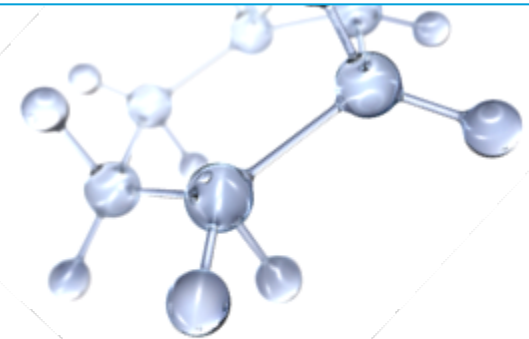

Recent Revisions to API 5L

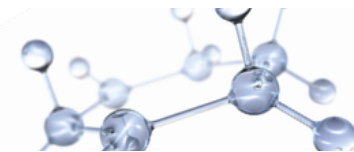


INGAA Foundation Best Practices in
Procurement and Manufacturing Workshop
Houston, TX

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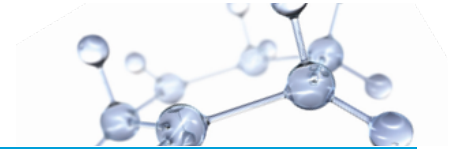
June 9, 2010

Outline



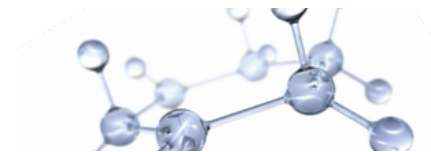
- Background on API 5L & Standards Development Process
- Timeline of Revisions
- Recent Industry/Regulatory Concerns
- Revisions to API 5L

Scope of API 5L

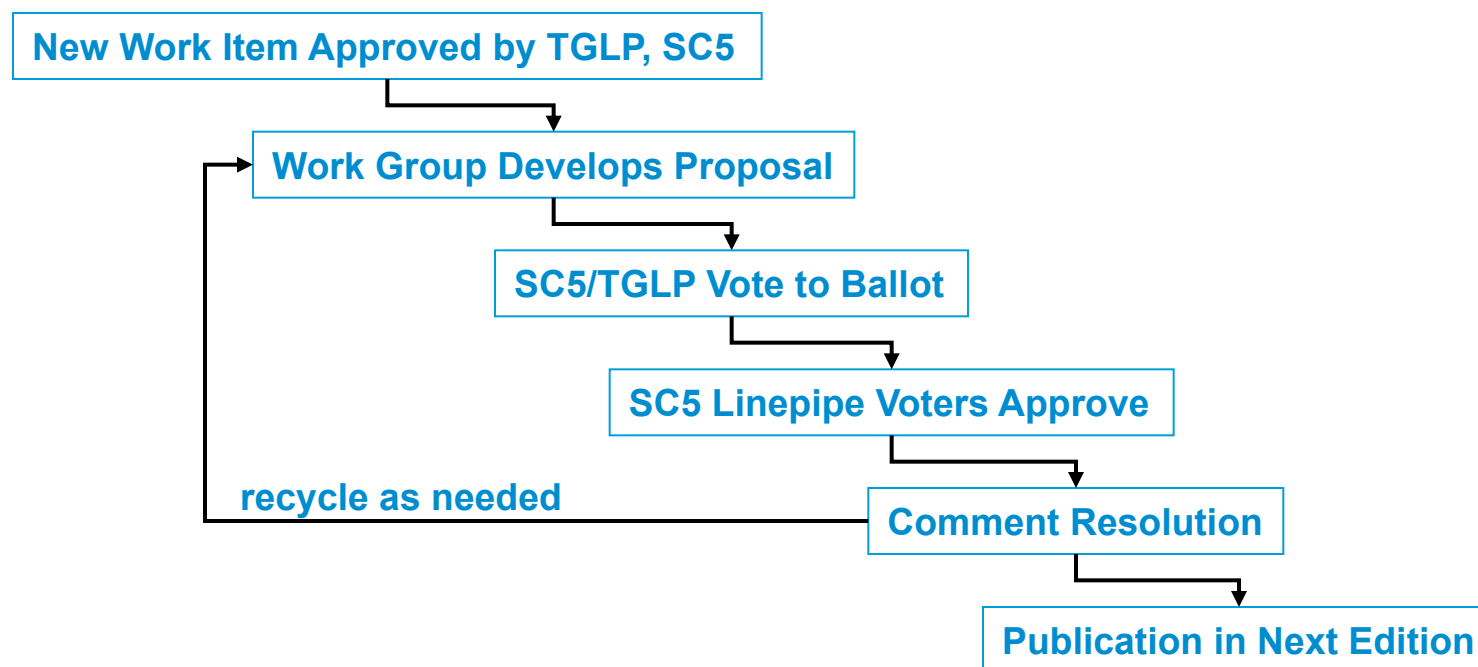


- Specification for pipes for use in pipeline transportation systems in the petroleum and natural gas industries
 - Service conditions include production flowlines to distribution piping and everything in between
- Covers a wide range of products
 - Seamless, EW, SAW, COW, longitudinal seam and spiral
 - Diameters from 0.4” to 84”, wall thickness from 1.7 mm to 52 mm
 - Range of steel chemistries and processing (TMCP, Q&T, Normalized, ...)
 - Over 80 items by agreement, “unless otherwise agreed” or “if agreed”
 - Optional Annexes for sour service, offshore, TFL pipe, ductile fracture propagation, manufacturing procedure qualification
 - Purchasers may supplement requirements

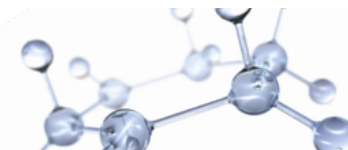
Development of 5L



- API SC5, Task Group on Linepipe responsible for maintenance of 5L
- Participants include users, manufacturers and consultants
- Process designed to achieve consensus
- Active participation of volunteers is essential to ensure 5L is up to date and meeting industry needs

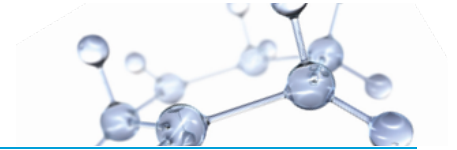


Timeline of Development of 5L



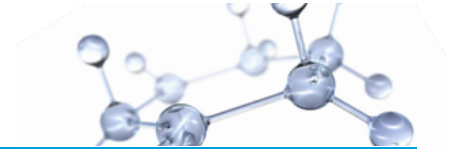
Mar. 2007	ISO 3183, 2nd Ed.	Developed by Joint API/ISO Workgroup for Harmonization
Oct. 2007	API 5L, 44 th Ed. (3183 + Annex N, O)	<ul style="list-style-type: none"> •Retest requirements •Repair weld qualification •Hardness test locations •Marking
Jan. 2009	Errata	•Editorial errors without technical changes
Feb. 2009	Addendum 1	<ul style="list-style-type: none"> •Processes requiring validation: pipe forming, seam welding, repair welding, heat treatment •Requirements for threaded and coupled pipe •Flattening test acceptance criteria •Test piece type for the tensile test
April 2010	Addendum 2	<ul style="list-style-type: none"> •X90Q, X100Q •Open hearth steelmaking with secondary refining •Jointer length requirements •Charpy test location •Chemistry (B) •Metallographic testing for seam weld cross penetration •Out of roundness measurement •Hardness, DWT, HIC retest requirements •Revise repair weld requirements
4Q 2010 (expected)	Addendum 3	<ul style="list-style-type: none"> •Manufacturing Procedure Specification/ •Manufacturing Procedure Qualification Test •Inspection and Test Plan •Validation/qualification of coil/plate •Test frequency for skelp end welds •Flattening retest requirements
2011 (expected)	5L, 45th Ed. / ISO 3183, 3rd Ed	<ul style="list-style-type: none"> •Re-harmonization of API 5L / ISO 3183 •Marking of multiple grades

Recent Industry Concerns



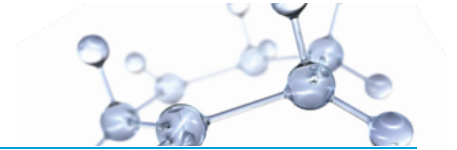
- 2008-2009 was a period of high pipe demand in US with lots of pipe sourced from around world
- Some pipe found with low and variable YS (up to 14 ksi below requirements), and some pipe expanded in body during field hydrostatic testing.
- May 2009: PHMSA advisory bulletin on low yield and tensile strength in high-strength microalloyed pipe
- June 2009: INGAA Pipe Summit to develop action plan
- June 2009: API workgroups initiated to develop proposed changes to API 5L. Scope included:
 - Manufacturing Procedure Specification
 - Inspection and Test Plan
 - Feedstock qualification and validation
 - Test/retest sampling locations

Feedstock Qualification and Validation



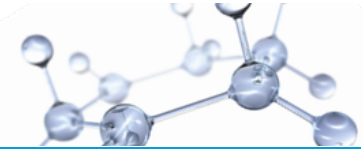
- Test unit definition expanded to include hot rolling practice
- Coil/plate rolling added as a process requiring validation
- Steel mill/rolling mill should have quality management system
- Variability of strength within coil/plate to be characterized
- Rolling practice deviations to be qualified

Tensile Test Locations



- Tensile sampling and flattening procedures to be documented
- Tensile retesting protocols expanded to include testing of adjacent locations
 - Applies to TMCP steels in grades X65 or higher
 - Recognizes rolling conditions (not just heat chemistry) can strongly affect properties
 - Retest locations chosen to bracket non-conforming part of coil/plate
 - Requires traceability of pipes to mother coil/plate or retesting of all pipes in test unit

MPS/MPQT/ITP



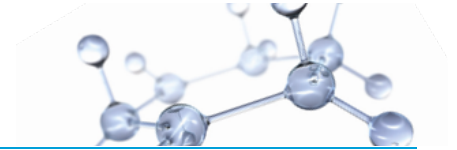
Manufacturing Procedure Specification (MPS) - describes the main characteristics of the manufacturing process that will be applied to a specific order of pipe.

Manufacturing Procedure Qualification Test (MPQT) - describes testing of initial production to qualify the MPS.

Inspection and Test Plan (ITP) – describes inspection activities, calibration requirements, responsible party, acceptance criteria

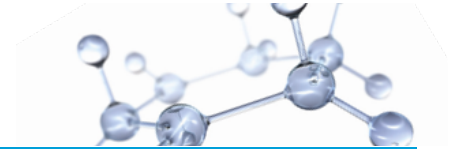
- MPS/MPQT/ITP in optional Annex B with content by agreement
- MPS/MPQT/ITP commonly applied to pipe orders for major projects by many users
- Existing MPS/MPQT format in current edition of 5L is brief and does not include all the details commonly requested by pipe purchasers
- ITP not included in current edition of 5L
- Enhanced MPS/MPQT/ITP with additional detail will benefit manufacturers and customers by promoting a common industry-wide format that meets industry needs

Features of Enhanced MPS



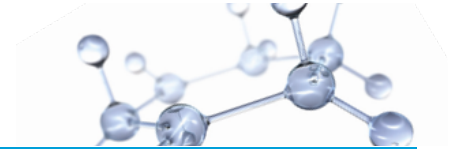
- Locations/equipment process descriptions
- Steelmaking & casting: chemistry ranges, segregation control, hydrogen control
- Hot rolling: temperature/time tolerances, plate/coil inspection, dimensional and mechanical property control, cropping, secondary processing
- Pipe manufacture: forming, welding procedure specification, seam heat treatment
- Heat treatment process controls
- Test/retest locations
- Rework/retest/release controls for non-conformances to manufacturer's practices
- Product identification and traceability practices
- Storage, handling, loading and shipping practices

Features of Enhanced MPQT



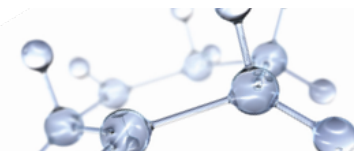
- All production tests performed as part of qualification
- Weld procedure qualification
 - HFW: welding process controls, mechanical test results, verification of seam heat treatment by metallography, hardness tests if applicable
 - SAW/COW: bevel dimensions, wire/flux, welding parameters, mechanical test results, hardness tests if applicable, chemistry
- Assessment of coil/plate tensile property variability and coil/plate to pipe strength changes
- Requalification – approval by purchaser and notification of requalified coil/plate/pipe
- Other data requested by purchaser

Features of ITP



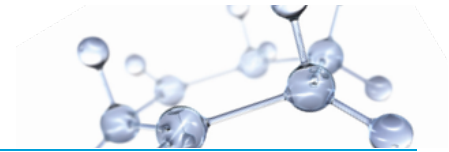
- Tests performed
- Test frequency
- Calibration
- Party responsible for activity (manufacturer, third party, ...)
- Acceptance criteria
- Results recording
- Witness and hold points

Status of Revisions



- Ballot closed May 12, passed with some negative votes
- Comments to be discussed at 2010 Exploration & Production Standards Conference on Oilfield Equipment and Materials, Washington DC, week of June 27
- Reballot of changes expected 3rd quarter, 2010
- Approved changes to be published in Addendum 3 in 4th quarter, 2010

Concluding Remarks



- Revisions to 5L will strengthen requirements to ensure quality, reduce potential for non-conforming pipe and provide improved tools for communication between manufacturer and purchaser
- Standards are not a substitute for good engineering
 - Standards reflect common requirements for most applications
 - Specific applications may require supplementary requirements
 - Standards are not a complete recipe for manufacturing or purchasing pipe
 - Qualified personnel needed to ensure that pipes and pipelines perform as intended