ENGINEERING STANDARD SPECIFICATION	Manitoba Operations	VALE
TITLE **MECHANICAL** **PIPING** **WELDED RUBBER LINED PIPE & FITTINGS - 100 PSIG**	VALE # **TH-SPEC-35027**	PAGE **1/11** REV. **4**

REVISIONS

Rev	Description	Rev'n by	App Sud	App PC	App Thom	App VB	App LH	App Clyd	App Act	Issue Date YYYY/MM/DD
1	Specification updated and format and number revised. Previous number 3503-11.01.610	AC 2011/11/29	AC 2012/01/12	N/A	N/A	N/A	N/A	N/A	N/A	2012/04/26
2	Approved for use in Thompson – Piping system Approval Requirements for MB updated	AC 2011/11/29	AC 2012/01/12	N/A	GS 2012/10/01	N/A	N/A	N/A	N/A	2012/10/02
3	2015 Standards Review See Appendix A	MDF 2015/04/01	MDF 2015/05/01	Pending	Pending	Pending	Pending	Pending	Pending	2015/05/14
4	Spec approved for MB Operations	N/A	N/A	N/A	HM 24 OCT 16	N/A	N/A	N/A	N/A	24 OCT 16

Sud = Sudbury, Ontario, PC = Port Colborne, Thom = Thompson, Manitoba, VB = Voisey's Bay, LH = Long Harbour, Act = Acton, England, Clyd = Clydach, Wales, N/A = Not Applicable

1.0 PURPOSE

This specification describes the minimum requirements for piping systems for abrasive slurries requiring rubber lined steel pipe and fittings at pressures up to and including 100 PSIG. The maximum temperature for this lining is 160 F. If oil is present in the slurry, determine the concentration to avoid possible deterioration of the rubber lining.

2.0 APPLICATION

Engineering design and specifications only approved for use with Vale Canada Limited, Thompson Operations or its successor or assignee. Any use a third party makes of this document or drawing, or any reliance on or decisions to be made based on it, beyond its use for Vale Canada Limited purposes are the responsibility of such third parties. Vale Canada Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this document or drawing beyond those specified herein.

This specification, applies at any Vale locations indicated with approval on the cover page, with the following exceptions:

2.1 EXCEPTIONS

None.

3.0 REFERENCE DOCUMENTATION

The following documents were used in the development of this document or have instructions and procedures applicable to it. They shall be used in their most recent revision.

TH-SPEC-35001	Identification and Classification
TH-SPEC-35002	Piping – General Requirements
TH-SPEC-35003	Welding Process Requirements
TH-SPEC-35048	Requirements for Pneumatic Testing of Piping Systems
TH-PROC-83006	Hydrostatic Testing
TH-SPEC-11007	Buried Pipelines Water
CSA B51	Boiler, Pressure Vessel and Pressure Piping Code
CSA Z180.1	Compressed Breathing Air and Systems
ASME B31.3	Process Piping
ASTM A53	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A234	Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service

ASTM A105	Standard Specification for Carbon Steel Forgings for Piping Applications
ASTM A106	Standard Specification for Seamless Carbon Steel Pipe for High Temperature Service
ASTM B61	Standard Specification for Steam or Valve Bronze Castings
ASTM B62	Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM F681	Standard Practice for use of Branch Connections
ASTM A139	Standard Specification for Arc Welded Steel Pipe
ASTM A536	Standard Specification for Ductile Iron Castings
ASTM A563	Standard Specification for Carbon Steel Track Bolts and Nuts
ASTM D2000	Standard Classification System for Rubber Products in Automotive Applications
ASTM A307	Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
ASTM A563	Specification for Carbon and Alloy Steel Nuts
ASTM A179	Standard Specification for Seamless Cold-Drawn Low-Carbon Steel Heat-Exchanger and Condenser Tubes
ASME F37	Standard Test Methods for Sealability of Gasket Materials
ASTM A193	Standard Specification for Alloy Steel and Stainless Steel Bolting for High Temperature Service or High Pressure Service
ASTM A194	Standard Specification for Carbon Steel and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service or Both
ASME B16.3	Malleable Iron Threaded Fittings
ASME B16.5	Pipe Flanges and Flanged Fittings
ASME B16.1	Gray Iron Pipe Flanges and flange Fittings
ASME B36.10	Welded and Seamless Wrought Steel Pipe
ASME B16.11	Forged fittings Socket Welded and Threaded
ASME B16.9	Factory-Made Wrought Buttwelding Fittings
ASME B16.34	Valves – Flanged, Threaded and Welding Ends
ASME B16.21	Nonmetallic Flat Gaskets for Pipe Flanges
ASME B18.2.1	Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)
ASME B18.2.2	Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
ASME B1.1	Unified Inch Screw Threads
ASME B16.39	Malleable Iron Threaded Pipe Unions
ASME B1.20.1	Pipe Threads, General Purpose (Inch)
ASME B16.25	Butt Welding Ends
ASME B18.2.1	Square, Hex, Heavy Hex and Askew Head Bolts
ASME B18.2.2	Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange and Coupling Nuts (Inch Series)

MSS SP-44	Steel Pipeline Flanges
MSS SP-67	Butterfly Valves
MSS SP-97	Integrally Reinforced Forged Branch Outlet Fittings
MSS SP-83	Class 3000 Steel Pipe Unions, Socket Welding and Threaded
SSPC-SP-5	White Metal Blast Cleaning

4.0 PIPING AND FITTINGS

Design Conditions

150 PSIG @ 149°F
Lowest rated component in system

Operating Conditions

100 PSIG @ ambient temperature

Design Fabrication Installation

In accordance with this specification and

TH-SPEC-35002	Piping – General Requirements
CSA B51	Boiler, Pressure Vessel and Pressure Piping Code
ASME B31.3	Process Piping
85-401-F-11997	Rubber Lined Fittings and Details

Approvals

ONTARIO:
Slurry systems, where the slurry is considered to be no more hazardous than water, are not subject to approval by regulatory agencies provided the pressure is less than 250 PSIG and the temperature does not exceed 150 deg.F

MANITOBA:
Piping systems are subject to the approval of the Manitoba Office of Fire Commissioner, Inspection and Technical Services Section, Steam and Pressure Plants Act.

NEWFOUNDLAND:
Piping systems are subject to the approval of the Newfoundland & Labrador, Department of Government Services, Public Safety Act, Boiler, Pressure Vessel and Compressed Gas Regulations.

Pipe

2" through 10" - Schedule 40 per ASME B36.10, carbon steel ASTM A53 Gr. B, ERW or seamless, beveled ends.

12" through 16" - 0.375" thick wall per ASME B36.10, carbon steel ASTM A53 Gr. B, ERW or seamless, beveled ends.

20" through 30" - 0.375" thick wall per ASME B36.10, carbon steel ASTM A139, Grade A or B, DSAW, beveled ends.

Fittings

2" through 10" – Schedule 40 per ASME B16.9, carbon steel ASTM A234 Grade WPB, butt weld

12" & Above - 0.375" thick wall per ASME B16.9, carbon steel ASTM A234 WPB, butt weld

Butt weld elbows to be long radius R = 1 1/2 x dia. or 3 x dia. as noted on project drawings.

Flanges

2" through 24" – slip-on, welding neck type, or lap joint, raised face, Class 150 per ASME B16.5, forged steel ASTM A105. Bore of welding neck flanges to suit pipe ID.

26" through 30" – welding neck type or lap joint, raised face, Class 150 per MSS SP-44, forged carbon steel ASTM A105. Bore of welding neck flanges to suit pipe ID.

Note: Flat faced flanges required at flanged flat faced cast iron valves for all sizes.

Pipe Joints

Flange Bolting: Carbon steel bolts to ASTM A307 Grade B, UNC threads with heavy hex nuts to ASTM A563 Grade A. Use Class 2A fit on bolts and 2B fit on nuts. Dimensions per ASME B1.1, B18.2.1 and B18.2.2.

Welded Joints
Essential variables to be in accordance with TH-SPEC-35003 for the welding procedure (WP) identified.

2” through 6” - WP3
8” through 30” - WP-1

Valves

See project drawings. All valves to be lockable.

Pipe Fabrication

Dimensions for length of spool are face to face of flange or stub-end.

Furnish lap joint stub-ends complete with lap joint flange on pipe or fitting.

Spools and fittings to be fabricated in accordance with Vale Engineering TH-SPEC-35002 "Piping - General Requirements" unless otherwise noted and drawing 85-401-F-11997.

Identify each spool piece by order number and mark number using aluminum paint.

Do not weld after preparations for rubber lining are complete or on completion of rubber lining.

Pipe Preparation For Rubber Lining

Grind smooth, welds that come into contact with rubber lining. Grind welds at flanges to 1/8" min. radius. Grind weld neck flanges to 1/8" min. radius at the inner face edge.

Pipe spools to be hydrostatically tested before rubber lining. Sandblast or shot blast internal pipe surfaces to a uniform white metal finish to remove all traces of rust, scale or other foreign matter, and free surfaces of laminations, deep seams, ridges, pits or other imperfections.

Procedure for blast cleaning of steel pipe to comply with steel structures Painting Council Bulletin, Surface Preparation Specification No. SSPC-SP-5.

When blast cleaning is complete, remove all dust by vacuum or air blast.

Coat blasted area with prime coat of bonding adhesive before rusting occurs.

Lining Specification

Rubber lining to be 40 -0/+5 Durometer after vulcanization, soft gum natural rubber at 1/4" minimum thickness.

Ensure rubber linings are free of defects, cracks, blisters or bulges, and have a smooth surface free of projections.

Carry the rubber lining for flanged pipe to outer edge of raised flange face such that no gasket is required.

Rubber lining of elbows and bends 8" and over to be 1/2" thick on outside radius covering 180 deg. of circumference. Rubber lining to be applied in two 1/4" thick layers. Feather edges of second layer. Tube seam to be on inside radius of elbow and bend.

Rubber lining for valves to be carried to the outer edge of the raised flange face or for flat face flanged valves to the inside of the bolt circle. Full face lining is not required.

Lining Procedure

Apply remaining coats of adhesive using uniform coats and allowing each coat to dry before applying the next coat.

Use adhesive cement of high quality material suitable for maximum adhesion between metal surface and crude rubber compound.

Dependent on pipe size, lay several lengths of coarse string full length of lining surface. Use no less than 3 lengths of string per length of pipe.

Cut sheet of rubber lining and form into a tube with O.D. of tube same as I.D. of pipe. Ensure seam of lining is well knitted and uniformly smooth.

Tackify the outside of tube, place tube on liner fabric and draw into place in pipe using caution not to scuff or damage the adhesive cement. Remove the liner and with light air pressure expand the rubber lining into place inside of pipe.

Place pneumatic expander near centre of pipe length and

expand rubber liner as expander is inched towards operator. Similarly, when first half of lining is expanded into place, repeat for other half of pipe, thus consolidating the lining and removing any entrapped air.

Vulcanize rubber lining by steam pressure cure to pipe or fitting.

Remove from vulcanizer and completely spark test the whole rubber lining.

Reline completely any length which displays leaks that cannot be reached for repairs.

Make repairs using a chemically cured repair rubber compatible with lining.

Edges of lining at flanges to be chamfered slightly by buffing.

5.0 TESTING

Testing must meet the requirements of ASME B31.3 for Category D fluid and TH-PROC-83006 (hydrostatic testing) or TH-SPEC-35048 (pneumatic testing - only at the discretion of the Engineer) and specific instructions in the scope of work.

Test Pressure	Duration	Additional Requirements
225 PSIG	Per Code	none

6.0 EXAMINATION AND INSPECTION

Examination and inspection must meet the requirements of ASME B31.3 for Category D fluid and specific instructions in the scope of work. Minimum 100% visual examination for pressure welds or welds to pressure retaining components and a complete inspection.

7.0 PAINTING - PIPE SYSTEM CLASSIFICATION AND IDENTIFICATION

The piping system shall be painted (classification) and labeled (identification) in accordance with TH-SPEC-35001. The piping system shall also be labeled at 20’ intervals with “Caution – Combustible Liner – no Hot Work”

8.0 APPENDICES

Appendix A: Revision and Transition Notes
Appendix B: Keywords

Appendix A: Revision and Transition Notes

(Revisions are listed in reverse chronological order with most recent revision at the top. Revision notes describe: what was changed, why it was changed, and the plan to implement the change, including whether changes are retroactive)

Revision 4
Approved for Manitoba Operations
Changed reference drawing number to 85-401-F-11197 from 99-999-F-04255

Revision 3
Title changed from 150 psig to 100 psig to reflect the nominal operating pressure.
Section 3: Added some reference codes and/or standards that were omitted
Section 4: Changed Pressure Rating to Design Conditions. Pressure rating is a component requirement while design pressure and temperature is a system requirement. Changed design conditions maximum temperature from 150 to 149 F to be consistent with other specifications and changed operating conditions from 110 F to ambient temperature as this will be the normal temperature. Replaced paragraph with list of requirements in Design Fabrication Installation section for clarity. Added ASME B36.10 references to the Pipe Section. The “lb .” was removed from Class designations per ASME definition. ANSI was removed from ANSI/ASME designations as ANSI/ASME is incorrect. Gasket section title replaced with Pipe Joint title and now includes welding section, flange bolts section and gasket section. Removed ZES reference from lockable valves note to be consistent with other specifications. Removed testing details from pipe preparation section as it is in the testing section. Added component minimum rating.
Section 5: Added table, added SPEC-35048 and PROC-83006 reference. Removed content that is in the SPEC or PROC for clarity. Corrected the test of 100 psig to 225 psig. Added drawing reference 99-999-G-4255.
Section 6: Added Inspection to title. Added inspection criteria per code. Clarified examination requirements. Removed acceptance criteria note as it is covered in the Code.
Section 7: Changed section title for clarity.

Note: The above changes are applicable to any new installations and/or modifications to existing systems from this date forward.

Revision 2
Approved for use in Thompson. Piping system approval requirements updated for Manitoba.

Revision 1
Document reviewed and updated against latest editions of referenced external standards
Document format and number changed due to Vale engineering Document Program changes in 2011. Previous Standard number was 3503-11.01.610 Rev 3.

Appendix B: Keywords

3503-11.01.610
SPEC-35027