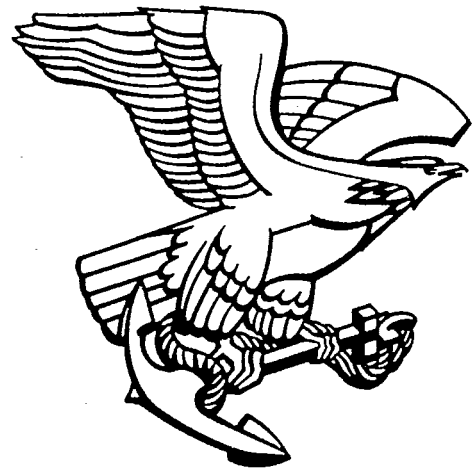




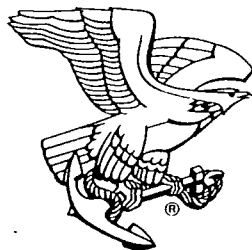
Guidance
Manual for

Material Selection and Inspection of Inert Gas Systems

1980

American Bureau of Shipping

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Foreword

This Manual is intended to summarize available information on the suitability of various materials for the many components of inert gas systems used on board merchant ships, and incidental information relating to maintenance, inspection, and testing. This information is based on a review of available technical literature, discussions with inert gas system manufacturers, and comments from the ABS Special Committee on Ship Operations and its Ad Hoc Committee on Inert Gas Systems. The document is intended to describe the state of the art as reported to the Bureau and should not be construed as an expression of ABS recommendation or preference.

The Bureau has established a program to acquire further information relative to the service performance of various materials in inert gas systems and expects to include the results of this study in a future revision of this Manual.

Guidance Manual for Material Selection and Inspection of Inert Gas Systems

1.0 Introduction

1.1 General

This Manual is intended to provide information relative to the selection, maintenance, inspection and testing of materials for inert gas systems using flue gas derived from ships' boilers. Separate gas generating plants which generally use low sulphur fuels have less corrosive environments and some of the comments contained herein may not be applicable.

1.2 Application

This Manual should be applied in conjunction with a careful assessment of the conditions associated with the particular design and maintenance schedule of the inert gas system under consideration, so that the guidelines can be applied to establish requirements for the expected service conditions.

1.3 Flue Gas Composition

This Manual is based upon a typical flue gas composition as shown below. It is expected that minor variation could be expected in operation.

Gas	% Vol. ¹
N ₂	80
CO ₂	12-14
O ₂	2-4 ²
SO ₂	0.2-0.3 ³
CO	Traces
NO	Traces
Water Vapor & Solid Particles	Remainder

Notes

- 1 It is recommended that the oxygen content of the flue gas be kept as low as possible by good combustion control in ships' boilers since higher oxygen content increases the corrosion of materials in the inert gas system.
- 2 The oxygen content of the flue gas may increase under the following conditions.

Poor combustion control at the boiler especially under part boiler load conditions.
Air being drawn down the uptake when boiler flue gas output is less than the inert gas blower demand especially under part boiler load conditions.
- 3 The sulphur dioxide content would vary depending upon the sulphur content of the fuel burnt.

1.4 Corrosion

The corrosion resistance of a particular alloy may be adversely affected by fabrication processes such as forming or welding. Some materials may also be susceptible to stress corrosion, particularly when the unit is not operating. When using dissimilar metals, the possible adverse effects of galvanic corrosion should be considered.

1.5 Maintenance

The units of the inert gas system should be located in such a way that inspection and repair work may be easily accomplished.

2.0 General Characteristics of Materials

2.1 Nonmetallic Materials and Nonmetallic Lined Materials

2.1.1 Overheating Rubber and fiberglass reinforced plastic (FRP) are degraded by exposure to elevated temperatures. Accordingly, special precautions should be taken to prevent such exposures. These precautions may provide for precooling of gases or suitable controls to prevent hot gas flow. To avoid inadvertent overheating, the outside surface of rubber or FRP lined pipe or chambers should be clearly marked to indicate "Welding or Heating not Permitted on this Surface".

2.1.2 Erosion or Vibration The use of materials lined with rubber or FRP should be avoided under conditions where they may be eroded by high velocity flows of air or water. For some applications, excessive vibration has been reported as a cause of damage of the bond to the underlying material.

2.1.3 Coating Soundness Particular care should be taken to assure the attainment and maintenance of an unbroken coating with a satisfactory bond in rubber or FRP coated materials during manufacture, installation, maintenance and inspection. The use of coating soundness tests such as spark testing should be considered. Close attention should be given to avoid coating failures since such failures are usually not detected until severe damage has occurred and such failures may not be easily repaired under field conditions.

2.1.4 Epoxy Paints and Tars Materials coated with epoxy paints or epoxy tars may be susceptible to erosion damage and peeling from minor surface flaws. These coatings are generally not considered as durable as rubber or FRP lined materials and should only be considered if appropriate supporting data is available to indicate their suitability for the intended service application. However, some instances where these coatings have proven to be satisfactory are indicated in 5.0. Zinc silicate paints are reported to exhibit excessive corrosion rates in acidic environments.

2.2 Ferrous Materials

2.2.1 Cast Iron These materials are considered generally satisfactory for inert gas valves, but should not be used without suitable linings or protective coatings in environments where acidic soot may accumulate.