Joint Proof & Experimental Unit

Proud & Safe | Results Beyond Reproach

Quality Control in Small Arms EPVAT Testing

MISSION

JPEU is to **deliver** objective quality evidence by conducting test and evaluation for the assurance of explosive ordnance and Defence materiel for the war fighter

VISION

JPEU is Australia's centre of expertise in test and evaluation of Defence explosive ordnance and weapon systems

ROLE

Provide specialist test and evaluation services, in explosive ordnance and weapon systems, to support Defence and the Commonwealth of Australia's wider interests

Introduction

Lewis Quill from JPEU
Graytown

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JOINT
PROOF &
EXPERIMENTAL
UNIT

Test Services

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Environmental

The testing of EO and non-EO items in a representative environment.

- Non-destructive Testing (radiography)
- Vibration
- Shock / Impact / Drop testing
- Temperature (inc. diurnal cycling)
- Humidity
- Salt/Water ingress
- Fog
- Pressure tests

Static

Functioning EO without employing full weapon sequence

- Manufactured explosives,
- Home-made explosives,
- Armour penetration
- Blast effects,
- Arena testing
- Insensitive munitions testing,
- Safe-arming testing,
- Pyrotechnics
- EO breakdown
- EO inerting
- Incident investigations

Dynamic

Employment of full weapon sequence to confirm projectile in flight

- 5.56 / 7.62 / 12.5 mm
- 25 / 30 / 40 / 81 mm
- 5” 54 cal
- 155 mm (Extended Range)
- Limited rocket
- Indoor No Danger Area small arms ranges
- Over-Water Recovery
- Range & Accuracy
- Test Of Function
- Electronic Pressure Velocity Action Time (EPVAT)
- Safe-arming & Fuze Function

Test Management

Implementing quality control in small arms EPVAT testing

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Test Management

- Ammunition testing
- Safety & Performance
- M-CMOPI
- EPVAT
- ISO/IEC 17025

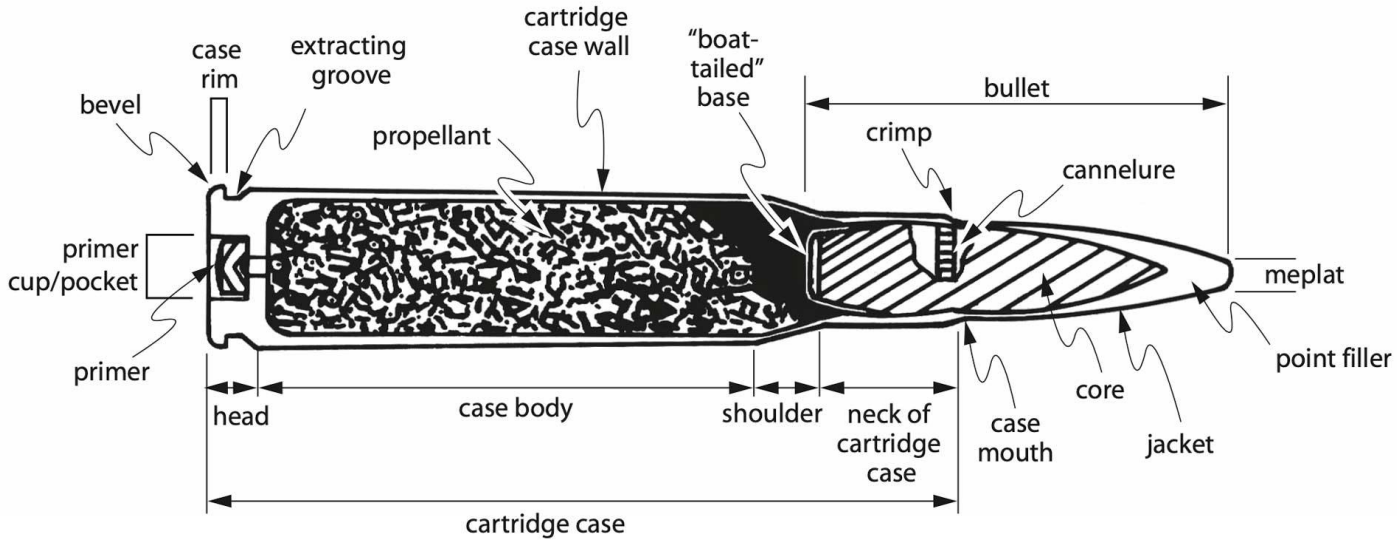

Image source: https://www.americanrifleman.org/content/back-to-basics-cartridge-cases/

What is EVPAT?

Electronic Pressure, Velocity & Action Time

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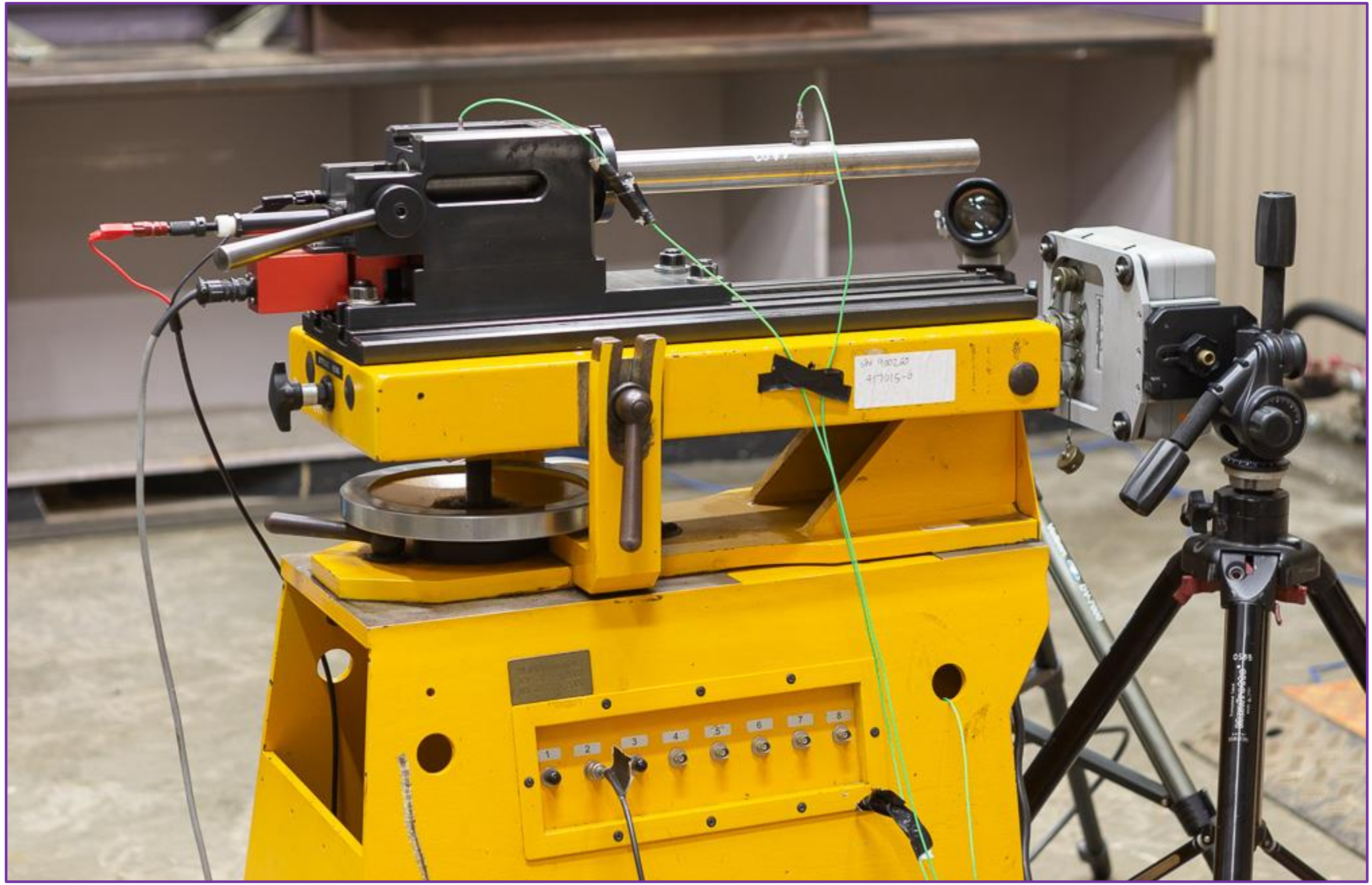

Photo Taken by Mr James Cowie at JPEU P&EE Graytown

Electronic Pressure, Velocity & Action Time

- Pre-fire checks
- Reference rounds
- Temperature variation of test rounds
- 30 Round Groups

Temperature (°C)	21	52	-54
Action Time (ms)	2.44	2.37	2.79

Mean action time varying with temperature (12.7mm Rounds)

Analysing results

Test Criteria and Validity

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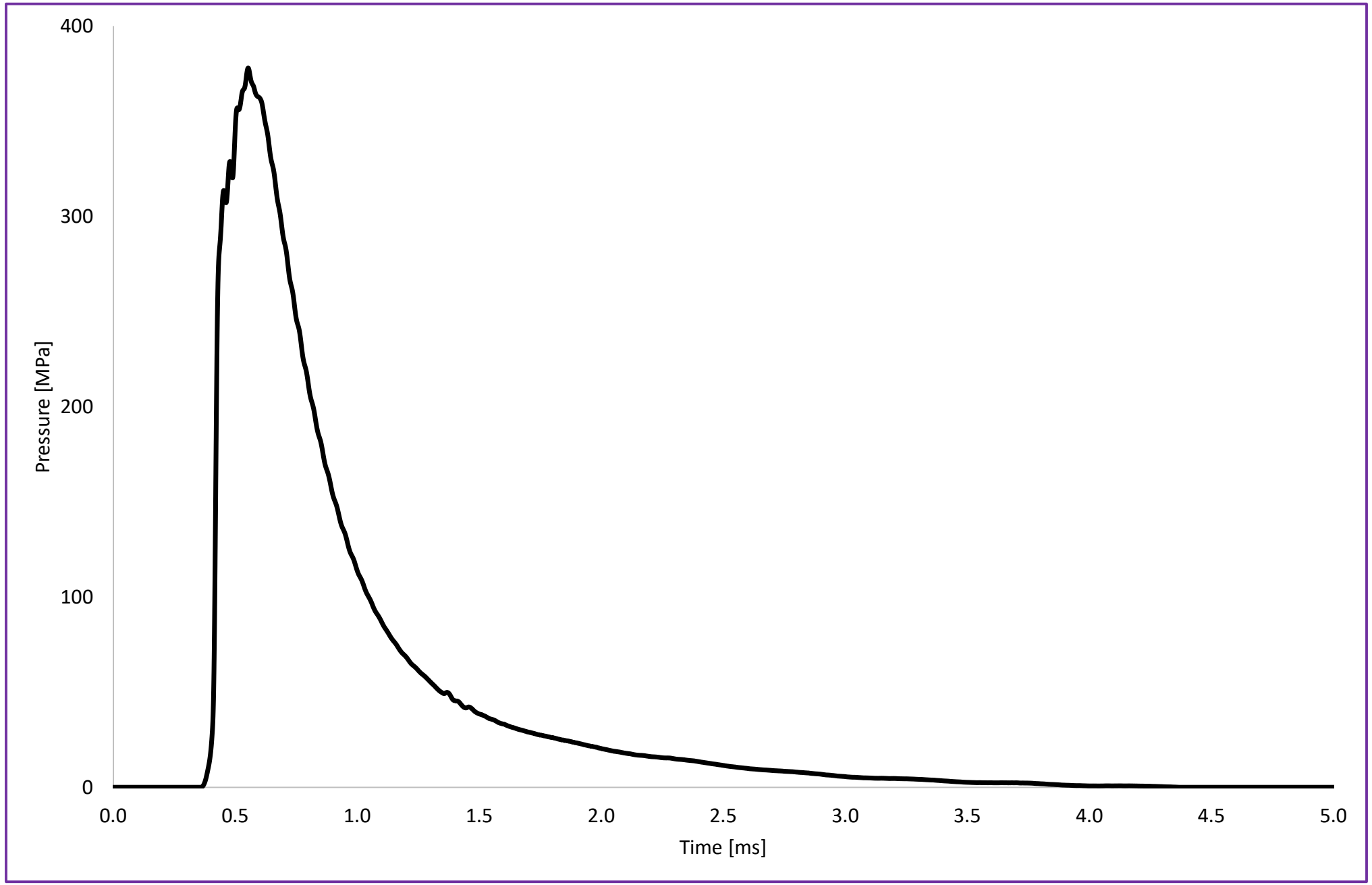
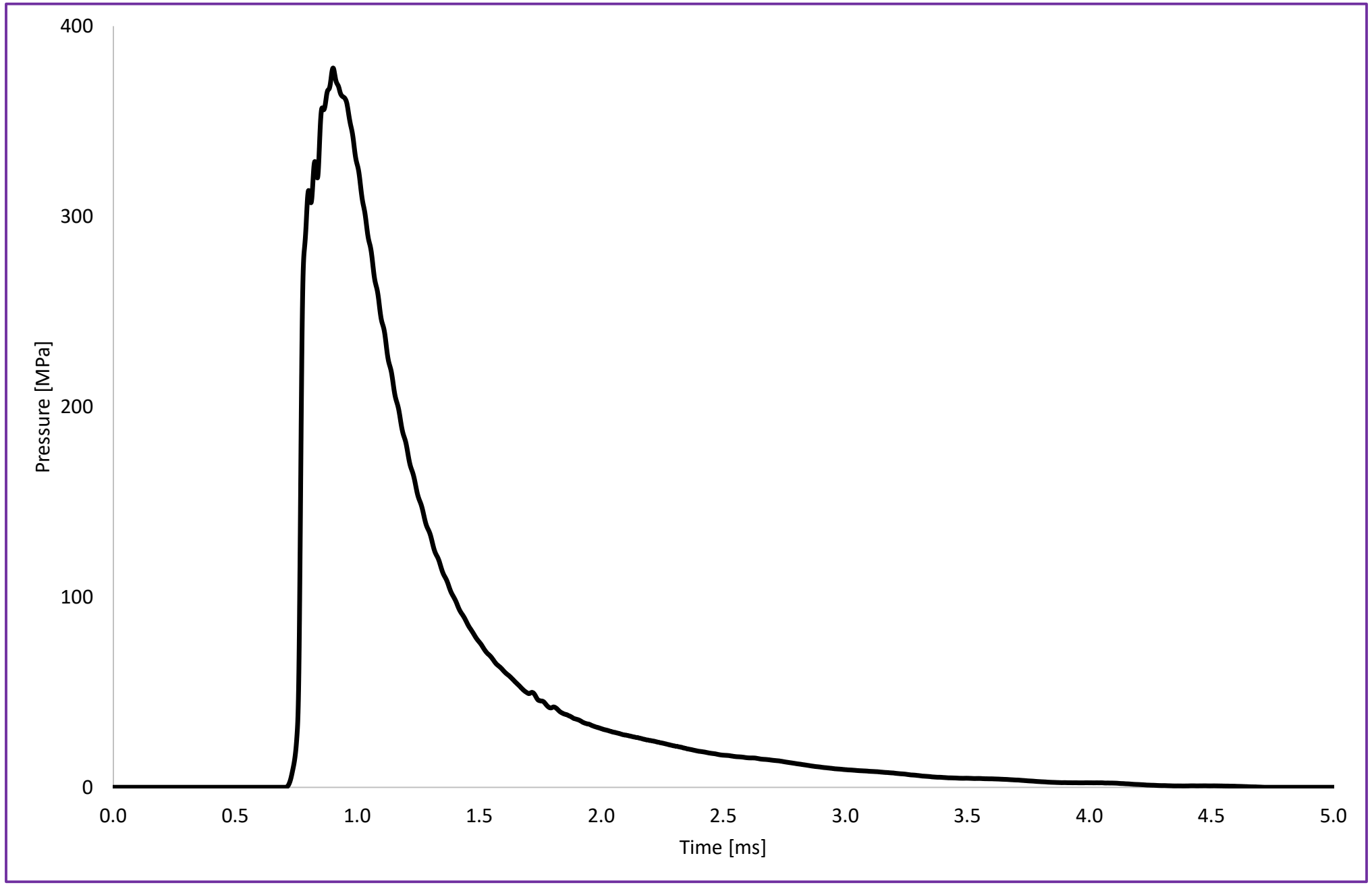
Electronic Pressure, Velocity & Action Time

Calibre	4.6 mm	5.56 mm	5.7 mm	7.62 mm	9 mm	9 mm	12.7 mm
Transducer	6215/GP6	6215/GP6	6215/GP6	6215/GP6	6203	6215/GP6	6215/GP6
Maximum Corrected Mean Case Mouth Pressure + 3 SD for +21 °C sample	460 MPa	445 MPa	370 MPa	445 MPa	265 MPa	285 MPa	450 MPa
Maximum Mean Velocity Difference between +52 °C sample and +21 °C sample	+ 50 m/s To - 50 m/s	+ 50 m/s To - 80 m/s	+ 30 m/s To - 30 m/s	+ 45 m/s to - 75 m/s	+ 30 m/s To - 30 m/s	+ 30 m/s To - 30 m/s	No Require-ment
Maximum Mean Action Time + 5 SD for -54 °C sample	2 ms	3 ms	2 ms	No Require-ment	No Require-ment	No Require-ment	4.5 ms

Source: NATO, Multi-Calibre Manual Of Proof and Inspection (M-CMOPI) for NATO Small Arms Ammunition.



Typical pressure time curve (5.56 mm)



Pressure time curve exhibiting initiation delay (5.56 mm)

Treatment of Outliers: "…A value should not be considered for exclusion on this basis unless it is at least 3.75 mean deviations calculated, including the suspect value (or the equivalent criterion: at least 3.00 standard deviations) from the mean."

ISO/IEC 17025

A framework for quality

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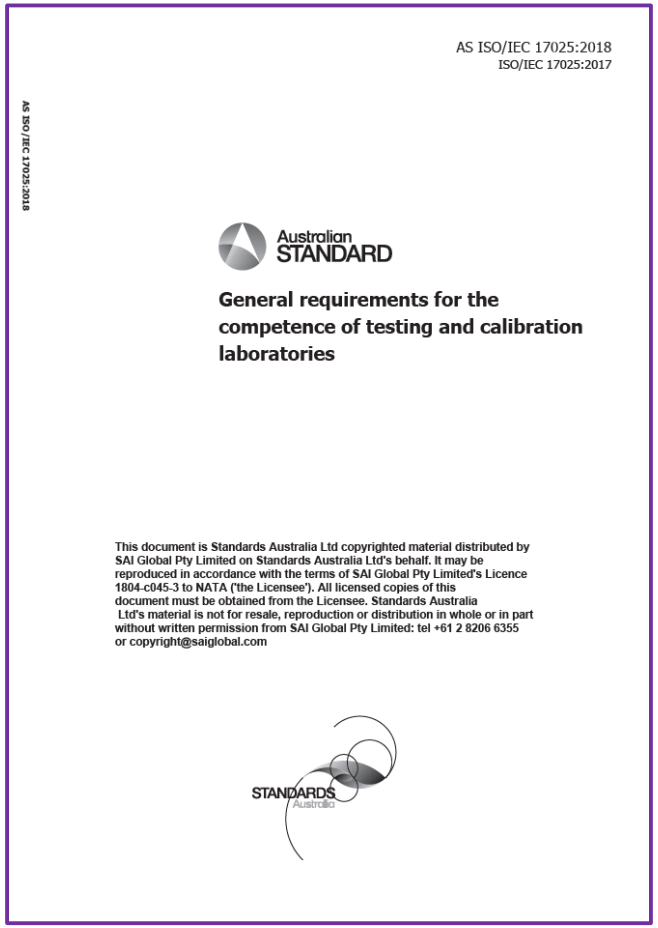
ISO/IEC 17025

- Used in conjunction with ISO 9001
- Calibration
- Metrological Traceability
- Uncertainty of Measurement
- Control Charts



AS ISO/IEC 17025:2018
ISO/IEC 17025:2017

AS ISO/IEC 17025:2018

Australian STANDARD

General requirements for the competence of testing and calibration laboratories

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STANDARDS Australia

Summary

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AUSTRALIAN DEFENCE FORCE

Questions