

University of Queensland
Department of Mining and Metallurgical Engineering

Mechanisms of Leaker Formation in Aluminium High Pressure Die Casting

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Written by Stephen Thompson

Co - Supervised by Nick Reid and Barrie Finnin

Principally Supervised by Gordon Dunlop

Declaration

This thesis contains no material that has been accepted for the award of any degree or diploma in any university and to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference is made.

Stephen Thompson.

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Abstract

Within this report an understanding of the mechanisms of leaker formation, both in general and in a specific aluminium high pressure die casting, is developed. This understanding is developed through several stages.

A review of previously published work determines casting defects that may contribute to the formation of leakers in high pressure die casting. Further review of the literature concentrates on understanding each of these defects and their effect on casting pressure tightness. The defects reviewed are, cold flakes, cold shuts, drag marks, gas porosity, oxide films, particulate inclusions, secondary operations that remove or damage the surface layer, shrinkage porosity, soldering, and surface cracks. This information is then compiled to form a “Fault Tree” that will assist in the determination of the “Root Causes” of leakers in a specific casting.

Observation of an automotive water inlet casting is then used to determine the likely root causes of leakers in a specific example. Defects found that may be root causes of leakers were cold shuts, gas porosity, shrinkage porosity, surface porosity due to volatilised fluids, drag marks, and surface cracks. The machining of critical areas of the casting also appeared to increase the likelihood of leaker formation.

Of these defects cold shuts appeared to be the most critical root cause of leakers. To analyse the effect process parameters on the occurrence of cold shuts and leakers a structured trial was carried out in which the die and metal temperatures were manipulated to increase the occurrence of leakers. The results show a strong link between the occurrence and extent of cold shuts and the occurrence of leakers. Furthermore, the results demonstrate a link between die temperatures and the occurrence of leakers.

Finally, a number of strategies to reduce the occurrence of leakers in the automotive water inlet casting are proposed and suggestions are made as to possible further investigation.

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