## Approved By:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
| Jim Harris  Project Quality Leader |  | Ashley Weatherington  QMS Coordinator |  |  |

## Document Revision Chart

The following chart lists the revisions made to this document tracked by version. Use this to describe the changes and additions each time this document is re-published. The description should include as many details of the changes as possible.

|  |  |  |  |
| --- | --- | --- | --- |
| **#.#** | **Section Modified and Revision Description** | **Date** | **Author** |
| 1.0 | Initial release (Reformat to GE requirements. No change to requirements) | 10/26/2011 | Liz Pullig |
| 1.1 | Update to ASTM E18-14 requirements and added as-found condition requirements (section 3.4.4). | 07/15/2015 | Liz Pullig |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

Table of Contents

1.0 [Purpose 3](#_Toc265139832)

2.0 [Scope / Application 3](#_Toc265139833)

3.0 [Procedure](#_Toc265139834) 3

4.0 [Responsibilities 5](#_Toc265139835)

5.0 [Quality Records 6](#_Toc265139836)

6.0 [Definitions 6](#_Toc265139837)

7.0 [References 6](#_Toc265139838)

8.0 [Compliance Requirements 6](#_Toc265139839)

# 1.0 Purpose

This procedure establishes the requirements for inspection, calibration, and certification of Rockwell hardness testers used to inspect products by Pressure Control Operating Units.

# 2.0 Scope / Application

This procedure complies with the requirements of the standards listed in Section 7.0 of this procedure and is applicable for all Pressure Control facilities.

**3.0 Procedure for Required Calibration Standards or Special Equipment**

**3.1 Required Equipment or Standards**

* Hardness Standard Test Blocks
* Arkansas Stone

**3.2 Calibration Procedure**

**3.2.1** Visually inspect all parts for damage and the legibility of markings. If damage is detected, the equipment shall be taken out of service, subject to be reworked or replaced. Otherwise, the calibration process may be continued.

**3.2.2** Check anvils for roughness, burrs, or scratches. If necessary, smooth with an Arkansas stone. Check that mating surfaces of anvil and capstan are clean and free of burrs. Check alignment of the indenters to centerline of capstan. Check indenters for burrs, scratches, or other damage. Check that mating surfaces of indenters and indenter holder are clean and free from burrs.

**3.3 Direct Verification**

**3.3.1** When direct verification is required, it shall be performed in accordance with the requirements of ASTM E18 section A1.3. An indirect verification shall be completed following successful direct verification.

**3.3.2** Rockwell hardness testing machines manufactured before the implementation of ASTM E18-07 revision may not have undergone the direct verification of the machine’s testing cycle. The test cycle verification requirement does not apply to testing machines manufactured before the implementation of ASTM E18-07 (01 Apr 2007), unless the testing machine is returned to the manufacturer for repair.

**3.4** **Indirect Verification**

**3.4.1** The testing machine shall be verified for each Rockwell scale that will be used prior to the next indirect verification. Hardness tests made using Rockwell scales that have not been verified do not meet ASTM E18 requirements.

**3.4.2** Standardized test blocks meeting the requirements of Annex 4 of ASTM E18 shall be used in the appropriate hardness ranges for each scale to be verified. The indenters to be used shall meet the requirements of Annex 3 of ASTM E18.

**3.4.3** Before performing the indirect verification, make at least two (2) preliminary indentations on a suitable test piece to ensure that the Hardness Testing machine is working freely and that the test block penetrator and anvil are seated adequately. The results of these preliminary indentations need not be recorded.

**3.4.4 As-Found Condition**

The as-found condition of the testing machine is to be assessed with the user’s indenter(s) that are normally used with the testing machine. At least two standardized test blocks (each from a different hardness range as defined in ASTM E18 Table A1.3) should be tested for each Rockwell scale that will undergo indirect verification. The difference in hardness between any of the standardized test blocks shall be at least 5 hardness points for each Rockwell scale.

On each standardized test block, make at least two measurements distributed evenly over the test surface. Determine repeatability R and the error E in accordance with ASTM E18 for each test block that is measured. The error E and repeatability R should be within the tolerances of ASTM E18 Table A1.3.

If the values fall outside of the specified tolerances, this is an indication that the hardness tests made since the last indirect verification may be suspect. This information shall be reported and the Pressure Control operating unit Quality representative shall evaluate the impact on materials or parts utilizing a Discrepant Equipment Form or equivalent record in accordance with QP-PC-7.6.

**3.4.5 Indirect Verification Procedure**

3.4.5.1 The testing machine is required to be verified using one or more of the user’s indenters. One standardized test block shall be tested from each of the hardness ranges (usually three ranges) for each Rockwell scale to be verified (reference Table A1.3 in ASTM E18). The difference in hardness between any of the standardized test blocks shall be at least five (5) hardness points for each Rockwell scale.

**3.4.5.2** Place test block on anvil and make a minimum of five (5) indentations (each block), distributed uniformly over the test surface (see diagram below). Determine the error E and the repeatability R in the performance of the testing machine per ASTM E18 for each hardness level of each Rockwell scale to be verified.

**3.5 Acceptance Criteria (Indirect Verification)**

**3.5.1** The error E and the repeatability R shall be within the tolerances of Table A1.3 of ASTM E18. The indirect verification shall be approved only when the testing machine measurements of repeatability and error meet the specified tolerances using the user’s indenter(s).

**3.5.2** In the event the testing machine fails the indirect verification, cleaning and maintenance, replacing the anvil, or replacing the indenter may be performed, followed by repeating the indirect verification. If the machine continues to fail the indirect verifications, or requires adjustment and/or repair, then the testing machine shall undergo a direct and indirect verification following the necessary adjustments and/or repairs.

**3.6 Calibration Frequency**

**3.6.1** The normal calibration frequency for Rockwell Hardness Testers shall be once every three-hundred and sixty-five (365) days using the indirect verification method as a minimum*.*

**3.6.2** In addition, Rockwell Hardness Testers shall be calibrated using the direct verification method upon initial purchase and after any adjustments, modifications, repairs that could affect the application of the test forces or the measuring system, or the machine hysteresis, or when a tester fails an indirect verification.

# 4.0 Responsibilities

The Quality Management Representatives for each Operating Unit are responsible for ensuring complete implementation and compliance with this procedure.

**5.0 Quality Records**

The following records produced by this procedure are considered Quality Records and shall be maintained and controlled according to the requirements in OGQ-0102 - Record Control:

* Completed calibration certificates complying with this procedure and SQ-02
* Controlled calibration process for in-house calibrations

# 6.0 Definitions and Acronyms

Refer to the [GE O&G QMS Lexicon](http://supportcentral.ge.com/products/sup_products.asp?prod_id=252527) for Terms, Definitions and Acronyms. Additional terms and acronyms are defined below. In case of conflict, the [GE O&G QMS Lexicon](http://supportcentral.ge.com/products/sup_products.asp?prod_id=252527) will take precedence.

**6.1 Definitions**

The following definitions are applicable to the use and implementation of this procedure:

* **Operating Unit** – identifies the various organizations and operating companies that make up Pressure Control.
* **Quality Management Representative** – as used in this procedure refers to the designated quality management representative for one of the Pressure Control Operating Units.
* **Product –** includes materials, parts, subassemblies, assemblies and subcontracted services.

**7.0 References**

The latest effective editions of the following specifications are included by reference in the text of this specification:

* ASTM E18 – Standard Test Methods for Rockwell Hardness of Metallic Materials
* OGQ-0102 – Record Control
* QP-PC-7.6 – Control of Monitoring and Measuring Devices
* SQ-02 – Supplier Quality Requirements for Calibration Services

# 8.0 Compliance Requirements

* Full compliance required by 15-AUG-2015

|  | GE Oil & Gas |
| --- | --- |
| Title: | Calibration of Rockwell Hardness Testers |
| Reference: | QC-514 |
| Revision: | 1.1 |
| Application Date: | 7/15/2015 |
| Expiration Date: | 7/15/2018 |
| Author: |  |
| External References: |  |