



AEROSPACE RECOMMENDED PRACTICE

ARP4715™**REV. A**

Issued 2000-12
Reaffirmed 2011-04
Revised 2018-04

Superseding ARP4715

Induction Hardening of Steel Components

RATIONALE

ARP4715A has been declared "STABILIZED" by SAE AMS Committee E Carbon and Low Alloy Steels as no longer state of the art and other sources are available in the open literature.

STABILIZED NOTICE

ARP4715A has been declared "STABILIZED" by SAE AMS Committee E Carbon and Low Alloy Steels. This document will no longer be updated and may no longer represent standard industry practice. This document was stabilized because the document contains technology that is no longer state of the art and other sources are available in the open literature. Previously this document was reaffirmed in December 2011. The last technical update of this document occurred in April 2000. Users of this document should refer to the cognizant engineering organization for disposition of any issues with reports/certifications to this specification; including exceptions listed on the certification.

NOTE: In many cases, the purchaser may represent a sub tier supplier and not the cognizant engineering organization.

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be revised, reaffirmed, stabilized, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2018 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
<http://www.sae.org>

SAE WEB ADDRESS:

Full document details: SAE ARP4715A

SAE values your input. To provide feedback on this Technical Report, please visit <http://standards.sae.org/ARP4715A>

Documents
Document Sharing Hub

1. SCOPE:

This recommended practice provides guidelines for the establishment of an induction hardening process for steel components. It is intended to be used as a guide for designers of induction hardened parts, for process auditors, and for purchase specifications and/or process sheets as applicable.

Induction heat treatment is intended for hardening of only selected areas of plain carbon or alloy steel components. A prior heat treatment may be specified for improved response of the overall component to induction hardening, or for control of properties in the balance of the part. AMS 2759 is recommended for such prior heat treatment.

2. APPLICABLE DOCUMENTS:

The following documents are often used in conjunction with induction hardening and should be considered when induction hardening is needed:

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2759 Heat Treatment of Steel Parts, General Requirements

AMS 2649 Etch Inspection of High Strength Steel Parts

SAE J423 Methods of Measuring Case Depth

ARP1820 Chord Method of Evaluating Surface Microstructural Characteristics

2.2 ASTM Documents:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19248-2959.

ASTM E 18 Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
ASTM E 92 Vickers Hardness of Metallic Materials
ASTM E 112 Determining the Average Grain Size
ASTM E 384 Microhardness of Materials

3. TECHNICAL:

3.1 Specifying Induction Hardening:

The extent of the induction hardening pattern should be fully defined on the engineering drawing.
The definition should include:

The minimum and maximum lengths or widths of the hardened zone or case (sometimes called induction harden pattern or IHP)

The minimum and maximum depth of the hardened zone or case

The minimum (and in some cases, the maximum) hardness of the case

The hardness of the core or unaffected base metal

The maximum extent of the heat affected, transition, or intermediate zones. These terms are often used interchangeably.

The minimum hardness permitted in the overtempered zone (In some cases, the width of the intermediate or transition zone may also be limited.)

Locations where hardness measurements or traverses should be taken.

Examples of ways to specify the extent and requirements of induction hardening are shown in Figure 1.

- 3.1.1 The transition or overtempered zone is located beneath the hardened zone. Having been exposed to temperatures not high enough to harden it, but substantially higher than the core or base metal tempering temperature, this area may be softer than the core or base metal. The designer may limit the extent of softening, either by specifying a minimum hardness, or by specifying the maximum width of the zone, or both. It is recommended that the permissible hardness reduction in the overtempered or transition zone be 4 to 8 points HRC below the original core or base metal hardness. A minimum width of 0.03 inch (0.76 mm) is often obtainable for smaller sections, but specifying the maximum width that can be tolerated in the design is recommended. A transition zone equal to the minimum case depth required by the specification or drawing is considered reasonable.
- 3.1.2 Hardness at the surface of the induction hardened range is generally measured by direct Rockwell or Superficial Rockwell hardness testing in accordance with ASTM E 18. However, depth of hardening and extent of heat affected zone are normally determined destructively, on a cross-section of the part, using microhardness techniques such as those of ASTM E 384, ARP1820 or SAE J423.