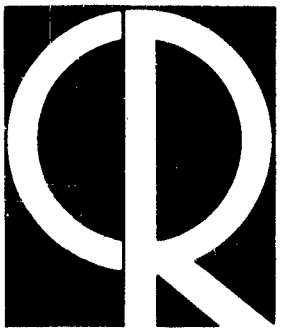
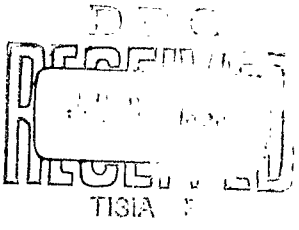
N-63-4-3

AFCRL-63-78
MARCH 1963



Research Note



Epoxy Vacuum Seal for Introduction of Leads Into Cryogenic Equipment

HERBERT G. LIPSON
LIONEL O. BOUTHILLETTE

ELECTRONIC MATERIAL SCIENCES LABORATORY PROJECT 4608
AIR FORCE CAMBRIDGE RESEARCH LABORATORIES, OFFICE OF AEROSPACE RESEARCH, UNITED STATES AIR FORCE, L.G. HANSCOM FIELD, MASS.

Requests for additional copies by Agencies of the Department of Defense, their contractors, and other government agencies should be directed to the:

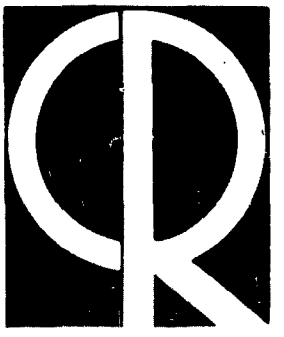
Defense Documentation Center
Arlington Hall Station
Arlington 12, Virginia

Department of Defense contractors must be established for DDC services, or have their 'need-to-know' certified by the cognizant military agency of their project or contract.

All other persons and organizations should apply to the:

U.S. DEPARTMENT OF COMMERCE
OFFICE OF TECHNICAL SERVICES,
WASHINGTON 25, D.C.

AFCRL-63-78
MARCH 1963



Research Note

Epoxy Vacuum Seal for Introduction of Leads Into Cryogenic Equipment

HERBERT G. LIPSON
LIONEL O. BOUTHILLETTE

ELECTRONIC MATERIAL SCIENCES LABORATORY PROJECT 4608
AIR FORCE CAMBRIDGE RESEARCH LABORATORIES, OFFICE OF AEROSPACE RESEARCH, UNITED STATES AIR FORCE, L.G. HANSCOM FIELD, MASS.

Abstract

A vacuum-tight replaceable seal for the introduction of thermocouple or electrical leads into cryogenic equipment is described. This seal which produces no thermal emf's at the junctions is easily constructed from commercially available parts with epoxy cement.

Contents

Epoxy Vacuum Seal for Introduction of Leads Into Cryogenic Equipment

1. INTRODUCTION

A vacuum-tight replaceable seal for the introduction of thermocouples or electrical leads into cryogenic equipment, for example, evacuated metal dewar systems, can be fabricated from commercially available parts using epoxy cement. This method requires no machining of O-ring tracks or compression screws, and it has been used in systems at pressures below 10^{-6} mm Hg.

The presence of a thermal gradient across a glass-to-metal seal used to bring thermocouple wires out of metal cryogenic equipment can produce additional thermal voltages if an electrical connection is made at the seal. Interruption of the wire by a dissimilar metal, such as a solder[1] or passage of the wire through a seal of the hollow metal lead type with soldering at both ends,[2] can produce these voltages. A thermal gradient may be present even if the outside junctions of a glass-to-metal seal appear to be at room temperature, since radiation exchange with the cold walls of the refrigerant container may keep the inside junctions at lower temperature.

Submitted for publication 18 January 1963.

2. PROCEDURE

To make a vacuum-tight, replaceable seal without making electrical contact, a thermocouple wire is first scraped clean of insulation and coated with a thin layer of epoxy cement over the length of the hollow tube insert of a glass-to-metal header. After the cement has hardened, the wire is passed through the insert and vacuum sealed by filling the ends of the tube with another coating of epoxy cement. A satisfactory cement for this purpose is a mixture of three parts of Hysol 6020 resin to one part Hysol 6020 hardener C.[3]

Figure 1 shows a schematic diagram of an easily constructed vacuum-tight assembly which has given reliable results over a long period of use. The leads are shown inserted through a multiple header of the Stupakoff standard type[4] and sealed with epoxy cement. The header is cemented to a brass pipe with Glyptal 1201 red enamel[5] which is soluble in acetone for easy removal and interchange of lead arrangements. The use of a vacuum coupling such as a Veeco quick coupling[6] as an entrance port makes it possible to insert lead assemblies, window arrangements, or other equipment into cryogenic apparatus without the machining of O-ring grooves and bolt assemblies. If a single diameter brass pipe is used with a larger vacuum coupling instead of the two-section pipe shown in Figure 1, no specially machined parts are necessary for assembly of the lead arrangement.

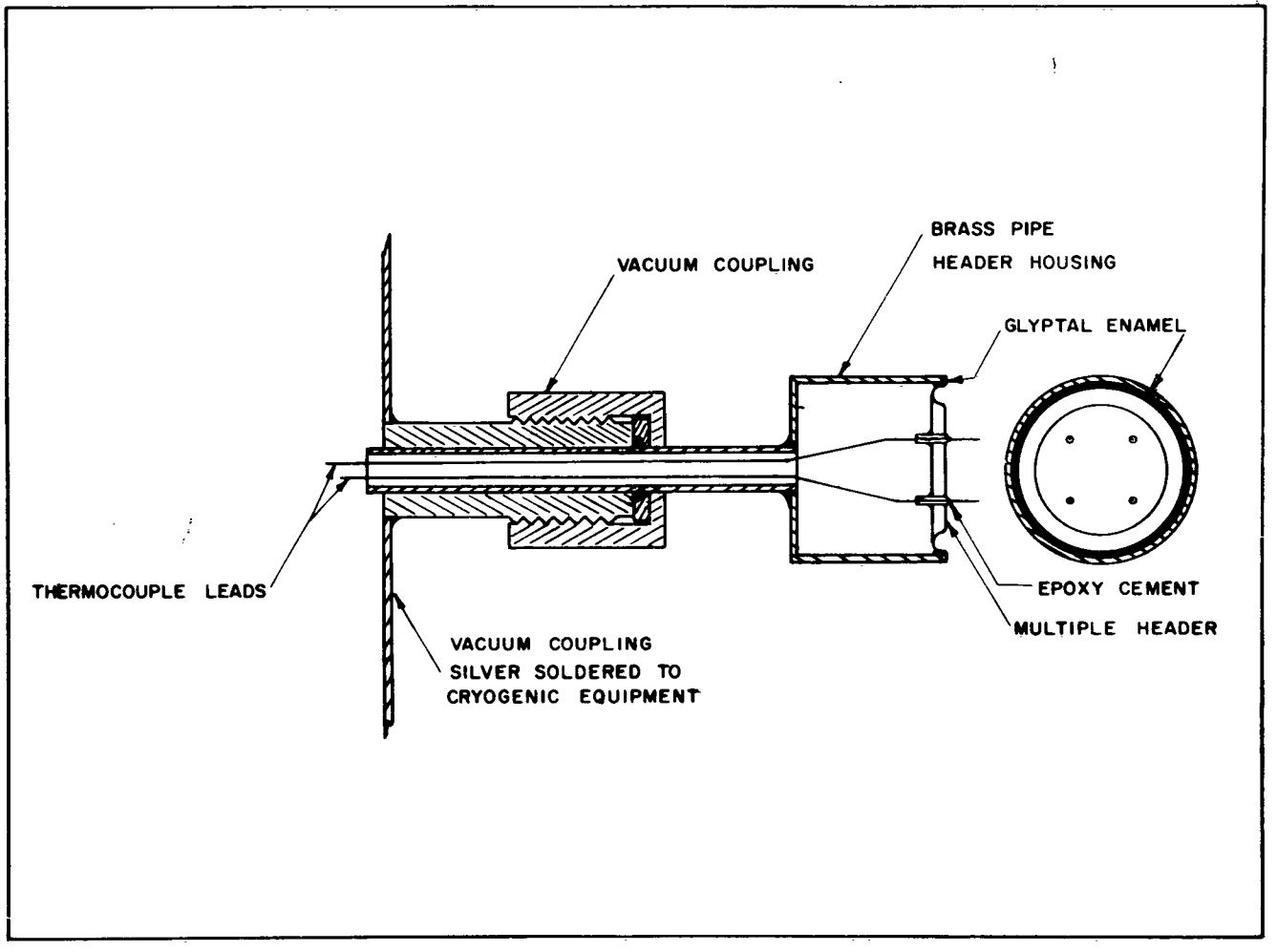


Figure 1. Schematic Diagram of Epoxy Cement Vacuum-seal Assembly for Introduction of Leads into Cryogenic Equipment.

References

1. R. B. Scott, Cryogenic Engineering, D. Van Nostrand Company, Inc., Princeton, New Jersey, 1959.
2. J. A. Stamper, Rev. Sci. Instr. 33, 461 (1962).
3. Houghton Laboratories, Inc., Olean, New York.
4. Stupakoff Ceramic and Manufacturing Company, Latrobe, Penn.
5. General Electric Insulating Materials Dept., Schenectady, New York.
6. Veeco Vacuum Corp., Plainview, New York.

UNCLASSIFIED

AF Cambridge Research Laboratories, Bedford, Mass.
EPOXY VACUUM SEAL FOR INTRODUCTION OF LEADS INTO CRYOGENIC EQUIPMENT, by H. G. Lipson and L. O. Bouthillette. January 1963. 6 pp. incl. illus. (Project No. 4608) AFCRL No. 63-78 Unclassified report

A vacuum-tight replaceable seal for the introduction of thermocouple or electrical leads into cryogenic equipment is described. This seal which produces no thermal emf's at the junctions is easily constructed from commercially available parts with epoxy cement.

1. Cryogenics
2. Vacuum seals

I. Lipson, H. G.
II. Bouthillette, L. O.

UNCLASSIFIED

UNCLASSIFIED

AF Cambridge Research Laboratories, Bedford, Mass.
EPOXY VACUUM SEAL FOR INTRODUCTION OF LEADS INTO CRYOGENIC EQUIPMENT, by H. G. Lipson and L. O. Bouthillette. January 1963. 6 pp. incl. illus. (Project No. 4608) AFCRL No. 63-78 Unclassified report

A vacuum-tight replaceable seal for the introduction of thermocouple or electrical leads into cryogenic equipment is described. This seal which produces no thermal emf's at the junctions is easily constructed from commercially available parts with epoxy cement.

1. Cryogenics
2. Vacuum seals

I. Lipson, H. G.
II. Bouthillette, L. O.

UNCLASSIFIED

UNCLASSIFIED

AF Cambridge Research Laboratories, Bedford Mass.
EPOXY VACUUM SEAL FOR INTRODUCTION OF LEADS INTO CRYOGENIC EQUIPMENT, by H. G. Lipson and L. O. Bouthillette. January 1963. 6 pp. incl. illus. (Project No. 4608) AFCRL No. 63-78 Unclassified report

A vacuum-tight replaceable seal for the introduction of thermocouple or electrical leads into cryogenic equipment is described. This seal which produces no thermal emf's at the junctions is easily constructed from commercially available parts with epoxy cement.

1. Cryogenics
2. Vacuum seals

I. Lipson, H. G.
II. Bouthillette, L. O.

UNCLASSIFIED

UNCLASSIFIED

AF Cambridge Research Laboratories, Bedford, Mass.
EPOXY VACUUM SEAL FOR INTRODUCTION OF LEADS INTO CRYOGENIC EQUIPMENT, by H. G. Lipson and L. O. Bouthillette. January 1963. 6 pp. incl. illus. (Project No. 4608) AFCRL No. 63-78 Unclassified report

A vacuum-tight replaceable seal for the introduction of thermocouple or electrical leads into cryogenic equipment is described. This seal which produces no thermal emf's at the junctions is easily constructed from commercially available parts with epoxy cement.

1. Cryogenics
2. Vacuum seals

I. Lipson, H. G.
II. Bouthillette, L. O.

UNCLASSIFIED