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REPORT NO. 740/9

REPORT OF BALLISTIC TESTS

BY CARROLL BLAIR

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BY

DR. CARROLL BLAIR

ORDNANCE CORPS DEPT.

1930

WATERTOWN ARSENAL  
WATERTOWN, MASS.



Fig. 3  
Normal impact on flat surface, hit B on Fig. 1.



Fig. 2  
Normal impact on spherical surface hit A on Fig. 1.

X5



Fig. 1  
Armor plate ball casting showing effect of normal impact  
of cal. .30, service velocity, a.p. bullets at 100 yds.  
range.

Watertown Arsenal  
 Report No. 710/9

September 29, 1933.

Report of Ballistic Test on Armor Plate  
 Ball Castings, Dwg. No. C53258 for Tank  
 T3E2 - P.C. 6107

Specimen selected was exceedingly porous. Following heat treatment was given before first test:

Normalizing:

- 6 hours at 1150°C - air cool
- 4 " " 950°C - " "
- 4 " " 850°C - furnace cool

Rough Machined:

- 1 1/2 hours at 1600°F - oil quench
- 1 1/2 " " 1000°F - furnace cool

Firing was then done at 100 yds. with service velocity .30 cal. a.p. ammunition which has a rated residual velocity of 2480 ft/sec at that range. Hits of normal impact were registered in both sound and porous structure on the flat surface and in porous structure on the spherical surface. In all cases of hits in porous metal the bullets changed direction sharply and tore themselves out normal to their line of flight penetrating not more than 1/2". The impact on sound metal gave no evidence of the bullet having changed direction and the penetration was apparently about 1/2". No measurement was made of penetration at this time as all hits were on sections of the casting of at least 3/4" thickness.

Brinell hardness of Specimen:

Flat Surface	424
Spherical "	395

The specimen was then annealed: 4 hours at 850°C and furnace cooled, machined to a thickness of between 1/2" and 5/8" and hardened as follows:

1 1/2 hours at 1600°F - oil quench  
 1 1/2 " " 1000°F - furnace cool

Firing was conducted at 100 yds. range cal. .30, service velocity a.p. ammunition and normal impact obtained on both flat and spherical surfaces.

Tabulated results:

Surface	Brinell	Thickness	Depth of Penetration	Nature of Metal Struck	Nature of Metal on Opposite side
Flat	418	19/32"	33/64"	Sound	Porous
Spherical	444	17/32"	31/64"	"	"

In each case the impact of the bullet was directly opposite an interior surface in which were blow holes of a diameter and depth of at least 1/8". The inner surface showed only a very slight protrusion and in neither case any sign of cracking, spalling or complete penetration as defined in U.S. Army Tentative Specification for light armor plate, AXS Rev. 1, May 1, 1933. Photographs of hits Figs. 1, 2 and 3.

Requirements for Ballistic resistance for homogeneous armor plate:

2500 f<sup>+</sup>/sec for .30 cal a.p. bullets on .500" thickness, no complete penetration (U.S. Army Tentative Specification for Light Armor Plate, AXS Rev. 1, May 1, 1933).

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