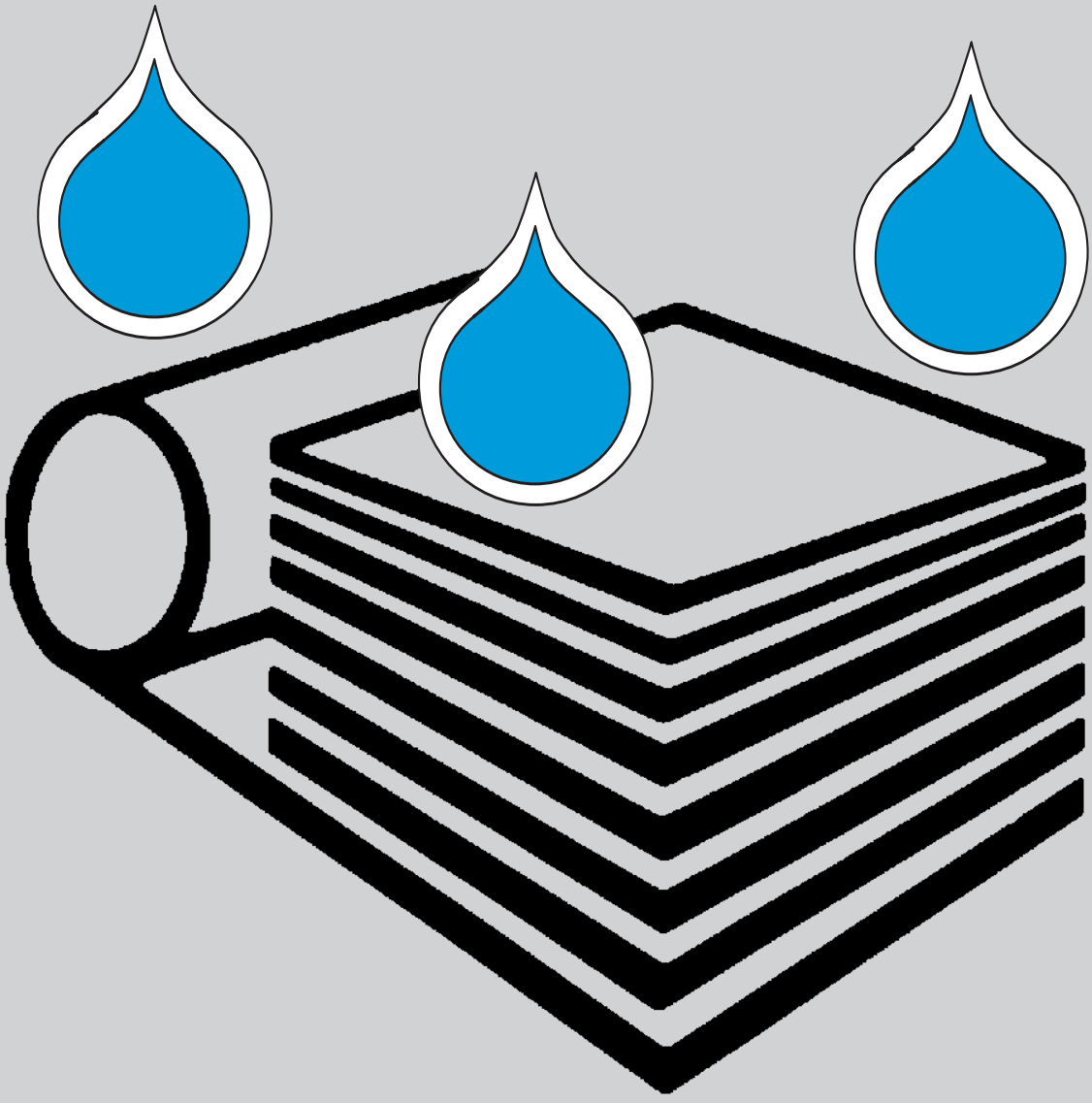
Guidelines for Minimizing Water Staining of Aluminum

The Aluminum Association
Incorporated



TR3

Guidelines for Minimizing Water Staining of Aluminum

The 2004, fourth edition has been revised through the support of the Technology Committee of the Sheet and Plate Division.

ALUMINUM ASSOCIATION SHEET AND PLATE DIVISION COMPANIES

Alcan Inc.
Alcoa Inc.
AMAG Rolling GmbH
ARCO Aluminum, Inc.
Coastal Aluminum Rolling Mills, Inc.
Corus Aluminium Rolled Products, USA
Gulf Aluminium Rolling Mill Co.
Jupiter Aluminum Corporation
Kaiser Aluminum and Chemical Corporation
Logan Aluminum, Inc.
Nichols Aluminum
Ormet Corporation
Pechiney Rolled Products
United Aluminum Corporation
Wise Metals Group

About The Aluminum Association

The Aluminum Association, based in Washington, DC with offices in Detroit, MI, represents U.S. and foreign-based primary producers of aluminum, aluminum recyclers and producers of semi-fabricated products as well as suppliers to the industry. Member companies operate almost 200 plants in North America and many conduct business worldwide.

NOTICE

Disclaimer

The use of any information contained herein by any member or non-member of The Aluminum Association is entirely voluntary. The Aluminum Association has used its best efforts in compiling the information contained in this book. While the Association believes that its compilation procedures are reliable, it does not warrant, either expressly or implied, the accuracy or completeness of this information. The Aluminum Association assumes no responsibility or liability for the use of the information herein.

All Aluminum Association published standards, data, specifications and other technical materials are reviewed and revised, reaffirmed or withdrawn. Users are advised to contact The Aluminum Association to ascertain whether the information in this publication has been superseded in the interim between publication and proposed use.

The Aluminum Association
Incorporated
900 19th Street, N.W., Washington, D.C. 20006
www.aluminum.org

FOURTH EDITION, JANUARY 2004

Guidelines for Minimizing Water Staining of Aluminum

Contents

1. Introduction 4
2. Causes of Water Stain 4
   A. External Sources 4
   B. Moisture Condensation 4
3. Packaging 7
4. Inspection Procedures 7
5. Prevention 8
6. Conclusion 8

Appendices

1. Aluminum Water Stain Prevention 9
2.A. Instrument Suppliers 10
2.B. Suppliers of Water Indicator Labels 10
2.C. Suppliers of Water Stain Preventatives 10

1. Introduction

Aluminum is naturally attractive and resistant to corrosion. Unlike most other metals, it takes care of itself. When exposed to dry or moist air it combines with oxygen to form a tough, transparent, protective oxide coating. In the presence of moisture, aluminum will not rust as will steel, but under certain conditions aluminum will stain. Such stains are usually found objectionable for esthetic reasons; they have no significant effect on strength but may cause processing problems where additional surface finishing or fabrication is to be performed. Virtually all staining problems occur during shipping, handling, or storage. Some of the incorrect practices that result in water staining and ways to minimize or avoid the staining are discussed in this pamphlet. A summary of the measures to minimize water staining is provided in Appendix 1 and is reproduced as a handy wall chart, which is included with this pamphlet. Copies of the chart may be obtained from The Aluminum Association.

2. Causes of Water Stain

Aluminum and other metals can stain when water is trapped between wraps, sheets or other mating surfaces. If there is no air flow to remove the water, prolonged contact between the water and the metal causes a reaction between the two which results in water stain. Figures 1 and 2 show examples of water staining on aluminum coiled and flat sheet, respectively. There are two main sources of this water:

A. External Sources

Obvious sources are rain, snow and water leaks. Water coming in contact with the surface of the aluminum from sources such as a leaking tarp on a truck or a leaking roof in a storage area has the potential for causing water stain.

B. Moisture Condensation

This is the more complex of the two sources and therefore harder to understand and control. Air normally contains moisture in the form of invisible water vapor. Relative humidity, expressed as a percentage, provides a measure of the amount of water vapor actually in the air compared to the total amount of water vapor that the air can hold. As the temperature of air increases, its capacity to hold water vapor increases.

Dew point is the temperature at which water vapor from the air begins to condense and is affected by the relative humidity and temperature of the air. The dew point can be determined from a chart (see Table 1), based on simple measurements of air temperature and relative humidity. The type of instrument used to measure (and log) temperature and relative humidity is shown in Figure 3. The older style of thermometers containing mercury should not be used because mercury from broken thermometers can corrode aluminum and other metals. Some suppliers of these instruments are listed in Appendix 2.A.



Figure 1 – Water Stain on Coil

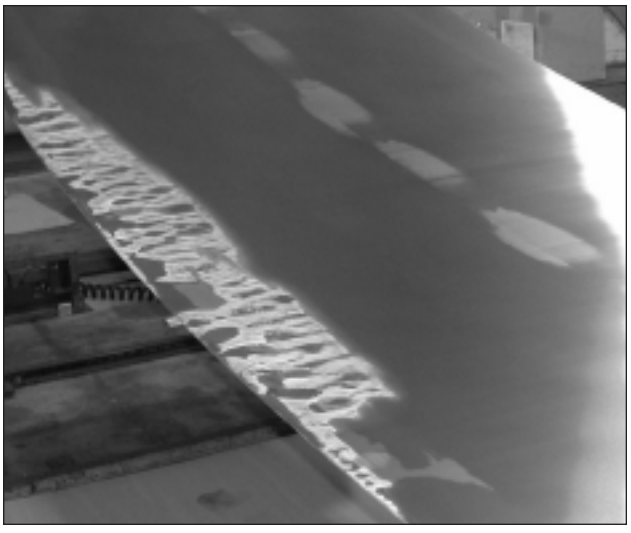


Figure 2 – Water Stain on Sheet