Status Update
Development Of New Hardness Conversion Tables For ASTM E140

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API Winter Meeting
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Project Overview

- Joint ASTM and API project
  - ASTM Task Group E28.06.02
  - API SC21 Task Group
  - API CSOEM providing funding

- The objective is to develop new hardness conversion tables for ASTM E140
  - PH nickel alloys (i.e., Alloys 718, 925, 935, 945, 625 Plus & 725)
  - Martensitic stainless steels (410, F6NM, and CA6NM)
  - Scales: HRC, HR15N, HV, HBW, and LEEB

- Results of the round robin test program will be published in an API Technical Report

- Data in the API Technical Report will be used to ballot new ASTM E140 tables in ASTM E28.06

- NOTE: A similar project to develop hardness conversion tables for duplex stainless steel and super duplex stainless steel is being coordinated by John Bringas, operating under A01.13, WK60655.
Status Update – PH Nickel Alloys & Martensitic Stainless Steels

• **January 2014**: Project approved by the API CSOEM

• **May 2014**: Project approved by ASTM E28.06

• **November 2015**: Round robin test procedure approved by ASTM E28.06

• **December 2015 – March 2016**: Six companies volunteered to do hardness testing
  Buehler plus Proceq for LEEB
  Exova
  David L. Ellis Co. Inc.
  PES Testing
  SUN-TEC
  Stress Engineering Services, Inc.

• **March 2016**: Calibration blocks purchased by API for circulation with test samples

• **July 2016**: All donated raw material for test samples received from:
  • Halliburton
  • HOWCO Metals
  • Mokveld Valves
  • Special Metals
  • Special Quality Alloys
Status Update – PH Nickel Alloys & Martensitic Stainless Steels - continued -

• August 2016: Test material shipped to David L. Ellis Co. for processing

• October 2016: David L. Ellis advises work required to grind, lap, & mark the test pattern is more than expected due 6” diameter of most test pieces, and requests funding from API for outside machine shop

• October 2016: API staff advises API will not be able to issue a contract until 2017, since they had budget coordination issues and already allocated their entire 2016 R&D budget

• February 2017: API staff issues contract for grinding, lapping, and marking

• April 2017: Stainless steel test pieces are ground and lapped, but machine shop advises they cannot process the non-magnetic nickel alloy test pieces

• August 2017: TUS Tech completes marking of test pattern on stainless steel test pieces – ready for testing

• September 2017: David L. Ellis Co. ships nickel alloy test pieces to BHGE, Houston for grinding and lapping

• January 2018: BHGE ships nickel alloy test pieces to Maya Gage Company for grinding & lapping.
• **2018:** Maya completes grinding and lapping and ships nickel alloy test pieces to TUS Tech.

• **2018:** TUS Tech completes marking of test pattern on nickel alloy test pieces – ready for testing

• **2018:** Start of round robin hardness testing

• **2018:** Round robin hardness testing completed

• **2018:** API SC21 Task Group analyzes round robin data, creates API Technical Report and submits for ballot

• **2018:** API SC21 approves the API Technical Report and submits for publication

• **2018:** ASTM E28.06.02 prepares and submits a ballot for new ASTM E140 hardness conversion tables

• **2018:** ASTM E28 approves the new ASTM E140 hardness conversion tables and submits for publication.
Round Robin Testing Sequence
Round Robin Testing

• Each lab in the round robin test will receive a 4 page test procedure

• Each lab in the round robin test will receive a set of data recording forms

• There are keys aspects to the testing:
  
  • Not all the labs have a Leeb test unit, so don’t start testing until arrangements have been made to borrow a Leeb test unit (Tom Ott with Proceq will assist)

  • The labs need to perform the testing in the required sequence
  HRC > HR15N > Vickers 10 KG > Leeb > HBW 10/3000

  • The labs need to perform the required calibration using the cal blocks provided with the test pieces

  • The labs need to test in the assigned section of the test pieces

  • The labs need to test in the specific locations in the concentric circles marked

  • The labs need to report the data using the data forms provided.
Round Robin Testing

The two rectangular samples will each have a semi-circle of hardness test locations.
Thank you.