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Modern ***Equipment Company, Inc.***

General Ladle Maintenance Manual



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(American Foundrymen’s Society - 10-Q-June ’98 (revised 9-8-98))	

Chapter 1.0

Introduction

1.1 Introduction

The purpose of this manual is to describe the various components and controls of your equipment, as well as to provide management, installation, operating, and maintenance personnel with the necessary information and instructions for achieving maximum safe performance and service life.

It is, therefore, necessary that engineering, operating, and maintenance personnel read, study, and understand this manual thoroughly to become familiar with the various components of the system and the manner in which they operate, *prior to operation*. This manual should be kept readily available and used as a reference when operating and servicing our equipment.

Every attempt has been made to make these instructions as complete as possible. However, it must be recognized that it would be virtually impossible to describe every situation encountered during installation, start-up, operation, and maintenance of this equipment. Furthermore, it is beyond the scope of this manual to cover the laws, regulations, and ordinances covering safety of employees and safe practices. It is, however, incumbent upon the user to consider and follow all laws and rules which might be applicable in his/her locality.

As purchaser and/or user of this equipment, you have the responsibility for providing competent operators and maintenance personnel who can exercise good judgement in the performance of their assigned duties.

This manual is designed to document technologies, equipment, systems and/or subsystems purchased from **Modern Equipment Company, Inc.** It should, therefore, be understood that revisions to or updating of the equipment, systems, and/or subsystems beyond the issue date of this manual shall be the sole responsibility of the purchaser or the user.

Questions which may arise from the use of this manual and the equipment described within should be brought to the attention of **Modern Equipment Company, Inc.**

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This manual is furnished as part of a service and is for the exclusive use of the end user for equipment purchased from **Modern Equipment Company, Inc.** The data is not to be used in any other equipment or application, in whole or in part, without the written permission of **Modern Equipment Company, Inc.** The right to photocopy or store the manual in a computer or retrieval system is reserved by **Modern Equipment Company, Inc.** Two manuals are provided by **Modern Equipment Company, Inc.** Additional copies are available from **Modern Equipment Company, Inc.** for a nominal fee.

1.2 Ladle Equipment Inspection

Congratulations on the purchase of your new **Modern Equipment Company** Ladle! **Immediately** after your ladle shipment has arrived, please check to make sure the ladle equipment contents are complete and undamaged before proceeding any further.

Promptly check all contents of the ladle shipment against the packing list and sign the carrier's Bill of Lading Form if the contents are in good condition.

If you are missing any parts or receive damaged items:

- 1) Missing parts or damage to the ladle must be noted on the carrier's Bill of Lading Form.
- 2) Missing parts or damage to the ladle must be verified and signed by the carrier's delivery person, on the carrier's Bill of Lading Form.
- 3) Immediately contact your delivery carrier, request an inspection and file a claim as required.
- 4) Contact **Modern Equipment Company's** Customer Service Department, for assistance as needed (262) 284-9431.

1.3 Important Safety Information

Specific safety instructions which are essential to observe, including precautions, warnings against hazardous practices, necessary information on safe operation, and proper maintenance of the equipment, are provided within the appropriate chapters and subsections of this manual.

All maintenance procedures must be done in accordance with the following safety standards: American National Standard Safety Requirement for Melting and Pouring of Metals in the Metal Casting Industry (ANSI Z241.2). The contents of this manual are offered as a guide to establish responsibility for the use of **Modern Equipment Company, Inc.'s** hot metal handling equipment. It is important that this entire manual be read and understood by personnel involved in the operation and maintenance of the equipment.



Personnel with a language barrier or a reading deficiency may require special assistance in understanding manual chapters covering equipment for which they have an operational or maintenance responsibility.

It is the customer's responsibility to ensure that copies of the manual are readily available at all times, assist operators as necessary, understand the various sections relating to their work and the use of the equipment.

1.3 Important Safety Information (continued)

1.31 Reliable Sources

Additionally, the customer should also obtain and utilize safety information available from your insurance carrier, and additional sources that may be required for your situation. Reliable sources to obtain safety information from are:

American Foundry Society Incorporated
AFS International Headquarters
505 State Street
Des Plaines, IL 60016

National Safety Council
425 North Michigan Avenue
Chicago, IL 60611

American National Standard Institute
1430 Broadway
New York, NY 10018

National Fire Protection Association
1 Barterjuarch Park
Quincy, MA 02265

Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402

U.S. Department of Labor
Occupational Safety and Health Administration
200 Constitution Avenue, NW
Washington, DC 20210

1.32 Hazard Statement Definitions

This manual contains the following types of hazard statements:



Refers to hazards and unsafe practices which may result in minor personal injury and/or equipment damage.



Refers to hazards and unsafe practices which may result in severe personal injury and/or equipment damage.



Refers to hazards and unsafe practices which may result in death, severe personal injury and/or equipment damage.



Refers to liquid hazards and unsafe practices which may result in death, severe personal injury and/or equipment damage.



Refers to electrical hazards and unsafe practices which may result in death, severe personal injury and/or equipment damage.

1.33 Safety Standards

It is the user's responsibility to obtain and comply with available safety information and standards.

It should be recognized that it is the owner's ultimate responsibility to comply with OSHA standards for the furnishing, placement, and maintenance of hazardous warning signs, warning lights, barriers, guards, shields, and safe access to all areas that must be reached by operators and maintenance personnel. It is incumbent on the buyer to determine that he has fulfilled his current OSHA responsibilities on his own initiative.

1.34 Ladle Design

Your ladle unit has been designed to hold specific capacities of molten material.



Do not attempt to modify any part of the ladle without Modern Equipment Company's written permission. Failure to comply may result in death, severe personal injury, equipment damage and/or equipment malfunction.

Design capacity for the molten metal has been based on the lining thickness and free top space. Refer to the ladle assembly drawing (see **Appendix E**).



Do not make any changes in refractory design, thickness, and/or density. Do not allow any slag or metal build-up to occur on the ladle shell. Failure to comply may result in death, severe personal injury, and/or equipment damage.

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Chapter 2.0

Ladle Operating Instructions

2.1 Ladle Operating Instructions



Always wear the required Personal Protective Equipment (PPE) (see **Appendix D**) when operating or servicing your ladle. Failure to comply may result in severe personal injury and/or equipment damage.



Do not attempt to modify any part of the ladle without Modern Equipment Company's written permission. Failure to comply may result in death, severe personal injury, equipment damage, and/or equipment malfunction.

Step 1: Secure the ladle to the lifting device.
(See Figures 1a & 1b)

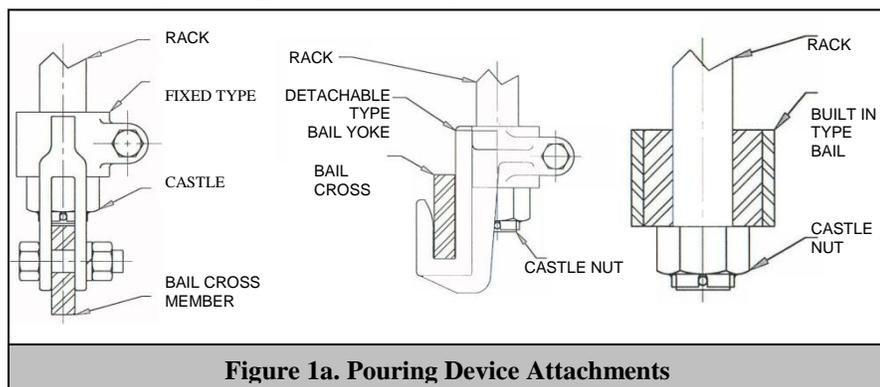


Figure 1a. Pouring Device Attachments

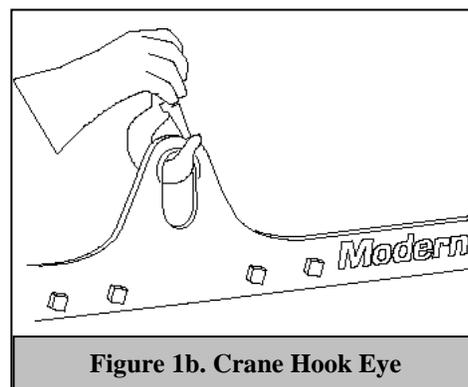


Figure 1b. Crane Hook Eye



Do not attempt to modify ladle load-carrying members without Modern Equipment Company's written permission. Failure to comply may result in death, severe personal injury, equipment damage, and/or equipment malfunction.

NOTE: If your ladle is not equipped with a cover, skip Step 2 and proceed with Step 3

Step 2: Open the cover on your ladle. (See Figure 2.)

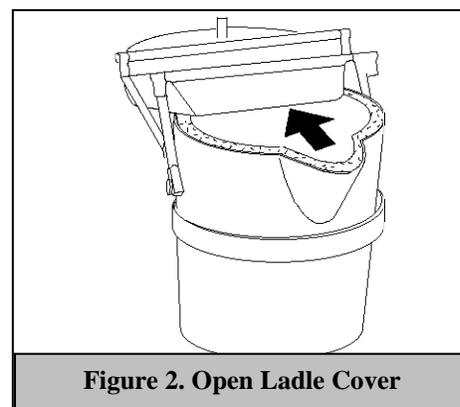


Figure 2. Open Ladle Cover

2.1 Ladle Operating Instructions (continued)

Step 3: Check to make sure the refractory lining has been properly installed, cured and preheated, according to manufacturer/ supplier instructions. Refer to the ladle assembly drawing (see **Appendix E**), for complete ladle refractory configuration. (See Figure 3.)



DANGER:

Follow instructions, guidelines, and recommendation of the refractory supplier/ manufacturer, requiring selection, installation, operation, maintenance, curing and preheating of lining. Failure to comply may result in explosion; which can cause death, severe personal injury, and/or equipment damage.

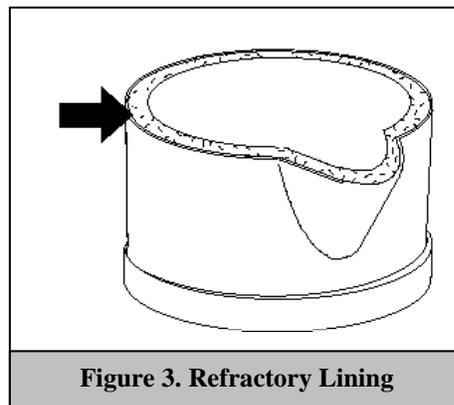


Figure 3. Refractory Lining

NOTE: If your ladle is equipped with a gearbox, skip Steps 4 - 9 and proceed with Step 10.

Step 4: Before the ladle is filled with molten metal, place the bail lock lever in the locked or engaged position. (See Figure 4.)



DANGER:

The bail lock lever must be in the locked or engaged position during traveling and/or receiving of molten metal. Failure to comply may result in spillage; which can cause death, severe personal injury and/or equipment damage.

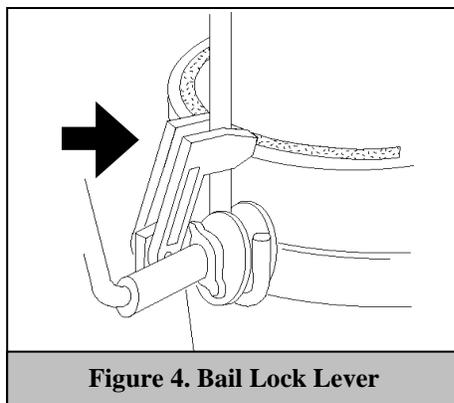


Figure 4. Bail Lock Lever

Step 5: Fill the ladle with the molten metal. (See Figure 5.) Care must be taken to prevent overflowing to the point where spilling may occur. Refer to the current ANSI Z241.2 specifications and the ladle assembly drawing (see **Appendix E**).



DANGER:

Keep all liquid products and contained liquid products away from the ladle. Failure to comply may result in explosion; which can cause death, severe personal injury, and/or equipment damage.

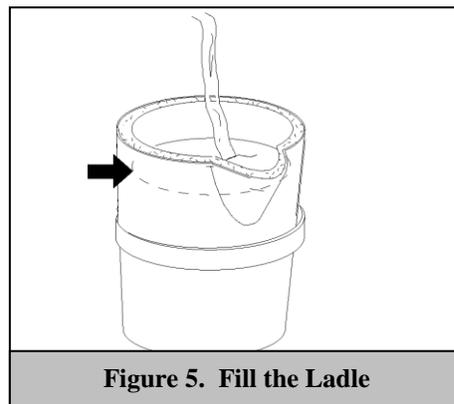


Figure 5. Fill the Ladle

2.2 Non Geared Ladle Operating Instructions

NOTE: If your ladle is not equipped with a cover, skip Step 6 and proceed with Step 7.

Step 6: After the ladle is filled with molten metal, close the cover of your ladle and transport to pouring area. (See Figure 6.)



The bail lock lever must be in the locked or engaged position during traveling and/or receiving of molten metal. Failure to comply may result in spillage; which can cause death, severe personal injury and/or equipment damage.

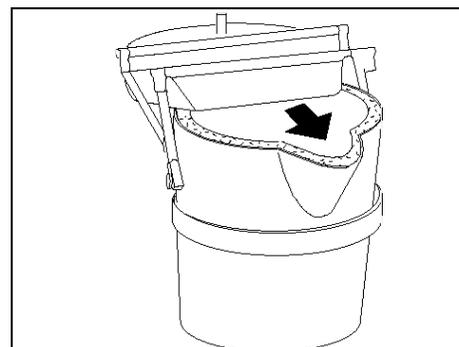


Figure 6. Close Ladle Cover

Step 7: After a travel destination is reached, place the bail lock lever in the unlocked or released position. (See Figure 7.)



Operator must have control of the ladle tilt lever before releasing the bail lock lever. Failure to comply may result in death, severe personal injury, and/or equipment damage.

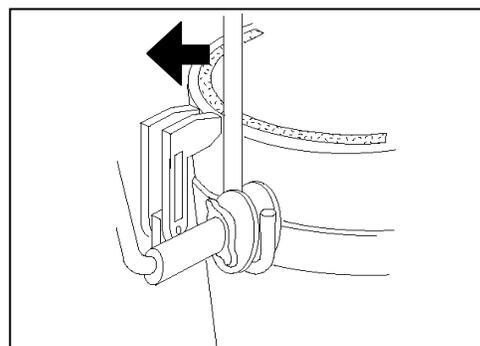


Figure 7. Release of Bail Lock Lever

Step 8: Depending on which direction your ladle operates, slowly move the lever to start the pouring of molten metal. Reverse the direction of the lever to stop the pouring of molten metal. (See Figure 8.)

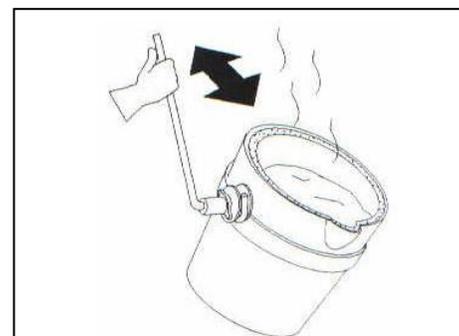


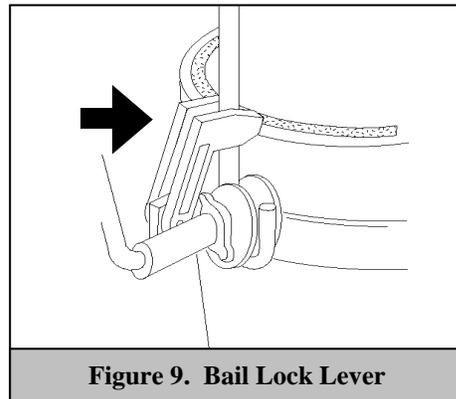
Figure 8. Starting and Stopping

2.2 Non Geared Ladle Operating Instructions (continued)

Step 9: After the ladle is emptied of molten metal, or the pouring operation is completed, place the bail lock lever in the locked or engaged position. (See Figure 9.)



The bail lock lever must be in the locked or engaged position during traveling and/or receiving of molten metal. Failure to comply may result in spillage; which can cause death, severe personal injury and/or equipment damage.



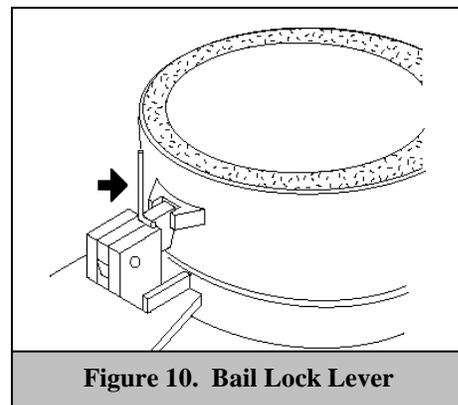
NOTE: If your ladle is not equipped with a gearbox, skip Steps 10-15 and continue on to 3.0 Preventive Maintenance Instructions.

2.3 Geared Ladle Operating Instructions

Step 10: Before the ladle is filled with molten metal, place the bail lock lever in the locked or engaged position.
(See Figure 10.)

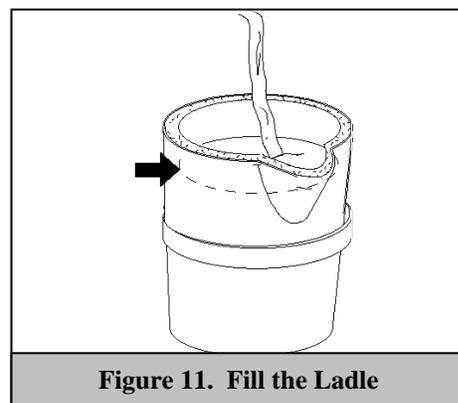


The bail lock lever or handwheel chain must be in the locked or engaged position during traveling and/or receiving of molten metal. Failure to comply may result in spillage; which can cause death, severe personal injury and/or equipment damage.



Keep all liquid products and contained liquid products away from the ladle. Failure to comply may result in explosion; which can cause death, severe personal injury, and/or equipment damage.

Step 11: Fill the ladle with molten metal. (See Figure 11.) Care must be taken to prevent overfilling to the point where spilling may occur. Refer to the current ANSI Z241.2-specifications and the ladle assembly drawing (see **Appendix E**).

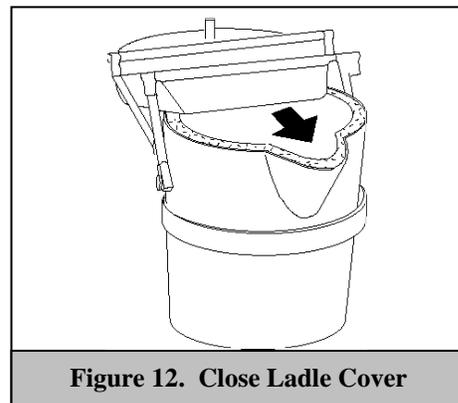


Note: If your ladle is not equipped with a cover, skip Step 12 and proceed to Step 13.

Step 12: After the ladle is filled with molten metal, close the cover of your ladle. (See Figure 12.)



The bail lock lever or handwheel chain must be in the locked or engaged position during traveling and/or receiving of molten metal. Failure to comply may result in spillage; which can cause death, severe personal injury and/or equipment damage.



2.3 Geared Ladle Operating Instructions (continued)

Step 13: After a travel destination is reached, place the bail lock lever in the unlocked or released position.
(See Figure 13.)



Operator must have control of the handwheel before releasing the bail lock lever. Failure to comply may result in death, severe personal injury, and/or equipment damage.

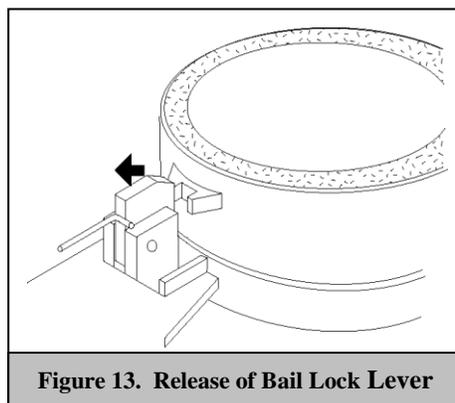


Figure 13. Release of Bail Lock Lever

Step 14: Depending on which direction your ladle operates, slowly turn the hand wheel clockwise or counterclockwise to start the pouring process of the molten metal. Reverse the direction of the wheel to stop the pouring process of molten metal. (See Figure 14.)

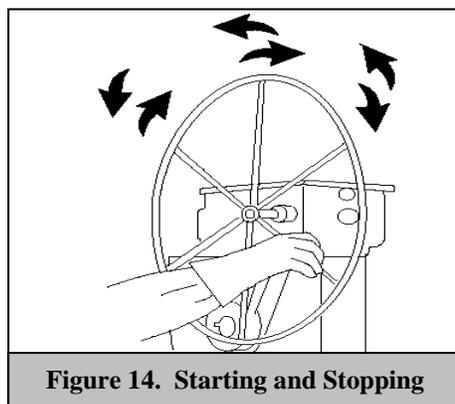


Figure 14. Starting and Stopping

Step 15: After the ladle is emptied of molten metal, or the travel destination is reached, place the bail lock lever in the locked or engaged position. (See Figure 15.)



The bail lock lever or hand wheel chain must be in the locked or engaged position during traveling and/or receiving of molten metal. Failure to comply may result in spillage; which can cause death, severe personal injury and/or equipment damage.

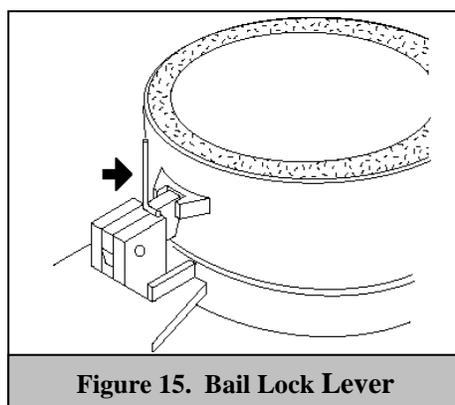
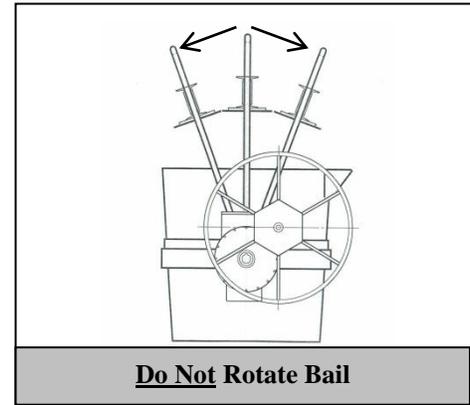


Figure 15. Bail Lock Lever



Do not use gearing to rotate bail. Excessive torque could be applied to the gears, which will cause premature wear and possible failure. Failure to comply may result in minor personal injury and/or equipment damage.¹



You are now ready to proceed with Preventive Maintenance Instructions.

¹ Revision 1, January 3, 2000 Added Caution

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Chapter 3.0

Preventive Maintenance

3.1 Preventive Maintenance Instructions

Follow the preventive Maintenance Schedule located in **Appendix B**.



Always wear the required Personal Protective Equipment (PPE) (see **Appendix D**) when operating or servicing your ladle. Failure to comply may result in severe personal injury and/or equipment damage.

It is necessary that operating and maintenance personnel become familiar with the various components of the equipment and the manner in which they operate (see note).



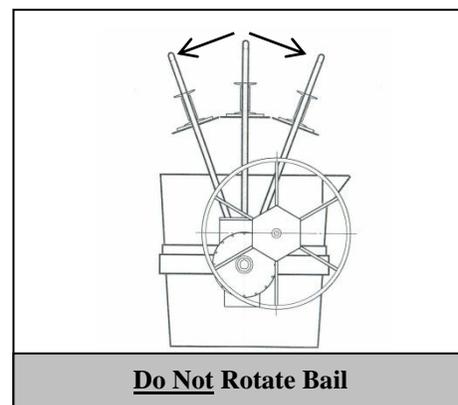
Personnel with a language barrier or a reading deficiency may require special assistance in understanding manual chapters covering equipment for which they have an operational or maintenance responsibility.

As purchaser and user of this equipment, you have the responsibility for providing competent trained installers, operators and maintenance personnel who can exercise good judgement in the performance of their assigned duties.

Do not repair or replace any part of the ladle or attempt any servicing, unless specifically recommended in published repair instructions. It is important you completely understand these instructions and have the skills to carry them out. Failure to comply may result in minor personal injury or equipment damage.



Do not use gearing to rotate bail. Excessive torque could be applied to the gears, which will cause premature wear and possible failure. Failure to comply may result in minor personal injury and/or equipment damage.²



Any questions which may arise from the use of this instruction and the equipment described should be brought to the attention of **Modern Equipment Company**.

² Revision 2, January 3, 2000 Added Caution

3.2 Inspection



If equipped with electric drive components, disconnect electrical supply at circuit breaker, fuse, or power source before servicing. Failure to comply may result in electrical shock; which can cause death, severe personal injury and/or equipment damage.

3.21 Tools Needed

No special tools are required to perform maintenance or repairs on *Modern Equipment Company* ladles or gearboxes. Standard maintenance tools will be adequate.

3.22 Lubrication



Ladle units must be lubricated after installation and according to the preventive maintenance schedule that is contained within this manual. Failure to comply may result in minor personal injury, and/or equipment damage.

The mechanical parts of *Modern* ladles must be kept sufficiently lubricated at all times to assure proper operation. This applies to gear cases, bottom pour slide mechanisms, and trunnion housings. All items shipped as part of a complete ladle assembly are packed with a proven high temperature grease. At least once a week during full time use, these items should be greased with a Zerk™ grease gun at all points provided for this purpose.



Apply lubricants with discretion and wipe up spills immediately. Do not over or under lubricate gear units. Failure to comply may result in minor personal injury, and/or equipment damage.

For Recommended Lubricant Product Information refer to **Appendix A**.

3.23 Contamination

Contamination and dirt may shorten the life of your equipment due to clogged grease lines. Always keep oil cans and grease guns clean and free of dust.

3.24 Gearings and Trunnions



Keep oil cans and grease guns clean and covered until use is needed, especially in areas that are prone to dust. Wipe each grease fitting and oil fill cap with a clean rag, before applying the lubricant. Failure to comply may result in minor personal injury, and/or equipment damage.



Inspect and/or replace all worn and defective parts on a timely basis. Failure to comply, may result in minor personal injury and/or equipment damage.

3.2 Inspection (continued)

Consideration should be given to the replacement of all damaged gearings that allow the entry of dirt, grit, or hot metal into the unit. Make periodic inspections of the unit, depending on the severity of use, looking for worn and damaged parts such as bushings, gears, bearings and covers.

3.25 Ladle Backlash

Excessive backlash in a ladle tilt may be caused by the cumulative affect of a series of worn parts; Therefore, it is important that you inspect for worn trunnion keys at the gears, housing and cover bushings, loose bail brackets, or noticeably worn teeth on all gears; particularly the worm wheel. Correct all defects before returning ladle to service.



Correct all defects before returning ladle to service. Failure to comply may result in death, severe personal injury, and/or equipment damage.

Consider the replacement of all worn parts. See preventive maintenance scheduling located in **Appendix B**.



Inspect and/or replace all worn and defective parts on a timely basis. Failure to comply, may result in minor personal injury and/or equipment damage.

3.26 Suspension

3.261 Crane Hook Eye and Crane Hook Eye Pins

Components must be inspected weekly for distortion, deterioration, grooves and cracks. Damaged parts or parts with wear exceeding 10% of the original dimension, must be replaced.

3.262 Bails and Trunnions

The bail and trunnion of the ladle must also be inspected periodically for distortion, deterioration, grooves and cracks. Damaged parts that are severely distorted or warped must be replaced.

3.263 Trunnion Shafts

Trunnion shafts must be inspected periodically for distortion, deterioration, grooves and cracks. Worn or damaged parts must be repaired or replaced.

3.2 Inspection (continued)

3.264 ANSI Specifications

All persons concerned with installation, operation, inspection and maintenance are urged to read the current ANSI Z241.2 specifications (available from American National Standard Institute, see page 4). Repair or alteration of or to load supporting parts can be hazardous. **Modern Equipment Company** should be consulted for further information.

3.27 Refractories

All ladles are furnished without refractory in the bowls. Refractories vary in thickness, type, quality and installation methods. Please consult your refractory supplier(s) for recommendations and instructions.



Follow instructions, guidelines, and recommendation of the refractory supplier/manufacturer, requiring selection, installation, operation, maintenance, curing and preheating of lining. Failure to comply may result in explosion; which can cause death, severe personal injury, and/ or equipment damage.

Ladles are balanced for linings shown on the assembly specification. Any deviation from these specifications may result in a dangerous unbalanced condition. Refer to the ladle assembly drawing (see **Appendix E**).



Do not make any changes in refractory design, thickness, and/or density. Do not allow any slag or metal build-up to occur on the ladle shell. Failure to comply may result in death, severe personal injury, and/or equipment damage.

3.3 Repair Parts Ordering

New parts are available from **Modern Equipment Company**. Always use genuine **Modern Equipment Company** parts.



Use only **Modern Equipment Company** original or authorized replacement parts. Failure to comply may result in minor personal injury or equipment damage.

When placing a "Parts Order", please refer to part and drawing data provided in this manual, to give **Modern Equipment Company** as much information as possible (see note).

NOTE: All relevant part numbers, serial numbers, contract numbers, customer P.O. numbers, and descriptions are helpful

You are now ready to proceed with Miter Gear Replacement Instructions.

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Chapter 4.0

Miter Gear Replacement Procedure

4.1 Miter Gear Replacement Procedure for Model “A” Gearings



Always wear the required Personal Protective Equipment (PPE) (see **Appendix D**) when operating or servicing your ladle. Failure to comply may result in severe personal injury and/or equipment damage.



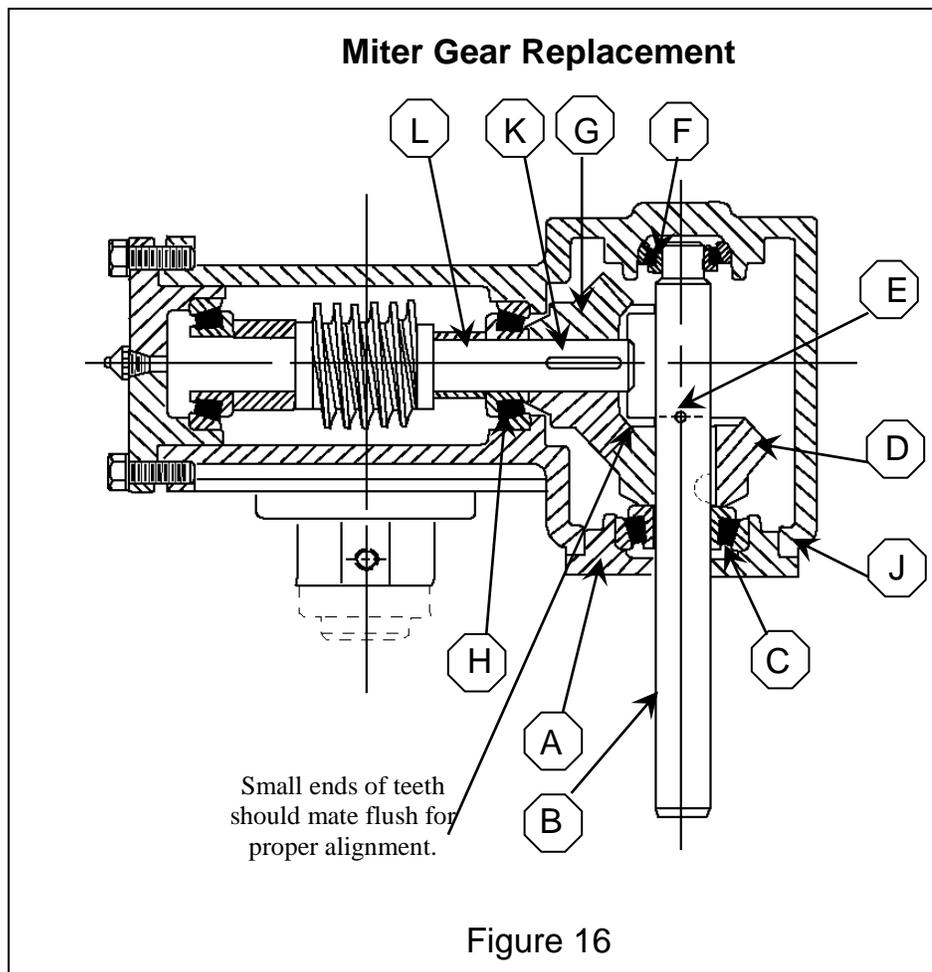
If equipped with electric drive components, disconnect electrical supply at circuit breaker, fuse, or power source before servicing. Failure to comply may result in electrical shock; which can cause death, severe personal injury and/or equipment damage.



When removing or disassembling the gearbox, the ladle must be placed on the floor. The bail should then be supported or properly braced before removing the torque bracket or disassembling the gearbox. Failure to do so could result in death, severe personal injury and/or equipment damage.

4.11 Tools Needed

No special tools are required to perform maintenance or repairs on **Modern Equipment Company** ladles or gearboxes. Standard maintenance tools will be adequate.



4.1 Miter Gear Replacement Procedure for Model “A” Gearings (continued)

Step 1: Loosen and remove the hex head cap screws (3) located in bearing cover “A” on the gear housing.



DANGER:

Do not attempt to modify any existing part of the ladle without **Modern Equipment Company’s** written permission. Failure to comply may result in death, severe personal injury, equipment damage, and/or equipment malfunction.

Step 2: Remove sub-assembly from the gear housing:

Lock Washers (3)
Bearing Cover “A”
Roller Bearings “C” (1 pair)
Shaft “B”
Miter gear “D”

Step 3: Remove miter gear “D” located on shaft “B” (see note).

NOTE: You may also refer to the ladle assembly drawing (see **Appendix E**), or the gear assembly drawing (see **Appendix H**), and the recommended spare parts lists (see **Appendices G & I**).



CAUTION:

Use only **Modern Equipment** original or authorized replacement parts. Failure to comply may result in minor personal injury or equipment damage.

Step 4: Slide replacement for miter gear “D” onto shaft “B”.

Step 5: If roll pin “E” has been removed or loosened, secure roll pin “E” into shaft “B”. Make sure both sides of pin extend 1/8” beyond shaft “B”.

Step 6: Loosen set screw located in miter gear “G”.

Step 7: Remove miter gear “G” located on shaft “L”.

Step 8: Add or remove shims from shim pack “H” between miter gear “G” and the roller bearings located on shaft “L” (see Step 15 for Miter Gear Alignment).



WARNING:

Always insert the key in the keyway when assembling or replacing gears. Failure to comply, may result in severe personal injury and/or equipment damage.

Step 9: If key “K” has been removed or loosened, secure the keyway located in shaft “L”.

Step 10: Slide replacement for miter gear “G” onto shaft “L”.

4.1 Miter Gear Replacement Procedure for Model “A” Gearings (continued)

Step 11: Tighten set screw located in miter gear “G”.

Step 12: Assemble sub-assembly consisting of:

Lock Washers (3)
Bearing Cover “A”
Roller Bearings “C” (1 pair)
Shaft “B”
Miter gear “D”



Miter gears must be properly aligned. If miter gears “D” & “G” do not properly align, shims will have to be added or removed from shim pack “H” & “F”. Failure to comply may result in severe personal injury and/or equipment damage.

Step 13: Add or remove shims from shim pack “F” between shaft “B” and the roller bearings.

Step 14: Place sub-assembly back into the gear housing.



Miter gears should mate flush as indicated in Figure 16. Failure to comply may result in severe personal injury and/or equipment damage.

Step 15: Adjust miter gears G & D so that the small ends of the teeth of both gears are flush.

If Gear “G” is improperly located shims may have to be added or removed from shim pack “H”.

If there is excessive longitudinal movement to handwheel shaft, shims may have to be added or removed from shim pack “F”.

With gears flush, the backlash should be approximately .010”. Shims may have to be added or removed from both shim packs equally to attain proper backlash and ensure that the small ends of the teeth are flush.

Step 16: Add or remove shims from shim pack “J” between gear cover “A” and the gear housing.

Step 17: Insert and tighten the hex head cap screws (3) into bearing cover “A”.



Ladle units must be lubricated after installation and according to the preventive maintenance schedule that is contained within this manual. Failure to comply may result in minor personal injury, and/or equipment damage.

Step 18: Add grease as required (see **Appendices A & B**).

4.2 Miter Gear Replacement Procedure for Model “C”, “D”, “E”, “F”, & “G” Gearings



WARNING:

Always wear the required Personal Protective Equipment (PPE) (see **Appendix D**) when operating or servicing your ladle. Failure to comply may result in severe personal injury and/or equipment damage.



DANGER:

If equipped with electric drive components, disconnect electrical supply at circuit breaker, fuse, or power source before servicing. Failure to comply may result in electrical shock; which can cause death, severe personal injury and/or equipment damage.



DANGER:

When removing or disassembling the gearbox, the ladle must be placed on the floor. The bail should then be supported or properly braced before removing the torque bracket or disassembling the gearbox. Failure to do so could result in death, severe personal injury and/or equipment damage.

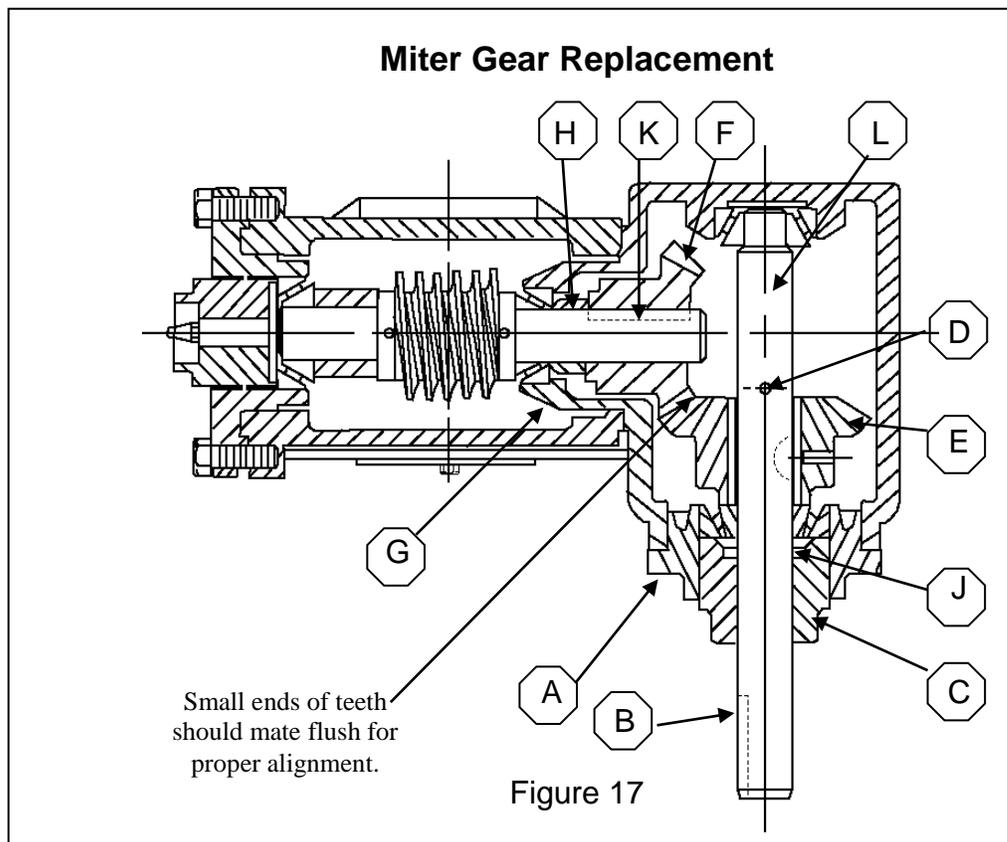
4.21 Tools Needed

No special tools are required to perform maintenance or repairs on **Modern Equipment Company** ladles or gearboxes. Standard maintenance tools will be adequate.



CAUTION:

Inspect and/or replace all worn and defective parts on a timely basis. Failure to comply, may result in minor personal injury and/or equipment damage.



4.2 Miter Gear Replacement Procedure for Model “C”, “D”, “E”, “F”, & “G” Gearings

Step 1: Loosen and remove the hex head cap screws (4) located in bearing cover “A” on the gear housing.



Do not attempt to modify any existing part of the ladle without **Modern Equipment Company's** written permission. Failure to comply may result in death, severe personal injury, equipment damage, and/or equipment malfunction.

Step 2: Remove sub-assembly from the gear housing:

Bearing Cover “A”
Adjusting Cover “C”
Lock Washers
Roller Bearings “J” (1 pair)
Shaft “B”
Miter gear “E”

Step 3: Loosen set screw located in miter gear “F”.

Step 4: Remove miter gear “F” from shaft (see note).

NOTE: You may also refer to the ladle assembly drawing (see **Appendix E**), or the gear assembly drawing (see **Appendix H**), and the recommended spare parts lists (see **Appendices G & I**).

Step 5: If you have a unit that contains spacer “G” skip to step 8. If you have a unit that does not have spacer “G” proceed to step 6.

Step 6: Remove key “K” from the keyway located in the shaft.

Step 7: Insert spacer “G” on shaft.

Step 8: Add or remove shims from shim pack “H” between miter gear “F” and spacer “G” located on the shaft (see Step 18 for gear alignment).



Always insert the key in the keyway when assembling or replacing gears. Failure to comply may result in severe personal injury and/or equipment damage.

Step 9: If key “K” has been removed or loosened secure the keyway located in the shaft.



Use only **Modern Equipment** original or authorized replacement parts. Failure to comply may result in minor personal injury or equipment damage.

4.2 Miter Gear Replacement Procedure for Model “C”, “D”, “E”, “F”, & “G” Gearings

Step 10: Slide replacement for miter gear “F” onto the shaft as far as possible.

Step 11: If you have a unit that has a tapered pin through miter gear “E” remove the pin.

Step 12: Locate hole “D” on Illustration 2485-1066-1. Drill a 3/16” diameter hole for pin “D” 90 to the keyway and through shaft “B”.

Step 13: Remove miter gear “E” located on shaft “B” (see note).

NOTE: You may also refer to the ladle assembly drawing (see **Appendix E**), or the gear assembly drawing (see **Appendix H**), and the recommended spare parts lists (see **Appendices G & I**).

Step 14: Insert roll pin “D” into shaft “B”. Make sure both sides of pin extend 1/8” beyond shaft “B”.

Step 15: Assemble sub-assembly consisting of:

Bearing Cover “A”
Adjusting Cover “C”
Lock Washers
Roller Bearings “J” (1 pair)
Shaft “B”
Miter gear “E”

Step 16: Place sub-assembly back into the gear housing.



Miter gears should mate flush as indicated in Figure 17. Failure to comply may result in severe personal injury and/or equipment damage.

Step 17: Add or remove shims from shim pack “L” between shaft “B” and roller bearings.

Step 18: Adjust miter gears E & F so that the small ends of the teeth of both gears are flush.

If Gear “F” is improperly located shims may have to be added or removed from shim pack “H”.

If there is excessive longitudinal movement to handwheel shaft, shims may have to be added or removed from shim pack “L”.

With gears flush, the backlash should be approximately .010”. Shims may have to be added or removed from both shim packs equally to attain proper backlash and ensure that the small ends of the teeth are flush.

Step 19: Adjust nut “C” by turning clockwise or counter clockwise, until smooth operation is obtained.

4.2 Miter Gear Replacement Procedure for Model “C”, “D”, “E”, “F”, & “G” Gearings

Step 20: Insert and tighten the hex head cap screws (4) into bearing cover “A”.



Ladle units must be lubricated after installation and according to the preventive maintenance schedule that is contained within this manual. Failure to comply may result in minor personal injury, and/or equipment damage.

Step 21: Add grease as required (see **Appendices F & H**).

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Appendix A - Recommended Lubricant

Product Information	
Aluminum Complex	
EP1 & EP2	
Thickening Agent	Aluminum Benzoate Stearate
Color	Dark Amber
Bulk Appearance	Smooth
Consistency	Buttery
Worked Penetration at 77°F, ASTM D-217	325 - 335 = EP1 265 - 295 = EP2
Drop Point Average	475 - 500°F
NLGI Grade	1 or 2
Oxidation Stability 100 Hours at 210°F	5 Maximum
Flash Point °F	425°F
Separation	NIL
Water Resistance	Excellent
Mineral Oil	
Viscosity at 210°F SUS	75 - 90
Viscosity at 100°F SUS	800 - 1200
Preferred Gear Lubricant: Allex EP-1	
Equivalentents	
ENCO	Nebula EP-1
Shell	Alvania EP-1
Standard Oil	Ryon EP-2
Texaco	Novatex EP-1
Recommended Supplier	Moraine Liquid Technologies 1212 W. 2 nd St. Oconomowoc, WI 53066 262-567-7523

Oil Center Research, Inc.
 PO Box 51871
 Lafayette, Louisiana

Appendix B

Preventive Maintenance Schedule

Preventive Maintenance Schedule		
<i>Per Procedures Outlined in Chapter 3.0</i>		
Daily Check	Date	Comments or Action Taken
Tighten all loose bolts		
Tighten loose handwheel		
Bail Lock - Check for proper operation		
Visual Inspection of Bail Assembly		
Check tilt operation for proper operation before filling with molten metal		
Weekly Check	Date	Comments or Action Taken
Lubrication on all grease fittings		
Crane Hook Eye		
Crane Hook Eye Pins		
Periodically Check	Date	Comments or Action Taken
Internal inspection of gears for wear and lubricate as necessary		
Internal inspection of bearings for wear and lubricate as necessary		
Internal inspection of bushings for wear and lubricate as necessary		
Trunnion Shafts		
Trunnion Shaft Keys		
Vertical Bail Arms		
Bail Cross Member		
Non-destructive test of components per current ANSI Z241.2 specification		

Appendix C

Recommended Clothing and Personal Protective Equipment

[American Foundrymen's Society - 10-Q-June '98 (revised 9-8-98)]

Recommended Clothing and Personal Protective Equipment (PPE) for Metal Melting and Pouring Operations

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RECOMMENDED CLOTHING AND PERSONAL PROTECTIVE EQUIPMENT (PPE) FOR METAL MELTING AND POURING OPERATIONS

I. Clothing A. Ferrous (Iron / Steel) Foundries

Potential Hazards and Considerations	Comments	Universal ^(a)	Application Specific ^(b)
<p><u>Hazards:</u></p> <ul style="list-style-type: none"> Burns from physical contact with molten metal splash, molten metal runout, spills, sparks, flames, hot surfaces. Burns and heat stress from exposure to radiant heat. <p><u>Considerations:</u></p> <ul style="list-style-type: none"> Amount of metal in furnace, ladle, and/or mold. Temperature of the metal or hot surface. The level of the metal and area of body that could be impacted by a splash, runout, sparks, flames, or hot surfaces. 	<ol style="list-style-type: none"> Amount of metal will affect the amount of radiant heat and quantity of metal, melted or poured, that could impact the body. Refer to ASTM F1002 and request to see the results of the ASTM F955 test for the specific fabric. Wear pants or leggings that cover the top of the boot to prevent molten metal and sparks from entering the boot. Never tuck pant legs inside the boot. If laced boots are worn, wear spats or leggings that cover the laces whenever molten metal or sparks could lodge in the tongue area. Do not wear Nomex because molten metal tends to stick to the fabric. Do not wear polyester, nylon, and other manmade materials that can melt and readily ignite. Long pants are required and long sleeve shirts are recommended. Wear clothing that does not trap molten metal and sparks, i.e. no cuffs, open pockets, loose legging tops, etc. Maintain all clothing in serviceable condition. No holes, rips or tears. Wear types of PPE in any combination to protect body parts that are exposed to heat or metal splatter as determined by the hazard assessment (HA). Consider heat stress when selecting clothing. 	<p><u>Socks and Undergarments:</u></p> <ul style="list-style-type: none"> 100% cotton <p><u>Outergarments</u> [©]</p> <ul style="list-style-type: none"> Treated wool Treated FR cotton 100% untreated cotton 100% untreated wool 	<p><u>Materials:</u></p> <ul style="list-style-type: none"> Aluminized Kevlar Aluminized cotton Leather FR cotton Wool Aluminized leather Aluminized wool <p>Types of PPE:</p> <ul style="list-style-type: none"> Coats Jackets Aprons Cape, sleeve(s) and bib Leggings Chaps Spats
<p><u>Abbreviations:</u></p> <ul style="list-style-type: none"> FR = Flame retardant PPE - personal protective equipment HA = hazard assessment (Refer to OSHA 29 CFR 1910.132) ASTM = American Society for Testing and Materials ASTM F1002 = Standard Performance Specification for Protective Clothing for Use By Workers Exposed to Specific Molten Substances and Related Thermal Hazards ASTM F955 = Standard Test Method for Evaluating Heat Transfer Through Materials for Protective Clothing Upon Contact With Molten Substances 		<p>^(a) recommended clothing for all melting and pouring operations</p> <p>^(c) other fabrics which are acceptable as determined by ASTM F1002 may also be worn</p>	<p>^(b) appropriate for the severity of the hazard; some operations may not require specific clothing beyond the universal requirements.</p>

RECOMMENDED CLOTHING AND PERSONAL PROTECTIVE EQUIPMENT (PPE) FOR METAL MELTING AND POURING OPERATIONS

I. Clothing
B. Non-Ferrous (Copper Base) Foundries

Potential Hazards and Considerations	Comments	Universal ^(a)	Application Specific ^(b)
<p><u>Hazards:</u></p> <ul style="list-style-type: none"> Burns from physical contact with molten metal splash, molten metal runout, spills, sparks, flames, hot surfaces. Burns and heat stress from exposure to radiant heat. <p><u>Considerations:</u></p> <ul style="list-style-type: none"> Amount of metal in furnace, ladle, and/or mold. Temperature of the metal or hot surface. The level of the metal and area of body that could be impacted by a splash, runout, sparks, flames, or hot surfaces. 	<ol style="list-style-type: none"> Amount of metal will affect the amount of radiant heat and quantity of metal, melted or poured, that could impact the body. Refer to ASTM F1002 and request to see the results of the ASTM F955 test for the specific fabric. Wear pants or leggings that cover the top of the boot to prevent molten metal and sparks from entering the boot. Never tuck pant legs inside the boot. If laced boots are worn, wear spats or leggings that cover the lacings whenever molten metal or sparks could lodge in the tongue area. Do not wear phosphorus treated cotton or Nomex because molten metal tends to stick to the fabric. Do not wear polyester, nylon, and other manmade materials that can melt and readily ignite. Long pants are required and long sleeve shirts are recommended. Wear clothing that does not trap molten metal and sparks, i.e. no cuffs, open pockets, loose legging tops, etc. Maintain all clothing in serviceable condition. No holes, rips or tears. Wear types of PPE in any combination to protect body parts that are exposed to heat or metal splatter as determined by the hazard assessment (HA). Consider heat stress when selecting clothing. 	<p><u>Socks and Undergarments:</u></p> <ul style="list-style-type: none"> 100% cotton <p><u>Outer Garments</u> [®]</p> <ul style="list-style-type: none"> Treated wool 100% untreated cotton 100% untreated wool 	<p><u>Materials:</u></p> <ul style="list-style-type: none"> Aluminized Kevlar Aluminized cotton Leather Wool Aluminized leather Aluminized wool <p>Types of PPE:</p> <ul style="list-style-type: none"> Coats Jackets Aprons Cape, sleeve(s) and bib Leggings Chaps Spats
<p>Abbreviations:</p> <ul style="list-style-type: none"> PPE - personal protective equipment HA = hazard assessment (Refer to OSHA 29 CFR 1910.132) ASTM = American Society for Testing and Materials ASTM F1002 = Standard Performance Specification for Protective Clothing for Use By Workers Exposed to Specific Molten Substances and Related Thermal Hazards ASTM F955 = Standard Test Method for Evaluating Heat Transfer Through Materials for Protective Clothing Upon Contact With Molten Substances 		<p>^(a) recommended clothing for all melting and pouring operations</p> <p>^(c) other fabrics which are acceptable as determined by ASTM F1002 may also be worn</p>	<p>^(b) appropriate for the severity of the hazard; some operations may not require specific clothing beyond the universal requirements.</p>

RECOMMENDED CLOTHING AND PERSONAL PROTECTIVE EQUIPMENT (PPE) FOR METAL MELTING AND POURING OPERATIONS

I. Clothing C. Aluminum Foundries

Potential Hazards and Considerations	Comments	Universal ^(a)	Application Specific ^(b)
<p><u>Hazards:</u></p> <ul style="list-style-type: none"> Burns from physical contact with molten metal splash, molten metal runout, spills, sparks, flames, hot surfaces. Burns and heat stress from exposure to radiant heat. <p><u>Considerations:</u></p> <ul style="list-style-type: none"> Amount of metal in furnace, ladle, and/or mold. Temperature of the metal or hot surface. The level of the metal and area of body that could be impacted by a splash, runout, sparks, flames, or hot surfaces. 	<ol style="list-style-type: none"> Amount of metal will affect the amount of radiant heat and quantity of metal, melted or poured, that could impact the body. Refer to ASTM F1002 and request to see the results of the ASTM F955 test for the specific fabric. Wear pants or leggings that cover the top of the boot to prevent molten metal and sparks from entering the boot. Never tuck pant legs inside the boot. If laced boots are worn, wear spats or leggings that cover the lacings whenever molten metal or sparks could lodge in the tongue area. Do not wear phosphorus treated cotton or Nomex because molten metal tends to stick to the fabric. Do not wear polyester, nylon, and other manmade materials that can melt and readily ignite. Long pants are required and long sleeve shirts are recommended. Wear clothing that does not trap molten metal and sparks, i.e. no cuffs, open pockets, loose legging tops, etc. Maintain all clothing in serviceable condition. No holes, rips or tears. Wear types of PPE in any combination to protect body parts that are exposed to heat or metal splatter as determined by the hazard assessment (HA). Consider heat stress when selecting clothing. 	<p><u>Socks and Undergarments:</u></p> <ul style="list-style-type: none"> 100% cotton <p><u>Outer Garments</u> [®]</p> <ul style="list-style-type: none"> Treated wool 100% untreated cotton 100% untreated wool Vinex 	<p><u>Materials:</u></p> <ul style="list-style-type: none"> Aluminized Kevlar Aluminized cotton Leather FR cotton without phosphorus Wool Aluminized leather Aluminized wool <p>Types of PPE:</p> <ul style="list-style-type: none"> Coats Jackets Aprons Cape, sleeve(s) and bib Leggings Chaps Spats
<p><u>Abbreviations:</u></p> <ul style="list-style-type: none"> FR = Flame retardant PPE - personal protective equipment HA = hazard assessment (Refer to OSHA 29 CFR 1910.132) ASTM = American Society for Testing and Materials ASTM F1002 = Standard Performance Specification for Protective Clothing for Use By Workers Exposed to Specific Molten Substances and Related Thermal Hazards ASTM F955 = Standard Test Method for Evaluating Heat Transfer Through Materials for Protective Clothing Upon Contact With Molten Substances 		<p>^(a) recommended clothing for all melting and pouring operations</p> <p>^(c) other fabrics which are acceptable as determined by ASTM F1002 may also be worn</p>	<p>^(b) appropriate for the severity of the hazard; some operations may not require specific clothing beyond the universal requirements.</p>

RECOMMENDED CLOTHING AND PERSONAL PROTECTIVE EQUIPMENT (PPE) FOR METAL MELTING AND POURING OPERATIONS

II. Eye Protection (All Metals)

Potential Hazards and Considerations	Comments	Universal	Application Specific ^(b)
<p><u>Hazards:</u></p> <ul style="list-style-type: none"> Eye injuries from foreign bodies, burns and/or infrared and ultraviolet radiation. <p><u>Considerations:</u></p> <ul style="list-style-type: none"> High temperature surfaces may emit infrared radiation. Electric arc may emit ultraviolet radiation. 	<ol style="list-style-type: none"> ANSI Z87.1 contains eye protection specification. Use the appropriate darker glasses for intense radiant energy. 	<ul style="list-style-type: none"> Safety Glasses with side protection 	<ul style="list-style-type: none"> Goggles Face Shield Tinted Glasses: <p><u>Iron</u> Shade #3 - #5 Green</p> <p><u>Steel</u> Shade #8 Green or Shade #6 Cobalt Blue</p> <p><u>Brass</u> Shade #3 - #5 Green or Shade #3 Green with #3 Aluminized Face Shield or Shade #6 Cobalt blue (half-lenses)</p> <p><u>Aluminum</u> Clear, No-Tint</p>
<p><u>Abbreviations:</u></p> <ul style="list-style-type: none"> ANSI = American National Standards Institute ANSI Z87.1 = Practice for Occupational and Educational Eye and Face Protection 			<p>^(b) appropriate for the severity of the hazard; some operations may not require specific clothing beyond the universal requirements.</p>

III. Face Protection (All Metals)

Potential Hazards and Considerations	Comments	Universal	Application Specific ^(b)
<p><u>Hazards:</u></p> <ul style="list-style-type: none"> Facial injuries from burns and/or infrared and ultraviolet radiation. <p><u>Considerations:</u></p> <ul style="list-style-type: none"> High temperature surfaces may emit infrared radiation. Electric arc may emit ultraviolet radiation 	<ol style="list-style-type: none"> Use tinted acrylic for infrared and ultraviolet radiation. Wear safety glasses with side shield along with face protection. 	Not Applicable	<ul style="list-style-type: none"> Full face shield, materials; acrylic or #40 wire mesh
			<p>^(b) appropriate for the severity of the hazard; some operations may not require specific clothing beyond the universal requirements.</p>

RECOMMENDED CLOTHING AND PERSONAL PROTECTIVE EQUIPMENT (PPE) FOR METAL MELTING AND POURING OPERATIONS

IV. Head Protection (All Metals)

Potential Hazards and Considerations	Comments	Universal	Application Specific ^(b)
<u>Hazards:</u> <ul style="list-style-type: none"> Injuries from falling objects, moving equipment and/or overhead obstructions. Burns from physical contact with molten metal splash, sparks, flames and/or hot surfaces. 	<ol style="list-style-type: none"> Use hard-hats that meet ANSI Z89.1. Cotton or wool caps may provide protection where metal splatter may contact head. 	Not applicable	<ul style="list-style-type: none"> Hard hat Cotton cap Wool cap
<u>Abbreviations:</u> <ul style="list-style-type: none"> ANSI - American National Standards Institute ANSI Z89.1 - Protective Headwear for Industrial Workers 			^(b) appropriate for the severity of the hazard; some operations may not require specific clothing beyond the universal requirements.

V. Foot Protection (All Metals)

Potential Hazards and Considerations	Comments	Universal	Application Specific ^(b)
<u>Hazards:</u> <ul style="list-style-type: none"> Injuries from falling or rolling objects, molten metal spill, burns from hot surfaces. 	<ol style="list-style-type: none"> Foot protection meets ANSI Z41. If metatarsals are worn select built in design or wear spats or leggings that cover areas where molten metal or sparks could lodge. A 6" or 8" "engineers boot" is recommended. If lace boots are worn, wear spats or leggings that cover the lacings whenever molten metal or sparks could lodge in the tongue area. Wear pants or leggings that cover the top of the boot to prevent molten metal and sparks from entering the boot. Never tuck pant legs inside the boot or spat. Do not use shoes with zippers or materials such as nylon, which could melt or ignite. 	<ul style="list-style-type: none"> Leather safety shoe, smooth toe. 	<ul style="list-style-type: none"> Metatarsal safety shoe
<u>Abbreviations:</u> <ul style="list-style-type: none"> ANSI - American National Standards Institute ANSI Z41 - Personal Protection - Protective Footwear 		^(a) recommended foot protection for all melting and pouring operations	^(b) appropriate for the severity of the hazard; some operations may not require specific clothing beyond the universal requirements.

RECOMMENDED CLOTHING AND PERSONAL PROTECTIVE EQUIPMENT (PPE) FOR METAL MELTING AND POURING OPERATIONS

VI. Hand Protection (All Metals)

Potential Hazards and Considerations	Comments	Universal	Application Specific ^(b)
<u>Hazards:</u> <ul style="list-style-type: none"> Burns from physical contact with molten metal splash, sparks, flames and/or hot surfaces. Scrapes, cuts and abrasions 	<ol style="list-style-type: none"> Consider need for dexterity and grip security when operating equipment. Consider the gauntlet type glove, if there is no change of metal being spilled into the glove. Do not wear Nomex or phosphorus (FR) treated cotton gloves, molten metal tends to stick to the fabric. 	Not applicable	<u>Materials:</u> <ul style="list-style-type: none"> Leather Cotton Wool Kevlar Wool Lined Kevlar Other Heat Resistant Materials <u>Types of PPE:</u> <ul style="list-style-type: none"> Mitts Cover Mitts Cover Pads Gloves
<u>Abbreviations:</u> <ul style="list-style-type: none"> FR - Flame Retardant PPE - Personal Protective Equipment 			^(b) appropriate for the severity of the hazard; some operations may not require specific clothing beyond the universal requirements.

VII. Hearing Protection (All Metals)

Potential Hazards and Considerations	Comments	Universal	Application Specific ^(b)
<u>Hazards:</u> <ul style="list-style-type: none"> Hearing loss due to noise exposure. 	<ol style="list-style-type: none"> Refer to OSHA 1910.95 for Hearing Conservation requirements. Be aware that foam ear plugs of urethane materials may be combustible. 	Not applicable	<ul style="list-style-type: none"> Ear Plugs Ear Muffs
<u>Abbreviations:</u>			^(b) appropriate for the severity of the hazard; some operations may not require specific clothing beyond the universal requirements.

RECOMMENDED CLOTHING AND PERSONAL PROTECTIVE EQUIPMENT (PPE) FOR METAL MELTING AND POURING OPERATIONS

VIII. Notes:

1. These charts should be used as a guide to select appropriate PPE to protect your employees from identified or anticipated hazards during furnace tending and/or metal pouring.
2. PPE requirements should be based on a hazards assessment as required by OSHA 29 CFR 1910.132. Each job should be evaluated.
3. PPE needed at any particular time is dependent on the task at hand and will vary over time. Periodic review is needed.
4. Consider engineering controls longer handles, trip carts, scrap inspection, preheat or remote automatic pouring.