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Additive manufacturing of metals — Non-destructive testing and evaluation — Defect detection in parts

Fabrication additive de métaux — Essais et évaluation non destructifs — Détection de défauts dans les pièces

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Foreword

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The committee responsible for this document is ISO/TC 261, *Additive manufacturing*, in cooperation with ASTM Committee F42, *Additive manufacturing technologies*, on the basis of a partnership agreement between ISO and ASTM International with the aim to create a common set of ISO/ASTM standards on additive manufacturing, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 438, *Additive manufacturing,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

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Introduction

In response to the urgent need for standards for Additive Manufacturing (AM), this document initially indicates Non-Destructive Testing (NDT) methods with potential to detect defects and determine residual strain distribution that are generated in AM processes. A number of these methods were verified. The strategy adopted was to review existing NDT standards for matured manufacturing processes which are similar to AM, namely casting and welding. This potentially reduces the number of standards required to comprehensively cover the defects in AM. For identified AM unique defects, this document proposes a two-level NDT approach: a star artefact as an Initial Quality Indicator (IQI) and *à la carte* artefact where an example shows the specific steps to follow for the very specific unique AM part to be built, paving the way for a structured and comprehensive framework.

Most metal inspection methods in NDT use ultrasound or X-rays, but these techniques cannot always cope with the complicated shapes typically produced by AM. In most circumstances X-ray computed tomography (CT) is a more suitable method, but it also has limitations and room for improvement or adaptation to AM, on top of being a costly method both in time and money.

This document includes post-process non-destructive testing of additive manufacturing (AM) of metallic parts with a comprehensive approach. It covers several sectors and a similar framework can be applied to other materials (e.g. ceramics, polymers, etc.). In-process NDT and metrology standards are referenced as they are being developed. This document presents current standards capability to detect which of the Additive Manufacturing (AM) flaw types and which flaws require new standards, using a standard selection tool. NDT methods with the highest potential will be tested.