

DETERMINATION OF THE INITIATION STRENGTH OF COMMERCIAL DETONATORS USING AN ADJUSTABLE-SENSITIVITY LIQUID EXPLOSIVE

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Abstract

The Bureau of Mines is developing a test to determine the initiating strength of commercial detonators. Various tests of "detonator strength" are in use, but many of them do not correlate well with each other, and so far, there is little evidence that any of them correlate well with the ability of detonators to initiate detonation in an explosive. Therefore, the Bureau decided to attempt a measurement of the ability of detonators to initiate detonation. To this end, an explosive mixture of adjustable sensitivity was developed. This mixture was a nitromethane emulsified with ethylene diamine, the emulsifier being "fine-tuned" by the addition of nitropropane. Most of the testing was done with military J-2, commercial No. 6 copper-hell and commercial No. 8 aluminum-hell detonators. Each test with detonators immersed in the explosive indicated marked discrepancies with other strength tests and with the expectation based on the presumed strength of the detonators. This prompted further investigation of directional effects in the initiation of explosive by detonators. For the additional test, detonators were fixed: (a) immersed in the test explosive, oriented axially, (b) with the tip of the detonator just touching the surface of the explosive, and (c) immersed in the explosive so that the tip of the detonator extended out of the explosive. Markedly different results were obtained in the three configurations, indicating that the directional effects are important. This explains why different detonator strength tests do not correlate well with each other. Some tests, such as the end-on and the index attack tests measure the total energy output, while others such as the side-on plate-test and the nail test measure the energy in the axial direction, and still others such as the lead block test measure the energy in the radial direction. The results indicate the importance of conducting the test in the manner in which the detonator is actually intended to be used.