

# Chapter 6

## Respiratory Protection and Personal Protective Equipment

⇒ ⇒ ⇒ **IF YOU PERFORM ABRASIVE BLASTING YOU MUST WEAR:**

### **A TYPE CE, ABRASIVE-BLASTING SUPPLIED-AIR RESPIRATOR**

⇒ ⇒ ⇒ **What is a Type CE, Abrasive Blasting Supplied Air Respirator?**

NIOSH defines a **Type CE respirator** as a Type C supplied-air respirator equipped with additional devices designed to protect the wearer's head and neck against impact and abrasion from rebounding abrasive material, and with shielding material such as plastic, glass, woven wire, sheet metal, or other suitable material to protect the window(s) of facepieces, hoods, and helmets. The facepiece, hood or helmet must not unduly interfere with the wearer's vision and must permit easy access to the external surface of such window(s) for cleaning. A **Type C respirator** is an airline respirator, for entry into and escape from atmospheres not immediately dangerous to life or health, which consists of a source of respirable breathing air, a hose, a detachable coupling, a control valve, orifice, a demand valve or pressure demand valve, and arrangement for attaching the hose to the wearer and a facepiece, hood, or helmet.

The MIOSHA adopted the federal regulation §1910.134 Respiratory Protection. 1910.134(d)(ii) requires that employers select a NIOSH-certified respirator. The respirator shall be used in compliance with the conditions of its certification.

⇒ ⇒ ⇒ **MIOSHA requires abrasive blasting respirators be worn by abrasive blasting operators when:**

- ⇒ When working inside blast-cleaning rooms.
- ⇒ When using silica sand in manual blasting operations where the nozzle and blast are not physically separated from the operator in an exhaust-ventilated enclosure.
- ⇒ Where concentrations of toxic dust dispersed by the abrasive blasting may exceed the exposure limits set in R 325.51102 et seq., being the Michigan occupational health air contaminant standard, and the nozzle and blast are not physically separated from the operator in an exhaust-ventilated enclosure.

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⇒ ⇒ ⇒ NIOSH recommends that you use a Type CE, supplied-air respirator attached to a good air source when open blasting **with any media**.

⇒ **What is a good air source?**

A good air source would be an ambient air pump, breathing air cylinders, or an air compressor. The air compressor should be constructed and located so contaminated air will not enter the compressor intake. Employers must ensure that carbon monoxide (CO) levels do not exceed 10 ppm in the breathing air delivered by a compressor that is not oil-lubricated. If the compressor is oil-lubricated, a high temperature alarm, or carbon monoxide alarm, or both, must be present to monitor carbon monoxide levels. It is a good work practice to utilize a carbon monoxide filter at all compressors supplying breathing air.

Between the air compressor and the airline respirator, an airline filter (purifying sorbent beds and filter) to remove oil mist, moisture, particulates and odor must be present. This airline filter must be maintained, replaced and refurbished per manufacturer's instructions. This information, along with the signature of the individual doing the maintenance, must be recorded on a tag and placed at the compressor. **The airline filter does not remove carbon monoxide (CO)**. It will **never** remove carbon monoxide.

**Because each worker's environment is different, and the amount of occupational exposure to crystalline silica dust varies, an occupational exposure determination should be completed before selecting an appropriate respirator.**

⇒ ⇒ ⇒ **MIOSHA OCCUPATIONAL HEALTH STANDARD PART 523: ABRASIVE BLASTING**

MIOSHA defines abrasive blasting as the forcible application of an abrasive to a surface by pneumatic pressure, hydraulic pressure, or centrifugal force. An abrasive-blasting respirator means a respirator constructed so that it covers the wearer's head, neck, and shoulders to protect the wearer from rebounding abrasive. A particulate filter respirator means an air-purifying respirator, commonly referred to as a dust or fume respirator, which removes most

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of the dust or fume from the air passing through the device.

Part 523 Rule 7 (a) mandates that the employer shall implement a respiratory protection program that meets the requirements of the MIOSHA Occupational Health Respiratory Protection Standard, Part 451 when respirators are required.

The MIOSHA Abrasive Blasting standard allows the use of properly fitted particulate-filter respirators, commonly referred to as dust-filter respirators, for short, intermittent, or occasional dust exposures such as cleanup, dumping of dust collectors, or unloading shipments of sand at a receiving point when it is not feasible to control the dust by enclosure, exhaust ventilation or other means. The respirator used shall be for protection against the specific type of dust encountered.

Dust-filter respirators may be used to protect the operator of outside abrasive-blasting operations where nonsilica abrasives are used on materials that have low toxicities and where the protection factor of the respirator is not exceeded. However, they may not be used for continuous protection if silica sand is used as the blasting abrasive or if toxic materials are blasted.

*Please refer to:  
Appendix VIII  
MIOSHA Occupational Health Standard  
Part 523 - Abrasive Blasting*

### **⇒ ⇒ ⇒ MIOSHA OCCUPATIONAL HEALTH STANDARD, PART 451: RESPIRATORY PROTECTION -- WRITTEN RESPIRATORY PROTECTION PROGRAM.**

A written respiratory protection program, with workplace specific procedures, must be established when respirators are necessary to protect the health of an employee or when the employer requires respirator use. The written program must include the procedures for: (a) selecting respirators; (b) medical evaluations of employees; (c) fit-testing; (d) proper use of respirators in routine and reasonably foreseeable emergency situations; (e) ensuring adequate air quality, quantity and flow of breathing air for air supplied respirators; and, (f) regularly

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evaluating the program effectiveness. The written program must also detail the procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, discarding, and otherwise maintaining the respirator, employee training concerning the hazards to which they are potentially exposed during routine and emergency situations and in the proper use of the respirator, including putting on and taking off the respirator, limitations on respirator use and how to maintain the respirator. MIOSHA adopted the federal respiratory protection standard 29 CFR 1910.134 rules.

**Appendix IX** contains the following information:

- MIOSHA Occupational Health Standard Part 451 – Respiratory Protection
- MIOSHA CET Publication #5730: Sample Program for a Respiratory Protection Program
- Respirator Medical Questionnaire en Espanol

⇒ MIOSHA Occupational Health Standard Part 453 – Respiratory Protection contains five mandatory appendices, four of which will be discussed on subsequent pages of this section. The appendices are:

- Appendix A to 1910.134: Fit Testing Procedures
- Appendix B-1 to 1910.134: User Seal Check Procedures
- Appendix B-2 to 1910.134: Respirator Cleaning Procedures
- Appendix C to 1910.134: OSHA Respirator Medical Evaluation Questionnaire
- Appendix D to 1910.134: Information for Employees Using Respirators When Not Required Under the Standard

### ⇒ ⇒ ⇒ **MEDICAL EVALUATION BEFORE YOU'RE ISSUED A RESPIRATOR:**

If you are required to wear a respirator or if you voluntarily use a respirator (excluding filter facepiece (dust mask) respirators), you must receive a medical evaluation by a physician or other licensed health care professional (PLHCP) to determine your ability to use it. A PLHCP may be a physician, a registered nurse, a nurse practitioner, a physician assistant or other licensed health care professional acting within the scope of his or her state license, registration, or certification. The medical evaluation must be provided before the initial fit-testing and before the respirator is used for the first time.

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A medical evaluation consists of the administration of a medical questionnaire or an initial medical examination that obtains the information contained on the questionnaire. The medical questionnaire and examinations must be administered in a confidential manner, and in a way that you understand the questionnaire content. The employer must provide an opportunity for you to discuss the questionnaire and examination results with the PLHCP, and medical follow-up if indicated by the PLHCP. **See Appendix IX - MIOSHA Respiratory Protection Standard, Part 451, Appendix C**

### ⇒ ⇒ ⇒ FIT-TESTING THE RESPIRATOR

Employees must be fit tested with the same make, model, style and size of the respirator they will wear before using any respirator with a negative or positive pressure tight-fitting facepiece. Loose-fitting respirators (such as hoods or helmets) that do not have a tight-fitting facepiece are not required to be fit tested.

Respirators with tight fitting facepieces must fit properly to provide protection. If a tight seal is not maintained between your face and the respirator facepiece, contaminated air will be drawn into the facepiece and you will be breathing contaminated air. Fit testing may be either qualitative (QLFT) or quantitative (QNFT). However, a QLFT limits the user to exposure levels that do not exceed 10x the permissible exposure limit of the air contaminant.

⇒ **Qualitative fit testing** involves introducing a gas, vapor, or aerosol test agent into an area around the head of the respirator user. If the respirator user can detect the presence of the test agent through subjective means, such as odor, taste, or irritation, the respirator fit is inadequate.

⇒ In a **Quantitative fit test**, the adequacy of respirator fit is assessed by measuring the amount of leakage into the respirator, by either generating a test aerosol as a test atmosphere, or using a controlled negative pressure to measure the amount of respirator leakage. Appropriate instrumentation is required to quantify respirator fit in QNFT.

Qualitative and quantitative fit testing must be conducted according to specific protocols and at specific intervals or on the occurrence of defined triggering events. **See Appendix IX - MIOSHA Respiratory Protection Standard, Part 451, Appendix A.**

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### ⇒ ⇒ ⇒ USER SEAL CHECK

Each time you put on a respirator with a negative or positive pressure tight-fitting facepiece, you must do a “User Seal” check before beginning work. The User Seal check is a quick and easy means of determining if your respirator is seated properly. This will minimize contaminant leakage into your respirator. **See Appendix IX - MIOSHA Respiratory Protection Standard, Part 451, Appendix B-1.**

### ⇒ ⇒ ⇒ MAINTENANCE AND CARE FOR YOUR RESPIRATOR.

To work properly and function correctly, respirators need to be properly inspected, cleaned and maintained before and after each use. **Your health depends on it!** It is required that your respirator is:

- Cleaned and disinfected as often as necessary to maintain a sanitary condition and before being stored. Respirators issued to more than one employee must be cleaned and disinfected before being worn by different individuals.
- Visually inspected before each use and during cleaning for any damage. Visual inspection detects factors that would interfere with proper performance. Look at: tightness of connections, conditions of various components (e.g., facepiece, headstraps, valves, connecting tube, etc.), shape distortion, and missing or loose components. Examine any elastomer parts for pliability and signs of deterioration.
- Stored away from light, heat, cold, moisture, dusts, chemicals and in a normal, upright position when not in use. To reduce dust contamination following cleaning, it is recommended that you store your respirator in an airtight plastic bag.

**See Appendix IX - MIOSHA Respiratory Protection Standard, Part 451, Appendix B-2.**

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### ⇒ ⇒ ⇒ MIOSHA/OSHA STATEMENT RELATING TO THE USE OF RESPIRATORY PROTECTIVE EQUIPMENT and OPERATOR PROTECTION:

**1910.94(5)(i) and 1910.134(d)(1)(ii):** Only respiratory protective equipment approved by NIOSH shall be used for protection of personnel against dust produced during Abrasive Blasting Operations.

Abrasive-blasting respirators shall be worn by all abrasive-blasting operators: When working inside of blast-cleaning rooms, or when using silica sand in manual blasting operations where the nozzle and blast are not physically separated from the operator in an exhaust ventilated enclosure, or where concentrations of toxic dust dispersed by the abrasive blasting may exceed the limits set in 1910.1000 and MIOSHA Part 302 Air Contaminants and the nozzle and blast are not physically separated from the operator in an exhaust-ventilated enclosure. NOTE: MIOSHA PEL's are more stringent than federal OSHA.

Properly fitted particulate filter respirators, commonly referred to as dust-filter respirators, may be used for short, intermittent, or occasional dust exposures such as cleanup, dumping of dust collectors, or unloading shipments of sand at a receiving point, when it is not feasible to control the dust by enclosure, exhaust ventilation, or other means. The respirators used must be approved by NIOSH under 42 CFR part 84 for protection against the specific type of dust encountered.

Dust-filter respirators may be used to protect the operator of outside abrasive-blasting operations where nonsilica abrasives are used on materials having low toxicities. Dust-filter respirators shall not be used for continuous protection where silica sand is used as the blasting abrasive, or toxic materials are blasted.

### ⇒ ⇒ ⇒ MIOSHA RULES RELATED TO COMPRESSED AIR FOR BLASTING:

⇒ **Occupational Health Rule Part 523- Abrasive Blasting, Rule (8).** Air for abrasive-blasting respirators must be free of harmful quantities of dusts, mists, or noxious gases, and meets the requirements for supplied-air quality and use specified in MIOSHA Occupational Health Standard, Part 451: Respiratory Protection

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⇒ **Part 451 (i) - Respiratory Protection.** Compressed breathing air shall meet at least the requirements for Grade “D” breathing air as described in ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1 - 1989.

- Part 451(i)(4): If cylinders are used to supply breathing air to respirators, the cylinders must meet the following requirements: (1) cylinders must be tested and maintained as prescribed in the Shipping Container Specification Regulations of the Department of Transportation (49 CFR Part 173 and Part 178), (ii) cylinders must have a certificate of analysis from the supplier that the breathing air meets the requirements for Grade D breathing air; and (iii) the moisture content in the cylinder does not exceed a dew point of -50 degrees F at 1 atmosphere pressure.
- Part 451(1)(5): If a compressor is used to supply breathing air to respirators, it shall be constructed and situated so as to: (i) prevent entry of contaminated air into the air-supply system; (ii) minimize moisture content to that the dew point at 1 atmosphere is 10 degrees F below the ambient temperature; (iii) have suitable in-line air purifying sorbent beds and filters to further ensure breathing air quality. Sorbent beds and filters shall be maintained and replaced or refurbished periodically following the manufacturer’s instructions; (iv) have a tag containing the most recent change date and the signature of the person authorized by the employer to perform the change. The tag shall be maintained at the compressor.
- Part 451(i)(6-7): For compressors that are not oil-lubricated, the employer shall ensure that carbon monoxide (CO) levels in the breathing air do not exceed 10 ppm.\* For oil-lubricated compressors, a high temperature or carbon monoxide alarm, or both, must be used to monitor carbon monoxide levels. If only high-temperature alarms are used, the air supply shall be monitored at intervals sufficient\*\* to prevent carbon monoxide in the breathing air from exceeding 10 ppm.

\* Not required to have CO alarm, but must ensure that the breathing air has less than 10 ppm CO by appropriate compressor placement, frequent or continuous air monitoring, CO filters or high-temperature alarm.

\*\* Intervals sufficient may be interpreted as having a program in place to monitor for CO, monitoring before, during and following each work shift, documenting the results of air monitoring, and being able to show documentation of air monitoring.

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- Part 451 (i)(8): The employer shall ensure that breathing air couplings are incompatible with outlets for nonrespirable worksite air or other gas systems. No asphyxiating substance shall be introduced into breathing airlines.

### ⇒ ⇒ ⇒ WHAT IS GRADE “D” BREATHING AIR?

As stated by MIOSHA, all operators' breathing apparatus **must** be supplied with clean, breathable, Grade “D” quality or better air as defined by the ANSI/Compressed Gas Association Commodity Specification for air G-7.1 - 1989. The following requirements define Grade “D” breathing air per the 1989 specification:

➤ OXYGEN	19.5% to 23.5%
➤ HYDROCARBONS	5 mg/m <sup>3</sup> maximum
➤ CARBON MONOXIDE	10 ppm maximum
➤ CARBON DIOXIDE	1,000 ppm maximum
➤ ODOR	No detectable odor
<hr/>	
➤ NO TOXIC CONTAMINANTS	at levels that make air unsafe to breathe

### ⇒ ⇒ ⇒ OSHA RULE 1910.94(a)(6) RELATED TO COMPRESSED AIR FOR BLASTING:

***Air supply and air compressors.*** Air for abrasive-blasting respirators shall be free of harmful quantities of dusts, mists, or noxious gases, and must meet the requirements for supplied-air quality and use specified in 29 CFR 1910.134(i).

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### ⇒ ⇒ ⇒ NIOSH RESPIRATOR USERS' NOTICE:

#### **ATTENTION: ALL USERS OF TYPE CE, ABRASIVE-BLAST SUPPLIED-AIR RESPIRATORS**

Publication Date of Users' Notice: May 23, 1996

The National Institute for Occupational Safety and Health (NIOSH) is updating information on (1) the kinds of respirators approved for abrasive-blast (sandblasting) operations and (2) the NIOSH recommendations for selection and use of these respirators. This information replaces the NIOSH Respirator User Notice dated October 4, 1993.

### ⇒ ⇒ ⇒ CURRENT CERTIFIED ABRASIVE-BLASTING RESPIRATORS

Type CE abrasive-blast supplied-air respirators are the only respirators suitable for use in abrasive-blasting operations.\* Currently, there are four kinds of Type CE abrasive-blast respirators certified by NIOSH. These four kinds of respirators and the NIOSH recommended assigned protection factors† (APF) are:

1. a continuous-flow respirator with a loose-fitting hood and an APF of 25;
2. a continuous-flow respirator with a tight-fitting facepiece and an APF of 50;
3. a positive-pressure respirator with a tight-fitting half-mask facepiece and an APF of 1000;
4. a pressure-demand or positive-pressure respirator containing a tight-fitting full facepiece and an APF of 2000.

\*Note: Air purifying and powered-air purifying respirators are not recommended for abrasive blasting operations, but may be suitable for auxiliary work such as outside clean-up operations.

†Note: OSHA APFs for abrasive blasting operations may differ somewhat from NIOSH recommended APFs.

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### ⇒ ⇒ ⇒ NIOSH RECOMMENDATIONS

NIOSH recommends the following for all abrasive-blasting operations:

1. Silica sand should NOT be used as an abrasive medium.
2. Respirators should not be used as the only means of preventing or minimizing exposures to airborne contaminants. Dust source controls such as containment systems, local exhaust systems, dust suppressants, water sprays, and good work practices must be implemented as the primary means of protecting workers. When dust source controls cannot keep exposures below the recommended exposure limits, controls must be supplemented with the use of respiratory protection.
3. Environmental monitoring by trained personnel should be conducted in all abrasive-blasting applications. This is necessary to select the proper respirator (APF) and insure that workers are not overexposed (i.e., measured contaminant concentration is less than the exposure limit multiplied by the respirator APF).
4. Anytime environmental conditions, airborne contaminants, or their concentrations are highly variable or poorly defined, high-level respiratory protection should be used, even if silica is not the abrasive agent.
5. If silica sand is used, despite its much greater hazard relative to other abrasive agents, only the highest level protection respirators (i.e., respirators certified by NIOSH as pressure-demand or positive pressure and with NIOSH recommended APFs of 1000 or 2000) should be used.
6. Respirators will only provide a satisfactory level of protection when they are selected, fitted, used, and maintained according to the manufacturer's written instructions, NIOSH approval limitations and guidelines, and MIOSHA regulatory requirements.

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⇒ ⇒ ⇒ **FOR MORE INFORMATION on the NIOSH Notice**

If you require additional information, or have further questions, please direct your request to:

Certification and Quality Assurance Branch  
Division of Safety Research  
1095 Willowdale Road  
Morgantown, WV 26505  
Telephone: (304) 285-5894, or call 1-800-35-NIOSH (1-800-356-4674)

⇒ ⇒ ⇒ **OSHA STATEMENT RELATING TO PRESSURE VESSELS:**

**1910.106(b) Pressure Vessels** shall be built in accordance with the code for unfired Pressure Vessels, Section VIII of the ASME Boiler and Pressure Vessel code, 1968. All Direct Pressure Blast Machines must be built to this code. You are not allowed to alter, weld or cut on the Blast Machine Tank.

⇒ ⇒ ⇒ **OSHA STATEMENT RELATING TO REMOTE CONTROL DEADMAN CONTROL SYSTEMS:**

**1910.244(b)** The blast cleaning nozzle shall be equipped with an operating valve, which must be held open manually.

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### ⇒ ⇒ ⇒ MIOSHA RULES RELATING TO PERSONAL PROTECTIVE EQUIPMENT

MIOSHA requires employers to determine if hazards are present or are likely to be present in their workplace. This process is called a hazard assessment. General Industry employers must complete a Certification of Hazard Assessment form to document the assessment of the workplace hazards. If the employer cannot eliminate or substantially reduce the hazards identified in the hazard assessment by feasible engineering controls, then the use of personal protective equipment (PPE) is required. When PPE must be used to reduce the exposure of employees to hazards, employers must:

- ⇒ Select the types of PPE that will protect the affected employee from the hazards identified in the hazard assessment.
- ⇒ Communicate the PPE selection decisions to the affected employee.
- ⇒ Properly fit, and have each affected employee use the appropriate PPE.
- ⇒ Provide training to affected employees using the PPE.
- ⇒ Keep training documentation that each affected employee has received and understood the training received. (General Industry requirement)
- ⇒ Ensure that defective or damaged personal protective equipment is not used.
- ⇒ Provide continuing evaluation of the program to determine its effectiveness in preventing employee injury or illness.

#### **Appendix X contains:**

- **MIOSHA Construction Safety Standard Part 6 - Personal Protective Equipment**
- **MIOSHA General Industry Safety Standard Part 33 - Personal Protective Equipment**
- **MIOSHA Construction Fact Sheet, Respiratory Protection in Construction**
- **MIOSHA CET publications to assist your efforts to assess your workplace and determine your personal protective equipment needs:**
  - MIOSHA CET Publication SP#16: Personal Protective Equipment for General Industry
  - MIOSHA CET Onsite Consultation Abatement Method Advice Publication # OSC-6096 for: GI Personal Protective Equipment Standard Part 33

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### ⇒ ⇒ ⇒ OSHA STATEMENT RELATING TO ABRASIVE BLAST OPERATOR PROTECTION:

**1910.94(a)(5)(v)** Operators shall be equipped with heavy canvas or leather gloves and aprons or equivalent protection to protect them from the impact of abrasives. Safety shoes shall be worn to protect against foot injury where heavy pieces of work are handled.

**1910.94(a)(5)(v)(b)** Equipment for protection of the eyes and face shall be supplied to the operator when the respirator design does not provide such protection and to any other personnel working in the vicinity of abrasive blasting operations.

### ⇒ ⇒ ⇒ MIOSHA STATEMENT RELATING TO GENERAL INDUSTRY ABRASIVE BLAST OPERATOR PROTECTION:

**Personal Protective Equipment Part 33, Rule 3394(2).** When abrasive blasting is not protected by an enclosure, the operator shall use heavy canvas or leather gloves and aprons or equivalent protection to provide protection from the impact of abrasives.

### ⇒ ⇒ ⇒ MIOSHA STATEMENT RELATING TO CONSTRUCTION INDUSTRY ABRASIVE BLAST OPERATOR PROTECTION:

**Personal Protective Equipment, Part 6, Rule 626(5).** When an employee is exposed to hazards such as radiation, alkalies, acids, abrasives, and temperature extremes other than those caused by weather conditions, appropriate head, body, and hand protection shall be worn to protect the employee from that hazard. Such personal protective equipment shall be provided by the employer.

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⇒ ⇒ ⇒ PERSONAL PROTECTIVE EQUIPMENT GUIDE TO HAZARD SOURCES.

Source	Type of Hazard	Protection
<b>IMPACT:</b> Chipping, grinding, machining, woodworking, sawing, masonry work, drilling, turning, chiseling, sanding, etc.	Flying fragments, objects, chips, turnings, particles, grinding fines.	Safety glasses, side shields, face shields.
<b>LIGHT OR RADIATION:</b> Welding, cutting, brazing, torch soldering.	Optical Radiation.	Welding goggles/shields w/shades as outlined in MIOSHA Part 33 (PPE).
<b>HEAT:</b> Furnace Operations.	High temperature, hot sparks, molten metal.	Faceshields (reflective), sleeves, gloves, coat.
<b>CHEMICALS:</b> Acid and chemical handling, degreasing, dipping, plating.	Splash, irritating mists, direct contact.	Gloves, chemical goggles, faceshields, aprons, special shoes/boots.
<b>FALLING OBJECTS:</b> Working in areas where potential for falling objects exists or bumping hazards.	Steel receiving, heavy parts transfer, overhead conveyors for parts movement, or low ceilings or mechanisms.	Hard hat, bump caps, safety shoes.
<b>SHARP OBJECTS:</b> Handling sharp edged parts, clearing turnings, objects which may pierce a foot or hand.	Deburring, removing turnings, assembling sharp parts.	Special cut resistant gloves, penetration resistant shoes.
<b>ELECTRICAL:</b> Direct or indirect contact with electricity.	Electricity.	Non-conductive safety shoes, hard hats, safety glasses, and gloves designed to reduce electrical shock and protect from sparks.

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### **Notes**