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DYNAMIC SHEAR TESTS ON FUZE CLOSING DISCS

by

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Origin of Material and Object of Investigation:

In a letter (File No. HQS 6233 Fuze 410 (DAD)) dated January 9, 1958, Mr. C.H.F. Cottee, for the Director of Armament Development, Department of National Defence, Army, Ottawa, requested that the relative shear properties of discs of SAE 1020 steel bar and SAE 1113 steel bar be determined under dynamic loading conditions.

The purpose of these tests was described in this letter as follows:

> "Fuze malfunctions have occurred in fuzes fitted with 24ST Aluminum closing discs and firing tests have shown that these can be overcome by substituting discs machined from SAE 1020 steel rod. It is now required to determine whether equally satisfactory results might be obtained with discs machined from a free machining steel, thereby furnishing a reduction in the cost of manufacture."

The present report contains the results of dynamic shear tests carried out on fuze closing discs fabricated from 24 ST aluminium alloy, 75 ST aluminium alloy, SAE 1020 steel sheet, SAE 1020 steel bar, and SAE 1113 steel bar.

Subsequent to the testing of these discs, a number of sample discs machined from "Ledloy", which is approximately SAE 1113 with a lead addition, were received for test. The results obtained on these discs

are also contained in this report.

Method of Test:

It was decided to compare the various materials by determining the impact load required to drive a 0.150 inch diameter pin through discs of each material. The pin and disc were held in a special adapter, supported on the base of a drop-impact machine, while the load was applied by allowing a hard surfaced steel striker, weighing 3½ pounds, to drop onto the pin. The height from which the striker was dropped was varied until a hole was punched completely through the disc.

The dimensions of the discs were specified to be within the following limits:

Diameter	0.732 in. - 0.735 in.
Thickness	0.060 in. - 0.065 in.

The diameter of the die into which the pin was driven was 0.200 inch.

Impact Tests:

The results of the more significant impact tests carried out on each material are listed below.

Material	Height, in.	Remarks
Aluminium		
24 ST	17	Unbroken, smooth cup.
	18	Hole completely punched.
Aluminium		
75 ST	17	Unbroken, smooth cup.
	18	Cracked, penetration incomplete.
	24	" "
	25	Hole completely punched.

Material	Height, in.	Remarks
Steel		
SAE 1020 sheet	30	Unbroken, smooth cup.
	32	Hole completely punched.
Steel		
SAE 1020 bar	36	Unbroken, smooth cup.
	38	Hole completely punched.
Steel		
SAE 1113 bar	25	Cracked, penetration incomplete.
	34	Hole almost completely punched.
	36	Hole completely punched.
Steel		
Ledloy	25	Unbroken, smooth cup.
	28	Cracked, penetration incomplete.
	36	Hole almost completely punched.
	38	Hole completely punched.

Hardness Tests:

The following hardness values were obtained on the steel specimens:

Material	Rockwell "B" Hardness
SAE 1020 sheet	52 - 55
SAE 1020 bar	87 - 88
SAE 1113 bar	97 - 98
Ledloy	95½ - 96

Remarks:

The above impact test results indicate that the SAE 1113 steel discs are considerably less ductile than the discs machined from SAE 1020 steel bar stock. The SAE 1113 steel discs cracked opposite the point of impact under a considerably lower load than the SAE 1020

discs. However, the impact loads required for complete penetration of discs of both materials were quite close.

The impact tests showed the Ledloy discs to be slightly more ductile than the SAE 1113 discs, although these materials behaved in a similar manner under test. A slightly higher impact load was required to punch a hole completely through the Ledloy discs than to punch a hole through the SAE 1113 discs.

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