

## TABLE OF CONTENTS

|                                                                          |            |
|--------------------------------------------------------------------------|------------|
| <b>FOREWORD</b> .....                                                    | <b>iii</b> |
| <b>LAGGING TASK FORCE</b> .....                                          | <b>iv</b>  |
| <b>NOTICE TO USERS OF THIS PUBLICATION</b> .....                         | <b>v</b>   |
| <b>TABLE OF CONTENTS</b> .....                                           | <b>vii</b> |
| <br><b>CHAPTER 1 INTRODUCTION</b>                                        |            |
| 1.1 INTRODUCTION .....                                                   | 1.1        |
| 1.2 SCOPE .....                                                          | 1.1        |
| 1.3 USES .....                                                           | 1.1        |
| 1.4 TERMS AND DEFINITIONS .....                                          | 1.1        |
| 1.5 PURPOSE .....                                                        | 1.1        |
| 1.6 OVERVIEW .....                                                       | 1.2        |
| 1.7 COMMON LAGGING MATERIALS .....                                       | 1.2        |
| <br><b>CHAPTER 2 MATERIALS</b>                                           |            |
| 2.1 ENVIRONMENTAL CONSIDERATIONS .....                                   | 2.1        |
| 2.2 LAGGING SUPPORT SYSTEMS (STRUCTURAL) .....                           | 2.2        |
| 2.3 EXPANSION AND CONTRACTION .....                                      | 2.15       |
| 2.4 JOINT & EDGE SEALING .....                                           | 2.15       |
| 2.5 NOISE AND SOUND CONTROL .....                                        | 2.15       |
| 2.6 FLAT SHEET VS. BOX RIB .....                                         | 2.18       |
| 2.7 WEIGHT .....                                                         | 2.20       |
| <br><b>CHAPTER 3 ACCEPTED INDUSTRY PRACTICES FOR SHEET METAL LAGGING</b> |            |
| 3.1 INTRODUCTION .....                                                   | 3.1        |
| 3.2 GENERAL APPLICATION TECHNIQUES .....                                 | 3.1        |
| 3.3 LEGEND .....                                                         | 3.2        |
| 3.4 LOCKS AND SEAMS .....                                                | 3.4        |
| 3.5 TANKS (SHELLS AND HEADS) .....                                       | 3.7        |
| 3.6 ROUND AND RECTANGULAR FLUE AND DUCT .....                            | 3.11       |
| 3.7 PENETRATIONS .....                                                   | 3.20       |
| 3.8 JOINTS AND SEALS .....                                               | 3.23       |
| 3.9 FLASHING .....                                                       | 3.28       |
| 3.10 DOORS AND OPENINGS .....                                            | 3.41       |
| 3.11 PRE-INSULATED LAGGING PANELS .....                                  | 3.49       |
| 3.12 BUCKSTAYS .....                                                     | 3.52       |
| 3.13 SPECIALTIES .....                                                   | 3.57       |



**CHAPTER 4    GUIDE SPECIFICATION**

4.1    INTRODUCTION ..... 4.1

4.2    DRAWINGS ..... 4.1

4.3    SEISMIC RESTRAINT PROVISIONS ..... 4.1

4.4    GUIDE SPECIFICATION ..... 4.1

**GLOSSARY ..... G.1**

**INDEX ..... I.1**



**TABLES**

1-1 Galvanized Steel Gages, Thickness and Weights ..... 1.3

1-2 Stainless Steel Gages, Thickness and Weights ..... 1.4

1-3 Aluminum Thickness and Weights ..... 1.6

2-1 Typical Wind Loading vs. Support Spacing for Sheet Metal Lagging ..... 2.12

2-2 Area Weight of Lagging ..... 2.20



## FIGURES

|                                                      |      |
|------------------------------------------------------|------|
| 2-1 Example of an H-Bar System .....                 | 2.3  |
| 2-2 Example of a Z-Bar System .....                  | 2.4  |
| 2-3 Example of a Stud and Drive Plate System .....   | 2.5  |
| 2-4 Example of a Pin and Sub-Girt System .....       | 2.7  |
| 2-5 Single Span Lagging Support .....                | 2.9  |
| 2-6 Double Span Lagging Support .....                | 2.11 |
| 2-7 "Hat Bar" or "Hat Channel" Sub-Girt .....        | 2.13 |
| 2-8 Typical Sheet Metal Screw .....                  | 2.14 |
| 2-9 Acoustical Insulation and Lagging System .....   | 2.17 |
| 2-10 Types of Ribbed Lagging .....                   | 2.19 |
| 3-1 Legend .....                                     | 3.3  |
| 3-2 Locks and Seams .....                            | 3.5  |
| 3-3 Tank (Shell & Head) .....                        | 3.8  |
| 3-4 Tank Head .....                                  | 3.9  |
| 3-5 Round Duct .....                                 | 3.12 |
| 3-6 Rectangular Duct .....                           | 3.13 |
| 3-7 Round Tee .....                                  | 3.14 |
| 3-8 Round Tee (continued) .....                      | 3.15 |
| 3-9 Round Elbow .....                                | 3.16 |
| 3-10 Round Elbow (continued) .....                   | 3.17 |
| 3-11 Square to Round Transition .....                | 3.18 |
| 3-12 Square to Round Transition (continued) .....    | 3.19 |
| 3-13 Penetration with Horizontal Movement .....      | 3.21 |
| 3-14 Boxed Opening .....                             | 3.22 |
| 3-15 Lap and Butt Joints .....                       | 3.24 |
| 3-16 Expansion Joint, Non-Metallic .....             | 3.25 |
| 3-17 Fabric Expansion Joint .....                    | 3.26 |
| 3-18 Weatherproof Metal Expansion Joint .....        | 3.27 |
| 3-19 Corner Closure on Rectangular Surface .....     | 3.29 |
| 3-20 Corner Closure on Curved Surface .....          | 3.30 |
| 3-21 Corner Construction .....                       | 3.31 |
| 3-22 Vertical Inside Corner Construction .....       | 3.32 |
| 3-23 Corner Construction at Horizontal Overlap ..... | 3.33 |
| 3-24 Corner Construction at Vertical Outside .....   | 3.34 |
| 3-25 Corner Construction at Vertical Inside .....    | 3.35 |
| 3-26 Horizontal to Vertical Inside Corner .....      | 3.36 |
| 3-27 Vertical Outside Corner .....                   | 3.37 |
| 3-28 Drip Detail .....                               | 3.38 |
| 3-29 Flashing at Slope .....                         | 3.39 |

## FIGURES (continued)

|                                                                         |      |
|-------------------------------------------------------------------------|------|
| 3-30 Flashing at Stiffener .....                                        | 3.40 |
| 3-31 Sootblower and Small Pipe Protrusions .....                        | 3.42 |
| 3-32 Test Port .....                                                    | 3.43 |
| 3-33 Access Door .....                                                  | 3.44 |
| 3-34 Covered Access Door .....                                          | 3.45 |
| 3-35 Header Box .....                                                   | 3.46 |
| 3-36 Louver .....                                                       | 3.47 |
| 3-37 Access Door In Lagging .....                                       | 3.48 |
| 3-38 Pre-Insulated Panel System .....                                   | 3.50 |
| 3-39 Sloped Top Surface and Vertical Pre-Insulated Lagging Panels ..... | 3.51 |
| 3-40 Lagging Construction Over Buckstays .....                          | 3.53 |
| 3-41 Plan View at Corners of Buckstays .....                            | 3.54 |
| 3-42 Vertical Buckstay with Lagging Cover .....                         | 3.55 |
| 3-43 Horizontal Buckstay with Lagging Cover .....                       | 3.56 |
| 3-44 Lagging at Hopper .....                                            | 3.58 |
| 3-45 Hopper Outlet Flange Detail .....                                  | 3.59 |



*THIS PAGE INTENTIONALLY LEFT BLANK*

## **CHAPTER 1**

# **INTRODUCTION**



## 1.1 INTRODUCTION

## 1.2 SCOPE

This document contains accepted practices for the fabrication and installation of sheet metal lagging. This document serves to establish standard methods to fabricate and install sheet metal lagging systems. *This document does not provide designs nor does it address safety issues.*

While it is not practical to include every conceivable lagging detail, most common situations are addressed. As in the case of all design, construction and installation procedures, proper engineering judgment must be exercised in conjunction with the specific engineering and detail information being furnished by the designer.

## 1.3 USES

Lagging is used to cover and protect insulated areas of equipment. Fabrication practices are provided herein to illustrate the requirements of the configurations most commonly encountered such as boiler walls, flues, ducts, precipitators, bag houses, selective catalytic reduction systems, air heaters, economizers, scrubbers, wind boxes, fans, etc. and to provide sufficient examples that reflect industry practices for lagging design and application. Although standardized components of any given lagging design may be representative of industry practices, the lagging system itself shall be individually designed for the particular installation, its configurations and its operating requirements.

## 1.4 TERMS AND DEFINITIONS

### 1.4.1 Glossary

See the Glossary for a complete list of terms and definitions related to sheet metal lagging.

### 1.4.2 Selected Terms and Definitions

#### 1.4.2.1 Lagging

A sheet material, typically steel or aluminum, used to cover a variety of types of insulation. Sheet metal lagging ranges in thickness from 20 gage (1.01 mm) to 16 gage (1.61 mm) for galvanized steel and 0.032 in. (0.81 mm) to 0.063 in. (1.60 mm) for aluminum, and

generally does not include a vapor barrier. Both ribbed and flat sheets are used. Thinner or thicker materials may be selected at the discretion of the specifier. All sheet metal lagging shall be sufficiently strong and durable to protect the underlying materials for the design life of the lagging.

#### 1.4.2.2 Cladding

An ambiguous and arcane term also sometimes used to describe sheet materials that cover insulation. In the sheet metal industry, “cladding” has traditionally referred to a protective metallic coating installed over, or bonded directly to, thermal insulation. This is primarily with applications involving round industrial duct.

A 1999 SMACNA survey of members revealed multiple and potentially confusing uses of terms that varied by region. For the purposes of this document, the term “cladding” will not be employed, and in the interests of unifying the industry’s terminology, “lagging” will be used exclusively in this and future SMACNA publications.

#### 1.4.2.3 Jacketing

A light gage covering material (usually over pipe insulation). Jacketing refers to a steel or aluminum sheet and ranges in thickness from 0.010 inch (0.26 mm) to 0.024 inch (0.61 mm) thick. A factory-applied moisture barrier is usually included on the back or underside of the jacketing material.

#### 1.4.2.4 Casing

If the thickness of the steel covering material is greater than 16 gage (1.61 mm), it is *not* considered lagging but is referred to as “casing”.

## 1.5 PURPOSE

The purpose of this document is to establish accepted industry practices for sheet metal lagging construction and installation. Lagging, as previously defined, is the material, typically steel or aluminum, ribbed or flat, used to cover insulation especially on large flat surfaces such as boiler walls, flues, ducts, precipitators, bag houses, selective catalytic reduction systems, air heaters, economizers, scrubbers, wind boxes, fans, etc.