

Liquid Pipeline Toolbox - Included Applications

Applications Description	Reference, Standard or Document Source
1. Pipeline Facilities	
1.1 Reinforcement of Welded Branch Connection	ASME B31.4 - 1998 Edition "Pipeline Transportation Systems for Liquid Hydrocarbons and other Liquids", Art. 404.3.1(c)
1.2 Relief Valves <ul style="list-style-type: none"> • Valves Requiring/Not Requiring Liquid Capacity Certification <ul style="list-style-type: none"> ○ Orifice Area Sizing ○ Discharge Flow Sizing 	ASME Section VIII and API RP 520 Part I - Sizing and Selection, Sixth Edition, March 1993
2. Hydraulics	
2.1 Liquid Pipeline Hydraulics <ul style="list-style-type: none"> ○ Darcy-Weisbach ○ Colebrook-White ○ Hazen-Williams ○ Heltzel ○ T.R. Aude ○ Shell/MIT 	<ul style="list-style-type: none"> • Pipeline Design for Hydrocarbons Gases & Liquids, ASCE, Committee on Pipeline Planning • Hydraulics for Pipeliners, Volume I: Fundamentals, Second Edition, C.B. Lester • Hydraulics of Pipeline Systems, Bruce E. Larock, Ronald Jeppson, Gary Watters
2.2 Darcy-Weisbach Pressure Drop Per Mile	<ul style="list-style-type: none"> • Flow of fluids, Technical Paper No.410, CRANE • Hydraulics for Pipeliners, Volume I: Fundamentals, Second Edition, C.B. Lester • Hydraulics of Pipeline Systems, Bruce E. Larock, Ronald W. Jeppson, Gary Z. Watters
2.3 Surge Analysis – Water Hammer	<ul style="list-style-type: none"> • Streeter, V.L. and Wylie, E.B. (1967), Hydraulic Transients, McGraw-Hill, • Streeter, V.L. (1969), Waterhammer Analysis. Jour. Hyd. Div., ASCE., Vol. 88, HY3, pp79-113 • Streeter, V.L. (1972), Unsteady Flow Calculations by Numerical Methods, ASME Journal of Basic Eng., pp457-466 • J. P Tullis (1989), Hydraulic Pipelines, John Wiley & Sons
3. PL Design & Stress Analysis	
3.1 Design Pressure-Steel Pipe	DOT Part 195 & ASME B31.4
3.2 Wall Thickness- Straight Steel Pipe	ASME B31.4
3.3 Design Pressure-Polyethylene Pipe	API 15LE
3.4 Wall Thickness - Polyethylene Pipe	API 15LE
3.5 Flume Design - Rational Method	ASCE, FHWA
3.6 Buoyancy Analysis & Concrete	A.G.A. GEOP Series, Book T-1

Coating Requirements	
3.7 Pipe Anchor Force Analysis	<ul style="list-style-type: none"> • Pipe Line Industry, Wilbur, W.E., February 1963 • Theory of Elasticity, Timoshenko, S.
3.7 Maximum Impact Load & Penetration Depth	DOT Code Part 192
3.9 Internal Pressure - % SMYS	DOT/TSI Gas Distribution Handbook
3.10 Hoop Stress & Longitudinal Stress	DOT/TSI Gas Distribution Handbook
3.11 Requirements to Move Unpressured Pipe	DOT Alert Notice 1/7/1992
3.12 Bending Stress & Deflection	DOT/TSI Gas Distribution Handbook
3.12 Maximum Allowable Pipe Span Length	Williams Gas Pipeline Documentation
3.13 Pipe Requirements for Horizontally Drilled Installation	Williams Gas Pipeline Documentation
3.15 Blasting Analysis	A.G.A "Pipeline Response to Buried Explosive Detonations
3.16 Bending Stress Caused by Fluid Flowing Around Pipeline	DOT/TSI Gas Distribution Handbook
3.17 Linear Thermal Pipeline Expansion	DOT/TSI Gas Distribution Handbook
3.18. Longitudinal Stress in Movement of In-Service Pipelines (API 1117)	API RP 1117 - Movement of In-Service Pipeline, Second Edition, August 1966
4. Pipeline Crossings	
4.1 Steel Pipelines Crossing Railroads & Highways	API RP-1102
4.2 Wheel Load Analysis	<ul style="list-style-type: none"> • ASME B31.4 - 1998 Edition of Pipeline Transportation Systems for Liquid Hydrocarbons and other Liquids, Art. 404.3.1(c) • Evaluation of Buried Pipe Encroachments BATTELLE, Petroleum Tech Center, 1983
4.3 Track Load Analysis	<ul style="list-style-type: none"> • ASME B31.4 - 1998 Edition of Pipeline Transportation Systems for Liquid Hydrocarbons and other Liquids, Art. 404.3.1(c) • Evaluation of Buried Pipe Encroachments, BATTELLE, Petroleum Tech Center, 1983
4.4 Design of Uncased Crossings	GPTC Guide for Transmission & Distribution Systems, AGA, Appendix G-192-15
5. External Corrosion Direct Assessment Toolset	
5.1 Remaining Life of Corroded PL & Re-assessment Interval for ECDA Region	GTI Report GRI-04/0093.6, NACE RP 0502, ASME B31.4, ASME B31.8, ASME B31.8S
5.2 Potential Impact Radius (PIR)	Potential Impact Radius Formula for Flammable Gases Other than Natural Gas", DOT/OPS TTO Number 13 Final Report

5.3 DCVG - % IR Drop	CATH- TECH, Cathodic Technology Limited
6. Pipeline Testing	
6.1 Pipeline Hydrostatic Testing	<ul style="list-style-type: none"> • DOT/TSI Gas Distribution Handbook • Pipeline Rules of Thumb Handbook, 3rd Edition
6.2 Pipeline Pressure Testing – Required Time	DOT/TSI Gas Distribution Handbook
6.3 Pipeline Pressure Testing – Maximum Pressure Drop	DOT/TSI Gas Distribution Handbook
6.4 Pipeline Blowdown – Time & Volume Lost	DOT/TSI Gas Distribution Handbook
6.5 Purging Calculations	DOT/TSI Gas Distribution Handbook
6.6 Pack in Pipeline	DOT/TSI Gas Distribution Handbook
7. Pipeline Corrosion	
7.1 Evaluation of MAOP in Corroded Areas	ASME B31G
7.2 Maximum Allowable Longitudinal Extent of Corrosion	ASME B31G
7.3 Rate of Electrical Current Flow Through the Corrosion Cell	DOT/TSI Gas Distribution Handbook
7.4 Relationship between Resistance & Resistivity	DOT/TSI Gas Distribution Handbook
7.5 Electrolyte Resistance from Surface of an Electrode to any Distance	DOT/TSI Gas Distribution Handbook
7.6 Corrosion Current Ohm's Law	DOT/TSI Gas Distribution Handbook
7.7 Electrical Resistance of a Conductor	DOT/TSI Gas Distribution Handbook
8. Cathodic Protection	
8.1 Estimated Weight of a Magnesium Anode	DOT/TSI Gas Distribution Handbook
8.2 Resistance to Earth of an Impressed Anode Ground Bed	DOT/TSI Gas Distribution Handbook
8.3 Rudenberg's Formula for the Placement of an Anode Ground Bed	National Association of Corrosion Engineers, Control of Pipeline Corrosion
8.4 Resistance to Earth of a Single Vertical Anode	National Association of Corrosion Engineers, Control of Pipeline Corrosion
8.5 Resistance to Earth of Multiple Vertical Anodes	National Association of Corrosion Engineers, Control of Pipeline Corrosion
8.6 Resistance to Earth of a Single Horizontal Anode	National Association of Corrosion Engineers, Control of Pipeline Corrosion
8.7 Req'd Number of Anodes & the Total Current Requirement	National Association of Corrosion Engineers, Control of Pipeline Corrosion
8.8 Power Consumption of a Cathodic Protection Rectifier	National Association of Corrosion Engineers, Control of Pipeline Corrosion

9. Databases	
9.1 Database of Physical Properties Of Fluids	British Gas - GasVLE
9.2 Pipe Database for Steel, Polyethylene & Custom Pipe	<ul style="list-style-type: none"> • Spec. for Line Pipe, API 5L • Std Steel Pipe, ASTM B36.10 • Spec. for Polyethylene Line Pipe, API 15LE
10. Gas Properties Calculations	
10.1 Gas Mixture Properties	AGA8 & API MPMS Chapter 14.5
10.2 Local Atmospheric Pressure	AGA Part 3
11. Utilities	
11.1 Gas Mixture Properties	GPA Standard 2172, AGA Report No. 8 API MPMS 14.2
11.2 Physical Properties of Fluids	Various
11.3 Document Management System	Application developed by TTI
11.4 Applications Integration Module	Application developed by TTI
11.5 Units Conversion Module	<ul style="list-style-type: none"> • International System of Units (SI) • ASTM Metric Guide E380-72E • ANSI Standard Z201.1 • AGA Gas Measurement Manual, Part 1
12. Standards/Regulations/Forms	
12.1 Pipeline Safety Laws	US Department of Transportation
12.2 DOT Regulations	US Department of Transportation 49 CFR - Parts 190-195
12.3 DOT Forms & Instructions for Reporting	US Department of Transportation 49 CFR - Parts 190-195
12.4 DOI-MMS Regulations	DOI – Minerals Management Service (30 CFR 250 - Subpart J)
12.5 Canadian Pipeline Standards	Canadian Standards Association Standards Code-Z622
12.6 Canadian Pipeline Standards	Canadian Standards Association Z662S1-05 <i>Supplement No. 1 to CAN/CSA-Z662-03,</i>