

ENCLOSURE 7



**US Army Corps
of Engineers**
Huntington District

Specifications for

MAGNOLIA LEVEE PIPE RE-LINING

BOLIVAR DAM, OHIO

**DEPARTMENT OF THE ARMY
HUNTINGTON DISTRICT, CORPS OF ENGINEERS
HUNTINGTON, WEST VIRGINIA**

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SECTION 02490

LANDSCAPING AND SEEDING

PART 1 GENERAL

1.01 DESCRIPTION

- A. Provide lime, fertilizer, seed, and mulch as specified herein, and needed for a complete and proper restoration of all disturbed areas associated with the project.

1.02 QUALITY CONTROL

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

PART 2 PRODUCTS

2.01 FERTILIZER

- A. Provide commercial balanced 12-12-12, (50% of Nitrogen shall be Urea form), uniform in composition, free-flowing, and suitable for application with approved equipment. The fertilizer shall be delivered to the site in bags labeled with the manufacturer's guaranteed analysis. Uniformly apply 400 pounds per acre of premium fertilizer to a depth of at least 4 inches prior to seeding.

2.02 SOIL AMENDMENT

- A. Apply agricultural limestone at a rate of one (1) tons per acre immediately prior to seedbed preparation.

2.03 MULCH

- A. Provide threshed straw of cereal grain, such as oats, wheat, barley, rye, rice, etc., or grass hay, or wood fiber shall be furnished.

2.04 GRASS SEED

- A. Seed mixtures with the following minimum percentage by weight of pure seed of each seed kind in the mixture in each lot shall be furnished and applied at a rate of 400 pounds per acre.

Table 1 Seed Mixture

Seed kind	Percentage by weight of each seed kind in mixture	Percentage by weight of pure live seed of each kind	Percentage by weight of live seed in mixture
Orchard Grass	55%	88%	48.4%
Perennial Ryegrass	25%	83%	20.7%
Japanese Millet	10%	90%	9.0%
Birdsfoot Trefoil	6%	90%	5.4%
Ladino Clover	4%	90%	3.6%

Total pure live seed in mixture 87.1%
Weed seed, not to exceed 1% by weight 1.0%
Other than weed and pure live seed, maximum . . . 11.9%
Total 100.0%

- B. In the event that seeding is performed between October 15th and March 31st, uniformly apply one hundred (100) pounds per acre of annual rye in addition to the above-mentioned seed mixture.

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 SOWING GRASS

A. Stage 1: Initial Dressing.

- 1. Rake or otherwise clear the disturbed area free of earth clods, debris, rocks, pipe, etc., and perform rough grading of the site in general conformance with the surrounding grade.

B. Stage 2: Final Dressing.

- 1. Grade all disturbed areas within the scope of the project to achieve final line and grades that tie smoothly to the surrounding grade and promote drainage.
- 2. Where the area to be seeded is not sufficiently pulverized to provide good seed bed, the seed bed shall be prepared by pulverizing the soil to a minimum depth of two inches (2") with a disk harrow, drag harrow, spike tooth or similar tool, immediately prior to seeding. All clods, rocks and undesirable material that would interfere with seeding operations shall be removed.
- 3. Apply lime uniformly at a rate of 1 ton per acre incorporated into the soil to a depth of at least 4 inches, fertilizer and seed immediately following seed bed preparation and lightly drag or rake to incorporate into the seed bed. Apply mulch immediately thereafter.

3.03 INSPECTION

- A. In addition to normal progress observations, schedule and conduct the following formal inspections, giving the Engineer at least 24 hours advance notice of readiness for inspection:

1. Final inspection within 24 hours after completion of sowing
2. Final inspection at the end of the maintenance period as discussed in Item 3.04 in this section.

3.04 MAINTENANCE

- A. Maintain seeding for 30 calendar days after planting is complete and continue throughout the warranty period until 95% coverage is achieved as determined by the COR.
- B. At the end of the maintenance period, all plant material shall be in a healthy growing condition.
- C. During the maintenance period, should the appearance of any planted area indicate weakness and probability of dying, re-sow that area without additional cost to the Government.
- D. Continue the maintenance period at no additional cost to the Government until previously noted deficiencies have been corrected, at which time the final inspection will be made.

3.05 CONTROL OF EROSION

- A. Provide and install temporary silt fence on the downstream side of excavated soil placed on embankments steeper than 4:1 (H:V) or otherwise specified on the Drawings or instructed by the COR.

--END OF SECTION--

SECTION 02830A

SLIPLINING OF STORM SEWERS AND CULVERTS USING SOLID-WALL HDPE PIPE

PART 1 GENERAL

1.01 SCOPE

- A. Provide all materials, labor and equipment necessary to rehabilitate existing culverts and storm sewer pipes utilizing solid-wall high density polyethylene (HDPE) pipe.
- B. In all instances, slip-lining rehabilitation shall include installation of a liner pipe having a constant Inside Diameter (ID) and Outside Diameter (OD) within an existing host pipe with a continuously grouted annular space.

PART 2 REFERENCE STANDARDS

Unless otherwise noted, reference is made to the latest version of the documents listed below. All work shall comply with the following reference standards unless specifically stated otherwise in this Specification.

ASTM F585 – Standard Practice for Insertion of Flexible Polyethylene Pipe into Existing Sewers

ASTM F714 – Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter

ASTM D2657 – Standard Practice for Heat-Joining Polyolefin Pipe and Fittings

ASTM D3350 – Standard Specification for Polyethylene (PE) Plastic Pipe and Fittings Materials

ASTM D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

PART 3 MATERIALS

3.01 PIPE

- A. Pipe and fittings shall be manufactured from high density compounds in accordance with ASTM D3350, cell classification 345464C with a designation of PE 3408 and minimum Dimension Ratios (DR) of twenty-six (26) for pipe 7 and seventeen (17) for pipes 8, 9, 10, 11, 12, 13, 14, and 15 respectively.
- B. Pipe shall be solid wall and have a smooth interior and exterior with no corrugations or ferrous elements.
- C. Pipe shall be marked at not less than 5 foot intervals with a coded number which identifies the manufacturer, SDR, size, materials, machine, date and shift on which the pipe was extruded.
- D. All pipes shall be specifically applicable for installation and use in the environment as required by this specification.

3.02 JOINTS

- A. Internal beads resulting from butt fusion shall be limited to a ¼" projection perpendicular to the inside wall of the pipe. Beads larger than ¼" shall be trimmed 360 degrees around the interior of the pipe. External beads resulting from butt fusion need not be trimmed unless the bead projection will negatively impact pipe installation or migration of annulus grout.
- B. Joints shall be water-tight over the range of head pressure as specified as a design requirement in this Specification. In addition, all joints shall be sufficiently water-tight such

that no grout is visible on the inside of the pipe at the completion of annular space grouting.

- C. Joints shall be either butt-fused welded in accordance with ASTM D3261 and D2657, or push-together with interlocking machined grooves with approved sealant. Screw-type or threaded joints will not be allowed.

3.03 FITTINGS

- A. Molded fittings shall be manufactured in accordance with ASTM D3261, and shall so marked.
- B. Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock, or molded fittings.

3.04 GROUT

- A. Provide cementitious grout for annular space grouting in accordance with Section 03601 of these Specifications.

PART 4 DESIGN REQUIREMENTS

The CONTRACTOR shall select, provide and install a slip-liner pipe that will meet all of the following requirements:

4.01 CONVEYANCE CAPACITY

- A. The liner pipe shall provide the maximum conveyance capacity possible while maintaining a 1-inch minimum average annular space between the host pipe and liner pipe for grouting.
- B. The ID of the liner pipe shall not be less than 80% of the nominal ID of the host pipe unless otherwise noted on the drawings.
- C. The only exception to this shall be if the contractor satisfactorily demonstrates to the COR that it is possible to construct the project with commercially available pipe diameters and

dimensions approved for use on this project.

4.02 DESIGN CRITERIA

- A. The CONTRACTOR shall demonstrate that the selected liner pipe is suitable for installation based on a detailed evaluation given the following parameters:
1. All existing pipelines shall be considered fully deteriorated. The Contractor shall not give ANY structural consideration being provided by the host pipe.
 2. Long-term analysis shall be considered 50 years.
 3. Live load need not be considered.
 4. Allowable long-term deflection is 5%.
 5. All pipes shall be designed based on information shown on the enclosed drawings with depths field verified by the CONTRACTOR.
 6. Use a Safety Factor of 2.0 for all parameters and calculations.
 7. Modulus of soil reaction shall be 1500 psi.
 8. Saturated unit weight of soil shall be 120 pcf.

4.03 SUBMITTALS

- A. The CONTRACTOR shall provide six (6) bound copies of the following information to the COR for review and approval prior to construction:
1. Manufacturer's literature pertinent to the proposed rehabilitation materials and methods. Specific information should include installation minimum/maximum allowable parameters (i.e. allowable grout pressure, axial compressive stress, etc.), recommended installation procedures, etc.

2. Detailed analysis and calculations demonstrating suitable application based on the following parameters:
 - a. Deflection
 - b. Confined buckling
 - c. Long-term (50 yr) hydrostatic buckling
3. Detailed Work Plan outlining the following items:
 - a. Proposed construction sequencing and scheduling
 - b. Areas requiring special construction techniques
 - c. Proposed methods for control of water (if applicable)
 - d. Proposed access and staging areas
 - e. Proposed work hours
 - f. Other pertinent information related to the project
4. Test results and certification of compliance for materials.
5. Documentation of manufacturer's certification of installers (as applicable).
6. Grout design as per Section 03601.
7. Manufacturer's recommendations regarding methods for repair of damage to liner pipe following installation.

PART 5 EXECUTION

5.01 CLEANING AND INSPECTION

- A. Prior to the installation of the slip-liner pipe, CONTRACTOR shall thoroughly clean the host pipes designated to receive the liner. Cleaning shall constitute removal of all debris, solids, roots, deposits, and other matter which would preclude proper installation of the slip-liner pipe and annulus grout. Water used for flushing and cleaning pipes prior to slip-line installation shall be maintained by the contractor to comply with regulatory agencies having jurisdiction regarding erosion prevention and sediment control procedures for storm water discharge.

5.02 CONTROL OF WATER

- A. CONTRACTOR shall provide for maintenance and control of water as necessary for satisfactory installation of the slip-liner and grout. Such work shall include by-pass pumping or berming and dewatering for submerged pipes. Proposed means and methods for control of water shall be submitted for approval to the COR.

5.03 PROOF TESTING

- A. A mandrel shall be pulled through all host pipes smaller than 36 inches in diameter where deformation, joint deflection or obstructions are observed prior to insertion attempts. The mandrel length of liner pipe shall be equal to the liner pipe joint length. Host pipes 36 inches in diameter and larger may be verified through man-entry, mandrel or both at the CONTRACTOR'S discretion. The mandrel shall have an outside diameter not less than that of the proposed slip-liner pipe plus 1-inch (note 1-inch grout requirement), shall be equal to the pipe joint length of the liner pipe to be installed and shall have a stiffness equal to or greater than that of the slip-liner pipe. A segment of slip-liner pipe may be used as a mandrel, but this test segment shall not be used as a permanent slip-liner pipe.

5.04 EXCAVATION

- A. All work as required by these Specifications shall be performed utilizing existing points of entry including headwalls, manholes, etc. Any other excavation along the length of the host pipe (between headwalls/manholes) is strictly prohibited. In the event that it becomes necessary to perform an excavation, the CONTRACTOR will be required to obtain written confirmation an excavation is warranted from the COR.

5.05 INSTALLATION

- A. All liner pipe installation shall be in accordance with the manufacturer's recommendations and the provisions of this Section. In the event of a conflict, the more restrictive of the two shall govern.
- B. Sections of slip-liner pipe shall be joined and pushed into the host pipe until a continuous liner pipe is created along the entire length of the host pipe. Pulling assistance with a winch or other mechanical means is allowed provided that the entire section of slip-liner pipe remains in compression during installation from heavy equipment pushing the pipe from the other side. Heavy equipment or vehicles shall not be allowed to pull the pipe through.
- C. Insertion may proceed from either upstream or downstream as suitable access is available, unless required otherwise.
- D. A push ring that distributes jacking/pushing forces 360° around the perimeter of the end wall of the slip-liner pipe shall be used for all insertions to prevent damage to the slip-liner pipe.
- E. An environmentally safe, sub-aqueous lubricant may be permitted upon prior approval by the COR.
- F. The CONTRACTOR shall use caution to prevent jagged edges from damaging the slip-liner pipe during insertion when the invert of host pipe has deteriorated significantly. In such cases, the CONTRACTOR is encouraged to install two (2); 1 to 2 inch diameter Schedule 40 galvanized steel pipe guide rails along the invert of the host pipe. These guide rails shall be tack-welded or bolted to the host pipe to prevent movement during insertion and shall be

withheld not less than 5 feet from the ends of the host pipe. The ends shall remain open such that the entire length of guide rail pipe shall be filled during annular space grouting. An alternate guide rail method may be prepared and submitted to the COR for review and approval.

- G. The CONTRACTOR shall consider thermal expansion/contraction affects such that the ends of the slip-liner pipe is flush with the existing headwall/manhole to within ½ inch. Reasonable attempts shall be made by the contractor to achieve a flush surface between the slip-lined pipe and the host pipe as determined by the COR.
- H. Once the slip-liner pipe has been installed, bulkheads shall be constructed in sequence from upstream to downstream at the end of each pipe segment; including gatewells and manholes located intermediately along the pipe length to be slip-lined. In addition, the shop drawings shall include the proposed locations of the grout/air ports and sketches of the proposed bulkheads, as well as the lengths of each grouting port. The lengths shall be staggered such that the entire run of the pipe can be completely grouted. Shop drawings shall include manufacturer's literature for accessories and form coating materials. The materials, dimensions, location of grout injection ports, vent tubes, etc. shall be designed by the CONTRACTOR and submitted for approval per the requirements of Section 03601 of these Specifications. The CONTRACTOR shall construct bulkheads a minimum of 24 hours after the completion of the slip-liner insertion process to allow for thermal equilibrium between the slip-liner pipe and the host pipe conditions and at most 72 hours after completion of the slip-liner insertion process to minimize exposure of the annulus to debris from a rainfall event.
- I. The contractor shall fill the annular space with grout between the ID of the host pipe and the OD on the liner pipe. The pipe shall be grouted along its entire length with cementitious grout. All materials, methods of grout installation shall be in accordance with Section 03601 of these Specifications.
- J. The CONTRACTOR shall take necessary precautions to maintain line and grade of the host pipe and avoid flotation of the liner pipe. This can be accomplished by providing blocking at 10, 12, and 2 o'clock (suggested locations) in the top of the pipe to prevent flotation during

grouting.

- K. Drilling holes in the slip-liner pipe for any reason is prohibited.
- L. At the completion of construction the exposed ends of all slip lined pipes shall have a clean, finished look with no visible signs of grout vents, injection tubes, etc.
- M. The bulkheads shall be hand-finished with a portland cement based grout to a professional quality appearance that exhibits a reasonable attempt at matching the existing concrete surface. After a sufficient curing period, a soluble reactive silicate concrete treatment such as “ChemTec One” should be applied over the entire headwall surface, including the bulkheads. Particular attention should be given to ensure the product is applied to the bulkhead grout properly.

5.06 SAFETY

- A. The CONTRACTOR shall perform all work in accordance EM 385-1-1. The CONTRACTOR shall note any areas that may involve entry and/or work in confined spaces and provide a Health and Safety Plan including provisions for confined space entry to the COR prior to performing work in these areas. It shall be the CONTRACTOR’S sole responsibility to prepare, maintain, monitor and enforce his Health and Safety Plan as well as maintain compliance with EM 385-1-1.

PART 6 QUALITY ASSURANCE

6.01 PERSONNEL AND EQUIPMENT

- A. The CONTRACTOR shall at all times provide suitable equipment as well as adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods necessary for successful completion of the work.

6.02 SUPERVISION

- A. The CONTRACTOR shall provide an experienced project superintendent as determined from resume submittals to be on the site at all time and shall have full authority to direct the CONTRACTOR'S means, methods, equipment and personnel and performance of the work.

PART 7 TESTING AND ACCEPTANCE

7.01 REWORK

- A. The CONTRACTOR shall remove any material that has not received prior approval from the COR, has not been completed in accordance with these Specifications or is otherwise not accepted as suitable work by the COR and replaced with an approved material at the CONTRACTOR'S sole expense.

7.02 FINAL VIDEO INSPECTION

- A. After all work is completed, the CONTRACTOR shall perform one CCTV inspection of all pipes at the CONTRACTOR's expense, documenting the post-installation conditions. This shall be provided to the COE for approval. All defects discovered during the post-installation video inspection shall be corrected by the CONTRACTOR at his expense before the work under the Contract will be considered for Substantial Completion. After the defects, if any, are corrected in accordance with manufacturer's recommendations, the affected pipe segment(s) shall be video inspected a second time as a follow-up inspection. All follow-up CCTV inspections will be performed by the CONTRACTOR, and all costs associated with such follow-up inspections associated with the correction of work shall be born by the CONTRACTOR and shall be withheld from final payment. The contractor shall provide final video to the COR for review and approval of finished work per pipe.

--END OF SECTION--

SECTION 03601

GROUT FOR SLIP-LINING NONSTRUCTURAL

PART 1 GENERAL

1.01 SCOPE

Provide all materials, labor and equipment necessary to completely fill the annular space between the slip-liner pipe and the host pipe with low-strength (300 psi) cementitious grout. The Contractor should follow the specifications listed in the scope unless otherwise directed by the COR or unless otherwise recommended by the pipe manufacturer.

PART 2 REFERENCE STANDARDS

Unless otherwise noted, reference is made to the latest version of the documents listed below. All work shall comply with the following reference standards unless specifically stated otherwise in this Specification.

ASTM C403 - Test Method for Time Setting of Concrete Mixtures by Penetration Resistance

ASTM C138 - Test Method for Unit Weight ASTM C150 - Portland Cement

ASTM C495 - Test Method for Compressive Strength of Lightweight Insulating Concrete

ASTM C618 - Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral
Admixture in Portland Cement Concrete

ASTM C939 - Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow
Cone Method)

ASTM C940-10a – Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts
for Preplaced-Aggregate Concrete in the Laboratory

ASTM C494 – Standard Specifications for Chemical Admixtures for Concrete

PART 3 MATERIALS AND EQUIPMENT

3.01 CEMENT

- A. Comply with ASTM C150. Pozzolans and other cementitious materials are permitted.

3.02 FLY ASH

- A. Comply with ASTM C 618; either Type C or Type F shall be used.

3.03 WATER

- A. Use only potable water obtained from a municipal water distribution system and transported, when required, in a clean, dedicated container designed specifically for such.

3.04 ADMIXTURE

- A. Admixtures shall be selected by the slip-lining grout manufacturer to meet performance requirements, improve pumpability, control set time, and reduce segregation. Admixtures shall not be biodegradable. Admixtures shall meet the requirements of ASTM C494 when applicable.

3.05 COMPRESSIVE STRENGTH

- A. The grout shall have a minimum penetration resistance of 100 psi in 24 hours when tested in accordance with ASTM C403 and a minimum compressive strength of 300 psi in 28 days when tested in accordance with ASTM C495.

3.06 PERFORMANCE REQUIREMENTS

- A. The grouting system shall have sufficient gages, monitoring devices, and tests to determine the effectiveness of the grouting operation and to ensure compliance with the liner pipe specifications and design parameters.

3.07 MIX DESIGN

- A. The CONTRACTOR shall develop one or more mix designs to completely fill the annular space based upon, but not restricted to, the following requirements:
 - 1. Size of annular void
 - 2. Absence or presence of water
 - 3. Sufficient strength and durability to prevent movement of the liner pipe
 - 4. Provide adequate retardation for placement
 - 5. Provide less than 1 percent shrinkage by volume
 - 6. Heat of hydration compatible with pipe material in accordance with pipe manufacturer's recommendations
 - 7. Shall have zero bleed
 - 8. Specific Gravity greater than 1.0 when outer pipe is full of water (if applicable).

3.08 MIXERS AND PUMPS

- A. The materials shall be mixed in equipment of sufficient size and capacity to provide the desired amount of grout material for each stage in a single operation. The system shall mix the grout to a homogeneous consistency and deliver grout to the injection point at a

steady pressure with a non-pulsating pump at the mix tank. The equipment shall be capable of mixing the grout at densities required for the approved procedures and shall also be capable of changing density as dictated by field conditions at any time during the grouting operation. The grout mixer shall be a high-speed, high-shear, colloidal type grout mixer capable of continuous mechanical mixing that will produce uniform and thoroughly mixed grout which is free of lumps and undispersed cement. The mixer shall be equipped with suitable water and admixture measuring devices calibrated to read in gallons and tenths and so designed that after each delivery the hands can be conveniently set back to zero. A paddle storage tank shall be used to agitate the mix prior to pumping.

3.09 PRESSURE GAUGES

- A. Pressure gauges shall be suitable for use in the grouting environment and have a working range between 1.5 to 2.0 times the design grout pressures, and have accuracy within 0.5% of full range.
- B. Provide, at a minimum, one pressure gauge at the point of injection and one pressure gauge at the grout pump.

3.10 TESTING EQUIPMENT

- A. A Baroid Mud Balance shall be used to check the specific gravity during pumping operations.

PART 4 SUBMITTALS

The CONTRACTOR shall provide six (6) bound copies of the following information to the COR for review and approval prior to construction:

- A. Qualifications and experience of grout mix applicator and Project Superintendent and support personnel.

- B. Grout mix design and trial mix tests, with set time, compressive strength, viscosity, and density test results.
- C. Initial set time of the grout.
- D. The 24 hour and 28 day minimum grout compressive strengths.
- E. The grout working time before a 15% change in density or viscosity occurs.
- F. The proposed grouting methods and procedures. Contractor shall submit a layout detail to include proposed locations for blocking, grout injection tubes and air vent tubes.
- G. Method for waste grout recovery.
- H. Estimated grout volume for each pipe per stage.
- I. The maximum injection pressures proposed as well as maximum allowable grout injection pressures as provided by the pipe manufacturer.
- J. Proposed grout stage volumes. Define the lengths of grout pipes for each stage. Stage lengths are limited to 20-30' unless justification can be provided as to the need for longer stages.
- K. Bulkhead designs and locations including vent and injection port location and proposed materials to be used in bulkhead construction. In addition the lengths of each port shall be shown.
- L. Method of flow control during grouting.
- M. Detailed plans depicting the method of cribbing the liner pipe to allow the grout to set when buoyant uplift is a factor.

- N. Written confirmation that the CONTRACTOR has coordinated grouting procedures with the grout installer and the liner pipe manufacturer. Confirmation shall also include that the CONTRACTOR has coordinated the attachment of the grout lines to the liner pipe so that they will not become clogged or detached during the installation process.
- O. For each different type of grout or variations in procedure of installation, a complete package shall be submitted. The submittal shall include each of the above items and the locations of conditions to which it applies.
- P. Detail measures or procedures to equalize the pressure between the inside and outside of the liner pipe so as to resist buoyant or bursting forces.

PART 5 EXECUTION

5.01 GROUT INJECTION

- A. Notify the COR at least 24 hours in advance of grouting operations. After installation of the injection ports and bulkheads, PVC caps shall be placed over the pipes to prevent any debris from entering the annular space.
- B. Once the slip-liner pipe has been installed, construct bulkheads at each end in sequence from upstream to downstream. Following construction of the bulkheads, the CONTRACTOR shall fill the annular space between the slip-liner pipe and the host pipe along its entire length with cementitious grout by injecting grout from one end of the pipe segment, allowing it to flow toward the other end. Grouting should proceed from the downstream bulkhead toward the upstream end. Grouting should commence at the injection port on the downstream bulkhead and continue until:
 - 1. Grout of similar specific gravity to that being mixed has been observed flowing from the downstream bulkhead vent and it has been closed.
 - 2. The air or water displacing from the pipe stops flowing
 - 3. The estimated total volume plus a percentage (approx. 10%), to allow for a tremie seal on the pipe, has been pumped.

Grouting should proceed from the longest line (say 100-110' in most instances) and progress through the successively shorter grout lines. Grout lines should be switched when:

1. The air or water displacing from the next shorter grout pipe stops flowing.
 2. The estimated volume plus a percentage (approx. 10%), to allow for a tremie seal on the next shorter pipe, has been pumped.
- C. Remove or control standing or running water in annular spaces to maintain the correct water ratio of the grout mixture.
- D. Limit pressure on the annular space to prevent damage to the liner. The gauged grout pressure at the pipe shall not exceed that of the pipe manufacturer's recommendation or 5 psi, whichever is smaller. Regardless of the pressure, the CONTRACTOR shall be solely responsible for any damage or distortion to slip-liner pipe due to grouting.
- E. The drilling of additional injection holes from the surface or through the liner pipe to facilitate grouting is prohibited.
- F. Injection of grout shall continue until all of the following conditions have been achieved unless otherwise approved by the COR:
1. The total estimated volume of grout for all stages on a given pipe has been injected
 2. The estimated volume of grout has been injected
 3. The exhausted grout recovered at each vent is not less than 85% of the density of the freshly injected grout
 4. The exhausted grout at each vent is not less than 85% of the original viscosity of the freshly injected grout
 5. Grout recovered from the vent is the same specific gravity as that being injected, per the use of the Baroid Mud Balance

6. The grout installer recommends ceasing grouting operations.
- G. No hardened grout is permitted in the liner pipe invert after completion of grouting operations.
- H. Cold weather grouting where the temperature is between 32-40° F during and after grouting the following conditions shall be met:
1. Temperature of the grout mix must be 60° F or higher at the time of pumping.
 2. The use of insulation/concrete blankets over areas of the levee behind the headwalls where the minimum cover above the frost line is not met for a period of 7 days.
- I. Cold weather grouting when the temperature is below 32° F during and after grouting the following conditions shall be met:
1. Temperature of the grout mix must be 60° F or higher at the time of pumping.
 2. The use of insulation/concrete blankets over areas of the levee behind the headwalls where the minimum cover above the frost line is not met for a period of 7 days.
 3. The use of an interior heater in the pipe that does not exceed the pipes maximum localized temperature for the first 24 hours after grouting.
- J. Hot weather grouting is permitted however, the CONTRACTOR shall use caution to prevent flash-setting of the grout. The CONTRACTOR is responsible for any replacement/repair necessary as a result of grouting in hot weather at no additional cost to the Government and to the satisfaction of the COR.

PART 6 TESTING

6.01 DENSITY

- A. Provide all personnel and equipment necessary to measure density in accordance with ASTM C138 or by another method as approved by the COR not less than two times per hour in the field during grouting operations. Grout that exceeds ± 3 lb/cubic foot of the design density shall be rejected.

6.02 VISCOSITY

- A. Provide all personnel and equipment necessary to measure viscosity in accordance with ASTM C939 not less than two times per hour in the field during grouting placement. The apparent viscosity shall not exceed 20 seconds unless otherwise approved by the COR.

6.03 COMPRESSIVE STRENGTH

- A. Collect, transport, cure, test and report samples in accordance with ASTM C495.
- B. Collect four (4) specimens (3"x6" cylinders) for each pipe at approximately the mid-point of the grouting operation.
- C. Test all specimens for compressive strength at 28 days. Additional specimens and tests may be performed at the CONTRACTOR'S discretion.
- D. Tests and companion specimens associated with oven-dry unit weight (ASTM C495 Item 9) are not required.
- E. The CONTRACTOR shall engage the services of an independent, COE Certified Testing Laboratory to collect and test specimens associated with the strength requirements of this Section. In addition, all field personnel associated with testing shall be from a COE Certified Testing Laboratory.

6.04 BAROID MUD BALANCE

- A. Provide all personnel and equipment necessary to test specific gravity with the Baroid Mud Balance in accordance with established procedures in the field during grouting placement.

--END OF SECTION--

SECTION 09 97 02

PAINTING: HYDRAULIC STRUCTURES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 1045	(1995; R 2001) Sampling and Testing Plasticizers Used in Plastics
ASTM D 1152	(2006) Methanol (Methyl Alcohol)
ASTM D 1153	(2006) Methyl Isobutyl Ketone
ASTM D 1200	(1994; R 2005) Viscosity by Ford Viscosity Cup
ASTM D 1210	(2005) Fineness of Dispersion of Pigment-Vehicle Systems by Hegman-Type Gage
ASTM D 153	(1984; R 2003) Specific Gravity of Pigments
ASTM D 281	(1995; R 2007) Oil Absorption of Pigments by Spatula Rub-Out
ASTM D 3721	(2005) Synthetic Red Iron Oxide Pigment
ASTM D 4417	(2003) Field Measurement of Surface Profile of Blast Cleaned Steel
ASTM D 520	(2000; R 2005) Zinc Dust Pigment
ASTM D 561	(1982; R 2003) Carbon Black Pigment for Paint
ASTM D 7091	(2005) Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nondestructive Coatings Applied to Non-Ferrous Metals
ASTM D 841	(2002) Nitration Grade Toluene
ASTM E 1347	(2006) Color and Color Difference Measurement by Tristimulus (Filter) Colorimetry

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC QP 1	(1998; E 2004) Standard Procedure for Evaluating Painting Contractors (Field Application to Complex Industrial Structures)
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SSPC QP 3 (2006; E 2007) Standard Procedure for Evaluating Qualifications of Shop Painting Applicators

SSPC SP 1 (1982; E 2004) Solvent Cleaning

SSPC SP 5 (2007) White Metal Blast Cleaning

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD-595 (Rev B; Am 1) Colors Used in Government Procurement

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with this section:

SD-04 Samples

Special Paint Formulas; G
Paint Formulations; G

Samples of all special paint formula, Military, Master Painter Institute, Commercial Item Description, and SSPC paints. For products that are specified to be applied in accordance with the manufacturer's recommendations the Contractor shall also submit the paint producers product data sheet or other written instructions for those products.

Solvent and Thinners; G

Samples of the thinners or solvents used to reduce the viscosity of the paint.

SD-06 Test Reports

Inspection

Documentation of inspections and operations performed shall be performed daily. The documentation shall be submitted after the paint operations have been completed.

SD-07 Certificates

Qualifications; G

Qualified Painting Contractor; G

A copy of their current SSPC QP 1 or SSPC QP 3 certification.

Coating Thickness Gage Qualification; G

Documentation of manufacturer's certification shall be submitted for all coating thickness gages.

1.3 QUALIFICATIONS

Qualifications and experience shall comply with the following.

1.3.1 Qualified Painting Contractor

The Contractor shall be a certified SSPC-QP 1 or SSPC QP 3 Painting Contractor.

1.3.2 Coating Thickness Gage Qualification

Documentation of certification shall be submitted for all coating thickness gages. Magnetic flux thickness gages as described in ASTM D 7091 shall be used to make all coating thickness measurements on ferrous metal substrates. Eddy current thickness gages as described in ASTM D 7091 shall be used to measure coating thickness on all nonferrous metal substrates. Gages shall have an accuracy of +/- 3 percent or better. Gages to be used on the job shall be certified by the manufacturer as meeting these requirements.

1.4 SAMPLING AND TESTING

The Contractor shall allow at least 30 days for sampling and testing. Sampling may be at the jobsite or source of supply. The Contractor shall notify the Contracting Officer when the paint and thinner are available for sampling. Sampling of each batch shall be witnessed by the Contracting Officer unless otherwise specified or directed. A 1-quart sample of paint and thinner shall be submitted for each batch proposed for use. The sample shall be labeled to indicate formula or specification number and nomenclature, batch number, batch quantity, color, date made, and applicable project contract number. Testing will be performed by the Government. Costs for retesting rejected material will be deducted from payments to the Contractor at the rate of 475 dollars for each paint sample retested and 100 dollars for each thinner retested.

1.5 PRE-TESTED VINYL PAINTS

The manufacturers listed below may have vinyl paints in stock that have been previously tested and approved by the Government in accordance with the requirement of these contract specifications. If the Contractor chooses to utilize these pre-tested vinyl paints for use in this contract in lieu of submitting liquid paint samples for testing, the Contractor shall contact Mr. Alfred Beitelman, ERDC-CERL-IL, (217) 373-7237 and request a copy of the test results of the specific batch of paint to be sent to the Contracting Officer.

Manufacturer

Sherwin-Williams
101 Prospect Ave., NW
Cleveland, OH 44115-1075
1-800-4-SHERWIN
<http://www.sherwin-williams.com>

BLP Mobile Paint Manufacturing Co.
4775 Hamilton Boulevard
Theodore, Alabama 36582

(251) 443-6110
Fax: (251) 408-0410
<http://www.blpmobilepaint.com>

1.5.1 Furnishing or Transportation of Samples for Testing

Costs incidental to the transportation of samples or materials shall be borne by the Contractor. Samples of materials for test verification and acceptance testing by the Government shall be delivered to the Corps of Engineers Division Laboratory, f.o.b., at the following address:

For delivery by mail:

U. S. Army Corps of Engineers
Construction Engineering Research Laboratory
ATTN: Alfred Beitelman
2902 Newmark Drive
Champaign, IL 61826
Telephone: 217-373-7237

Coordination for each specific test, exact delivery location, and dates will be made Mr. Alfred Beitelman.

1.6 PAINT PACKAGING, DELIVERY, AND STORAGE

Paints shall be processed and packaged to ensure that within a period of one year from date of manufacture, they will not gel, liver, or thicken deleteriously, or form gas in the closed container. Paints, unless otherwise specified or permitted, shall be packaged in standard containers not larger than 5 gallons, with removable friction or lug-type covers. Containers for vinyl-type paints shall be lined with a coating resistant to solvents in the formulations and capable of effectively isolating the paint from contact with the metal container. Each container of paint or separately packaged component thereof shall be labeled to indicate the purchaser's order number, date of manufacture, manufacturer's batch number, quantity, color, component identification and designated name, and formula or specification number of the paint together with special labeling instructions, when specified. Paint shall be delivered to the job in unbroken containers. Paints that can be harmed by exposure to cold weather shall be stored in ventilated, heated shelters. All paints shall be stored under cover from the elements and in locations free from sparks and flames.

1.7 SUBMITTAL PROCEDURES

1.7.1 Submittal Classification

Submittals are classified as follows:

1.7.1.1 Government Approved

Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," they are considered to be "shop drawings."

1.7.1.2 Information Only

They are not considered to be "shop drawings" within the terms of the Contract Clause referred to above.

All submittals not requiring Government approval will be for information only. They are not considered to be "shop drawings" within the terms of the Contract Clause referred to above.

1.7.2 Approved Submittals

The Contracting Officer's approval of submittals shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory. Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work. After submittals have been approved by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.7.3 Disapproved Submittals

If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, a notice in accordance with the Contract Clause "Changes" shall be given promptly to the Contracting Officer.

1.7.4 General

The Contractor shall make submittals as required by the specifications. The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all submittals shall be the same as those used in the contract drawings. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. Prior to submittal, all items shall be checked and approved by the Contractor's and each item shall be stamped, signed, and dated by the CQC System Manager indicating action taken. Proposed deviations from the contract requirements shall be clearly identified. Submittals shall include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals. Submittals requiring Government approval shall be scheduled and made prior to the acquisition of the material or equipment covered thereby. Samples remaining upon completion of the work shall be picked up and disposed of in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

1.7.5 Submittal of Shop Drawings

a. The Contractor shall prepare and submit for approval six (6) copies of all shop drawings, as called for under the various sections of these specifications.

b. Five (5) sets of all shop drawings will be retained and one (1) set will be returned to the Contractor with one (1) copy of ENG Form 4025, indicating approval or corrective action required.

c. Shop drawings shall be complete, legible, and detailed. Check and coordinate shop drawings of subcontractors and suppliers prior to submitting them. If the Contractor considers any correction indicated to constitute a change to the contract drawings or specifications, notice, as required under the Contract Clause, "CHANGES" shall be given to the Contracting Officer.

d. Each shop drawing submitted for approval shall be listed on a separate line of ENG Form 4025 and in accordance with the form's instructions.

e. Promptly after approval, five (5) additional sets of all shop drawings made on durable permanent paper, shall be furnished for distribution.

f. Installation of the affected items will not be permitted prior to receipt of these distribution copies of the shop drawings, unless such installation is specifically authorized in writing.

g. Duplicate and distribute reproductions of shop drawings, copies of product data, and samples, which bear the Contracting Officer's approval, to job site file, record documents file, subcontractors, suppliers, and other concerned entities.

1.7.6 Submission

Shop drawings shall be submitted as specified above to:

US Army Corps of Engineers
Attn: Mr. Dale Smith, CELRH-OR-TM
502 8th Street
Huntington, WV 25701

1.7.7 Submittal Control Document

Within ten (10) days after receipt of notice to proceed, the Contractor shall complete and submit to the Contracting Officer, the original and two (2) copies of SUBMITTAL REGISTER, ENG Form 4288, listing all submittals and dates. In addition to those items listed on ENG Form 4288, the Contractor shall furnish submittals for any deviation from the plans or specifications. The scheduled need dates must be recorded on the document for each item for control purposes. In preparing the document, adequate time (minimum of thirty (30) days) will be allowed for review and approval, and possible resubmittal. Scheduling shall be coordinated with the approved progress schedule. The Contractor's Quality Control representative shall review the listing at least every thirty (30) days and take appropriate action to maintain an effective system. Copies of updated or corrected listing shall be submitted to the Contracting Officer at least every sixty (60) days in the quantity specified. Payment will not be made for any material or equipment which does not comply with contract requirements.

At the end of this section is a submittal register showing items of equipment and materials for which submittals are required by the specifications; this list may not be all inclusive and additional submittals

may be required. The Government will provide the initial submittal register in electronic format. Thereafter, the Contractor shall maintain a complete list of all submittals, including completion of all data columns. Dates on which submittals are received and returned by the Government will be included in its export file to the Contractor. The Contractor shall track all submittals.

The sample transmittal form (ENG Form 4025) attached to this section shall be used for submitting both Government approved and information only submittals in accordance with the instructions on the reverse side of the form. These forms will be furnished to the Contractor. This form shall be properly completed by filling out all the heading blank spaces and identifying each item submitted. Special care shall be exercised to ensure proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.

1.7.8 Deviations

For submittals which include proposed deviations requested by the Contractor, the column "variation" of ENG Form 4025 shall be checked. The Contractor shall set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

1.7.9 Control of Submittals

The Contractor shall carefully control his procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."

1.7.10 Government Approved Submittals

Upon completion of review of submittals requiring Government approval, the submittals will be identified as having received approval by being so stamped and dated. Five copies of the submittal will be retained by the Contracting Officer and one copy of the submittal will be returned to the Contractor.

1.7.11 Information Only Submittals

Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

1.7.12 Stamps

Stamps used by the Contractor on the submittal data to certify that the submittal meets contract requirements shall be similar to the following:

CONTRACTOR (Firm Name) _____ Approved _____ Approved with corrections as noted on submittal data and/or attached sheets(s). SIGNATURE: _____ TITLE: _____ DATE: _____

PART 2 PRODUCTS

2.1 SPECIAL PAINT FORMULAS

Special paints shall have the composition as indicated in the formulas listed herein. Where so specified, certain components of a paint formulation shall be packaged in separate containers for mixing on the job. If not specified or otherwise prescribed, the color shall be that naturally obtained from the required pigmentation.

2.2 PAINT FORMULATIONS

Special paint formulas shall comply with the following:

2.2.1 Formula V-766e, Vinyl-Type White (or Gray) Impacted Immersion Coating

INGREDIENTS	PERCENT BY MASS
Vinyl Resin, Type 3	5.6
Vinyl Resin, Type 4	11.6
Titanium Dioxide and (for Gray)	
Carbon Black	13.0
Diisodecyl Phthalate	2.9
Methyl Isobutyl Ketone	32.0
Toluene	34.7
Ortho-Phosphoric Acid	0.2
	100.0

a. The dispersion of pigment shall be accomplished by means of pebble mills or other approved methods to produce a fineness of grind (ASTM D

1210) of not less than 7 on the Hegman scale. Grinding in steel-lined or steel-ball mills will not be permitted. No grinding aids, antissettling agents, or any other materials except those shown in the formula will be permitted. The paint shall show the proper proportions of specified materials when analyzed by chromatographic and/or spectrophotometric methods. The ortho-phosphoric acid shall be measured accurately and diluted with at least four parts of ketone to one part of acid and it shall be slowly incorporated into the finished paint with constant and thorough agitation.

b. The viscosity of the paint shall be between 60 and 90 seconds using ASTM D 1200 and a No. 4 Ford cup.

c. The white and gray paints shall be furnished in the volume ratio designated by the purchaser. The gray paint shall contain no pigments other than those specified. Enough carbon black shall be included to produce a dry paint film having a reflectance of 20-24 (ASTM E 1347). The resulting gray color shall approximate color 26231 of FED-STD-595.

2.2.2 Formula VZ-108d, Vinyl-Type Zinc-Rich Impacted Immersion Coating

INGREDIENTS	PERCENT BY WEIGHT	POUNDS	GALLONS
COMPONENT A			
Vinyl Resin, Type 3	16.6	109.2	9.65
Methyl Isobutyl Ketone	80.6	528.9	79.30
Suspending Agent E	0.7	4.6	0.28
Suspending Agent F	0.4	2.7	0.19
Methanol	0.5	3.3	0.50
Synthetic Iron Oxide (Red)	1.2	7.9	0.19
	<u>100.0</u>	<u>656.6</u>	<u>90.11</u>
COMPONENT B			
Silane B	100.0	4.1	0.47
COMPONENT C			
Zinc Dust	100.0	550.0	9.42
			<u>100.00</u> (mixed paint)

a. The iron oxide and suspending agents shall be dispersed into the vehicle (Component A) to a fineness of grind of not less than 4 on the Hegman scale (ASTM D 1210). Grinding in steel-lined containers or using steel-grinding media shall not be permitted. The sole purpose of the iron oxide pigment is to produce a contrasting color. A red iron oxide-type 3 vinyl resin vehicle paste may be used in place of dry iron oxide provided compensating adjustment are made in the additions of Type 3 resin and methyl isobutyl ketone. The finished product with zinc dust added shall produce a paint which has a red tone upon drying and a reflectance of not more than 16 (ASTM E 1347).

b. VZ-108d paint shall be supplied as a kit. Each kit shall consist of 4.5 gallons (33.1 pounds) of Component A in a 5-gallon lug closure type pail, 27.5 pounds of zinc dust (Component C) packaged in a 1-gallon plastic pail, and 3 fluid ounces of silane (Component B) packaged in a glass bottle of suitable size having a polyethylene lined cap. The bottle of silane shall be placed on the zinc dust in the 1-gallon pail. In addition to standard labeling requirements, each container of each component shall be properly identified as to component type and each container label of Component A shall carry the following: MIXING AND APPLICATION INSTRUCTIONS: WARNING - THIS PAINT WILL NOT ADHERE TO STEEL SURFACES UNLESS COMPONENT B IS ADDED. Remove the 3 ounces of bottled Component B (silane) from the Component C (zinc dust) container and add to the base paint Component A) with thorough stirring. Then sift the zinc dust into the base paint while it is being vigorously agitated with a power-driven stirrer and continue the stirring until the zinc dust has been dispersed. The mixed paint shall at some point be strained through a 30-60 mesh screen to prevent zinc dust slugs from reaching the spray gun nozzle. The paint shall be stirred continuously during application at a rate that will prevent settling. If spraying is interrupted for longer than 15 minutes, the entire length of the hose shall be whipped vigorously to redisperse the zinc. If the spraying is to be interrupted for more than 1 hour, the hose shall be emptied by blowing the paint back into the paint pot. Thinning will not normally be required when ambient temperatures are below about 80 degrees F, but when the ambient and steel temperatures are higher, methyl isoamyl ketone (MIAK) or methyl isobutyl ketone (MIBK) should be used. If paint is kept covered at all times, its pot life will be about 8 days.

2.3 INGREDIENTS FOR SPECIAL PAINT FORMULAS

The following ingredient materials and thinners apply only to those special paints whose formulas are shown above in detail.

2.3.1 Pigments and Suspending Agents

2.3.1.1 Carbon Black

Carbon black shall conform to ASTM D 561, Type I or II.

2.3.1.2 Zinc Dust

Zinc dust pigment shall conform to ASTM D 520, Type II.

2.3.1.3 Iron Oxide

Iron oxide, (Dry) synthetic (red), shall conform to ASTM D 3721. In addition, the pigment shall have a maximum oil absorption of 24 and a specific gravity of 4.90 to 5.20 when tested in accordance with ASTM D 281 and ASTM D 153, Method A, respectively. When the pigment is dispersed into specified vinyl paint formulation, the paint shall have color approximating FED-STD-595 color 10076 (dark red paint), and shall show no evidence of incompatibility or reaction between pigment and other components after 6 months storage.

2.3.1.4 Titanium Dioxide

Titanium dioxide in vinyl paint Formula V-766e shall be one of the following: Kronos 2160 or 2101, Kronos, Inc.; Ti-Pure 960, E.I. Dupont DeNemours and Co., Inc.

2.3.1.5 Suspending Agent E

Suspending Agent E shall be a light cream colored finely divided powder having a specific gravity of 2 to 2.3. It shall be an organic derivative of magnesium aluminum silicate mineral capable of minimizing the tendency of zinc dust to settle hard without increasing the viscosity of the paint appreciably. MPA-14, produced by RHEOX, Inc., has these properties.

2.3.1.6 Suspending Agent F

Suspending Agent F shall be a light cream colored finely divided powder having a specific gravity of approximately 1.8. It shall be an organic derivative of a special montmorillonite (trialkylaryl ammonium hectorite). Bentone 27, produced by RHEOX, Inc., has these properties.

2.3.2 Resins, Plasticizer, and Catalyst

2.3.2.1 Diisodecyl Phthalate

Diisodecyl Phthalate shall have a purity of not less than 99.0 percent, shall contain not more than 0.1 percent water, and shall have an acid number (ASTM D 1045) of not more than 0.10.

2.3.2.2 Vinyl Resin, Type 3

Vinyl resin, Type 3, shall be a vinyl chloride-acetate copolymer of medium average molecular weight produced by a solution polymerization process and shall contain 85 to 88 percent vinyl chloride and 12 to 15 percent vinyl acetate by weight. The resin shall have film-forming properties and shall, in specified formulations, produce results equal to Vinylite resin VYHH, as manufactured by the Union Carbide Corporation.

2.3.2.3 Vinyl Resin, Type 4

Vinyl resin, Type 4, shall be a copolymer of the vinyl chloride-acetate type produced by a solution polymerization process, shall contain (by weight) 1 percent interpolymerized dibasic acid, 84 to 87 percent vinyl chloride, and 12 to 15 percent vinyl acetate. The resin shall have film-forming properties and shall, in the specified formulations, produce results equal to Vinylite resin VMCH, as manufactured by the Union Carbide Corporation.

2.3.2.4 Ortho-phosphoric Acid

Ortho-phosphoric acid shall be a chemically pure 85-percent grade.

2.3.3 Solvent and Thinners

2.3.3.1 Methanol

Methanol (methyl alcohol) shall conform to ASTM D 1152.

2.3.3.2 Methyl Isobutyl Ketone

Methyl isobutyl ketone (MIBK) shall conform to ASTM D 1153.

2.3.3.3 Toluene

Toluene shall conform to ASTM D 841.

2.3.4 Silane B

Silane B for Formula VZ-108d shall be N-beta-(aminoethyl)-gamma-aminopropyltrimethoxy silane. Silane A-1120, produced by the C.K. Witco Corporation, and Silane Z-6020, produced by Dow Corning Corporation, are products of this type.

2.3.5 Propylene Oxide

Propylene oxide shall be a commercially pure product suitable for the intended use.

2.4 TESTING

2.4.1 Chromatographic Analysis

Solvents in vinyl paints and thinners shall be subject to analysis by programmed temperature gas chromatographic methods and/or spectrophotometric methods, employing the same techniques that give reproducible results on prepared control samples known to meet the specifications. If the solvent being analyzed is of the type consisting primarily of a single chemical compound or a mixture of two or more such solvents, interpretation of the test results shall take cognizance of the degree of purity of the individual solvents as commercially produced for the paint industry.

2.4.2 Vinyl Paints

Vinyl paints shall be subject to the following adhesion test. When V-766 or V-106 formulations are tested, 5 to 7 mils (dry) shall be spray applied to mild steel panels. The steel panels shall be essentially free of oil or other contaminants that may interfere with coating adhesion. The test panels shall be dry blast cleaned to a White Metal grade which shall be in compliance with SSPC SP 5. The surface shall have an angular profile of 2.0 to 2.5 mils as measured by ASTM D 4417, Method C. When V-102 or V-103 formulations are tested, they shall be spray applied over 1.5 to 2.5 mils (dry) of V-766 or V-106 known to pass this test. When VZ-108 is tested, the coating shall be mixed in its proper proportions and then spray applied to a dry film thickness of 1.5 to 2.5 mils above the blast profile. The VZ-108 shall be top coated with a V-766 known to pass this test. In all cases, the complete system shall have a total dry film thickness of 5 to 7 mils above the blast profile. After being air dried for 2 hours at room temperature, the panel shall be dried in a vertical position for 16 hours at 120 degrees F. After cooling for 1 hour, the panel shall be immersed in tap water at 85 to 90 degrees F for 48 to 72 hours. Immediately upon removal, the panel shall be dried with soft cloth and examined for adhesion as follows: With a pocket knife or other suitable instrument, two parallel cuts at least 1 inch long shall be made 1/4 to 3/8 inch apart through the paint film to the steel surface. A third cut shall be made perpendicular to and passing through the end of the first two. With the tip of the knife blade, the film shall be loosened from the panel from the third cut between the parallel cuts for a distance of 1/8 to 1/4 inch. With the panel being held horizontally, the

free end of the paint film shall be grasped between the thumb and forefinger and pulled vertically in an attempt to remove the film as a strip from between the first two cuts. The strip of paint film shall be removed at a rate of approximately 1/10 inch per second and shall be maintained in a vertical position during the process of removal. The adhesion is acceptable if the strip of paint breaks when pulled or if the strip elongates a minimum of 10 percent during its removal. Paints not intended to be self-priming shall exhibit no delamination from the primer.

PART 3 EXECUTION

3.1 CLEANING AND PREPARATION OF SURFACES TO BE PAINTED

3.1.1 General Requirements

Surfaces to be painted shall be cleaned before applying paint or surface treatments. Deposits of grease or oil shall be removed in accordance with SSPC SP 1, prior to mechanical cleaning. Solvent cleaning shall be accomplished with mineral spirits or other low toxicity solvents having a flash point above 100 degrees F. Clean cloths and clean fluids shall be used to avoid leaving a thin film of greasy residue on the surfaces being cleaned. Items not to be prepared or coated shall be protected from damage by the surface preparation methods. Cleaning and painting shall be so programmed that dust or other contaminants from the cleaning process do not fall on wet, newly painted surfaces, and surfaces not intended to be painted shall be suitably protected from the effects of cleaning and painting operations. Welding of, or in the vicinity of, previously painted surfaces shall be conducted in a manner to prevent weld spatter from striking the paint and to otherwise reduce coating damage to a minimum; paint damaged by welding operations shall be restored to original condition. Surfaces to be painted that will be inaccessible after construction, erection, or installation operations are completed shall be painted before they become inaccessible.

3.1.2 Ferrous Surfaces

Ferrous surfaces shall be dry blast-cleaned to SSPC SP 5. The blast profile, unless otherwise specified, shall be 1.5 to 2.5 mils as measured by ASTM D 4417, Method C. Appropriate abrasive blast media shall be used to produce the desired surface profile and to give an angular anchor tooth pattern. If recycled blast media is used, an appropriate particle size distribution shall be maintained so that the specified profile is consistently obtained. Steel shot or other abrasives that do not produce an angular profile shall not be used. Weld spatter not dislodged by blasting shall be removed with impact or grinding tools and the areas reblasted prior to painting. Surfaces shall be dry at the time of blasting. Blast cleaning to SSPC SP 5 shall be done in the field and, unless otherwise specifically authorized, after final erection. Within 8 hours after cleaning, prior to the deposition of any detectable moisture, contaminants, or corrosion, all ferrous surfaces blast cleaned to SSPC SP 5 shall be cleaned of dust and abrasive particles by brush, vacuum cleaner, and/or blown down with clean, dry, compressed air, and given the first coat of paint. The coating shall be maintained in good condition by cleaning and touching up of areas damaged during the fabrication and delivery to the Government.

3.1.3 Damp and Wet Ferrous Metal Surfaces

Ferrous surfaces that are wet with condensation or standing or running water, shall be blast-cleaned to SSPC SP 5. The blast profile, unless otherwise specified, shall be 1.5 to 3.0 mils as measured by ASTM D 4417, Method C. Appropriate abrasive blast media shall be used to produce the desired surface profile and to give an angular anchor tooth pattern. Steel grit or shot media shall not be used. Weld spatter not dislodged by blasting shall be removed with impact or grinding tools and the areas reblasted prior to painting. Surfaces shall be as dry as possible at the time of blasting. Immediately after cleaning and prior to the formation of extensive corrosion products, all ferrous surfaces blast cleaned to SSPC SP 5 shall be cleaned of residual abrasive particles, and given the first coat of paint. A slightly visible rust bloom shall be permitted on surfaces to be painted.

3.2 PAINT APPLICATION

3.2.1 General

The finished coating shall be free from holidays, pinholes, bubbles, runs, drops, ridges, waves, laps, excessive or unsightly brush marks, and variations in color, texture, and gloss. Application of initial or subsequent coatings shall not commence until the Contracting Officer has verified that atmospheric conditions and the surfaces to be coated are satisfactory. Each paint coat shall be applied in a manner that will produce an even, continuous film of uniform thickness. Edges, corners, crevices, seams, joints, welds, rivets, corrosion pits, and other surface irregularities shall receive special attention to ensure that they receive an adequate thickness of paint. Spray equipment shall be equipped with traps and separators and where appropriate, mechanical agitators, pressure gauges, pressure regulators, and screens or filters. Air caps, nozzles, and needles shall be as recommended by the spray equipment manufacturer for the material being applied. Airless-type spray equipment may be used only on broad, flat, or otherwise simply configured surfaces, except that it may be employed for general painting if the spray gun is equipped with dual or adjustable tips of proper types and orifice sizes. Airless-type equipment shall not be used for the application of vinyl paints.

3.2.2 Mixing and Thinning

Paints shall be thoroughly mixed, strained where necessary, and kept at a uniform composition and consistency during application. Paste or dry-powder pigments specified to be added at the time of use shall, with the aid of powered stirrers, be incorporated into the vehicle or base paint in a manner that will produce a smooth, homogeneous mixture free of lumps and dry particles. Where necessary to suit conditions of the surface temperature, weather, and method of application, the paint may be thinned immediately prior to use. Thinning shall generally be limited to the addition of not more than 1 pint per gallon of the proper thinner; this general limitation shall not apply when more specific thinning instructions are provided. Paint that has been stored at low temperature, shall be brought up to at least 70 degrees F before being mixed and thinned, and its temperature in the spray tank or other working container shall not fall below 60 degrees F during the application. Paint that has deteriorated in any manner to a degree that it cannot be restored to essentially its original condition by customary field-mixing methods shall not be used and shall be removed from the project site. Paint and thinner that is more than 1 year old shall be

resampled and resubmitted for testing to determine its suitability for application.

3.2.3 Atmospheric and Surface Conditions

Paint shall be applied only to surfaces that are above the dew point temperature and that are completely free of moisture as determined by sight and touch. Paint shall not be applied to surfaces upon which there is detectable frost or ice. Except as otherwise specified, the temperature of the surfaces to be painted and of air in contact therewith shall be not less than 45 degrees F during paint application nor shall paint be applied if the surfaces can be expected to drop to 32 degrees F or lower before the film has dried to a reasonably firm condition. During periods of inclement weather, painting may be continued by enclosing the surfaces and applying artificial heat, provided the minimum temperatures and surface dryness requirements prescribed previously are maintained. Paint shall not be applied to surfaces heated by direct sunlight or other sources to temperatures that will cause detrimental blistering, pinholing, or porosity of the film.

3.2.4 Time Between Surface Preparation and Painting

Surfaces that have been cleaned and/or otherwise prepared for painting shall be primed as soon as practicable after such preparation has been completed but, in any event, prior to any deterioration of the prepared surface.

3.2.5 Method of Paint Application

Unless otherwise specified, paint shall be applied by brush or spray to ferrous metal surfaces. Special attention shall be directed toward ensuring adequate coverage of edges, corners, crevices, pits, rivets, bolts, welds, and similar surface irregularities. Other methods of application to metal surfaces shall be subject to the specific approval of the Contracting Officer.

3.2.6 Coverage and Film Thickness

Film thickness or spreading rates shall be as specified hereinafter. Where no spreading rate is specified, the paint shall be applied at a rate normal for the type of material being used. In any event, the combined coats of a specified paint system shall completely hide base surface and the finish coats shall completely hide undercoats of dissimilar color.

3.2.6.1 Measurement on Ferrous Metal

Where dry film thickness requirements are specified for coatings on ferrous surfaces, measurements shall be made with a gage qualified in accordance with paragraph Coating Thickness Gage Qualification. They shall be calibrated and used in accordance with ASTM D 7091. They shall be calibrated using plastic shims with metal practically identical in composition and surface preparation to that being coated, and of substantially the same thickness (except that for measurements on metal thicker than 1/4 inch, the instrument may be calibrated on metal with a minimum thickness of 1/4 inch). Frequency of measurements shall be as recommended for field measurements by ASTM D 7091 and reported as the mean for each spot determination. The instruments shall be calibrated or calibration verified prior to, during, and after each use.

3.2.7 Progress of Painting Work

Where painting has commenced, the complete painting operation, including priming and finishing coats, on that portion of the work shall be completed as soon as practicable, without prolonged delays. Sufficient time shall elapse between successive coats to permit them to dry properly for recoating, and this period shall be modified as necessary to suit adverse weather conditions. Paint shall be considered dry for recoating when it feels firm, does not deform or feel sticky under moderate pressure of the finger, and the application of another coat of paint does not cause film irregularities such as lifting or loss of adhesion of the undercoat. All coats of all painted surfaces shall be unscarred and completely integral at the time of application of succeeding coats. At the time of application of each successive coat, undercoats shall be cleaned of dust, grease, overspray, or foreign matter by means of airblast, solvent cleaning, or other suitable means. Undercoats of high gloss shall, if necessary for establishment of good adhesion, be scuff sanded, solvent wiped, or otherwise treated prior to application of a succeeding coat. Coats on metal shall be applied after erection except as otherwise specified and except for surfaces to be painted that will become inaccessible after erection.

3.2.8 Contacting Surfaces

When ordinary bolted contact is to exist between surfaces of ferrous or other metal parts of substantially similar chemical composition, such surfaces will not be required to be painted, but any resulting crevices shall subsequently be filled or sealed with paint. Contacting metal surfaces formed by high-strength bolts in friction-type connections shall not be painted. Where a nonmetal surface is to be in bolted contact with a metal surface, the contacting surfaces of the metal shall be cleaned and given three coats of the specified primer. Unless otherwise specified, corrosion-resisting metal surfaces, including cladding therewith, shall not be painted.

3.2.9 Drying Time Prior to Immersion

Minimum drying periods after final coat prior to immersion shall be: at least 3 days. Minimum drying periods shall be increased twofold if the drying temperature is below 65 degrees F and/or if the immersion exposure involves considerable abrasion.

3.2.10 Protection of Painted Surfaces

Where shelter and/or heat are provided for painted surfaces during inclement weather, such protective measures shall be maintained until the paint film has dried and discontinuance of the measures is authorized. Items that have been painted shall not be handled, worked on, or otherwise disturbed until the paint coat is fully dry and hard. All metalwork coated prior to final erection shall be stored out of contact with the ground in a manner and location that will minimize the formation of water-holding pockets; soiling, contamination, and deterioration of the paint film, and damaged areas of paint on such metalwork shall be cleaned and touched up without delay.

3.2.11 Vinyl Paints

3.2.11.1 General

Vinyl paints shall be spray applied, except that areas inaccessible to spraying shall be brushed. All of the vinyl paints require thinning for spray application except the zinc-rich vinyl paint (Formula VZ 108d) which will normally require thinning only under certain weather conditions. Thinners for vinyl paints shall be as follows:

APPROXIMATE AMBIENT AIR TEMPERATURE (Degrees F [Degrees C])

Below 50 [Below 10]	MEK
50 - 70 [10 - 21]	MIBK
Above 70 [Above 21]	MIAC

The amount of thinner shall be varied to provide a wet spray and avoid deposition of particles that are semidry when they strike the surface. Vinyl paints shall not be applied when the temperature of the ambient air and receiving surfaces is less than 35 degrees F nor when the receiving surfaces are higher than 125 degrees F. Each spray coat of vinyl paint shall consist of a preliminary extra spray pass on edges, corners, interior angles, pits, seams, crevices, junctions of joining members, rivets, weld lines, and similar surface irregularities followed by an overall double spray coat. A double spray coat of vinyl-type paint shall consist of applying paint to a working area of not less than several hundred square feet (meters) in a single, half-lapped pass, followed after drying to at least a near tack-free condition by another spray pass applied at the same coverage rate and where practicable at right angles to the first. Bolts and similar surface projections shall receive sprayed paint from every direction to ensure complete coverage of all faces. Pits, cracks, and crevices shall be filled with paint insofar as practicable, but in any event, all pit surfaces shall be thoroughly covered and all cracks and crevices shall be sealed off against the entrance of moisture. Fluid and atomization pressures shall be kept as low as practicable consistent with good spraying results. Unless otherwise specified, not more than 2.0 mils, average dry film thickness, of vinyl paint shall be applied per double spray coat. Except where otherwise indicated, an undercoat of the vinyl-type paint may receive the next coat any time after the undercoat is tack-free and firm to the touch, provided that no speedup or delay in the recoating schedule shall cause film defects such as sags, runs, air bubbles, air craters, or poor intercoat adhesion. Neither the prime coat nor any other coat shall be walked upon or be subjected to any other abrading action until it has hardened sufficiently to resist mechanical damage.

3.2.11.2 Vinyl Zinc-Rich Primer

Primer shall be field mixed combining components A, B, and C. Mixing shall be in accordance with label instructions. After mixing, the paint shall be kept covered at all times to avoid contamination and shall be applied within 8 days after it is mixed. When the ambient and/or steel temperature is below about 80 degrees F, the paint will not normally require thinning; however, the paint shall at all times contain sufficient volatiles (thinners) to permit it to be satisfactorily atomized and to provide a wet spray and to avoid deposition of particles that are semidry when they reach the surface. The paint shall be stirred continuously during application at a rate that will prevent the zinc dust from settling. When spraying is resumed after any interruption of longer than 15 minutes, the entire length

of the material hose shall be whipped vigorously until any settled zinc is redispersed. Long periods of permitting the paint to remain stagnant in the hose shall be avoided by emptying the hoses whenever the painting operation is to be suspended for more than 1 hour. The material (paint) hoses shall be kept as short as practicable, preferably not more than 50 feet in length. Equipment used for spraying this zinc primer shall not be used for spraying other vinyl-type paints without first being thoroughly cleaned, since many of the other paints will not tolerate zinc contamination; no type of hot spray shall be used. An average dry film thickness of up to 2.5 mils may be applied in one double-spray coat. Unless specifically authorized, not more than 8 days shall elapse after application of a VZ-108d zinc-rich coat before it receives a succeeding coat.

3.2.11.3 Vinyl Paints

Vinyl Paint Formula V-766e is a ready-mixed paint designed to be spray applied over a wide range of ambient temperatures by field thinning with the proper type and amount of thinner. For spray application, it shall be thinned as necessary up to approximately 25 percent (1 quart/gallon of base paint) with the appropriate thinner; when ambient and steel temperatures are above normal, up to 40-percent thinning may be necessary for satisfactory application.

3.3 PAINT SYSTEMS APPLICATION

The required paint systems and the surfaces to which they shall be applied are shown in this paragraph, and/or in the drawings. Supplementary information follows.

3.3.1 Surface Preparation

The method of surface preparation and pretreatment shown in the tabulation of paint systems is for identification purposes only. Cleaning and pretreatment of surfaces prior to painting shall be accomplished in accordance with detailed requirements previously described.

3.3.2 System No. 5-E-Z

Paint shall be spray applied to an average dry film thickness of a minimum of 7.0 mils for the completed system, and the thickness at any point shall not be less than 5.5 mils. The dry film thickness of the zinc-rich primer shall be approximately 2.5 mils. The specified film thickness shall be attained in any event, and any extra coats needed to attain the specified thickness shall be applied at no additional cost to the Government. Attaining the specified film thickness by applying fewer than the prescribed number of coats or spray passes will be acceptable provided heavier applications do not cause an increase in pinholes, bubbles, blisters, or voids in the dried film and also provided that not more than 2.0 mils (dry film thickness) per double spray coat nor more than 1.0 mil per single spray pass of nonzinc paint shall be applied at one time.

3.4 INSPECTION

The Contractor shall inspect, document all work phases and operations on a daily basis. As a minimum the daily documentat shall contain the following:

- a. Inspections performed, including the area of the structure involved and the results of the inspection.
- b. Surface preparation operations performed, including the area of the structure involved, the mode of preparation, the kinds of solvent, abrasive, or power tools employed, and whether contract requirements were met.
- c. Thinning operations performed, including thinners used, batch numbers, and thinner/paint volume ratios.
- d. Application operations performed, including the area of the structure involved, mode of application employed, ambient temperature, substrate temperature, dew point, relative humidity, type of paint with batch numbers, elapsed time between surface preparation and application, elapsed time for recoat, condition of underlying coat, number of coats applied, and if specified, measured dry film thickness or spreading rate of each new coating.

After completion of the paint operation, the Contractor shall submit all documentation of the painting operations to the Contracting Officer.

3.5 PAINTING SCHEDULES

SYSTEM NO. 5-E-Z

Items or surfaces to be coated: All Ferrous Surfaces

SURFACE PREPARATION	1st COAT	2nd COAT	3rd COAT	4th COAT
White metal blast cleaning (SSPC SP 5)	Vinyl zinc- rich VZ-108d (double spray coat)	Gray Vinyl V-766e (double spray coat)	White Vinyl V-766e (double spray coat)	Gray Vinyl V-766e (double spray coat)

-- End of Section --

