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(**THE CONVECTIVE HEAT TRANSFER**
BIBLIOGRAPHY)

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Science and Technology Division
Library of Congress
Washington, D. C.*

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THE CONVECTIVE HEAT TRANSFER BIBLIOGRAPHY

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FOREWORD

This report has been prepared by the Science and Technology Division, Library of Congress, as a task under Delivery Order No. D. O. 33(657)-63-388 and previous Orders, which covered the compilation of a bibliography and index on the subject of convective heat transfer. The work has been carried out under the direction of the Materials Information Branch, Materials Applications Division, Air Force Materials Laboratory, with John H. Charlesworth, MAAM, as project monitor. This is a summary technical report covering the entire task from February 1961 through August 1967.

The compilation of the Convective Heat Transfer Bibliography was performed under the direction of Dr. Clement R. Brown, Head of the Special Bibliographies Section, with the assistance of quite a few people, most of whom are no longer at the Library of Congress. The major professional contributions were made by Joseph Enke, Jack R. Gibson, Thomas Goodwin, Peter Halpin, Thomas LaMoure, and Miss Joyce Wolfe. Clerical assistance was rendered by Mrs. Lillie Frye, Mrs. Virginia Sims, and Mrs. Beatrice Treese, and particularly Mrs. Patricia Gravatt, who typed most of the abstract cards. Our special thanks go to Mrs. Treese, Mrs. Frye and Mr. Gibson for their excellent work in coding the 2000 abstract cards for subject indexing and preparing the code listings. Finally, we are indebted to Mr. John Charlesworth of AFML for his guidance on this task and his patience in awaiting the final products.

This report has been reviewed and is approved.



EDWARD DUGGER

Chief, Materials Information Branch
Materials Applications Division
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ABSTRACT

The Convective Heat Transfer Bibliography is a compilation of 2000 references with abstracts to the monographic, periodical, and report literature issued from 1955 to 1962, on the subject of convective heat transfer and its aerospace applications. The references and abstracts have been typed on 5x8 cards. The bibliography is supplemented by a set of 2000 IBM punched cards, constituting a subject index in considerable depth to the same references, and suitable for retrieving the information in the respective abstracts. This report defines the scope of the task, outlines the bibliographic procedures followed, and describes the end products resulting from the work.

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THE CONVECTIVE HEAT TRANSFER BIBLIOGRAPHY

I. INTRODUCTION

The Convective Heat Transfer Bibliography is a compilation of 2000 references with abstracts of monographic, periodical, and report literature issued from 1955 to 1962 on the subject of convective heat transfer. It is supplemented by a set of 2000 IBM punched cards constituting a subject index in considerable depth to the same references. It was compiled by the Special Bibliographies Section of the Science and Technology Division, Library of Congress, for the Air Force Materials Laboratory, Wright-Patterson Air Force Base, Ohio, under Delivery Order (33-616)-61-05, and subsequent Delivery Orders. The IBM punched cards are intended to serve as a "satellite" subsystem to the extensive Document Retrieval System now in operation at the Aerospace Materials Information Center of AFML.

This report describes the task as originally defined and its later modifications, the scope of the literature search carried out, the characteristics of the individual reference and abstract, card, the bibliographic procedures followed, and finally the IBM cards and codes forming the subject index suitable for retrieving the information in the respective abstracts.

II. THE TASK

1. Requirements. As defined in the original Delivery Order (33-616)-61-05, this task was the compilation and indexing of a comprehensive bibliography on convective heat transfer, with abstracts. Each reference was to be typed on a 5x8 card, furnished in duplicate, serially numbered, and assigned "descriptive terms" indicating the subject matter of the reference. In addition, each of these index terms was to be key-punched on a standard 80 column IBM card, with the serial number and other identification for the given reference.

2. Previous history. Interest in the compilation of the present bibliography was engendered by the existence, in the files of the Science and Technology Division of the Library of Congress, of an incomplete compilation of several thousand unannotated references on the very broad subject of Heat Transfer. This compilation had been started under a general Office of Naval Research contract (primarily covering other services) but which was discontinued by ONR, along with other literature surveys, for budget

reasons. It was therefore originally intended to include all of those references (1938-1949) related to the subject of convective heat transfer in the present compilation, but this has not been possible as will be explained later.

3. Administrative changes. The terms, including the scope of the compilation, of Delivery Order (33-616)-61-05 were based upon an estimate of costs and time required, submitted previously by the Library of Congress. A sampling type of preliminary survey of existing literature had at that time indicated that the task would require at least three years, and a tentative annual rate of funding was suggested. This rate of funding was followed for the first two years, but before the end of two years work, it was evident that at least two more years work would be required, with an appreciable increase in funding, if LC was to cope with some 100% increase in heat transfer literature between 1958 and 1961, undoubtedly resulting from the developing interest in space travel and high-speed aircraft at that time. At the request of AFML, a revised budget was submitted in January 1963, but after several months delay, we were advised that the Air Force would be unable to furnish more than 70% of the funds requested, with no assurance of further funds in the future. This decision greatly affected the further progress of the task and was the primary reason why the task was not completed as originally planned. The resulting changes in plans and the final product will be indicated later.

III. SCOPE

1. Subject. The subject scope was well-defined in the above Delivery Order by means of an outline agreed upon by the Air Force Materials Laboratory (AFML) and the Library of Congress (LC). Both free and forced convective heat transfer, the effects of various factors, heat transfer processes involving convection, heat transfer media, heat exchangers, and heat transfer and related measurements, were to be included. Later, a "Guidance Outline," indicating in more detail which subjects were to be included, and which were to be excluded, was drawn up in a conference between representatives of AFML and LC. With few modifications, the Subject Outline and Guidance Outline have been followed carefully in searching for references throughout the task. Both are shown in Appendix I.

2. Time period to be covered. Originally it was intended to include the applicable references to literature issued from 1938 to 1949, compiled previously, and all literature published from 1950 on.

When the funds became curtailed in 1963, however, it was decided to cover as much of the literature after 1954 as possible, and hopefully to include the earlier compilation.

3. Types of literature. Monographs (books) and journal papers, in English, French, German, Russian and other languages, were to be included, together with both unclassified and classified reports. Actually, however, the bulk of the material is in English, and with few exceptions, only unclassified reports have been included. The titles and abstracts for the latter are unclassified.

IV. THE REFERENCE AND CARD

Each item in the bibliography consists of a citation, or reference, and an abstract, on a 5x8 card, with assigned index terms.

1. Citation. For books, the citation gives in this order:

Name of the first author, followed by his initials.

Names of other authors, if any, in normal order.

Title in English, in brackets if translated.

Title in original language, if other than English.

Place of publication.

Date of publication.

Number of pages.

The citation for journal articles gives:

Name of first author, and initials.

Names of other authors, if any, in normal order.

Title in English, in brackets if translated.

Title in original language, if other than English.

Name of journal, using abbreviated elements (See Appendix II).

Journal volume number, issue number, date, and full pagination of paper.

The citation for reports is similar to that being used in the Technical Abstract Bulletin, and is as follows:

Name of corporate author (Agency or contractor), giving the parent organization first, followed by the name and location of the major subdivision doing the work.

Title of the report.

Names of personal authors.

Date of report, pagination, notes on tables etc.

Contract number, if any.

Contractor's (or sponsoring agency's) report number.

Accession number in a collection (e.g., AD 191234).

Security classification.

Further identification, such as translation information, paper number in a series, etc. is frequently added.

2. Abstract. The abstract is usually of the informative type, describing the work that was done, and summarizing the principal results obtained. The author's (or contractor's) abstract has been used whenever it has been deemed adequate for the purpose of the bibliography, in which case credit is given.

3. Abstract card. Each reference and abstract has been typed on a 5x8 card, identified by a six-digit number in the upper right corner. The first two digits indicate the year of publication and the last four an "accession number" for publications of that year, assigned as the item was being processed. Open literature items (books and journal articles) were assigned numbers below 5000, while reports have numbers from 5000 up. (Some numbers were assigned to items later omitted so that for any one year some consecutive numbers may be missing.) The various subject index terms assigned to the given

reference are listed at the bottom of the card, below the abstract. In the case of lengthy abstracts, a continuation card (or cards) was used, and the index terms appear on this card.

4. Subject index terms. Every item has been assigned a number of index terms which serve to indicate all of the subjects relating to convective heat transfer and of significant importance in the given item. These subject index terms were selected from a list of about 1000 terms which had been compiled by the bibliographers and approved by the Air Force Materials Laboratory after revision. The "Alphabetical Listing of Subject Codes" (See Appendix IV) constitutes a complete list of the subject terms used, although it should be noted that in some cases the original term used on the card has been edited or elaborated in compiling the Alphabetical Listing.

V. PROCEDURE

In compiling this bibliography some seven operations were involved. These included: searching, verifying, abstracting, indexing, editing, typing, and proofreading.

1. Searching. The first step consisted of compiling as many references as possible which were tentatively judged to be pertinent to the subject on the basis of title, abstract or subject indexes, etc. The following are the principal sources which have been searched for this task:

Library of Congress card catalogs.

Engineering Index, 1949-1961.

Heat Bibliography (annual volumes issued by the Department of Scientific and Industrial Research, Great Britain)

About 50 "core" journals, cover to cover.

Various symposia, etc., on heat transfer.

Title Announcement Bulletin (original TAB), complete from 1953 to 1957.

Technical Abstract Bulletin (present TAB) from 1957 through 1961.

Various bibliographies appearing in publications already abstracted.

Many other sources, such as Chemical Abstracts and Science Abstracts, could have been searched if more time and funds had been available. As it was, a total of over 18,000 unverified references were obtained by searching. Assuming that many of these would eventually be eliminated as duplicates or not pertinent, it is obvious that had it been possible to follow the original plan, a bibliography of several thousand more items could have been compiled. In addition, there could have been some 1500 unannotated references to the 1938-1949 publications collected in the previous task, but not edited.

2. Verifying and abstracting. Every effort is made to verify references in the original, which serves to eliminate errors in the citation, to determine that the publication is pertinent to the subject, to permit the preparation of an adequate abstract, and to provide additional references to the subject. If the paper is pertinent, abstracting is done at this time, or the author's abstract is used, if adequate (See Sect. IV-2 for a description of the abstract). A total of 2800 abstracts were prepared, but it was possible to index, edit, and type only 2000 of them in the final form.

3. Indexing. In general, the assignment of the subject index terms (See Section IV-3) was made later inasmuch as it was not advisable to establish the list of index terms until at least 1000 references had been abstracted. Usually indexing was done by the editor, and has been based on the abstract rather than the complete paper.

4. Editing. Experienced personnel, thoroughly familiar with the subject, were assigned to editing both the citation and abstract, and selecting the index terms. The editing bibliographer was responsible for determining that the abstract and indexing were adequate.

5. Typing and proofreading. After editing the complete reference, abstract and index terms were typed on a 5x8 card, using an IBM proportional spacing electric typewriter, in "Charter" type. If necessary, a second and third card was used rather than type on the back of the first card. The card was then proofread, and after corrections had been made, three Xerox copies were made. Two of these were sent to AFML in sets of 1000 references each. Samples of completed cards are shown in Appendix **III**.

VI THE IBM CARD

The final phase of this task was the preparation of a master set of IBM cards with the following information:

Abstract card number
Author (or authors)
Index terms in code

1. Abstract card number. The abstract card number consists of the six digit number assigned to the reference at time of processing (See Sect. IV-3), which serves to indicate the year of publication, whether the item is a report or an "open" publication, and the accession number, prefixed by the letter C to indicate a Library of Congress abstract. This is followed by 1, 2, or 3 which indicate this is the first, second or third IBM card for this item. The first 10 columns on the IBM card are used for this identification. Examples are:

C58-0116-1
C60-5008-2

2. Author(s). Columns 12 through 32 are used for authors. For books and papers, the last name of the first author followed by his initials (without periods), and as much of the names of second and third authors, without initials but separated by spaces, as 21 columns would permit, are punched directly on the card. Thus the authors of Item no. 58-0116 are P. Fortescue and D. V. Wordsworth, which names become FORTESCUE P WORDSWORTH on the card. Anonymous publications are indicated by the first 21 letters of the title; thus the entry for "New Metals-Research and Production" becomes NEW METALS RESEARCH. Punctuation and diacritical marks are omitted.

For reports, the first 21 letters of the name of the organization producing the report are used. Thus Sylvania Electric Products, Inc., etc., becomes SYLVANIA ELECTRIC PRO. In general, commonly accepted abbreviations have been used, including acronyms such as NASA for National Aeronautics and Space Administration, WADC for Wright Air Development Center, etc.

3. Index terms in code. Each index term has been assigned a three digit (in a few cases four digit) code number and the IBM cards have been punched with the code numbers corresponding to the subjects listed on the abstract cards. For example, abstract number 58-0116 has been indexed and coded as follows:

Gas turbines	325
Regenerators	672
Heat exchangers	354
Coolants	158

These numbers appear along the top right margin of IBM card no. C58-0116-1. Columns 34 to 80 inclusive have been reserved for the subject codes, which permits a maximum of twelve three-digit codes, separated by spaces. A second IBM card, identified in the same manner as the first, except with the number 2 in column 10, has been used wherever there are more than twelve subjects and a third card for more than 24 index terms.

Since there turned out to be a total of 1031 index terms, it was necessary to assign 4-digit codes to 32 subjects. On the 24 IBM cards affected, the four-digit codes are punched first, without spaces, followed by the three-digit numbers spaced as usual. This Card number C60-0218-1 is coded 101610141030 352 488, indicating five subjects.

4. Subject code listings. Two code listings for use with the IBM master cards have been supplied. The Numerical Listing in an arrangement of all subject codes used, from 001 to 999, and from 1001 to 1032, in numerical order. The Alphabetical Listing is a list of the same subjects, in alphabetical order, with the corresponding code number in the left column. Certain characteristics of the terminology and word order used in these listings are pointed out, and a special table listing the temperature ranges corresponding to codes 795 to 805 inclusive, is included.

The following are illustrated in Appendix IV:

- (1) Sample IBM card for an open literature item showing personal author (C58-0116-1)
- (2) Sample IBM cards for a report item, showing corporate author and more than 12 subjects requiring two cards (C60-5008-1 and C60-5008-2)
- (3) Sample IBM card, using four-digit subject codes (C60-0218-1)
- (4) Subject code; numerical listing.
- (5) Subject code; alphabetical listing.
- (6) Codes for temperature ranges.

VII. SUMMARY AND CONCLUSIONS

A partial bibliography on Convective Heat Transfer, consisting of 2000 references with abstracts, to both published literature and reports issued during the period 1955 - 1962 has been compiled for the Air Force Materials Laboratory. Each reference has been subject-indexed in considerable depth, using about 1000 approved terms, based primarily on the material at hand. The reference, abstract and index terms have been typed on 5x8 abstract cards, two copies of which were delivered to the Air Force Materials Laboratory in lots of 1000 each. In addition the sponsoring agency has been supplied with a master set of over 2000 IBM cards, each identified by a number and the name of either the personal or corporate author, and punched by a series of numeric codes indicating the index terms assigned to the given reference.

APPENDIX I

a. Subject Outline

1. Heat transfer in general
2. Convection
 - (a) Theory
 - (b) Mathematics
 - (c) Natural convection
 - (d) Fluid flow with heat transfer
3. Effects of various factors
 - (a) Gravity
 - (b) Centripetal acceleration
 - (c) Pressure
 - (d) Electromagnetic forces
 - (e) Boundary conditions
 - (f) Turbulence
 - (g) Magnetic and electric fields
4. Heat transfer processes involving convection
 - (a) Boiling
 - (b) Evaporation
 - (c) Condensation
 - (d) Thermal diffusion
5. Heat transfer media
 - (a) Liquid metals
 - (b) Organic fluids
 - (c) Other fluids
 - (d) Two phase mixture
6. Heat exchangers in general
 - (a) Theory
 - (b) Design
 - (c) Operation
 - (d) Performance

7. Heat exchanger types

- (a) Boilers
- (b) Condensers
- (c) Fluid heaters
- (d) Evaporators
- (e) Cooling equipment

8. Heat transfer and related measurements

- (a) Conductivities
- (b) Emissivities
- (c) Heat transfer coefficients
- (d) Temperature
- (e) Pressure
- (f) Viscosity
- (g) Heat content
- (h) Specific heat

b. Guidance Outline

Object: Convective heat transfer with respect to fluid heat transfer media, including those which can be used as coolants and lubricants for aircraft and space vehicle power systems; also environmental heat transfer within and without the aircraft or space vehicle, including aerodynamic heating. Research, development and applications to be included.

To be included

To be omitted

I. HEAT TRANSFER IN GENERAL

Convection

Cryogenics down to temperature of liquid oxygen
(-218°C)

Conduction per se
Radiation per se
Convection only below
-218°C
1°K (Absolute zero)

To be included

To be omitted

I. HEAT TRANSFER IN GENERAL (continued)

Related fields

In any case:
Magnetohydrodynamics
(possibly)

Unless convective heat
transfer is involved:
Fluid dynamics
Reacting gas
Dissociating gas
Turbulence
Boundary layer
Mass transfer
Thermodynamics
Heat insulation

II. CONVECTION

Theory
Mathematics
Natural convection
Forced convection
Fluid flow with H.T.
to or from the fluid

Heat sources

Aerodynamic heating

Electrical induction
Radioactivity
Acoustical energy

Convection in:

Ceramics
Chemical engineering
Electrical equipment cooling
Electronic equipment cooling
Metallurgy
Nuclear physics
Physical chemistry
Physics
Refrigeration
Solar power
Waste heat utilization

Air conditioning
Biology
Chemistry in general
Household heating
Industrial heating
Medicine
Meteorology
Oceanography

To be included

To be omitted

II. CONVECTION (continued)

Specific subjects

Flow with shock wave
Entropy changes
Thermodynamics
Energy balances
Compression without
heat addition externally

III. EFFECTS OF VARIOUS FACTORS

Boundary conditions
Centripetal acceleration
Density
Dissociation-association
Electromagnetic forces
Gravity
Ionization
Pressure
Turbulence

Acoustics
Chemical reactions
Combustion
Shock waves

IV. HEAT TRANSFER PROCESSES INVOLVING CONVECTION

Boiling
Condensation
Evaporation
Fusion
Melting
Solidification
Sublimation
Supercooling
Thermal diffusion
Transpiration
Physical chemistry
aspects of changes in state

Ablation
Natural evaporation

To be included

To be omitted

V. HEAT TRANSFER MEDIA

Coolants
Liquid metals
Lubricants
Organic fluids
Steam (limited*)
Two phase mixtures
Water (limited*)

Antifreeze as such
Non-Newtonian fluids
Plasmas (outer space)
Solids in "fluid-like"
form

*omit basic thermal
properties (steam tables,
etc.)

Properties

Emissivity
Flammability
PVT relations
Specific heat
Specific volume
Thermal conductivity
Thermal diffusivity
Toxicity

Other thermodynamic
properties (entropy, etc.)
Quality of steam

VI. HEAT EXCHANGERS IN GENERAL

Theory
Design
Operation
Performance
Components
 Tubes
 Fins
 Plates

Methods of testing
Manufacture
Maintenance
Repair
Automatic control systems

1955 forward only:
Control devices:
 Temperature
 Pressure
 Flow

To be included

To be omitted

VI. HEAT EXCHANGERS IN GENERAL (continued)

Design, operation and performance factors

Resistance to fluid flow
Effects of corrosion, scale,
etc. on H.T.

1955 forward only:

Handbook data
Strength
Thermal efficiency
Thermal economy
Mechanical efficiency
Cost economy

VII. HEAT EXCHANGER TYPES

Boilers
Condensers
Cooling equipment
Evaporators
Fluid heaters
Regenerators (non-steam)
Superheaters (non-steam)

Distillation equipment
Economizers
Furnaces
Heat pumps
Heaters
Preheaters
Steam regenerators
Steam superheaters

a. Types of boilers

Water tube
Fire tube
Electric
Nuclear

Stationary (power plants)
Marine
Package

b. Types of cooling equipment

Water as coolant
Air as coolant
Vapor phase cooling
Evaporative cooling
Transpiration cooling

Spray cooling

To be included

To be omitted

VII. HEAT EXCHANGER TYPES (continued)

For power equipment only:

Oil coolers
Intercoolers
Intake charge cooling

c. Cooling applications

Aircraft engines
Gas turbines
Rocket motors

Automotive engines
Diesel engines
Machining operations

For aircraft or space
vehicles only:

Space cooling
Mechanical equipment
Electrical equipment
Electronic equipment

d. Types of fluid heaters

Gases
Organic liquids
Other H.T. media

Feedwater

e. Kinds of reference material

News items with something
revolutionary only
Descriptive material if
quantitative data are given
Reviews with H.T. data
Critical evaluations, com-
parisons, etc. of methods,
equipment, instruments

Popular material
News items in general
Short descriptive material
Descriptive material without
design or performance data

To be included

To be omitted

VIII. HEAT TRANSFER AND RELATED MEASUREMENTS

Thermal conductivity
Emissivity
Heat transfer coefficient
Temperature
Pressure
Density
Viscosity
Fluid flow
Heat content
Specific heat

a. Measurements in general

Effects of factors listed in
 III
* Errors and corrections in
 measurement
Instruments:
 *Design principles and data
 *Accessory equipment such as
 leads, circuits, indicators,
 recorders
 *Applications
 *Proper installation
 *Operation
 *Calibrating methods

Theory
Mathematics
Interpretation aids:
 Charts
 Nomographs
 Formulas
 Correction tables, etc.
Industrial equipment in
 general

b. Thermal conductivity

Data

Fluids
Heat exchanger materials

Mathematical derivations

Fluids

Solids

* For precision type laboratory
 and research instruments only

*Omit for industrial type
 of instruments

To be included

To be omitted

VIII. HEAT TRANSFER AND RELATED MEASUREMENTS (continued)

Methods of determination

Fluids

Solids

c. Emissivity

Data for fluids and solids

Total radiation

Method of measurement

d. Heat transfer coefficient

Data for all conditions
involving fluids

Data for solids

Heat exchangers omitted
in VII

Data for all types of heat
exchangers in VII

Structural elements

Methods of measurement or calcu-
lation

Derivation of formulas

e. Temperature

Range:

Liquid O₂ to over 100,000°F

Differential temperature
measurements

Calibration methods down to -80°F

Instruments

*Thermometers

*Thermocouples

*Thermopiles

*Pyrometers

*Resistance thermometers

Temperature indicating
paints and crayons

Spectroscopic methods
in general

f. Pressure

Range:

10 mm. absolute to
3000 p.s.i.

Differential pressure
measurements

Pressure due to light,
sound, etc.

To be included

To be omitted

VIII. HEAT TRANSFER AND RELATED MEASUREMENTS (continued)

Instruments

*Vacuum gages
*Manometers
*Pressure gages

g. Density (Specific volume)

Data for fluids
Temp. range as in (e)
Pressure range as in (f)

Data for solids
Method of determination

h. Viscosity

Data for Newtonian fluids
Methods of determination
Theory
Formulas

Non-Newtonian fluids

i. Fluid flow

Range:
No restrictions
Calibration methods

Instruments

*Flowmeters
*Rotameters
*Orifice meters
*Electromagnetic flowmeters

Pitot tubes
Displacement meters

Applications

*Air
*Gases
*Water
*Oil
*Organic liquids

*Precision type laboratory and
research instruments only

*Omit industrial
type instruments

To be included

To be omitted

VIII. HEAT TRANSFER AND RELATED MEASUREMENTS (continued)

j. Heat Content

Data on fluids

Data on solids
Methods of determination

k. Specific heat

Data

Fluids and solids
Both C_p and C_v

Methods of determination

Fluids

Solids

APPENDIX II

List of Abbreviated Words for Serial Titles

acad.	Academy
aeronaut.	Aeronautic(al), Aeronautics
akad.	akademija [Ru]
Amer.	American
appl.	Applied
Brit.	British
bur.	Bureau
canad.	Canadian
chem.	Chemical, Chemistry
conf.	Conference
eng.	Engineering
engrs.	Engineers
indus.	Industrial, Industry
inst.	Institute, Institution
internat.	International
izvest.	izvestija [Ru]
jour.	Journal
mag.	Magazine
math.	Mathematical, Mathematics
mech.	Mechanic(al), Mechanics
nat.	National

List of Abbreviated Words for Serial Titles (continued)

philos.	Philosophic(al)
phys.	Physical, Physics
proc.	Proceedings
progr.	Progress
quart.	Quarterly
refrig.	Refrigeration
res.	Research
rev.	Review
roy.	Royal
sci.	Science
scient.	Scientific
soc.	Society
technol.	Technologic(al), Technology
trans.	Transactions
univ.	University
zeitschr.	Zeitschrift [Ge]

APPENDIX III

Sample Reference-Abstract Cards

55-0001

Fuks, N. A.

[THE MECHANICS OF AEROSOLS.] Mekhanika aerorozlei. Moskva, Izdatel'stvo Akademii Nauk SSSR, 1955, 351 p. (Translated as CWL Special Publication 4-12, Army Chemical Center, Chemical Warfare Labs., Md., [1958], 448 p. 581 refs. QD549.F913; AD 227876) QD549.F9

Limited information is contained on interrelations of aerosols and such thermal phenomena as convection, diffusion, evaporation, condensation, and action of radiometric forces (aerosol particles being repelled by heated bodies.)

58-0116

Fortescue, P. and D. V. Wordsworth

GAS-TURBINE REGENERATOR PERFORMANCE. Eng., v. 185, Feb. 25, 1958: 284-286.

This article seeks to show how the bulk of a regenerator, in a very-high-temperature nuclear reactor-gas turbine closed circuit, is affected by the choice of working fluid. Completely general conclusions about heat-exchanger sizes are reached and quantitative results with different gases are tabulated.

60-5008

National Bureau of Standards. Cryogenic Engineering Lab., Boulder, Colo.

A COMPENDIUM OF THE PROPERTIES OF MATERIALS AT LOW TEMPERATURE (PHASE I). PROPERTIES OF FLUIDS, V. J. Johnson - ed. Rept. for Jan. 1958 - Mar. 1959 on Thermophysical Properties of Cryogenic Materials. Oct. 1960, 1 vol., diagrs., tables, refs. (AF 33(616)58-4; WADD TR 60-56, pt. 1) AD 249644 UNCLASSIFIED

Data are given for the properties of density (including some PVT data), expansivity, thermal conductivity, specific heats and enthalpy, transition heats, phase equilibria, dielectric constants, adsorption, surface tension and viscosity for the solid, liquid and gas phases of helium, hydrogen, neon, nitrogen, oxygen, air, carbon monoxide, fluorine, argon and methane wherever adequate data could be collected. Data sheets, primarily in graphic form, are presented from "best values" of data collected. The source of the material used, other references and tables of selected values with appropriate comments are furnished with each data sheet to document the data presented. Conversion tables and other helpful information are also included. Although bound, the volume is intended basically as a looseleaf report for continuous expansion and revision as new and revised data sheets are produced. The specified temperature range of primary interest was from near absolute zero to 110°K. Where desirable and practicable, however, data are included for temperatures up to near room temperature (300°K). (Author, modified)

Cryogenic fluids; Liquids; Gases; Temperature, cryogenic; Helium; Hydrogen; Neon; Nitrogen; Oxygen; Air; Carbon monoxide; Fluorine; Argon; Methane; Density; PVT data; Thermal conductivity; Specific heat; Enthalpy; Viscosity; Handbooks

Library of Congress
Science and Technology Division
Convective Heat Transfer

APPENDIX IV

a. Sample IBM cards

1. Open literature; personal author

C58-0116-1 FORTESCUE P WORDSWORTH 325 672 354 158

[illegible]

2. Four-digit subject codes

C60-0218-1 JENNINGS L D MILLER S101610141030 352 488

[illegible]

3. Report; corporate author; more than 12 subjects, requiring
2 cards

060-5008-1 NBS

180 457 326 809 379 391 523 536 558 018 118 295

[illegible]

C60-5008-2 NPS

053 499 199 633 824 728 245 905 347

[illegible]

b. Subject code; numerical listing

001 Ablation
002 Absorber materials
003 Acceleration
004 Acetamide, dimethyl
005 Acetate, butyl
006 Acetate, ethyl
007 Acetate, vinyl
008 Acetone
009 Acetone - water mixtures
010 Acetylene
011 Acoustic effects
012 Acoustic vibration
013 Additives
014 Adiponitrile
015 Aerodynamic heating
016 Aerosols
017 Aerospace vehicles
018 Air
019 Air coils
020 Air coolers
021 Air cooling
022 Aircraft
023 Aircraft, hypersonic
024 Aircraft, supersonic
025 Aircraft (X-15)
026 Aircraft engines
027 Aircraft equipment
028 Aircraft fuel
029 Aircraft materials
030 Airfoils
031 Airframe materials
032 Airframes
033 Air-helium mixtures
034 Alcohols
035 Aliphatic compounds
036 Alloys
037 Altitude
038 Accomodation coefficient
039 Aluminum
040 Aluminum 61S
041 Aluminum 1100
042 Aluminum 3003
043 Aluminum alloys
044 Aluminum bromide
045 Aluminum chloride

046 Aluminum oxide
047 Aluminum-Mg
048 Aluminum-1.2 Mn
049 Ammonia
050 Analog methods
051 Analysis
052 Annular fins
053 Annular flow
054 Annuli
055 Argon
056 Argon - benzene mixtures
057 Argon - xenon mixtures
058 Armco iron
059 Aspect ratio
060 Austenitic
061 Axial mixing
062 Axially symmetric bodies
063 Bakelite
064 Benzene, 1, 4-diphenoxy
065 Benzene, dichloro
066 Benzene mixtures
067 Benzene - toluene mixtures
068 Benzenes
069 Benzenes, chloro
070 Benzenes, trimethyl
071 Benzoic acid
072 Beryllium
073 Beryllium acetate complex
074 Beryllium copper
075 Beryllium oxide
076 Bibliography
077 Thermometers, bimetallic
078 Binary mixtures
079 Bingham fluid
080 Biphenyl, monoisopropyl
081 Bismuth-lead alloys
082 Ether, bis(p-phenoxyphenyl)
083 Bluff bodies
084 Blunt bodies
085 Bodies of revolution
086 Boilers
087 Boiling
088 Diatomaceous earth, borated
089 Boundary conditions

090 Boundary layer factors
091 Boundary layer flow
092 Boundary layer transition
093 Boundary layers
094 Brass
095 Bromine
096 Bubble formation
097 Bulk boiling
098 Bulk modulus
099 Acetate, amyl
100 Bulk velocity
101 Buoyancy
102 Burnout
103 Butadiene
104 Butane
105 Butane, trichloroheptafluoro
106 Butanol
107 Butene, methyl
108 Butyrate, ethyl
109 Cadmium
110 Calcium aluminates
111 Calcium borate
112 Calibration
113 Calorimeters
114 Carbon
115 Carbon dioxide
116 Air - carbon dioxide mixtures
117 Carbon disulfide
118 Carbon monoxide
119 Alumel
120 Carbon tetrachloride
121 Carbopol
122 Carboxy methyl cellulose
123 Centripetal acceleration
124 Ceramic coatings
125 Ceramic fuels
126 Ceramics
127 Cesium
128 Channels
129 Channels, circular
130 Channels, flat
131 Channels, horizontal
132 Channels, rectangular
133 Channels, triangular

134 Channels, vertical
135 Chlorine
136 Ethanol, 2-chloro - ether, diisopropyl mixtures
137 Chromium
138 Chromium-plated
139 Coatings
140 Compatibility
141 Compressibility
142 Compressible flow
143 Compressors
144 Computation
145 Condensation
146 Condensation coefficient
147 Condensers
148 Condensers, tube
149 Condensers, wire
150 Cones
151 Configuration
152 Contamination
153 Contamination effects
154 Convection coefficient
155 Convection velocity
156 Convective heat transfer
157 Coolant pumps
158 Coolants
159 Cooling
160 Cooling coils
161 Cooling equipment
162 Cooling systems
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166 Corn syrup
167 Correlation
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174 Critical point
175 Critical region
176 Critical state
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204 Diborane
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218 Dissociation-association
219 Dodecanethiol
220 Dodecene
221 Drops

222 Dropwise condensation
223 Ducts
224 Ducts, circular
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227 Ducts, horizontal
228 Ducts, polygonal
229 Ducts, rectangular
230 Ducts, triangular
231 Ducts, vertical
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250 Ethane, trifluoro
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254 Amine, ethyl
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264 Evaporation coefficient
265 Evaporators

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275 Flames
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282 Flow control
283 Flow friction
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285 Flow pulsations
286 Flow rate
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311 Freon 115
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313 Friction coefficient
314 Friction factors
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360 Heat exchangers, parallel-flow
361 Heat exchangers, periodic-flow
362 Heat exchangers, plastic
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369 Heat flux probes
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374 Heat transfer models
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377 Heating systems
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379 Helium
380 Argon - helium mixtures
381 Argon - helium - xenon mixtures
382 Helium - xenon mixtures
383 Hemispheres
384 Heptane
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386 Hexane
387 High altitude
388 Hydraulic fluids
389 Hydraulic systems
390 Hydrocarbon flames
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392 Hydrogen chloride
393 Hydrogen sulfide
394 Air - hydrogen mixtures
395 Hydrogen - oxygen flames
396 Hydrogen - oxygen mixtures

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398 Hypervelocity vehicles
399 Ice
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401 Incompressible flow
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405 Indopol polybutene H300
406 Inert gases
407 Injection cooling
408 Inorganic compounds
409 Instrumentation
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502 Methane, trifluoro
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546 Nusselt number
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616 Prandtl number (> 10.0)
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618 Vinyl chloride
619 Pressure control

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621 Pressure drop
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864 Tube banks
865 Tube orientation
866 Tubes
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869 Tubes, circular
870 Tubes, concentric
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872 Tubes, elliptical
873 Tubes, flat
874 Tubes, fluted
875 Tubes, horizontal
876 Tubes, porous
877 Tubes, rectangular
878 Tubes, round
879 Tubes, smooth
880 Tubes, vertical
881 Tubes, vortex
882 Tungsten
883 Turbine blades
884 Turbine disks
885 Turbulence
886 Turbulent boundary layer
887 Turbulent flow

888 Turpentine
889 Spectroscopic analysis
890 Ultrasonics
891 Uranium alloys
892 Uranium - molybdenum alloys
893 Bismuth - uranium dioxide slurry
894 Uranium oxide
895 Vacuum gages
896 Vapor pressure
897 Vaporization
898 Vaporizing bodies
899 Vapors
900 Velocity
901 Velocity distribution
902 Velocity profile
903 Vibration
904 Viscosimeters
905 Viscosity
906 Viscosity coefficient
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921 Methyl ethyl ketone - water mixtures
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923 Waxes
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930 Wood's metal
931 Working fluids
932 Xenon

933 Xylene
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972 Glycerine - water mixtures
973 Milk
974 Aluminum fluoride
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976 Lithium halides
977 Sodium chloride

978 Air - glycerine mixtures
979 Alkyl halides
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981 Thiol, trifluoromethane
982 Neon - nitrogen mixtures
983 Krypton - nitrogen mixtures
984 Nitrogen - xenon mixtures
985 Acetic acid - water mixtures
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987 Molecular beams
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989 Silicon halides
990 Zinc halides
991 Sulfur halides
992 Argon - hydrogen mixtures
993 Argon - nitrogen mixtures
994 Argon - oxygen mixtures
995 Helium - oxygen mixtures
996 Krypton - oxygen mixtures
997 Oxygen - xenon mixtures
998 Iron sulfate
999 Deuterium

1000	(Not used)
1001	Acetamide, dimethyl - water mixtures
1002	Air - benzene mixtures
1003	Bismuth telluride
1004	Bismuth - thorium slurry
1005	Boron
1006	Boron hydrides
1007	Carbon tetrachloride - methylene chloride mixtures
1008	Carbon tetrachloride - water mixtures
1009	Chlorine monofluoride
1010	Glycerol - water mixtures
1011	Gold alloys
1012	Hydrogen - water vapor mixtures
1013	Krypton - xenon mixtures
1014	Lanthanum
1015	Lead - uranium slurry
1016	Lutetium
1017	Methane, bromodichlorofluoro
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1019	Neon - xenon mixtures
1020	Nitrogen - oil mixtures
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1023	Palladium
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1031	Air - methanol mixtures
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c. Subject code; alphabetical listing

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002	Absorber materials
947	Absorption
003	Acceleration
038	Accommodation coefficient
004	Acetamide, dimethyl
1001	Acetamide, dimethyl - water mixtures
099	Acetate, amyl
005	Acetate, butyl
006	Acetate, ethyl
007	Acetate, vinyl
985	Acetic acid - water mixtures
008	Acetone
009	Acetone - water mixtures
010	Acetylene
011	Acoustic effects
012	Acoustic vibration
013	Additives
014	Adiponitrile
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018	Air
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1002	Air - benzene mixtures
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1031	Air - methanol mixtures
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034	Alcohols
035	Aliphatic compounds
979	Alkyl halides
036	Alloys
037	Altitude
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039	Aluminum
040	Aluminum 61S
041	Aluminum 1100
042	Aluminum 3003
043	Aluminum alloys
044	Aluminum bromide
045	Aluminum chloride
974	Aluminum fluoride
046	Aluminum oxide
047	Aluminum-1Mg
048	Aluminum-1Mn
980	Amine, diethyl - water mixtures
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d. Codes for Temperature ranges

Code No.	<u>Designation</u>	<u>°K</u>	<u>°C</u>	<u>°F</u>
795	Temp 000	0 to 33	-273 to -240	-459 to -400
796	Temp 010	34 to 200	-239 to -73	-399 to -99
797	Temp 030	201 to 293	-72 to +20	-98 to +68
798	Temp 050	294 to 373	21 to 100	69 to 212
799	Temp 070	374 to 589	101 to 316	213 to 600
800	Temp 090	590 to 811	317 to 538	601 to 1000
801	Temp 110	812 to 1089	539 to 816	1001 to 1500
802	Temp 130	1090 to 1922	817 to 1649	1501 to 3000
803	Temp 150	1923 to 5811	1650 to 5538	3001 to 10,000
804	Temp 170	5812 to 55,811	5539 to 55,538	10,001 to 100,000
805	Temp 190	over 55,811	over 55,538	over 100,000

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13. ABSTRACT The Convective Heat Transfer Bibliography is a compilation of 2000 references with abstracts to the monographic, periodical, and report literature issued from 1955 to 1962, on the subject of convective heat transfer and its aerospace applications. The references and abstracts have been typed on 5x8 cards. The Bibliography is supplemented by a set of 2000 IBM punched cards, constituting a subject index in considerable depth to the same references, and suitable for retrieving the information in the respective abstracts. This report defines the scope of the task, outlines the bibliographic procedures followed, and describes the end products resulting from the work.		

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