794	Black – VSi

Process Modification/Substitution
Engineering Controls
Work Practice Controls
Personal Protective Equipment

Digital Performance™ Series

Lightweight helmet with superior headgear for ultimate comfort.

Meets ANSI Z87.1+ and CSA Z94.3 Standards	3-Year Warranty

3 YEAR WARRANTY

Viewing Area: 7.2 sq in

Arc Sensors: 3

Operating Modes: 3 – Weld, Cut, Grind

Weight: 17 oz

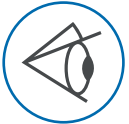| Part #:	Description:
282000	Black
282001	Blue Rage™
282002	'64 Custom™
282005	Crusher™
284218	Replacement Headgear
282013	Helmet Lighting Accessory Kit*

Black

Blue Rage™

'64 Custom™

Crusher™

* Accessory sold separately

Process Modification/Substitution
Engineering Controls
Work Practice Controls
Personal Protective Equipment

***ClearLight*™** Lens Technology

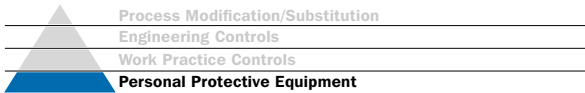Enhanced Headgear

Auto On/Off

Digital Controls

Helmet Lighting*

Digital
Performance™
ClearLight™ Lens Technology

Miller®

Enhanced Gen 3.5 Headgear:
Flexible, ergonomic design
provides enhanced support
and stability.

'64™ Custom

Process Modification/Substitution
Engineering Controls
Work Practice Controls
Personal Protective Equipment

Digital Elite™ Series

Industry-leading helmet provides high-performance versatility.

| Meets ANSI Z87.1+ and CSA Z94.3 Standards | 3-Year Warranty |

3 YEAR WARRANTY

Viewing Area: 9.2 sq in

Arc Sensors: 4

Operating Modes: 4 – Weld, Cut, Grind & X-Mode™

Weight: 18 oz

Part #:	Description:
281000	Black
281001	Lucky's Speed Shop™
281002	Stars and Stripes™ III
281003	Inferno™
281004	Vintage Roadster™
281007	Raptor™
281009	Gear Box™
284218	Replacement Headgear
282013	Helmet Lighting Accessory Kit*

Black

Lucky's Speed Shop™

Stars and Stripes™ III

Inferno™

Vintage Roadster™

Raptor™

NEW!

Gear Box™

* Accessory sold separately

Process Modification/Substitution
Engineering Controls
Work Practice Controls
Personal Protective Equipment

ClearLight™ Lens Technology

X-Mode™

AutoSense™

Enhanced Headgear

Auto On/Off

Digital Controls

Helmet Lighting*

Enhanced Gen 3.5 Headgear:
Flexible, ergonomic design
provides enhanced support
and stability.

Vintage Roadster™

Process Modification/Substitution
Engineering Controls
Work Practice Controls
Personal Protective Equipment

Digital Infinity™ Series

Largest viewing area maximizes visibility.

Meets ANSI Z87.1+ and CSA Z94.3 Standards	3-Year Warranty

3 YEAR WARRANTY

Viewing Area: 13.4 sq in

Arc Sensors: 4

Operating Modes: 4 – Weld, Cut, Grind & X-Mode™

Weight: 22 oz

Part #:	Description:
280045	Black
280047	Black Ops™
280048	Departed™
280049	Stars and Stripes™
280053	Imperial™
280051	Relic™
271325	Replacement Headgear with Comfort Cushion
282013	Helmet Lighting Accessory Kit*

Black

Black Ops™

Departed™

Stars and Stripes™

Imperial™

Relic™

* Accessory sold separately

Process Modification/Substitution
Engineering Controls
Work Practice Controls
Personal Protective Equipment

13.4 square inches
The largest view helmet for demanding applications

ClearLight™ Lens Technology

X-Mode™

AutoSense™

InfoTrack™

Enhanced Headgear

Auto On/Off

Digital Controls

Helmet Lighting*

Enhanced Gen 3.5 Headgear:
Flexible, ergonomic design provides
enhanced support and stability.

Black Ops™

..

Process Modification/Substitution
Engineering Controls
Work Practice Controls
Personal Protective Equipment

Enhanced Gen 4 Headgear:
Flexible, ergonomic design provides enhanced support and stability.

T94™ Series

Maximized comfort, visibility and productivity for the professional welder.

| Meets ANSI Z87.1+ and CSA Z94.3 Standards | 3-Year Warranty |

3 YEAR WARRANTY

ClearLight™ Lens Technology

X-Mode™

InfoTrack™ 2.0

Enhanced Headgear

Auto On/Off

Digital Controls

Helmet Lighting*

T94™ Helmet

Viewing Area: 9 sq in

Arc Sensors: 4

Operating Modes: 4 - Weld, Cut, Grind & X-Mode™

Integrated Grind Shield: No

External Grind Button: Yes

Half Shade Settings: Yes

Weight: 21 oz

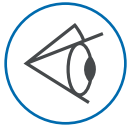| Part #:	Description:
260482	T94™
281361	Helmet Lighting Accessory Kit*

T94™

T94i™

T94i™ Helmet

Viewing Area: 9 sq in

Arc Sensors: 4

Operating Modes: 4 - Weld, Cut, Grind & X-Mode™

Integrated Grind Shield: Yes

External Grind Button: No

Half Shade Settings: Yes

Weight: 26 oz

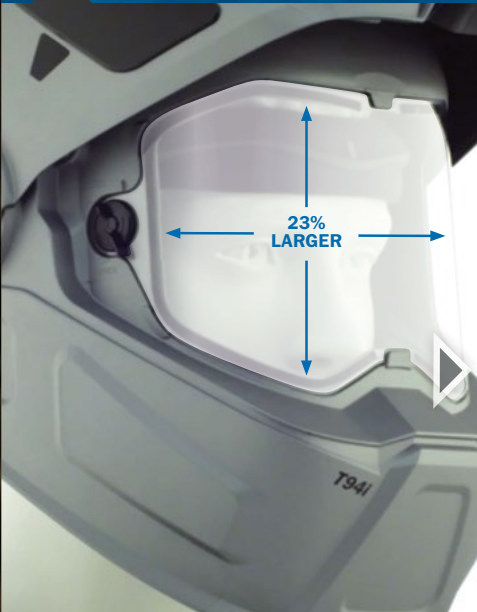| Part #:	Description:
260483	T94i™
281361	Helmet Lighting Accessory Kit*

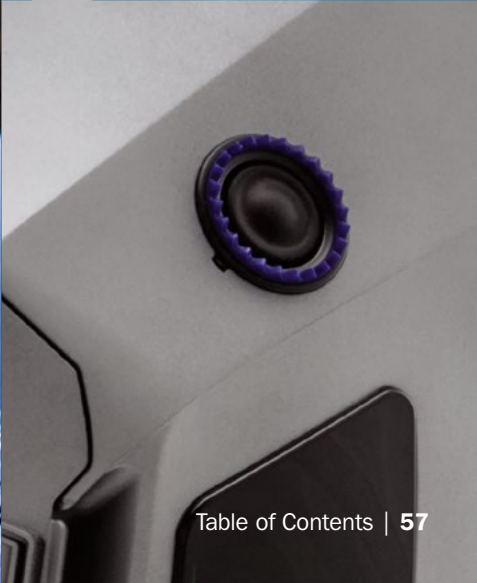* Accessory sold separately

Shade 5.0 Side Windows – Enhances peripheral vision, amplifying sense of surroundings

T94i™ Clear Grind Shield – 44 square inch integrated grind shield for increased helmet on time and fewer eye injuries
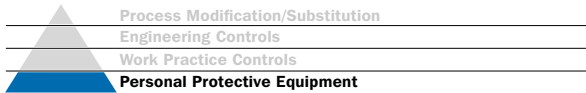
23%
LARGER

T94i

T94™ External Grind Mode – Switch to grind mode with the push of a button

Process Modification/Substitution
Engineering Controls
Work Practice Controls
Personal Protective Equipment

Weld-Mask™

Compact auto-darkening lenses allow users to weld in spaces where access with traditional welding helmets is limited. Ideal for welding in tight spaces, mobile welding and welding inspection.

Meets CE/ANSI/CSA/AS NZ Standards	2-Year Warranty

2 YEAR WARRANTY

X-Mode*
(Weld-Mask 2 only)

Part #:	Description:
267370	Weld-Mask™
280982	Weld-Mask™ 2

Overall Key Product Features:

- ▶ Soft close-fitting eye covering provides total darkness for precision welding.

- ▶ Face shield and flame-resistant head cover provide coverage for UV/IR rays and applications with limited spatter.

- ▶ Ideal for use with hard hats. Both Weld-Mask models fit under a hard hat without the need of an adapter.

Weld-Mask™ Features:

- ▶ Ideal for auto restoration and other DIY environments. Narrow design provides protection without getting in the way.

- ▶ Shades 5, 7, 9, 11 and 13 for use with MIG, TIG, stick, and gas welding and cutting.

- ▶ Extremely lightweight (7.8 oz), virtually eliminates neck strain.

Weld-Mask™

Weld-Mask™ 2 Features:

- ▶ Ideal for industrial or construction environments.

- ▶ Shades 5-13 for use with MIG, TIG, stick, and gas welding and cutting.

- ▶ Wide singular lens provides unmatched auto-darkening range of visibility.

- ▶ X-Mode™ electromagnetically senses the weld to eliminate sunlight interference and continuously detects the arc even if sensors are blocked.

- ▶ Miller® Reusable Half-Mask™ respirators* and Classic safety glasses* seamlessly fit under Weld-Mask™ 2 for added safety and compliance.

Flashlight accessory* converts your Weld-Mask™ 2 into a headlamp, freeing both hands for welding.

*Accessory sold separately

Weld-Mask™ 2

External controls for quick and convenient access

Lightweight design reduces neck strain

Weld-Mask™ Accessories

Weld-Mask

Part #:	Description:
267420	Front Cover Lens
267421	Weld-Mask™ FR Head Cover**
270055	CR2032 Replacement Battery

Weld-Mask 2

Part #:	Description:
280985	Front Cover Lens
280983	Weld-Mask™ 2 FR Head Cover**
217043	CR2450 Replacement Battery
281188	Light Accessory Kit*

 * Accessory sold separately

** For use with Weld-Mask auto-darkening goggles, or under a traditional welding helmet for added protection

Process Modification/Substitution
Engineering Controls
Work Practice Controls
Personal Protective Equipment

Face Shield

Designed to provide industrial strength, maximum protection and extreme durability in various welding applications.

Meets ANSI Z87.1+ and CSA Z94.3 Standards	90 Day Warranty

HDV

HDV Technology

Clear

Clear + Anti-Fog

Shade 3

Shade 5

Part #:	Description:
288269	Clear
288274	Clear + Anti-Fog
288270	Shade 3
288273	Shade 5
288275	Clear Replacement Lens
288278	Clear + Anti-Fog Replacement Lens
288276	Shade 3 Replacement Lens
288277	Shade 5 Replacement Lens
288280	Replacement Headgear and Crown
222003	Halo Hard Hat Adapter
259637	Slotted Hard Hat Adapter Clips
282013	Face Shield Lighting Accessory Kit

Overall Key Product Features:

▶ Impact-resistant shield for increased durability and protection

▶ Lightweight design for all-day wear and comfort

▶ Anti-fog coating prevents fogging for enhanced visibility
Only applies to Clear + Anti-Fog

▶ Made of polycarbonate material that provides up to 99.9 percent UVA/UVB/UVC protection to help prevent eye damage

▶ HDV Technology provides a sharp detailed view at any angle without distortion
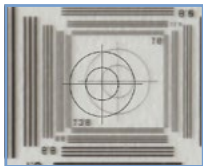
Competitive Shield
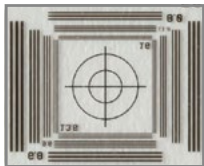
With HDV Technology

Targeted Applications:

▶ Grinding

▶ Plasma Cutting

▶ Oxy-Fuel Cutting

▶ Machining

▶ Brazing

▶ Soldering

▶ Chipping

Helmet Consumables

Cover Lenses

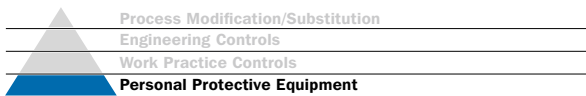| Part #:	Description:	Quantity:
231411	Front: Classic, Classic VS, Pro-Hobby	5 pkg
231410	Inside: Classic, Classic VS, Classic VSi, Pro-Hobby	5 pkg
231921	Front: Performance	5 pkg
770237	Inside: Performance, Titanium 7300, 2x4 Flip-Up	5 pkg
216326	Front: Elite, Titanium 1600, Titanium 1600i, Titanium 7300, Titanium9400, Titanium 9400i, MP-10	5 pkg
216327	Inside: Elite, Titanium 9400, Titanium 9400i	5 pkg
271320	Front: Infinity	5 pkg
271319	Inside: Infinity	5 pkg
235628	Inside: Titanium 1600i, MP-10 Front: Classic VSi	5 pkg
261830	Grind Shield: 2x4 Flip-Up	5 pkg
265304	Front: T94, T94i	5 pkg
216327	Inside: T94, T94i	5 pkg
258979	Grind Shield: T94i	1 pkg
245818	9400i & VSi Replacement Grind Shield	1 pkg
260197	Side Window Covers: T94, T94i	2 pkg

Bulk Cover Lenses

Part #:	Description:	Quantity:
216326B	Front: Elite, Titanium, MP-10	50 pkg
216327B	Inside: Elite, Titanium, 9400i	50 pkg
231921B	Front: Performance	50 pkg
770237B	Inside: Performance	50 pkg
231411B	Front: Pro-Hobby, Classic	50 pkg
265304B	Front: T94, T94i	50 pkg
216327B	Inside: T94, T94i	50 pkg

Magnifying Lenses

Part #:	Magnification:	Part #:	Magnification:
212242	2.5	212237	1.25
212241	2.25	212236	1.00
212240	2.00	212235	.75
212239	1.75		
212238	1.5		

Process Modification/Substitution
Engineering Controls
Work Practice Controls
Personal Protective Equipment

Head & Face Accessories

Miller recommends MSA The Safety Company

Slotted Hard Hat Adapter
259637

Compatible with most slotted hard hats.
(Helmet and hard hat not included)

Halo Hard Hat Adapter
213110 (XL and XLi Series)
222003 (Titanium, XLix, Elite, Performance, ProHobby, Classic and MP-10 Series)
265315 (T94 Series)
Compatible with Fibre Metal and MSA hard hats. Other brands may or may not fit.
(Helmet and hard hat not included)

Helmet Hook
251018
• Holds your helmet or grinding shield
• Silicone strap secures helmet in place

Weld-Mask™ Hard Hat Adapter
285757
Compatible with Weld-Mask™ and Weld-Mask™ 2

Fabric Headband
770249

Lithium Battery - CR2450
217043

T94 Helmet Bib
279078
• Flame-resistant material provides additional neck coverage

Helmet Bib
253882
• WeldX™ helmet bib provides added protection
• Velcro® attachment
Fits all series except T94

T94™ Helmet Cape
279080
• Flame-resistant material provides additional back-of-neck coverage

Job-Site Tool Bag
228028
• Unzipped bag opening: 12 x 18-1/2 in
• Padded shoulder strap
• Over 20 separate pockets

Headgear - Gen 1
770246

Headgear - Gen 3.5
284218

Headgear - Gen 4
260486

Face Shield Headgear and Crown
288280

Helmet Bag with Miller® Logo
770250
• Drawstring closure
• Ultra-soft inside liner
• Exterior storage pouch

2x4 Auto-Darkening Lenses
287825 (Shade 8)
287828 (Shade 9)
287830 (Shade 10)
287833 (Shade 11)
• Auto-On/Auto-Off
• Light state shade #3
Fits all 2x4 inch windows. 3-year warranty

Helmet Lighting
282013
Lighting accessory kit for MP-10™, Classic, Digital Performance™, Digital Elite™ and Digital Infinity™ Series Welding Helmets

T94™ Helmet Lighting
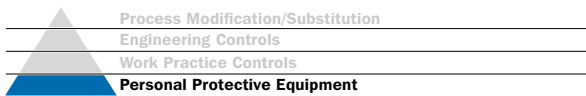281361
Designed exclusively for T94™ Series Welding Helmets

Weld-Mask™ 2 Lighting Kit
281188
Lighting accessory kit designed exclusively for Weld-Mask 2

Process Modification/Substitution
Engineering Controls
Work Practice Controls
Personal Protective Equipment

Safety and Cutting Glasses

Meets ANSI Z87.1+ Standards

Key Product Features:

▶ Anti-Fog

▶ Form-fitting orbital eye coverage enhances protection

▶ Shatterproof polycarbonate lenses

▶ Rubber ear pads on select models for additional comfort

▶ Wrap around designs meet ANSI side shield requirements

Classic

- Angle adjustable temples for personalized fit
- Lightweight for all-day comfort
- Frameless design provides unobstructed view

Frame Style/Color	Lens	Part #
Classic	Clear	272187
Gen 1 - Black	#3	235662
	#5	235658
Spark™	Clear	272190
Spatter™ - Black	Clear	272191
Slag™ - Black	Clear	272201
	I/O	272202
	#5	272205

Gen 1

- Soft foam protection keeps dust and perspiration from the eye
- Flexible temples conform to user's head

Spark™

- Wrap-around design enhances vision
- Flexible over-molded temples conform to user's head
- Rubber nose piece provides comfort and prevents slipping

Spatter™

- Rubber temples and nose piece provide extreme comfort and security
- Enhanced comfort and styling promote compliance
- Half-frame increases view

Slag™

- Rubber temples and nose piece provide extreme comfort and security
- Enhanced comfort and styling promote compliance
- Full-frame design optimizes protection

Lens Options

Select from a range of lens options for any application

- All lenses feature anti-fog coating and high-quality optics
- I/O (Indoor/Outdoor) lenses feature light shading with a mirrored finish to reduce glare in indoor and outdoor applications
- Shade #3 and #5 green IR lenses offer protection for cutting, brazing, or soldering applications

Clear

I/O

#3

#5

Hand and Body Protection

Jackets, gloves and apparel can be found in every welding facility, but not all products are created equal. Making sure your operators are wearing the best protection for the application is critical in not only reducing injuries and downtime, but also ensuring optimal performance. If the protection is comfortable, has a good fit, and provides the necessary protection, your weld operators will keep it on – increasing productivity and compliance.

Process Modification/Substitution
Engineering Controls
Work Practice Controls
Personal Protective Equipment

The Talk: Terms and definitions used in this section

NFPA: National Fire Protection Association, the world's leading advocate of fire prevention. The NFPA develops, publishes and distributes codes and standards intended to minimize the possibility and effects of fire and other risks.

ANSI: American National Standard Institute, a nonprofit organization that defines and oversees common standards and assessment systems.

Kevlar® Thread: Almost 2½ times stronger than nylon or polyester, with a heat decomposition (turns to ash) of 800 degrees Fahrenheit.

Flame Retardant: Materials that have been chemically treated to prevent the start or slow the growth of a fire.[1]

Flame Resistance: Materials that are inherently self-extinguishing and resistant to catching fire. Protection is built into the fiber itself and can never be worn away or washed out.[2]

The Statistics: Hand & Body

70%

70 percent of employees with hand injuries reported not wearing gloves at the time of the injury. The injuries of the remaining 30 percent were caused by inadequate, damaged or inappropriate gloves.[3]

44%

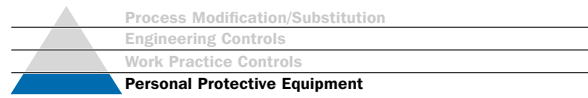**More than 25 percent of all workplace accidents involve hand injuries.[4]**

[1] https://www.niehs.nih.gov/health/topics/agents/flame_retardants/index.cfm
[2] https://www.firecontrolsystems.biz/fire-safety/flame-resistant-vs-fire-retardant/
[3] https://ohsonline.com/Articles/2018/06/01/Safety-Professionals-Weve-Got-a-Problem.aspx
[4] https://www.medexpress.com/blog/workplace-wellness/hand-injuries-risk-and-cost.html

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Are You Covered?

Protecting worker's hands and bodies is not only essential to safeguarding their most critical instruments on the job, but is also a regulated requirement. OSHA requires personal protective clothing for workers who weld, cut or braze.

Selecting the right hand and body protection can affect more than safety – apparel and gloves made specifically for the demands of welding contribute to increased comfort, productivity and performance.

OSHA Standard 1910.132

- Employees exposed to the hazards created by welding, cutting, or brazing operations must be protected by PPE in accordance with the requirements of the general personal protective equipment standard. Appropriate protective clothing required for any welding will vary with the size, nature and location of the work to be performed.

ANSI Z49.1[1]

- Requires all welders to wear protective flame-resistant gloves that provide the heat resistance and general hand protection needed for welding.

- All gloves shall be in good repair, dry and capable of providing protection from electric shock by the welding process.

- Insulating linings should be used to protect areas exposed to high radiant energy.

- Clothing and apparel must provide sufficient coverage and be made of suitable materials to minimize skin burns, ideally leather or flame-resistant materials.

NFPA 51B, 5.1 Personal Protective Clothing

- Clothing shall be selected to minimize the potential for ignition, burning, trapping hot sparks and electric shock.

[1] https://app.aws.org/technical/AWS_Z49.pdf

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Welding Gloves

Although extremely preventable, hand injuries are a common workplace injury. The number one reason workers remove hand protection is due to discomfort[1]. Miller gloves are designed using a three-dimensional pattern to provide an excellent fit, resulting in unprecedented comfort and dexterity – keeping gloves on your operators and alleviating injuries.

Glove 101

- ▶ Select gloves made of materials that will perform best according to the specific application.
- ▶ Make sure the glove fits for added safety, comfort and dexterity. A glove that is too big or small can decrease performance and increase the risk of injury.
- ▶ Engage workers in the selection process – they'll be more likely to wear them if they choose them.
- ▶ Conduct regular inspections to make sure the gloves are in good condition before wearing. Replace any gloves that are worn or torn.

How to Get the Proper Fit
Measure Around Your Dominant Hand

Size:	Inch:
XS	6 - 7
S	7 - 8
M	8 - 9
L	9 - 10
XL	10 - 11
XXL	11 - 12

Glove Features

Component	Thread	Lining			
Material	Kevlar®	Wool	Cotton/Foam	Cotton	Aluminized
Feature	• High heat resistance • 2 ½ times stronger than nylon or polyester thread • Has little to no stretch for a tight seam	• Best heat protection • Thicker, with somewhat limited dexterity • Designed for higher heat and cold weather applications • Wicks Moisture	• Good for medium - to heavy-stick welding applications • Cotton absorbs moisture • Foam protects against heat	• Maximum dexterity • Maximum moisture absorption	• Reflects radiant heat for high heat handling

Component	Exterior					
Material	Cowhide	Deerskin	Pigskin	Goatskin	Sheepskin	Silicone
Feature	• Most versatile • Various grades and grains available, which affects pliability and strength • Ideal for Stick and MIG welding and handling	• Extremely soft • Snug fit provides maximum dexterity • Ideal for TIG welding and lighter-duty handling	• Soft and durable • Naturally resistant to moisture • Extremely breathable • Ideal for Stick and MIG welding and handling	• Greatest tensile strength for weight • Resistant to scraping and rubbing • Ideal for TIG and MIG welding and handling	• High dexterity rating • Smooth surface for wire handling • Ideal for TIG welding	• Strong and durable • Resists temperature extremes, oxidation and ultraviolet radiation • Withstands up to 660˚F • Repels moisture

[1] http://www.ishn.com/articles/print/98084-taking-off-the-gloves-theres-no-reason-for-noncompliance

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Sewn with 100% flame-resistant Kevlar® thread for maximum seam strength

Double-layered insulated pig skin palm provides extreme durability and protection
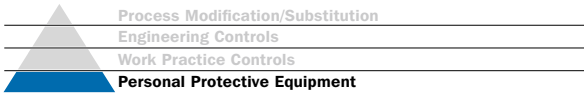
The Power of Blue®

Miller®

Strategically placed patches on palm and back for extended glove life

Extra Heavy Duty MIG/Stick glove shown

Each glove is made from multiple pieces of material, creating a three-dimensional pattern that comfortably wraps and supports the hand for increased comfort and dexterity

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Performance Gloves

Unprecedented comfort and performance with exceptional dexterity and flexibility.

Heavy Duty MIG Stick

- Strategically placed patches on palm and back for extended glove life
- Double layered insulated palm and back
- Premium pig grain leather provides extreme durability and protection

MIG (Lined)

- Dual padded palm for added comfort
- Fleece insulated palm, foam insulated back
- Cow grain palm, pig split back and goat grain inner fingers provide exceptional dexterity and comfort

TIG

- Completely unlined for heightened feel and dexterity
- Triple padded palm for added comfort
- Premium goat grain leather offers superior flexibility and dexterity

TIG/Multitask

- Wool back provides ultimate insulation
- Dual padded palm for added comfort
- Premium goat grain leather offers superior flexibility and dexterity

Metalworker

- Durable top grain leather and spandex back for enhanced durability and dexterity
- Neoprene wrist with Velcro® closure increases fit and support
- Padded, reinforced palm and thumb saddle for extended wear
- Not intended for welding

Performance Gloves

	SM	M	L	XL	2XL
Heavy Duty MIG Stick	–	–	263339	263340	269615
MIG/Lined	–	263332	263333	263334	269618
TIG	263346	263347	263348	263349	–
TIG/Multitask	263352	263353	263354	263355	–
Metalworker	–	251066	251067	251068	–

Performance Gloves are sold in six packs.

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Classic Gloves

Traditional design for the value-minded welder.

Heavy-Duty MIG/Stick

- Reflective insulation on back reduces heat impact
- Moisture-wicking fleece and foam insulation
- Pig grain palm, pig split back and cuff

MIG (Pigskin)

- Reinforcement patches enhance durability
- Moisture-wicking fleece and foam insulation
- Pig split leather palm, back and cuff

MIG (Cowhide)

- Reinforcement patches enhance durability
- Moisture-wicking fleece and foam insulation
- Cow split palm, pig split back and cuff

TIG

- Thin internal padding for added comfort
- Unlined palm for precise dexterity
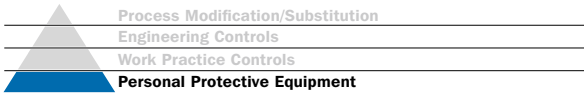- Sheep grain palm, cow split back, pig split cuff

Work

- Dual-padded palm for added durability
- Fleece back provides ultimate insulation
- Cow grain leather offers superior durability and abrasion resistance

Classic Gloves

	M	L	XL	2XL
Heavy-Duty MIG/Stick	–	271877	271887	269615
MIG (Pigskin)	–	279875	279876	–
MIG (Cowhide)	–	271890	271891	–
TIG	279897	279898	279899	–
Work	266041	266042	266043	–

Classic Gloves are sold individually.

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Welding Apparel

Protective welding apparel that performs in your specific environment is crucial to keeping weld operators safe and on the job. Not all apparel is created equal – construction and quality materials combine for an ideal fit that encourages weld operators to keep their PPE on, increasing compliance and performance.

🔥 4 Steps to Creating an FR Program[1]

1 Identify Your Hazards
What exposures do your weld operators face?

2 Perform a Hazard Assessment
Identify industry standards and regulations.

3 Select the Right PPE
Based on specific applications, determine the best protection for your weld operators.

4 Educate/Train Your Team
Make your team aware of the importance, maintenance and proper usage of protective apparel.
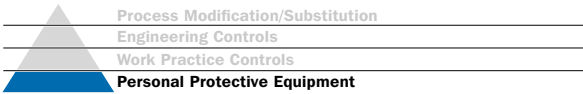
Select Your Fabric

Fabric	Description	Cost	Durability	Protection Level
Classic FR Cotton	Ideal for everyday use. Nine ounce, flame-resistant, pre-shrunk fabric features quality material without compromising your bottom line.	$	•	Light-Duty
INDURA® FR Cotton	The Indura brand name is derived from "Industrial Durability." Indura is a 100% cotton, flame-resistant fabric, guaranteed for the life of the garment. Indura will self-extinguish and will not ignite, but it can burn.	$$	• •	Light-Duty
Combo	Perfect mix of top-grain leather and Indura FR cotton, providing additional protection in high-exposure areas.	$$$	• • •	Medium-Duty
WeldX™	Proprietary coating blend provides enhanced protection while maintaining comfortability. Machine washable, retains FR properties. A Miller exclusive.	$$$$	• • • •	Medium-Duty
Leather	Top-grain pigskin leather withstands sparks and spatter for long-term industrial use.	$$$$	• • • • •	Heavy-Duty

[1] https://www.aiha.org/blog/the-abcs-of-ppe

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Classic FR Cotton

Key Product Features:

▶ Ideal for everyday use

▶ Nine ounce, flame-resistant, navy cotton

▶ Pre-shrunk fabric

▶ All Classic FR cotton apparel features finished hems and reinforced stitching for enhanced durability

Classic FR Cotton Jacket

- Barracuda style stand-up collar for extra neck protection
- Accessible inside pocket
- Five button snaps provide added protection
- "Fold-in" sleeve snaps for a better fit around the wrist
- 30 inch torso length

Classic FR Cotton Apron

247149
- 35 inch length
- Convenient elastic band ensures a superior fit around the neck and waist
- Accessible front pocket

Classic FR Cotton Sleeves

247148
- 18 inch length
- One-handed cinch closure for easy accessibility
- "Fold-in" sleeve snaps for a better fit around the wrist

LIGHT DUTY

Classic FR Cotton Jacket

	S	M	L	XL	2XL	3XL	4XL	5XL
Part #	244749	244750	244751	244752	244754	244755	244756	244758
Chest Width	42 in	46 in	50 in	54 in	58 in	62 in	66 in	70 in
Sleeve Length	31 in	32 in	33 in	34 in	35 in	36 in	37 in	38 in
Shoulder Width	15.5 in	17 in	18.5 in	20 in	21.5 in	23 in	24.5 in	26 in

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INDURA® FR Cotton

LIGHT DUTY

Key Product Features:

▶ Derived from "Industrial Durability" 100% cotton, flame-resistant fabric

▶ Flame-resistance guaranteed for the life of the garment

▶ Pre-shrunk fabric

INDURA® FR Cotton Jacket

- Barracuda style stand-up collar for extra neck protection
- Easy-access slash front pockets
- "Fold-in" sleeve snaps for a better fit around the wrist
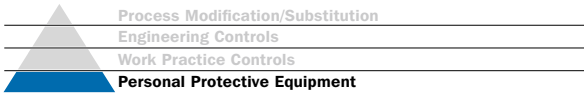- Reinforced snaps to prevent ripping
- 30 inch torso length

INDURA® FR Cotton Jacket

	M	L	XL	2XL
Part Number	258097	258098	258099	258100
Chest Width	48 in	52 in	56 in	60 in
Sleeve Length	33 in	34 in	35 in	36 in
Shoulder Width	19 in	20 in	21 in	22 in

HAND & BODY PROTECTION
Combo

Combo

Key Product Features:

▶ Perfect mix of top-grain leather and INDURA® FR cotton, providing additional protection in high-exposure areas

▶ Flame-resistant INDURA® 100% cotton is guaranteed for the life of the garment

▶ Pre-shrunk fabric

Combo Jacket

- Top-grain leather placed on sleeves and shoulders to increase overall protection
- Barracuda style stand-up collar for extra neck protection
- Easy-access slash front pockets
- "Fold-in" sleeve snaps for a better fit around the wrist
- Reinforced snaps with leather prevent ripping
- 30 inch torso length

Combo Sleeves

231096

- Top-grain leather is lightweight and can be positioned for more protection where needed
- Wide elastic band at top of sleeve for a secure fit
- Flame-resistant cuff for extra comfort and protection
- 21 inch length

Leather® Bib/Apron

231125

- Provides added protection where you need it for extended jacket life
- Patented hidden snap design

Combo Jacket

	M	L	XL	2XL
Part Number	231081	231082	231083	231084
Chest Width	46 in	50 in	52 in	58 in
Sleeve Length	33 in	34.5 in	35 in	37 in
Shoulder Width	18 in	19 in	20 in	22 in

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WeldX™

A Miller® exclusive

Key Product Features:

▶ WeldX™ coating blend provides enhanced protection while maintaining comfortability

▶ Flame-resistant properties repel sparks and spatter

▶ Chromium free for easy disposal

▶ Machine washable, retains FR properties

▶ All WeldX products have finished hems and reinforced stitching for enhanced durability

MEDIUM DUTY

WeldX™ Jacket

- 7 oz WeldX™ front and sleeves combined with 9 oz flame-resistant navy cotton back provides optimal protection for industrial use
- Lined sleeves for added protection
- Zipper closure with Velcro® storm flap
- Extended rear tail
- Vented back for improved air flow
- Barracuda style stand-up collar for extra neck protection
- Accessible inside pocket
- "Fold-in" sleeve snaps for a better fit around the wrist
- 32 inch torso length

WeldX™ Jacket

	S	M	L	XL	2XL	3XL	4XL	5XL
Part #	247114	247115	247116	247117	247118	247119	247120	247121
Chest Width	42 in	46 in	50 in	54 in	58 in	62 in	66 in	70 in
Sleeve Length	31 in	32 in	33 in	34 in	35 in	36 in	37 in	38 in
Shoulder Width	15.5 in	17 in	18.5 in	20 in	21.5 in	23 in	24.5 in	26 in

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Leather

Key Product Features:

▶ Top-grain pigskin leather withstands sparks and spatter for extreme, long-term industrial use

▶ Sewn entirely with Kevlar® thread for added durability at each seam

Grain Leather Jacket

• Barracuda style stand-up collar for extra neck protection
• Expandable leather strategically placed for enhanced mobility
• Satin lining for added comfort
• Reinforced snaps to prevent ripping
• 30 inch torso length

Grain Leather Jacket

	L	XL	2XL
Part Number	231090	231091	231092
Chest Width	52 in	56 in	60 in
Sleeve Length	34 in	35 in	36 in
Shoulder Width	20 in	21 in	22 in

Key Product Features:

▶ Premium pig split leather

▶ Sewn entirely with Kevlar® thread for added durability at each seam

Split Leather Jacket

• Extended rear tail for additional protection
• "Expandable" leather strategically placed for optimal mobility
• Mesh lining for comfort and breathability
• Sewn entirely with Kevlar® thread, adding structural durability at each seam

Split Leather Jacket

	S	M	L	XL	2XL	3XL	4XL	5XL
Part Number	273212	273213	273214	273215	273216	273217	273218	273219
Chest Width	44 in	48 in	52 in	56 in	60 in	64 in	68 in	72 in
Sleeve Length	32 in	33 in	34 in	35 in	36 in	37 in	38 in	39 in
Shoulder Width	18 in	19 in	20 in	21 in	22 in	24 in	25 in	27 in

General Fabric Care 🗑

Classic FR, INDURA®, WeldX™
The best results in cleaning and utilization of detergent supplies are obtained when using softened water. Classic and INDURA® fabrics can be washed at temperatures up to 165 degrees Fahrenheit (75 degrees Celsius). Softeners, starches, bleach, hydrogen peroxide bleach and soap are not recommended.

Combo, Leather
Dry clean only.

The thermal protective properties of any flame resistant fabric can be compromised by the presence of contaminants on the fabric. Even though the original fabric is fully flame resistant as measured by standard test protocols, flammable contaminants on garments can ignite and burn until consumed, thereby increasing heat transfer to the wearer and leading to flame resistance failure. Garments must be laundered thoroughly to remove contaminants. It is recommended to wash garments prior to wearing. Load size 65 to 80 percent of capacity.

It is recommended that garments be washed and dried inside out. This will minimize surface abrasion and aid in maintaining the surface appearance of garments constructed of UltraSoft®, UltraSoft AC® and INDURA® fabrics.

The flame resistant polymer contained in UltraSoft®, UltraSoft AC® and INDURA® fabrics is highly resistant to most acids, bases and solvents. Exposure to strong acids, such as hydrochloric or sulfuric, however, may degrade the strength of the cotton fiber and even cause holes in the fabric. Additionally, these fabrics should not be exposed to strong oxidizers, such as bleach (over 6 percent sodium hypochlorite) and hydrogen peroxide, and strong reducers, such as sodium hydrosulfite. Strong oxidizing and reducing agents can cause an adverse reaction with the flame resistant polymer.

Heat Stress Protection

Heat stress is not only a serious condition for workers, but it can greatly reduce productivity and increase operator errors. The heat of the welding arc and added warmth of protective clothing can make already hot conditions even more intense for weld operators. Miller cooling products help cool your body and can be an effective solution to help improve the weld operator's well being and performance on the job.

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The Talk: Terms and definitions used in this section

Acclimatization: The time needed for physiological adaptation to extreme temperature changes. An average individual takes about 1 to 2 weeks to adapt to extreme hot temperatures.

Body Heat Balance: Steady state equilibrium between body heat production and heat loss to the environment.

Heat Stress: Net heat load to which a worker may be exposed from the combined contributions of metabolic heat, environmental factors (i.e., air temperature, humidity, air movement, and radiant heat), and clothing requirements.[1]

Threshold Limit Values (TLV): Guidelines designed for use by industrial hygienists in making decisions regarding safe levels of exposure to various chemical substances and physical agents found in the workplace.

Statistics & Trends: Heat Stress

4%
The amount workers output decreases for each degree above 80 degrees Fahrenheit.[2]

2,830
Nonfatal occupational injuries and illnesses involving days away from work in a single year due to exposure to environmental heat.[3]
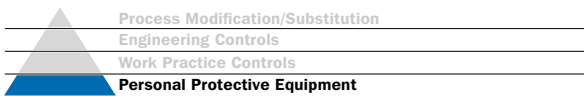
[1] https://www.nsc.org/Portals/0/Documents/facultyportal/Documents/fih-6e-appendix-b.pdf
[2] https://news.uchicago.edu/story/rising-temperatures-harm-worker-productivity-causing-global-losses
[3] https://www.bls.gov/opub/ted/2017/work-injuries-in-the-heat-in-2015.htm

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CoolBelt™

Designed for industrial use, this lightweight, belt-mounted cooling system delivers maximum airflow, keeping the weld operator's head and face cool. With temperatures up to 17 degrees Fahrenheit cooler under the hood, the operator experiences improved comfort and lower incidence of heat stress and illness.

Part #:	Description:
245230	CoolBelt™

* Not compatible with XL Series™ Helmets

Key Product Features:

- ▶ Dual air speeds provide airflow adjustability

- ▶ Constant airflow removes hot, stagnant air and reduces lens fog

- ▶ Swivel hose connection for maximum maneuverability

- ▶ Lightweight lithium ion rechargeable battery – up to 6 hours of run time

- ▶ LED button shows battery status and current airflow speed

By cooling ambient air by 15ºF, a worker will make approximately 90% fewer errors[1]

[1] http://www.cdc.gov/niosh/topics/heatstress

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Miller® Welding Safety & Health
Protect What Matters

Providing a clean, compliant and comfortable work environment will not only help you attract and retain valuable talent, but it can also lead to better weld quality and improved productivity.

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