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SECTION 09310

CERAMIC TILE

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 in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A108.1A	(1992) Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar
ANSI A108.1B	(1992) Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar
ANSI A108.5	(1992) Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar
ANSI A108.10	(1992) Installation of Grout in Tilework
ANSI A118.1	(1992) Dry-Set Portland Cement Mortar
ANSI A118.2	(1992) Conductive Dry-Set Portland Cement Mortar
ANSI A118.4	(1992) Latex-Portland Cement Mortar
ANSI A118.6	(1992) Ceramic Tile Grouts
ANSI A137.1	(1988) Ceramic Tile

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 33	(1997) Concrete Aggregates
ASTM C 144	(1997) Aggregate for Masonry Mortar
ASTM C 150	(1997) Portland Cement
ASTM C 206	(1984; R 1997) Finishing Hydrated Lime
ASTM C 207	(1991; R 1997) Hydrated Lime for Masonry Purposes
ASTM C 648	(1998) Breaking Strength of Ceramic Tile

ASTM C 1027 (1984; R 1990) Determining Visible Abrasion Resistance of Glazed Ceramic Tile

ASTM C 1028 (1996) Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method

TILE COUNCIL OF AMERICA (TCA)

TCA Hdbk (1997) Handbook for Ceramic Tile Installation

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Tile; G

Manufacturer's catalog data.

Tile
Mortar and Grout

Manufacturers preprinted installation and cleaning instructions.

SD-04 Samples

Tile; G

Samples of sufficient size to show color range, pattern, type and joints.

SD-07 Certificates

Tile
Mortar, Grout, and Adhesive

Certificates indicating conformance with specified requirements. A master grade certificate shall be furnished for tile.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Materials shall be kept dry, protected from weather, and stored under cover in accordance with manufacturer's instructions.

1.4 ENVIRONMENTAL REQUIREMENTS

Ceramic tile work shall not be performed unless the substrate and ambient temperature is at least 50 degrees F and rising. Temperature shall be maintained above 50 degrees F while the work is being performed and for at

least 7 days after completion of the work. When temporary heaters are used they shall be vented to the outside to avoid carbon dioxide damage to new tilework.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1-year period shall be provided.

PART 2 PRODUCTS

2.1 TILE

Tile shall be standard grade conforming to ANSI A137.1. Containers shall be grade sealed. Seals shall be marked to correspond with the marks on the signed master grade certificate. Tile shall be impact resistant with a minimum breaking strength for wall tile of 90 lbs and 250 lbs for floor tile in accordance with ASTM C 648. Floor tile shall have a minimum coefficient of friction of 0.60 wet and dry in accordance with ASTM C 1028.

Floor tile shall be Class III-Medium Heavy Traffic, durability classification as rated by the manufacturer when tested in accordance with ASTM C 1027 for abrasion resistance as related to foot traffic. Specially shaped tiles shall be provided as required at corners, edges, etc.

2.1.1 Glazed Wall Tile

Glazed wall tile and trim shall be cushion edged with matte glaze. Tile shall be 1" x 1" x 3/8" inches. Color shall be selected by the Contracting Officer.

2.2 SETTING-BED

The setting-bed shall be composed of the following:

2.2.1 Aggregate for Concrete Fill

Aggregate shall conform to ASTM C 33. Maximum size of coarse aggregate shall not be greater than one-half the thickness of concrete fill.

2.2.2 Portland Cement

Cement shall conform to ASTM C 150, Type I, white for wall mortar and gray for other uses.

2.2.3 Sand

Sand shall conform to ASTM C 144.

2.2.4 Hydrated Lime

Hydrated lime shall conform to ASTM C 206, Type S or ASTM C 207, Type S.

2.3 WATER

Water shall be potable.

2.4 MORTAR, GROUT, AND ADHESIVE

Mortar, grout, and adhesive shall conform to the following:

2.4.1 Dry-Set Portland Cement Mortar

ANSI A118.1.

2.4.2 Conductive Dry-Set Mortar

ANSI A118.2.

2.4.3 Latex-Portland Cement Mortar

ANSI A118.4.

2.4.4 Ceramic Tile Grout

ANSI A118.6; dry-set grout or latex-portland cement grout.

PART 3 EXECUTION

3.1 PREPARATORY WORK AND WORKMANSHIP

Surface to receive tile shall be inspected and shall conform to the requirements of ANSI A108.1A or ANSI A108.1B for surface conditions for the type setting bed specified and for workmanship. Variations of surface to be tiled shall fall within maximum values shown below:

TYPE	WALLS	FLOORS
Dry-Set Mortar	1/8 inch in 8 ft.	1/8 inch in 10 ft.
Latex portland cement mortar	1/8 inch in 8 ft.	1/8 inch in 10 ft.

3.2 GENERAL INSTALLATION REQUIREMENTS

Tile work shall not be started until roughing in for mechanical and electrical work has been completed and tested, and built-in items requiring membrane waterproofing have been installed and tested. Floor tile installation shall not be started in spaces requiring wall tile until after wall tile has been installed. Tile shall be installed with the respective surfaces in true even planes to the elevations and grades shown. Tilework shall be laid out to minimize cuts less than one half the tile in size. Wall and floor tiles shall be aligned to give straight uniform grout lines. Special shapes shall be provided as required for sills, jambs, recesses, offsets, external corners, and other conditions to provide a complete and neatly finished installation. Tile bases and coves shall be solidly backed with mortar.

3.3 INSTALLATION OF WALL TILE

Wall tile shall be installed in accordance with the TCA Hdbk, method W-243.

3.3.1 Dry-Set Mortar and Latex-Portland Cement Mortar

Dry-set or Latex-portland cement shall be used to install tile in accordance with ANSI A108.5. Latex portland cement shall be used when installing porcelain ceramic tile.

3.4 INSTALLATION OF FLOOR TILE

Floor tile shall be installed in accordance with TCA Hdbk, method F-113.

3.4.1 Dry-Set and Latex-Portland Cement

Dry-set or Latex-portland cement mortar shall be used to install tile directly over properly cured, plane, clean concrete slabs in accordance with ANSI A108.5. Latex portland cement shall be used when installing porcelain ceramic tile.

3.4.2 Ceramic Tile Grout

Ceramic Tile grout shall be prepared and installed in accordance with ANSI A108.10.

3.5 EXPANSION JOINTS

Joints shall be formed as indicated and sealed as specified in Section 07900 JOINT SEALING.

3.5.1 Walls

Expansion joints shall be provided at control joints in backing material. Wherever backing material changes, an expansion joint shall be installed to separate the different materials.

3.5.2 Floors

Expansion joints shall be provided over construction joints, control joints, and expansion joints in concrete slabs.

3.6 CLEANING AND PROTECTING

Upon completion, tile surfaces shall be thoroughly cleaned in accordance with manufacturer's approved cleaning instructions. Acid shall not be used for cleaning glazed tile. Floor tile with resinous grout or with factory mixed grout shall be cleaned in accordance with instructions of the grout manufacturer. After the grout has set, tile wall surfaces shall be given a protective coat of a noncorrosive soap or other approved method of protection. Tiled floor areas shall be covered with building paper before foot traffic is permitted over the finished tile floors. Board walkways shall be laid on tiled floors that are to be used as passageways by workmen. Damaged or defective tiles shall be replaced.

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SECTION 09880

PVC LINERS FOR CONCRETE PIPE AND 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 in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 412 (1998; Rev. A) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension

1.2 LOCATION OF APPLICABILITY

This specification shall be applied to materials, installation, and testing of polyvinyl chloride (PVC) liners, where called for, in reinforced concrete pipe, precast concrete manholes, and cast-in-place concrete structures.

All work for and in connection with the installation of the lining in concrete pipe, and the field sealing and welding of joints, shall be done in strict conformity with all applicable specifications, instructions, and recommendations of the lining manufacturer.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

PVC Liner; G

Show orientation of liner installation in pipeline. Not necessary if shown in other submitted literature.

SD-03 Product Data

PVC Liner; G

Submit manufactures test data, and literature of the PVC liner to confirm information indicated in the specifications, but not shown in the manufactures catalog brochures; including but not limited to tensile strength, elongation at break, shore durometer,

Type D (with respect to initial test results), and weight change following elongation test.

Show material properties, thicknesses, chemical resistivity, adhesives, solvents, and activators.

SD-07 Certificates

PVC Liner; G

Certificate stating that the PVC liner to be used meets the criteria outlined in these specifications and that the manufacturer of the lining has successfully used the lining in sewage conditions recognized as corrosive or otherwise detrimental to concrete.

SD-08 Manufacturer's Instructions

PVC Liner; G

Submit manufactures installation instructions. Show how pipeline and manholes will be lined. Show returns, corners, joints, and coverage. Show location and type of field welds.

SD-09 Manufacturer's Field Reports

PVC Liner; G

Submit installation inspection reports for all field applied PVC liners to the satisfaction of the Contracting Officer. Material inspection specimens taken from sheets and strips at any time prior to final acceptance of the work, when tested as specified, shall meet the requirements set forth herein. Inspection shall be performed by a manufacturer's representative, or other competent person familiar with the manufactures requirements for product installation. Proper inspection is the contractors responsibility.

PART 2 PRODUCTS

2.1 COMPOSITION

The material used in the liner, welding strips, and other accessory items, shall be a combination of poly vinyl chloride resin, pigments and plasticizers, specially compounded to remain flexible. Poly vinyl chloride resin shall constitute not less than 99 percent, by weight, of the resin used in the formulation. Copolymer resins will not be permitted. Linear Low Density Polyethylene (LLDPE) may also be submitted for use; if approved by the Contracting Officer.

2.2 PHYSICAL PROPERTIES

- a. All plastic liner plate sheets, welding strips and other accessory items, shall have the following physical properties when tested at 77 degree F \pm 5 degrees.

Property	Initial	(Par. 2.4)
Tensile Strength	2,200 psi min.	2,100 psi min.
Elongation at Break	200% min.	200% min.
Shore Durometer, Type D	1-sec, 50-60 10-sec, 35-50	±5 ±5
(w.r.t. initial test results)		
Weight Change	—	1.5%

- b. Tensile specimens shall be prepared and tested in accordance with ASTM D 412 using Die B. Weight change specimens shall be 1 inch by 3 inch samples. Specimens for testing of initial physical properties may be taken from liner plate sheet and welding strip at any time prior to final acceptance of the work.
- c. Liner plate locking extensions embedded in concrete shall withstand a test pull of at least 100 pounds per linear inch, applied perpendicularly to the concrete surface for a period of one minute, without rupture of the locking extensions or withdrawal from embedment. This test shall be made at a temperature of 70- 80 degrees F inclusive.
- d. All plastic liner plate sheets, including locking extensions, all joint, corner and welding strips shall be free of cracks, cleavages or other defects adversely affecting the protective characteristics of the material. The engineer may authorize the repair of such defects by approved methods.
- e. The lining shall have good impact resistance, shall be flexible and shall have an elongation sufficient to bridge up to 1/4 inch settling cracks, which may occur in the pipe or in the joint after installation without damage to the lining.
- f. The lining shall be repairable at any time during the life of the pipe or structure.
- g. Liner locking extensions embedded in concrete shall withstand a test pull of at least 100 pounds per linear inch, applied perpendicularly to the concrete surface for a period of one minute, without rupture of the locking extensions or withdrawal from embedment. This test shall be made at a temperature between 70 degrees F to 80 degrees F, inclusive.
- h. The liner must be continuous and free of pinholes both across the joints and in the liner itself. Plastic liner sheets, including locking extensions and all joint, corner, and welding strips, shall be free of cracks, cleavages, or other defects adversely affecting the protective characteristics of the material.

2.3 CHEMICAL RESISTANCE

Chemical resistance tests shall be used for pre-qualification and when material formulations are changed.

After conditioning to constant weight at 110 degree F, tensile specimens and weight change specimens shall be exposed to the following solutions for

a period of 112 days at 77 degree F±5 degrees.

At 28 day intervals, tensile specimens and weight change specimens shall be removed from each of the chemical solutions and tested in accordance with paragraph 2.2. b. If any specimen fails to meet the 112 day requirements before completion of the 112-day exposure, the material shall be rejected.

Chemical Solution	Concentration
Sulfuric Acid	20%*
Sodium hydroxide	5%
Ammonium hydroxide	5%*
Nitric acid	1%*
Ferric chloride	1%
Soap	0.1%
Detergent (linear alkyl benzyl sulfonate or LAS)	0.1%
Bacteriological	BOD not less than 700 ppm

*Volumetric percentages of concentrated C.P. grade reagents.

2.4 BASIC SHEET DIMENSIONS

- a. Liner sheets shall be a minimum of 0.065 inch in thickness. Locking extensions (T-shaped) of the same material as that of the liner shall be integrally extruded with the sheet. Locking extensions shall be approximately 2 1/2 inches apart and shall be at least 0.375 inch high.
- b. Sheets shall have a nominal width of 48 inches and a length of no more than 24 feet except that longer lengths may be supplied on special order. Lengths specified shall include a tolerance at a ratio of ±1/4 inches for each 100 inches.
- c. Special sized, factory pre-welded and tested sheets shall be available on special order.

2.5 PIPE-SIZE SHEETS AND ACCESSORIES

- a. Pipe linings shall be supplied as pipe-size sheets, fabricated by shop-welding the basic-size sheets together. Shop welds shall be made by lapping sheets a minimum of ½ inch and applying heat and pressure to the lap to produce a continuous welded joint. Tensile strength measure across shop-welded joints in accordance with ASTM D 412 shall be at least 2000 psi.
- b. If required, strap channels shall be 1 inch wide maximum of 3/16 inch remains.
- c. Sheets also can be supplied in prefabricated, pipe-size tubular-shaped sheets, ready to lower onto the inner pipe forms. These normally do not require the use of strap channels.
- d. Welding strips shall be approximately 1 inch wide with a minimum width of 7/8 inch. The edges of weld strips shall be beveled in the manufacturing process. Thickness of weld strip shall be a normal 1/8 inch.
- e. Joint strips for pipe shall be 4 inches wide with a minimum width

of 3 1/2 inches. Thickness of joint strips shall be a nominal of 3/32 inch.

- f. Prior to preparing the sheets for shipment, they shall be tested for pinholes using an electrical spark tester set between 18,000 and 22,000 volts. Any holes shall be repaired and retested.

2.6 FLAPS

Transverse flaps may be provided at the ends of sheets for pipe. Locking extensions shall be removed from flaps so that a maximum of 1/32 inch of the base of the locking extension is left on the sheet.

2.7 ADHESIVES AND CLEANERS

2.7.1 Adhesives

Adhesives that will deleteriously affect the liner or strip in any way shall not be applied to the liner or to any of the liner strips. Flammable adhesives and solvents shall not be used for any purpose in connection with plastic liner with locking extensions.

2.7.2 Cleaning Agents

Cleaning agents for use with plastic liner with locking extensions shall be a water soluble, nonflammable product not detrimental to the plastic liner.

2.8 FACTORY TESTING

The liner shall be shop tested for holes with a spark tester set to provide from 18,000 to 22,000 volts. Prior to shipment from the manufacturer's plant, sheets having holes shall be shop-repaired and retested. Repairs shall be made by welders qualified as specified in Part 3, EXECUTION. The Contracting Officer may test samples at the point of manufacture during production of sheet and strip material.

PART 3 EXECUTION

3.1 QUALIFICATION OF INSTALLERS

3.1.1 Applicators

The application of plastic liner to forms and other surfaces shall be considered as highly specialized work, and personnel performing this type of work shall be trained in methods of installation.

3.1.2 Welders

Each welder shall pre-qualify by successfully passing a welding test before doing any welding. Pre-qualification may be required at any time deemed necessary by the Contracting Officer. All test welds shall be made in the presence of the Contracting Officer and shall consist of the following:

- a. Two pieces of liner, at least 15 inches long and 9 inches wide, shall be lapped 1 1/2 inches and held in a vertical position.
- b. A welding strip shall be positioned over the edge of the lap and welded to both pieces of liner. Each end of the welding strip shall extend at least 2 inches beyond the liner to provide tabs.

- c. The weld specimen shall be submitted to the Contracting Officer and will be tested as follows:
 - 1. Each welding strip tab, tested separately, shall be subjected to a 10-pound pull normal to the face of the liner with the liner secured firmly in place. There shall be no separation between the strip and liner when the welding tables are submitted to the test pulls.
 - 2. Three test specimens shall be cut from the welded sample and tested in tension across the welds. If none of these specimens fail when tested as specified in Part 2, Paragraph 2.5.a, the weld will be considered as satisfactory in tension.
 - 3. If one of the specimens fails to pass the tension test, a retest will be permitted. The retest shall consist of testing three additional specimen cut form the original weld sample. If all three of the retest specimens pass the test, the weld will be considered satisfactory.
- d. A disqualified welder may submit a new welding sample after receiving sufficient off-the-job training to warrant reexamination.

3.2 GENERAL

- a. Installation of the lining, including preheating of sheets in cold weather and the welding of all joints, shall be done in accordance with the recommendations of the liner manufacturer.
- b. Coverage of the lining shall not be less than the minimum shown on the plans. The interior of all pipe shall be lined with a minimum of 330 degrees of coverage. The non-lined portion of the pipe shall be centered about the flow line of the pipe.
- c. The lining shall be installed with the locking extensions running parallel with the longitudinal axis of the pipe.
- d. The lining shall be held snugly in place against inner forms.
- e. Locking extensions shall terminate not more than 1 1/2 inches from the end of the inside surface of the pipe section. Joint flaps when used shall extend approximately 4 inches beyond the end of the inside surface.
- f. Concrete poured against lining shall be vibrated, spaded or compacted in a careful manner so as to protect the lining and produce a dense, homogenous concrete, securely anchoring the locking extensions into the concrete.
- g. In removing forms, care should be taken to protect the lining from damage. Sharp instruments shall not be used to pry forms from lined surfaces. When forms are removed, any nails that remain in the lining shall be pulled, without tearing the lining, and the resulting holes clearly marked.
- h. All nail and tie holes and all cut, torn and seriously abraded areas in the lining shall be patched. Patches made entirely with welding strip shall be fused to the liner over the entire patch

area. Larger patches may consist of smooth liner sheet applied over the damaged area with adhesive. All edges must be covered with welding strip fused to the patch and the sound lining adjoining the damaged area.

- i. Hot joint compounds, such as coal tar, shall not be poured or applied to the lining.
- j. The contractor shall take all necessary measures to prevent damage to installed lining from equipment and materials used in or taken through the work.

3.3 APPLICATION TO CONCRETE PIPE - SPECIAL REQUIREMENTS

- a. The lining shall be set flush with the inner edges of the bell or spigot end of a pipe section and shall extend to the opposite end or to approximately 4 inches beyond the opposite end depending upon the type of lining joint to be made with the adjoining concrete pipe.
- b. Wherever concrete pipe or cast-in-place structures protected with lining, join structures not so lined (such as brick structures, concrete pipe or cast-in-place structures with clay lining or clay pipe), the lining shall be extended over and around the end of the pipe and back into the structure for not less than 4 inches. This protecting cap may be molded or fabricated from the lining material but need not be locked into the pipe.
- c. Where a pipe lateral (not of plastic lined concrete) is installed through lined concrete pipe, the seal between the lined portion and the lateral shall be made by the method prescribed for cast-in-place structures under Paragraph 3.5.b.
- d. Lined concrete pipe may be cured by standard curing methods.
- e. Care shall be exercised in handling, transporting and placing lined pipe to prevent damage to the lining. No interior hooks or slings shall be used in lifting pipe. All handling operations shall be done with an exterior sling or with a suitable fork lift.
- f. On pipe having a 360 degree liner coverage, the longitudinal edges of the sheet shall be butt welded. When pipe tubes are furnished, these are shop-welded joints made in accordance with 2.5.a.
- g. No pipe with damaged lining will be accepted until the damage has been repaired to the satisfaction of the Contracting Officer.

3.4 FIELD JOINTS IN LINING FOR CONCRETE PIPE

- a. The joint between sections of lined pipe shall be prepared in the following manner: If required, the inside joint shall be filled and carefully pointed with cement mortar in such a manner that the mortar shall not, at any point, extend into the pipe beyond the straight line connecting the surfaces of the adjacent pipe sections. Pipe joints must be dry before lining joints are made.
- b. All mortar and other foreign materials shall be removed from lining surfaces adjacent to the pipe joint, leaving them clean and dry.

- c. Field joints in the lining at pipe joints may be either of the following described types:

Type P-1: The joint shall be made with a separate 4 inch joint strip and two welding strips. The 4 inch joint strip shall be centered over the joint, heat-sealed to the lining, then welded along each edge to adjacent liner sheets with a 1 inch weld strip. The 4 inch joint strip shall lap over each sheet a minimum of 1/2 inch.

Type P-2: The joint shall be made with a joint flap with locking extensions removed per Paragraph 2.6 and extending approximately 4 inches beyond the pipe end. The joint flap shall overlap the lining in the adjacent pipe section a minimum of 1/2 inch and be heat-sealed in place prior to welding. The field joint shall be completed by welding the flap to the lining of the adjacent pipe using 1 inch weld strip. Care shall be taken to protect the flap from damage. Excessive tension and distortion in bending back the flap to expose the pipe during laying and joint mortaring shall be avoided. At temperatures below 50 degree F, heating of the liner may be required to avoid damage.

- d. The joint flap or strip on beveled pipe shall be trimmed to a width (measured from the end of the spigot) of approximately 4 inches for the entire circumferential length of the lining.
- e. All welding of joints is to be in strict conformance with the specifications and instructions of the lining manufacture. Welding shall fuse both sheets and weld strip together to provide a continuous joint equal in corrosion resistance and impermeability to the liner plate. Hot air welding tools shall provide effluent air to the sheets to be joined at a temperature between 500 and 600 degrees F. Welding tools shall be held approximately 1/2 inch from and moved back and forth over the junction of the two materials to be joined. The welding tool shall be moved slowly enough as the weld progresses to cause a small bead of molten material to be visible along both edges and in front of the weld strip.
- f. The following special requirement shall apply when the liner coverage is 360 degrees: When groundwater is encountered the lining joint shall not be made until pumping of groundwater has been discontinued for at least three days and no visible leakage is evident at the joint. When welding the downstream side of a joint strip or flap, do not weld 6 to 8 inches at the pipe invert to provide relief of potential future groundwater buildup.

3.5 APPLICATION TO CAST-IN-PLACE CONCRETE STRUCTURES - SPECIAL REQUIREMENTS

- a. Linear sheets shall be closely fitted and properly secured to the inner forms. Sheets shall be cut to fit curved and warped surfaces using a minimum number of separate pieces.
- b. Unless otherwise shown on the plans, the lining shall be returned at least 3 inches at the surfaces of contact between the concrete structure and items not of concrete (including manhole frames, gate guides, clay pipe or brick manholes and clay or cast iron pipes). The same procedure shall be followed at joints where the

type of protective lining is changed or the new work is built to join existing unlined concrete. At each return, the returned liner shall be sealed to the item in contact with the plastic-lined concrete using the adhesive system recommended by the liner manufacturer. If the liner cannot be sealed with this adhesive because of the joint at the return being too wide or rough or because of safety regulations, the joint space shall be densely caulked with lead wool or other approved caulking material to a depth of 2 inches and finished with a minimum of 1 inch of an approved corrosion resistant material.

3.6 JOINTS IN LINING FOR CAST-IN-PLACE CONCRETE STRUCTURES

- a. Lining at joints shall be free of all mortar and other foreign material and shall be clean and dry before joints are made.
- b. Field joints in the lining shall be of the following described types, used as prescribed:

Type C-1: The joint shall be made with a separate 4 inch joint strip and two welding strips. The 4 inch joint strip shall be centered over the joint, heat-sealed to the liner then welded along each edge to adjacent sheets with a 1 inch wide welding strip. The width of the space between adjacent sheets shall not exceed 2 inches. The 4 inch joint strip shall lap over each sheet a minimum of 1/2 inch. It may be used at any transverse or longitudinal joint.

Type C-2: The joint shall be made by lapping sheets not less than 1/2 inch. One 1 inch welding strip is required. The upstream sheet shall overlap the one downstream. The lap shall be heat-sealed into place prior to welding on the 1 inch welding strip.

Type C-3: The joint shall be made by applying 2 inch waterproof tape or 1 inch wide welding strip on the back of the maximum 1/4 inch gap butt joint or by some other method approved by the engineer to prevent wet concrete from getting under the sheet. After the forms have been stripped, a 1 inch welding strip shall be applied over the face of the sheet.

- c. All welding is to be in strict conformance with the specifications of the lining manufacturer and Paragraph 3.4.e.

3.7 TESTING AND REPAIRING DAMAGED SURFACES

- a. After the pipe is installed in the trench, all surfaces covered with lining, including welds, shall be tested with an approved electrical holiday detector (Tinker & Rasor Model No. AP-W with power pack) with the instrument set between 18,00 and 22,00 volts. All welds shall be physically tested by a nondestructive probing method. All patches over holes, or repairs to the liner wherever damage has occurred, shall be accomplished in accordance with Paragraph 3.2.h.
- b. Each transverse welding strip which extends to a lower edge of the liner shall be tested and approved by the Contracting Officer. The welding strips shall extend 2 inches below the liner to provide a tab. A 10-pound pull will be applied to each tab. The

force will be applied normal to the face of the structure by means of a spring balance. Liner adjoining the welding strip will be held against the concrete during application of the force. The 10-pound pull will be maintained if a weld failure develops, until no further separation occurs. Defective welds will be retested after repairs have been made. Tabs shall be trimmed away neatly by the installer of the liner after the welding strip has passed inspection. Inspection shall be made within 2 days after the joint has been completed in order to prevent tearing the projecting weld strip and consequently damage to the liner from equipment and materials used in or taken through the work.

3.8 CLEAN UP

Before acceptance, the liner shall be cleaned to the satisfaction of the Contracting Officer.

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SECTION 09920

COATING SYSTEMS

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 in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 154	(1996) Guide for Testing Varnishes
ASTM D 412	(1998; Rev. A) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension
ASTM D 751	(1998) Coated Fabrics
ASTM D 903	(1998) Peel or Stripping Strength of Adhesive Bonds
ASTM D 2369	(1998) Volatile Content of Coatings
ASTM D 3366	(1995) Color of Maleic Anhydride and Phthalic Anhydride in the Molten State and After Heating (Platinum-Cobalt Scale)
ASTM E 96	(1995) Water Vapor Transmission of Materials

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C550	(1990) Protective Epoxy Interior Coatings for Valves and Hydrants
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SSPC: THE SOCIETY FOR PROTECTIVE COATING (SSPC)

SSPC SP 2	(1995) Hand Tool Cleaning
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1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Coal Tar Coating for Pipeline

Polyurethane Coatings for Exterior of Manholes and Pipeline Joints; G

Epoxy Coating for Steel Manholes

SD-08 Manufacturer's Instructions

Polyurethane Coatings for Exterior of Manholes and Pipeline Joints; G

1.3 LOCATION OF APPLICABILITY

- a. A coal-tar coating shall be applied to the exterior of all reinforced concrete sewerage pipeline.
- b. Epoxy coatings shall be applied to steel components of manholes and steel pipe as shown on the plans.
- c. A bitumen modified polyurethane membrane shall be applied over the joints of all reinforced concrete sewerage pipeline and precast and steel CML&C sewerage manhole structures following installation to provide a continuous watertight exterior seal.

PART 2 PRODUCTS

2.1 POLYURETHANE COATING

The following polyurethane coatings shall be available for use:

Type 1: For horizontal Surfaces

Type 2: For vertical Surfaces

Knifegrade: For cracks, voids and other surfaces

2.1.1 Physical Properties

The bitumen modified polyurethane membrane shall have the following properties:

Property	Test Method	Results		
		Type 1	Type 2	Knifegrade
Viscosity (poise)	Brookfield	35±5	35±5	-
Weight (lb per gallon)	-	10±0.	2 9.12±0.2	-
Percent Solids (by weight)	ASTM D 2369	85	82	100
Percent Solids (by volume)	ASTM D 2369	78	77	100
Tackfree Time (at 77°F and 55% R.H.)	FS TT-S-230c	12-16 hrs	12-16 hrs	48-72 hrs
Recoat Time (at 77°F and 55% R.H.)	-	16-24 hrs	16-24 hrs	-

Property	Test Method	Results		
		Type 1	Type 2	Knifegrade
Hardness (shore A)	ASTM D 3366	15A	30A	35±5
Tensile Strength (psi)	ASTM D 412	300	436	400
Percent Elongation	ASTM D 412	1000	700	700
Water Vapor Transmission (grains/hr/sq. ft)	ASTM E 96	2.08	1.412	-
Adhesion to Concrete	ASTM D 903	8 lb/in.	9 lb/in.	15 lb/in.
Hydrostatic Pressure Resistance	ASTM D 751	-	94 psi	-
Resistance to Decay	ASTM D 154	(1)	(1)	(1)
Moisture Vapor Transmission _ (grains/hr/sq. ft)			1.42 - before decay 1.563 1.56 - after decay	
Flash Point	-	120 °F	150 °F	-
Recovery (percent)	ASTM D 412	98	96	-
Shrinkage	-	-	-	Negligible
Weight Loss (Heat Aging)	FS TT-S-230	-	-	0.83%
Color (1) No surface defects.	-	black	black	black

2.2 EPOXY COATINGS

All epoxy coatings of steel coatings shall be fusion bonded shop applied. Field touch up of coatings will be as indicated herein.

2.2.1 Temporary Work Suspension

The Contractor shall not paint during adverse atmospheric conditions such as high drying winds, dust, high humidity, extreme surface temperatures or exterior work or any other conditions which would affect the quality of the paint finish. Painting shall not be done while other tradesmen are working.

2.2.2 Materials

Except as otherwise provided herein, the material used shall be 100% powder epoxy, fusion bonded, and shall be 3-M Company primer and "Scotchkote," 206N or 134, or approved equal.

Where, in the Contracting Officer's opinion, because of the nature of the nature of the item being coated it would be impossible to use the fusion-bonded powder epoxy method without causing damage to the item, the use of a liquid epoxy, factory applied by the manufacturer of the item being coated, will be permitted. Said liquid epoxy shall be 3-M Company epoxy primer and "Scotchkote" 312 or 124, or DeVoe Coating Co., Devran 184.

The use of liquid epoxy other than those specified, including the

equipment manufacturer's proprietary coating system, must be reviewed and approved by the Contracting Officer prior to use.

PART 3 EXECUTION

3.1 GENERAL

3.2 QUALITY ASSURANCE

3.2.1 Applicators

- a. The applicator shall be a licensed specialty contractor in the business of applying elastomeric membrane roofing and waterproofing for a minimum of five (5) years.
- b. The applicator shall be approved for the work by the manufacturer.

3.2.2 Manufacturer

- a. Manufacturer shall certify in writing that the applicator is approved for this type and size of project.
- b. Before starting work, the manufacturer shall visit the site to inspect substrates and related work by others. The manufacturer shall be notified in writing five (5) days prior to inspection.

3.3 SURFACE PREPARATION

Prior to commencement of work, all concrete surfaces shall be clean, dry, and in the proper condition to receive the coating system.

3.4 COATING APPLICATION

3.4.1 Polyurethane Coatings

- a. The coatings shall be applied with an approved method as indicated by the manufactures instructions for spraying, brushing, or caulking gun. The coatings shall be applied with a thickness according to the following chart:

Property	Thickness		Knifegrade
	Type 1	Type 2	
Smooth Surfaces	60 mils (1)	60 mils (1)	-
Rough Surfaces	90 mils (1)	90 mils (1)	-
Cracks	-	-	up to 1" void

(1) Coating shall be applied with a minimum of two coatings

- b. The coatings shall be applied to the exterior of the joints of each sewerage pipeline and steel CML&C sewerage manhole structures to form a continuous watertight exterior seal.

3.4.2 Epoxy Coatings

3.4.2.1 Surface Preparation

The surface shall be blast-cleaned in accordance with SSPC-SP-5 (White Metal Blast Cleaning). The grit size used shall be as recommended by the epoxy manufacturer.

3.4.2.2 Application

Application of the epoxy coating shall be in accordance with the manufacturer's instructions; provided that, if liquid epoxy is permitted, it shall be applied in not less than three spray coats to give the required total thickness.

3.4.2.3 Thickness of Coating

The minimum liquid epoxy dry coating thickness shall be 12 mils for all equipment valves, piping, and appurtenances, as noted herein or on the plans; however, the thickness of coating in the grooves for valves or fittings designed to receive a rubber gasket shall be approximately 5 mils.

3.5 INSPECTION

Coating thickness shall be checked and verified adequate by the inspector for each application. Any inadequacies or irregularities in the application shall be identified to the Contracting Officer for resolution.

3.5.1 Inspection

Coating thickness shall be checked with a nondestructive magnetic type thickness gage. Coating integrity shall be tested in accordance with AWWA C550-90 Subsection 5.3.3. All pinholes shall be marked, repaired and retested. No pinholes or other irregularities will be permitted in the final coating.

3.5.2 Field Repairs

If small local repairs are necessary, they shall be made using a liquid epoxy recommended by the manufacturer of the epoxy with which the item was initially coated. The surface must first be hand tool cleaned in accordance with SSPC SP 2 (Hand Tool Cleaning). The repair epoxy material shall be applied in accordance with the manufacturer's instructions.

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SECTION 09940

PAINTING - HYDRAULIC STRUCTURES AND APPURTENANT WORKS

PART 1 GENERAL

1.1 GENERAL INFORMATION

This section covers all operations in connection with preparation of surfaces and application of paint and other specified materials.

1.2 DEFINITIONS AND NOMENCLATURE

1.2.1 Paint

The term "paint" as used herein includes emulsions, enamels, paints, stains, varnishes, sealers, and other coatings, organic or inorganic, whether they be used as prime, intermediate, or finish coats. This definition does not include troweled or sprayed metal coatings.

1.2.2 Shop Painting

The term "shop painting", as referred to herein or on the specification and shop drawings, covers surface preparation and painting operations conducted in a shop, mill, or plant before shipment of paint-receiving items to the project site.

1.2.3 Field Painting

The term "field painting", as referred to herein or on the specification and shop drawings, covers surface preparation and painting operations conducted at the project site.

1.2.4 Touch-Up Painting

The term "touch-up painting" refers to the application of paint on small areas of painted surfaces to repair mars, scratches, and other defects where the coating has deteriorated in order to restore the coating to an unbroken condition.

1.2.5 Repainting

The term "repainting" designates the cleaning and recoating, with the same or similar materials originally used, on extensive areas on which the existing coatings have deteriorated or otherwise have not provided adequate protection.

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. Latest revisions and versions shall be used regardless of the dates shown

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI Z87.1 (1989; Errata; Z87.1a) Occupational and Educational Eye and Face Protection
- ANSI Z358.1 (1998) Emergency Eyewash and Shower Equipment

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM D 153 (1984; R 1996) Specific Gravity of Pigments
- ASTM D 281 (1995) Oil Absorption of Pigments by Spatula Rub-Out
- ASTM D 362 (1984) Industrial Grade Toluene
- ASTM D 520 (2000) Zinc Dust Pigment
- ASTM D 561 (1982; R 1996) Carbon Black Pigment for Paint
- ASTM D 740 (1994) Methyl Ethyl Ketone
- ASTM D 846 (1984) Ten-Degree Xylene
- ASTM D 1045 (1995) Sampling and Testing Plasticizers Used in Plastics
- ASTM D 1152 (1989; R 1993) Methanol (Methyl Alcohol)
- ASTM D 1153 (1994) Methyl Isobutyl Ketone
- ASTM D 1200 (1994) Viscosity of Paints, Varnishes, and Lacquers by Ford Viscosity Cup
- ASTM D 1210 (1996) Fineness of Dispersion of Pigment-Vehicle Systems by Hegman-Type Gage
- ASTM D 1400 (1994) Nondestructive Measurement of Dry Film Thickness of Nonconductive Coatings Applied to a Nonferrous Metal Base
- ASTM D 3721 (1983; R 1991) Synthetic Red Iron Oxide Pigment
- ASTM E 97 (1982) 45-degree, 0-degree, Directional Reflectance Factor of Opaque Specimens by Broad-Band Filter Reflectometry

AMERICAN WATER WORKS ASSOCIATION (AWWA)

- AWWA C203 (1997; addenda C203a - 1999) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied

CORPS OF ENGINEERS (COE)

COE EM 385-1-1 Safety and Health Requirements Manuals

CODE OF FEDERAL REGULATIONS (CFR)

CFR 29 Part 1910 (1995) Occupational Safety and Health Standards

FEDERAL SPECIFICATIONS (FS)

FS TT-P-320 (Revision D) Pigment, Aluminum; Powder and Paste for Paint

FEDERAL STANDARDS (FED-STD)

FED-STD 595 (1974, Revision B) Colors

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH Pub. No. 87-108 Respirator Decision Logic

NIOSH Pub. No. 84-100 NIOSH Manual of Analytical Methods

SSPC: THE SOCIETY FOR PROTECTIVE COATING (SSPC)

SSPC SP 3 (1995) Power Tool Cleaning

SSPC SP 5 (1994) White Metal Blast Cleaning

SSPC SP 7 (1994) Brush-Off Blast Cleaning

1.3.1 Special Formulations

Special formulations indicated herein that are not covered by Federal or other nationally recognized standard specifications are specified in paragraph: SPECIAL PAINT FORMULATIONS NOT COVERED BY STANDARD SPECIFICATIONS.

1.4 SAMPLING AND TESTING

1.4.1 General

Batches of paint which are proposed to be used shall be stored in an approved shelter on the project site or segregated at the source of supply sufficiently in advance of need to allow 30 days for sampling and testing. The Contracting Officer shall be notified when the paint is available for sampling. Sampling of each batch will be witnessed by the Contracting Officer unless otherwise specified or directed. Samples of paint submitted for approval shall be clearly labeled to indicate formula or specification number and nomenclature, batch number, batch quantity, color, date made, and applicable project contract number. Where specifically indicated herein or where indicated in a standard specification for a finished product, separate samples of ingredient materials shall be furnished. The

ingredient samples shall be clearly identified by commercial name, trade designation, manufacturer, batch or lot number, and such other data as may be required. Testing of paint for compliance with the specifications will be performed in a Government designated laboratory at no expense to the Contractor except that the cost of testing any sample representing material that replaces previously rejected material will be deducted from payments to the Contractor at the rate of \$400.00 for each replacement sample. An additional 14 days shall be allowed for retesting.

1.4.2 Special Paint Formulations Not Covered by Standard Specifications

1.4.2.1 Solvents and Thinners

Solvents in vinyl and epoxy paints and thinners are subject to analysis by programmed temperature gas chromatographic methods and/or spectrophotometric methods, employing the same techniques which 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.

1.4.2.2 Adhesion Test

All vinyl paints are subject to the following adhesion test. When V-766 formulations are tested, 5 to 7 mils (dry) shall be spray-applied to mild steel panels sandblasted to white metal. When V-102 formulations are tested, they shall be spray applied over 1.5 to 2.5 mils (dry) of V-766 known to pass this test. When VZ-108d 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 sandblast profile. In all cases, the complete system shall have a total dry film thickness of 5 to 7 mils above the sandblast 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 F. After cooling for 1 hour, the panel shall be immersed in tap water at 85 to 90 F for 48 to 72 hours. Immediately upon removal, the panel shall be dried with a 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 inches apart through the paint film to the steel surface. A third cut shall be made perpendicular to and passing through the ends 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 so as 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 removal. Upon being removed by this method, the paint film shall either break or elongate a minimum of 10 percent. Paints not intended to be self priming shall exhibit no delamination from the primer.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be

submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Safety and Health Submittal; G.

The following is a listing of safety and health submittal items required by this contract. The submittals shall be provided as required in COE EM 385-1-1, Section 8.

1. Qualifications and Experience Statement.
2. Accident Prevention Plan.
 - a. Administrative Requirements.
 - b. Activity Hazard Analysis Procedures.
 - c. Confined Space Procedures.
 - d. Respiratory Protection Program.
 - e. Material Safety Data Sheet.
 - f. Airborne Sampling Plan.
 - g. Ventilation Assessment.
 - h. Worker Hazard Communication Program.
 - i. Medical Surveillance Program.
 - j. Other Safety and Health Submittal Items as required in COE EM 385-1-1, Appendix Z.

SD-04 Samples

Special Formulation Paints and Thinners; G

Two 1-quart samples of each batch of special formulation (vinyl or epoxy type) paint and thinners shall be submitted for approval.

For ingredient materials submittal requirements see paragraph: PAINT FORMULATIONS. When the required quantity of any paint is 10 gallons or less, samples of the paint and ingredient materials need not be submitted, but instead a signed certificate from the paint manufacturer shall be submitted showing the percentage of each ingredient used to produce the material and a statement that the material complies with all of the requirements of the formulation. Each ingredient shall be clearly identified as provided for above.

Federal Specification Paints and Thinners; G

When the required amount of a material of a particular type of color is more than 10 gallons, a 1-quart sample of each batch proposed to be used shall be submitted. When the required quantity of any type is 10 gallons or less, either of the following shall be supplied:

1. A certified test report showing the results of required tests made on the material and a statement that it meets all of the specification requirements.

2. A certified test report showing the results of required tests made on a previous batch of paint produced by the same firm using the same ingredients and formulation except for minor differences necessitated by a color change and a statement that the previous batch met all of the specifications requirements. A report of tests shall also be supplied on the proposed batch showing the following properties applicable to the material specification: color, gloss, drying time, opacity, viscosity, weight per gallon, and fineness of grind.

Proprietary Brands of Paints; G

When the required quantity of a particular type or color of a paint covered by a Federal Specification is 10 gallons or less, a proprietary name brand, shelf item paint of the same type and with similar properties to the material specified may be proposed without sampling. To receive consideration, the paint must be in the original container with the manufacturer's label affixed. A statement from the supplier shall be submitted showing that the paint is appropriate as to type, color and gloss and is a premium grade of paint.

SD-06 Test Reports

Airborne Sampling

- a. Laboratory Conducted - within 5 working days after taking samples.
- b. Direct Reading Instrumentation - same day as taken.

1.6 PACKING, LABELING, DELIVERY AND STORAGE OF PAINTS

Paints shall be so processed and packaged as to ensure that within a period of 1 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 in size with removable friction or lug-type covers. Containers for vinyl-type paints shall be lined with a coating resistant to the 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 clearly and durably labeled to indicate the purchaser's order number, date of manufacture, manufacturer's batch number, quantity, color, component identification, and the 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 SAFETY AND HEALTH PROVISIONS

1.7.1 General

The safety and health provisions contained herein shall be complied with in addition to those provisions contained in the Contract Clause, "Accident Prevention, Alt 1". These additional provisions are intended to amplify those contained in the aforementioned clause. In any conflict between the "Accident Prevention" clause and this section, the provisions of this section shall govern. All required safety and health plans and procedures shall be developed consistent with current federal regulations as described in CFR 29, Part 1910, Occupational Safety and Health Standards; CFR 29 Part 1926, Safety and Health Regulations for Construction; COE EM 385-1-1, U.S. Army Corps of Engineers Safety and Health Requirements Manual; the permissible exposure limits (PEL's) contained in the latest edition of the American Conference of Governmental Industrial Hygienist's (ACGIH) booklet entitled "Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment and Biological Indices with Intended Changes"; and the provisions of these specifications. The Contractor shall comply with the more stringent PEL's contained in either CFR 29 Part 1010 or the ACGIH booklet. In order to comply with these specifications, the Contractor shall prepare for review and approval, specific safety and occupational health submittal items identified in paragraph: SAFETY AND HEALTH SUBMITTAL REQUIREMENTS, and as further described below.

1.7.2 Safety and Health Submittal Requirements

1.7.2.1 Qualification and Experience Statement

A written Qualification(s) and Experience Statement shall be submitted for approval signed and dated by the Contractor and the "Qualified and Competent Person(s)" as defined in COE EM 385-1-1, stating that the Contractor has selected to develop the required safety and health submittal items and who will act as the Contractor's on-site safety and health representative(s) during the contract period. Approval of this submission must be obtained prior to the submission of other required safety and health submittal items.

1.7.2.2 Accident Prevention Plan

a. General. The criteria included in COE EM 385-1-1, Appendix Y, "Suggested Contractor's Accident Prevention Plan Format", as amplified below, shall be followed when preparing the Accident Prevention Plan. The plan, at a minimum, shall include each of the topic areas listed below, but may include other safety and health criteria as deemed necessary. Each topic shall be developed in a concise manner to include management and operational aspects.

b. Administrative Requirements

1. Administrative responsibilities for effecting the Accident Prevention Plan (i.e., identification and accountability of Contractor personnel responsible for accident prevention).
2. Local requirement, if any, which must be complied with (i.e., noise control, traffic problems, parking, and other similar items).
3. Methods proposed to control and coordinate the work of subcontractors including list of subcontractors.
4. Plans for layout and use of temporary construction buildings, facilities, and equipment including how the Contractor plans to control those of subcontractors.

5. Plans for initial indoctrination, continued safety education, and training for the Contractor's and subcontractor's employees. The Safety Indoctrination Plan shall include, but may not be limited to the following:

(a) General policy and pertinent provisions of COE EM 385-1-1, the Contractor's Accident Prevention Plan, and Activity Hazard Analyses.

(b) General safety and occupational health rules.

(c) Responsibilities and authorities of employees during the contract including accident reporting, protection of property, and safety of others.

(d) Procedure for reporting and correcting unsafe conditions or practices.

(e) Identification of specific hazards of the tasks (assignments) employees are to perform and the administrative (standard operating procedures) engineering and personal protective controls to mitigate those hazards.

(f) Procedures and schedules of safety meetings for indoctrination and training of supervisor and employees. Requirements for employee indoctrination and continued training by project safety officer shall include the following and as further defined elsewhere in these documents.

(1) Training of Contractor's employees for compliance to the Contractor Activity Hazard Analyses of the Accident Prevention Plan.

(2) Material handling.

(3) Heavy equipment.

(4) Electrical (including temporary electrical).

(5) Safe clearance procedures.

(6) Fire and explosion protection and prevention.

(7) Confined space standard operating procedures.

(8) Respiratory protection equipment (selection, fit, use, inspection, maintenance, storage, training, and other criteria in accordance with COE EM 385-1-1, Section .07.B.).

(9) Hazard communication for employees to include identification of potential hazards, effects of exposure, and control measures to be used for chemical products and physical agents that may be encountered during the performance of work on this contract and other criteria in accordance with CFR 29 Part 1910.1200.

(10) Training in the use and understanding of material safety data sheets and chemical product hazard warning labels.

- (11) Selection, use, inspection, maintenance, and storage of personal protective clothing and equipment.
 - (12) Communication methods and systems to be used (i.e., voice, hand signals, radios, or other means).
 - (13) Safe work procedures on or around water areas (water safety).
 - (14) Personal hygiene (washing and cleaning facilities, sanitation, eating, smoking, and drinking requirements).
 - (15) Training in types, use of, and safety features of portable and fixed mechanical supply and exhaust ventilation systems.
 - (16) Hearing protection.
 - (17) Training in Contractor substance abuse control.
 - (18) Medical surveillance.
 - (19) Emergency medical and first aid requirements per COE EM 385-1-1, Section 4.
 - (20) Fire fighting and other emergency plans and procedures.
 - (21) Emergency equipment and supplies (i.e., emergency eye wash/shower and absorbent media for cleaning up spills and other equipment and supplies).
6. Plans for continuous job clean up and safe access and egress at the job site.
 7. Plans for emergency procedures (i.e., ambulance service, fire protection, water-related accidents, and other site specific emergencies that could occur).
 8. Plans for job site safety inspection, industrial hygiene, and worker and environmental monitoring of hazardous chemical and physical agents.
 9. Record keeping procedures. Provide detailed description of methods and procedures proposed for collecting and maintaining required records such as medical monitoring, industrial hygiene, environmental sampling and analysis, safety inspections, safety meetings, and other records required by Federal, State and local regulations.
 10. Procedures for accident investigations and reporting (see COE EM 385-1-1, Section 2).
 11. Description and sketch of temporary power distribution system.
 12. Procedures and details of fall protection systems.
 13. Description of safe clearance procedures.

c. Activity Hazard Analysis Procedures

Activities Hazard Analysis Procedures shall be developed as part of the

Accident Prevention Plan. The procedures shall define how the Contractor will implement the Activity Hazard Analysis in accordance with the criteria in Appendix Y(b) of COE EM 385-1-1 as further described below:

1. In accordance with the requirements of COE EM 385-1-1, Section 1, paragraph 01.A.05, prior to the beginning of each major phase of work, an Activity Hazard Analysis (phase plan) shall be prepared for that work phase. This analysis shall address the hazards for each activity to be performed in that work phase and shall detail procedures and safeguards necessary to eliminate the hazards or reduce the risks to an acceptable level.

2. This analysis shall be developed to identify the sequence of work, the specific safety and health hazards anticipated, and the control measures to be implemented to minimize or eliminate each hazard. The Activity Hazard Analysis shall address the following major points:

- (a) Activity being performed (i.e., identify major phase).
- (b) Sequence of work.
- (c) Hazards to be controlled.
- (d) Control measure(s) to mitigate the hazards.

3. A work phase in the analysis is defined as a major operation involving a type of work which presents hazards that must be adapted or controlled and which has not been experienced in previous operations, or when a new subcontractor or work crew is to perform work. For example, major phases include site preparation, sandblasting, surface cleaning (to include abrasive blasting, and painting).

4. The analysis for each major work phase will be discussed by the Contractor and the Contracting Officer. Work shall not proceed on that phase until the Contractor's Activity Hazards Analysis Procedures have been approved by the Contracting Officer.

d. Confined Space Procedures

Confined space is defined in COE EM 385-1-1, Section 27. The Contractor shall develop detailed written standard operating procedures for confined space monitoring, training, entry, work and emergency actions in accordance with COE EM 385-1-1, Section 27, and as further described. The procedures shall include the items listed below as minimum, and may consider additional factors as identified by the Contractor.

1. Equipment and procedures to be used for testing the air in confined spaces prior to entry and during work, to determine oxygen content, and to detect combustible and toxic atmospheres. Include equipment approvals for use in immediately-dangerous-to-life-or-health (IDLH) environments (example: Factory Mutual and Underwriters' Laboratory); and certificates of calibration which include type of equipment, model number, date of calibration, firm conducting calibration, and signature of individual certifying calibration.

2. Detailed emergency procedures for each type of confined work space including appropriate methods of communication (i.e., visual, voice, hand signal, radio, or other method) and escape or rescue methods. Communication procedures must be established for personnel working in

high noise environments or toxic atmospheres to ensure that such workers do not void the effectiveness of personal protective equipment in order to communicate with others.

3. A decision-tree diagram identifying the individual(s) by name, their qualifications, and detailing their responsibilities for administering the Contractor's confined space program to include issuance of confined space permits, confined space monitoring, communication, and standby responsibilities.

4. A detailed discussion of the confined space permit system to be used. Specifically, provide a copy of the permit which will be utilized with instructions for completion and issuance.

5. Detail of the procedures to be utilized for conducting simulated drills prior to initiating work in confined spaces to ensure that the emergency procedures developed are feasible. For example, entrance and exit openings to the confined space must be large enough for a rescue worker wearing a self-contained breathing apparatus (SCBA) to get himself and the victim out.

6. Safe entry procedures under emergency conditions.

7. Full description of how standby personnel will be trained and used for all confined space operations. See Paragraph e. Respiratory Protection Program.

8. Methods of inspection of personal protective equipment prior to use in confined space.

9. Work practices and other engineering controls designed to reduce airborne hazardous chemicals exposures to a minimum.

10. Specification of the design and installation of ventilation systems for confined work spaces to provide for the dilution of paint solvent vapor within the confined space (see paragraph: VENTILATION AND RESPIRATORY PROTECTION). Describe how the contractor plans to use ventilation smoke tube kits, Mine Safety Appliance (MSA) of Pittsburgh, PA, Part No. 458481, or equal to evaluate the adequacy of air flow patterns in all parts of the confined space.

11. Full description of how all affected workers will be trained in confined space emergency procedures including space entry (i.e., oxygen deficiency and enrichment, and combustible and toxic gases and vapors); methods of evacuation confined space environment (i.e., use of oxygen meters, combustible gas meters, detector tubes, and any other chemical or physical agent sampling detecting devices to be used); entry procedures; isolation and lockout; air monitoring; work in confined space; standby personnel; respiratory protection procedures; communication procedures; safety equipment; smoking policy; use of entry permits; and appropriate escape of rescue procedures.

e. Respiratory Protection Program

As part of the Accident Prevention Plan, a comprehensive written respiratory protection program shall be developed in accordance with OSHA regulation CFR 29 Part 1910.134 and COE EM 385-1-1, Section 07.B, and consistent with the guidance contained in the National Institute for Occupational Safety and Health (NIOSH) document entitled Respirator

Decision Logic DHHS (NIOSH) Publication No. 87-108. Copies of this document may be obtained by contacting NIOSH Publications in Cincinnati, Ohio, (513) 533-8280. The program shall define policies and procedures for the selection, fit testing, use, training, maintenance, cleaning, storage, record keeping, and medical requirements for uses. The program shall include a listing of the type of respirators to be worn and their National Institute for Occupational Safety and Health and/or Mine Safety and Health Administration (NIOSH/MSHA) approval statements and numbers.

f. Material Safety Data Sheets

Procedures shall be fully detailed for obtaining and providing material safety data sheets (MSDS's) for hazardous materials that will be brought onto the job site. For the purpose of the contract, hazardous materials are those described by Federal Standard 313 (latest version) and the OSHA Hazard Communication Standard CFR 29, paragraph 1910.1200. MSDS's for Contractor-furnished hazardous materials must be obtained from the product manufacturer, importer, distributor, or supplier, and a copy shall be submitted to the Contracting Officer prior to use.

g. Airborne Sampling Plan

An air sampling plan shall be developed and submitted as part of the Accident Prevention Plan detailing the NIOSH, Factory Mutual, or Underwriters' Laboratories approved equipment, equipment calibration procedures, sampling methods, and analytical procedures to be used based on the type of work to be performed, confined space air monitoring procedures required in accordance with paragraph: Confined Space Procedures, and anticipated toxic contaminants to be generated. The constituents of the paint systems, thinners, cleaners, and abrasive media shall be reviewed as well as confined spaces to be entered to determine the scope of the sampling plan. The sampling plan shall allow for approved methods of sampling and analysis by NIOSH sampling and analytical methods. The name of the laboratory to be used to conduct the analysis of any collected air samples shall be submitted. The laboratory shall be accredited by the American Industrial Hygiene Association (AIHA) as described in paragraph: ATMOSPHERIC TESTING. The plan shall note procedures to give detail of how the Contracting Officer will be given the laboratory conducted analysis of air sampling within 5 working days of the sample date, and the results from direct reading instrumentation on the same day the samples were collected.

h. Ventilation Assessment

The method to be used to provide ventilation assessment required by paragraph: VENTILATION shall be submitted for approval.

i. Worker Hazard Communication Program

A worker hazard communication program shall be submitted for Contractor employees consistent with CFR 29 Part 1910.1200 and State and local worker "right-to-know" rules and regulations. The program shall detail how the Contractor's employees will be informed of the constituents of the paint systems, thinners, solvent cleaners, abrasive blasting media, and other materials used, as well as their potential hazards and toxic effects; how they will be informed of control measures that may be taken to prevent or minimize exposure; how they will also be informed of any exposure hazards associated with removal of surface coating materials. This submittal shall show how the hazardous materials to be used or generated during work operations are to be identified, and how employees will be informed of the

hazards prior to beginning the work task(s). In addition, the program shall detail how the Contractor will ensure, prior to usage, that all Contractor-furnished containers of paints, thinners, or other hazardous materials are labeled in accordance with the requirements of the OSHA Hazard Communication Standard CFR 29 Part 1910.1200. The program shall describe procedures to ensure that workers will not open any chemical product containers which are improperly labeled, and how the Contracting Officer will be informed of any chemical product containers that are improperly labeled. The program shall also detail the requirements for labeling a product after it has been transferred from a labeled shipping container to a secondary container to ensure that information required by the OSHA Hazard Communication standard is placed on the secondary container.

j. Medical Surveillance

A description of how medical surveillance will be provided to the work force, and a statement from the examining physician indicating the name of each employee who has been medically evaluated as described in paragraph: Medical Evaluation and cleared to perform the work required by the Contractor. The statement shall detail any physical limitations, the employee's physical and psychological capability to wear respiratory protective equipment and perform job related tasks, and bear the date of the medical evaluation, the physician's name, signature, and telephone number. The description shall state how potential employees will be made fully aware that facial hair cannot interfere with the sealing surface or valve function of respirators required to be worn.

1.7.3 Abrasive Blasting

1.7.3.1 Hoses and Nozzles

Hose of a type to prevent shocks from static electricity shall be used. Hose lengths shall be joined by metal couplings to the outside of the hose to avoid erosion and weakening of the couplings. The couplings shall be fastened together in a way which will prevent accidental disengagement. Nozzles shall be attached to the hose by fittings that will prevent the nozzle from unintentionally becoming disengaged. Nozzle attachments shall be of metal and shall fit onto the hose externally. A dead man type control device shall be provided at the nozzle end of the blasting hose to cut off the flow in the event the blaster loses control of the hose. Hoses and all fittings used for abrasive blasting shall be inspected frequently to ensure timely replacement before an unsafe amount of wear has occurred.

1.7.3.2 Blasting Helmets

Blasting operators shall be protected by NIOSH/MSHA approved air line fed abrasive blasting helmets of a continuous flow, positive pressure type. Breathing air, source of supply, and other respirator criteria shall conform to the requirements of COE EM 385-1-1, Section 07.B.

1.7.3.3 Protective Clothing

Blasting operators shall be protected against injury from impact of blast abrasives by wearing appropriate protective equipment including heavy canvas or leather gloves and aprons or equivalent protection. Safety shoes or boots shall be worn. Hearing protectors shall be worn during all blasting operations.

1.7.3.4 Workers Other Than Blasters

Workers other than blasting operators working in close proximity to abrasive blasting operations shall be protected by utilizing NIOSH/MSHA approved half face or full face air purifying respirators equipped with high efficiency particulate air (HEPA) filters, eye protection meeting or exceeding ANSI Z87.1, and hearing protectors (ear plugs and/or ear muffs). Representative air sampling in the breathing zone of the worker shall be obtained prior to permanent issuance of any respiratory protection to assure that the protection factor of the respirator is not exceeded. Air sampling will not be required when non-silica containing abrasive blasting material (1 percent free silica content or less) is used and it has been established that the surface coating to be removed will not generate toxic airborne particulates (for example lead or chromates).

1.7.4 Cleaning with Compressed Air

As required in paragraph 16.E.07 of COE EM 385-1-1, cleaning with compressed air is prohibited except where the pressure has been reduced to less than 30 pounds per square inch (psi) or the air hose is equipped with a pressure reducing valve. Persons using high pressure compressed air for blow down after abrasive blasting operations shall be protected by the equipment required for abrasive blasters in paragraph: BLASTING HELMETS AND PROTECTIVE CLOTHING.

1.7.5 Cleaning with Solvents

1.7.5.1 Ventilation and Respiratory Protection

Ventilation shall be provided in confined or enclosed spaces where solvents are used for cleaning to remove solvent vapors at the source and to dilute their concentration to no greater than 10 percent of the lower explosive limit (LEL). Exhaust ducts shall discharge clear of the working areas and possible sources of ignition. Persons conducting solvent cleaning in confined or enclosed spaces shall wear NIOSH/MSHA approved SCRA with a full face piece operated in a pressure d or other positive pressure mode or supplied air respirators (SAR) (airline type) with full face piece operated in pressure demand or other positive pressure mode in combination with an auxiliary SCBA (emergency escape bottle, operated in pressure demand or other positive pressure mode). Auxiliary SCBA must be of sufficient duration to permit escape to safety if the air supply is interrupted. Representative air monitoring in accordance with the Contractor's air monitoring plan shall be conducted to determine hazardous atmospheres. Contractor confined space procedures (see paragraph: Confined Space Procedures) shall be implemented prior to confined or enclosed space solvent cleaning operations. Where cleaning activities using solvents are being carried out in areas that the Contractor's on-site safety and health representative have determined are NOT confined or enclosed spaces, persons conducting such cleaning shall wear as a minimum NIOSH/MSHA approved chemical cartridge/canister half or full face piece air purifying/respirators that have sorbent suitable for the chemical properties of the anticipated gas/vapor contaminant(s) and for the anticipated exposure levels. Whenever high airborne concentrations of particulates are anticipated or encountered during cleaning with solvents, approved air purifying chemical cartridge/ canister respirators that have a particulate prefilter suitable for the specific type(s) of gas/vapor and particulate contaminants and for the exposure concentration shall be worn. Air monitoring shall be conducted in the breathing zone of the worker to determine specific solvent vapor concentrations prior to the permanent issuance of respiratory equipment to assure that the assigned protection

factor (APF) of the respirator is not exceeded. APF is defined as the anticipated workplace level of respiratory protection provided by a properly functioning respirator or class or respirators to a percentage of properly fitted and trained users. The maximum specified use concentration for a respirator shall be determined by multiplying the permissible exposure limit for the contaminant by the protection factor assigned to a class of respirators. (Refer to the NIOSH Pub. No. 87-108 for guidance.)

1.7.5.2 Protective Clothing

Exposure of skin and eyes to solvents shall be avoided by utilization of appropriate chemical resistant gloves, apron, clothing (if applicable), safety goggles, and face shield. Guidance regarding selection of appropriate clothing may be obtained by consulting the American Conference of Governmental Industrial Hygienists publication "Guidance to the Selection of Chemical Protective Clothing", Volumes I and 11, 1987. Copies may be obtained by contacting ACGIH in Cincinnati, Ohio, at (513) 661-7881.

1.7.6 Pretreatment of Metals and Concrete with Acids

1.7.6.1 Personal Protective Equipment

Exposure of skin and eyes to acids shall be avoided by wearing appropriate acid resistant gloves, apron, clothing (if applicable), approved safety goggles, and face shields.

1.7.6.2 Emergency Equipment

The following requirement for the acid pretreatment operation is in addition to that required by paragraph 04.A.06 of COE EM 385-1-1. In accordance with ANSI Z358.1, an emergency eyewash which provides at least 15 minutes of continuous clean water flow and a deluge shower shall be provided for the acid pretreatment operation.

1.7.7 Mixing Epoxy Resin Formulations

1.7.7.1 Ventilation

Local exhaust ventilation shall be provided in the area where the curing agent and resin are mixed. This ventilation shall be capable of providing at least 100 linear feet per minute of air flow at the mixing station.

1.7.7.2 Personal Protective Equipment

Exposure of skin and eyes to epoxy resin components shall be avoided by wearing appropriate chemically resistant gloves, aprons, safety goggles, and face shields meeting or exceeding the requirements of ANSI Z87.1.

1.7.7.3 Medical precautions

Individuals who have a history of sensitivity to epoxy resin systems shall have been medically evaluated before any exposure could occur. Individuals who are medically evaluated as exhibiting a sensitivity to epoxy resins should not conduct work tasks or otherwise be exposed to such chemicals. Individuals who develop a sensitivity shall be immediately removed from further exposure and medically evaluated.

1.7.7.4 Emergency Equipment

An emergency eyewash capable of providing at least 15 minutes of continuous water flow and a deluge shower shall be provided within close proximity to the epoxy resin mixing operation in accordance with ANSI Z358.1.

1.7.7.5 Special Conditions

Smoking shall be prohibited during all epoxy resin mixing operation.

1.7.8 Paint Application

1.7.8.1 Fire and Explosion Protection

a. Ventilation

A ventilation assessment shall be conducted for enclosed and confined spaces prior to initiating activities to ensure that an adequate amount of makeup air will be provided. All areas of these spaces shall be swept by moving air. The effectiveness of the ventilation shall be checked by using ventilation smoke tubes and taking frequent oxygen and combustible gas readings during painting operations. When using solvent based paints in enclosed and confined spaces, ventilation shall be provided to exchange air in the space at a rate of 5,000 cubic feet per minute per spray gun in operation. Except for a zone within 5 feet in any direction from an operating spray nozzle, the concentration of volatile material at any location in the confined or enclosed space shall not exceed 20 percent of the LEL. This may be accomplished by increasing the volume of air exhausted and by carefully selecting the exhaust and supply fan locations. Requirements for electrical equipment are found in paragraph: Explosion-Proof Equipment. It may be necessary to install both a mechanical supply and exhaust ventilation system to effect adequate air changes within the confined space. All air moving devices shall be located and affixed to an opening of the confined space in such manner that assures that the airflow is not restricted or short circuited and is supplied in the proper direction. Means of egress shall not be blocked. Ventilation shall be continued after completion of painting and through the drying phase of the operation. If the ventilation system fails or the concentration of volatiles exceeds 20 percent of the LEL (except in the zone immediately adjacent to the spray nozzle) painting shall be stopped and spaces evacuated until such time that adequate ventilation is provided.

An audible alarm which signals system failure shall be an integral part of the ventilation system. Exhaust ducts shall discharge clear of the working areas and away from possible sources of ignition.

b. Atmospheric Testing

The Airborne Sampling Plan shall be implemented that is required by paragraph: Airborne Sampling Plan. Representative air samples shall be collected to determine if toxic contaminants are being generated in concentrations that may be harmful to workers. The Contractor shall utilize NIOSH-approved sampling and analytical methods as described in NIOSH Pub. No. 84-100. A copy may be obtained by contacting NIOSH Publication in Cincinnati, Ohio, at (513) 533-8287. Laboratories utilized to analyze samples shall be AIHA accredited and shall have demonstrated proficiency in the analysis to be performed as evidenced by successful passing participation in the joint NIOSH/AIHA Analytical Testing Proficiency Program (PAT). A listing of AIHA approved laboratories and PAT participants may be obtained by calling AIHA in Akron, Ohio, at (216) 762-7294. Confined spaces shall be tested prior to and continuously during painting operations, to determine the effectiveness of the ventilation

system (see paragraph: Confined Space Procedures). Intrinsically safe oxygen, combustible gas, and other monitoring instruments to be used in confined spaces (certified by FM and/or Underwriters' Laboratories for use in Class 1, Division 1, Group A, B, C, and D hazardous areas) shall be used to determine if adequate levels of oxygen and safe concentrations of combustibles or toxic contaminants exist. A minimum level of 19.5 percent oxygen and a maximum concentration of 20 percent of the lower explosive limit for combustible materials are mandatory requirements for safe work in these spaces, except for the zone within 5 feet in any direction from an operating spray nozzle.

Periodic testing shall also be conducted in confined space areas adjacent to the area where spray painting is occurring and in areas where the air is being exhausted from the confined space to ensure safe concentrations of oxygen, combustibles, and toxic contaminants are maintained. All air monitoring equipment shall be calibrated prior to each use and rechecked after each use. The oxygen and combustible gas meter(s) shall be equipped with an audible alarm which signals unsafe levels of oxygen and/or combustible gases.

c. Explosion-Proof Equipment

All electrical wiring, lights, and other equipment located in the paint spraying area shall be of the explosion proof type designed for operation in Class 1, Division 1, Group D, Hazardous Locations, as-required by the National Electrical Code. Electrical wiring, motors, and other equipment outside of, but within 20 feet of any spraying area, shall not spark and shall conform to the provisions in Class I, Division 2, Group 2, Hazardous Locations. Electric motors used to drive exhaust fans shall not be placed inside spraying areas or ducts. Fan blades and portable air ducts shall be constructed of nonferrous materials. All motors and associated control equipment shall be properly maintained and grounded. The metallic parts of air moving devices, spray guns, connecting tubing, and all duct work shall be electrically bonded and the bonded assembly shall be grounded.

d. Further Precautions

Workers shall wear non-sparking safety shoes. All solvent drums taken into the spraying area shall be placed on nonferrous surfaces and shall be grounded. Metallic bonding shall be maintained between containers and drums when materials are being transferred. Insulation on all power and lighting cables shall be inspected to ensure that the insulation is in excellent working condition and is free of all cracks and worn spots. Cables should be further inspected to ensure that no connections are within 50 feet of the operation, that lines are not overloaded, and that they are suspended with sufficient slack to prevent undue stress or chafing.

e. Ignition Sources

Ignition sources to include lighted cigarettes, cigars, pipes, matches, or cigarette lighters shall be prohibited in areas of solvent cleaning, paint storage, paint mixing, or paint application.

1.7.8.2 Health Protection

a. Respirators

The Respirator Protection Program developed in paragraph: Respiratory Protection Program shall be implemented. During all spray painting

operations, spray painters shall use approved SCBA or SAR (airline) respirators, unless valid air sampling has demonstrated contaminant levels to be consistently within concentrations that are compatible with air purifying respirator protection factors. All respiratory equipment shall be selected and used in accordance with COE EM 385-1-1, 07.B, and CFR 29 Part 1910.134, and consistent with the guidance contained in NIOSH Pub. No. 87-108. During all confined space spray painting operations, only NIOSH/MSHA approved SCBA with half face or full face piece operated in pressure demand or other positive pressure mode or a SAR (air line) with a half or full face piece or painters helmet, hood, or suit operated in pressure demand or other positive pressure mode in combination with an auxiliary SCBA (emergency escape bottle) operated in pressure demand, or other positive pressure mode shall be used. Auxiliary SCBA must be of such duration to permit escape to safety if air supply is interrupted. All employees who wear air purifying type respirators shall be quantitatively or qualitatively fit tested, using NIOSH approved procedures, for the specific type air purifying respirators they will wear. Persons with facial hair that interferes with the sealing surface of the face piece to face seal or interferes with respirator valve function shall not be allowed to perform work requiring respirator protection. Air purifying chemical cartridge/canister half or full face piece respirators that have a particulate pre-filter and are suitable for the specific type(s) of gas/vapor and particulate contaminants may be used for nonconfined space painting, mixing, and cleaning (using solvents), provided the measured or anticipated concentrations of the contaminants in the breathing zone of the exposed worker does not exceed the Assigned Protection Factor (APF) for the respirator, and the gas/vapor has good warning properties or the respirator assembly is equipped with a NIOSH approved End of Service Life Indicator for the gas(es)/vapor anticipated or encountered. Where paint contains toxic elements such as lead, cadmium, chromium, or other toxic particulates that may become airborne during painting in non-confined spaces, air purifying half face and full face piece respirators or powered air purifying respirators, equipped with appropriate gas/vapor cartridges in combination with a high efficiency filter, shall be used. Standby personnel used for all confined space operations shall be equipped with SCBA with a minimum breathing air supply of 30 minutes. Individuals selected to act as standby personnel shall be medically evaluated to ensure that they are physically and psychologically able to perform rescue duties while wearing a SCBA. In addition, they shall be thoroughly trained in confined space monitoring techniques, communications to be used, and emergency rescue techniques. Communications (i.e., visual, voice, signal line, radio, or other means) shall be maintained between workers inside confined space and standby personnel outside at all times.

b. Protective Clothing and Equipment

All workers shall wear safety shoes or boots, appropriate gloves to protect against the chemical to be encountered, and breathable protective full body covering during spray painting applications. Where necessary for emergencies, protective equipment such as life lines, body harnesses, or other means of personnel removal shall be utilized during confined space work.

1.7.9 Medical Status

1.7.9.1 Medical Evaluation

Prior to the start of work and annually thereafter, all Contractor employees working with or around paint systems, thinners, blast media,

those required to wear respiratory protective equipment, and those who will be exposed to high noise levels shall be medically evaluated for the particular type of exposure they may encounter. The evaluation shall include:

- a. Audiometric testing and evaluation of employees who will work in the noise environments.
- b. Vision screening (employees who use full face piece respirators shall not wear contact lenses).
- c. Medical evaluation shall include, but shall not be limited to the following:
 1. Medical history including, but not limited to alcohol use with emphasis on liver, kidney, and pulmonary systems, and sensitivity to chemicals to be used on the job.
 2. General physical examination with emphasis on liver, kidney, and pulmonary system.
 3. Determination of the employee's physical and psychological ability to wear respiratory protective equipment and perform job related tasks.
 4. Determination of baseline values of biological indices for later comparison to changes associated with exposure to paint systems and thinners or blast media which include:
 - (a) Liver function tests to include SGOT, SGPT, GGPT, alkaline phosphatase, and bilirubin.
 - (b) Complete urinalysis.
 - (c) EKG (employees over age 40).
 - (d) Blood urea nitrogen (bun).
 - (e) Serum creatinine.
 - (f) Pulmonary function test FVC and FEV.
 - (g) Chest x-ray (if medically indicated).
 - (h) Blood lead (for individuals where it is known there will be an exposure to materials containing lead).
 - (i) Other criteria that may be deemed necessary by the Contractor's physician.
 - (j) Physician's statements for individual employees that medical status would permit specific task performance.

1.7.9.2 Change in Medical Status

Any employee whose medical status has changed negatively due to work related chemical and/or physical agent exposure while working with or around paint systems and thinners, blast media, or other chemicals shall be evaluated by a physician, and a physician's statement shall be obtained as described in paragraph (i) above prior to allowing the employee to return

to those work tasks. The Contracting Officer shall be notified in writing of any negative changes in employee medical status and the results of the physician's reevaluation statement.

PART 2 PRODUCTS

2.1 SPECIAL PAINT FORMULATIONS NOT COVERED BY STANDARD SPECIFICATIONS

2.1.1 Exceptions

The ingredient materials described in this section are applicable only to the special paint formulations specified hereinafter and not to those finished product coatings governed by Federal or other standard specifications.

2.1.2 General

Special paints shall have the composition as indicated in the formulas listed herein. When so specified, certain components of a paint formulation shall be packed in separate containers for mixing on the job.

2.1.3 Colors and Tints

Colors shall conform to the listed chip of FED-STD 595, "Colors." If not specified or otherwise prescribed, the color shall be that naturally obtained from the required pigmentation.

2.1.4 Paint Formulations

2.1.4.1 Aluminum Paint, Vinyl-Type, Ready Mixed (Formula V-102e):

Ingredients	Percent by Weight
Vinyl Resin, Type 3	18.2
Aluminum Powder	8.3
Diisodecyl Phthalate	3.1
Methyl Isobutyl Ketone	33.8
Toluene	36.6
	100.0

a. Processing. This paint shall be furnished with the aluminum pigment mixed to the vehicle.

b. Viscosity. The viscosity of this paint shall not exceed 90 seconds using a No. 4 Ford cup (ASTM D 1200).

c. Adhesion Test. This paint is subject to the adhesion test for vinyl paints as stated earlier.

d. Samples. Except for batches of 10 gallons or less, samples of paint submitted for approval shall include separate samples of all ingredient materials.

2.1.4.2 Vinyl-Type White (or Gray) Paint (Formula V-766e):

Ingredients	Percent by Weight
Vinyl Resin, Type 3	5.6
Vinyl Resin, Type 4	11.6
Titanium Dioxide and	

Ingredients	Percent by Weight
(for Gray) Carbon Black	13.0
Diisodecyl Phthalate	2.9
Methyl Isobutyl Ketone	32.0
Toluene	34.7
Ortho-Phosphoric Acid	.2
	100.0

a. Processing. The dispersion of pigment in this paint 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 seven on the Hegman scale. Grinding of this formula in steel lined or steel ball mills will not be permitted. No grinding aids, anti-settling agents, or any other materials except those shown in the formula will be permitted. The paint shall show the proper proportions of specified solvents when analyzed by chromatographic and/or spectrophotometric methods. The ortho-phosphoric acid shall be measured with great care and diluted with at least four parts of methyl isobutyl ketone to one part acid. It shall be slowly incorporated into the finished paint with constant and thorough agitation.

b. Viscosity. The viscosity of this paint should not exceed 90 seconds using a No. 4 Ford cup (ASTM D 1200).

c. Adhesion Test. This paint is subject to the adhesion test for vinyl paint outlined in an earlier paragraph.

d. Colors. 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 result in the dry paint film having a reflectance of 20-24 (ASTM E 97). The resulting gray color shall approximate color 26231 of FED-STD 595.

e. Samples. Except for batches of 10 gallons or less, samples of this paint submitted for approval shall include separate samples of all ingredient materials.

2.1.4.3 Vinyl-Type Zinc-Rich Primer (Formula VZ-108d):

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	.7	4.6	.28
Suspending Agent F	.4	2.7	.19
Methanol	.5	3.3	.50
Synthetic Iron Oxide (Red)	1.2	7.9	.19
	100.0	656.6	90.11
COMPONENT B			
Silane B	100.0	4.1	.47
COMPONENT C			
Zinc Dust	100.0	550.0	9.42
			100.00
			(Mixed Paint)

a. Processing. The iron oxide and suspending agents in VZ-108d paint shall be dispersed into the vehicle (Component A) to a fineness of grind of

not less than four on the Hegman scale (ASTM D 1210). The sole purpose of the iron oxide pigment is to produce a contrasting color. A red iron oxide Type 3 vinyl resin vehicle paste such as RBH 5436 produced by the Color and Chemical Division, Interchemical Corp., Hawthorne, NJ, may be used in place of dry iron oxide provided compensating adjustments 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 reflectance of not more than 16 (ASTM E 97).

b. Packaging and Labeling. 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 can, and 3 fluid ounces of silane (Component B) packaged in a polyethylene bottle or corrugated paper-wrapped glass bottle of suitable size. This bottle of silane shall be placed on the zinc dust in the gallon can. 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 shall not adhere to steel surfaces unless Component B is added. Remove 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 to 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 an hour, the hose shall be emptied by blowing the paint back into the paint pot. Thinning shall not normally be required when ambient temperatures are below about 80 F, but when the ambient temperatures are higher, methyl isomly ketone (MIAK) or methyl isobutyl ketone (HIBK) should be used. If paint is kept covered at all times, its pot life shall be about 8 days."

c. Adhesion Test. This paint is subject to the adhesion test outlined in an earlier paragraph.

d. Samples. Except for batches of 10 gallons or less, samples of VZ-108d shall include separate samples of all ingredient materials.

2.1.4.4 Coal Tar Enamel Paint

This paint shall conform to that specified by AWWA C203 standards as manufactured with Type 1 pitch. Finished product samples submitted for approval shall be accompanied by a list showing all of its raw material ingredients, the name of the manufacturer of each, and the trade name and/or code designation by which the producer identifies his ingredient product.

2.1.5 Ingredient Materials and Thinners for Special Paint Formulations

The following ingredient materials apply only to those paints whose formulations are shown above in detail.

2.1.5.1 Pigments and Suspending Agents:

a. Aluminum Powder. Aluminum powder shall conform to FS TT-P-320, Type

1, Class 2.

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

c. Zinc Dust Pigment. Zinc dust pigment shall conform to ASTM D 520, Type I or II, except paint to be used in potable water tanks or as otherwise directed shall contain Type II pigment only.

d. Iron Oxide, Synthetic (Red). Iron oxide, (dry) synthetic (red), shall conform to ASTM D 3721. Additionally, 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 the specified vinyl paint formulation, the paint shall have colors approximating those produced by pigments R-2199 (light color) and R-6098 (dark color), products of Mineral, Pigments and Metals Division, Chas. Pfizer Co., 235 East 42nd Street, New York, NY 10017, and shall show no evidence of incompatibility or reaction between pigment and other components after 6 months storage.

e. Titanium Dioxide. The titanium dioxide in vinyl paint Formula V-766e shall be one of the following: Titanox 2160 or 2101, NL Chemicals; Ti-Pure 960, E. J. DuPont DeNemours and Co., Inc.; or Unitane OR-650, Kermira, Inc.

f. 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. Bentone 14, produced by the Pigments and Chemical Division, NL Industries, Inc., has these properties.

g. Suspending Agent F. Suspending Agent F shall be a light cream colored, finely divided powder having a specific gravity of approximately 1.70. It shall be an organic derivative of a special montmorillonite. Bentone 27, produced by the Pigments and Chemical Division, KL Industries, Inc., has these properties.

2.1.5.2 Resins, Plasticizers, and Catalysts

a. 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.

b. 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 the specified formulations, produce results equal to "Vinylitel" Resin VYHH as manufactured by the Union Carbide Corporation.

c. 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 disbasic 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.

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

2.1.5.3 Solvents and Thinners:

a. Methanol (Methyl Alcohol). Methanol (Methyl Alcohol) shall conform to ASTM D 1152.

b. Methyl Ethyl Ketone (MEK). Methyl Ethyl Ketone (MEK) shall conform to ASTM D 740.

c. Methyl Isobutyl Ketone (MIBK). Methyl Isobutyl Ketone (MIBK) shall conform to ASTM D 1153.

d. Methyl Isoamyl Ketone (MIAK). Methyl Isoamyl Ketone (MIAK) shall be of at least 97 percent purity, shall have a distillation of 139 C to 149 C and shall have specific gravity (at 20/200C) of 0.812 to 0.815. The acidity in 1 gram of the material shall have an acid number (ASTM D 1045) of not more than 20.

e. Toluene. Toluene shall conform to ASTM D 362.

f. Xylene. Xylene shall conform to ASTM D 846.

2.1.5.4 Silane B

Silane B for vinyl zinc-rich paint Formula V-108d shall be N-beta-(aminoethyl)-gamma-aminopropyltrimethoxysilane. Silane A-1120 produced by the Union Carbide Corporation, and Silane Z-6020 produced by Dow Chemical Company are products of this type.

PART 3 EXECUTION

3.1 CLEANING AND PREPARATION OF SURFACES TO BE PAINTED

3.1.1 General

Surfaces to be painted shall be clean 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 flashpoint 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. Machinery shall be protected against entry of blast abrasive and dust into working parts. 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 such manner as 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

3.1.2.1 Permanently Coated Ferrous Surfaces

Ferrous surfaces that are to be permanently and continuously in exterior or interior atmospheric exposure and other surfaces as directed shall be cleaned by means of power tools or by dry blasting to the brush-off grade. Cleaning and priming shall be done in or at the shop unless otherwise directed or permitted. Power tool cleaning shall conform to the requirements of SSPC SP 3. Brush-off blast cleaning shall conform to the requirements of SSPC SP 7. Irrespective of the overall cleaning method used, welds and adjoining surfaces within a few inches thereof shall be cleaned of weld flux, spatter, and other harmful deposits by blasting, power impact tools, power wire brush, or such combination of these and other methods as may be necessary for complete removal of each type of deposit. The combination of cleaning methods need not include blasting when preparation of the overall surfaces is carried out by the power tool method, but brush scrubbing and rinsing with clean water, after mechanical cleaning is completed, will be required unless the latter is carried out with such thoroughness as to remove all soluble alkaline deposits. Wetting of the surfaces during water-washing operations shall be limited to the weld area required to be treated, and such areas shall be dry before painting. Welds and adjacent surfaces cleaned thoroughly by blasting alone will be considered adequately prepared provided that weld spatter not dislodged by the blast stream shall be removed with impact or grinding tools. All surfaces shall be primed as soon as practicable after cleaning, but in any event prior to any contamination or deterioration of the prepared surfaces. To the greatest degree possible, steel surfaces shall be cleaned (and primed) prior to lengthy outdoor storage in order to minimize breakdown of mill scale and consequent rusting.

3.1.2.2 Ferrous Surfaces Subject to Extended periods of Immersion

Ferrous surfaces subject to extended periods of immersion or otherwise as required shall be dry blast cleaned to a grade approaching White Metal grade which shall be in accordance with SSPC SP 5, except that a limited relaxation from the uniform White Metal grade of surface cleanliness will be permitted, as described below. The metal shall be cleaned to such a degree that if a large surface were divided approximately into 6-inch squares, at least 75 percent of the subdivisions would meet the White Metal grade of cleanliness and the remaining subdivisions would be randomly distributed. Within these small, randomly distributed areas, a minor relaxation from White Metal cleanliness will be permitted, consisting only of very slight shadows, stains, and discolorations stemming from very thin, adherent, sparsely scattered residues of mill scale and corrosion products.

No relaxation from the White Metal grade will be permitted on surface irregularities such as edges, interior angles, welds, rivet lines, and junctions of joining members. The overall blasting effort expended shall be not less than two-thirds (2/3) of that which would be required to accomplish the White Metal grade of cleanliness on the specific surfaces involved, but this limitation shall not be construed as a waiver of any of the requirements above. 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 a grade approaching White Metal shall be done in the field and, unless otherwise specifically authorized, after final erection. Within 8 hours after cleaning and prior to the deposition of any detectable moisture, contaminants, or corrosion, all ferrous surfaces blast cleaned to a grade approaching White Metal shall be cleaned of dust and abrasive particles by brushing, vacuum cleaning, and/or blowdown with clean, dry compressed air, and given the first coat of paint. Upon written request, mill or shop

cleaning may be authorized of assembled or partially assembled components specified to receive one of the vinyl-type paint systems. The surfaces, if shop blasted, shall be shop coated with the first and second coats of the specified paint system except that the epoxy zinc-rich primed surfaces shall receive an extra single spray coat of the zinc primer at the time field painting is started as specified in the paint system instructions. The shop coating shall be maintained in good condition by cleaning and touching up on areas damaged during the construction period. Appearance of pinpoint or general rusting prior to application of field coats will be considered as evidence of poor workmanship, requiring reblasting and repainting. Prior to the field application of subsequent coats, soiled areas of the shop coating shall be thoroughly cleaned and all welds or other unpainted or damaged areas shall be cleaned and coated in such manner as to make them equivalent to adjacent, undamaged paint surfaces.

3.2 PAINT APPLICATION

3.2.1 General

The finished coating shall be free from holidays, pinholes, bubbles, runs, drops, ridges, waves, laps, unnecessary 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 at the surfaces to be coated are satisfactory or has waived specific verification. All paint coats shall be applied in such manner as to produce an even, continuous film of uniform thickness. Edges, corners, crevices, seams, joints, welds, rivets, 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 shall 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 power stirrers, be incorporated into the vehicle or base paint in such manner as to produce a smooth, homogeneous mixture free of lumps and dry particles. Where necessary, in the opinion of the Contracting officer, to suit conditions of surface, temperature, weather, and method of application, the packaged paint may be thinned immediately prior to use by the addition of not more than 1 pint per gallon of the proper thinner, provided that this general limitation shall not apply when more than specific thinning instructions are provided. Paint that has been stored at low temperature, shall be brought up to at least 70 degrees F before mixed and thinned, and its temperature in the spray tank or other working container shall not fall below 60 degrees F during application. Paint that has deteriorated in any manner to such 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 sampled and submitted for testing to determine its suitability for application.

3.2.3 Atmospheric and Surface Conditions

Paints shall be applied only to surfaces that are above the dewpoint temperature and that are completely free of moisture as determined by sight and touch. In no case shall any paint 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 above 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

3.2.5.1 General

Unless otherwise specified, paint shall be applied by brush or spray to ferrous and nonferrous metal surfaces. Special attention shall be directed toward ensuring adequate coverage of edges, corners, crevices, rivets, bolts, welds, and similar surface irregularities. Other methods of application to metal surfaces shall be subject to approval. All coats on plaster, concrete, or other nonmetallic surfaces shall be applied by brush, roller, spray, or a combination thereof provided that the latter methods, in the opinion of the Contracting Officer, produce films that are suitable in appearance and equivalent in quality to those obtained by brush application. Whenever application of paint by a special method to a surface is permitted or directed, it is to be understood that all areas inaccessible to that method shall be coated by alternate means.

3.2.5.2 Touch-Up Painting of Systems 2 and 16

a. General

Each item requiring repair by touch-up shall be cleaned and inspected by the Contractor to determine the type of deficiencies and the method of rehabilitation required. The method of paint rehabilitation will depend on whether the specific paint deficiency is only surface oriented or if it extends to base metal. The general guideline is if the paint deficiency is superficial only and is not detrimental to the long-term life of the coating, rework of the defect does not require sandblasting to base metal. If the deficiency extends through the coating to base metal or is the type of defect which will preclude a long-term life of the coating, the area shall be sandblasted to base metal. All weld splatter, existing or new, shall be removed. Final determination of method of rehabilitation shall be by the Contracting Officer.

b. Repair

The general conditioning of the overall item to receive touch-up paint shall be such as will give adequate surface adhesion as specified when the paint coating is applied. Adequacy of surface preparation preparatory to painting is subject to approval. The method of repair of surface deficiencies will vary considerably and will depend on the type and magnitude of the deficiency. Methods used shall be as follows:

1. Paint Deficiencies Which Do Not Extend to Base Metal.

(a) Pinholes, Bubbles, and Abrasions

Method One. After cleaning area with one or a mixture of vinyl paint thinners, thoroughly saturate the area with the thinner solution and daub the area with a stiff bristled brush so as to work the paint into the pinhole, bubble, or abrasion. Final paint applications to produce the specified mil thickness and/or number of coats required shall be spray or brush applied.

Method Two. Brush a heavy coat of one or a mixture of vinyl paint thinners onto the area, working it into the depressed area immediately followed by paint application using a short-nap roller, immediately followed by another brush application of thinner. The drying time of the thinner is very important in remedying pinhole, bubble, and abrasion deficiencies, therefore, the slower drying thinners will seep into the innermost voids and be more successful.

(b) Porous Surfaces

Fixing of porous surfaces which do not extend to base metal will vary with the magnitude and depth of the porosity. A misting spray of the thinner will melt the surface of a porous paint coating. The drying time of the thinner is very important in remedying porous paint coatings; slower drying thinners will seep into the innermost voids and be more apt to remedy the problem.

2. Paint Deficiencies Which Extend to Base Metal. Require sandblasting to a grade approaching white metal grade as previously specified, and careful attention since the edges of the remaining paint will be frayed and curled. Edges shall be hand steel brushed to remove the frays and curls, and immediately thereafter a heavy coat of one or a mixture of vinyl paint thinners shall be applied which shall be rubbed into the edge with lint free cotton rags. The surface shall then be painted to reach the required mil thickness for the first and second coat; then the final two top coats shall be applied to the entire surface.

3. Existing paint surfaces without deficiencies shall be prepared for application of the two top coats of the system. The surfaces, including the areas that did have deficiencies, but were touched up as specified above, shall comply with the following prior to application of the top final coat. All contaminants shall be removed as required by paragraph, "Inspection and Cleaning," by brushoff sandblasting using a very fine sand, low pressure, and a high nozzle-to-work distance. Due to the time element of when the areas were initially brushoff blast cleaned to when the top coating is to be applied, the surface treatment for preparation shall be reexamined and an air blast cleaning, a light brushoff blast cleaning, or mopping down with a ketone solvent and

immediately wiping off contaminants with a clean, dry, lint-free rag may be required. The final determination shall be by the Contracting Officer before the final top coat is applied.

3.2.5.3 Touch-Up Painting of Vinyl Paint Systems 3 and 4

Painted features designated to be touched up require work to remedy existing paint deficiencies. Touch-up painting is limited to areas of vinyl paint system Nos. 3 and 4 only. Paint deficiencies will vary considerably from feature to feature. Each item to be touched up shall be cleaned and inspected to determine the type of deficiencies and the method of rehabilitation required. The method of paint rehabilitation will depend on whether the specific paint deficiency is only surface oriented or if it extends to base metal. The general guideline is if the paint deficiency is superficial only and is not detrimental to the long-term life of the coating, rework of the defect does not require sandblasting to base metal. If the deficiency extends through the coating to base metal or is the type of defect which will preclude a long-term life of the coating, the area shall be sandblasted to base metal. All weld splatter, existing, or new, shall be removed. Final determination of method of rehabilitation shall be by the Contracting Officer. Blasted surface areas shall be wiped down with a clean cloth saturated with methyl ethyl ketone. The line of paint interfacing with the exposed base metal shall then be rubbed down vigorously to preclude curling of the edges.

3.2.5.4 Inspection and Cleaning

- a. Inspection of the surfaces of features requiring touch-up paint is required before and after cleaning.
- b. Preliminary inspection shall be made to identify areas that obviously need sandblasting to base metal. These include areas with rust nodules and/or rust showing through pinholes. These areas shall be permanently marked so they are still discernible after completion of the cleaning operation.
- c. Cleaning of the remaining area, excluding the areas defined above that will require sandblasting to base metal, shall be accomplished with a brushoff sandblast. The degree of cleanliness required is that all loose paint and contamination are removed.
- d. The paint coating shall be inspected after the cleaning to discern areas of paint deficiencies. Areas of paint deficiencies shall be marked. Separate marking system shall be used to distinguish between general surface deficiencies and deficiencies which require sandblasting to base metal. Upon completion of the inspection, the areas requiring sandblasting shall be noted. Where the required sandblasting for a specific plane area exceeds 40 percent of the area, the entire plane area shall be sandblasted and repainted all coats of paint as specified. The plane area noted above is defined as the surface area within the confines encompassed by breaks in the continuity of the section.

3.2.5.5 Preparation of Surfaces for Touch-Up Painting

- a. The general conditioning of the overall item to receive touch-up paint shall be such as will give adequate surface adhesion as specified when the paint coating is applied. Adequacy of surface preparation preparatory to painting is subject to approval.

b. The method of repair of surface deficiencies will vary considerably and will depend on the type and magnitude of the deficiency. Methods used shall be as follows:

1. Paint Deficiencies Which Do Not Extend to Base Metal.

(a) Pinholes, Bubbles, and Abrasions

Method One. After cleaning area with one or a mixture of vinyl paint thinners, thoroughly saturate the area with the thinner solution and daub the area with a stiff bristled brush so as to work the pain into the pinhole, bubble, or abrasion. Final paint applications(s) to product the specified mil thickness and/or number of coats required shall be spray or brush applied.

Method Two. Brush apply a heavy coat of one or a mixture of vinyl paint thimers onto the area, working it into the depressed area immediately followed by paint application using a short-nap roller, immediately followed by another brush application of thinner. The drying time of the thinner is very important in remedying pinhole, bubble, and abrasion deficiencies, therefore, the slower drying thinners will seep into the innermost voids and be more successful.

(b) Porous Surfaces

Fixing of porous surfaces which do not extend to base metal will vary with the magnitude and depth of the porosity. A misting spray of the thinner will melt the surf ace of a porous paint coating and will remedy the deficiency. The drying time of the thinner is very important in remedying porous paint coatings, therefore, slower drying thinners will seep into the innermost voids and be more apt to remedy the problem.

2. Paint Deficiencies Which Extend to Base Metal.

They require sandblasting to a grade approaching white metal grade as previously specified, and careful attention since the edges of the remaining paint will be frayed and curled. The exterior edge of the sandblasted area shall be done so as to produce gradual slope of the surrounding coating. Edges shall be hand steel brushed to remove the frays and curls, and shall immediately thereafter have a heavy coat of vinyl paint thinner applied or a mixture of vinyl paint thinners which shall be rubbed into the edge with lint free Cotton rags. The surfaces shall be painted to reach the required mil thickness for the first and second coat, then the final two top coats shall be applied to the entire surface.

3. Existing paint surfaces without deficiencies shall be prepared for application of the two top coats of the system. The surfaces, including the areas that did have deficiencies, but were touched up as specified above, shall comply with the following prior to application of the top final coat. All contaminants shall be removed as required by paragraph: Touch-Up Painting of Systems 2 and 16 by brushoff sandblasting using a very fine sand, low pressure, and a high nozzle-to-work distance. Due to the time element of when the areas were initially brushoff blast cleaned to when the top coating is to be applied, the surface treatment for preparation shall be reexamined and an air blast cleaning, a light brushoff blast cleaning or mopping down with a ketone solvent and immediately wiping off contaminants with a

clean, dry, lint free rag may be required. The final determination shall be by the Contracting Officer before the final top coat is applied. Painted surfaces adjacent to exposed metal (after blast cleaning) shall be tapered out smoothly in lieu of sharp lines or ridges.

3.2.6 Coverage and Film Thickness

3.2.6.1 General

The actual surface area covered per gallon of paint shall not exceed the spreading rates prescribed for specific paints. 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 the base surface and the finish coats shall completely hide undercoats of dissimilar color.

3.2.6.2 Measurements on Ferrous Metal

Where dry film thickness requirements are specified for coatings on ferrous surfaces, measurements shall be made with one of the thickness gauges listed. They shall be calibrated and used in accordance with ASTM D 1186. 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. The instruments shall be calibrated in the thickness range expected to be encountered and the range of accuracy determined. If thickness readings are encountered outside of the calibrated range, the instrument shall be recalibrated and measurements retaken. The instruments shall be calibrated or calibration verified prior to, during, and after each use. Authorized thickness gauges are as follows:

- a. Mikrotest, Elektro-Physik, Inc.
- b. Inspector Gauge, Elcometer Instruments, Ltd.
- c. Positest, Defelsko Corporation.
- d. General Electric, Type B, General Electric Company.
- e. Minitector, Elcometer Instruments, Ltd.
- f. Positector 2000, Defelsko Corporation.

3.2.6.3 Measurements on Nonferrous Metal

Where dry film thickness requirements are specified for coatings applied to nonferrous metal surfaces, measurements shall be made with one of the thickness gauges listed. They shall be calibrated in accordance with ASTM D 1400 on metal 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). The instruments shall be calibrated in the thickness range expected to be encountered and the range of accuracy determined. If thicknesses are encountered outside of the calibrated range for the instrument, the instrument shall be recalibrated and measurements retaken. The instruments shall be calibrated or calibration verified prior to during, and after each use. Authorized

thickness gauges are as follows:

- a. Positector 3000 (aluminum and copper only).
- b. Defelsko Corporation Minitector Model 250N, 150N, or 150FN.
- c. Elcometer Instruments, Ltd.

3.2.7 Progress of Painting Work

Where field painting on any type of surface 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, or foreign matter by means of airblast, solvent cleaning, or other suitable means. Cement and mortar deposits on painted steel surfaces, not satisfactorily removed by ordinary cleaning methods, shall be brush-off blast cleaned and completely repainted as required. 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. Field 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 riveted or 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 off 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 riveted or bolted contact with a metal surface, the contacting surfaces of the metal shall be prepared and coated as specified for the adjacent areas. Unless otherwise specified, corrosion-resisting metal surfaces including cladding therewith, and rubber seals shall not be painted.

3.2.9 Drying Time Prior to Wetting

3.2.9.1 Painted Surfaces Exposed to Water

Painted surfaces that are subject to be exposed to water shall be permitted a final drying time as long as practicable, but in any event the following minimum requirements shall be met: Epoxy systems shall not be allowed to become wet until the final coat has dried at least 5 days. Vinyl-type paint systems shall not be allowed to become wet except as noted below. Minimum drying periods may be required to be increased up to twofold if the drying temperature is below 65 degrees F and/or if the immersion exposure involves considerable abrasion.

3.2.9.2 Vinyl Paint Systems

Vinyl paint systems shall not be allowed to get wet until the final coat has dried at least 4 days based upon a 65 degrees F minimum temperature. The drying time shall double to 8 days from a 45 degrees F minimum temperature. Drying times for minimum temperatures between 65 degrees F and 45 degrees F shall be prorated on a straight line basis, i.e., at 55 degrees F the drying time shall be 6 days. Drying times for temperatures below 45 degrees F shall be 16 days.

3.2.9.3 Minimum Temperatures

The minimum temperatures referenced above, during the final drying time, shall be based upon the minimum temperatures incurred within any 12-hour period. The minimum temperatures used in determining drying times shall be based upon the minimum temperature incurred for a period of 1 hour, either consecutively or in part during the noted 12-hour period. A temperature reading device shall be provided and maintained that will automatically read temperatures adjacent to the structure for 30-minute increments while a paint coating is curing before immersion.

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 in the shop or field prior to final erection shall be stored out of contact with the ground in such manner and location as 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. The specified first overall field coat of paint shall be applied within a reasonable period after the shop coat and in any event before weathering of the shop coat becomes extensive.

3.2.11 Special Directions for Mixing and Applying 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. (See following subparagraphs for more specific thinning instructions.) Selection of thinners (see earlier paragraph for thinner code identification) for all vinyl paints shall be in accordance with Table I:

TABLE I
Approximate Ambient Air Temperature
Degrees F

Below 50	50 - 70	Above 70
MEK	MIBK	MIAC

The amount of thinner shall be varied to suit the specific paint and prevailing temperature and wind conditions, and shall at all times be sufficient 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 receiving surfaces is less

than 35 F nor when the receiving surfaces are higher than 125 degrees F. Each spray coat of vinyl paint contemplated by these specifications shall consist of a preliminary, extra spray pass on edges, corners, interior angles, seams, crevices, junctions of joining members, rivets, weld lines, and similar surface irregularities followed by an overall double spray coat (single spray coat for glass flake-containing formulas). 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 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. A single spray constitutes a coat for the vinyl paints containing glass flake. Rivets, bolts, and similar surface projections shall receive sprayed paint from every direction in order 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 at any time after the undercoat is tack free and firm to the touch provided that no speedup or delay in the recasting 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 (Formula VZ-108d)

Vinyl zinc-rich primer (Formula VZ-108d) is a three-component paint which must be field mixed. It is packaged as a 5-gallon kit consisting of 4.5 gallons of base paint (Component A), 27.5 pounds of zinc dust (Component C) packaged in a 1-gallon pail, and a 3-ounce bottle of Silane (Component B) placed on top of the zinc dust in the gallon pail. To prepare the primer for application, add the Silane to the base paint and stir thoroughly. 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 well dispersed and the mixture is smooth. The mixed paint shall at some point be strained through a 30 to 60 mesh screen to prevent undispersed zinc dust slugs from reaching the spray gun nozzle. 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 avoid deposition of particles that are semidry when they reach the surface. Where thinning is required, the appropriate thinner shall be selected from Table I. 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 an 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 the application of a VZ-108d zinc-rich coat before it receives a succeeding coat.

3.2.11.3 Vinyl Paints (Formulas V-102e and V-766e)

Vinyl paints (Formulas V-102e and V-766e) are ready mixed paints 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, they shall be thinned as necessary up to approximately 25 percent (1 quart per gallon of base paint) with the appropriate thinner shown in Table I; when ambient and steel temperatures are above normal, up to 40 percent thinning may be necessary for satisfactory application. V-766e paints containing field-added abrasive shall be applied only with conventional air-atomization spray equipment including an air driven stirrer capable of keeping the paint homogeneous.

3.2.12 Special Directions for Mixing and Applying Coal Tar Enamel

See AWWA C203 standards.

3.2.13 Painter and Quality Control Personnel

3.2.13.1 Experience

Painters shall be well versed and experienced in the use of painting equipment, preparation of the specified paints, and application of the specified paints. Deficiencies in any paint coating shall be removed and repainted. The painter or painters responsible will not be allowed to perform more painting until the Contractor demonstrates that the painter or painters are competent.

3.2.13.2 Contractor's Quality Control personnel

The Contractor's quality control personnel shall be experienced in paint inspection of the specified paints and methods of application proposed. Credentials of each quality control person that will be inspecting paint shall be furnished, showing the individual is versed in inspection techniques. Each quality control person shall have had training and experience in inspection of the specified paints heretofore specified.

3.2.14 Paint Records

Data shall be recorded on each coat of paint applied as follows:

- a. Date and time - start and finish
- b. Description of item painted
- c. Temperature of item to be painted (degrees F), start and finish
- d. Temperature of air in immediate area (degrees F), start and finish
- e. Average paint thickness
- f. Type and lot number of paint and paint manufacturer

- g. Name of painter and company
- h. Method of application
- i. Comments
- j. Dewpoint temperature, start and finish
- k. Drying time
- l. Type and amount of thinner(s) used
- m. Time between start and finish of surface preparation and start of painting

Temperature shall be recorded from the noted areas to portray the minimum and maximum range of temperature. The Contractor shall sign and date the data sheet after they have inspected the paint coating and is assured of its adequacy. The Contracting Officer shall then sign the data sheet when assured of the adequacy of the paint coating. The Contractor will not be permitted to apply the next coating of paint until a signature of the Contracting Officer is affixed to the data sheet. The Contractor shall utilize, but not be limited to, the following tools for inspection: a thickness gauge as specified herein and a pinhole tester equal to the model 169/2 pinhole tester manufactured by Zormco Electronics Corporation, and a magnifying glass. Instrumentation shall be provided to record, either directly or indirectly, dewpoint temperature, ambient temperature, and surface temperature of the item to be painted or a representative item as approved. The records of the above data shall be given to the Contracting Officer.

3.3 PAINT SYSTEMS TO BE APPLIED--NUMBER OF COATS AND FORMULAS

3.3.1 General

The required paint system and the surfaces to which they shall be applied are listed in this Section, Paragraph: Paint Systems and Painting Schedule. Contractor shall indicate paint systems on the shop drawings. Supplementary information follows:

3.3.1.1 Fabricated and Assembled Items

Items that have been fabricated and/or assembled into essentially their final form and that are customarily cleaned and painted in accordance with the manufacturer's standard practice will be exempted from equivalent surface preparation and painting requirements described herein, provided that: (a) surfaces primed (only) in accordance with such standard practices are compatible with specified field-applied finish coats; (b) surfaces that have been primed and finish painted in accordance with the manufacturer's standard practice are of acceptable color and are capable of being satisfactorily touched up in the field; and (c) items expressly designated herein to be cleaned and painted in a specified manner are not coated in accordance with the manufacturer's standard practice if different from that specified herein.

3.3.1.2 Colors and Tints

Colors and tints shall match the respective color specimens designated by, or shall otherwise be subject to approval. Where specified or directed,

alternate applications of successive undercoats having the same color shall be tinted with small amounts of lampblack or other approved ingredients, ground in a vehicle compatible with the paint being tinted, in order to ensure that all surfaces are properly coated with the specified number of paint coats. Tinting of vinyl-type paints shall be done only by the manufacturer.

3.3.1.3 Surface Preparation

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

3.3.2 Paint Systems and Painting Schedule

See paragraph: Supplementary Application instructions for supplementary application instructions pertaining to the following paint systems:

3.3.2.1 SYSTEM NO. 2

Items or surfaces to be coated: as noted on the drawings.

1. Surface Preparation: Power tool or brushoff blast cleaning.
2. First Coat: SSPC Paint 25.
3. Second Coat: FS-TT-P-38 (Aluminum)
4. Third Coat: FS-TT-P-38 (Aluminum)

3.3.2.2 SYSTEM NO. 3-A-Z

Items or surfaces to be coated: as noted on the drawings.

1. Surface Preparation: Approaching white metal blast cleaning.
2. First Coat: Vinyl zinc-rich VZ-108d (double spray coat).
3. Second Coat: White Vinyl V-766e (double spray coat).
4. Third Coat: Aluminum Vinyl V-102e (double spray coat).
5. Fourth Coat: Aluminum Vinyl V-102e (as needed to obtain required thickness).

3.3.2.3 SYSTEM NO. 4

Items or surfaces to be coated: as noted on the drawings.

1. Surface Preparation: Approaching white metal blast cleaning.
2. First Coat: White Vinyl V-766e (double spray coat).
3. Second Coat: Gray Vinyl V766e (double spray coat).
4. Third Coat: White Vinyl V766e (double spray coat).
5. Fourth Coat: Gray Vinyl V766e (double spray coat).

6. Fifth Coat: Gray Vinyl V766e (double spray coat).

NOTE: Gray vinyl paint color approximates color chip 26231 of FED-STD 595 (Color).

3.3.2.4 SYSTEM NO. 16

Items or surfaces to be coated: as noted on the drawings.

1. Surface Preparation: Power tool or brushoff blast cleaning.
2. First Coat: SSPC Paint 25.
3. Second Coat: FS TT-P-489 (Class A).
4. Third Coat: FS TT-P-489 (Class A).

3.3.3 Supplementary Application Instructions

Surfaces shall be coated with the system indicated in the schedule and/or as noted in accordance with the following instructions:

1. System No. 2. The first coat shall be brush or spray applied in the shop at a spreading rate not to exceed 600 square feet per gallon and touched up in the field as required to maintain its integrity at all times. The second and third coats of the system shall be applied in the field at a maximum spread rate of 450 square feet per gallon. Prior to applying field coats all field welds, other bare metal, and damaged areas of the shop-primed surfaces shall be cleaned and primed as previously specified except that application shall be by brush.
2. System No. 3-A-Z. This vinyl paint system shall be spray applied to an average dry film thickness of 6.0 mils for the completed system and the thickness at any point shall be not less than 5.0 mils. The approximate dry film thickness after application of the first and second double spray coats shall be 2.5 and 4.0 mils, respectively. The specified film thickness shall be attained in any event, and any additional coats needed to do so shall be applied at no additional cost to the Government. Attainment of the specified total 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, blisters, or voids in the dried film and 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 non-zinc paint shall be applied in any event. See safety provisions and special directions for applying vinyl-type paints.
3. System No. 4. This vinyl paint system shall be spray applied to an average dry film thickness of at least 7.5 mils for the completed system and the thickness at any point shall be not less than 6.0 mils. The specified total film thickness shall be attained in any event and any additional coats needed to do so shall be applied. Attainment of the specified film thickness in 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 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 shall be applied in any event. See safety provisions and

special directions for applying vinyl-type paints.

4. System No. 16. Finish color shall approximate color chip No. 16440 of FED-STD 595. No paint shall be applied to machine-finished surfaces. Pipe threading and cutting compounds shall be removed by solvent washing prior to application of paint to pipe surfaces.

3.4 PROTECTION OF NON-PAINTED ITEMS AND CLEANUP

Walls, equipment, fixtures, and all other items in the vicinity of the surfaces being painted shall be maintained free of damage by paint or painting activities. Prompt cleanup of any paint spillage and prompt repair of any painting activity damage shall be required.

-- End of Section --

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SECTION 09950

INORGANIC ZINC COATING

PART 1 GENERAL

1.1 GENERAL INFORMATION

This section covers all operations in connection with preparation of surfaces and application of the inorganic zinc coating to the specified steel items.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referenced to in the text by basic designation only. Latest versions shall be used.

FEDERAL STANDARDS (FED-STD)

FED-STD 141 (1985, Rev. C) Paint, Varnish, Lacquer and Related Materials: Methods of Inspection, Sampling and Testing

SSPC: THE SOCIETY FOR PROTECTIVE COATING (SSPC)

SSPC SP 10 (1994) Near White Blast Cleaning

1.3 SAMPLING AND TESTING

1.3.1 General

The Contractor shall submit materials from the coating manufacturer that are proposed to be used on this project in accordance with the specifications. Batches of the coating system which are proposed to be used shall be stored in an approved shelter on the project site or segregated at the source of supply sufficiently in advance of need date to allow 14 days for the sampling and testing. The Contracting Officer shall be notified when the coating system is available for sampling. Sampling of each batch will be witnessed by the Contracting Officer unless otherwise specified or directed. Samples of the coating system submitted for approval shall be clearly labeled to indicate formula or specification number and nomenclature, batch or lot number, batch quantity, date made, and project contract number. Testing of the coating system for compliance with the specifications will be performed in a Government-designated laboratory at no expense to the Contractor except that the cost of testing any sample representing material that replaces previous rejected material will be deducted from payments to the Contractor at the rate of \$400 for each replacement sample. An additional 14 days shall be allowed for retesting.

1.3.2 Testing

Except as otherwise indicated, inspection and tests will be performed in accordance with the applicable provisions of FED-STD 141.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Respiratory Protection Program; G

A copy of the proposed program.

SD-04 Samples

Samples of the Coating System; G

Samples shall include two unopened one gallon containers (normal minimum size) of the inorganic zinc coating material, sampled at the factory at the time of coating containerizing for testing. A smaller size sample, down to one-quart size, may be submitted provided that properties of the coating materials remain representative of the coating system. One set of two samples shall be furnished for each batch of each coat. Additional check samples may be taken at the job site at the Contracting Officer's discretion.

SD-07 Certificates

Coating System

Certificates of compliance that the materials meet the requirements specified; product data sheet for each component of the coating system and a material safety data sheet for each component of the coating system.

SD-09 Manufacturer's Field Reports

Coating Records

A copy of the coating records for each coat of inorganic zinc coating applied. The records shall be submitted with information similar to that submitted for paint records; see SECTION 09940: PAINTING HYDRAULIC STRUCTURES AND APPURTENANT WORKS.

1.5 SAFETY PROVISIONS

The Contractor shall meet all safety provisions of the latest version of EM 385-1-1 and the provisions published by the manufacturer for storage, handling, application preparation, use of and drying of this coating system.

1.6 APPROVED SOURCES

The following products have been determined to comply with specification requirements for waterborne inorganic zinc-rich primers used in

undercoating properly prepared structural steel in transportation maintenance and construction projects.

1. Inorganic Coatings, Inc. (800) 345-0531; IC 531 Inorganic Zinc-Rich Primer
2. Valspar Corporation(818) 334-8251; MZ-6 Hi-Ratio Inorganic Zinc-Rich Primer
3. Devoe Coatings Co.(504) 272-2470; Cathacote 309 Water-Based Inorganic Zinc Coating
4. DuPont Coatings Co. (800) 346-4748; Ganicin 347WB Water-Based Inorganic Zinc
5. Ameron, Protective Coatings Division (800) 255-1264; Diomecote 21-7 Water-Based Inorganic Zinc Silicate

The effective period for this list is indeterminate. Other products will be considered for inclusion on this list subject to evaluation and approval.

PART 2 PRODUCTS

2.1 GENERAL

The coating system for all steel surfaces to be coated on this project shall incorporate a National Aeronautics and Space Administration (NASA) formulated water- based high-ratio potassium silicate inorganic zinc coating.

2.2 COLOR

The color shall be a grey naturally obtained from the required pigmentation.

2.3 INGREDIENTS

The coating system supplied for this project shall conform to the following minimum requirements:

Zinc in dry film:	85 percent by weight
Solids:	74 percent by weight 65 percent by volume
Thinner:	Water
Drying Time To Touch:	15-45 minutes
Drying Time To Topcoat:	2 hours
Heat Resistance:	725 degrees F continuous
VOCs:	0

PART 3 EXECUTION

3.1 CLEANING AND PREPARATION OF SURFACES TO BE COATED

3.1.1 Cleaning

Surfaces to be coated with inorganic zinc coating system shall be clean before abrasive blasting and before applying the coating system. The removal of oil and grease shall be accomplished without the use of solvents.

3.1.2 Surface Preparation

The steel surfaces to be coated with the inorganic zinc coating shall be abrasive blasted to an SSPC SP 10, near white blast. Welds and adjoining surfaces within a few inches thereof shall be cleaned of weld flux, splatter and other harmful deposits as may be necessary for complete removal of each type of deposit.

3.2 COATING APPLICATION

3.2.1 General

The finished coating shall be free from holidays, pinholes, bubbles, runs, drops, ridges waves, laps, unnecessary marks and variations in color, texture and appearance. All coating shall be applied in such a manner as to produce an even, continuous film of uniform thickness. Edges, corners, crevices, seams, joints, welds and other surface irregularities shall receive special attention to ensure that they receive an adequate thickness of coating. Spray equipment shall be equipped with traps and separators and where appropriate, mechanical agitators, pressure gauges, pressure regulators, screens, or filters. Air caps, nozzles and needles shall be as recommended by the spray equipment and/or the coating manufacturer for the material being applied. Airless-type equipment shall not be used without written approval of the Contracting Officer.

3.2.2 Mixing and Thinning

The coating system shall be thoroughly mixed, strained where necessary, and kept at a uniform composition and consistency during application. The zinc pigment dust shall, with the aid of power stirrers, be incorporated into the vehicle in such a manner as to produce a smooth, homogenous mixture free of lumps and dry particles. Where necessary to suit conditions of surface, temperature, weather and method of application, the packaged coating system may be thinned with water according to the coating system manufacturer's recommendations.

3.2.3 Atmospheric and Surface Conditions

The coating system shall be applied only to surfaces that are at least 5 degrees F above the dew point and that are completely free of moisture as determined by sight and touch. Also the surface and ambient temperatures must be at least 40 degrees F during the application period and until the coating is dry and hard. During periods of inclement weather, the coating system may be applied by enclosing the surfaces and applying artificial heat, provided the minimum temperatures and surface dryness requirements specified above are maintained. The coating system shall not be applied to surfaces, heated by the direct sunlight or other sources, at temperatures that will cause detrimental effects to the film. The first layer of the coating system shall be dry and hard before applying the topcoat layer.

3.2.4 Time Between Surface Preparation and Application of Coating System

Surfaces that have been cleaned and/or otherwise prepared for application of the coating system shall be coated as soon as practicable after such

preparation in accordance with the coating manufacturer's recommendations.

3.3 COATING THICKNESS

The coating system shall be applied with total minimum thickness of 6 mils in two coats.

3.4 COATING RECORDS

Data shall be recorded for each layer of coating system applied. Provide same type of information as shown for paint records in SECTION 09940: PAINTING HYDRAULIC STRUCTURES AND APPURTENANT WORKS.

3.5 PROTECTION OF SURROUNDING AREA

Walls slabs, fixtures, and all other items in vicinity of surfaces being coated shall be maintained free of damage from the coating activities. Prompt cleanup of spillage and prompt repair of any coating activity damage shall be required.

-- End of Section --