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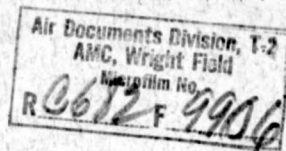
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Div 18

NATIONAL DEFENSE RESEARCH COMMITTEE
of
OFFICE OF SCIENTIFIC RESEARCH AND DEVELOPMENT
WAR METALLURGY DIVISION



Advisory Report
on
INDEXING OF DIVISION 18 NDRC REPORTS:
REPORTS ON MAGNESIUM ALLOYS

by
HELEN L. PURDUM
RESEARCH INFORMATION DIVISION
WAR METALLURGY COMMITTEE

OSRD No. 6667
Serial No. 14-663
Copy No. 29

June 15, 1946

June 15, 1946

To: Dr. James B. Conant, Chairman
National Defense Research Committee of the
Office of Scientific Research and Development

From: War Metallurgy Division (Div. 18), NDRC

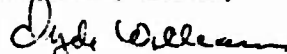
Subject: Advisory Report on "Indexing of Division 18,
NDRC Reports: Reports on Magnesium Alloys"

The attached advisory report was prepared by the Research Information Division of the War Metallurgy Committee and has been approved by representatives of the Committee.

It is believed that this index will prove valuable to the Armed Services as a guide to the reports on Magnesium Alloys issued by Division 18, NDRC.

I recommend acceptance as a satisfactory advisory report from the War Metallurgy Committee under the provisions of Contract OMSr-307 between the Office of Scientific Research and Development and the National Academy of Sciences.

Respectfully submitted,



Clyde Williams, Chief
War Metallurgy Division, NDRC

Enclosure

PREFACE

The distribution of this report is as follows:

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INDEX
of
DIVISION 18 NDRC REPORTS:
REPORTS ON MAGNESIUM ALLOYS

Reports Indexed:

M-28	M-125	M-210	M-341
M-36	M-129	M-213	M-353
M-50	M-150	M-214	M-354
M-65	M-151	M-237	M-381
M-76	M-152	M-274	M-454
M-103	M-169	M-276	M-471
M-104	M-170	M-289	M-553
M-105	M-177	M-292	M-647
M-106	M-189	M-313	M-652
M-110	M-197	M-330	

Index Prepared by:

Helen Purdum, Librarian
Research Information Division
War Metallurgy Committee

June 15, 1946

TABLE OF CONTENTS

	<u>Page</u>
DESIGNATION OF ALLOY SYMBOLS	1
SUBJECT LIST OF PROJECTS WITH REPORT NUMBERS	2
NUMERICAL LIST OF REPORTS	3
SUBJECT INDEX	13
TABLE OF MAGNESIUM ALLOY SYMBOLS AND COMPOSITIONS	30

Designation of Alloy Symbols

Magnesium alloy compositions have been indexed under Dowmetal symbols only, even though the reports indexed contain the results of experimental work on both AMC (American Magnesium Corporation) and Dowmetal Alloys. This indexing procedure brings together under one heading all information on alloys of identical or nearly identical composition. Some of the reports also refer to magnesium alloys by AMS (Aeronautical Material Specifications) and SAE (Society of Automotive Engineers) specification symbols. A table of approximate equivalence, including these four groups of symbols, appears at the end of the Subject Index.

Some of the reports on magnesium alloys include information on aluminum alloys. This information has been indexed under the Alcoa (Aluminum Company of America) symbols.

SUBJECT LIST OF PROJECTS WITH REPORT NUMBERS

Magnesium alloys

Deformation Characteristics
NRC-70

Deformation Characteristics of
Magnesium Alloys. M-150, M-189,
M-213, M-214, M-276, M-341, M-354,
M-454.

Fatigue Properties
NRC-22

Fatigue Properties of Magnesium
Alloys. M-36, M-76, M-125, M-169,
M-213, M-289, M-354, M-381.

Formability
NRC-44

Formability of Magnesium Alloy
Sheet. M-65, M-110, M-151,
M-170, M-210, M-213, M-274,
M-313, M-330, M-353, M-354.

Heat Treatment see Properties and Heat Treatment

High Temperature
SP-15

High Temperature Properties of
Light Alloys. M-292.

Physical and Stress
Corrosion Properties
NRC-67

Physical and Stress Corrosion
Properties of Magnesium Alloy
Sheet. M-152, M-197, M-213,
M-237, M-471, M-647.

Properties and Heat
Treatment
NRC-21

Properties and Heat Treatment of
Magnesium Alloys. M-28, M-50,
M-103, M-104, M-105, M-106,
M-129, M-177, M-213, M-354.

Stress Corrosion Properties see Physical and Stress Corrosion
Properties

Research, Survey of Current
SP-26

Survey of Current Research on Magnesium
and Magnesium Alloys Being Conducted
in the U. S.
M-553, M-652.

NUMERICAL LIST OF REPORTS

Serial M-28
OSRD 1099

Progress Report on Properties and Heat Treatment of Magnesium Alloys, by John E. Dorn. Dec. 11, 1942.

Project No. NRC-21 (Contract OEMsr-647, University of California).

Preliminary investigation of the physical properties and heat treatment of magnesium alloys.

Serial M-36
OSRD 1146

Progress Report on Fatigue Properties of Magnesium Alloys and Structures: Fatigue Properties of Magnesium Alloy Sheet, by H. J. Russell. Jan. 19, 1943.

Project No. NRC-22 (Contract OEMsr-729, Battelle Memorial Institute).

Discusses the development of testing techniques for magnesium alloy sheet, including a description of test results on Dow Metal J Sheet.

Serial M-50
OSRD 1291

Progress Report on Properties and Heat Treatment of Magnesium Alloys, by John E. Dorn. March 10, 1943.

Project No. NRC-21 (Contract OEMsr-647, University of California)

Investigations on (1) the effect of specimen size upon determination of tensile properties, (2) notch sensitivity, (3) damping capacity, and (4) the influence of heat treatment on tensile properties.

Serial M-65
OSRD 1485

Progress Report on Formability of Magnesium Alloy Sheet, by John E. Dorn. May 21, 1943.

Project No. NRC-44 (Contract OEMsr-839, University of California)

A description of the test equipment and test schedules which are to be used, and consideration of the use of data which are to be determined.

NUMERICAL LIST OF REPORTS

Serial M-110
OSRD 1791

Progress Report on Formability of Magnesium Alloy Sheet, by John E. Dorn and A. C. Ballaseyus. Sept. 1, 1943

Project No. NRC-44 (Contract OEMsr-839, University of California)

Covers the tensile testing of Dowmetal J-1a and J-1h sheet 0.064 inches thick under various conditions of temperature and strain rate.

Serial M-125
OSRD 1858

Progress Report on Fatigue Properties of Magnesium Alloys and Structures: Fatigue Properties of Magnesium Alloy Sheet, by H. W. Russell. Sept. 27, 1943.

Project No. NRC-22 (Contract OEMsr-729, Battelle Memorial Institute)

Data on the fatigue strength of J and M magnesium alloy sheet and a fatigue study of riveted, spot-welded, Cyclewelded, and Heliarc-welded joints.

Serial M-129
OSRD 1950

Progress Report on Properties and Heat Treatment of Magnesium Alloys, by J. E. Dorn, E. G. Thomson, and I. Cornet. Oct. 14, 1943.

Project No. NRC-21 (Contract OEMsr-647, University of California)

A continuation of the experimental work on the notch sensitivity of magnesium alloys.

Serial M-150
OSRD 2076

Progress Report on Deformation Characteristics of Magnesium Alloys, by C. S. Barrett, F. N. Rhines, and C. T. Haller, Nov. 15, 1943.

Project No. NRC-70 (Contract OEMsr-1083, Carnegie Institute of Technology)

Results to date of investigations on the effects of bending, straightening, compressing, cold rolling and recrystallization on the preferred orientation of magnesium sheet, as well as a study of the cracks resulting from tensile loading and bending.

- 4 -
NUMERICAL LIST OF REPORTS

- Serial M-76
OSRD 1457 Progress Report on Fatigue Properties of Magnesium Alloys and Structures: Fatigue Properties of Magnesium Alloy Sheet, by H. W. Russell. May 17, 1943.
- Project No. NRC-22 (Contract OEMsr-729, Battelle Memorial Institute)
- Investigations on the fatigue strength of four different magnesium alloys of various sheet widths and thicknesses, and of riveted, Cyels welded, and spot welded joints.
- Serial M-103
OSRD 1818 Final Report on Properties and Heat Treatment of Magnesium Alloys: Part I - The Effect of Size Upon Tensile Properties of Specimens of Magnesium Alloy Sheet, by John E. Dorn and Dan M. Finch. Sept. 3, 1943.
- Project No. NRC-21 (Contract OEMsr-647, University of California)
- A study of the effect of size on the tensile properties of four magnesium alloys.
- Serial M-104
OSRD 1819 Final Report on Properties and Heat Treatment of Magnesium Alloys: Part II - Notch Sensitivity of Magnesium Alloys, by John E. Dorn and J. L. Meriam. Sept. 3, 1943.
- Project No. NRC-21 (Contract OEMsr-647, University of California)
- Presents an initial evaluation of the notch sensitivity of magnesium alloys.
- Serial M-105
OSRD 1820 Final Report on Properties and Heat Treatment of Magnesium Alloys: Part III - Damping Capacity of Magnesium Alloys, by John E. Dorn and Julius J. Jelinek. Sept. 3, 1943.
- Project No. NRC-21 (Contract OEMsr-647, University of California)
- Investigations on the damping capacities of three magnesium-base extrusions, nine magnesium-base sand castings, and seven aluminum-base sand and permanent mold castings.
- Serial M-106
OSRD 1821 Final Report on Properties and Heat Treatment of Magnesium Alloys: Part IV - Heat Treatment of Magnesium Alloys, by John E. Dorn, Israel I. Cornet, Alan E. Flanigan and Ralph Hultgren. Sept. 3, 1943.
- Project No. NRC-21 (Contract OEMsr-647, University of California)
- Studies of the solution heat treatment and aging of AMS 4434 (Downmetal C) magnesium casting alloys.

NUMERICAL LIST OF REPORTS

Serial M-151
OSRD 2062

Final Report on Formability of Magnesium Alloy Sheet: Part I - Elevated Temperature Variables Speed Tensile Tests on Magnesium Alloys, by J. E. Dorn and A. C. Ballasayus. Nov. 19, 1943.

Project No. NRC-44 (Contract OEMer-839, University of California)

This report consists of numerous graphs and charts which give tensile data as functions of temperature and speed.

Serial M-152
OSRD 2063

Progress Report on Physical and Stress Corrosion Properties of Magnesium Alloy Sheet, by M. A. Hunter. Nov. 25, 1943.

Project No. NRC-67 (Contract OEMer-1033, Rensselaer Polytechnic Institute)

Investigations on the optimum conditions for short time testing of the stress-corrosion cracking of magnesium alloy sheet. Data on the correlation of microstructure with the susceptibility to stress-corrosion cracking is also included.

Serial M-169
OSRD 3033

Final Report on Fatigue Properties of Magnesium Alloys and Structures: Fatigue Properties of Magnesium Alloy Sheet-Part I, by L. R. Jackson, H. J. Grover, W. W. Beaver, and H. A. Russell. Dec. 23, 1943.

Project No. NRC-22 (Contract OEMer-729, Battelle Memorial Institute)

Summarizes test results reported in previous progress reports, together with some additional data, and presents general conclusions from tests on (1) monoblock samples of sheet, (2) samples notched by drilled rivet holes, and (3) jointed samples.

Serial M-170
OSRD 2079

Final Report on Formability of Magnesium Alloy Sheet: Part II - Forming of Bends on the Gustin Press, by J. E. Dorn, J. J. Jelinek, and A. C. Ballasayus. Nov. 26, 1943.

Project No. NRC-44 (Contract OEMer-839, University of California)

Presents die and part design data relative to the permissible limits of forming bends and to the spring-back for bending the current standard magnesium alloy sheets for temperatures of 70°F to 450°F.

NUMERICAL LIST OF REPORTS

Serial M-177
OSRD 3043

Final Report on Properties and Heat Treatment of Magnesium Alloys: Part V - Section I - The Sensitivity of Magnesium Alloy Sheet to Drilled, Reamed, and Punched Holes by J. S. Dorn and E. G. Thomsen, Section II - The Notch Sensitivity of Magnesium Alloy Extrusions and the Influence of Various Factors by J. S. Dorn and I. Cornet. Dec. 20, 1943.

Project No. NRC-21 (Contract OEMsr-647, University of California)

Investigations of the effect of (1) circular holes in test coupons, and (2) artificially produced scratches on the tensile strength of magnesium alloy sheet.

Serial M-189
OSRD 3016

Progress Report on Deformation Characteristics of Magnesium Alloys: Metallography of Commercial Magnesium Sheet, by C. S. Barrett, F. N. Rhines, and C. T. Haller. Dec. 9, 1943.

Project No. NRC-70 (Contract OEMsr-1083, Carnegie Institute of Technology).

Discusses an etching solution which has proven satisfactory for developing the structure of twins and revealing precipitates in magnesium sheet of 3% and of 6% aluminum composition.

Serial M-197
OSRD 3175

Progress Report on Physical and Stress Corrosion Properties of Magnesium Alloy Sheet, by M. A. Hunter. Jan. 14, 1944.

Project No. NRC-67 (Contract OEMsr-1033, Rensselaer Polytechnic Institute).

Covers further stress-corrosion cracking tests of magnesium alloy sheet, giving data on stress-corrosion in various heat treated alloys. Additional data are given on the effect of pH of corroding solutions on cracking times in heat treated sheets.

Serial M-210
OSRD 3350

Final Report on Formability of Magnesium Alloy Sheet: Part III - Evaluation of the Deep Drawing Properties of Magnesium Alloys at Elevated Temperatures, by J. S. Dorn, D. M. Finch, and J. J. Jelinek. March 8, 1944.

Project No. NRC-44 (Contract OEMsr-839, University of California)

A discussion of the optimum forming conditions for the deep drawing magnesium alloys, giving details on the effects of die and punch design as well as the influence of other factors on drawability.

NUMERICAL LIST OF REPORTS

Serial M-213 Advisory Report on The Effect of Combined Stresses on
OSRD 3218 the Ductility of Metals, by J. E. Dorn and E. G. Thomson.
Feb. 2, 1944.
(War Metallurgy Committee)

Reviews the existing knowledge of the effect of combined stress on the ductility of metals, and presents a method of calculating the permanent strains at fracture under combined stresses.

Serial M-214 Progress Report on Deformation Characteristics of
OSRD 3272 Magnesium Alloys, by C. S. Barrett, F. N. Rhines, and
C. T. Hallor. Feb. 14, 1944.

Project No. NRC-70 (Contract OEMsr-1083, Carnegie Institute of Technology)

Studies of (1) intercrystalline and trans-crystalline fractures in pure cast magnesium and (2) twinning in magnesium alloy sheet.

Serial M-237 Progress Report on Physical and Stress Corrosion
OSRD 3477 Properties of Magnesium Alloy Sheet, by M. A. Hunter.
April 6, 1944.

Project No. NRC-67 (Contract OEMsr-1033, Rensselaer Polytechnic Institute)

Additional information on the effects of heat treatment on the physical and stress corrosion properties of magnesium alloy sheet.

Serial M-274 Final Report on Formability of Magnesium Alloy Sheet:
OSRD 3791 Part IV - Forming Stretch Flanges in the Gusrin Press, by
John E. Dorn and Erich G. Thomsen. June 5, 1944.

Project No. NRC-44 (Contract OEMsr-839, University of California)

Presents data which define the limits of stretch formability and provide a guide for the design and fabrication of stretch flanges of magnesium alloys.

NUMERICAL LIST OF REPORTS

Serial M-276
OSRD 3713

Progress Report on Deformation Characteristics of Magnesium Alloys, by C. S. Barrett, F. N. Rhines, and C. T. Haller. May 22, 1944.

Project No. NRC-70 (Contract OEMsr-1083, Carnegie Institute of Technology)

Studies of twinning in magnesium alloy sheet, of preferred orientation in extruded magnesium slabs, and of intercrystalline and trans-crystalline fractures in pure cast magnesium.

Serial M-289
OSRD 3792

Final Report on Fatigue Properties of Magnesium Alloys and Structures: Fatigue Properties of Magnesium Alloy Sheet - Part II, by L. R. Jackson, H. J. Grover, W. W. Beaver, and H. A. Russell. June 12, 1944.

Project No. NRC-22 (Contract OEMsr-729, Battelle Memorial Institute)

Results of fatigue studies of FS-1 sheet, corrosion fatigue studies of FS-1 in salt solutions, and preliminary fatigue studies of FS-1-h and J-1h sheet after precipitation heat treatment.

Serial M-292
OSRD 4150

Final Report on High Temperature Properties of Light Alloys: Part II - Magnesium, by L. L. Wyman. Sept. 18, 1944.

Survey Project No. SP-15 (Contract OEMsr-307, National Academy of Sciences)

Serial M-313
OSRD 3940

Final Report on Formability of Magnesium Alloy Sheet: Part V - Forming Shrink Flanges in the Guerin Press, by John E. Dorn, Erich G. Thomsen, and Don Cunningham. July 14, 1944.

Project No. NRC-44 (Contract OEMsr-839, University of California)

Presents data on the limits of shrink formability and provides basic information necessary for the design and fabrication of shrink flanges of magnesium alloys.

NUMERICAL LIST OF REPORTS

Serial M-330
OSRD 4042

Final Report on Formability of Magnesium Alloy Sheet: Part VI - Forming Beads on the Guerin Press, by Erich G. Thomsen, Don Cunningham, and John E. Dorn. Aug. 10, 1944.

Project No. NRC-44 (Contract OMSr-839, University of California)

Presents data for the design and tooling of internal beads for six magnesium alloys at temperatures up to 450°F.

Serial M-341
OSRD 4070

Progress Report on Deformation Characteristics of Magnesium Alloys, by C. S. Barrett, F. N. Rhinos, C. T. Haller, and B. H. Alexander. Aug. 10, 1944.

Project No. NRC-70 (Contract OMSr-1083, Carnegie Institute of Technology)

Studies of the effect of deformation and heat treatment on the crystalline structure of magnesium alloys.

Serial M-353
OSRD 4171

Final Report on Formability of Magnesium Alloy Sheet: Part VII - Stretch Forming Magnesium Alloys, by D. M. Finch, I. G. Lotze, and J. E. Dorn. Sept. 20, 1944.

Project No. NRC-44 (Contract OMSr-839, University of California)

Results of investigations on the stretch forming properties of magnesium alloys at elevated temperatures.

Serial M-354
OSRD 4172

Advisory Report on Stress-Strain Relationships for J₁ Magnesium Alloy Extrusion under Biaxial Stresses, by D. M. Cunningham, E. G. Thomsen, and J. E. Dorn. Sept. 20, 1944.

(War Metallurgy Committee)

A study of some of the fundamental assumptions of the theory of plastic flow under combined stresses by means of tests on J₁ magnesium alloy extrusions.

NUMERICAL LIST OF REPORTS

Serial M-381
OSRD 4282

Final Report on Fatigue Properties of Magnesium Alloys and Structures: Fatigue Properties of Magnesium Alloy Sheet - Part III, by L. R. Jackson, H. J. Grover, W. W. Beaver, and H. W. Russell. Oct. 20, 1944.

Project No. NRC-22 (Contract OEMsr-729, Battelle Memorial Institute)

Results of a study of the corrosion fatigue strength of magnesium sheet alloys. Some miscellaneous items, completing work described in previous reports, are also discussed.

Serial M-454
OSRD 4653

Final Report on Deformation Characteristics of Magnesium Alloys, by C. S. Barrett, F. N. Rhinss, C. T. Haller, and B. H. Alexander. Jan. 29, 1945.

Project No. NRC-70 (Contract OEMsr-1083, Carnegie Institute of Technology)

Results of an investigation of the effects of deformation and heat treatment on the crystal structures of magnesium alloys.

Serial M-471
OSRD 4824

Progress Report on Physical and Stress Corrosion Properties of Magnesium Alloy Sheet, by M. A. Hunter, A. Jones, R. H. Trathen, S. Mackay, J. M. Parks and J. F. Throop. March 17, 1945.

Project No. NRC-67 (Contract OEMsr-1033, Rensselaer Polytechnic Institute)

Investigations of the effects of certain variables on the physical and stress corrosion properties of magnesium alloy sheet. The principal variables considered were heat treatments and procedures and temperatures of rolling.

Serial M-553
OSRD 5400

Advisory Report on A Survey of Research on Magnesium and Magnesium Alloys Being Conducted by Government Agencies, Branches of the Armed Services, and Producers and Fabricators of Magnesium, by J. C. De Haven. Aug. 3, 1945.

Survey Project No. SP-26 (Contract OEMsr-307, National Academy of Sciences)

A survey of current research being conducted on magnesium and magnesium alloys.

NUMERICAL LIST OF REPORTS

Serial M-647
OSRD 6596

Final Report on Physical and Stress Corrosion Properties of Magnesium Alloy Sheet, by M. A. Hunter, A. Jones, S. Mackay, R. H. Trathen, J. M. Parks, and J. F. Throop. Feb. 7, 1946.

Project No. NRC-67 (Contract OSMer-1033, Rensselaer Polytechnic Institute)

Summarizes the results of investigations of the physical and stress corrosion properties of magnesium alloy sheet, and discusses new methods of procedure and heat treatments undertaken in an attempt to improve the properties.

Serial M-652
OSRD 6599

Advisory Report on "Suggested Research Topics on Magnesium and Magnesium Alloys", by the War Metallurgy Committee. Feb. 25, 1946.

Survey Project No. SP-26 (Contract OSMer-307, National Academy of Sciences)

This report reviews a previous report (M-553) pointing out where additional research might be warranted, and where the scope of existing research projects might be expanded advantageously.

SUBJECT INDEX

Aluminum alloys

- Alcoa 24ST (bar, extruded)
 - Hardness M-177
 - Microstructure M-177
 - Tensile properties M-177
 - Eccentricity of stress, Effect of M-177
 - Notch effect
 - Notches M-177
- Alcoa 24ST (sheet)
 - Formability
 - Critical bend radii M-170
 - Tensile properties M-104, M-177
 - Notch effect
 - Holes M-104
 - Scratches M-177
- Alcoa 24 STAlclad (sheet)
 - Tensile properties M-104, M-177
 - Notch effect
 - Holes M-104
 - Scratches M-177
- Alcoa 43 (casting)
 - Hardness M-177
 - Tensile properties M-177
 - Eccentricity of stress, Effect of M-177
 - Notch effect
 - Notches M-177
- Alcoa 122 (casting)
 - Hardness M-177
 - Tensile properties M-177
 - Eccentricity of stress, Effect of M-177
 - Notch effect
 - Notches M-177
- Alcoa 195-T4 (casting)
 - Damping capacity M-105
 - Tensile properties M-105
- Alcoa 195-T6 (casting)
 - Damping capacity M-105
 - Tensile properties M-105
- Alcoa 214 (casting)
 - Damping capacity M-105
 - Tensile properties M-105
- Alcoa 220-T4 (casting)
 - Damping capacity M-105
 - Tensile properties M-105
- Alcoa 356-T4 (casting)
 - Damping capacity M-105
 - Tensile properties M-105
- Alcoa 356-T6 (casting)
 - Damping capacity M-105
 - Tensile properties M-105

- 14 -
SUBJECT INDEX

Aluminum alloys (Cont'd)

- Alcoa B195-T4 (casting)
 - Damping capacity M-105
 - Tensile properties M-105
- Ductility See: Plastic deformation
- European alloys See: Magnesium alloys: Specific alloys
European
- Experimental alloys See: Magnesium alloys: Specific alloys
Experimental

Magnesium

- Crystalline structure
 - Preferred orientation
 - Roller straightening, Effect of M-150
 - Twinning
 - Bending, Effect of M-150
 - Roller straightening, Effect of M-150
 - X-ray diffraction M-150
 - Fractures
 - Bending speed, Effect of M-214
 - Casting practice, Effect of M-214, M-276
 - Compression, Effect of M-341, M-454
 - Crystalline structure M-214
 - X-ray diffraction M-214
 - Heat treatment, Effect of M-214, M-276, M-341, M-454
 - Quenching media, Effect of M-214, M-276
 - Intercrystalline vs. transcrystalline M-214, M-276, M-341, M-454
 - Microstructure M-214, M-341, M-454
 - Microstructure M-150, M-276
 - Impurities in M-341, M-454
 - Microstructure M-276, M-454
 - Research
 - Suggested problems and development M-553, M-652
 - Survey of research being conducted by government agencies,
branches of the armed services, and producers and fabricators
of magnesium M-553
 - Surface treatment M-214, M-276
 - Tensile properties M-276
 - Heat treatment, Effect of M-214, M-276
 - Quenching media, Effect of M-214
 - Macroscopic examination M-214
 - Utilization and application M-553
- Magnesium
- (extrusion)
 - Crystalline structure
 - Preferred orientation
 - Rolling, Effect of cold M-454
 - (sheet)
 - Cracking
 - Crystalline structure, Effect of M-454
 - Microstructure M-150
 - Rolling, Effect of cold M-454

- 15 -
SUBJECT INDEX

Magnesium

(sheet) (Cont'd)

- Crystalline structures
 - Element in solution M-341, M-454
 - Preferred orientation
 - Bending, Effect of M-454
 - Roller straightening, Effect of M-454
 - Rolling, Effect of cold M-454
 - Rolling, Effect of hot M-454
 - Random orientation, Production of M-150
- Slip
 - Compression, Effect of M-454
- Twinning
 - Compression, Effect of M-454
 - Temperature, effect of M-454
- X-ray diffraction M-454
- Fractures
 - Microstructure M-150
- Microstructure
 - Compression, Effect of M-454

Magnesium alloys: European See: Magnesium alloys: Specific alloys
European

Magnesium alloys: Experimental See: Magnesium alloys: Specific alloys
Experimental

Magnesium alloys: General

-Research

- Suggested problems and development M-553, M-652
- Survey of research being conducted by government agencies, branches of the armed services, and producers and fabricators of magnesium M-553

-Utilization and application M-553

Magnesium alloys: General

(bar, extruded)

- Tensile properties
- Testing methods and equipment M-177

(casting)

- Damping capacity
 - Testing methods and equipment
 - Norton damping capacity machine M-105
- Tensile properties

-Testing methods and equipment M-177

(sheet)

- Cracking
 - Crystalline structure, Effect of M-454
 - Rolling, Effect of cold M-454
- Crystalline structure
 - Preferred orientation
 - Rolling, Effect of cold M-454
 - Rolling, Effect of hot M-454
 - X-ray diffraction M-454
- Fatigue properties
 - Testing methods and equipment M-289
 - Krouse machine M-36

SUBJECT INDEX

Magnesium alloys: General

(shast) (Cont'd)

- Formability
 - Testing methods and equipment M-353
 - Draw press M-65, M-210
 - Guerin press M-65, M-170, M-274, M-313, M-330
- Microstructure
 - Etching solution M-189
- Stress corrosion properties
 - Testing methods and equipment M-471
- Tensile properties
 - Notch effect
 - Hole forming methods and equipment M-177
 - Scratch forming methods and equipment M-177
 - Testing methods and equipment M-28, M-65, M-103, M-104, M-110, M-151

(tubing, extruded)

- Damping capacity
 - Testing methods and equipment
 - Norton damping capacity machine M-28, M-105
- Plastic deformation
 - Determined by tensile tests M-354
- Tensile properties
 - Testing methods and equipment
 - Biaxial tension M-354

Magnesium alloys: Specific Alloys

- AMC (American Magnesium Corporation) Alloys
 - See conversion tabs following this index.
- AMS (Aeronautical Material Specifications) Alloys
 - See conversion table following this index.

Downmetal C

- Physical properties M-292
- Temperature, Effect of elevated M-292

Downmetal C (casting)

- Aging M-106
- Damping capacity M-50, M-105
 - Heat treatment, Effect of M-105
 - Heat treatment and aging, Effect of M-105
- Hardness M-177
- Heat treatment M-50, M-106
- Microstructure M-177
 - Aging, Effect of M-106
 - Heat treatment, Effect of M-50, M-106
- Tensile properties M-105, M-106, M-177
 - Eccentricity of stress, Effect of M-177
 - Heat treatment, Effect of M-105, M-106
 - Heat treatment and aging, Effect of M-105, M-106
- Notch effect
 - Notches M-106, M-177

Downmetal F8

- Physical properties M-292
- Temperature, Effect of elevated M-292

Downmetal F8 (casting)

- Bending
 - Notch effect M-214
- Fractures
 - Casting practice, Effect of M-214

- 17 -
SUBJECT INDEX

Magnesium alloys: Specific Alloys (Cont'd)

Downmetal Fs (extrusion)

-Cracking

- Annealing, Effect of M-276
- Rolling, Effect of cold M-276

Downmetal Fs (sheet)

-Compressive properties

- Orientation of sample M-471
- Rolling practice, Effect of M-471
- Corrosion properties M-647
- Crystalline structure M-454
- Preferred orientation

- Compression, Effect of M-276
- Rolling, Effect of hot M-276, M-454

-Twinning

- Bending, Effect of M-150
- Compression, Effect of M-341
- Roller straightening, Effect of M-150
- Speed of deformation, Effect of M-454
- Temperature, Effect of M-341
- X-ray diffraction M-150, M-276, M-341, M-454

-Stress corrosion properties

- Orientation of sample M-471
- Rolling practice, Effect of M-471

-Tensile properties

- Compression, Effect of M-276
- Orientation of sample M-471
- Rolling, Effect of hot M-276
- Rolling practice, Effect of M-471

Downmetal Fs (tubing, extruded)

- Damping capacity M-50, M-105
- Microstructure M-105
- Twinning M-105

-Tensile properties M-105

Downmetal Fs-1-2 (sheet)

- Corrosion properties M-471
- Cupping properties M-169
- Fatigue failures

- Corrosion, Effect of M-289
- Microscopic examination M-289

-Fatigue properties M-169, M-289

- Corrosion, Effect of M-289
- Microstructure
- Corrosion, Effect of M-289
- Notch effect
- Holes M-289

-Formability

- Bending properties M-330
- Temperature, Effect of elevated M-330
- Critical bend radii M-170
- Temperature, Effect of elevated M-170
- Drawing properties M-210
- Microstructure M-210
- Temperature, Effect of elevated M-210

- 18 -

SUBJECT INDEX

Magnesium alloys: Specific alloys

Downmetal Fe-1-a (sheet)

-Formability (Cont'd)

- Orientation of sample M-170
- Shrink forming properties M-313, M-353
 - Flanges M-313
 - Temperature, Effect of elevated M-313, M-353
- Spring back M-170, M-313
 - Temperature, Effect of elevated M-170
- Stretch forming properties M-274, M-353
 - Flanges M-274
 - Temperature, Effect of elevated M-274, M-353
- Hardness M-169, M-289
- Microstructure M-169, M-210, M-289
- Resistivity, Electrical M-169
- Stress corrosion properties M-471
- Tensile properties M-129, M-151, M-169, M-170, M-177,
M-210, M-274, M-289, M-454, M-471

-Notch effect

- Hole forming conditions M-177
- Holes M-129, M-177
- Scratches M-177
- Orientation of sample M-151
- Size effect M-129, M-177
- Strain rate, Effect of M-151
- Temperature, Effect of elevated M-151, M-454

Downmetal Fe-1-b (sheet)

-Compressive properties

- Orientation of sample M-647
- Rolling practice, Effect of M-647
- Corrosion properties M-471
- Crystalline structure
 - Twining M-214
 - Bending, Effect of M-454
- Cupping properties M-169
- Fatigue failures
 - Corrosion, Effect of M-289
 - Microscopic examination M-289
- Fatigue properties M-169, M-289
 - Corrosion, Effect of M-289
 - Heat treatment, Effect of M-289
 - Microstructure
 - Corrosion, Effect of M-289
- Notch effect
 - Holes M-289
- Stress corrosion, Effect of M-289

-Formability

- Bending properties M-330
 - Temperature, Effect of elevated M-330
- Critical bend radii M-170
 - Temperature, Effect of elevated M-170
- Orientation of sample M-170

SUBJECT INDEX

Magnesium alloys: Specific alloys

Downmetal Ps-l-h (sheet)

-Formability (Cont'd)

-Shrink forming properties M-313, M-353

-Flanges M-313

-Temperature, Effect of elevated M-313, M-353

-Spring back M-170, M-313

-Temperature, Effect of elevated M-170

-Stretch forming properties M-274, M-353

-Flanges M-274

-Temperature, Effect of elevated M-274, M-353

-Hardness M-169, M-289

-Microstructure M-152, M-169, M-289

-Heat treatment, Effect of M-152, M-289

-Resistivity, Electrical M-169

-Stress corrosion properties M-152, M-197, M-471

-Heat treatment, Effect of M-197, M-471, M-647

-Orientation of sample M-471, M-647

-Rolling practice, Effect of M-471

-Surface treatment, Effect of M-471

-Tensile properties M-129, M-151, M-152, M-169, M-170, M-177,

M-197, M-237, M-274, M-289, M-471

-Heat treatment, Effect of M-197, M-237, M-471, M-647

-Notch effect

-Hole forming conditions M-177

-Holes M-129, M-177

-Scratches M-177

-Orientation of sample M-151, M-237, M-471, M-647

-Rolling practice, Effect of M-647

-Size effect M-129, M-177

-Strain rate, Effect of M-151

-Stress corrosion, Effect of M-289

-Temperature, Effect of elevated M-151

Downmetal Ps-A (sheet)

-Crystalline structure

-X-ray diffraction M-454

Downmetal Ps-H (sheet)

-Cracking

-Crystalline structure, Effect of M-454

-Rolling, Effect of cold M-454

-Crystalline structure

-Preferred orientation

-Annealing, Effect of M-150

-Bending, Effect of M-276

-Rolling, Effect of cold M-150, M-454

-Rolling, Effect of hot M-454

-Random orientation; Production of M-454

-Twining M-274

-Bending, Effect of M-276, M-454

-Compression, Effect of M-150

-Roller straightening, Effect of M-454

-X-ray diffraction M-150, M-276, M-454

SUBJECT INDEX

Magnesium alloys: Specific alloys

Downmetal Fe-M (sheet) (Cont'd)

- Microstructure M-189
- Stress corrosion properties M-197
 - Heat treatment, Effect of M-197
 - Orientation of sample M-197
- Tensile properties M-197
 - Heat treatment, Effect of M-197
 - Orientation of sample M-197

Downmetal H

- Physical properties M-292
 - Temperature, Effect of elevated M-292

Downmetal H (casting)

- Damping capacity M-105
 - Heat treatment, Effect of M-105
 - Heat treatment and aging, Effect of M-105
- Tensile properties M-105
 - Heat treatment, Effect of M-105
 - Heat treatment and aging, Effect of M-105

Downmetal J

- Physical properties M-292
 - Temperature, Effect of elevated M-292

Downmetal J (bar, extruded)

- Hardness M-177
- Microstructure M-177
- Tensile properties M-129, M-177
 - Eccentricity of stress, Effect of M-177
 - Notch effect
 - Notches M-129, M-177
- Prestretching, Effect of M-177

Downmetal J (sheet)

- Compressive properties
 - Heat treatment, Effect of M-471
 - Rolling, Effect of cold M-471
 - Rolling practice, Effect of M-471
- Formability
 - Stretching properties
 - Temperature, Effect of elevated M-471
- Stress corrosion properties
 - Heat treatment, Effect of M-471
 - Rolling, Effect of cold M-471
 - Rolling, Effect of warm M-471
 - Rolling practice, Effect of M-471
- Tensile properties M-471
 - Heat treatment, Effect of M-471
 - Rolling, Effect of cold M-471
 - Rolling, Effect of warm M-471
 - Rolling practice, Effect of M-471

SUBJECT INDEX

Magnesium alloys: Specific alloys (Cont'd)

Downmetal J (tubing, extruded)

-Damping capacity M-28, M-50

-Microstructure M-28

-Twinning M-28

-Microstructure M-28

Downmetal J-1 (extrusion)

-Cracking

-Annealing, Effect of M-276

-Rolling, Effect of cold M-276

Downmetal J-1 (sheet)

-Compressive properties

-Rolling, Effect of warm M-647

-Rolling practice, Effect of M-647

-Crystalline structure

-Preferred orientation

-Bending, Effect of M-454

-Compression, Effect of M-276

-Roller straightening, Effect of M-454

-Rolling, Effect of hot M-276, M-454

-Twinning

-Compression, Effect of M-276

-Rolling, Effect of hot M-276

-X-ray diffraction M-276, M-454

-Hardness

-Heat treatment, Effect of M-237, M-647

-Rolling, Effect of hot M-237, M-647

-Microstructure

-Heat treatment, Effect of M-237, M-647

-Rolling, Effect of cold M-237

-Rolling, Effect of hot M-237, M-647

-Rolling, Effect of warm M-237, M-647

-Rolling practice, Effect of M-647

-Stress corrosion properties

-Heat treatment, Effect of M-237, M-647

-Rolling, Effect of cold M-237, M-647

-Rolling, Effect of hot M-237, M-647

-Rolling, Effect of warm M-237, M-647

-Rolling practice, Effect of M-647

-Tensile properties M-471

-Heat treatment, Effect of M-237, M-471, M-647

-Rolling, Effect of cold M-237, M-471, M-647

-Rolling, Effect of hot M-237, M-647

-Rolling, Effect of warm M-237, M-471, M-647

-Rolling practice, Effect of M-471, M-647

Downmetal J-1 (tubing, extruded)

-Crystalline structure

-Preferred orientation M-354

-Damping capacity M-105

-Microstructure M-105

-Microstructure M-354

-Plastic deformation

-Mathematical calculations M-354

SUBJECT INDEX

Magnesium alloys: Specific alloys

Dowmetal J-1 (tubing, extruded) (Cont'd)

- Tensile properties M-105, M-354
- Stress-strain diagrams M-354
- Stressos, Biaxial M-354

Dowmetal J-1-a (sheet)

- Compressive properties M-152, M-647
- Roller straightening, Effect of M-152, M-647

-Crystalline structure

-Microstructure

- Roller straightening, Effect of M-150

-Preferred orientation

- Roller straightening, Effect of M-150

-Twinning M-214

- Bending, Effect of M-150

- Roller straightening, Effect of M-150

- Speed of deformation, Effect of M-454

- X-ray diffraction M-150, M-454

-Cupping properties M-76, M-169

-Fatigue failures

- Macroscopic examination M-76, M-169

- Welds, Heliarc M-125, M-169

- Welds, Spot M-125, M-169

- Microscopic examination M-76, M-125, M-169

- Welds, Heliarc M-169

-Fatigue properties M-36, M-76, M-125, M-169

- Microstructure M-76, M-169

-Notch effect

- Holes M-125, M-169

- Orientation of sample M-125, M-169

- Riveted joints M-125, M-169

- Size effect M-169

- Welds, Cycle M-125, M-169

- Welds, Heliarc M-125, M-169

- Welds, Spot M-125, M-169

-Formability

- Beadng properties M-330

- Temperature, Effect of elevated M-330

- Critical bend radii M-170

- Temperature, Effect of elevated M-170

- Drawing properties M-210

- Microstructure M-210

- Temperature, Effect of elevated M-210

- Orientation of sample M-170

- Shrink forming properties M-313, M-353

- Flanges M-313

- Temperature, Effect of elevated M-313, M-353

- Spring back M-170, M-313

- Temperature, Effect of elevated M-170

- Stretch forming properties M-274, M-353

- Flanges M-274

- Temperature, Effect of elevated M-274, M-353

SUBJECT INDEX

Magnesium alloys: Specific alloys

Dowmetal J-1-a (sheet) (Cont'd)

- Hardness M-36, M-76, M-125, M-169
- Welds, Heliarc M-125, M-169
- Welds, Spot M-125, M-169
- Microstructure M-36, M-76, M-103, M-169, M-189, M-210
- Resistivity, Electrical M-76, M-169
- Stress corrosion properties M-647
- Roller straightening, Effect of M-647
- Tensile properties M-36, M-50, M-76, M-103, M-104, M-110, M-125, M-151, M-169, M-170, M-177, M-210, M-274, M-454, M-647
- Notch effect
- Hole forming conditions M-50, M-104, M-129, M-177
- Holes M-50, M-104, M-125, M-129, M-169, M-177
- Microscopic examination M-177
- Scratches M-177
- Orientation of sample M-104, M-110, M-125, M-151, M-169
- Riveted joints M-169
- Roller straightening, Effect of M-152, M-647
- Size effect M-50, M-103, M-104, M-177
- Strain rate, Effect of M-110, M-151
- Temperature, Effect of elevated M-110, M-151, M-454
- Temperature, Effect of low M-104
- Welds, Cycle M-169
- Welds, Heliarc M-169
- Welds, Spot M-169

Dowmetal J-1-b (sheet)

- Compressive properties M-647
- Orientation of sample M-647
- Roller straightening, Effect of M-647
- Rolling practice, Effect of M-647
- Corrosion properties M-471, M-647
- Cracking
- Crystalline structure, Effect of M-454
- Rolling, Effect of cold M-454
- Crystalline structure
- Element in solution
- Heat treatment, Effect of M-341, M-454
- Rolling, Effect of cold M-341, M-454
- Precipitate, Distribution of
- Bending, Effect of M-341, M-454
- Preferred orientation
- Compression, Effect of M-276, M-341, M-454
- Roller straightening, Effect of M-150
- Rolling, Effect of cold M-454
- Rolling, Effect of hot M-341, M-454
- Temperature, Effect of M-276, M-341, M-454
- Random orientation, Production of M-454
- Twinning M-214
- Bending, Effect of M-150, M-454
- Compression, Effect of M-276, M-341, M-454
- Roller straightening, Effect of M-150
- Temperature, Effect of M-276, M-454
- X-ray diffraction M-150, M-276, M-341, M-454

SUBJECT INDEX

Magnesium alloys: Specific alloys

Downstall J-1-h (sheet) (Cont'd)

- Cupping properties M-76, M-169
- Fatigue failures
 - Heat-treatment, Effect of M-289
 - Macroscopic examination M-76, M-169
 - Welds, Cycle M-169
 - Welds, Heliarc M-125, M-169
 - Welds, Spot M-76, M-125, M-169
 - Microscopic examination M-76, M-169, M-289
 - Welds, Cycle M-76
 - Welds, Spot M-76
- Fatigue properties M-36, M-76, M-125, M-169, M-289, M-381
 - Corrosion, Effect of M-381
 - Speed of testing, Effect of M-381
 - Welds, Heliarc
 - Microscopic examination M-381
 - Heat treatment, Effect of M-289, M-381
 - Notch effect
 - Holes M-125, M-169, M-381
 - Notches M-381
 - Orientation of sample M-76, M-125, M-169
 - Riveted joints M-76, M-125, M-169
 - Rolling, Effect of cold M-381
 - Size effect M-36, M-76, M-169
 - Welds, Cycle M-76, M-125, M-169, M-381
 - Welds, Heliarc M-125, M-169
 - Microscopic examination M-381
 - Welds, Spot M-76, M-125, M-169
- Formability
 - Bending properties M-330
 - Temperature, Effect of elevated M-330
 - Critical bend radii M-170
 - Temperature, Effect of elevated M-170
 - Orientation of sample M-170
 - Shrink forming properties M-313, M-353
 - Flanges M-313
 - Temperature, Effect of elevated M-313, M-353
 - Spring back M-170, M-313
 - Temperature, Effect of elevated M-170
 - Stretch forming properties M-274, M-353
 - Flanges M-274
 - Temperature, Effect of elevated M-274, M-353
- Hardness M-36, M-76, M-125, M-169, M-381
 - Welds, Heliarc M-125, M-169
 - Welds, Spot M-125, M-169
- Microstructure M-28, M-36, M-76, M-103, M-152, M-169, M-189, M-381
 - Heat treatment, Effect of M-152, M-289, M-341, M-381, M-454, M-647
 - Quenching media, Effect of M-237, M-647
 - Precipitates, Distribution of
 - Banding, Effect of M-341, M-454
 - Rolling, Effect of cold M-152, M-341, M-381, M-454, M-647
 - Welds, Cycle M-169

SUBJECT INDEX

Magnesium alloys: Specific alloys

Downmetal J-1-h (sheet) (Cont'd)

- Resistivity, Electrical M-76, M-169
- Stress corrosion properties M-152, M-197, M-471
 - Corroding solution, Effect of M-197
 - Heat treatment, Effect of M-197, M-237, M-471, M-647
 - Quenching media, Effect of M-237
 - Orientation of sample M-237, M-471, M-647
 - Roller straightening, Effect of M-647
 - Rolling, Effect of cold M-647
 - Rolling practice, Effect of M-647
 - Surface treatment, Effect of M-471
- Tensile properties M-28, M-36, M-50, M-76, M-103, M-104, M-110, M-125, M-151, M-152, M-169, M-170, M-177, M-197, M-237, M-274, M-381, M-471, M-647
 - Annealing, Effect of M-152
 - Corrosion, Effect of M-471, M-647
 - Heat treatment, Effect of M-152, M-197, M-237, M-289, M-381, M-471, M-647
 - Quenching media, Effect of M-237, M-647
 - Notch effect
 - Hole forming conditions M-177
 - Holes M-28, M-104, M-125, M-169, M-177, M-381
 - Microscopic examination M-104
 - Scratches M-177
 - Orientation of sample M-28, M-110, M-125, M-151, M-169, M-237, M-471, M-647
 - Riveted joints M-76, M-169
 - Roller straightening, Effect of M-647
 - Rolling, Effect of cold M-381, M-647
 - Rolling practice, Effect of M-647
 - Size effect M-28, M-50, M-103, M-104, M-177
 - Strain rate, Effect of M-110, M-151
 - Stress corrosion, Effect of M-289, M-381
 - Temperature, Effect of elevated M-110, M-151
 - Temperature, Effect of low M-104
 - Welds, Cycle M-76, M-169, M-381
 - Welds, Hotiarc M-169
 - Welds, Spot M-76, M-169

Downmetal M

- Physical properties M-292
- Temperature, Effect of elevated M-292

Downmetal M (bar, extruded)

- Hardness M-177
- Microstructure M-177
- Tensile properties M-129, M-177
 - Eccentricity of stress, Effect of M-177
 - Notch effect
 - Notches M-129, M-177
 - Prestretching, Effect of M-177

SUBJECT INDEX

Magnesium alloys: Specific alloys (Cont'd)

Dowmetal M (extrusion)

- Cracking
 - Annealing, Effect of M-276
 - Rolling, Effect of cold M-276
- Crystalline structure
 - Preferred orientation
 - Annealing, Effect of M-276
 - Rolling, Effect of cold M-276
 - X-ray diffraction M-276

Dowmetal M (sheet)

- Crystalline structure M-454
- Preferred orientation
 - Rolling, Effect of hot M-454
- X-ray diffraction M-454

Dowmetal Ma (sheet)

- Crystalline structure
 - X-ray diffraction M-454
- Cupping properties M-76, M-169
- Fatigue failures
 - Macroscopic examination M-76, M-169
 - Microscopic examination M-169
- Fatigue properties M-76, M-169
 - Microstructure M-76, M-169
- Formability
 - Beading properties M-330
 - Temperature, Effect of elevated M-330
 - Critical bend radii M-170
 - Temperature, Effect of elevated M-170
 - Drawing properties M-210
 - Microstructure M-210
 - Temperature, Effect of elevated M-210
 - Orientation of sample M-170
 - Shrink forming properties M-313, M-353
 - Flanges M-313
 - Temperature, Effect of elevated M-313, M-353
 - Spring back M-170, M-313
 - Temperature, Effect of elevated M-170
 - Stretch forming properties M-274, M-353
 - Flange M-274
 - Temperature, Effect of elevated M-274, M-353
- Hardness M-76, M-125, M-169
- Microstructure M-76, M-103, M-169, M-210
- Resistivity, Electrical M-169
- Tensile properties M-50, M-76, M-103, M-104, M-151, M-169,
M-170, M-177, M-210, M-274, M-454
 - Notch effect
 - Hole forming conditions M-177
 - Holes M-50, M-104, M-177
 - Scratches M-177
 - Orientation of sample M-104, M-151
 - Size effect M-50, M-103, M-104

SUBJECT INDEX

Magnesium alloys: Specific alloys

Downmetal M (sheet)

-Tensile properties (Cont'd)

-Strain rate, Effect of M-151

-Temperature, Effect of elevated M-151, M-454

Downmetal M (sheet)

-Cracking

-Crystalline structure, Effect of M-454

-Rolling, Effect of cold M-454

-Crystalline structure

-Preferred orientation

-Compression, Effect of M-341

-Rolling, Effect of cold M-341, M-454

-Rolling, Effect of hot M-341, M-454

-Temperature, Effect of M-341

-Random orientation, Production of M-454

-Twining M-214

-Bending, Effect of M-454

-Compression, Effect of M-341, M-454

-Speed of deformation, Effect of M-454

-Temperature, Effect of M-341

-X-ray diffraction M-341, M-454

-Cupping properties M-76, M-169

-Fatigue failures

-Macroscopic examination

-Welds, Heliarc M-125, M-169

-Welds, Spot M-125, M-169

-Microscopic examination M-125

-Welds, Heliarc M-169

-Welds, Spot M-169

-Fatigue properties M-76, M-125, M-169

-Notch effect

-Holes M-125, M-169

-Orientation of sample M-125, M-169

-Riveted joints M-125, M-169

-Size effect M-169

-Welds, Cyclo M-125, M-169

-Welds, Heliarc M-125, M-169

-Welds, Spot M-125, M-169

-Formability

-Bending properties M-330

-Temperature, Effect of elevated M-330

-Critical bend radii M-170

-Temperature, Effect of elevated M-170

-Orientation of sample M-170

-Shrink forming properties M-313, M-353

-Flanges M-313

-Temperature, Effect of elevated M-313, M-353

-Spring back M-170, M-313

-Temperature, Effect of elevated M-170

-Stretch forming properties M-274, M-353

-Flanges M-274

-Temperature, Effect of elevated M-274, M-353

SUBJECT INDEX

Magnesium alloys: Specific alloys

Downmetal Mh (sheet) (Cont'd)

- Hardness M-76, M-125, M-169
- Welds, Heliarc M-125, M-169
- Welds, Spot M-125, M-169
- Microstructure M-76, M-103, M-169
- Welds, Cycle M-169
- Resistivity, Electrical M-169
- Tensile properties M-50, M-76, M-103, M-104, M-125, M-151, M-169, M-170, M-177, M-274
- Crystalline structure, Relation to M-454
- Notch effect
 - Hole forming conditions M-177
 - Holes M-50, M-104, M-125, M-169, M-177
 - Scratches M-177
- Orientation of sample M-104, M-125, M-151, M-169
- Riveted joints M-169
- Size effect M-50, M-103, M-104, M-177
- Strain rate, Effect of M-151
- Temperature, Effect of elevated M-151
- Welds, Cycle M-169
- Welds, Heliarc M-169
- Welds, Spot M-169

Downmetal Q

- Physical properties M-292
- Temperature, Effect of elevated M-292

Downmetal Q (bar, extruded)

- Aging M-177
- Hardness M-129, M-177
- Heat treatment M-177
- Microstructure M-177
 - Aging, Effect of M-177
 - Heat treatment, Effect of M-177
- Tensile properties M-129, M-177
 - Aging, Effect of M-129
 - Eccentricity of stress, Effect of M-177
 - Heat treatment, Effect of M-129
 - Notch effect
 - Notches M-129, M-177
- Prestretching, Effect of M-177

Downmetal Q-1 (tubing, extruded)

- Damping capacity M-105
- Microstructure M-105
- Tensile properties M-105

Downmetal R

- Physical properties M-292
- Temperature, Effect of elevated M-292

Downmetal R (casting)

- Damping capacity M-105
- Heat treatment, Effect of M-105
- Heat treatment and aging, Effect of M-105

SUBJECT INDEX

- Magnesium alloys: Specific Alloys
 - Downmetal R (casting) (Cont'd)
 - Tensile properties M-105
 - Heat treatment, Effect of M-105
 - Heat treatment and aging, Effect of M-105
 - Downmetal X (bar, extruded)
 - Hardness M-177
 - Microstructure M-177
 - Tensile properties M-129, M-177
 - Eccentricity of stress, Effect of M-177
 - Notch effect
 - Notches M-129, M-177
 - European
 - Physical properties M-292
 - Temperature, Effect of elevated M-292
 - Experimental
 - Physical properties M-292
 - Temperature, Effect of elevated M-292
 - Experimental (sheet)
 - Compressive properties M-647
 - Heat treatment M-471, M-647
 - Rolling practice M-647
 - Stress corrosion properties M-152, M-237, M-471, M-647
 - Surface treatment M-471, M-647
 - Tensile properties M-237, M-471, M-647
 - SAE (Society of Automotive Engineers) Alloys
 - See Conversion Table following this index.
- Plastic deformation
 - Determined by tensile tests M-354
 - Mathematical calculations M-213, M-354
 - Theory M-213, M-354
- Research
 - Suggested problems and development for magnesium and magnesium alloys M-553, M-652
 - Survey of research being conducted by government agencies, branches of the armed services, and producers and fabricators of magnesium and magnesium alloys M-553
- Survey of research being conducted by government agencies, branches of the armed services, and producers and fabricators of magnesium M-553

MAGNESIUM ALLOY SYMBOLS AND COMPOSITIONS*

Magnesium alloy compositions have been indexed under Dowmetal symbols only, even though the reports indexed contain the results of experimental work on both AMC (American Magnesium Corporation) and Dowmetal Alloys. This indexing procedure brings together under one heading all information on alloys of identical or nearly identical composition. Some of the reports also refer to magnesium alloys by AMS (Aeronautical Material Specifications) and SAE (Society of Automotive Engineers) specification symbols.

Dowmetal	Symbols			Nominal composition		(percent)
	AMC	AMS	SAE	Al	Mn	Zn
C	260	4434	500	9.0	0.1	2.0
Fs	52S		52	2.8	0.3	1.0
Fs-l-a	52S-0			2.8	0.3	1.0
Fs-l-h	52S-H			2.8	0.3	1.0
Fs-A				2.7	0.3	1.0
Fs-H				2.7	0.3	1.0
H	265	4420	50	6.0	0.2	3.0
J	57S		520	6.5	0.2	0.7
J-l	57S			6.5	0.2	0.7
J-l-a	57S-0	4380		6.5	0.2	0.7
J-l-h	57S-H	4381		6.5	0.2	0.7
M	3S				1.5	
Mh	330	4370a	51		1.5	
Mh	3S-H	4370h	51		1.5	
O	58S			8.5	0.2	0.5
O-l				8.5	0.2	0.5
R	263	4490	501	9.0	0.2	0.6
X	74S			3.0	0.2	3.0

* Experimental alloys tested in reports M-152, M-237, M-292, M-471 and M-647 are not included in this table.

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682

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Purdum, H. L.

DIVISION: Materials (8) 56

SECTION: Magnesium and Alloys (11) 7

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ABSTRACT

An index is prepared of information on magnesium alloys of identical or nearly identical composition. These alloys are indexed under Dowmetal symbols, although results of experimental work on AMC alloys are included. Also referred to are the specification symbols of AMS and SAE. Some of the reports contain information on aluminum alloys, which is indexed under the Alcoa symbols.

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AL INDEX

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