

NORTH MARIN WATER DISTRICT
 TECHNICAL SPECIFICATION
 FOR
 DESIGN, FABRICATION AND ERECTION OF
 A WELDED STEEL WATER STORAGE TANK
 SPECIFICATION T-1

2	11/10/05	ADD SCREEN REQUIREMENTS	DSJ	DM	DM
1	04/13/94	REVISED AND REISSUED FOR CONSTRUCTION	JH	EMSR	CD
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REV	DATE	DESCRIPTION	BY	CHK	APP

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1.0 SCOPE

1.1 Scope Covered By This Specification

This Specification applies to the furnishing of all plant, labor, equipment and materials as shown on the design drawings, and as further specified herein, including, but not limited to:

- 1.1.1 Design, fabrication, erection, inspection and testing of a flat-bottom, welded steel water storage tank in accordance with AWWA D100 with all appurtenances, braces and structural members.
- 1.1.2 Design and construction of a concrete ringwall foundation for a flat-bottom welded steel water storage tank in accordance with AWWA D100.

1.2 Scope Not Covered By This Specification

This Specification does not apply to the following items:

- 1.2.1 Site grading and earthwork for a tank site.
- 1.2.2 Surface preparation and painting of tank surfaces.
- 1.2.3 Corrosion protection for a tank.
- 1.2.4 Disinfection of a tank.

2.0 ABBREVIATIONS

AC	Alternating Current
ACI	American Concrete Institute
API	American Petroleum Institute
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
CAL/OSHA	State of California, Department of Industrial Relations, Division of Occupational Safety and Health
DC	Direct Current

NEC	National Electric Code
NEMA	National Electrical Manufacturer's Association
NMWD	North Marin Water District
SSPC	Steel Structures Painting Council
UBC	Uniform Building Code

3.0 REFERENCED CODES AND STANDARDS

Unless otherwise specified herein or shown on the drawings, work under this Specification shall be performed in accordance with the following codes and standards in force on the date of award of the Contract to which this Specification is a part thereof:

ACI 301	Specifications for Structural Concrete for Buildings
API 650	Welded Steel Tanks for Oil Storage
ASTM D1751	Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
AWWA D100	Welded Steel Tanks for Water Storage
CAL/OSHA Title 8, Div. 1, Chapter 4, Subchapter 4	Construction Safety Orders
CAL/OSHA Title 8, Div. 1, Chapter 4, Subchapter 7	General Industrial Safety Orders
NEMA 3	Rain tight electrical box
NMWD C-3	NMWD Technical Specification For Furnishing Bulk Concrete, Specification C-3
NMWD C-11	NMWD Technical Specification For Detailing, Fabricating and Furnishing Structural Steel and Miscellaneous Metal, Specification C-11
NMWD P-2	NMWD Technical Specification for Valves, Specification P-2

NMWD T-1	NMWD Technical Specification for Design, Fabrication and Erection of a Welded Steel Water Storage Tank, Specification T-1
NMWD T-4	NMWD Technical Specification for Coating a Welded Steel Water Storage Tank, Specification T-4
NMWD T-5	NMWD Technical Specification for Cathodic Protection of a Welded Steel Water Storage Tank, Specification T-5
SSPC VIS1-89	Visual Standard For Abrasive Blast Cleaned Steel

4.0 SUBMITTALS AND APPROVALS

4.1 Working Drawings

- 4.1.1 Upon award of the Contract, the Contractor shall submit, as soon as practical, two sets of reproducible drawings and calculations for approval by the District Engineer, which shall include:
- Complete engineering and design computations for the tank, appurtenances and tank foundation, including seismic computations.
 - Structural steel cutting and fabrication plans.
 - Complete shop and field erection drawings with details showing the location, size, shape, thickness and grade of all structural components, including accessories and appurtenances.
 - Welding procedures and details.
 - Catalog cuts, including descriptions of standard manufactured items.
- 4.1.2 The Contractor shall allow at least one week for submitted drawings to be in the possession of the District Engineer for correction or approval.
- 4.1.3 The District Engineer shall return one of the two sets showing changes or approval. If the drawings are not approved, they shall be corrected and resubmitted promptly.

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- 4.1.4 No change shall be made on any drawing after it has been approved by the District Engineer, except at the District Engineer's direction.
- 4.1.5 Subsequent changes made necessary by field conditions shall be submitted for approval.
- 4.1.6 Working drawings and calculations submitted by the Contractor shall be prepared or checked and signed by a Civil or Structural Engineer registered in the State of California.
- 4.1.7 The Contractor shall purchase materials and equipment and begin fabrication required under the Contract only after the drawings have been approved by the District Engineer.
- 4.2 The Contractor must furnish an affidavit of compliance stating that the work and materials furnished meet the requirements of this Specification.
- 4.3 Certified copies of mill test reports for all structural steel components shall be submitted to the District Engineer.
- 4.4 The Contractor shall provide the District Engineer with welder qualifications two full working days before the welder is to begin work. The District Engineer shall reserve the right to approve or reject any welders.
- 4.5 The Contractor shall submit installation, operation, and maintenance manuals to the District Engineer for tank accessories and equipment requiring cleaning and/or maintenance. Each manual shall have a title page which includes the name, address, and telephone number of the Contractor. Each manual shall contain the following information for each item covered:
- Manufacturer's name, address, telephone number, and nearest designated service representative.
 - Identification number.
 - Manufacturer's instructions regarding proper installation, operation and maintenance.
 - A table stating various maintenance procedures to be performed and the recommended frequency of each maintenance procedure.
 - Drawings of the equipment, including part names and technical specifications.

- 4.6 At the conclusion of the tank fabrication and erection work the Contractor shall submit a written report containing the information outlined in AWWA D100, Section 11.2.1 and certification in accordance with AWWA D100, Appendix C, Section C.1.3.
- 4.7 The successful Contractor shall submit detailed work procedures to the District for approval prior to the start of tank construction.

5.0 DESIGN

- 5.1 The Contractor shall design the tank, appurtenances and concrete ringwall tank foundation in accordance with AWWA D100, including Appendix C.
- 5.2 Design shall comply with CAL/OSHA safety orders.
- 5.3 The concrete ringwall foundation shall be designed using the soil characteristics and allowable bearing pressure provided on the Soil Information Sheet in the Special Conditions.
- 5.4 To ensure uniform bearing of the tank on the concrete ring wall foundation, a non-combustible, flexible, fibrous pad shall be inserted between the tank annular ring and the foundation surface, covering the entire portion of the foundation under the annular ring.
- 5.5 The design metal temperature shall be 50°F.
- 5.6 Snow loading may be ignored for roof and support design.
- 5.7 All fabrication shall be by welding and no corrosion allowance need be provided to any parts.
- 5.8 The roof shall be supported so that it does not bow under its design dead loads or allow ponding of rainwater.
- 5.9 Shell plate joints shall have complete penetration butt welds.
- 5.10 Butt welds subject to secondary stress shall be complete penetration butt welds.
- 5.11 The exterior tank ladder shall be installed with a safety rail climbing device by Saf-T-Climb or equal.

5.12 Seismic Design

5.12.1 The site is in seismic zone 4. Seismic design shall be in accordance with Section 13 of AWWA D100 using the parameters provided on the Seismic Data Sheet in the Special Conditions. The Special Conditions may be found in contract documents or attached to this Specification.

5.12.2 The design point for each course shall be at its bottom. The Variable Design Point Method as defined in API 650 shall not be used.

5.13 Girders, rafters, and columns shall be designed of standard structural steel shapes or open web beams fabricated from standard structural steel shapes.

5.14 With the exception of rolled structural shapes, all exterior and interior structural components shall be constructed of round stock or shall have well rounded corners and edges.

5.15 The center column shall be designed as a primary member

5.16 Electrical

5.16.1 The Contractor shall install all electrical equipment to provide a complete system ready for operation at the tank site and as indicated on the District Plans. Electrical work shall be in accordance with the NEC.

5.16.2 Conduit, conduit supports and accessories shall be hot-dipped galvanized.

5.16.3 All switch, outlet and junction boxes as required by code or convenience shall be deep-cast type with threaded conduit hubs as required for exterior service.

5.16.4 Burrs and sharp edges shall be removed.

5.16.5 Conduits shall be free of foreign matter and shall be cleaned as necessary prior to pulling wire.

5.16.6 Sufficient length shall be left at ends of wires to make connections conveniently to equipment and devices.

5.16.7 Terminal lugs shall be solderless-type ring terminal lugs.

5.16.8 Equipment enclosures shall be NEMA 3.

5.16.9 The tank level transmitter shall be a Rosemount Model 1151GP transmitter or equal and shall have the following properties:

- The level transmitter shall be of the indicating and transmitting type. The movement of the primary element shall be converted electronically to produce a 4 to 20 milliamp DC signal. No mechanical switches or motors shall be utilized.
- Indications shall be displayed on a minimum of 2-inch scale.
- The transmitters shall be furnished for wall mounting. The transmitter case shall contain a terminal strip for power supply and signal wires suitable for a No. 14 wire size.
- The transmitter shall have an accuracy of $\pm 0.25\%$ over calibrated span and $\pm 1.0\%$ for indications.
- The transmitter shall be suitable to operate in an ambient temperature range of 32°F to 150°F.
- The operational pressure range for the tank level transmitter shall be stated in the Special Conditions.

5.17 The tank level transmitter power supply shall operate with 115 volts AC.

5.18 Additional information necessary for design is shown on the District Plans.

5.19 Coating shall be in accordance with NMWD T-4.

5.20 Cathodic Protection shall be in accordance with NMWD T-5.

6.0 MATERIALS

6.1 Materials shall be in accordance with AWWA D100, including Appendix C.

6.2 The fibrous pad between the tank and the ringwall foundation shall conform to ASTM D1751.

6.3 Steel plate shall be free from pitting and may have no more rusting than as generally shown on SSPC-VIS1-89, Rust Grade B.

6.4 Valves shown on the tank drawings which are to be installed by the Contractor shall conform to the requirements of NMWD P-2.

- 6.5 Tank screens and fasteners shall be brass or Type 316 stainless steel. The screening shall consist of three layers; the exterior layer being expanded metal sheet, ½" #18 mesh; the middle being wire cloth, #18 mesh, 0.017" diameter wire and the interior layer wire cloth #4 mesh, 0.047" diameter wire. The three screen layers, fasteners and retainer bars shall be of the same material or steel retainer bars may be used if they are coated with the same protective coating system used on the interior or exterior of the tank.

7.0 FIELD OPERATIONS AND REQUIREMENTS

- 7.1 The District will provide a baseline and reference benchmark in the vicinity of the work to be performed.
- 7.2 Concrete for the tank ringwall foundation shall be in accordance with NMWD C-3.
- 7.3 Field operations and welding shall comply with AWWA D100, including Appendix C.
- 7.4 Field Operations shall comply with CAL/OSHA safety orders.
- 7.5 If present, shop primer shall be in accordance with NMWD T-4.
- 7.6 The finished tank shall be circular, have a good appearance and shall be free of dents and buckles.
- 7.7 Ringwall Foundation
- 7.7.1 The excavation for the concrete ringwall shall be made in natural undisturbed material. Where fill material is encountered, the concrete ringwall shall be extended downward to the undisturbed natural material. All vertical structural concrete surfaces shall be formed above and below the ground surface. Over-excavation inside and around the foundation trench shall be backfilled with concrete or sand compacted to 95% compaction.
- 7.7.2 The top surface of the concrete ringwall shall be level. Top surface areas not level shall if high, be ground off, or if low be filled with an Epoxy nonshrink filler according to manufacturer's recommendations.
- 7.8 Welding
- 7.8.1 Any welding done by welders not approved by the District shall be removed at the expense of the Contractor.

- 7.8.2 It is the Contractors responsibility to clean all welded joints of slag, burrs and weld spatter, and to round any sharp edges or rough welds by blasting. If blasting is impractical, other methods such as grinding, or power wire brushing followed by a rust-inhibitive water wash may be used to remove weld flux residue provided a degree of cleanliness satisfactory to the District Engineer is obtained.
- 7.8.3 The Contractor shall repair or replace any defective or incomplete welding.
- 7.9 It is the Contractor's responsibility to comply with federal, state and local regulations with regard to transporting the tank and appurtenances or any portion thereof to and from the job site.
- 7.10 The Contractor shall properly dispose of all excess materials and wastes generated from construction of the steel tank.
- 7.11 Construction activity is prohibited within the dripline of trees which are being saved unless specifically approved by the District Engineer.
- 7.12 The District has made no provisions for power at the tank site. The Contractor shall be responsible to supply power to the job site if required for the Contractor's work.

8.0 INSPECTION AND TESTING

- 8.1 Inspection and testing shall be done in accordance with AWWA D100, including Appendix C.
- 8.2 Inspection by removal of sectional specimens shall not be permitted.
- 8.3 Radiographic testing of welds shall be performed as the work progresses. Upon completion, the radiographic film shall become the property of the District.
- 8.4 All tank-bottom plate lap welds, and column-bearing plate-to-floor plate lap welds shall be vacuum box tested for leakage.
- 8.5 Shell-to-bottom fillet welds shall be inspected for their entire length by a right-angle vacuum box and a solution film, or by applying light diesel oil. Additionally, the first weld pass shall be inspected by applying light diesel oil to the side opposite the first weld pass made. The oil shall be allowed to stand at least 4 hours and then the weld inspected for wicking of oil through the weld. The oil shall be removed before the weld is completed.

8.6 Hydrotesting

8.6.1 Upon completion of tank fabrication work the storage tank shall be filled with water to the overflow level.

8.6.2 The water to fill the tank once shall be furnished by the District at no cost to the Contractor. Additional water for retests will be at the Contractor's expense and shall be charged at the current rate in effect in accordance with District regulations.

8.6.3 Once the reservoir is completely filled, it shall sit for a period of 24 hours. If no leaks are present, the tank has satisfactorily passed the hydrotest.

8.6.4 If leaks are present, repairs shall be made by welding at no additional cost to the District.

8.7 The tank shall be accepted after the tank has proved free from leaks and other defects to the satisfaction of the District Engineer. Acceptance by the District of the completed work as herein specified 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 tank.

NORTH MARIN WATER DISTRICT
 TECHNICAL SPECIFICATION
 FOR
 MOVING
 A WELDED STEEL WATER STORAGE TANK
 SPECIFICATION T-3

1	04/13/94	REVISED AND REISSUED FOR CONSTRUCTION			
0	05/24/93	ISSUED FOR CONSTRUCTION	EMSR	JH	CD
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1.0 SCOPE

1.1 Scope Covered By This Specification

This Specification applies to the furnishing of all plant, labor, equipment and materials as shown on the design drawings, and as further specified herein, including, but not limited to:

- 1.1.1 Disassembly of a flat-bottom, welded steel water storage tank.
- 1.1.2 Re-erection of a flat-bottom, welded steel water storage tank.
- 1.1.3 Removal of tank, appurtenances, and underground and above ground facilities piping from the old tank site.
- 1.1.4 Designing and furnishing new tank appurtenances to replace those found unsuitable for reuse.
- 1.1.5 Design and construction of a concrete ringwall foundation for a flat-bottom, welded steel water storage tank in accordance with AWWA D100.
- 1.1.6 All design and construction shall comply with CAL/OSHA safety orders.

1.2 Scope Not Covered By This Specification

- 1.2.1 Site grading and earthwork for a tank site.
- 1.2.2 Painting of tank surfaces.
- 1.2.3 Cathodic protection for a tank.
- 1.2.4 Disinfection of a tank.

2.0 ABBREVIATIONS

API	American Petroleum Institute
AWWA	American Water Works Association
CAL/OSHA	State of California, Department of Industrial Relations, Division of Occupational Safety and Health
NMWD	North Marin Water District
SSPC	Steel Structures Painting Council

3.0 REFERENCED CODES AND STANDARDS

Unless otherwise specified herein or shown on the drawings, work under this specification shall be performed in accordance with the following codes and standards in force on the date of award of the Contract to which this specification is a part thereof:

API 653	Tank Inspection, Repair, Alteration and Reconstruction
AWWA D100	Welded Steel Tanks for Water Storage
CAL/OSHA Title 8, Div. 1, Chapter 4, Subchapter 4	Construction Safety Orders
CAL/OSHA Title 8, Div. 1, Chapter 4, Subchapter 7	General Industrial Safety Orders
NMWD C-3	NMWD Technical Specification for Furnishing Bulk Concrete, Specification C-3
NMWD C-11	NMWD Technical Specification for Detailing, Fabricating and Furnishing of Structural Steel and Miscellaneous Metal, Specification C-11
NMWD T-1	NMWD Technical Specification for Fabrication and Erection of a Welded Steel Water Storage Tank, Specification T-1
SSPC-VIS1-89	Visual Standard for Abrasive Blast Cleaned Steel

4.0 SUBMITTALS AND APPROVALS

4.1 Working Drawings

4.1.1 Upon award of the Contract, the Contractor shall submit, as soon as practical, two sets of reproducible drawings and calculations for approval by the District Engineer, which shall include:

- Complete engineering and design computations for the tank, appurtenances and tank foundation, including seismic computations.
- Structural steel cutting and fabrication plans.

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- Complete shop and field erection drawings with details showing the location, size, shape, thickness and grade of all structural components, including accessories and appurtenances.
 - Welding procedures and details.
 - Catalog cuts, including descriptions of standard manufactured items.
- 4.1.2 The Contractor shall allow at least one week for submitted drawings to be in the possession of the District Engineer for correction or approval.
- 4.1.3 The District Engineer shall return one of the seven sets showing changes or approval. If the drawings are not approved, they shall be corrected and resubmitted promptly.
- 4.1.4 No change shall be made on any drawing after it has been approved by the District Engineer, except at the District Engineer's direction.
- 4.1.5 Subsequent changes made necessary by field conditions shall be submitted for approval.
- 4.1.6 Working drawings and calculations submitted by the Contractor shall be prepared or checked and signed by a Civil or Structural Engineer registered in the State of California.
- 4.1.7 The Contractor shall purchase materials and equipment and begin fabrication required under the Contract only after the drawings have been approved by the District Engineer.
- 4.2 The Contractor must furnish an affidavit of compliance stating that the work and materials furnished meet the requirements of this Specification.
- 4.3 Certified copies of mill test reports for all structural steel components shall be submitted to the District.
- 4.4 The Contractor shall provide the District with welder qualifications two full working days before the welder is to begin work. The District shall reserve the right to approve or reject any welders.

4.5 The Contractor shall submit installation, operation, and maintenance manuals to the District for tank accessories and equipment requiring cleaning and/or maintenance. Each manual shall have a title page which includes the name, address, and telephone number of the Contractor. Each manual shall contain the following information for each item covered:

- Manufacturer's name, address, telephone number, and nearest designated service representative.
- Identification number.
- Manufacturer's instructions regarding proper installation, operation and maintenance.
- A table stating various maintenance procedures to be performed and the recommended frequency of each maintenance procedure.
- Drawings of the equipment, including part names and technical specifications.

4.6 At the conclusion of the tank fabrication and erection work the Contractor shall submit a written report containing the information outlined in AWWA D100, Section 11.2.1 and certification in accordance with AWWA D100, Appendix C, Section C.1.3.

5.0 DESIGN

5.1 Design of new or replacement appurtenances, including the concrete ringwall tank foundation shall be in accordance with NMWD T-1.

5.2 The re-erected tank shall have all the details and appurtenances required by the most recent version of AWWA D100. The Contractor is responsible to notify the District of any deficiencies in the existing tank that do not meet the current requirements of AWWA D100 and which do not appear as items to be added, deleted or changed on the NMWD Plans.

6.0 MATERIALS

6.1 Existing and new materials shall be in accordance with NMWD C-3, C-11 and T-1. The Contractor shall replace all existing fasteners.

6.2 New steel plate shall be free from pitting and may have no more rusting than as generally shown on SSPC-VIS1-89, Rust Grade B.

7.0 FIELD OPERATIONS AND REQUIREMENTS

- 7.1 Field operations including tank disassembly and erection shall comply with NMWD T-1 and API 653. Where the two standards differ, AWWA D100 shall govern.
- 7.2 The Contractor shall notify the District of any portions of the tank which are corroded or unsuitable for reuse and replace those portions. District payment for work to provide replacement materials and/or labor which is not described or shown in the Contract documents shall be done in accordance with the General and Special Conditions of the Contract.

8.0 INSPECTION AND TESTING

- 8.1 Inspection and testing shall be done in accordance with NMWD T-1.

NORTH MARIN WATER DISTRICT
 TECHNICAL SPECIFICATION
 FOR
 COATING
 A WELDED STEEL WATER STORAGE TANK
 SPECIFICATION T-4

3	09/26/97	Add references, contractor programs required for submittal, misc. revisions	ER		
2	09/26/95	Revised and reissued for Construction	PS	ER	CD
1	06/10/94	Revised and reissued for Construction	PS	JH	CD
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1.0 SCOPE

1.1 Scope Covered By This Specification

This Specification applies to the furnishing of all plant, labor, equipment and materials as shown on the design drawings, and as further specified herein, including, but not limited to:

1.1.1 Coating the inside and outside surfaces of new or existing welded steel tanks used for potable water storage, including but not limited to methods and requirements for materials, surface preparation, materials application, inspection and testing, and handling and disposal of debris.

1.2 Scope Not Covered By This Specification

1.2.1 Fabrication and erection of the tank.

1.2.2 Hydrotest of the tank.

1.2.3 Disinfection of the tank

2.0 ABBREVIATIONS

CAL/OSHA California Occupational Safety and Health Regulations

CCR California Code of Regulations

CERCLA Comprehensive Environmental Response, Compensation, and Liability Act

CFR Code of Federal Regulations

DOHS State Department of Health Services

EPA Environmental Protection Agency

MSDS Material Safety Data Sheet

NFPA National Fire Protection Association

NIOSH National Institute for Occupational Health Safety

NPDES National Pollutant Discharge Elimination System

NSF National Sanitation Foundation

SSPC Steel Structures Painting Council

VOC Volatile Organic Compounds

3.0 REFERENCED CODES AND STANDARDS

Unless otherwise specified herein or shown on the drawings, work under this Specification shall be performed in accordance with the following codes and standards in force on the date of award of the Contract to which this Specification is a part thereof:

CCR Title 8, Div.1 Ch.4, Subchapter 7	CAL/OSHA General Industry Safety Orders
CCR Title 8, Div.1 Ch.4, Subchapter 4	CAL/OSHA Construction Safety Orders
29 CFR 1910	Occupational Safety and Health Standards (General Industry Standards)
29 CFR 1910.1025	Lead
29 CFR 1926	Safety and Health Regulations for Construction (Construction Industry Standards)
29 CFR 1926.62	Lead
40 CFR 50	National Primary and Secondary Ambient Air Quality Standards
40 CFR 117	Determination of Reportable Quantities for Hazardous Substances
40 CFR 122	EPA Administered Permit Program: The National Pollutant Discharge Elimination System
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 300	National Oil and Hazardous Substances Pollution Contingency Plan
40 CFR 302	Designation, Reportable Quantities, and Notification

EPA Method 3050	Acid Digestion of Sediments, Sludges, and Soils
NFPA 70	National Electric Code
NIOSH Method 7082	Lead
NSF 61	Drinking Water System Components, Health Effects
SSPC Guide 6I(CON)	Guide for Containing Debris Generated During Paint Removal Operations
SSPC Guide 7I(DIS)	Guide for the Disposal of Lead-Contaminated Surface Preparation Debris
SSPC-PA 1	Shop, Field and Maintenance Painting
SSPC-PA 2	Measurement of Dry Paint Thickness with Magnetic Gages
SSPC-PA Guide 3	A Guide to Safety in Paint Application
SSPC-SP 1	Solvent 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 8	Pickling
SSPC-SP 10	Near-White Blast Cleaning
SSPC-Vis 1-89	Visual Standard for Abrasive Blast Cleaned Steel

4.0 INFORMATION REQUIRED TO USE THIS SPECIFICATION

The following information is required to use this Specification and will be found in the Special Conditions. The Special Conditions may be found either in the contract documents or attached to this Specification.

- 4.1 Size of the tanks to be painted or repainted.
- 4.2 Specific coating systems required for interior and exterior surfaces of each tank to be painted, including colors, gloss, surface preparation and coating thicknesses required.

- 4.3 In the case of tanks to be recoated; type of existing tank coatings and type of surface preparation required. Existing coatings shall be tested for lead and lab test results shall be made a part of the Special Conditions. If lead is shown to be present, the Contractor must comply with all federal, state and local laws regarding the removal of lead paint and the handling of lead paint debris as a hazardous material.
- 4.4 In the case of tanks being recoated; the manner in which existing surface defects and damage due to corrosion will be corrected prior to recoating, and how much time will be permitted for the repair to be made.

5.0 SUBMITTALS AND APPROVALS

- 5.1 The Contractor must furnish a notarized affidavit of compliance stating that the work and materials furnished meet requirements of this Specification and comply with Federal, state and local laws pertaining to the work.
- 5.2 The Contractor shall be a California licensed contractor approved by the coating manufacturer or appointed representative. Written verification of such approval must be submitted to the District with the Contractor's bid.
- 5.3 The Contractor shall have successfully completed 3 similar coating jobs in the last 3 years and shall submit job names, locations and references for the jobs.
- 5.4 The Contractor shall submit to the District a list of all thinners, primers, abrasives and coating materials to be used for the job, along with MSDS for each product.
- 5.5 The Contractor shall submit the terms of any applicable warranties for materials provided.
- 5.6 A test report shall be prepared and submitted to the District Engineer at the conclusion of dry film thickness testing. The test report shall be certified by a representative of the District who witnessed the testing. The report shall include the test film thickness gage used, test locations, the dry film thickness at each location and the name of the person making the tests.
- 5.7 The Contractor shall prepare and deliver to the District Engineer an inspection report covering the first anniversary inspection that shall include, the number and type of failures observed, the percentage of the surface area where failure has occurred, the names of the persons making the inspection, and color photographs illustrating each type of failure. If the Contractor shall prepare a similar inspection report if he attends the two year guarantee inspection.
- 5.8 Contractor Provided Written Work Programs

The Contractor shall provide detailed written work plans, programs and procedures at least 7 days prior to beginning work. The submittals must be approved by the District prior to the start of work. Programs shall include the items listed below, as applicable to the work being performed.

- 5.8.1 Removal/Containment/Ventilation Plan - The contractor shall provide a written plan for the methods to be employed for surface preparation, containment and ventilation, and collection of debris. The Contractor shall submit drawings for District review. The District may require the drawings to be reviewed by professional structural and/or mechanical engineers.
- 5.8.2 Environmental Protection Program - The Contractor shall submit the following testing and evaluation programs that will be used to confirm that the work does not violate Federal, state and local laws. Laboratory qualifications shall be provided.
- 5.8.2.1 Ambient Air Quality - The Contractor shall submit a written program for air monitoring at the project site to confirm that fugitive dust emissions do not violate Federal, state and local laws. Monitoring of particulate matter equal or greater than 10 micrometers in aerodynamic size (PM 10) and airborne particulate lead shall be done in accordance with 40 CFR 50, and a control plan for visible emissions shall be submitted. Lead emissions using personal monitors shall be monitored in accordance with NIOSH Method 7082. The Contractor shall specify the type and number of samplers to be used, their proposed locations, provisions for background monitoring, the duration of monitoring and the evaluation procedure to be employed.
- 5.8.2.2 Soil Analysis - The Contractor shall provide a written plan for the sampling and analysis of pre-job and post-job soil samples from identical locations for total lead content. The number of tests proposed, test locations, and sampling procedure shall be provided. The analysis for lead shall be conducted in accordance with EPA Method 3050, or approved equal.
- 5.8.2.3 Water Analysis - The Contractor provide a written plan for any planned discharge of water and/or sediment to an offsite drainage system and shall outline the sampling and testing protocol to be used for pre-job and post-job analysis of pollutants in the water and sediment. The Contractor shall be responsible to obtain an NPDES permit in accordance with 40 CFR 122 and shall provide a written plan for strict following of its requirements.
- 5.8.3 Worker Protection Program - The Contractor shall submit a worker protection program in accordance with Federal, state and local laws. For work involving lead based paint, workers shall be protected in accordance with 29 CFR Sections 1910.1025 and 1926.62. The worker protection program shall include the Contractor's reps confined space program.

5.8.4 Handling, Disposal, and Analysis of Debris - The Contractor shall provide the following written procedures. Laboratory qualifications shall be provided, where applicable.

5.8.4.1 Sampling and Testing of Debris - Written procedures that will be followed for the sampling and testing of debris to determine if it is a hazardous waste. Debris includes, but is not limited to paint, spent abrasives, stripper solutions, water from water removal methods, and hygiene water.

5.8.4.2 Handling and Site Storage - A written plan for the handling and site storage of hazardous waste in accordance with the requirements of 40 CFR 262 and 40 CFR 265. The Contractor shall confirm that an EPA identification number will be obtained and that proper manifesting of the waste and site storage limitations will be addressed. The Contractor's plan shall provide for preparedness, prevention, and contingency plans for the steps to be taken in the event of an unplanned release or emergency.

5.8.4.3 Transportation - Written confirmation that proper transportation of hazardous waste will be accomplished in accordance with the requirements of 40 CFR 263, including the name of the licensed transporter.

5.8.4.4 Disposal - Written confirmation that hazardous waste will be treated and disposed of in accordance with the requirements of 40 CFR 264 and 40 CFR 268. The program shall provide assurance that the debris is handled properly from cradle to grave, provide the name of the licensed disposal facility, and include a schedule for the submittal of the completed manifests to the owner.

5.8.4.5 Clearance Testing - Written programs for the decontamination of reusable items prior to removal from the project site, or for the proper testing and disposal of the materials if decontamination is not possible or desirable.

5.8.4.6 Reportable Releases - Written plan for reportable CERCLA releases in accordance with 40 CFR 300 and 40 CFR 302 and reportable releases of hazardous substances into the water in accordance with 40 CFR 117.

5.9 Bidding contractors must submit detailed outlines the programs required of the Contractor in section 5.8 of this Specification.

6.0 MATERIALS

6.1 Materials must be approved by the District Engineer. Any material not approved shall be removed from the job site immediately.

6.2 Materials shall comply with the requirements of Federal, state and local laws that are in effect at the time or in the location of use.

6.3 Product Information

The manufacturer's name, specific product name, and batch number shall appear on each product container. In addition, the manufacturer shall furnish and keep at the job site the following information for each specific product.

6.3.1 MSDS for each product.

6.3.2 Identification of components shipped in separate containers.

6.3.3 Complete mixing instructions, including mixing methods, mixing times, acceptable thinning materials and acceptable tinting pigments.

6.3.4 The quality and type of thinner recommended for each method of application shall be listed. Thinning recommendations shall address the extreme limits of the allowable temperature range for application as well as intermediate temperatures. Viscosity of liquid materials, when ready for application, shall be indicated in units appropriate for field determination, such as the Zahn cup.

6.3.5 The percent solids by volume for liquid materials.

6.3.6 The theoretical spreading rate in square feet per gallon at 1 mil dry film thickness.

6.3.7 The net weight per US gallon for liquid materials and the net weight of the total contents of a container for other materials.

6.3.8 Recommended drying time between coats and before immersion stated as the number of hours at 70°F and 50% relative humidity and at upper and lower limits of recommended application temperature and humidity.

6.3.9 The pot life after mixing shall be stated with a description of variations caused by changes in temperature, humidity, or other ambient conditions.

6.3.10 Flammability, toxicity, allergenic properties, and any other hazardous characteristics requiring field precautions shall be clearly identified and specific safety practices shall be stipulated.

6.3.11 For interior coatings, the amount of ventilation required during application inside a closed tank shall be stated.

6.4 Abrasive material shall be angular, low dusting and graded to produce to profile specified by the coating system manufacturer and shall not contain hazardous material.

- 6.5 Coating materials shall contain no lead.
- 6.6 Specified materials must have the performance listed in the manufacturer's technical specifications for the specific product. To be considered as equal, a material must be of the same general classification, must meet or exceed the performance criteria listed in the manufacturer's technical specifications for the product named in the Special Conditions, must be suitable for the anticipated service conditions, and must be approved in writing by the District.
- 6.7 Coating materials to be used in contact with potable water must be certified to meet the requirements of NSF 61, and regulations of the Bay Area Air Quality Management District governing VOC emissions. Only solvents approved for use by the manufacturer thereby meeting the requirements of NSP 61 may be used.

7.0 FIELD OPERATIONS AND REQUIREMENTS

- 7.1 It is the intent of these specifications that coating systems shall be provided which meet the standards for best grades of coating.
- 7.2 All work shall be done in a manner satisfactory to the District Engineer.
- 7.3 The Contractor's field operations shall at all times comply with Federal, state and local laws that are in effect at the time or in the location of use.
- 7.4 For new tanks, coating work shall begin immediately after erection and successful hydrotest of the tank.
- 7.5 Methods and procedures for the handling and application of coatings shall meet the requirements of SSPC-PA 1 and the manufacturer's instructions. In the case of a discrepancy, the manufacturer's instructions shall govern.
- 7.6 Surface Preparation
 - 7.6.1 All surfaces must be clean, dry, and free of any dirt, dust, grease, oils, salts, or other deleterious materials prior to primer or paint application.
 - 7.6.2 It is not necessary to perform any surface preparation, priming or coating on the underside of the reservoir bottom plates or the interior surfaces of the tank overflow.
 - 7.6.3 Existing or shop applied coatings which have been scratched or are poorly adhering shall be removed and surfaces shall be cleaned to the SSPC standard recommended by the manufacturer, before being recoated. Such areas shall blend well into existing properly adhering primer.

- 7.6.4 The following surfaces shall be completely blasted and primed prior to erection: inside surface 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. Damaged or contaminated primer shall be repaired after erection.
- 7.6.5 For new tanks, prior to priming, welded areas must be cleaned of all slag, burrs and spatter. Sharp edges and rough welds must be rounded. It is the responsibility of the tank fabricator to clean and prepare welds as described above, however, the coating contractor shall be prepared to perform touch up work that is required to properly prepare surfaces to be coated at no cost to the District.
- For tanks being recoated, existing surface defects and damage due to corrosion shall be corrected prior to coating as specified in the Special Conditions.
- 7.6.6 Prior to priming, newly fabricated and erected tank surfaces shall be cleaned according to the SSPC standard level recommended by the manufacturer for the appropriate type of service. The District shall use SSPC-Vis 1-89 to identify proper surface preparation.
- 7.6.7 Contractor shall cover the ground in front of the shell manway used for personnel access with a tarp to reduce tracked-in contamination of the tank bottoms. The tarp shall be kept free of contaminants. Contractor shall furnish and use contaminant-free canvas overshoes for entry into the tank following completion of the sandblasting. Contractor shall keep at least two spare pairs of overshoes on-site for use by District representatives to inspect the work.
- 7.6.8 Where existing coating has deteriorated or the new coating system will not adhere to the existing coating, all existing coating shall be removed and the surfaces shall be cleaned to the SSPC standard recommended by the manufacturer for new steel for the appropriate type of service.
- 7.6.9 For bidding purposes, it is the Contractor's responsibility to determine the preparation required for the coating of existing tank surfaces in accordance with this Specification. The Contractor may call the District Engineer to make an appointment to inspect the existing tank for the purposes of obtaining adequate information to formulate a bid.
- 7.6.10 Prior to applying protective coating materials, all surfaces to be coated shall be air blown free of contaminants using dry air (less than 35% relative humidity at the hose nozzle). Contaminants on the bottom surface of the tank will also be removed, using dry air or vacuum, a minimum distance of 12 feet from the surface being coated. Condensation on the underside of the roof shall be blown or wiped dry prior to any bottom cleaning or coating.

7.7 Application

- 7.7.1 Spray painting shall be conducted under controlled conditions, and the Contractor shall be fully responsible for any damage, both on-site and off-site, occurring from spray painting. Conventional spraying and airless spraying are acceptable methods.
- 7.7.2 A minimum of one stripe coat shall be brush applied to welds, seams, bolts, rivets, sharp corners, inside angles, edges, and other irregular surfaces, and allowed to dry prior to spraying or roller application of the final coat.
- 7.7.3 Shop applied prime coats may be applied by any method in accordance with this specification that attains an acceptable coating. All areas where shop primer has been damaged shall be cleaned according to the SSPC standard recommended by the primer manufacturer in the field and primed with the same primer applied to the same dry film thickness as the shop coat.
- 7.7.4 Application of coatings shall be done by spraying for interior surfaces, and by spraying or rolling for exterior surfaces or as recommended by the manufacturer's instructions.
- 7.7.5 Ventilation shall continue while the coating is being applied and dried or cured.
- 7.7.6 Dehumidification equipment may be specified by the District Engineer if coating is done during wet or humid conditions.
- 7.7.7 All openings will be covered to keep all abrasive or paint out of tank interior when working on tank exterior.

7.8 Safety Precautions

- 7.8.1 All equipment shall be non-sparking and explosion-proof.
- 7.8.2 Ventilating system effectiveness should be checked by periodic explosimeter readings. Except for a zone immediately adjacent to an operating spray nozzle, the concentration of volatile material should not exceed 20% of the lower explosive limit. The zone of higher concentration should not extend more than 5 feet in any direction from the spray nozzle.
- 7.8.3 Workers performing blasting operations shall wear air-supplied helmets. All other persons exposed to blasting dust shall wear filter-type respirators and safety goggles.
- 7.8.4 When coatings are applied inside the tank, all persons exposed to toxic vapors shall wear air-supplied masks.

- 7.8.5 Lighting fixtures and flexible cords shall comply with the requirements of NFPA 70 for the atmosphere in which they will be used.
- 7.8.6 The contractor shall immediately notify the District of any spill of material that is a hazardous substance. The Contractor shall not contaminate the soil with hazardous material, and shall prohibit the release of hazardous materials into bodies of water or drainage systems.
- 7.8.7 The Contractor will be responsible to test waste debris to determine if it must be disposed of as a hazardous material and the Contractor shall be responsible to properly dispose of all debris.
- 7.8.8 Contractor operations shall meet requirements for CAL/OSHA at all times.
- 7.9 The Contractor shall furnish all tools and power necessary to perform the work outlined in this Specification at no cost to the District.
- 7.10 After curing of the final interior coat has been completed and prior to tank disinfection by the District, the Contractor shall, under District inspection, clean the inside of the tank with potable water by hosing down all surfaces with a high pressure hose and nozzle of sufficient size to deliver a minimum flow of 50 gpm. All water and material resulting from the cleaning operation shall be removed from the tank.

8.0 INSPECTION AND TESTING

- 8.1 Prior to coating prepared steel, the District shall inspect the surface profile for compliance with the manufacturer's recommendations or as stated otherwise in the Special Conditions.
- 8.2 All coating work, shall be done in the presence of or approved by a District furnished inspector. Shop priming shall be inspected unless noted otherwise in the Special Conditions.
- 8.3 All coating work shall be performed immediately upon immediately upon inspection of the prepared surface.
- 8.4 All coating work will be tested by using methods and devices accepted as industry standards and as approved by the Engineer.
- 8.5 District inspection shall include, but not be limited to, monitoring of environmental conditions, spot checking of wet and dry film thickness, inspection of application methods and conditions of materials delivered to the job and just prior to application.

- 8.6 The Contractor shall provide and position all rigging, lighting, scaffolding, labor, inspection, calibration and safety equipment to facilitate all inspection. Inspection equipment shall include:

- Steel surface temperature thermometers (2)
- Sling psychrometer
- Psychrometric charts
- Wind meter
- Surface profile comparator
- Testex Press AO \cong Film System tape
- Hypodermic needle nozzle orifice gauge
- Abrasive sieve test
- SSPC-Vis 1-89 surface preparation standard
- WFT gauge
- DFT gauge with certified thickness calibration plates
- Low voltage holiday detector
- Viscosity cup
- Thermometer
- Explosimeter

8.7 Coating Film Thickness Testing

8.7.1 When film thicknesses are specified without an indicated tolerance, the allowable gage tolerance shall be twice the indicated accuracy of the measurement; that is, for a measurement with an indicated accuracy of $\nabla 0.25$ mil, the allowable film thickness tolerance is $\nabla 0.5$ mil.

8.7.2 The dry film thickness shall be measured by the Contractor in accordance with SSPC-PA 2. The dry film thickness measurements shall be made by the Contractor while surfaces are accessible at locations selected by the District's representative.

8.8 Holiday Testing

The total coating system on all interior surfaces below the overflow shall be tested by the Contractor in the presence of a District representative with a wet-sponge, low-voltage holiday detector after the coating system has cured. The sponge shall be kept saturated with an electrolyte (5% sodium chloride) and a surfactant (2% household detergent). During testing the wet sponge shall be kept in continuous contact with the painted surface. Locations where holidays are detected shall be marked for repair and retested after repair work has been completed.

8.9 Completion of work

After Contractor cleaning under District inspection and District disinfection, the District shall conduct VOC testing as required by the State Department of Health Services (DOHS). Successful VOC test results shall constitute completion of Contractor work. Should any contaminant exceed DOHS requirements, the costs of subsequent draining, filling and testing shall be performed at the Contractor's

expense. The District shall provide a notice of acceptance to the Contractor upon successful completion of work.

8.10 First Anniversary Inspection

8.10.1 The interior and exterior surfaces of the tank shall be inspected by District representatives and the Contractor at approximately one year after the coating work has been completed to determine whether any repair work is necessary.

8.10.2 The District shall establish a date for inspection and shall notify the contractor at least 30 days in advance. If an inspection date is not established within 13 months after completion of painting work, the first anniversary inspection shall be waived.

8.10.3 The District shall partially or fully drain the tank and provide safety equipment, suitable interior lighting and ventilation for the tank inspection, or the District may hire a qualified diver to inspect the tank.

8.10.4 Locations where coating has peeled, bubbled, or cracked or where corrosion is evident shall be considered as failure of the coating system. The Contractor shall make repairs at all points where failures are observed by removing the deteriorated coating, cleaning the surface, and recoating with the same coating system. If the area of failures exceeds 25% of the area of a portion of the tank surface, then for that portion, the entire coating system shall be removed and recoated. For the purposes of determining the need for complete recoating, the inside roof, shell, and floor and the outside roof and shell shall each be considered separately. The District may, at any point during or after the work under this Specification, use destructive test instruments to analyze coating failures observed. The District will establish a starting date and a reasonable time of completion for remedial work.

8.10.5 All remedial work performed shall be guaranteed for two years from completion for defects of materials and workmanship. The District may conduct a first anniversary inspection of remedial work and require repair of failures pursuant to this Specification.

8.11 Two Year Guarantee

The Contractor guarantees the work and materials furnished by him for two years after notice of acceptance is issued by the District to the Contractor. The Contractor's guarantee includes that materials furnished by him or any work performed by him shall be the best of its class and that work and materials fully meet the requirements of this Specification. Remedial work required shall be performed and guaranteed as stated in Section 8.10. The Contractor may, at his option, be present during the two year warranty inspection.

NORTH MARIN WATER DISTRICT
 TECHNICAL SPECIFICATION
 FOR
 CATHODIC PROTECTION OF
 A WELDED STEEL WATER STORAGE TANK
 SPECIFICATION T-5

0	06/02/93	ISSUED FOR CONSTRUCTION			
REV	DATE	DESCRIPTION	BY	CHK	APP

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1.0 SCOPE

1.1 Scope Covered By This Specification

This Specification applies to the furnishing of all plant, labor, equipment and materials as shown on the design drawings, and as further specified herein, including, but not limited to:

1.1.1 Design, installation and activation of an automatically controlled impressed-current cathodic protection system to protect the interior coating of a steel water tank from corrosion.

1.2 Scope Not Covered By This Specification

1.2.1 Construction of a steel water storage tank

1.2.2 Coating a steel water storage tank

1.2.3 Disinfection of a steel water storage tank

2.0 ABBREVIATIONS

AC	Alternating Current
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
AWG	American Wire Gage
AWWA	American Water Works Association
DC	Direct Current
FCC	Federal Communications Commission
NEC	National Electrical Code
NEMA	National Electric Manufacturers Association
SCR	Silicon Control Rectifier

3.0 REFERENCED CODES AND STANDARDS

Unless otherwise specified herein or shown on the drawings, work under this Specification shall be performed in accordance with the following codes and standards in force on the date of award of the Contract to which this Specification is a part thereof:

AWWA D104 Automatically Controlled Impressed-Current Cathodic Protection for the Interior of Steel Water Tanks

NEMA 4 Waterproof, Watertight Electrical Box

4.0 SUBMITTALS AND APPROVALS

- 4.1 The Contractor shall submit to the District an affidavit of compliance that all materials and procedures conform to this Specification.
- 4.2 Working Drawings
 - 4.2.1 Upon award of the Contract, the Contractor shall submit, as soon as practical, two (2) sets of reproducible drawings and calculations for approval by the District.
 - 4.2.2 Working drawings shall show all pertinent data concerning the installation of the system, including component make and model numbers as well as associated material specifications.
 - 4.2.3 The District Engineer shall return one of the two sets showing required changes or approval. If the drawings are not approved, they shall be corrected and resubmitted.
 - 4.2.4 No change shall be made on any drawing after it has been approved by the District Engineer, except at the District Engineer's direction.
 - 4.2.5 Subsequent changes necessary by field conditions shall be submitted for approval.
 - 4.2.6 The Contractor shall allow at least one week for submitted drawings to be in the possession of the District Engineer for approval.
- 4.3 The Contractor shall submit a complete report in accordance with AWWA D104, Section 5.
- 4.4 The Contractor shall submit to the District information outlined in AWWA D104 including information outlined in Appendix A, Section A.5 at the conclusion of work.
- 4.5 The successful Contractor shall submit detailed work procedures to the District for approval prior to the start of tank construction.

5.0 DESIGN

- 5.1 The contractor shall design an automatically controlled impressed-current cathodic protection system in accordance with AWWA D104.
- 5.2 The following information is in the Special Conditions or on District plans of the Contract that this Specification is a part of, and should be used for design information. The Special Conditions may be found in the contract documents or attached to this Specification.
- Tank dimensions, including height from bottom capacity level to top capacity level.
 - Type of protective coating.
 - Total dissolved solids (mg/L) and conductivity ($\mu\text{mho/cm}$) of the potable water to be stored in the tank.
 - The location of the power unit.
- 5.3 The system shall be designed to protect the tank when 20% of the submerged coated surface has failed.
- 5.4 The cathodic protection power unit shall be a Cathodic Protection Services Co. Micro-Polatrol unit or equal. The power unit shall be solid-state, air-cooled and consistent with the necessary potential control circuitry, transformers, rectifiers, circuit breaker, meter, wiring terminals and appurtenances and of adequate capacity to meet the requirements of the system.
- 5.5 Transformer voltage tap adjusters shall not be used to control the operation of the power unit.
- 5.6 The entire power unit shall be field serviceable.
- 5.7 The power unit shall be designed to operate at 110 volt, single phase, 60 cycle, AC input.
- 5.8 The power unit cabinet shall be grounded to the tank with a weld connection.
- 5.9 The power unit/controller shall have the following standard features:
- Auto-restart after power outage
 - Short circuit and surge protection
 - Accept all standard reference electrodes
 - Digital readout
 - FCC approval
 - Adjustable current limit

- Display potential for any operating mode continuously or on demand
- Automatic temperature compensating circuitry
- Clock circuit
- Fingertip panel control

5.10 The power unit shall be capable of operating in the following 3 modes with fingertip panel control selection of the desired operating mode.

5.10.1 Manual Mode

The power unit shall operate as a conventional rectifier continuously delivering pre-selected current to the anodes. In this mode, the automatic control shall be locked out without affecting the preprogrammed settings for other modes of operation. The output of the power unit shall be regulated from 0 to 100% of rated capacity without the use of transformer taps.

5.10.2 Automatic Mode No. 1

The controller shall automatically and continuously monitor the potential of the structure and make necessary adjustments in the current output to maintain the structure potential at the pre-selected value. A single reference electrode placed within 1 to 2 cm. from the protected structure shall be used to measure the potential and control the operation of the power unit.

5.10.3 Automatic Mode No. 2

This mode shall function the same as Automatic Mode No. 1 except the potential shall be monitored against a reference electrode located some distance from the protected structure. The measured potential shall be free of IR drop error.

5.11 The transformer shall be of the separate primary and secondary type and shall withstand continuous operation 10% above rated input voltage at the maximum rated DC output. The transformer shall be designed for a maximum hot spot heat rise not to exceed 120°F.

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CATHODIC PROTECTION OF A
WELDED STEEL WATER STORAGE TANK

- 5.12 The rectifier elements shall be silicon with adequate cooling surfaces so that their normal temperature rise at rated capacity will not exceed that specified by NEMA. The rectifier elements shall be air-cooled and shall be housed in the power unit cabinet.
- 5.13 The control circuit of the power unit shall be designed to continuously monitor the potential of the structure and automatically regulate the protective current as required to maintain the potential at the pre-selected level. A micro-processor shall be used for overall system control and phase controlled SCRs for current regulation.
- 5.14 The circuit breaker shall be of the single phase, 2 pole, series trip, manually reset, magnetic type not affected by change in ambient temperature.
- 5.15 Short circuit protection shall be provided by consistently monitoring the current and when fault is sensed, the SCR gating circuits shall be disabled so that bridges will cease conducting within 8.53 milliseconds.
- 5.16 The operating temperature of the power unit shall be monitored continuously by an inherent circuitry. Should the temperature of the power unit exceed 120°F, the unit shall automatically reduce its output to a non-destructive level. As the ambient temperature permits, the unit shall automatically revert to its normal operation.
- 5.17 The power unit shall be housed in a NEMA 4 metal cabinet suitable for outdoor use with the provision for locking. The enclosure shall be equipped with brackets suitable for wall or pole mounting.
- 5.18 The wires to connect components of the power unit shall be stranded or solid copper meeting the requirements of the NEC for allowable current carrying capacity. Locking devices shall be used as required on all bolted connections. The DC output terminals shall be conveniently located and shall be of the solderless pressure type sized to accommodate wires as required for safe operation of the cathodic protection system. Provision for connecting the AC power shall be made available in the form of insulated pigtailed or shielded terminals.
- 5.19 The standard reference electrodes shall have a reproducible potential and shall remain stable for a minimum of two years.
- 5.20 Long life anodes with a 15 year minimum life shall be used and shall be vertically suspended inside the tank.

- 5.21 The long life anode material shall be in accordance with AWWA D104, Section 3.3.1.2, and shall be the material most economical to use over the expected life of the anode.
- 5.22 The anodes shall have connecting lead wires no smaller than #8 AWG 7 strand, with high molecular weight polyethylene insulation.
- 5.23 Rubber or synthetic covered wire run in heavy wall rigid steel conduit shall be used for the positive wires from the power unit to the anode circuits. The copper wire shall be of sufficient size to conduct an amperage equal to at least 150% of the rated amperage of the power unit. The size used shall be established by the NEC for the allowable current-carrying capacity. The conduit shall be secured to the structure at intervals of not more than ten feet.
- 5.24 The District shall provide primary service line power to input terminals on the power unit. If the power unit is mounted at a remote location, the District shall run DC and control circuit wiring from power unit to the structure, in accordance with manufacturer's recommendations.

6.0 MATERIALS

- 6.1 The system components shall be in accordance with the requirements of AWWA D104.

7.0 FIELD OPERATIONS AND REQUIREMENTS

- 7.1 Workmanship for installation and energizing of the system shall be done in accordance with the requirements of AWWA D104.

8.0 INSPECTION AND TESTING

- 8.1 Testing shall be performed in accordance with the requirements of AWWA D104.
- 8.2 After installation of the cathodic protection and after tank disinfection, the Contractor shall energize, test, and adjust the system.