PROTECTIVE COATINGS FOR WELDED STEEL RESERVOIRS

I. STANDARDS

A. GENERAL

1. Scope - The work of this section involves the coating of all interior surfaces including, but not limited to the shell, roof framing, roof plates, columns, floor, piping, manways, and ladders; and involves the painting of all exterior surfaces including, but not limited to, the shell, roof, manways, ladders (including cage and door), hatches, vents, and exposed piping.

2. Related Work Specified Elsewhere-
   a. Painting of Buried Ferrous Metal Surfaces
   b. Painting of Wood, Concrete, Masonry Surfaces
   c. Construction of Welded Steel Reservoirs

3. Reference Specifications and Standards - Without limiting the general aspect of the requirements of these specifications, all work shall conform to the applicable requirements of the American Water Works Association Standard D102 and the Steel Structures Painting Manual, Volume 2 - Systems and Specifications, latest revision, published by Steel Structures Painting Council, and the manufacturer's recommendations.

4. Contractor - The Contractor shall hold a current state contracting license and have a successful history in the application of specified products to surfaces of steel standpipes, reservoirs, or elevated tanks for water storage. Upon request, he shall substantiate this requirement by furnishing a list of references.

5. Contractor Submittals - The Contractor shall submit color charts for all finish paint materials, and product data sheets and material safety data sheets for all paint materials specified.

6. Quality Assurance -
   a. Surface Preparation - Surface preparation will be based upon comparison with "Visual Standard for Abrasive Blast Cleaned Steel," SSPC-Vis 1 89.
   b. No coating or paint shall be applied to wet or damp surfaces, in rain, snow, fog, or mist, when the steel temperature or surrounding air temperature is less than 5 degrees above the dew point, nor in conditions not recommended by the manufacturer.

      If such conditions are prevalent, coating or painting shall be delayed or postponed until conditions are favorable. The day's coating or painting

shall be completed in time to permit the film sufficient drying time prior to damage by atmospheric conditions.

c. Dehumidification - Contractor shall provide dehumidification of the tank interior during the entire time when surface preparation and coating application is performed. The contractor shall use a dehumidifier capable of 2 complete air changes per hour and capable of maintaining a relative humidity of 35%.

d. Sealing of Roof Plate Lap Joints on the Tank Interior - The roof plate lap joints and the roof/shell (or roof/knuckle) junction shall be sealed with Sikaflex 1a sealant as manufactured by the Sika Corporation or approved equal.

e. Thickness and Holiday Checking - Thickness of coatings and paint shall be checked with a non-destructive, magnetic type thickness gauge. Coating integrity of all interior coated surfaces shall be tested with an approved holiday detection device. Non-destructive holiday detectors shall not exceed 100 volts nor shall destructive holiday detectors exceed the voltage recommended by the manufacturer of the coating system. For thicknesses between 10 and 20 mils (0.25mm and 0.50mm) a non-sudsing type wetting agent such as Kodak Photo-Flo, shall be added to the water prior to wetting the detector sponge. All pinholes shall be marked, repaired in accordance with the manufacturer's printed recommendations and re-tested. No pinholes or other irregularities will be permitted in the final coating. Holiday detection devices shall be operated in the presence of a representative of the Owner, if any.

   In cases of dispute concerning film thickness, measurements made with instruments shown to be in calibration with the National Bureau of STANDARDS calibration plates shall predominate.

f. Inspection Devices - Until final acceptance of coating and painting, the Contractor shall furnish and make available to the Owner's representative inspection devices in good working condition for detection of holidays and measurement of dry film thickness of coating and paint. The contractor shall also furnish U.S. Department of Commerce, National Bureau of Standards certified thickness calibration plates to test accuracy of dry-film thickness gauge. All inspection devices shall be in good working order.

g. Acceptable Devices - Acceptable devices include, but are not limited to K-D "Bird Dog" non-destructive holiday detector and Tinker-Rasor Model M-1 for coating to 20 mils (0.50mm) dry film thickness; Tinker-Rasor Model AP and AP-W holiday detectors for coatings in excess of 20 mils (0.50mm) dry film thickness; and "Inspector" units, or equal, for dry film

thickness gauging. Inspection devices shall be operated in accordance with the manufacturer's instructions.

h. Warranty Inspection - The Owner shall conduct the warranty inspection during the eleventh month following completion or placement into service of all coating and painting work required by this section. All defective work shall be repaired in accordance with the manufacturer's recommendation and the satisfaction of the Owner in order to bring the defective areas up to the quality level of the original work required by this specification.

7. Safety and Health Requirements - In accordance with the requirements set forth by regulatory agencies applicable to the construction industry and in accordance with the manufacturer's printed instructions and appropriate technical bulletins and manuals, the Contractor shall provide and require use of personal lifesaving equipment for persons working on or about the site.

As a minimum, personal lifesaving equipment shall properly address protection of those persons in the following categories:

Head and Face Protection
Respiratory Devices
Ventilation
Sound Levels
Illumination
Temporary Ladders and Scaffolding

II. PRODUCTS

A. GENERAL

1. All materials shall be delivered to the jobsite in their original, unopened containers bearing the manufacturer's name, brand and batch number. Requests for material substitutions must be made and approved in writing.

2. All coatings and paints shall be stored in enclosed structures when necessary to protect them from weather and excessive heat or cold. Flammable coatings or paints must be stored to conform to City, County, State, and Federal safety codes for flammable coating or paint materials. All coatings shall be protected from freezing.

3. All materials used for surface preparation, priming, and coating shall meet the requirements of all applicable Local, State, and Federal air regulatory agencies.

B. INTERIOR AND EXTERIOR COATING MATERIALS

Material shall conform to the following requirements:

1. Coating materials shall be suitable for the intended use. The manufacturer shall recommend their materials for the intended service. Interior immersion coatings must be on the current USEPA or NSF Standard 61 list for potable water coatings and meet all requirements of the State Health Department.

2. Only high-grade products of manufacturers having an established good reputation in the manufacture of quality protective coatings shall be used.

3. Materials shall be used within the manufacturer's recommended shelf life unless otherwise approved in writing by the manufacturer.

4. Where practicable, each succeeding coat of paint shall be of a different color, shade, or gloss. Where a particular finish color is specified herein, it is for bidding purpose only. The Engineer shall select the exterior finish color from the manufacturer's standard color sheets.

5. Where alternate products are specified, selection from among the alternates is at the Contractor's option.

6. The Contractor may submit for consideration paint materials of manufacturer's other than those specified herein. The Contractor shall provide satisfactory documentation from the firm manufacturing the proposed material that the material meets the specified requirements and is equivalent to or better than the listed materials in the following properties.

    a. Quality
    b. Durability
    c. Resistance to abrasion and physical damage
    d. Life Expectancy
    e. Ability to recoat in future
    f. Solids content by volume
    g. Dry film thickness per coat
    h. Compatibility with other coatings
    i. Suitability for the intended service
    j. Resistance to chemical attack
    k. Temperature limitations in service and during application
    l. Type and quality of recommended undercoats and topcoats
    m. Ease of Application
    n. Ease of repairing damaged areas
    o. Stability of colors

7. Materials and processes for hot-dip galvanized products shall conform to ASTM A-123.

C. DISINFECTION MATERIALS

Disinfection materials shall conform to the requirements of AWWA Standard C652, latest revision.

III. EXECUTION

A. GENERAL

1. All coating and painting shall conform to applicable standards of the Steel Structures Painting Council Manual.

2. Work shall be performed by skilled craftsmen qualified to perform the specified work in a manner comparable with the best standards of practice. Continuity of personnel shall be maintained and transfers of key personnel shall be coordinated with Owner's representative.

3. The Contractor shall provide a supervisor at the worksite during cleaning and application operations. The supervisor shall have the authority to coordinate work and make decisions pertaining to fulfillment of their contract.

4. Dust, dirt, oil, grease or any foreign matter that will affect the adhesion or durability of the finish must be removed.

5. Coating and painting systems include surface preparation, prime coating and finish coatings. All prime coatings may be shop applied or field applied. As indicated elsewhere in this section, some prime coatings must be applied prior to erection. The Contractor shall provide a prime coat compatible with the finish coat as specified.

Any prime coatings that are damaged or contaminated during fabrication, transportation, or erection shall be thoroughly cleaned and touched up in the field as specified. The Contractor shall use repair procedures that insure the complete protection of all adjacent primer. The specified repair method and equipment may include wire brushing, hand or power tool cleaning or dry air blast cleaning as permitted by the coating manufacturer. In order to prevent injury to surrounding painted areas blast cleaning may require use of lower air pressure, smaller nozzle, smaller abrasive particle sizes, short blast nozzle distance from surface, shielding and masking. If damage is too extensive or uneconomical to repair, the item shall be re-cleaned and coated or painted as necessary to provide a quality coating.

6. The Contractor's coating and painting equipment shall be designed for application of materials specified and shall be maintained in first class working condition. Compressors shall have suitable traps and filters to remove water and oils from the air.

7. Application of the first coat shall follow surface preparation and cleaning. Any cleaned areas showing surface contamination prior to application of the first coat shall be re-cleaned prior to application of first coat.

8. The Contractor shall employ forced air ventilation during the application of interior coatings. After completion of the interior coatings, proper curing procedures shall be followed. Adequate cure time shall be allowed prior to performing disinfection and prior to filling the tank for the leak test.

B. SURFACE PREPARATION

1. General - The latest revision of the following surface preparation specifications of the Steel Structures Painting Council shall form a part of this specification by reference:

SSPC-SP 1	:	SOLVENT CLEANING
SSPC-SP 2	:	HAND TOOL CLEANING
SSPC-SP 3	:	POWER TOOL CLEANING
SSPC-SP 5	:	WHITE METAL BLAST CLEANING
SSPC-SP 6	:	COMMERCIAL BLAST CLEANING
SSPC-SP 7	:	BRUSH-OFF BLAST CLEANING
SSPC-SP 10	:	NEAR WHITE BLAST CLEANING
SSPC-SP 11T	:	POWER TOOL CLEANING TO BARE METAL

In case of questions about the quality of blast cleaning provided, the SSPC blasting standards for visual comparison and the corresponding definitions shall be consulted.

2. Slag and weld metal accumulation not removed by the tank fabricator, erector, or installer shall be removed by chipping or grinding. All sharp edges shall be peened, ground or otherwise blunted as recommended by the coating manufacturer.

3. Field blast cleaning for all surfaces shall be with dry abrasive unless otherwise approved.

4. Maximum particle size of abrasives used in blast cleaning shall be that which will produce a profile in accordance with recommendations of the manufacturer of the specified coating system.

5. Abrasive used in field blast cleaning operations shall be new and free of contaminants that would interfere with adhesion or performance of the coating system. For unconfined blasting operations, abrasives shall meet air quality board regulatory requirements. Abrasives shall not be reused unless they are free of contamination that would be detrimental to the adhesion or performance of the coating system.

6. During blast cleaning operations, caution shall be exercised to insure that existing coatings or paint are not exposed to abrasion from blast cleaning. Any existing coatings thus damaged shall be restored to their previous state.

7. The Contractor shall keep the area of his work in a clean condition and shall not permit blasting materials to accumulate and constitute a nuisance or hazard to the prosecution of the work or operation of the existing facilities.

8. If necessary, blast-cleaned surfaces shall be dry cleaned prior to application of specified coating or paint. No coating or paint shall be applied over damp surfaces.

C. APPLICATION

1. Coating and paint application shall conform to the requirements of Steel Structures Painting Council Painting Application Specification SSPC-PA-1, latest revision for "Shop, Field and Maintenance Painting".

2. Thinning shall be permitted as recommended by the manufacturer for the conditions of application.

3. Each application of coating or paint shall be applied evenly, free of sags and runs, with no evidence of poor workmanship. Care shall be exercised to avoid lapping on glass or hardware. Coating and paint shall be sharply cut to lines. Finished surfaces shall be free from defects or blemishes.

4. If required to prevent damage, protective coverings or drop cloths shall be used to protect floors, fixtures and equipment. Care shall be exercised to prevent coating or paint from being spattered onto surfaces that are not to be coated or painted. Surfaces from which materials cannot be removed satisfactorily shall be recoated or repainted to produce a finish satisfactory to the Owner.

5. When two coats of coating or paint are specified, the first coat shall contain sufficient approved color additive to act as an indicator of coverage or the two coats must be of contrasting color, shade or gloss.

6. All material shall be applied in accordance with the manufacturer's recommendations and these specifications.

7. At least one spray-brush coat shall be applied to irregular interior surfaces such as unusually rough welds or corners.

8. Where the number of coats or dry film thickness is specified, they shall be considered a minimum. The Contractor shall apply additional coats as necessary to achieve the specified dry film thickness.

D. INTERIOR AND EXTERIOR COATINGS

1. SCOPE
This section covers shop applied primers and field applied coatings for interior and exterior surfaces of welded steel reservoirs for storage of potable water.

2. COATING PROCEDURES
Coating procedures and recoat cycles are critical. It is imperative that the manufacturer's recommendations be strictly followed. The manufacturer must approve any deviation from their printed literature prior to starting alternate procedures.

3. SURFACES WHICH MUST BE BLASTED AND PRIMED PRIOR TO ERECTION
The following surfaces shall be completely blasted and primed prior to erection: both sides of roof plates, all surfaces of rafters and girders, column caps, mating surfaces of bolted connections of the roof structure, other areas of the roof made inaccessible after erection. These surfaces shall be prepared and primed prior to erection as specified in paragraphs 6 and 7, COATING SYSTEMS.

4. SURFACES WHICH MAY BE BLASTED AND PRIMED PRIOR TO ERECTION
At the Contractor's option, the following surfaces may be either blasted and primed prior to erection, or blasted and primed after erection: interior and exterior of shell plates, interior and exterior of knuckles on knuckle roof tanks, the bottom plates of the reservoir, roof supporting columns. Areas other than those specifically mentioned may be cleaned and primed prior to erection upon approval from the engineer. These surfaces shall be prepared and primed as specified in paragraph 6 and 7, COATING SYSTEMS.

5. SURFACES NOT TO BE PAINTED
Though it is the intent of this specification to properly protect all tank surfaces, it is not a requirement to perform any surface preparation, priming, or coating on the underside of the reservoir bottom plates or on the interior surfaces of the tank overflow.

COATING SYSTEMS

Following are descriptions of the various coatings to be applied, locations of application, number and thickness of coats to be applied, quality of surface preparation required, and the total system thickness. These requirements are considered to be the minimum acceptable. The Contractor shall apply additional coats as necessary to achieve the specified minimum dry film thickness.

6. COATING SYSTEMS FOR INTERIOR RESERVOIR SURFACES

6a. UNDERSIDE OF ROOF PLATES, ALL SURFACES OF RAFTERS AND GIRDERS, COLUMN CAPS, CONTACT SURFACES OF BOLTED CONNECTIONS OF THE ROOF STRUCTURE, AND INTERIOR AREAS WHICH WILL BE MADE INACCESSIBLE AFTER ERECTION.

SURFACE PREPARATION: All surfaces shall be prepared prior to erection, in the shop or in the field, in accordance with SSPC-SP10 near white blast cleaning.

PRIMING: After proper surface preparation, all surfaces shall receive a coat of epoxy to a dry film thickness of two (2) mils. If desired for construction purposes, edges of parts to be welded in the field may have the coating held back from the edge or tapered to a thinner film thickness near the edge. The color for this coat shall be red or other suitable color. Specified accessories shall be hot-dip galvanized.

TREATMENT: All surfaces which were hot-dip galvanized shall be treated as required by the coating manufacturer prior to the application of touchup and finish coatings.

FIRST FIELD COAT: After erection, all exposed surfaces damaged or contaminated during fabrication, transportation, or erection or prior to painting shall be prepared in accordance with the manufacturer's instructions. All surfaces shall then receive a coat of epoxy to a dry film thickness of approximately five (5±) mils. The color of this coat shall be beige or other suitable color.

FINISH: After observing proper recoat cycle and surface condition, apply one coat of epoxy to a dry film thickness of approximately five (5±) mils. The color of this coat shall be white.

TOTAL SYSTEM: The total coating system for the exposed surfaces of these areas shall achieve a minimum dry film thickness of twelve (12) mils.

6b. INTERIOR PRE-PRIMED SURFACES NOT INCLUDED IN SUBSECTION 6a ABOVE

SURFACE PREPARATION: All surfaces shall be prepared, either in the shop or in the field, in accordance with SSPC-SP10 near white blast cleaning.

PRIMING: After proper surface preparation, all surfaces shall receive a coat of epoxy to a dry film thickness of two (2) mils. If desired for constructions purposes, edges of parts to be welded in the field may have the coating held back from the edge or tapered to a thinner film thickness near the edge. The color for this coat shall be red or other suitable color.

FIRST FIELD COAT: After erection, all exposed surfaces damaged or contaminated during fabrication, transportation, or erection or prior to painting shall be prepared in accordance with the manufacturer's instructions. All surfaces shall then receive a coat of epoxy to a dry film thickness of approximately five (5±) mils. The color of this coat shall be beige or other suitable color.

FINISH: After observing proper recoat cycle and surface condition, apply one coat of epoxy to a dry film thickness of approximately five (5±) mils. The color of this coat shall be white.

TOTAL SYSTEM: The total coating system for the exposed surfaces of these areas shall achieve a minimum dry film thickness of twelve (12) mils.

6c. INTERIOR SURFACES NOT PRE-PRIMED

SURFACE PREPARATION: All exposed surfaces shall be prepared in accordance with SSPC-SP10 near white blast cleaning.

PRIMING: After proper surface preparation, all surfaces shall receive a coat of epoxy to a dry film thickness of approximately six (6±) mils. The color of this coat shall be beige or other suitable color.

FINISH: After observing proper recoat cycle and surface condition, apply one coat of epoxy to a dry film thickness of approximately six (6±) mils. The color of this coat shall be white.

TOTAL SYSTEM: The total coating system for the exposed surfaces of these areas shall achieve a minimum dry film thickness of twelve (12) mils.

7. COATING SYSTEMS FOR EXTERIOR RESERVOIR SURFACES

7a. EXTERIOR GALVANIZED ACCESSORIES AND EXTERIOR SURFACES OF THE SHELL AND ROOF

SURFACE PREPARATION: All surfaces shall be prepared, either in the shop or in the field, in accordance with SSPC-SP10 near white blast cleaning.

PRIMING: Prior to erection and after proper surface preparation, the topside of roof plates shall receive a coat of epoxy to a minimum dry film thickness of two (2) mils. Either prior to or after erection and after proper surface preparation, exterior surfaces of the shell shall receive a coat of epoxy to a minimum dry film thickness of two (2) mils. If desired for construction purposes, edges of ports to be welded in the field may have the coating held back from the edge or tapered to a thinner film thickness near the edge. The color of this coat shall be red or other suitable color. Specified accessories shall be hot-dip galvanized.

TREATMENT: All surfaces which were hot-dip galvanized shall be treated as required by the coating manufacturer prior to the application of touchup and finish coatings.

FIRST FIELD COAT: After erection, all exposed surfaces damaged or contaminated during fabrication, transportation, or erection or prior to painting shall be prepared in accordance with the manufacturer's instructions. All surfaces shall then receive a coat of epoxy to a dry film thickness of approximately two (2$\pm$) mils. This coat shall be tinted so that the exterior finish coat will cover in one coat.

FINISH: After observing proper recoat cycle and surface condition, apply one coat of polyurethane to a minimum dry film thickness of two (2) mils. This coat shall be in the exterior finish color selected by the owner.

TOTAL SYSTEM: The total coating system for these surfaces shall achieve a minimum dry film thickness of six (6) mils.

7b. EXTERIOR SURFACES AND ACCESSORIES NOT INCLUDED IN 7a ABOVE

SURFACE PREPARATION: All surfaces shall be prepared in accordance with SSPC-SP10 near white blast cleaning.

PRIMING: After proper surface preparation, all surfaces shall receive one or more coats of epoxy to a dry film thickness of approximately four (4$\pm$) mils. This coat shall be tinted so that the exterior finish coat will cover in one coat.

FINISH: After observing proper recoat cycle and surface condition, all surfaces shall receive a coat of polyurethane to a minimum dry film thickness of two (2) mils. This coat shall be in the exterior finish color selected by the Owner.

TOTAL SYSTEM: The total coating system for these surfaces shall achieve a minimum dry film thickness of six (6) mils.

E. CLEAN-UP - Upon completion of the work, all staging, scaffolding, containers, rubbish, and waste coating material shall be removed from the site or destroyed in a manner approved by the Owner. Coating or paint spots and oil or stains upon adjacent surfaces shall be removed and the job site cleaned. All damage to surfaces resulting from the work of this section shall be cleaned, repaired or refinished to meet the requirement of this specification at no cost to the Owner.

F. OMISSION - Care has been taken to delineate herein those surfaces to be painted and those surfaces not to be painted. However, if painting requirements have been inadvertently omitted from this section or other sections of these specifications, it is intended that all exposed ferrous metal surfaces, unless specifically exempted herein, shall receive first class protective coating equal to that given the same type of surface pursuant to these specifications.

G. DISINFECTION - Disinfection of interior surfaces shall be performed in the presence of the Engineer in accordance with all the requirements of applicable regulatory agencies. Disinfection shall be performed after protective coatings have been applied to the interior surfaces. Prior to disinfecting, the complete interior shall be washed down with clean water and thoroughly flushed out. Disinfection shall be accomplished by one of the methods outlined in AWWA C652, latest edition. Chlorine solution accumulated on the bottom shall be drained to waste. Rinsing with clear water after disinfecting is not required.

H. BACTERIOLOGICAL AND VOC TESTING - After the disinfection and hydrotesting procedures are completed and before water from the storage facility is released to the distribution system, water from the facility shall be sampled and tested for bacteriological and volatile organic compound (VOC) levels. These tests shall be conducted by the owner.

I. ACCEPTANCE AND WARRANTY - The reservoir coating work shall be deemed accepted when the reservoir coatings have been cured, and the reservoir disinfected and filled for water sampling the owner, or thirty days from completion of curing and disinfection, whichever is later. The acceptance by the Owner of the completed work as specified herein is subject to the Contractor's warranty for the completed work against defects in materials or workmanship furnished by the Contractor for a period of one year from the date of acceptance of the work.

*** END OF SECTION ***

TYPICAL PAINT SYSTEM SUMMARY *

LOCATION	PRIOR TO ERECTION	FIELD APPLICATION
Interior Floor, Shell, Roof, Knuckle, Structure, Columns and Accessories	Blast :SSPC-SP10 Prime : Epoxy coating 1 coat to 2 mils	Touchup Blast : SSPC-SP10 Touchup and Intermediate Coat: Epoxy coating Intermediate coat areas to 5 mils ± Touchup/Intermediate area to 7 mils± Finish : Epoxy coating 1 coat to 5 mils ± TOTAL SYSTEM: 12 MILS MDFT
Exterior Roof, Shell Knuckle and Accessories	Blast : SSPC-SP10 Prime : Epoxy coating 1 coat to 2 mils	Touchup Blast : SSPC SP10 Touchup and Intermediate Coat: Epoxy coating Intermediate coat areas to 2 mils ± Touchup intermediate area to 4 mils± Finish : Polyurethane coating 1 coat to 2 mils TOTAL SYSTEM : 6 MILS MDFT

* Notes:

1) This summary is provided for convenience only. The specifications shall govern the actual performance of the work.
2) MDFT represents Minimum Dry Film Thickness.
3) The number of coats represented here is the minimum required. Additional coats shall be applied as necessary to achieve the minimum dry film thickness specified.

MATERIAL SPECIFICATIONS

INTERIOR EPOXY*

TNEMEC	:	V140F
DEVOE	:	233H

EXTERIOR EPOXY

TNEMEC	:	V140F
DEVOE	:	231

POLYURETHANE

TNEMEC	:	1075
DEVOE	:	378

* NOTES:
- All coatings must meet applicable air regulatory board requirements.
- Interior epoxies must be on the current USEPA or NSF Standard 61 list for potable water coatings and meet all requirements of the State Health Department