

**Remaining Life Assessment of Ageing Pharmaceutical Pressure Vessels Using
AD 2000 And API 579**

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STATEMENT BY THE AUTHOR

I hereby declare that this submission is my own work and to the best of my knowledge, it contains no material previously published or written by another person, nor material which to a substantial extent has been accepted for the award of any other degree or diploma at any educational institution, except where due acknowledgement is made in the thesis.


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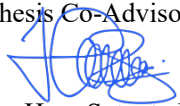
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ABSTRACT

REMAINING LIFE ASSESSMENT OF PHARMACEUTICAL PRESSURE VESSELS

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This thesis develops a repeatable remaining life assessment methodology for ageing pharmaceutical pressure vessels at the H-84 biopharmaceutical production facility at Boehringer Ingelheim, Biberach, based on their current condition after decades of service. Two austenitic stainless-steel vessels, T-538 (partially jacketed) and T-290 (full-length half-coil jacket), were assessed using ultrasonic thickness measurements taken at critical regions including the jacketed regions, knuckles, nozzles and weld-adjacent zones. Measured values were compared against documented originals and used AD 2000 pressure and fatigue calculations. Additionally, an API 579-inspired corrosion-based remaining life approach was applied. For T-538, localized thinning at the jacketed shell was confirmed through validation against T-531, a vessel of similar configuration. Due to the variation observed in this region, a corrosion-based remaining life of approximately 13 years was calculated, consistent with the governing fatigue life at the nozzle on the jacket. For T-290 the drain nozzle was found to fall below the minimum required wall thickness, attributed to undocumented grinding. As a result, the remaining life could not be established without further rectification. This study demonstrates that combining AD 2000 fatigue analysis with an API 579 inspection

methodology bridges a gap in current European practice, where wall-loss monitoring is not systematically addressed.

Keywords: remaining life assessment, ultrasonic thickness measurement, AD 2000, API 579, pressure vessels.



DEDICATION

To my parents, who supported my four-year-old “scientist” dreams, and to the beautiful pandemonium I call home, Sri Lanka.



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