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Glass Lining Submittal

US Pipe Fabrication Vitco®, SG-14®

ASTM B1000-15 Compliant

I. Substrate Materials

Pipe used for glass lining shall be the product of one manufacturer and applied in one of the manufacturer's fabrication facilities.

Glass lining shall meet all requirements of ASTM B1000-15.

Glass linings shall be applied to Class 53 or thicker ductile iron pipe or ductile iron fittings.

Steel pipe minimum wall thickness will vary with diameter and fitting and end configurations (see Table I.) U.S. Pipe Fabrication should be consulted for the proper size.

Pipe and fittings used for glass lining shall be ordered without lining or coatings.

Ductile iron pipe shall be ordered from the foundry as "for glass lining".

Table I. Minimum Wall Thickness for Steel Pipe

Diameter	Minimum Wall
10 inch or smaller	Schedule 40*
12 inch and larger	3/8 inch *
* consult with US Pipe Fabrication for minimum wall thickness	

II. Preparation of Substrate

Pipe or fittings shall be ground to remove casting anomalies which will interfere with the lining quality.

Large defects in fittings may be ground and welded using approved welding procedures.

Minor defects in fittings may be patched using approved materials and procedures.

When applied to steel fabrications, all internal welds must be ground smooth and any voids or slag holes must be ground out, re-welded and ground smooth.

Pipe and/or fittings shall be grit blasted.

III. Lining Material

The glass lining applied to pipe and fittings shall be hard, smooth, continuous vitreous material which is formulated to prevent the adherence of grease in sludge and scum lines, and to resist the adherence of crystalline metal salt deposits (Struvite and Vivionite) to sludge and centrate lines in sewage and wastewater treatment plants.

The glass portion of the lining, the frit(s) used in the formulation, as supplied from the manufacturer, shall have a density of 2.5 to 3.0 grams per cubic centimeter as measured by ASTM D-792.

IV. Lining Process

The slip (mixed slurry) shall be prepared according to documented procedures. Pertinent quality control characteristics including specific gravity (SG) and pick-up shall be recorded.

The slip shall be applied to the freshly blasted substrate within 8 hours of blasting.

The slip shall be applied to a minimum wet film thickness (WFT) to provide the desired dry film thickness (DFT).

The freshly applied slip shall be thoroughly dried prior to the firing process.

The coated product shall be fired according to documented procedures. Times and temperatures should reflect those needed to provide the physical and corrosion results desired. Pertinent quality control characteristics including oven temperature and time at temperature should be recorded.

The fired lining shall be inspected.

V. Lining Characteristics

The lining shall be of a light, bright color to allow visual detection of defects more easily prior to electronic holiday detection testing. Glass linings are not intended to be Holiday free, but to prevent the build-up of grease, scum, and crystalline metal salt deposits.

The entire finished coating shall be a minimum of 10 mils (0.010 inch) as tested with an acceptable Type I or Type II dry film thickness gage as described in ASTM D7091.

The finished lining shall be able to withstand a strain of 0.001 inch/inch of the base metal without visible damage to the glass.

The glass lining shall have a minimum hardness of 5 on the Moh's hardness scale.

The lining shall be capable of withstanding an instantaneous thermal shock from ambient +350^{o}F to ambient without visible crazing, blistering or spalling.

The lining shall be resistant to corrosion by an HCl solution adjusted to a PH of 3 at 125^{o}F and a NaOH solution adjusted to a PH of 10 at 125^{o}F. Demonstration of this shall be by a weight loss of not more than 3 milligrams per square inch when exposed for 30 minutes.

There shall be negligible visible loss of surface gloss to the lining after immersing a cut production sample in an 8% by weight sulfuric acid solution at 148^{o}F for a period of 10 minutes.

VI. Inspection, Testing, and Certification

Qualification Testing

Laboratory Testing Results of representative production samples shall be available for review. These include:

a. Strain testing of the base material to 0.001 inch/inch.

b. Hardness of the lining using the Moh's scratch hardness scale.

c. Thermal shock testing of a 350^{o}F differential from ambient.

d. Weight loss when exposed to a solution of HCl adjusted to PH of 3 at 125^{o}F for 30 minutes.

e. Weight loss when exposed to a solution of NaOH adjusted to PH of 10 at 125^{o}F for 30 minutes.

f. Surface gloss condition when a cut piece is exposed to an 8% by weight solution of H_2SO_4 at 148^{o}F for 10 minutes.

Routine Quality Testing

Each pipe/fitting shall be inspected prior to shipment. Inspection shall include:

a. Lining thickness as tested with a Type I or Type II dry film thickness gage as described in ASTM D7091.
b. Holiday testing shall be performed to a documented procedure. It shall use the low voltage wet sponge testing apparatus as described in ASTM D5162, Test Method A. The testing should insure that for long pipe, testing is performed from both ends of the pipe with the diameter of the dampened sponge exceeding the diameter of the pipe so that the sponge is in full circumferential contact with the lining. Wetting agents should not be used. The sponge should be moved over the surface at a moderate rate approximately 0.3 m/s (1 ft/s) using a two pass (in and out)motion over each area. Care should be exercised near the exposed pipe ends to prevent excess water from tracking and giving a false indication. Limits for holidays are given in Table II included at the end of this document.

c. The finished glass lined pipe straightness shall comply with the following:

Fabricated (Flanged and Grooved Ends)	Bell X Spigot Pipe
3/8 inch in 20 feet	5/8 inch in 20 feet
0.01875 in per foot	0.03125 in per foot

d. Copies of the test results from the Routine Quality Testing shall be available for review.

A document of compliance attesting that the lining meets the requirements of this specification, the internal procedures, and applicable standards of ASTM, ANSI, NACE, SSPC and NAPF shall be available for review and/or accompany each shipment.

A label shall be affixed to the interior of each piece showing the inspector's initials and the Quality Control Sequence Number of the part.

Documentation for each pipe/fitting shall include the identification of each item by customer mark number and description, Quality Control Sequence Number, the date tested, the inspector identity, and the test results.

VII. Miscellaneous

a. The applicator shall have a minimum of five (5) years of successful experience in the application of high temperature glass and porcelain coatings for the wastewater and sewage treatment industry.

b. All glass lining of pipe and fittings shall be from one manufacturer.

c. All handling and/or lifting of glass lined pipe and fittings must be done on the exterior only. Lifting with internal hooks, forks or chains shall not be done at any time.

d. Welding on glass-lined pipe shall not be performed. Wall collars, restrained joint weld ends, etc. shall be welded applied prior to glass lining.

e. Tapping shall also be done prior to glass lining.

f. Glass lined pipe can be successfully cut for field closure pieces using approved procedures from the manufacturer.

g. The standard for quality shall be U.S. Pipe Fabrication VITCO® SG-14®.

Table II. Allowable holiday indications

Fittings	Maximum Number of Holidays	Pipe	Maximum Number of Holidays*
-	-	3 inch diameter up to 10 foot long	6
4 inch through 8 inch diameter	5	4 inch through 8 inch diameter	12
10 inch through 18 inch diameter	8	10 inch through 18 inch diameter	20
20 inch diameter and larger	10	20 inch diameter and larger	28

*NOTE: Except as noted, these are for 20 foot lengths. For shorter lengths the maximum is proportional to the 20 foot length.