7.62mm Case Rupture Failure Analysis

5 June 2019

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Bobby Woolsey
• Multiple lot acceptance tests at the Lake City Army Ammunition Plant (LCAAP) from 2017-2018
  – 10 partial and complete circumferential ruptures

• 7.62mm M80 shot in the M240 weapon system

M80 ruptured case and subsequent cartridge which failed to chamber (middle)
• All cartridge case hardness data were within acceptable limits

• However, the **hardness gradient** appeared significant

• A steep hardness gradient can cause a localized region of stress

• The technical team worked to *improve the hardness gradient*

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**CASE DWG NOTE**: “The greatest probability of satisfactory function of cartridges assembled with these cases occurs when the graph of these average readings is **generally parallel to the limit gradients** and is **free from sharp angular departures** therefrom in the region 0.5” from the head to 1.875” from the head.”
• 7.62mm cases rely on induction heating coils to rapidly anneal the body of the case

• **Precise coil manufacture** and **precise positioning** with respect to the case are required in order to yield consistent anneal results

• Coil geometry and position resulted in cases with a large hardness gradient just below the shoulder
• The design of the ceramic insert allowed the copper anneal coil to shift during setup.

• Across 16 case manufacturing machines, each coil functioned differently because of variation in setup.

• The team worked to reduce the sources of annealing variability across the machines.
Old ceramic insert design  New ceramic insert design  New ceramic insert design with coil

A redesigned anneal coil reduced setup variability among machines
• Positioning the part further in the coil allows for more **heat applied lower** on the body of the case

• This shift reduced hardness in the 1.25” region which reduced the hardness gradient and resulting localized stress

• Results in case hardness parallel to the drawing limits
• These changes caused a shift at our most critical location on the case

• The improvements have prevented any further case ruptures to date
An improved 7.62mm case manufacturing process was implemented at LCAAP

Resulted in a more robust 7.62mm case which is less prone to rupturing in the M240 weapon system

Zero (0) case ruptures have occurred since new process implementation

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