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Additive manufacturing of metals — Test artefacts — Compression validation specimens for lattice designs

Fabrication additive de métaux — Pièces types d'essai — Éprouvettes de validation de compression pour les conceptions de treillis

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Foreword

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Introduction

Validation and verification activities to support the manufacture of components are critical quality requirements to ensure reliable production of consistent parts. Additive manufacturing (AM) offers the opportunity to seamlessly incorporate computationally designed, high resolution, lattice structures into components. On the other hand, AM systems can have different capabilities in terms of feature resolution, therefore impacting physical properties of lattice structures. In order to ensure quality requirements, there is a need to develop standardized lattice specimen geometries that can be used as surrogates in destructive evaluations. Specifically, components incorporating lattice structures can be placed under compressive loads. Since lattice designs, including, beam, gyroid or schwartz, can be unique to manufacturers, a standardized approach is needed to ensure that the lattice design is adequately represented and can be consistently assessed. This can allow for the evaluation of the compressive mechanical strength with adequate representation of the manufacturing of the lattice design.

This document provides the lattice compression specimen and other AM specific considerations for using the specimen per an existing compression test method like ASTM E9 or ISO 13314. Although ASTM E9 and ISO 13314 provide standard methods of compression testing for metallic materials, in this document specific considerations for lattice structures, such as the minimum number of unit cells, ductile and brittle material considerations, the option for building specimens with endplates, and differences between regular and non-regular lattices are included along with reporting requirements of AM build parameters.