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DEPARTMENT OF MINES AND RESOURCES

BUREAU OF MINES

CANADA

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Ottawa, April 29, 1946.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 2039.

Fatigue Properties of Three "As Cast" Magnesium
Alloys (AZ92X, AZ80X and AZ63X).

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(Copy No. 4.)

Bureau of Mines
Division of Metallic
Minerals

Physical Metallurgy
Research Laboratories

CANADA

DEPARTMENT
OF
MINES AND RESOURCES

Mines and Geology Branch

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Introduction:

This investigation was carried out to determine the fatigue properties of three "as cast" magnesium alloys. The magnesium metal used in these tests was produced by the Silicon Reduction process in the plant of Dominion Magnesium Limited at Haley, Ontario. The results obtained, together with values published by the Dow Chemical Company, Flint, Michigan, will be given in this report for comparative purposes.

Chemical Analysis:

The three alloys used in this investigation had the following chemical composition:

TABLE I.

Alloy Symbol	Heat	A n a l y s i s							Mg
		Chemical			Spectrographic				
		Al	Zn	Mn	Fe	Si	Pb	Cu	
AZ92X	EA	9.25	2.10	0.33	.001	.015	.004	.001	Balance
AZ80X	EB	8.14	0.55	0.55	.001	.015	.004	.003	"
AZ63X	EC	6.13	3.17	0.43	.001	0.15	.004	.002	"

TABLE II. - Results of Tensile Tests.

Alloy	AZ92X	AZ80X	AZ63X
Ultimate stress, p.s.i.	28,100	30,200	32,100
0.2 per cent proof stress, p.s.i.	17,600	15,500	14,700
Elongation, per cent in 2 inches	2.2	5.6	6.8
Modulus of elasticity, p.s.i.	6.5×10^6	6.5×10^6	6.5×10^6
Brinell hardness (500-kg. load),	65	50	50

Castings:

The test specimens were cast in sand moulds and were X-rayed for porosity before machining. The casting was a P.M.R.L. "as cast" tensile bar.

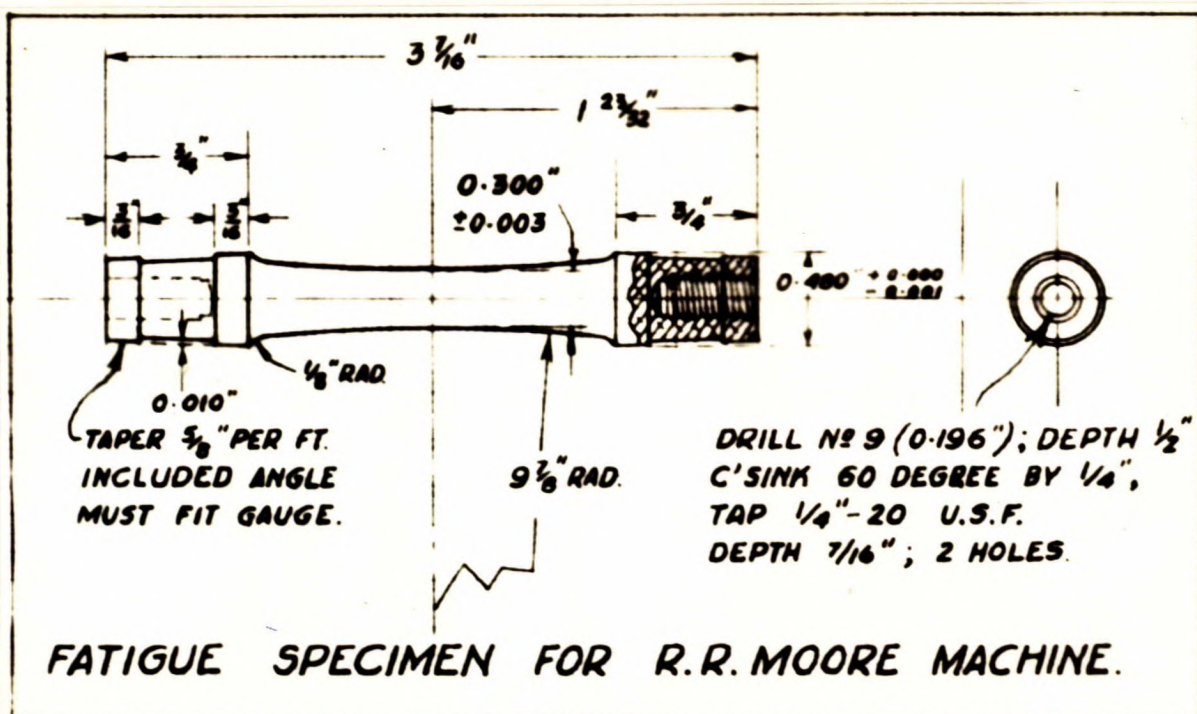
Rotating Bending Fatigue Tests:

The fatigue strength of the three alloys investigated was determined on a high speed Moore rotating beam fatigue testing machine operated at approximately 10,000 r.p.m. The test specimens used were standard Moore fatigue test pieces, as shown in Figure 1. After machining, the surface was polished longitudinally with 00 emery cloth. The alloys were tested to 10^7 cycles. The results are given in Table III.

(Continued on next page)

(Rotating Bending Fatigue Tests, cont'd) -

Figure 1.



MOORE FATIGUE SPECIMEN.

TABLE III.

Alloy	Specimen Number	Applied Stress, p.s.i.	Number of Cycles
AZ92X	EA-13	12,000	+10 ⁷
	" 11	14,000	+10 ⁷
	" 15	14,500	+10 ⁷
	" 17	15,000	969,000
	" 14	15,000	1,018,000
AZ80X	EB-11	13,000	+10 ⁷
	" 16	14,000	+10 ⁷
	" 18	14,500	8,793,000
	" 17	15,000	6,503,000
	" 12	20,000	58,000
AZ63X	EC-17	11,000	10 ⁷
	" 12	12,000	10 ⁷
	" 38	13,000	10 ⁷
	" 22	14,000	10 ⁷
	" 23	15,000	1,209,000

Summary:

The fatigue strength, in p.s.i. at ten million reversals, of the three "as cast" magnesium alloys tested are shown in Table IV, together with values published[Ⓢ] by Dow Chemical Company, Flint, Michigan.

[Ⓢ] In "American Foundryman" (A.F.A. official magazine), December 1945, p. 59, Table 6.

(Summary, cont'd) -

TABLE IV.

Laboratory	Alloys	Heat Treatment	Endurance Limit p.s.i. (10^7 reversals)
B. of M. Dow	AZ92X "	A.C. "	14,500 13,500
B. of M. Dow	AZ80X "	" "	14,250 14,200
B. of M. Dow	AZ63X "	" "	14,000 12,600

Remarks:

The values reported above were obtained on single determinations on samples taken from a heat of each alloy.

The results of this investigation show that the fatigue properties of "as cast" magnesium made in these Laboratories are equal, and in some cases superior, to properties reported for similar alloys produced by the Dow Chemical Company,

It is intended to perform further tests, using a larger number of samples.

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