

Guidelines for Aluminum Scrap Receiving and Inspection Based on Safety and Health Considerations

Second Edition

The Aluminum Association

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Guidelines for Aluminum Scrap Receiving and
Inspection Based on Safety and Health Considerations



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GUIDELINES FOR ALUMINUM SCRAP RECEIVING AND INSPECTION BASED ON SAFETY AND HEALTH CONSIDERATIONS Second Edition

These *Guidelines* have been developed by the Aluminum Association's Task Force on Scrap Charging with review and comment by the Institute of Scrap Recycling Industries (ISRI).

The *Guidelines* are based on information believed to be reliable and are offered in good faith but without any guarantee. The conditions which exist in individual plants vary widely, and thus no uniformly applicable standards exist for handling scrap aluminum. Accordingly, the Aluminum Association and its member companies assume no responsibility or liability for the general applicability of the guidelines and recommendations herein, which though based on state-of-the-art knowledge may not be appropriate in all situations. Users of these *Guidelines* should adapt the recommendations herein, as appropriate, to the precise conditions of the individual facility and should always exercise independent discretion in establishing plant or facility operating practices.

No warranty, expressed or implied, is made of this information by the Aluminum Association or by any of its member companies.

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I. INTRODUCTION

A. Purpose of these *Guidelines*

These *Guidelines* have been prepared and published with the aim of helping aluminum scrap remelters prevent accident and injury due to moisture and contamination in scrap, and of promoting the cooperation and understanding of all scrap suppliers, transporters and handlers in preventing such incidents. Incidents have been reported of explosions caused by contamination from fertilizer or water being charged into a furnace. Eruptions of molten metal from melting furnaces have been caused by containers of water being charged.

The Aluminum Association recognizes that different scrap remelters may have different facilities, equipment and procedures and may, therefore, adopt a variety of safety practices appropriate to their individual circumstances.

In presenting these *Guidelines*, the Association does not either suggest or intend that all aluminum scrap remelters should adopt and follow them completely and without deviation. Some plants may find some of these *Guidelines* inapplicable to their operations; others may adopt alternative or different safety practices not mentioned here in response to their individual circumstances. These *Guidelines* are entirely safety-related and are not intended to provide commercial advice or guidance of any kind.

The *Guidelines*, then, offer information and suggestions derived from general industry experience for the consideration of individual plants in designing and operating their own scrap-remelting safety programs.

All remelting plant and other scrap-handling personnel are expected to follow the safety- and health-related procedures established by their own plant managements. These *Guidelines* are not intended to pre-empt or replace those procedures.

B. Scope

Solid bulk aluminum is a very safe noncombustible metal, but molten aluminum and aluminum powder can be highly reactive — capable of releasing large amounts of energy in chemical reactions. Water, nitrates and other oxidizers can cause devastating explosions if charged into a furnace that already holds molten aluminum.

Various heavily oxidized metals can combine with molten aluminum in a potentially serious thermite reaction; flammable materials can catch fire. Radioactive materials, PCBs and certain other toxic substances can endanger the health of both scrapyard and remelting plant workers. Aluminum “fines” — granulated or powdered aluminum — can explode if mixed with air in the presence of an ignition source. Even live ammunition has been discovered in aluminum scrap!

General safety practices are discussed in the Aluminum Association's *Guidelines for Handling Molten Aluminum, Third Edition*, but hazards of the sort described above must be prevented before aluminum scrap reaches the remelting furnace.

Consequently, the following guidelines deal with practices intended to keep water and other contaminants out of aluminum scrap destined for remelting; to discover water and contaminants in incoming aluminum scrap; to remove water and contaminants from incoming scrap when possible; and to reject and report unacceptably contaminated scrap.

C. Overview

Section II begins the *Guidelines* themselves by discussing safety-related aspects of aluminum scrap purchase orders and specifications. Clear, comprehensive purchase orders and specifications help to avoid confusion, to discourage the delivery of scrap containing unacceptable contamination, and to make inspection more effective.

Section III identifies the major types of contamination which may be found in aluminum scrap and outlines the hazards each of them presents to human health and safety.

Section IV discusses preparedness: some types of equipment, facilities, procedures and aids which may enhance the effectiveness of scrap reception, inspection and handling from the safety standpoint.

Section V suggests general guidelines for dealing with scrap found or suspected to contain dangerous or unknown powders, radioactivity, excessive water or other unacceptable safety-related contaminants.

Section VI suggests guidelines for safety-related inspections which may be performed before incoming scrap is unloaded.

Section VII discusses a more complete range of safety-related scrap testing and visual inspections which can be performed during and after unloading. It notes the importance of breaking open bales and other scrap assemblages for internal inspection. It also suggests a final inspection inside the cargo area of the delivery vehicle after the scrap has been unloaded, as an additional check for signs of contamination.

Certain types of scrap contamination — particularly nitrates and fertilizers containing nitrates, phosphates, and other oxidizing agents — cannot be charged safely into furnaces containing molten aluminum, and cannot be reliably removed from scrap. We are not aware of any method for safe use of such scrap in an aluminum remelting plant. Other types of contaminated scrap may also be rejected by remelting plants, depending upon each plant's capabilities and procedures.

Section VIII describes the Aluminum Association's Molten Metal Incident Reporting Program in which reports of incidents worldwide are collected and analyzed, with reports and timely alerts issued to the participants. It is open to all molten aluminum handlers. This cooperative reporting system helps companies identify causes and patterns of incidents and, as a result, improve their safety practices.

Section IX describes The Aluminum Association's Scrap Rejection Notification Program in which loads of scrap rejected for reasons of safety or health are reported to the Association by telefax. The reports are quickly reviewed and transmitted to all participating plants to apprise them of a rejected load and the reason for rejection.

Finally, Section X refers the reader to other publications for additional information related to safety and health aspects of aluminum scrap remelting.

II. SAFETY-RELATED SCRAP SPECIFICATIONS AND PURCHASE ORDERS

A. Aluminum scrap purchase specifications

In order to minimize scrap contamination problems it is often helpful for aluminum scrap purchasing specifications to clearly define:

1. Acceptable scrap description which is understood by both buyer and seller.
2. Unacceptable or restricted scrap contents, which, for example, may include but are not limited to:
 - a. Fertilizers and other materials containing nitrates, sulfates or other oxidizing agents; salt fluxes contaminated with nitrates, sulfates or oxidizers; and any unknown powder.
 - b. Water, snow or ice in excess of plant processing capabilities.
 - c. Volatile substances in excess of plant processing capabilities.
 - d. Closed containers, crimped tubing, aerosol cans, automobile air bag inflation cartridges, ammunition cartridges, fire extinguishers, freon tanks, oxygen and acetylene cylinders, detonators and similar objects.
 - e. Aluminum fines in excess of plant processing capabilities.
 - f. Heavily oxidized metal in excess of plant treatment capabilities.
 - g. Hydrocarbons (e.g. oil, flammable liquids) in excess of plant processing capabilities.
 - h. PCBs or other toxic materials at levels which constitute or create a health hazard.
 - i. Radioactive materials.
 - j. Aluminum-lithium alloys unless specified.

NOTE: Certain forms of aluminum scrap, such as borings, turnings, saw chips, fines, pit cleanings, etc., which contain oil and water, should not be mixed with other scrap unless specified. Extreme care must be taken in processing these forms of scrap.

B. Aluminum scrap purchase orders

Should:

1. Specify acceptable packaging, container and transport vehicle.
2. Specify required protection against moisture and other contamination.
3. Define required scrap specifications using industry standard nomenclature and terminology.
4. Specify required insurance coverage.

C. Scrap shipment documentation

Should include:

1. Scrap purchase order and specifications.
2. Scrap identification tagging.
3. Bill of Lading.
4. Manifest.
5. Up-to-date Material Safety Data Sheet (MSDS) if not previously provided.

III. SCRAP-RELATED HEALTH AND SAFETY HAZARDS

Water, nitrates and a wide variety of other materials and objects have the potential to cause explosions, fires and other serious threats to life, health and property, if they are carried by scrap into molten aluminum.

Careful scrap inspection, storage and, where appropriate, preparation, are vital to prevent molten metal incidents and other mishaps.

A number of the most significant types of aluminum scrap contamination are listed here with brief descriptions of the hazards they pose if charged into molten aluminum:

A. Nitrates, sulfates, oxidizers, fertilizers, and unknown powders or residues

Explosion hazard; risk of burns, physical injury, death, severe property damage. These are probably the most hazardous contaminants which can be put into a furnace. Even the small amount of powder residue that may remain after washing may be enough to cause an explosion.

Also, salt fluxes which should in principle be harmless may be difficult to distinguish from nitrates, sulfates and oxidizers, and may have become contaminated with them. Therefore, they should be treated like any unknown powder, unless known to be safe.

B. Water, snow or ice entrapped in scrap, sows or pigs

Explosion hazard ranging from “pops” to major explosions; risk of burns, physical injury, death, severe property damage.

Aluminum sows or pigs may contain hidden water in internal cavities.

C. Volatile substances

Potential explosion and fire hazards; risk of burns, physical injury, potential exposure to toxic fumes, death, severe property damage.

Volatile substances are those which vaporize readily at ordinary temperatures. The most common volatiles are oils and other liquids.

The hazard posed specifically by volatiles is that they may vaporize and expand forcefully if immersed in molten metal, causing a non-chemical “explosion” which may splash molten metal out of the furnace and possibly trigger a chemical explosion if the volatiles are flammable and/or an aluminum mist is created.

D. Closed containers, crimped tubing, aerosol cans, automobile air bag inflation cartridges, ammunition cartridges or detonators and similar objects

Explosion hazard, potential exposure to toxic fumes; risk of burns, physical injury, health effects, death, severe property damage.

Closed containers, crimped tubing, beverage cans or bottles, radiators, heat exchangers and other “traps” in scrap may conceal hazardous amounts of water or other volatile liquids capable of causing explosions.

Containers may also hold flammable or toxic materials.

Live ammunition and explosive detonators have occasionally been discovered in aluminum scrap, posing obvious hazards to all scrap workers who handle it.

Aerosol cans, fire extinguishers, automobile air bag inflation cartridges and similar closed containers may contain gases or chemicals capable of explosive expansion in the heat of a molten aluminum bath.

Even if chemical explosion is not likely, such gas-expansion explosions can splash molten metal out of a furnace, threatening nearby workers.

E. Aluminum “fines”

Aluminum-powder explosion hazard; risk of burns, physical injury, death, severe property damage.

While bulk aluminum is non-combustible, finely divided aluminum can burn or explode very forcefully when concentrated and mixed with air or a chemical oxidizing agent. The presence of aluminum fines, generated by machining, grinding or crushing processes presents a possible hazard if conditions are present in which they may be concentrated and become airborne and may be ignited.

F. Heavily oxidized metals

1. Explosion hazard due to absorbed or chemically bonded water; risk of burns, physical injury, death, severe property damage.
2. Thermite reaction hazard: chemical reaction generating very high temperatures and extreme release of heat; risk of burns, death; risk of secondary explosion with severe injury and property damage.

G. Oil, grease or other hydrocarbons

Fire hazard: risk of burns, smoke inhalation, and equipment damage.

H. PCBs, PCB-contaminated oils or other toxic materials:

1. PCB (polychlorinated biphenyls)

Direct skin contact hazard; risk of adverse health effects. Can be concentrated by fume-collection equipment.

2. Heavy metals, including selenium, lead, cadmium

Release or generation of toxic fumes by furnace heat; risk of adverse health effects. Can be concentrated by fume collection equipment.

I. Radioactive materials

1. Risk of exposure of nearby personnel to unshielded radioactive materials in all stages of the operation.
2. Risk of release of shielded radioactive material upon melting in a furnace, exposing furnace workers and others.

Radiation-exposure hazard; risk of adverse health effects.

J. Aluminum-lithium alloys

Aluminum-lithium alloys present particular health and safety considerations and require specialized handling and processing for safe remelting.

Improper procedures with aluminum-lithium may increase the risk of molten metal-water explosions and may expose workers to health hazards from certain lithium compounds which may form at elevated temperatures.

For further information, refer to *Safety, Health and Recycling Aspects of Aluminum-Lithium Alloys, Publication T-4*, by the Aluminum Association.

K. Unbalanced or improperly loaded or transported scrap

Falling or shifting load hazard; risk of impact or crushing injuries.

Exposure to sharp edges of scrap; risk of cuts and penetration injuries.