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Introduction

The requirements mandated by the U.S. Occupational Health and Safety Act (OSHA) for organizations specify a protocol that is to be followed for the protection of the safety and health of employees. The protocol specifies first, that exposure to a safety or health hazard be eliminated if possible. If total elimination is not possible, the potential hazard is then to be reduced through the implementation of engineering controls, work practices and administrative controls. Personal protective equipment (PPE) is to be regarded as the last resort of protection against a potential hazard. If elimination and controls of a potential hazard are not possible then PPE is to be used. However, there are several requirements pertaining to the types of PPE and how the PPE is to be used and maintained.

The United States of America Occupational Safety and Health Administration, Department of Labor specifies in the Code of Federal Regulations, Part 29 CFR 1910 Subpart I - Personal Protective Equipment various requirements for determining the types, use and care of personal protective equipment for individuals.

The following information copied from Paragraph 1910.132 - General Requirements is listed here, in part, for the benefit of the user of this guide. The user should inform himself or herself of the complete requirements of the full text of Part 29 CFR on personal protective equipment as it applies to his or her organization and not solely rely on the following abbreviated outtakes.

§ 1910.132 General Requirements

(a) Application. Protective equipment, including personal protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices and protective shields and barriers, shall be provided, used, and maintained in a sanitary and reliable condition wherever it is necessary by reason of hazards of processes or environment, chemical hazards, radiological hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact.

(b) Employee-owned equipment. (See 1910.132 (b) for full text)

(c) Design. (See 1910.132 (c) for full text)

(d) Hazard assessment and equipment selection. (1) The employer shall assess the workplace to determine if hazards are present, or are likely to be present, which necessitate the use of personal protective equipment (PPE). If such hazards are present, or likely to be present, the employer shall:

   (i) Select, and have each affected employee use, the types of PPE that will protect the affected employee from the hazards identified in the hazard assessment:
   (ii) Communicate selection decisions to each affected employee; and
   (iii) Select PPE that properly fits each affected employee.

   (2) The employer shall verify that the required workplace hazard assessment has been performed through a written certification that identifies the workplace evaluated; the person certifying that the evaluation has been performed; the date(s) of the hazard assessment; and, which identifies the document as a certification of hazard assessment.

(e) Defective and damaged equipment. (See 1910.132 (e) for full text)
(e) Defective and damaged equipment. (See 1910.132 (e) for full text)

(f) Training. (1) The employer shall provide training to each employee who is required by this section to use PPE. Each such employee shall be trained to know at least the following:

(i) When PPE is necessary;
(ii) What PPE is necessary;
(iii) How to properly don, doff, adjust, and wear PPE;
(iv) The limitations of the PPE; and,
(v) The proper care, maintenance, useful life and disposal of PPE.

(2) Each affected employee shall demonstrate an understanding of the training specified in paragraph (f)(1) of this section, and the ability to use PPE properly, before being allowed to perform work requiring the use of PPE.

(3) When the employer has reason to believe that any affected employee has already been trained does not have the understanding and skill required by paragraph (f) (2) of this section, the employer shall retrain each such employee. Circumstances where retraining is required include, but are not limited to, situations where:

(i) Changes in the workplace render previous training obsolete; or
(ii) Changes in the types of PPE to be used render previous training obsolete; or
(iii) Inadequacies in an affected employee’s knowledge or use of assigned PPE indicate that the employee has not retrained the requisite understanding or skill.

(g) (See 1910.132 (g) for full text)

In addition to the requirements mandated by OSHA, it is recommended that the wearing of jewelry, including exposed body piercing jewelry, be prohibited from the die casting environment.

It is also worthy to note that the use of certain types of PPE clothing may add to the heat load of a worker such as with individuals operating die casting machines and those who melt and transport metal. If a program for the management of the potential of heat stress is not in effect in your organization, one may be required to be developed and implemented. A hazard assessment of specific tasks performed in your facility will assist in determining if there is a need for this type of program.
Scope

This guide describes special considerations for selection and use of personal protective equipment (PPE) and special clothing for work situations that potentially present a risk of exposure to die casting operations hazards. It is intended to supplement an individual die casting operation’s Hazard Assessment for Personal Protective Equipment Selection.

This guide does not supersede other standards and requirements such as OSHA Regulations, ANSI Standards, manufacturer recommendations as listed on Safety Data Sheets (SDS’s) and product information or other standards that relate to personal protective equipment.

This guide is not intended to be the absolute answer to a die casting organization's selection of PPE for its personnel. It is provided as a tool for use in completing the hazard assessment of each job performed in the die casting facility. Company personnel, with their intimate knowledge and familiarity of the various intricacies of the die casting process are in the best position to determine what PPE is the most appropriate, practical, effective and useful for employee health and safety.

A sample Hazard Assessment form is provided in Appendix 1 of this book.

The North American Die Casting Association or its participants are not responsible for, and can not be held liable for errors or omissions on behalf of this document. To the best of our knowledge, findings herein are true and accurate at the time of writing.

Definitions

Chaps – long leggings made of leather, aluminized cotton or wool worn over pants from the waist to the ankle.

Clothing – refers to garments customarily worn in both work and non-work environments and may include shirts, pants, undergarments, socks and shoes (also see Special Clothing).


Hazardous Zone – that area where the potential for bodily injury exists.

Leggings – PPE garment covering the lower leg (usually extending from the knee to the ankle).

Personal Protective Equipment (PPE) – includes a variety of garments and devices worn by workers to protect from hazards and injury.

Smock – a garment worn over regular clothing to protect them.

Spats – a covering for the top and sides of the shoe or boot (metatarsal, instep and ankle area).

Special Clothing – specifically designed garments with designs, fabrics or treatments possessing protective characteristics such as aluminized coats, pants and gloves, heat and fire resistant gloves and jackets.
This table is a list of commonly required PPE for various operations in a die casting facility. Basic PPE for each operation is listed in **bold and italics**. Other items listed may or may not be required and should be determined by a hazard assessment; along with any additional PPE not listed here. Each operation has its own section later in the book that goes into more detail about the recommended PPE.

### Abbreviations

- **ANSI** – American National Standards Institute
- **ASTM** – American Society for Testing and Materials
- **CFR** – Code of Federal Regulations
- **FR** – Flame Resistant
- **HA** – Hazard Assessment (refer to OSHA 29 CFR 1910.132)
- **OSHA** – Occupational Safety and Health Administration
- **PEL** – Permissible Exposure Limit
<table>
<thead>
<tr>
<th>Maintenance Millwright/ Pipefitter/ Plumber/Welder</th>
<th>Maintenance Electrician</th>
<th>Painter/Janitor</th>
<th>Chemical Coating/ Water Treatment Facility Operator</th>
<th>Lift Truck Driver</th>
<th>Inspection/ Quality Personnel</th>
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<td><strong>Safety Glasses with Side Shields</strong></td>
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<tr>
<td>Cutting Goggles</td>
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<tr>
<td>Grinding Goggles</td>
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<td><strong>Chemical Resistant Rubber Apron</strong></td>
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<td><strong>Chemical Resistant Rubber Gloves</strong></td>
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<td><strong>Natural Fiber Pants</strong></td>
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<td><strong>Natural Fiber Pants</strong></td>
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<td><strong>Non- Conducting Steel Toe Safety Shoes</strong></td>
<td><strong>Steel Toe Safety Shoes</strong></td>
<td><strong>Steel Toe Safety Shoes</strong></td>
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<td><strong>Fall Protection</strong></td>
<td><strong>Fall Protection</strong></td>
<td><strong>Half-face Respirator</strong></td>
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<td><strong>Half-face Respirator</strong></td>
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Guidelines for PPE in Die Casting Operations
General Clothing and PPE for All Personnel in the Die Casting Plant

A basic level of PPE should be identified for all personnel who enter the die casting environment while production is taking place. This basic level of PPE is required for anyone who enters the manufacturing area, including, but not limited to: office personnel, contractors, visitors. Because this is for everyone in the manufacturing area it will be referenced, but not listed again for the die casting specific roles.

The following is the recommended minimum protection for anyone who enters the manufacturing area in a die casting facility.

• Approved safety glasses with side shields
• Approved steel toe safety shoes or boots
• Hearing protection (either ear plugs or ear muffs)
• 100% cotton or wool socks and undergarments
• 100% cotton or wool outer garments
  o Long sleeve shirt
  o Long pants without cuffs

Considerations for Hazard Assessment:
• Potential for molten metal “spitting” from cold chamber shot sleeve, hot chamber gooseneck/nozzle, or die parting line.
• Potential for dust or loose particles to get kicked up into the air
• Items that could potentially fall onto a foot
• Noise level in the facility

Recommendations and Comments:
• Reference 29 CFR 1910.132 for OSHA General PPE requirements.

A. Clothing
• Refer to ASTM F 1002 and request to see the results of the ASTM F 955 test for specific fabrics.
• Wear long pants made of natural fibers such as 100% cotton or 100% wool that cover the top of the safety shoe or boot to prevent molten metal and flash from entering the footwear. Never tuck pant legs inside the shoes or boots. Long pants are not to have cuffs.
• Wear shirts or smocks with long sleeves made of natural fibers such as 100% cotton or 100% wool.
• Do not wear phosphorus treated cotton because molten metal tends to stick to the fabric.
• Do not wear polyester, nylon and other man-made materials. Molten metal will melt the material and cause it to stick to body parts. Man-made materials can also ignite.
• Wear clothing that does not trap molten metal (i.e., no cuffs, open pockets, unbuttoned shirts).
• Maintain all protective clothing in serviceable condition. No holes, rips, tears or repaired fabrics.
• Flame retardant properties must be maintained. Refer to ASTM F 1449.
• Wear types of PPE in any combination as needed to protect body parts that are exposed to heat or metal splatter as determined by the hazard assessment for each work activity.
• Protective clothing may add to the heat load of the worker. Recognize the potential for heat stress when selecting special clothing. A heat stress program may be necessary to manage the potential heat stress.
B. Eye and Face Protection

C. Hearing Protection
- Reference OSHA Standard 29 CFR 1910.95

D. Head, Hand & Foot Protection
- Head
  - Reference OSHA Standard 29 CFR 1910.135
  - Reference ANSI Z89.1 for hard hat specifications.

- Foot
  - Reference ASTM F 2412 and F 2413 for foot protection specifications.
  - Wear pants that cover the top of the shoe or boot to prevent molten metal and flash from entering the footwear. Never tuck pant legs into the footwear.
  - Do not use shoes that are equipped with zippers or materials that could melt or ignite.
**Clothing and PPE for Die Cast Machine Operators (Manual and Automatic) and Die Casting Machine Set-up Personnel**

**Basic Protection:**
All Die Casting Machine Operators and Set-up Personnel are recommended to wear the PPE listed in General Clothing and PPE for All Personnel in the Die Casting Plant as well as:

- Heat resistant and slip resistant gloves

<table>
<thead>
<tr>
<th>Potential Hazards:</th>
<th>Application Specific Protection:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluate the applicability of these items when performing the hazard assessment.</td>
<td>Based on the results of the hazard assessment, some operations may require additional PPE beyond the basic protection. Additional PPE is noted below.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hazards:</th>
<th>Materials:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Burns from physical contact with:</td>
<td>• 100% Cotton (treated &amp; untreated)</td>
</tr>
<tr>
<td>o Molten Metal</td>
<td>• 100% Wool (treated &amp; untreated)</td>
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<tr>
<td>- Splash</td>
<td></td>
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<tr>
<td>- Spills</td>
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<tr>
<td>- Spitting Die</td>
<td></td>
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<tr>
<td>- Shot Sleeve or Gooseneck Spit</td>
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<tr>
<td>- Exploding Biscuit</td>
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<tr>
<td>- Hot Castings</td>
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<td>- Hot Machine Surfaces</td>
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<tr>
<td>- Hot Die Casting Dies</td>
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<td>- Hot Oil</td>
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<td>- Hot Water</td>
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<tr>
<td>o Radiant Heat</td>
<td></td>
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<tr>
<td>• Cuts/Contusions</td>
<td></td>
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<tr>
<td>- Casting flash</td>
<td></td>
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<tr>
<td>- Sharp edges on castings and dies</td>
<td></td>
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<tr>
<td>- Tools such as files, hammers, pliers, knives</td>
<td></td>
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<tr>
<td>• Airborne Contaminants such as die lubrication</td>
<td></td>
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<tr>
<td>• Eye and face injuries from foreign bodies, chemicals</td>
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<tr>
<td>• Foot injuries from falling objects</td>
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<tr>
<td>• Hearing loss due to noise exposure</td>
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</table>

<table>
<thead>
<tr>
<th>Types of PPE:</th>
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<tbody>
<tr>
<td><strong>Eye Protection</strong></td>
<td></td>
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<tr>
<td>• Face Shield – Required for manual ladling of molten metal into shot sleeve.</td>
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</tr>
<tr>
<td><strong>Hearing Protection</strong></td>
<td></td>
</tr>
<tr>
<td>(As determined by the results of the hazard assessment and including noise level monitoring results.)</td>
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</tr>
<tr>
<td>• Ear Plugs</td>
<td></td>
</tr>
<tr>
<td>• Ear Muffs</td>
<td></td>
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<tr>
<td>• Ear Caps</td>
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<table>
<thead>
<tr>
<th>Head, Hand, Trunk &amp; Foot Protection</th>
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</thead>
<tbody>
<tr>
<td>• Hard Hat</td>
<td></td>
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<tr>
<td>• Bump Cap</td>
<td></td>
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<tr>
<td>• Gloves</td>
<td></td>
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<tr>
<td>• Heat Retardant Jacket</td>
<td></td>
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<tr>
<td>• Metatarsal Foot Protection</td>
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<tr>
<th>Fall Protection</th>
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<tr>
<td>• May be required for Set-up personnel</td>
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<tr>
<td>• See Appendix 3 (pg. 42)</td>
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</tbody>
</table>
Considerations for Hazard Assessment:

- Presence of molten metal in furnace, ladle and die.
- Temperature of metal and/or hot surfaces on the machine.
- Potential for molten metal “spitting” from cold chamber shot sleeve, hot chamber, gooseneck/nozzle or die parting line.
- Temperature of hot castings and dies.
- Radiant energy from molten metal and castings that could impact the body.
- Sharp edges from castings and flash.
- Materials being handled (die lubricant, anti-seize compounds, shot tip lubricant).
- High temperatures from hot oil and water.

Recommendations and Comments:


A. Clothing

- Refer to ASTM F 1002 and request to see the results of the ASTM F 955 test for specific fabrics.
- Wear long pants made of natural fibers such as 100% cotton or 100% wool that cover the top of the safety shoe or boot to prevent molten metal and flash from entering the footwear. Never tuck pant legs inside the shoes or boots. Long pants are not to have cuffs.
- Wear shirts or smocks with long sleeves made of natural fibers such as 100% cotton or 100% wool.
- Do not wear phosphorus treated cotton because molten metal tends to stick to the fabric.
- Do not wear polyester, nylon and other man-made materials. Molten metal will melt the material and cause it to stick to body parts. Man-made materials can also ignite.
- Wear clothing that does not trap molten metal (i.e., no cuffs, open pockets, unbuttoned shirts).
- Maintain all protective clothing in serviceable condition. No holes, rips, tears or repaired fabrics. Flame retardant properties must be maintained. Refer to ASTM F 1449.
- Wear types of PPE in any combination as needed to protect body parts that are exposed to heat or metal splatter as determined by the hazard assessment for each work activity.
- Protective clothing may add to the heat load of the worker. Recognize the potential for heat stress when selecting special clothing. A heat stress program may be necessary to manage the potential heat stress.

B. Eye and Face Protection

- When face protection is worn, safety glasses with side shields must also be worn.

C. Hearing Protection

- Reference OSHA Standard 29 CFR 1910.95
D. Head, Hand & Foot Protection

• Head
  o Reference OSHA Standard 29 CFR 1910.135
  o Reference ANSI Z89.1 for hard hat specifications.

• Hand
  o Consider need for dexterity and grip security when operating equipment.
  o Consider heat content of casting when handling hot castings.

• Foot
  o Reference OSHA Standard 29 CFR 1910.136
  o Reference ASTM F 2412 and F 2413 for foot protection specifications.
  o Wear pants that cover the top of the shoe or boot to prevent molten metal and flash from entering the footwear. Never tuck pant legs into the footwear.
  o Do not use shoes that are equipped with zippers or materials that could melt or ignite.
Clothing and PPE for Trim Press Operators and Trim Press Set-up Personnel

**Basic Protection:**
All Trim Press Operators and Trim Press Set-up Personnel are recommended to wear the PPE listed in General Clothing and PPE for All Personnel in the Die Casting Plant as well as:

- Heat resistant and slip resistant gloves

### Potential Hazards:
Evaluate the applicability of these items when performing the hazard assessment

### Hazards:
- Burns from physical contact with:
  - Hot Castings
- Cuts/Contusions
  - Castings Flash
  - Sharp Edges on Castings
  - Tools such as files, hammers, pliers, knives
- Airborne Contaminants such as die lubrication
- Eye and face injuries from foreign bodies, chemicals
- Foot injuries from falling objects
- Hearing loss due to noise exposure

### Application Specific Protection:
Based on the results of the hazard assessment, some operations may require additional PPE beyond the basic protection. Additional PPE is noted below.

### Materials:
- 100% Cotton (treated & untreated)
- 100% Wool (treated & untreated)

### Types of PPE:

**Eye Protection**
- Face Shield

**Hearing Protection**
(As determined by the results of the hazard assessment and including noise level monitoring results.)
- Ear Plugs
- Ear Muffs
- Ear Caps

**Head, Hand, Trunk & Foot Protection**
- Hard Hat
- Bump Cap
- Gloves
- Metatarsal Foot Protection

(May be required for Set-up Personnel)
- Heat Retardant Jacket

### Considerations for Hazard Assessment:
- Temperature of hot castings.
- Sharp edges from castings and flash.
- Materials being handled (die lubricant, oil).
**For Set-up Personnel**

- Radiant energy from molten metal and castings that could impact the body.

**Recommendations and Comments:**


**A. Clothing**

- Refer to ASTM F 1002 and request to see the results of the ASTM F 955 test for specific fabrics.
- Wear long pants made of natural fibers such as 100% cotton or 100% wool that cover the top of the safety shoe or boot to prevent molten metal and flash from entering the footwear. Never tuck pant legs inside the shoes or boots. Long pants are not to have cuffs.
- Wear shirts or smocks with long sleeves made of natural fibers such as 100% cotton or 100% wool.
- Maintain all protective clothing in serviceable condition. No holes, rips, tears or repaired fabrics. Flame retardant properties must be maintained. Refer to ASTM 1449.
- Do not wear phosphorus treated cotton because molten metal tends to stick to the fabric.
- Do not wear polyester, nylon and other man-made materials. Molten metal will melt the material and cause it to stick to body parts. Man-made materials can also ignite.
- Wear clothing that does not trap molten metal (i.e., no cuffs, open pockets, unbuttoned shirts).
- Protective clothing may add to the heat load of the worker. Recognize the potential for heat stress when selecting special clothing. A heat stress program may be necessary to manage the potential heat stress.
- Wear types of PPE in any combination as needed to protect body parts that are exposed to heat or metal flash as determined by the hazard assessment for each work activity.

**B. Eye and Face Protection**

- When face protection is worn, safety glasses with side shields must also be worn.

**C. Hearing Protection**

- Reference OSHA Standard 29 CFR 1910.95

**D. Head, Hand & Foot Protection**

- **Head**
  - Reference OSHA Standard 29 CFR 1910.135
  - Reference ANSI Z89.1 for hard hat specifications.

- **Hand**
  - Consider need for dexterity and grip security when operating equipment.
  - Consider heat content of casting when handling hot castings.

- **Foot**
  - Reference ASTM F 2412 and F 2413 for foot protection specifications.
  - Wear pants that cover the top of the shoe or boot. Never tuck pant legs into the footwear.
  - Do not use shoes that are equipped with zippers or materials that could melt or ignite.
### Clothing and PPE for Die Repairman/Machinist and Furnace Repair Personnel

#### Basic Protection:
All Die Repairmen/Machinists and Furnace Repair Personnels are recommended to wear the PPE listed in General Clothing for All Personnel in the Die Casting Plant.

#### Potential Hazards:
Evaluate the applicability of these items when performing the hazard assessment.

<table>
<thead>
<tr>
<th>Hazards:</th>
<th>Application Specific Protection:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burns from physical contact with:</td>
<td>Based on the results of the hazard assessment, some operations may require additional PPE beyond the basic protection. Additional PPE is noted below.</td>
</tr>
<tr>
<td>- Molten Metal</td>
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<tr>
<td></td>
<td>- Splash</td>
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<tr>
<td></td>
<td>- Spills</td>
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<td></td>
<td>- Spitting Die</td>
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<tr>
<td></td>
<td>- Shot Sleeve or Gooseneck Spit</td>
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<td></td>
<td>- Exploding Biscuit</td>
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<tr>
<td></td>
<td>- Hot Castings</td>
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<tr>
<td></td>
<td>- Hot Machine Surfaces</td>
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<tr>
<td></td>
<td>- Hot Die Casting Dies</td>
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<tr>
<td></td>
<td>- Hot Oil</td>
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<tr>
<td></td>
<td>- Hot Water</td>
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<tr>
<td>- Radiant Heat</td>
<td></td>
</tr>
<tr>
<td>- Welding/Cutting Sparks Materials being cut and welded</td>
<td></td>
</tr>
<tr>
<td>Cuts/Contusions</td>
<td></td>
</tr>
<tr>
<td>- Casting flash</td>
<td></td>
</tr>
<tr>
<td>- Sharp edges on Castings</td>
<td></td>
</tr>
<tr>
<td>- Tools such as files, hammers, pliers, knives, refractory ramming tools</td>
<td></td>
</tr>
<tr>
<td>Airborne Contaminants such as die lubrication</td>
<td></td>
</tr>
<tr>
<td>Eye and face injuries from foreign bodies, chemicals</td>
<td></td>
</tr>
<tr>
<td>Head injuries from falling objects, moving equipment and/or overhead obstructions</td>
<td></td>
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<tr>
<td>Foot injuries from falling objects</td>
<td></td>
</tr>
<tr>
<td>Hearing loss due to noise exposure</td>
<td></td>
</tr>
<tr>
<td>Rotating machinery</td>
<td></td>
</tr>
</tbody>
</table>

#### Hazards:

- Burns from physical contact with:
  - Molten Metal
    - Splash
    - Spills
    - Spitting Die
    - Shot Sleeve or Gooseneck Spit
    - Exploding Biscuit
    - Hot Castings
    - Hot Machine Surfaces
    - Hot Die Casting Dies
    - Hot Oil
    - Hot Water
  - Radiant Heat
  - Welding/Cutting Sparks Materials being cut and welded
- Cuts/Contusions
  - Casting flash
  - Sharp edges on Castings
  - Tools such as files, hammers, pliers, knives, refractory ramming tools
- Airborne Contaminants such as die lubrication
- Eye and face injuries from foreign bodies, chemicals
- Head injuries from falling objects, moving equipment and/or overhead obstructions
- Foot injuries from falling objects
- Hearing loss due to noise exposure
- Rotating machinery

#### Materials:
- 100% Cotton (treated & untreated)
- 100% Wool (treated & untreated)

#### Types of PPE:

**Eye Protection**
- Face Shield
- Welding Hood
- Cutting Goggles
- Grinding Goggles

**Hearing Protection**
(As determined by the results of the hazard assessment and including noise level monitoring results.)
- Ear Plugs
- Ear Muffs
- Ear Caps

**Head, Hand, Trunk & Foot Protection**
- Hard Hat
- Bump Cap
- Gloves
- Heat Retardant Jacket
- Metatarsal Foot Protection
- Welding Jacket

**Respiratory Protection**
Furnace Repair Personnel: May be required for particulate, metal and organic fumes
- Half-face Respirator
Considerations for Hazard Assessment:

- Presence of molten metal in furnace, ladle and die.
- Temperature of metal and/or hot surfaces on the machine.
- Potential for molten metal “spitting” from cold chamber shot sleeve, hot chamber, gooseneck/nozzle or die parting line.
- Temperature of hot castings.
- Radiant energy from molten metal and castings that could impact the body.
- Sparks and radiant light from welding and cutting.
- Sharp edges from castings and flash.
- Materials being handled (die lubricant, anti-seize compounds, shot tip lubricant).

Recommendations and Comments:


A. Clothing
- Refer to ASTM F 1002 and request to see the results of the ASTM F 955 test for specific fabrics.
- Wear long pants made of natural fibers such as 100% cotton or 100% wool that cover the top of the safety shoe or boot to prevent molten metal and flash from entering the footwear. Never tuck pant legs inside the shoes or boots. Long pants are not to have cuffs.
- Wear shirts or smocks with long sleeves made of natural fibers such as 100% cotton or 100% wool.
- Do not wear phosphorus treated cotton because molten metal tends to stick to the fabric.
- Do not wear polyester, nylon and other man-made materials. Molten metal will melt the material and cause it to stick to body parts. Man-made materials can also ignite.
- Wear clothing that does not trap molten metal (i.e., no cuffs, open pockets, unbuttoned shirts).
- Maintain all protective clothing in serviceable condition. No holes, rips, tears or repaired fabrics. Flame retardant properties must be maintained. Refer to ASTM F 1449.
- Wear types of PPE in any combination as needed to protect body parts that are exposed to heat or metal splatter as determined by the hazard assessment for each work activity.
- Protective clothing may add to the heat load of the worker. Recognize the potential for heat stress when selecting special clothing. A heat stress program may be necessary to manage the potential heat stress.

B. Eye and Face Protection
- When face protection is worn, safety glasses with side shields must also be worn.

C. Hearing Protection
- Reference OSHA Standard 29 CFR 1910.95

D. Head, Hand & Foot Protection
- Head
  - Reference OSHA Standard 29 CFR 1910.135
  - Reference ANSI Z89.1 for hard hat specifications.
• Hand
  o Consider need for dexterity and grip security when operating equipment.
  o Consider heat content of casting when handling hot castings.

• Foot
  o Reference OSHA Standard 29 CFR 1910.136
  o Reference ASTM F 2412 and F 2413 for foot protection specifications.
  o Wear pants that cover the top of the shoe or boot to prevent molten metal and flash from entering the footwear. Never tuck pant legs into the footwear.
  o Do not use shoes that are equipped with zippers or materials that could melt or ignite.

• Respirator
  o Refer to NIOSH certification 42 CFR 84 for respirator selection.
  o Respirator selection must be appropriate for the type of contaminant, for concentration and duration of exposure.
  o Where respirators are required, employees must be medically evaluated and approved, fit-tested and trained in the use, care and storage of the equipment prior to use.
  o Facial hair must not interfere with respirator seal to the operator’s face.
### Guidelines for PPE in Die Casting Operations

#### Clothing and PPE for Central Melting Furnace Tender/(Adding Stock/Cleaning/Drossing Furnaces) and Personnel Transporting Metal/Cleaning Holding Furnaces

**Basic Protection:**
All Central Melting Furnace Tenders and Personnel Transporting Metal/Cleaning Holding Furnaces are recommended to wear the PPE listed in General Clothing and PPE for All Personnel in the Die Casting Plant as well as:
- Heat resistant gloves
- Approved face shields

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<table>
<thead>
<tr>
<th>Potential Hazards:</th>
<th>Application Specific Protection:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluate the applicability of these items when performing the hazard assessment.</td>
<td>Based on the results of the hazard assessment, some operations may require additional PPE beyond the basic protection. Additional PPE is noted below.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hazards:</th>
<th>Materials:</th>
</tr>
</thead>
<tbody>
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<td>• Burns from physical contact with:</td>
<td>• 100% Cotton (treated &amp; untreated)</td>
</tr>
<tr>
<td>o Molten Metal</td>
<td>• 100% Wool (treated &amp; untreated)</td>
</tr>
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<td>- Hot Water</td>
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<tr>
<td>o Radiant Heat</td>
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</tr>
<tr>
<td>• Cuts/Contusions</td>
<td></td>
</tr>
<tr>
<td>- Casting flash</td>
<td></td>
</tr>
<tr>
<td>- Sharp edges on castings and dies</td>
<td></td>
</tr>
<tr>
<td>- Tools such as files, hammers, pliers, knives</td>
<td></td>
</tr>
<tr>
<td>• Airborne Contaminants such as die lubrication</td>
<td></td>
</tr>
<tr>
<td>• Eye and face injuries from foreign bodies, chemicals</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>• Hearing loss due to noise exposure</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Types of PPE:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Eye Protection</strong></td>
</tr>
<tr>
<td>• Face Shield</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hearing Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>(As determined by the results of the hazard assessment and including noise level monitoring results.)</td>
</tr>
<tr>
<td>• Ear Plugs</td>
</tr>
<tr>
<td>• Ear Muffs</td>
</tr>
<tr>
<td>• Ear Caps</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Head, Hand, Trunk &amp; Foot Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Hard Hat</td>
</tr>
<tr>
<td>• Bump Cap</td>
</tr>
<tr>
<td>• Gloves</td>
</tr>
<tr>
<td>• Heat Retardant Jacket</td>
</tr>
<tr>
<td>• Metatarsal Foot Protection</td>
</tr>
<tr>
<td>• Aluminized Leggings</td>
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<tr>
<td>• Aluminized Spats</td>
</tr>
</tbody>
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<table>
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<tr>
<th>Respiratory Protection</th>
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<tbody>
<tr>
<td>May be required for particulate, metal, and organic fumes</td>
</tr>
<tr>
<td>• Half Face Respirator</td>
</tr>
</tbody>
</table>
Considerations for Hazard Assessment:

- Presence of molten metal in furnace, ladle and die.
- Temperature of metal and/or hot surfaces on the machine.
- Potential for molten metal “spitting” from cold chamber shot sleeve, hot chamber, gooseneck/nozzle or die parting line.
- Temperature of hot castings.
- Radiant energy from molten metal and castings that could impact the body.
- Sparks and radiant light from welding and cutting.
- Sharp edges from castings and flash.
- Materials being handled (die lubricant, anti-seize compounds, shot tip lubricant).

Recommendations and Comments:


A. Clothing
- Refer to ASTM F 1002 and request to see the results of the ASTM F 955 test for specific fabrics.
- Wear long pants made of natural fibers such as 100% cotton or 100% wool that cover the top of the safety shoe or boot to prevent molten metal and flash from entering the footwear. Never tuck pant legs inside the shoes or boots. Long pants are not to have cuffs.
- Wear shirts or smocks with long sleeves made of natural fibers such as 100% cotton or 100% wool.
- Do not wear phosphorus treated cotton because molten metal tends to stick to the fabric.
- Do not wear polyester, nylon and other man-made materials. Molten metal will melt the material and cause it to stick to body parts. Man-made materials can also ignite.
- Wear clothing that does not trap molten metal (i.e., no cuffs, open pockets, unbuttoned shirts).
- Maintain all protective clothing in serviceable condition. No holes, rips, tears or repaired fabrics. Flame retardant properties must be maintained. Refer to ASTM F 1449.
- Wear types of PPE in any combination as needed to protect body parts that are exposed to heat or metal splatter as determined by the hazard assessment for each work activity.
- Protective clothing may add to the heat load of the worker. Recognize the potential for heat stress when selecting special clothing. A heat stress program may be necessary to manage the potential heat stress.

B. Eye and Face Protection
- When face protection is worn, safety glasses with side shields must also be worn.

C. Hearing Protection
- Reference OSHA Standard 29 CFR 1910.95

D. Head, Hand & Foot Protection
- Head
  - Reference OSHA Standard 29 CFR 1910.135
  - Reference ANSI Z89.1 for hard hat specifications.
• Hand
  o Consider need for dexterity and grip security when operating equipment.
  o Consider heat content of casting when handling hot castings.

• Foot
  o Reference OSHA Standard 29 CFR 1910.136
  o Reference ASTM F 2412 and F 2413 for foot protection specifications.
  o Wear pants that cover the top of the shoe or boot to prevent molten metal and flash from entering the footwear. Never tuck pant legs into the footwear.
  o Do not use shoes that are equipped with zippers or materials that could melt or ignite.

• Respirator
  o Refer to NIOSH certification 42 CFR 84 for respirator selection.
  o Respirator selection must be appropriate for the type of contaminant, for concentration and duration of exposure.
  o Where respirators are required, employees must be medically evaluated and approved, fit-tested and trained in the use, care and storage of the equipment prior to use.
  o Facial hair must not interfere with respirator seal to the operator’s face.
Guidelines for PPE in Die Casting Operations

Clothing and PPE for Shot Blast and Sand Blast Equipment Operators

**Basic Protection:**
All Shot Blast and Sand Blast Equipment Operators are recommended to wear the PPE listed in General Clothing and PPE for All Personnel in the Die Casting Plant.

**Potential Hazards:**
Evaluate the applicability of these items when performing the hazard assessment.

<table>
<thead>
<tr>
<th>Hazards:</th>
<th>Application Specific Protection:</th>
</tr>
</thead>
</table>
| • Cuts/Contusions  
  - Casting flash  
  - Sharp edges on Castings  
  - Tools such as files, hammers, pliers, knives  
  - Airborne Contaminants such shot blast cabinet dust, silica and casting dust  
  - Eye and face injuries from foreign bodies, chemicals  
  - Foot injuries from falling objects  
  - Hearing loss due to noise exposure | Based on the results of the hazard assessment, some operations may require additional PPE beyond the basic protection. Additional PPE is noted below. |

**Materials:**
• 100% Cotton (treated & untreated)  
• 100% Wool (treated & untreated)

**Types of PPE:**

- **Eye Protection**
  • Face Shield  
  • Goggles

- **Hearing Protection**
  (As determined by the results of the hazard assessment and including noise level monitoring results.)
  • Ear Plugs  
  • Ear Muffs  
  • Ear Caps

- **Head, Hand, Trunk & Foot Protection**
  • Hard Hat  
  • Bump Cap  
  • Gloves  
  • Heat Retardant Jacket  
  • Metatarsal Foot Protection

- **Sand Blast Equipment Operators**
  Working inside a blast cabinet will require:
  • Leather Jacket  
  • Leather Chaps  
  • Leather Spats  
  • Leather Gloves

- **Respiratory Protection**
  • Powered air-purifying respirator  
  • Full head hood with purifying respirator
Considerations for Hazard Assessment:

- Presence of silica and metal dust and other airborne contaminants.
- Sharp edges from castings and flash.
- Materials being handled (alloy, silica dust).
- Body temperature from additional PPE (sand blast).
- Bulky PPE (sand blast).
- High dust area (for sand blast).
- High air pressure and high velocity sand stream (sand blast).

Recommendations and Comments:


A. Clothing
- Refer to ASTM F 1002 and request to see the results of the ASTM F 955 test for specific fabrics.
- Wear long pants made of natural fibers such as 100% cotton or 100% wool that cover the top of the safety shoe or boot. Never tuck pant legs inside the shoes or boots. Long pants are not to have cuffs.
- Wear shirts or smocks with long sleeves made of natural fibers such as 100% cotton or 100% wool.
- Do not wear phosphorus treated cotton because molten metal tends to stick to the fabric.
- Do not wear polyester, nylon and other man-made materials. Molten metal will melt the material and cause it to stick to body parts. Man-made materials can also ignite.
- Maintain all protective clothing in serviceable condition. No holes, rips, tears or repaired fabrics. Flame retardant properties must be maintained. Refer to ASTM F 1449.
- Wear types of PPE in any combination as needed to protect body parts that are exposed to heat or metal splatter as determined by the hazard assessment for each work activity.
- Protective clothing may add to the heat load of the worker. Recognize the potential for heat stress when selecting special clothing. A heat stress program may be necessary to manage the potential heat stress.

B. Eye and Face Protection
- When face protection is worn, safety glasses with side shields must also be worn.

C. Hearing Protection
- Reference OSHA Standard 29 CFR 1910.95

D. Head, Hand & Foot Protection
- Head
  - Reference OSHA Standard 29 CFR 1910.135
  - Reference ANSI Z89.1 for hard hat specifications.
- Hand
  - Consider need for dexterity and grip security when operating equipment.
• Foot
  o Reference OSHA Standard 29 CFR 1910.136
  o Reference ASTM F 2412 and F 2413 for foot protection specifications.
  o Wear pants that cover the top of the shoe or boot. Never tuck pant legs into the footwear.
  o Do not use shoes that are equipped with zippers or materials that could melt or ignite.

• Respirator
  o Refer to NIOSH certification 42 CFR 84 for respirator selection.
  o Respirator selection must be appropriate for the type of contaminant, for concentration and duration of exposure.
  o Where respirators are required, employees must be medically evaluated and approved, fit-tested and trained in the use, care and storage of the equipment prior to use.
  o Facial hair must not interfere with respirator seal to the operator’s face.
**Clothing and PPE for Maintenance Millwright, Maintenance Pipefitter/Plumber, Maintenance Welder**

**Basic Protection:**
All Maintenance Millwrights, Maintenance Pipefitters/Plumbers, Maintenance Welders are recommended to wear the PPE listed in General Clothing and PPE for All Personnel in the Die Casting Plant.

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<tr>
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<table>
<thead>
<tr>
<th>Types of PPE:</th>
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<tbody>
<tr>
<td><strong>Eye Protection</strong></td>
</tr>
<tr>
<td>• Face Shield</td>
</tr>
<tr>
<td>• Welding Hood (Millwright and Welder)</td>
</tr>
<tr>
<td>• Cutting Goggles (Millwright and Welder)</td>
</tr>
<tr>
<td>• Grinding Goggles (Millwright and Welder)</td>
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</tbody>
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<table>
<thead>
<tr>
<th><strong>Hearing Protection</strong></th>
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<tr>
<td>(As determined by the results of the hazard assessment and including noise level monitoring results.)</td>
</tr>
<tr>
<td>• Ear Plugs</td>
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<tr>
<td>• Ear Muffs</td>
</tr>
<tr>
<td>• Ear Cap</td>
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<table>
<thead>
<tr>
<th><strong>Head, Hand, Trunk &amp; Foot Protection</strong></th>
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</thead>
<tbody>
<tr>
<td>• Hard Hat</td>
</tr>
<tr>
<td>• Bump Cap</td>
</tr>
<tr>
<td>• Gloves</td>
</tr>
<tr>
<td>• Heat Retardant Jacket</td>
</tr>
<tr>
<td>• Metatarsal Foot Protection</td>
</tr>
<tr>
<td>• Welding Jacket (Millwright and Welder)</td>
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<thead>
<tr>
<th><strong>Fall Protection</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• See Appendix 3 (pg. 42)</td>
</tr>
</tbody>
</table>
Considerations for Hazard Assessment:

- Presence of molten metal in furnace, ladle and die.
- Temperature of metal and/or hot surfaces on the machine.
- Potential for molten metal “spitting” from cold chamber shot sleeve, hot chamber, gooseneck/nozzle or die parting line.
- Temperature of hot castings, dies and machine parts.
- Radiant energy from molten metal and castings that could impact the body.
- Sharp edges from castings and flash.
- Materials being handled (oils, greases, chemicals)

Recommendations and Comments:


A. Clothing
- Refer to ASTM F 1002 and request to see the results of the ASTM F 955 test for specific fabrics.
- Wear long pants made of natural fibers such as 100% cotton or 100% wool that cover the top of the safety shoe or boot to prevent molten metal and flash from entering the footwear. Never tuck pant legs inside the shoes or boots. Long pants are not to have cuffs.
- Wear shirts or smocks with long sleeves made of natural fibers such as 100% cotton or 100% wool.
- Do not wear phosphorus treated cotton because molten metal tends to stick to the fabric.
- Do not wear polyester, nylon and other man-made materials. Molten metal will melt the material and cause it to stick to body parts. Man-made materials can also ignite.
- Wear clothing that does not trap molten metal (i.e., no cuffs, open pockets, unbuttoned shirts).
- Maintain all protective clothing in serviceable condition. No holes, rips, tears or repaired fabrics. Flame retardant properties must be maintained. Refer to ASTM F 1449.
- Wear types of PPE in any combination as needed to protect body parts that are exposed to heat or metal splatter as determined by the hazard assessment for each work activity.
- Protective clothing may add to the heat load of the worker. Recognize the potential for heat stress when selecting special clothing. A heat stress program may be necessary to manage the potential heat stress.

B. Eye and Face Protection
- When face protection is worn, safety glasses with side shields must also be worn.

C. Hearing Protection
- Reference OSHA Standard 29 CFR 1910.95

D. Head, Hand & Foot Protection
- Head
  - Reference OSHA Standard 29 CFR 1910.135
  - Reference ANSI Z89.1 for hard hat specifications.
• Hand
  o Consider need for dexterity and grip security when operating equipment.
  o Consider heat content of casting when handling hot castings.

• Foot
  o Reference OSHA Standard 29 CFR 1910.136
  o Reference ASTM F 2412 and F 2413 for foot protection specifications.
  o Wear pants that cover the top of the shoe or boot to prevent molten metal and flash from entering the footwear. Never tuck pant legs into the footwear.
  o Do not use shoes that are equipped with zippers or materials that could melt or ignite.
#### Clothing and PPE for Maintenance Electrician

**Basic Protection:**
All Maintenance Electricians are recommended to wear the PPE listed in General Clothing and PPE for All Personnel in the Die Casting Plant.

**NOTE:** Reference NFPA-70E requirements for determining hazards and PPE for Maintenance Electricians

**Potential Hazards:**
Evaluate the applicability of these items when performing the hazard assessment.

<table>
<thead>
<tr>
<th>Hazards:</th>
<th>Application Specific Protection:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Burns from physical contact with:</strong></td>
<td>Based on the results of the hazard assessment, some operations may require additional PPE beyond the basic protection. Additional PPE is noted below.</td>
</tr>
<tr>
<td>o Molten Metal</td>
<td></td>
</tr>
<tr>
<td>- Splash</td>
<td></td>
</tr>
<tr>
<td>- Spills</td>
<td></td>
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<tr>
<td>- Spitting Die</td>
<td></td>
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<tr>
<td>- Shot Sleeve or Gooseneck Spit</td>
<td></td>
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<tr>
<td>- Exploding Biscuit</td>
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<tr>
<td>- Hot Castings</td>
<td></td>
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<tr>
<td>- Hot Machine Surfaces</td>
<td></td>
</tr>
<tr>
<td>- Hot Die Casting Dies</td>
<td></td>
</tr>
<tr>
<td>- Hot Oil</td>
<td></td>
</tr>
<tr>
<td>- Hot Water</td>
<td></td>
</tr>
<tr>
<td>o Radiant Heat</td>
<td></td>
</tr>
<tr>
<td><strong>Electrical shock hazards</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Cuts/Contusions</strong></td>
<td></td>
</tr>
<tr>
<td>- Casting flash</td>
<td></td>
</tr>
<tr>
<td>- Sharp edges on castings and dies</td>
<td></td>
</tr>
<tr>
<td>- Tools such as files, hammers, pliers, knives</td>
<td></td>
</tr>
<tr>
<td><strong>Airborne Contaminants such as die lubrication</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Eye and face injuries from foreign bodies, chemicals</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Head injuries from falling objects, moving equipment and/or overhead obstructions</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Foot injuries from falling objects</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Hearing loss due to noise exposure</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Materials:**
- 100% Cotton (treated & untreated)
- 100% Wool (treated & untreated)

**Types of PPE:**

**Eye Protection**
- Face Shield

**Hearing Protection**
(As determined by the results of the hazard assessment and including noise level monitoring results.)
- Ear Plugs
- Ear Muffs
- Ear Cap

**Head, Hand, Trunk & Foot Protection**
- Hard Hat
- Bump Cap
- Gloves
- Heat Retardant Jacket
- Metatarsal Foot Protection
- Special requirements for footwear that does not conduct electricity

**Fall Protection**
- See Appendix 3 (pg. 42)

Reference NFPA-70E for determining full PPE requirements.
Considerations for Hazard Assessment:

- Presence of molten metal in furnace, ladle and die.
- Temperature of metal and/or hot surfaces on the machine.
- Potential for molten metal “spitting” from cold chamber shot sleeve, hot chamber, gooseneck/nozzle or die parting line.
- Temperature of hot castings.
- Radiant energy from molten metal and castings that could impact the body.
- Sharp edges from castings and flash.
- Materials being handled (die lubricant, anti-seize compounds, shot tip lubricant).
- Hazards from electrical shock.

Recommendations and Comments:

- NOTE: Reference NFPA-70E requirements for determining hazards and PPE for Maintenance Electricians
- Refer to 29 CFR 1910, Subpart S, Electrical

A. Clothing
- Refer to ASTM F 1002 and request to see the results of the ASTM F 955 test for specific fabrics.
- Wear long pants made of natural fibers such as 100% cotton or 100% wool that cover the top of the safety shoe or boot to prevent molten metal and flash from entering the footwear. Never tuck pant legs inside the shoes or boots. Long pants are not to have cuffs.
- Wear shirts or smocks with long sleeves made of natural fibers such as 100% cotton or 100% wool.
- Do not wear phosphorus treated cotton because molten metal tends to stick to the fabric.
- Do not wear polyester, nylon and other man-made materials. Molten metal will melt the material and cause it to stick to body parts. Man-made materials can also ignite.
- Wear clothing that does not trap molten metal (i.e., no cuffs, open pockets, unbuttoned shirts).
- Maintain all protective clothing in serviceable condition. No holes, rips, tears or repaired fabrics. Flame retardant properties must be maintained. Refer to ASTM F 1449.
- Wear types of PPE in any combination as needed to protect body parts that are exposed to heat or metal splatter as determined by the hazard assessment for each work activity.
- Protective clothing may add to the heat load of the worker. Recognize the potential for heat stress when selecting special clothing. A heat stress program may be necessary to manage the potential heat stress.

B. Eye and Face Protection
- When face protection is worn, safety glasses with side shields must also be worn.

C. Hearing Protection
- Reference OSHA Standard 29 CFR 1910.95

D. Head, Hand & Foot Protection
- Head
  - Reference OSHA Standard 29 CFR 1910.135
  - Reference ANSI Z89.1 for hard hat specifications.
• Hand
  o Consider need for dexterity and grip security when operating equipment.

• Foot
  o Reference OSHA Standard 29 CFR 1910.136
  o Reference ASTM F 2412 and F 2413 for foot protection specifications.
  o Wear pants that cover the top of the shoe or boot to prevent molten metal and flash from entering the footwear. Never tuck pant legs into the footwear.
  o Do not use shoes that are equipped with zippers or materials that could melt or ignite.
  o Special requirements for footwear that is designed to be non-conductive for electricity.
## Guidelines for PPE in Die Casting Operations

### Clothing and PPE for Painters and Janitors

#### Basic Protection:
All Painters and Janitors are recommended to wear the PPE listed in General Clothing and PPE for All Personnel in the Die Casting Plant.

<table>
<thead>
<tr>
<th>Potential Hazards:</th>
<th>Application Specific Protection:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluate the applicability of these items when performing the hazard assessment.</td>
<td>Based on the results of the hazard assessment, including industrial hygiene monitoring results some operations may require additional PPE beyond the basic protection including specific respiratory protection. Additional PPE is noted below.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hazards:</th>
<th>Materials:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Burns from physical contact with:</td>
<td>• 100% Cotton (treated &amp; untreated)</td>
</tr>
<tr>
<td>o Molten Metal</td>
<td>• 100% Wool (treated &amp; untreated)</td>
</tr>
<tr>
<td>- Splash</td>
<td></td>
</tr>
<tr>
<td>- Spills</td>
<td></td>
</tr>
<tr>
<td>- Spitting Die</td>
<td></td>
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<tr>
<td>- Shot Sleeve or Gooseneck Spit</td>
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<tr>
<td>- Exploding Biscuit</td>
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<td>- Hot Castings</td>
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</tr>
<tr>
<td>- Hot Die Casting Dies</td>
<td></td>
</tr>
<tr>
<td>- Hot Oil</td>
<td></td>
</tr>
<tr>
<td>- Hot Water</td>
<td></td>
</tr>
<tr>
<td>o Radiant Heat</td>
<td></td>
</tr>
<tr>
<td>• Cuts/Contusions</td>
<td></td>
</tr>
<tr>
<td>- Casting flash</td>
<td></td>
</tr>
<tr>
<td>- Sharp edges on castings and dies</td>
<td></td>
</tr>
<tr>
<td>- Tools such as files, hammers, pliers, knives</td>
<td></td>
</tr>
<tr>
<td>• Airborne Contaminants such as die lubrication</td>
<td></td>
</tr>
<tr>
<td>• Eye and face injuries from foreign bodies, chemicals</td>
<td></td>
</tr>
<tr>
<td>• Head injuries from falling objects, moving equipment and/or overhead obstructions</td>
<td></td>
</tr>
<tr>
<td>• Foot injuries from falling objects</td>
<td></td>
</tr>
<tr>
<td>• Hearing loss due to noise exposure</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Types of PPE:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Eye Protection</strong></td>
</tr>
<tr>
<td>• Face Shield</td>
</tr>
<tr>
<td><strong>Hearing Protection</strong></td>
</tr>
<tr>
<td>(As determined by the results of the hazard assessment and including noise level monitoring results.)</td>
</tr>
<tr>
<td>• Ear Plugs</td>
</tr>
<tr>
<td>• Ear Muffs</td>
</tr>
<tr>
<td>• Ear Cap</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Head, Hand, Trunk &amp; Foot Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Hard Hat</td>
</tr>
<tr>
<td>• Bump Cap</td>
</tr>
<tr>
<td>• Gloves</td>
</tr>
<tr>
<td>• Heat Retardant Jacket</td>
</tr>
<tr>
<td>• Metatarsal Foot Protection</td>
</tr>
<tr>
<td>• Chemical resistant rubber gloves</td>
</tr>
<tr>
<td>• Chemical resistant rubber apron</td>
</tr>
<tr>
<td>• Chemical resistant rubber coat and pants (worn over regular work clothes)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fall Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>• See Appendix 3 (pg. 40)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Respiratory Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>(As determined by the results of the hazard assessment including industrial hygiene monitoring.)</td>
</tr>
<tr>
<td>• Half-face air-purifying respirator</td>
</tr>
</tbody>
</table>
Considerations for Hazard Assessment:

- Dust, fumes, entire work environment.
- Radiant energy from molten metal and castings that could impact the body.
- Materials being handled (soaps, paints, solvents, cleaners die lubricant, oils, shot tip lubricant).
- Presence of molten metal in furnaces, ladles and dies.
- Temperature of metal and/or hot surfaces on equipment.
- Potential for molten metal “spitting” from cold chamber shot sleeve, hot chamber, gooseneck/nozzle or die parting line.
- Temperature of hot castings.
- Radiant energy from molten metal and castings that could impact the body.
- Sharp edges from castings and flash.

Recommendations and Comments:


A. Clothing
- Refer to ASTM F 1002 and request to see the results of the ASTM F 955 test for specific fabrics.
- Wear long pants made of natural fibers such as 100% cotton or 100% wool that cover the top of the safety shoe or boot to prevent molten metal and flash from entering the footwear. Never tuck pant legs inside the shoes or boots. Long pants are not to have cuffs.
- Wear shirts or smocks with long sleeves made of natural fibers such as 100% cotton or 100% wool.
- Do not wear phosphorus treated cotton because molten metal tends to stick to the fabric.
- Do not wear polyester, nylon and other man-made materials. Molten metal will melt the material and cause it to stick to body parts. Man-made materials can also ignite.
- Wear clothing that does not trap molten metal (i.e., no cuffs, open pockets, unbuttoned shirts).
- Maintain all protective clothing in serviceable condition. No holes, rips, tears or repaired fabrics. Wear types of PPE in any combination as needed to protect body parts that are exposed to heat or other hazards as determined by the hazard assessment for each work activity.
- Protective clothing may add to the heat load of the worker. Recognize the potential for heat stress when selecting special clothing. A heat stress program may be necessary to manage the potential heat stress.

B. Eye and Face Protection
- When face protection is worn, safety glasses with side shields must also be worn.

C. Hearing Protection
- Reference OSHA Standard 29 CFR 1910.95

D. Head, Hand & Foot Protection
- Head
  - Reference OSHA Standard 29 CFR 1910.135
  - Reference ANSI Z89.1 for hard hat specifications.
• Hand
  o Consider need for dexterity and grip security when operating equipment.

• Foot
  o Reference OSHA Standard 29 CFR 1910.136
  o Reference ASTM F 2412 and F 2413 for foot protection specifications.
  o Wear pants that cover the top of the shoe or boot. Never tuck pant legs into the footwear.
  o Do not use shoes that are equipped with zippers or materials that could melt or ignite.

• Respirator
  o Refer to NIOSH certification 42 CFR 84 for respirator selection.
  o Respirator selection must be appropriate for the type of contaminant, for concentration and duration of exposure.
  o Where respirators are required employees must be medically evaluated and approved, fit-tested and trained in the use, care and storage of the equipment prior to use.
  o Facial hair must not interfere with respirator seal to the operator’s face.
Clothing and PPE for Chemical Coating and Water Treatment Facility Operating Personnel (Impregnation, Chromating...)

**Basic Protection:**
All Painters and Janitors are recommended to wear the PPE listed in General Clothing and PPE for All Personnel in the Die Casting Plant.

<table>
<thead>
<tr>
<th>Potential Hazards:</th>
<th>Application Specific Protection:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluate the applicability of these items when performing the hazard assessment.</td>
<td>Based on the results of the hazard assessment, some operations may require additional PPE beyond the basic protection. Additional PPE is noted below.</td>
</tr>
</tbody>
</table>

**Hazards:**
- Burns from physical contact with:
  - Chemicals
  - Hot water
  - Splashes
  - Spills
- Cuts/Contusions
  - Tools such as files, hammers, pliers, knives
- Airborne Contaminants
- Eye and face injuries from foreign bodies, chemicals
- Foot injuries from falling objects
- Hearing loss due to noise exposure

**Materials:**
- 100% Cotton (treated & untreated)
- 100% Wool (treated & untreated)

**Types of PPE:**

- **Eye Protection**
  - Face Shield

- **Hearing Protection**
  (As determined by the results of the hazard assessment and including noise level monitoring results.)
  - Ear Plugs
  - Ear Muffs
  - Ear Cap

- **Head, Hand, Trunk & Foot Protection**
  - Hard Hat
  - Bump Cap
  - Chemical resistant rubber gloves
  - Chemical resistant rubber apron
  - Chemical resistant rubber coat and pants (worn over regular work clothes)
  - Metatarsal Foot Protection

**Considerations for Hazard Assessment:**
- Sharp edges from castings and flash.
- Materials being handled (Chemicals, hot water).

**Recommendations and Comments:**
A. Clothing
- Refer to ASTM F 1002 and request to see the results of the ASTM F 955 test for specific fabrics.
- Wear long pants made of natural fibers such as 100% cotton or 100% wool that cover the top of the safety shoe or boot. Long pants are not to have cuffs.
- Never tuck pant legs inside the shoes or boots. Wear shirts made of natural fibers such as 100% cotton or 100% wool.
- Maintain all protective clothing in serviceable condition. No holes, rips, tears or repaired fabrics.
- Wear types of PPE in any combination as needed to protect body parts as determined by the hazard assessment for each work activity.
- Protective clothing may add to the heat load of the worker. Recognize the potential for heat stress when selecting special clothing. A heat stress program may be necessary to manage the potential heat stress.

B. Eye and Face Protection
- When face protection is worn, safety glasses with side shields must also be worn.
- Based on hazard assessment a respirator may be required.

C. Hearing Protection
- Reference OSHA Standard 29 CFR 1910.95

D. Head, Hand & Foot Protection
- Head
  - Reference OSHA Standard 29 CFR 1910.135
  - Reference ANSI Z89.1 for hard hat specifications.
- Hand
  - Consider need for dexterity and grip security when operating equipment.
- Foot
  - Reference ASTM F 2412 and F 2413 for foot protection specifications.
  - Wear pants that cover the top of the shoe or boot.
  - Do not wear footwear that is equipped with zippers or materials that could react with chemicals, melt or ignite.
Clothing and PPE for Lift Truck Drivers

**Basic Protection:**
All Lift Truck Drivers are recommended to wear the PPE listed in General Clothing and PPE for All Personnel in the Die Casting Plant.

<table>
<thead>
<tr>
<th>Potential Hazards:</th>
<th>Application Specific Protection:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluate the applicability of these items when performing the hazard assessment.</td>
<td>Based on the results of the hazard assessment, some operations may require additional PPE beyond the basic protection. Additional PPE is noted below.</td>
</tr>
</tbody>
</table>

**Hazards:**
- Burns from physical contact with:
  - Molten Metal
    - Splash
    - Spills
    - Spitting Die
    - Shot Sleeve or Gooseneck Spit
    - Exploding Biscuit
    - Hot Castings
    - Hot Machine Surfaces
    - Hot Die Casting Dies
    - Hot Oil
    - Hot Water
  - Radiant Heat
- Cuts/Contusions
  - Casting flash
  - Sharp edges on castings and dies
  - Tools such as files, hammers, pliers, knives
- Airborne Contaminants such as die lubrication
- Eye and face injuries from foreign bodies, chemicals
- Foot injuries from falling objects
- Hearing loss due to noise exposure

**Materials:**
- 100% Cotton (treated & untreated)
- 100% Wool (treated & untreated)

**Types of PPE:**

**Hearing Protection**
(As determined by the results of the hazard assessment and including noise level monitoring results.)
- Ear Plugs
- Ear Muffs
- Ear Cap

**Head, Hand, Trunk & Foot Protection**
- Hard Hat
- Bump Cap
- Gloves
- Heat Retardant Jacket

**Considerations for Hazard Assessment:**
- Presence of molten metal in furnace, ladle and die.
- Temperature of metal and/or hot surfaces on the machine.
- Potential for molten metal “spitting” from cold chamber shot sleeve, hot chamber, gooseneck/nozzle or die parting line.
- Temperature of hot castings.
- Radiant energy from molten metal and castings that could impact the body.

**Recommendations and Comments:**
A. Clothing
- Refer to ASTM F 1002 and request to see the results of the ASTM F 955 test for specific fabrics.
- Wear long pants made of natural fibers such as 100% cotton or 100% wool that cover the top of the safety shoe or boot to prevent molten metal and flash from entering the footwear. Never tuck pant legs inside the shoes or boots. Long pants are not to have cuffs.
- Wear shirts or smocks with long sleeves made of natural fibers such as 100% cotton or 100% wool.
- Do not wear phosphorus treated cotton because molten metal tends to stick to the fabric.
- Do not wear polyester, nylon and other man-made materials. Molten metal will melt the material and cause it to stick to body parts. Man-made materials can also ignite.
- Wear clothing that does not trap molten metal (i.e., no cuffs, open pockets, unbuttoned shirts).
- Maintain all protective clothing in serviceable condition. No holes, rips, tears or repaired fabrics. Flame retardant properties must be maintained. Refer to ASTM F 1449.
- Wear types of PPE in any combination as needed to protect body parts that are exposed to heat or metal splatter as determined by the hazard assessment for each work activity.

B. Eye and Face Protection
- Reference ANSI Standard Z87.1-1967 for eye protection

C. Hearing Protection
- Reference OSHA Standard 29 CFR 1910.95

D. Head, Hand & Foot Protection
- Head
  - Reference OSHA Standard 29 CFR 1910.135
  - Reference ANSI Z89.1 for hard hat specifications.
- Hand
  - Consider need for dexterity and grip security when operating equipment.
  - Consider heat content of casting when handling hot castings.
- Foot
  - Reference ASTM F 2412 and F 2413 for foot protection specifications.
  - Wear pants that cover the top of the shoe or boot to prevent molten metal and flash from entering the footwear. Never tuck pant legs into the footwear.
  - Do not use shoes that are equipped with zippers or materials that could melt or ignite.
Clothing and PPE for Inspection/Quality Personnel

**Basic Protection:**
All Inspection/Quality Personnel are recommended to wear the PPE listed in General Clothing and PPE for All Personnel in the Die Casting Plant.

### Potential Hazards:
Evaluate the applicability of these items when performing the hazard assessment.

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<thead>
<tr>
<th>Hazards:</th>
<th>Application Specific Protection:</th>
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<tbody>
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</tr>
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<td></td>
</tr>
<tr>
<td>• Foot injuries from falling objects</td>
<td></td>
</tr>
<tr>
<td>• Hearing loss due to noise exposure</td>
<td></td>
</tr>
</tbody>
</table>

### Materials:
- 100% Cotton (treated & untreated)
- 100% Wool (treated & untreated)

### Types of PPE:

- **Eye Protection**
  - Face Shield

- **Hearing Protection**
  (As determined by the results of the hazard assessment and including noise level monitoring results.)
  - Ear Plugs
  - Ear Muffs
  - Ear Cap

- **Head, Hand, Trunk & Foot Protection**
  - Hard Hat
  - Bump Cap
  - Gloves
  - Heat Retardant Jacket
  - Metatarsal Foot Protection

### Considerations for Hazard Assessment:
- Presence of molten metal in furnaces, ladles and dies.
- Temperature of metal and/or hot surfaces on the machine.
- Potential for molten metal “spitting” from cold chamber shot sleeve, hot chamber, gooseneck/nozzle or die parting line.
- Temperature of hot castings.
- Radiant energy from molten metal and castings that could impact the body.
- Sharp edges from castings and flash.
- Materials being handled (die lubricant, chemicals).
Recommendations and Comments:


A. Clothing
- Refer to ASTM F 1002 and request to see the results of the ASTM F 955 test for specific fabrics.
- Wear long pants made of natural fibers such as 100% cotton or 100% wool that cover the top of the safety shoe or boot to prevent molten metal and flash from entering the footwear. Never tuck pant legs inside the shoes or boots. Long pants are not to have cuffs.
- Wear shirts or smocks with long sleeves made of natural fibers such as 100% cotton or 100% wool.
- Do not wear phosphorus treated cotton because molten metal tends to stick to the fabric.
- Do not wear polyester, nylon and other man-made materials. Molten metal will melt the material and cause it to stick to body parts. Man-made materials can also ignite.
- Wear clothing that does not trap molten metal (i.e., no cuffs, open pockets, unbuttoned shirts).
- Maintain all protective clothing in serviceable condition. No holes, rips, tears or repaired fabrics. Flame retardant properties must be maintained. Refer to ASTM F 1449.
- Wear types of PPE in any combination as needed to protect body parts that are exposed to heat or metal splatter as determined by the hazard assessment for each work activity.
- Protective clothing may add to the heat load of the worker. Recognize the potential for heat stress when selecting special clothing. A heat stress program may be necessary to manage the potential heat stress.

B. Eye and Face Protection
- When face protection is worn, safety glasses with side shields must also be worn.

C. Hearing Protection
- Reference OSHA Standard 29 CFR 1910.95

D. Head, Hand & Foot Protection

- Head
  - Reference OSHA Standard 29 CFR 1910.135
  - Reference ANSI Z89.1 for hard hat specifications.

- Hand
  - Consider need for dexterity and grip security when operating equipment.
  - Consider heat content of casting when handling hot castings.

- Foot
  - Reference ASTM F 2412 and F 2413 for foot protection specifications.
  - Wear pants that cover the top of the shoe or boot to prevent molten metal and flash from entering the footwear. Never tuck pant legs into the footwear.
  - Do not use shoes that are equipped with zippers or materials that could melt or ignite.
Document References and Website Locations

**OSHA Standard**
- 29 CFR 1910 Subpart I – Personal Protective Equipment
  
  
  [http://ehso.com/OSHA/OSHA_SBSPPE_eye.htm#4](http://ehso.com/OSHA/OSHA_SBSPPE_eye.htm#4). Refer to Appendix 2

**ASTM Standards**
- E 2349 Standard Practice for Safety in Metal Casting Operations
- F995 - 07 Standard Test Method for Evaluating Heat Transfer Through Materials for Protective Clothing Upon Contact with Molten Metal Substances
- F 1002 – 06 Standard Performance Specification for Protective Clothing for Use by Workers Exposed to Specific Molten Substances and Related Thermal Hazards
- F 1060 Standard Test Method for Thermal Protective Performance of Materials for Hot Surface Contact
- 1117 Standard Specification for Dielectric Footwear
- F 1449 Standard Guide for Care and Maintenance of Flame Resistant and Thermally Protective Clothing
- F 2412 Standard Test Methods for Foot Protection
- F 2413 Standard Specification for Performance Requirements for Protective Footwear
- D6554-00 Standard Performance Specification for 100% Cotton Denim
  
  [www.astm.org](http://www.astm.org)

**ANSI Standards**
- ANSI/ISEA 105 American National Standard for Hand Protection Selection Criteria
  
  [www.ansi.org](http://www.ansi.org)

**NFPA Standards**
- NFPA 70E: Standard for Electrical Safety in the Workplace
  

**NIOSH Certification**
- 42 CFR 84 for respirator selection
  
  [http://www.cdc.gov/niosh/](http://www.cdc.gov/niosh/)
Appendix 1

PPE HAZARD ASSESSMENT

<table>
<thead>
<tr>
<th>Facility: ___________________________________________________</th>
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<tbody>
<tr>
<td>Department: ________________________________________________</td>
</tr>
<tr>
<td>Job/Task: __________________________________________________</td>
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<tr>
<td>Date: ______________________________________________________</td>
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<table>
<thead>
<tr>
<th>General Body Parts Affected</th>
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<tbody>
<tr>
<td>Hazards Present</td>
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</tr>
<tr>
<td>Impact</td>
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<tr>
<td>Penetration</td>
</tr>
<tr>
<td>Foreign Bodies</td>
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<tr>
<td>Pinch/Caught</td>
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<tr>
<td>Falling, rolling</td>
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<tr>
<td>Objects</td>
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<tr>
<td>Sharp Objects</td>
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<tr>
<td>Heat/Hot Surfaces</td>
</tr>
<tr>
<td>Molten Metal</td>
</tr>
<tr>
<td>UV/IR Radiation</td>
</tr>
<tr>
<td>Chemicals</td>
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<tr>
<td>Dust/Fume</td>
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<tr>
<td>Noise</td>
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<tr>
<td>Electrical</td>
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## PPE HAZARD ASSESSMENT

### SPECIFIC PERSONAL PROTECTIVE EQUIPMENT REQUIRED

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<tr>
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<th>Check if Applicable</th>
<th>Specification</th>
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<tr>
<td>Jackets</td>
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<tr>
<td>Apron</td>
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</tr>
<tr>
<td>Cape/Sleeve/Bib/Hood</td>
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<tr>
<td>Coveralls</td>
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<tr>
<td>Waterproof/Rain Gear</td>
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<td><strong>ARM/HANDS</strong></td>
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<td>Protective Sleeves</td>
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<td>Gloves</td>
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<td><strong>LEGS/FEET</strong></td>
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<td>Rubber Boots</td>
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<tr>
<td>Full Face Shield</td>
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<td>Cutting Goggles</td>
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<td>Half Mask</td>
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<tr>
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<td>Supplied Air Respirator</td>
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<tr>
<td><strong>FALL PROTECTION</strong></td>
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</table>

Evaluated by: ____________________
Date: ______________
Certified by: ____________________
Date: ______________

Guidelines for PPE in Die Casting Operations
Appendix 2

OSHA RECOMMENDED EYE AND FACE PROTECTORS

Appendix 3

SOURCES OF INFORMATION FOR FALL PROTECTION GEAR

Federal Register, Vol. 59, No. 152, August 9, 1994, pp. 40672 – 40753


29 CFR 1910 Subpart D, Walking-Working Surfaces

29 CFR 1926 Subpart M, Floor and Wall Openings

29 CFR 1926 Subpart X, Stairways and Ladders

29 CFR 1926.104, Safety Belts, Lifelines, and Lanyards

29 CFR 1926.105, Safety Nets

29 CFR 1926.451, Scaffolds General Requirements

