



Designation: **A1080—15 A1080/A1080M – 19**

Standard Practice for Hot Isostatic Pressing of Steel, Stainless Steel, and Related Alloy Castings¹

This standard is issued under the fixed designation ~~A1080~~; A1080/A1080M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This practice covers general requirements for ~~Hot Isostatic Pressing~~ hot isostatic pressing (HIP) of steel, stainless steel, and related alloy castings.

1.2 *Units*—The values stated in either SI units or inch-pound units are to be regarded as standard. No other units of measurement are included in this standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate ~~safety~~ safety, health, and health environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

~~A703~~ A703/A703M Specification for Steel Castings, General Requirements, for Pressure-Containing Parts

~~A781~~ A781/A781M Specification for Castings, Steel and Alloy, Common Requirements, for General Industrial Use

~~A957~~ A957/A957M Specification for Investment Castings, Steel and Alloy, Common Requirements, for General Industrial Use

~~A985~~ A985/A985M Specification for Steel Investment Castings General Requirements, for Pressure-Containing Parts

~~E220~~ Test Method for Calibration of Thermocouples By Comparison Techniques

2.2 AMS Standards:³

~~AMS 2750~~ Pyrometry

3. Terminology

3.1 Definitions:

3.1.1 *autoclave, n*—a pressure-containing vessel used in the HIP process.

3.1.2 *hot isostatic pressing (HIP), n*—a ~~solid-state~~ solid-state process which applies heat and pressure simultaneously to objects in an autoclave via an inert gas in such a way as to eliminate internal voids and obtain desired properties.

3.1.3 *inert gas, n*—a nonoxidizing gas used for pressurizing a HIP vessel.

4. Ordering Information

4.1 The authorization or requirement for hot isostatic pressing (HIP) shall be agreed upon between purchaser and supplier and must be documented.

¹ This practice is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.18 on Castings.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, <http://www.sae.org>.

*A Summary of Changes section appears at the end of this standard

4.1.1 The ~~Supplementary Requirements~~ supplementary requirements of the ~~Common Requirements Specifications~~ common requirements specifications contain a section for authorization of hot isostatic pressing (HIP) of castings. These ~~Common Requirements Specifications~~ common requirements specifications include, but are not limited to:

- ~~A703~~ Specification for Steel Castings, General Requirements, for Pressure-Containing Parts
- ~~A781~~ Specification for Castings, Steel and Alloy, Common Requirements, for General Industrial Use
- ~~A957~~ Specification for Investment Castings, Steel and Alloy, Common Requirements, for General Industrial Use
- ~~A985~~ Specification for Steel Investment Castings General Requirements, for Pressure-Containing Parts
- ~~A703/A703M~~ Specification for Steel Castings, General Requirements, for Pressure-Containing Parts
- ~~A781/A781M~~ Specification for Castings, Steel and Alloy, Common Requirements, for General Industrial Use
- ~~A957/A957M~~ Specification for Investment Castings, Steel and Alloy, Common Requirements, for General Industrial Use
- ~~A985/A985M~~ Specification for Steel Investment Castings General Requirements, for Pressure-Containing Parts

4.2 The HIP processing parameters shall be as agreed upon between the purchaser and supplier.

5. Processing Parameters

5.1 The HIP processing parameters shall be as agreed upon between the purchaser and supplier.

5.2 The following parameters are commonly used for most steel castings: process castings under an inert atmosphere at not less than 14 500 psi [100 MPa] within the range of 1975 to 2250 °F [1080 to 1235 °C]. Hold castings at the selected temperature for 2 h minimum and cool under an inert atmosphere to below 795 °F [425 °C].

6. Quality Requirements

6.1 The HIP process shall, at a minimum, document and have traceability for:

- 6.1.1 Operating parameters for each autoclave/vessel used in production.
- 6.1.2 Software and instrumentation used for control and documentation purposes.
- 6.1.3 Gas used to backfill or quench.
- 6.1.4 Contact fixturing within the autoclave.

6.2 Methods of gas dilution, replenishment, reuse, and purification shall be documented in a written procedure.

6.3 Fixtures, plates, trays, spacers, hangers, containers, and baskets shall be made of a material compatible with the parts to be treated or shall be adequately isolated to ~~assure~~ ensure that undesirable reactions, product contamination, and distortions do not occur.

6.4 Prior to pressurization, adequate care shall be taken to ensure that no product contamination occurs.

7. Autoclave Type/Qualification

7.1 Autoclave shall consist of inert gas pressurization, internally heated cold wall pressure vessel type.

7.2 Unless otherwise specified, the selection and type of inert gas shall be at the discretion of the HIP processor.

7.3 When argon is used, the gas emanating from the autoclave prior to hot isostatic pressing shall be a minimum of ~~99.98%~~ 99.98 % by volume (200 ppm total impurities) as determined by online gas analysis and shall not exceed the requirements specified in **Table 1**.

7.4 When a gas other than argon is used, the type and purity level shall be agreed upon by the purchaser and supplier prior to processing.

8. Temperature Uniformity

8.1 A temperature uniformity survey shall be conducted at a ~~6-month~~ six-month maximum interval on each HIP unit using a typical production load of parts or material under typical operating parameters.

TABLE 1 Argon Gas Purity Requirements

Impurity Element	Maximum % by Volume	ppm (vol/vol)
Nitrogen	0.005%	50
Nitrogen	0.005 %	50
Hydrogen	0.0125%	125
Hydrogen	0.0125 %	125
Oxygen	0.0025%	25
Oxygen	0.0025 %	25
Hydrocarbons (as methane, CH ₄)	0.0025%	25
Hydrocarbons (as methane, CH ₄)	0.0025 %	25
Total	0.020%	200
Total	0.020 %	200
Dewpoint (H ₂ O)		-45°C
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