Preparing Activity: NAVFAC

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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DIVISION 33 - UTILITIES

SECTION 33 01 50.65

INSPECTION OF FIELD FABRICATED FUEL STORAGE TANKS

02/21

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SECTION 33 01 50.65

INSPECTION OF FIELD FABRICATED FUEL STORAGE TANKS
02/21

NOTE: This guide specification covers the requirements for an out of service Inspection of a Field Fabricated Fuel Storage Tank.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

For cases when inspection is followed by repair, use this Section with 33 01 50.75 REPAIR OF FIELD FABRICATED FUEL STORAGE TANK. Insert applicable requirements from 33 01 50.75 should this Section be used stand alone.

Make use of this Section in consultation with SMEs listed below. The Section requires considerable judgment and specialized professional engineering competence. There are substantial consequences to a fuel storage tank inspection. Do not use this Section unless professionally competent and proficient in the assessment of fuel storage tank integrity.

Knowledge and competence in topics covered in this

Section are maintained by each Service center of excellence. Subject Matter Expert (SME) is defined as Service Headquarters Subject Matter Experts:

Air Force - The Air Force Fuels Facilities Subject Matter Expert (AFCEC/COS)

Army - Headquarters, U.S. Army Corps of Engineers, POL-MCX Facilities Proponent (CECW-EC) through the Army Petroleum Center (APC)

Navy/Marine Corps - NAVFAC POL Facility Subject Matter Expert (NAVFAC EXWC, CI11)

****

PART 1 GENERAL

1.1 REFERENCES

****

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

****

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

AMERICAN PETROLEUM INSTITUTE (API)

API 570	(2016; Addendum 1 2017; Addendum 2 2018; ERTA 1 2018) Piping Inspection Code: In-Service Inspection, Rating, Repair, and Alteration of Piping Systems
API MPMS 2.2A	(1995; R 2017) Manual of Petroleum Measurement Standards Chapter 2-Tank Calibration Section 2A-Measurement and Calibration of Upright Cylindrical Tanks by the Manual Tank Strapping Method
API MPMS 2.2B	(1989; R 2019) Manual of Petroleum Measurement Standards Chapter 2: Tank

	Calibration - Section 2B: Calibration of Upright Cylindrical Tanks Using the Optical Reference Line Method
API MPMS 2.2C	(2002; R 2013) Manual of Petroleum Measurement Standards Chapter 2: Tank Calibration - Section 2C - Calibration of Upright Cylindrical Tanks Using the Optical-Triangulation Method
API MPMS 2.2D	(2003; R 2014) Manual of Petroleum Measurement Standards Chapter 2: Tank Calibration - Section 2D Calibration of Upright Cylindrical Tanks Using the Internal Electro-Optical Distance-Ranging Method
API RP 571	(2020) Damage Mechanisms Affecting Fixed Equipment in the Refining Industry
API RP 574	(2016) Inspection Practices for Piping System Components
API RP 575	(2020) Inspection Practices for Atmospheric and Low-Pressure Storage Tanks
API RP 579-1	Fitness-For-Service
API RP 1110	(2013; R 2018) Recommended Practice for the Pressure Testing of Steel Pipelines for the Transportation of Gas, Petroleum Gas, Hazardous Liquids, Highly Volatile Liquids, or Carbon Dioxide
API RP 2207	(2017; 7th Ed) Preparing Tank Bottoms for Hot Work
API Std 521	(2014; 6th Ed) Pressure-relieving and Depressuring Systems
API Std 650	(2013; Errata 1 2013; Addendum 1 2014; Errata 2 2014; Addendum 2 2016; Addendum 3 2018) Welded Tanks for Oil Storage
API Std 653	(2014; Addendum 1 2018) Tank Inspection, Repair, Alteration, and Reconstruction
API Std 2015	(2018) Requirements for Safe Entry and Cleaning of Petroleum Storage Tanks

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ANSI/ASNT CP-189	(2020) ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-16	(2017; Errata 2018; Supp 1 2018) Minimum

	Design Loads and Associated Criteria for Buildings and Other Structures

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.1	(2003; R 2018) Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B16.5	(2020) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.21	(2021) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.48	(2015) Line Blanks
ASME B18.2.1	(2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(2022) Nuts for General Applications: Machine Screw Nuts, and Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
ASME B40.100	(2022) Pressure Gauges and Gauge Attachments
ASME BPVC SEC V	(2017) BPVC Section V-Nondestructive Examination

ASTM INTERNATIONAL (ASTM)

ASTM A193/A193M	(2023) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A194/A194M	(2023) Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
ASTM A325	(2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A563	(2021; E 2022a) Standard Specification for Carbon and Alloy Steel Nuts
ASTM D610	(2008; R 2019) Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces
ASTM E1316	(2020a) Standard Terminology for Nondestructive Examinations
ASTM E2807	(2011; R 2019) Standard Specification for 3D Imaging Data Exchange
ASTM F436	(2011) Hardened Steel Washers

ASTM F3125/F3125M	(2019) Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30	(2024) Flammable and Combustible Liquids Code
NFPA 326	(2015) Standard for Safeguarding of Tanks and Containers for Entry, Cleaning, or Repair

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PA 2	(2015; E 2018) Procedure for Determining Conformance to Dry Coating Thickness Requirements

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS3275	(2009; Rev C) Sheet, Acrylonitrile Butadiene (NBR) Rubber and Non-Asbestos Fiber Fuel and Oil Resistant

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety -- Safety and Health Requirements Manual

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-PRF-907	(2020; Rev H) Antiseize Thread Compound, High Temperature
UFC 3-301-01	(2023) Structural Engineering
UFC 3-460-03	(2017; with Change 1, 2021) Petroleum Fuel Systems Maintenance

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.146	Permit-required Confined Spaces

1.2 DEFINITIONS

****

NOTE: Requirements in this Section must be checked against requirements in the project Statement of Work or Project Program to ensure that there is not a conflict.

****

1.2.1 DoD Tank Features List

As used in this Section, documentation of functional and physical attributes in the form of a spreadsheet which the Contracting Officer will provide after award. This document is in addition to the API Std 653 Annex C inspection checklist.

1.2.2 Hazardous Area

As used in this Section, any area within 30 meters 100 feet of active storage tanks, areas within 30 meters 100 feet of leaking sections of fuel pipelines or other vapor sources, areas within 60 meters 200 feet of the downwind side of potential vapor emission sources (i.e., pressure-vacuum vents, sample ports, or open vents on active tanks; leaking sections of pipelines), areas within existing tanks, and areas within a tunnel or adit.

1.2.3 Hot Work

For work covered by this section: drilling, boring, flame heating, welding, torch cutting, brazing, carbon arc gouging, grinding, abrasive blasting, or any work which produces heat, by any means, of 200 degrees C 400 degrees F or more; or in the presence of flammables or flammable atmospheres, other ignition sources such as spark or arc producing tools or equipment, static discharges, friction, impact, open flames or embers, nonexplosion-proof lights, fixtures, motors or equipment.

1.2.4 Independent

Impartial third party not a part or affiliated with Contractor or subcontractor principal or subsidiary businesses.

1.2.5 Inspector of Record

The individual, certified as a fuel storage tank inspector, in responsible charge of the storage tank inspection who will attest to the suitability for service. The recognized certification is API Std 653.

1.2.6 Mandatory Repair

Action necessary to preserve or restore the structural and hydraulic integrity of the tank or piping, or to mitigate a safety hazard. Includes any condition which has or may breach the hydraulic or structural integrity of the tank prior to the next integrity inspection.

1.2.7 Marine Chemist

The holder of a valid Certificate issued by the National Fire Protection Association in accordance with the "Rules for Certification of Marine Chemists" establishing the individual as a Qualified Person pursuant to NFPA 326.

1.2.8 MAWP

Maximum allowable working pressure: As used in this Section, maximum internal pressure in the piping system for continued operation at the most severe condition of coincident internal or external pressure and temperature expected during service.

1.2.9 Mil

A unit of length equal to 0.001 of an inch.

1.2.10 Progressive Indication

A response from a nondestructive examination interpreted to be relevant and evaluated to be time-dependent deterioration such as active corrosion.

1.2.11 Recommended Repair

Action intended to extend the service life of the tank or piping and to address conditions that currently, or within the next service interval, will not have an adverse affect on tank operability or integrity. Applicability is limited to exclude soft or elastomeric parts for any pressure containing system.

1.2.12 Tank Engineer

One or more licensed professional engineers, or an engineering firm acceptable to the Contracting Officer, knowledgeable and experienced in the engineering disciplines associated with the evaluation of mechanical and material characteristics that affect the integrity and reliability of storage tanks. The storage tank engineer is the tank inspection subject matter expert.

1.2.13 Tank Inspection

As used in this Section, a tank inspection is a multi-disciplinary engineering assessment of all petroleum, oil, and lubricant storage tank systems within or connected to the tank hydraulic boundary. Systems include nozzles, appurtenances and conveyance systems such as piping, stilling well, valve, flow control, cathodic protection, overfill protection, spill prevention, containment, leak detection, fire suppression, gauging, ventilation, lighting, and other electrical systems. Inspection includes a review of cathodic protection reports and relevant as-built records when available. Unless stated otherwise in the [Project Program][Statement of Work], the limits are the boundary of secondary containment.

1.2.14 Tank Inspector

An individual certified as a fuel storage tank inspector. The recognized certification is API Std 653.

1.3 ADMINISTRATIVE REQUIREMENTS

****

NOTE: Piping hydrostatic test for use on cut and cover tank piping within the hydraulic boundary or on drain-dry AST piping.

****

1.3.1 Sequencing

[Schedule hydrostatic test of nozzle piping to occur early during the inspection phase. Report results in the preliminary inspection report.

] Schedule tank inspection(s) to occur in accordance with Section 01 14 00

WORK RESTRICTIONS.

1.3.2 Safety Permits and Equipment

Acquire safety permits and necessary safety equipment in compliance with Installation Requirements, Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS, Section 33 01 50.55 CLEANING OF PETROLEUM STORAGE TANKS, and EM 385-1-1. A permit is required for all hot work. The storage tank is a confined space and entry must be made in accordance with requirements of EM 385-1-1 Section 34.

1.3.3 Regulatory Requirements

Obtain permits required to comply with local, State, and Federal regulations.

1.4 SUBMITTALS

****

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force, and NASA projects, or choose the second bracketed item for Army projects.

****

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When

used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Tank Inspector Credentials; G[, [_____]]

[Piping Inspector Credentials; G[, [_____]]

] Tank Engineer Credentials; G[, [_____]]

NDE Examiner Credentials; G[, [_____]]

NDE Firm Credentials; G[, [_____]]

Hydrostatic Test Plan; G[, [_____]]

Inspection Plan; G[, [_____]]

Preliminary Inspection Report; G[, [_____]]

Inspection Report; G[, [_____]]

SD-06 Test Reports

Hydrostatic Test Report; G[, [_____]]

SD-07 Certificates

Instrument Calibration Certificate

SD-10 Operation and Maintenance Data

Electronic Tank Calibration Table; G[, [_____]]

1.5 QUALITY ASSURANCE

1.5.1 Modification of References

Perform work in accordance with UFC 3-460-03. Except as modified herein, work must conform to [API 570, API RP 574,]API Std 653, and API RP 575.

1.5.2 Qualification and Certification

1.5.2.1 Tank Engineer

Qualification: Minimum [four][seven] years verifiable experience in evaluation, design, repair, and integrity assessment of [field fabricated][cut and cover] fuel storage tanks. Provide evidence of having completed tank inspections, inspections of repairs, or integrity assessments on at least five similar size and type tanks within the previous four years.

Certification: Licensed Professional Civil or Mechanical Engineer. [Certification as an API Std 653 tank inspector.]Provide Tank Engineer Credentials and qualification.

1.5.2.2 Tank Inspector

Qualification: Minimum [four][seven] years verifiable experience performing inspections[of bulk fuel storage tanks][of cut and cover fuel storage tanks]. Provide evidence of having completed inspections on at least five similar size and type storage tanks within the previous four years.

Certification: API Std 653 tank inspector. Provide Tank Inspector Credentials to include API Std 653 certification and qualification.

[1.5.2.3 Piping Inspector

****

NOTE: Piping inspector for use if piping and nozzle inspection and piping hydrostatic test on cut and cover tank piping that is part of the tank hydraulic boundary or on drain-dry AST piping is within the purview of the inspection scope.

****

Qualification: Minimum four years verifiable experience performing fuel piping inspections of the same size and type as required. Provide evidence of having completed at least five similar inspections within the previous four years.

Certification: API 570 piping inspector. Provide Piping Inspector Credentials to include API 570 certification and qualification.

]1.5.2.4 Non-Destructive Examination (NDE) Company

Qualification: [Independent third party company][Company] with minimum four years verifiable experience conducting:

a. Tank plate scanning for surface, subsurface, and backside indications

b. Weld examination for surface and subsurface indications

Certification: NDE Firm Credentials to include contact information, industry qualification, and experience.

1.5.2.5 Non-Destructive Examiner

Qualification: Examiners must be qualified to perform non-destructive examination in accordance with API Std 653 and API Std 650. Examiners must meet minimum requirements for qualification in ANSI/ASNT CP-189. Qualified examiners must have minimum five years verifiable experience performing non-destructive examination of fuel storage tanks. Experience is defined as work activity performing a specific NDE method under the direction of qualified supervision but does not include time spent in training programs.

Certification: Examiners certified to at least Level II requirements compliant with ANSI/ASNT CP-189 for the applicable method. Level II Limited certification does not meet this requirement. Provide NDE Examiner Credentials to include qualification and certification.

1.6 INSPECTION PLAN

Submit Inspection Plan pursuant to Section [01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES][01 33 00 SUBMITTAL PROCEDURES].

1.6.1 Desired Service Interval

****

NOTE: Use judgment regarding Desired Service Interval. OOS repair durations can be lengthy. Goal is 20-year interval but must account for repair duration. If 24 years is infeasible or unnecessary, use 12 years. Ensure interval is consistent with requirements in work statement.

****

Unless otherwise stated in the [Project Program][Statement of Work], use [12][24] years as the interval to the next inspection.

1.6.2 Environmental Conditions

Plan ventilation and tank entry means which will provide a gas-free environment suitable for safe entry. Comply with Section 33 01 50.55 CLEANING OF PETROLEUM STORAGE TANKS and API Std 2015. Prepare for tank bottom work consistent with API RP 2207.

1.6.2.1 Gas Test Holes

Liquid or hydrocarbon vapor might exist [in the tank shell to substrate interstice][below the bottom plates]. Should the space be required to be sampled or inerted, provide an engineered detail to install and repair test holes. Purge the interstice with inert gas if required to establish gas-free conditions and in accordance with API RP 2207. Provide test holes pursuant to paragraph GAS TEST HOLE INSTALLATION. Repair gas test holes in accordance with paragraph GAS TEST HOLE REPAIR.

[1.6.3 Tank Geometric Data

****

NOTE: Use this paragraph in the event a qualitative data from a LIDAR survey of the tank interior is desired.

****

Plan a survey regime which will result in a thorough, electronic dataset of tank interior surfaces and internal piping. Data must be non-proprietary and conform to ASTM E2807. Point density must be adequate to provide surface resolution of 0.20 inch each axis. Data are intended for use as a permanent set of baseline geometric information and to be registered with inspection data. Ensure point cloud is supported directly within AUTOCAD software.

][1.6.4 Destructive Testing

****

NOTE: Use this paragraph should it be expected that confirmation of inspection NDE will be useful or required, if there are questions about weldability, or if metallurgical properties of the material need

to be established. Do not use destructive testing unless warranted and repairs are programmed. Require in the Project Program or SOW the quantity, size, and location of coupons. If NDE confirmation is being performed, select locations based on inspection thickness data.
****

Provide destructive testing which will obtain test coupons, submit them to a laboratory for analysis, and report [metal loss,]chemical, mechanical, macrographic, and metallographic properties of the material. Use the services of an accredited test laboratory. Design the testing to inform the repair design and weld procedure qualification as required in Section 33 01 50.75 REPAIR OF FIELD FABRICATED FUEL STORAGE TANKS. [Compare and report the metal loss data with results of the NDE performed during inspection.]Coupon location, size, and quantity are pursuant to requirements in the [Project Program][Statement of Work].

]1.6.5 Actionable Indication Determination

Retroactive compliance with criteria such as UFC, DoD Standard Design, and API Std 650 is not required. Many vintage tank welds fully perform despite noncompliance with current weld profile or spacing criteria. Evaluate past performance of welds and assess the expectation for continued performance in structural and hydraulic integrity. Do not find a weld actionable solely for the purpose of current criteria compliance, unless the finding informs a recommendation that affects integrity or operability.

[1.6.6 Aboveground Storage Tank

****
NOTE: Use this paragraph only for aboveground tanks.
****

Plan the storage tank inspection and other specialized engineering services. Use the API Std 653 Annex C inspection checklist. In addition, incorporate inspection of components which fall outside the scope of API Std 653[and API 570], but which fall within the scope of this Section. Plan the inspection to validate storage tank conditions in order to fully inform a repair design.

Specify complementary examination methods capable of detecting and sizing surface and subsurface defects, as well as product and backside corrosion. Qualitative methods are acceptable for screening purposes as long as requirements of this Section are met and quantitative data are obtained by follow-on means.

Plan an inspection approach which will examine 100 percent, as interior appurtenances allow, of the tank bottom. Tailor plan to specific facility conditions. Address relevant damage mechanisms pursuant to engineering best practice and API RP 571. Do not use a risk-based approach.

1.6.6.1 Corrosion Rate

Screen inspection data to distinguish progressive versus non-progressive indications but use only progressive indications in rate calculations. Calculate corrosion rates per region per API Std 653 and include in preliminary report.

1.6.6.2 Remaining Thickness Analysis

Calculate minimum plate thickness for all regions. Assume product side corrosion rate for coated regions is zero if the expected life of the coating system equals or exceeds the service interval. Report the thickness required to achieve, at the end of the service interval, 100 mils of plate thickness.

1.6.6.3 Remaining Service Life

Classify relevant indications into mandatory and recommended categories. Apply requirements in paragraph SUITABILITY FOR SERVICE.

1.6.6.4 Atmospheric Vent Capability

Calculate the normal and emergency atmospheric vent requirements at maximum rates of fill and issue. Assess capability of vents and their conformance to NFPA 30.

][1.6.7 Cut and Cover Tank

****
NOTE: Use this paragraph only for cut and cover tanks.
****

Plan the storage tank inspection and other specialized engineering services. Incorporate inspection of components which fall outside the scope of API Std 653[and API 570], but which fall within the scope of this Section. Plan the inspection to validate storage tank conditions in order to fully inform a repair design.

Specify complementary examination methods capable of detecting and sizing surface and subsurface defects, as well as product and backside corrosion. Qualitative methods are acceptable for screening purposes as long as requirements of this Section are met and quantitative data are obtained by follow-on means.

Plan an inspection approach which will examine 100 percent, as interior appurtenances allow, of the tank shell and bottom. Tailor plan to specific facility conditions. Address relevant damage mechanisms pursuant to engineering best practice and API RP 571. Do not use a risk-based approach.

1.6.7.1 Modified Inspection Approach Analysis

Use a modified approach in order to apply principles of API Std 653 to the extent practicable, and also assess unique characteristics of cut and cover storage tanks. Evaluate tank conditions through a systematic approach led by the Tank Engineer. Many original construction welds are noncompliant with current standards and practices for geometry and spacing. Use engineering judgment when recommending repair of existing fully-performing but noncompliant welds.

Provide a Modified Inspection Approach Analysis (MIAA) which describes the engineering basis for the inspection. Adhere to principles of API Std 653. Take into account the tank design and construction methods. Incorporate best engineering practice. Analyze and submit the MIAA in accordance with

Section [01 33 10.05 20 DESIGN SUBMITTAL PROCEDURES][01 33 00 SUBMITTAL PROCEDURES].

1.6.7.2 Modified API Inspection

Use an inspection regime which implements this Section and principles of API Std 653, API RP 575[, API 570, and API RP 574].

1.6.7.3 Corrosion Rate

****
NOTE: Calculate corrosion rate using two methods. Evaluate results to determine which is more conservative.
****

Organize thickness data into bottom and shell regions. Screen inspection data to distinguish progressive versus non-progressive indications but use only progressive indications in rate calculations. Calculate long term corrosion rates per region as the quotient of metal loss and time. Calculate corrosion rates in accordance with API Std 653. Use assumptions in Table 1. Report thickness in mils and rates in mils per year.

Table 1 Corrosion and Remaining Thickness Assumptions

Minimum thickness, (mils) end of service interval	100
Original service start year	[_____]
Nominal thickness (mils, bottom)	[_____]
Nominal thickness (mils, other regions)	[_____]
Desired Service Interval (years)	See paragraph DESIRED SERVICE INTERVAL

1.6.7.4 Remaining Thickness Analysis

****
NOTE: Use a factor of safety in the corrosion rate if needed to mitigate inspection uncertainty risk on tanks without RPB and/or leak detection, or if needed as a best practice.
****

Use the corrosion rate calculated from values in Table 1 and the method in API Std 653. Report the required thickness to achieve 100 mils of plate thickness at the end of a service interval, using both the long term corrosion rate and with the API corrosion rate method.

]1.6.8 Non-Destructive Examination

Plan an examination to provide complementary non-destructive techniques. Do not rely on a single technology. Ensure techniques, in the aggregate, have the capability to detect backside corrosion at the minimum volume as well as through holes. Procedures must be compliant with ASME BPVC SEC V.

Qualitative methods are acceptable for screening as long as requirements of this Section are met and quantitative data are obtained by follow-on means.

Record associated geometric data for relevant indications. Identify examiner(s) used at each indication.

Specify VT, UT, and VBT techniques fully compliant with this Section, ASME BPVC SEC V, and API Std 650. Adhere to NDE terminology in ASTM E1316. Provide an NDE Plan which includes requirements of ASME BPVC SEC V.

1.6.8.1 Plate Scan

Provide bottom [and shell]plate scanning to screen surfaces for backside corrosion. Provide UT at regions where tank scanning cannot be conducted. Prove up backside indications with an ultrasonic method.

1.6.8.2 Weld Examination

Provide bottom [and shell]weld examination independent of plate scanning. Characterize indications as actionable based on hydraulic or structural integrity and not on criteria compliance. Identify conditions which are symptomatic of poor weld performance.

1.6.8.3 Vacuum Box Testing

Provide a procedure to test in two pressure increments. Start the test with a 3 psig differential. Maintain vacuum pressure for at least 10 seconds. Slowly increase to 8 psig differential and maintain for at least 10 seconds. Record examiner(s) and register test data with the geometric dataset.

1.6.8.4 NDE Reliability

If MFL is used, comply with API Std 653 Annex G requirements for qualification of tank bottom examiners. Only third-party companies, having no conflict of interest in tank bottom examination applications, may facilitate qualification tests. For any other technique, provide a qualified procedure and documentation that examiners are capable of reliably detecting backside metal loss with the procedure.

[1.6.9 Tank Piping

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NOTE: Piping inspection and piping hydrostatic test are for use on cut and cover tank piping that is part of the tank hydraulic boundary or on drain-dry AST piping.

Use judgment on which type of test to specify. Identify test boundaries and whether there are means for isolation. Hot work during the inspection phase may be required. Identify local test water disposition requirements.

****

Plan an inspection of tank process piping, drain and water draw lines, nozzle necks, flanges, and valves. Inspect to provide condition information, identify deterioration, and establish geometric data.

Incorporate into the inspection plan principles of API 570 and API RP 574.

1.6.9.1 Tank Piping Hydrostatic Test

[Plan a temperature compensated, volume and pressure reconciled hydrostatic test. Segments are drain-dry piping and any piping exposed to tank head. Test to the isolation valve flange. Plan the test consistent with API RP 1110. Isolate test segments with suitable means. Use water as the test medium. Test pressure must be meaningful and not less than 150 psig unless an alternative is authorized by the Contracting Officer. Do not exceed the rating of an ASME B16.5, carbon steel, ANSI Class 150 flange. Minimum test duration is four hours.

Test must analyze consistent and inconsistent error, the magnitude of lost volume, and data trends. Inconsistent error able to be reconciled to less than 0.25 degree F is an acceptable result unless an alternate threshold is authorized by the Contracting Officer.

Prepare Hydrostatic Test Plan consistent with API RP 1110 and this Section. Submit in accordance with Section [01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES][01 33 00 SUBMITTAL PROCEDURES]. Include:

a. Site specific test procedure and pressure

b. Description of equipment, piping, and valves to be used, including one line diagram(s)

c. Method to secure test segment

d. Test record form

e. Current instrument calibration certificates

f. List of test segments and intended test pressure for each

g. Acceptance criterion

h. Method to characterize test water to screen for contaminants

i. Method to transport, store, and dispose test water

j. Post-test engineering analysis

][Plan a combined strength and leak test consistent with principles of UFC 3-460-03 Appendix G. Strength test pressure component must be meaningful and not less than 150 psig unless an alternative is authorized by the Contracting Officer. Leak test component must use a method which has been third party certified by the National Work Group on Leak Detection Evaluations. Segments are drain-dry piping and any piping exposed to tank head. Test to the isolation valve flange. Provide tests early in the inspection evolution.

]]1.7 SUITABILITY FOR SERVICE

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NOTE: Program mechanical repairs to provide 24 years of service even if a State or local jurisdiction requires a shorter compliance inspection interval. Revisit this approach and

apply judgment once condition data are received.
****

Evaluate inspection data to determine suitability for continued use. Identify conditions which pose a risk to integrity. Determine a metal loss threshold for mandatory repairs.

In the determination of mandatory repairs:

a. Use a "first, do no harm" approach to classifying tank repairs.

b. Use Desired Service Interval as the time to next inspection unless notified otherwise by the Contracting Officer.

c. Use minimum remaining thickness (MRT) no less than 100 mils at the next inspection.

d. Do not classify as mandatory repair of conditions which are noncompliant with current standards but are un-related to structural or hydraulic integrity (e.g., gouge, improper weld spacing, weld profile).

e. Apply repair determination to individual indications. Do not average across an entire plate or course.

1.8 PROJECT/SITE CONDITIONS

1.8.1 Preparation for Inspection

Develop written procedures in accordance with API Std 653 and API RP 575 for entry and re-entry into a storage tank. Ensure gas-generating, pyrophoric, or toxic residues have been removed. Review requirements in this Section and the inspection plan to test the interstice for hydrocarbons and purge as necessary. Do not start inspection until storage tank has been certified by the Marine Chemist to be safe for entry, and requirements of this Section, Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS, and EM 385-1-1 have been met.

PART 2 PRODUCTS

2.1 Gaskets

Composition ring, one piece factory cut, compliant with ASME B16.21, Buna-N. Gaskets must be composed of either graphite or synthetic fibers in a nitrile binder and must be resistant to the effects of aviation hydrocarbon fuels and manufactured of fire-resistant materials. Use full-faced gaskets for flat-face flanged joints. Use ring gaskets on raised-face flanged joints. Buna-N material must conform to SAE AMS3275. Select a gasket suitable for the work and test pressure of the fluid.

2.2 Fasteners

2.2.1 Flange Bolts, Nuts, and Washers

Bolts for pipe flanges, flanged fittings, manway covers, valves, and accessories must conform to ASME B18.2.1. Bolts must be of sufficient length to obtain full bearing on the nuts and must project no more than three full threads beyond the nuts with the bolts tightened to the required torque. Bolts must be regular hexagonal bolts conforming to

ASME B18.2.1 with material conforming to ASTM A193/A193M, Class 2, Grade B8, stainless steel, when connections between steel and aluminum are made, and Grade B7 when only carbon steel components are involved. Bolts must be threaded in accordance with ASME B1.1, Class 2A fit, Coarse Thread Series, for sizes one inch and smaller and Eight-Pitch Thread Series for sizes larger than one inch. Where aluminum is bolted to steel, use stainless steel fasteners.

Nuts for pipe flanges, flanged fittings, valves and accessories must conform to ASME B18.2.2, hexagonal, heavy series with material conforming to ASTM A194/A194M, Grade 8, stainless steel for stainless steel bolts, and Grade 7 for carbon steel bolts. Nuts must be threaded in accordance with ASME B1.1, Class 2B fit, Coarse Thread Series for sizes one inch and smaller and Eight-Pitch Thread Series for sizes larger than one inch.

Use chromium molybdenum alloy washers dimensioned to ASTM F436 flat circular for chromium molybdenum bolts. Use stainless steel washers dimensioned in accordance with ASTM F436 flat circular and fabricated from the same grade of stainless steel as the bolt. Use torque wrenches to tighten flange bolts to the torque recommended by the gasket manufacturer or to eliminate drips. Tighten in the pattern recommended by the gasket manufacturer. Use anti-seize compound on stainless steel bolts.

2.2.2 Structural Bolts, Nuts, and Washers

a. Bolts: ASTM F3125/F3125M (ASTM A325), Type 1, heavy hex style, plain finish. Ensure bolt heads are distinctively marked with the manufacturer unique identifier and grade. Bearing type connections are Type N unless determined otherwise.

b. Nuts: ASTM A563, Grade C, heavy hex style, plain finish. Ensure nuts are distinctively marked with the manufacturer's unique identifier and grade.

c. Washers: ASTM F436, Type 1, circular. When the outer face of the joint has a slope greater than 1:20 with respect to a plane normal to the bolt axis, use ASTM F436, Type 1, beveled to compensate for the lack of parallelism.

2.2.3 Thread Lubricant

Provide thread lubricant on fastener to minimize galling compliant with MIL-PRF-907 Anti-Seize Compound on fasteners external to the tank. On tank interior fasteners use SAE 30 oil.

PART 3 EXECUTION

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NOTE: This Section is not ordinarily intended to be used without Section 33 01 50.75 REPAIR OF FIELD FABRICATED FUEL STORAGE TANK. If used stand-alone, incorporate appropriate requirements from that section.

****

3.1 CONTROL OF HAZARDOUS ENERGY

Prior to entry, provide proper lockout and tagout of the storage tank and appurtenances to completely isolate from sources of energy. Items to be

isolated include nozzles, valves, pumps, and motor starters. Isolate tank and piping with physical means such as blind flanges compliant with ASME B16.5 or solid-plate line blanks compliant with ASME B16.48 to prevent fuel or vapor transfer into the tank or piping. Isolation means must be of sufficient strength to withstand pressure which might be exerted by the product being blanked off, and must be gasketed on both sides if line blank is inserted between two flanges. Do not use a valve as means of isolation. Execute in accordance with accepted Accident Prevention Plan, Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS and EM 385-1-1. Coordinate lockout / tagout with site fuels operator.

3.1.1 Thermal Relief

Evaluate thermal relief capability on active facility piping isolated from the tank. Should isolation means result in a segment of active piping unprotected from thermal overpressure, provide temporary means consistent with API Std 521 to relieve the overpressure. Consult with operators to determine existing relief pressures and adjust temporary relief settings to ensure overpressure does not occur.

3.2 TANK PLATE ACCESS

Provide means of access to all areas of the tank envelope for personnel, materials, and equipment. Provide lighting, ventilation, and access to the work for the Contracting Officer representative while inspection is being performed.

3.3 GAS-FREE ENVIRONMENT

Degas tank until requirements of Section 33 01 50.55 CLEANING OF PETROLEUM STORAGE TANKS, the accepted Accident Prevention Plan, API Std 2015, 29 CFR 1910.146, and the certified Marine Chemist are met. Obtain gas-free certification from the Marine Chemist. Maintain the gas-free environment. Purge the interstice with inert gas as-needed to remove hydrocarbon vapors consistent with API RP 2207.

3.4 TANK CLEANING

Clean tank in accordance with this Section and Section 33 01 50.55 CLEANING OF PETROLEUM STORAGE TANKS. The interior surfaces must be cleaned not to bare metal but only to the surface of sound coating, free of rust, dirt, scale, loose material, fuel, oil, grease, sludge, and other deleterious material. Do not damage sound coating material. If coating is loose or disbonded and interferes with the tank inspection, remove it and clean the surfaces to bare [metal][concrete]. If tank coating repair or replacement is required in the [Project Program][Statement of Work], clean surfaces to the level of cleanliness necessary for coating removal and recoating work to proceed. Cleanliness requirements of this paragraph are not intended to meet coating surface preparation requirements.

3.5 DATA MANAGEMENT

Organize data in a non-proprietary management system such as a database or spreadsheet. Serialize all NDE and API inspection indications with a unique identifier. The system must have the capability to easily be searched to track the provenance of each inspection indication to repair. Cloud-based systems are not acceptable.

Categorize indications pursuant to definitions in ASTM E1316.

3.6 GAS TEST HOLE INSTALLATION

In the event verification of conditions in the interstice is required and pursuant to Marine Chemist requirements, install gas test holes in accordance with the inspection design and hot work permit. Drill with a pneumatic tool using cooling lubricant. Test hole diameter must not exceed 3/16 in. Record all gas test hole locations in the indications database with a serialized identifier. Mark all test hole locations adjacent to the hole in a neat and professional manner which will remain evident following the repair. Repair gas test holes in accordance with paragraph GAS TEST HOLE REPAIR.

3.7 PHOTOGRAPHIC DOCUMENTATION

Document conditions with well-illuminated photographic means and minimum capture resolution of 2560 x 1920. Only downsample images for reporting purposes. Provide full resolution images in electronic format on portable media. USB flash drives are not allowed. Include photographs which document the condition of the tank, general overall layout, and discrepancies.

3.8 STORAGE TANK INSPECTION

Arrive at site with all necessary equipment and material. Perform a thorough storage tank inspection in accordance with API Std 653, API RP 575, [API 570,]this Section, and pursuant to the engineered inspection plan. Scan 100 percent of tank [bottom][hydraulic surfaces] as interior appurtenances allow, to screen for discontinuities, flaws, anomalies, corrosion, cracks, gouges, laminations, and other conditions. Collect data to be used in the assessment of corrosion growth, structural integrity, brittle fracture, and hydraulic integrity. Complete the DoD Tank Features List and the API Std 653 checklist and provide them with the preliminary report.

Populate a database with inspection results. Distinguish between product-side and back-side indications. Categorize indications into corrosion-based and non corrosion-based indications.

3.8.1 Protect in Place

Protect in place motors, pumps, impellers, risers, floating roof, and ATG probe and conductors. Mark indications and inspection information on tank plates in a neat and professional manner. Do not use fluorescent paint in the tank.

3.8.2 Inspection Before and During Cleaning

Pressure washing can remove trace indications in areas requiring further examination. Perform a visual screening of the tank by the API Std 653 inspector prior to cleaning. Make a record of areas of disbonded or deteriorated coating. Provide oversight during cleaning to ensure excessive pressure is not applied to the coating system.

3.8.3 Appurtenances

Measure roof support columns and gauge tubes to determine whether they are plumb. Verify whether gauge tubes are slotted and centered over the datum plate. Verify operability of alarms, hatches, manway cover, davit arm,

and tape gauge. Assess condition of miscellaneous conduit, tubing, product recovery system, hydraulic control valve and piloting, thermal relief, water drawoff system, floating roof seals, handrail, stairway, and landing. Pneumatically test repad telltale holes pursuant to requirements in API Std 650.

3.8.4 Structure

Examine the tank structure, joints, and columns. Assess whether there are signs of strain[or water intrusion]. Determine whether columns have thinned areas or metal loss, and whether tube columns have relief weepholes.

3.8.5 Atmospheric, Circulation, Emergency Vents

Assess condition of vent screen suitability. Verify emergency vent freely operates.

[3.8.6 Coating Condition Survey (CCS)

****
NOTE: Use this paragraph if coating is not planned to be removed and CCS is warranted.
****

Pursuant to [Project Program][Statement of Work] requirements, provide an [internal][external][internal and external] coating condition survey (CCS) by an independent NACE Certified Protective Coating Specialist (PCS). PCS minimum qualifications are provided in Section [01 45 00.05 20 DESIGN AND CONSTRUCTION QUALITY CONTROL][01 45 00 QUALITY CONTROL]. PCS who is providing the CCS must have verifiable experienced in the field of epoxy and (poly)urethane coating analysis, coating failure forensics, and coating system design. PCS must not be affiliated with, employed by, or have an ownership interest in a materials manufacturer or vendor, or with any subcontractor performing coating services in fulfillment of this [Project Program][Statement of Work]. Submit qualifications and experience of the proposed PCS, and the CCS report per Section [01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES][01 33 00 SUBMITTAL PROCEDURES].

Use visual observations and non-destructive testing in the survey. Provide objective ratings of coating system conditions at various tank regions. Evaluate the degree of rusting in accordance with ASTM D610. Assess coating adhesion, hardness, and measure dry film thickness (DFT) in accordance SSPC PA 2. Determine whether entire coating system or regions thereof are candidates to receive overcoating, spot repair, or a combination of both in order to extend the system service life. The intent of the CCS is for the Government to receive objective third-party information about the most cost-effective method of corrosion control. The Government will use that information to base decisions to extend the life of the facility. The CCS must contain detailed observations and analytical data about the coating, its condition, and the substrate. Cite industry criteria applied in the survey. Minimum CCS report contents are listed below.

a. Condition of existing coating system and film

b. Toxicity Characteristic Leaching Procedure test results that identify the existence of potentially hazardous substances which may impact coating management (e.g., lead, cadmium, chromium, arsenic, barium,

mercury, selenium, silver).

c. Analysis of remaining life, suitability for overcoating, and basic technical requirements for overcoating

d. Basis information for cost-effective management of the coating system such as film thickness, and percentage areas of rust, checking, blistering, and chalking

e. Recommendations to achieve cost effective management of coating systems, including overcoating and spot repair quantities, dimensions, and limits

][3.8.7 Coating Assessment

****
NOTE: Use this paragraph if CCS is not warranted and ordinary inspection is desired.
****

Provide an assessment of the tank coating systems. Identify type and extent of existing systems. Identify extent of coating failure, disbondment, and blisters. Perform dry film thickness (DFT) measurements in accordance with SSPC PA 2. Measure DFT on the external shell and roof, and internal bottom regions. Organize and report the DFT data in tabular form. Identify the minimum, maximum, and average thickness obtained from the regions.

]3.8.8 Engineering Assessment

Use the data obtained during the inspections to perform an engineering assessment of the hydraulic and structural conditions of the storage tank and its appurtenances. Determine and report backside corrosion rates for regions of the tank. Calculate the remaining service life.

3.9 NDE TECHNIQUES

Mark relevant indications on tank surfaces in a neat and professional manner adjacent to the indication. Repair areas of removed coating in accordance with [Project Program][Statement of Work] requirements.

3.9.1 Visual Examination

Visually inspect the overall condition of the tank. Include manway cover, atmospheric vent system, sump, and floating roof. Assess corrosion, coating condition, welds, appurtenances, gauging tubes, nozzles. Apply API RP 575 recommended practices for performing a tank inspection. Enhance visual acuity with a magnifying lens of 5X to 10X power wherever required to discern indications otherwise not clear. Measure size and contour of welds with suitable gages. Minimum light intensity at the examination surface must be 100 foot-candles. The VT procedure must be compliant with ASME BPVC SEC V.

[3.9.2 Shell Examination

****
NOTE: Shell scan for use on cut and cover tanks
****

Scan tank shell hydraulic surfaces for indications such as metal loss, pits, cracks, gouges, and general corrosion. Distinguish between product and backside indications.

Quantify indications with an ultrasonic method. Be vigilant to detect large areas of uniformly-corroded metal and laminations. In areas inaccessible by scanning, use UT to characterize condition. Mark relevant indications on tank surfaces in a neat and professional manner adjacent to the indication.

]3.9.3 Bottom Examination

Scan 100 percent of the tank bottom, as interior appurtenances allow, for indications such as metal loss, pits, cracks, gouges, and general corrosion. Distinguish between product and backside indications.

Measure metal thickness with an ultrasonic method. Procedures must be compliant with ASME BPVC SEC V. Record measurements, exclusive of coating, for all tank bottom plates. Provide UT thickness measurement on no less than five locations per plate and at indications from the screening technologies determined to be relevant.

Mark relevant indications on tank surfaces in a neat and professional manner adjacent to the indication. Register UT data locations with geometric dataset.

3.9.4 Vacuum Box Testing

Perform VBT on locations in the tank where a breach in the hydraulic boundary is suspected. Use a procedure compliant with this Section and ASME BPVC SEC V. Evacuate the vacuum box slowly. Do not increase vacuum during active bubble formation. The VBT standard for acceptance is the no leak condition and API Std 650.

[3.10 PIPING AND NOZZLE INSPECTION

****

NOTE: Piping and nozzle inspection and piping hydrostatic test for use on cut and cover tank piping that is part of the tank hydraulic boundary or on drain-dry AST piping.

****

Pursuant to [Project Program][Statement of Work] requirements, perform an inspection of tank piping using the principles of API 570 and API RP 574. For areas determined to require further investigation, provide Fitness for Service evaluation pursuant to API RP 579-1 assessment methodology.

Examine nozzle necks, fittings, flanges, low points, thermal relief, expansion joints, slide pads, and vibration isolators. Assess suitability and serviceability.

3.10.1 Tank Piping Hydrostatic Test

Notify the Contracting Officer 14 days prior to hydrostatic test. Hydrotest piping in accordance with API RP 1110 and the Test Plan. Test the segment from inside the tank to the first accessible flange outside the tank. Utilize alternative means to isolate unflanged piping. Remove appurtenances within the test segment and isolate with blind flanges.

Deploy components with pressure rating no less than existing flanges. Maintain the pressure within the piping for the test duration with no leakage or reduction in gauge pressure. Do not use an instrument without a calibration certificate.

Provide means to remove entrapped air. For inaccessible piping, account for the volume of any test medium added or removed by measuring with a calibrated meter. Provide means of communication between technicians at each end of the test segment. Ensure test water contains less than 50 ppm chloride content. Generate a test record contemporaneous with each test event.

3.10.1.1 Instruments

a. Instruments must be clean, in good working order, and within the interval of its calibration.

b. Calibrate all test instruments against a standard by an accredited laboratory. Calibration must have taken place no more than six months prior to the test. Calibration certificates must include the Model, Serial Number, date of certification, and must be signed by the calibrating company. Provide current Instrument Calibration Certificate for measurement instruments.

c. Provide indicating pressure test gauge connected directly to the segment and readily visible to the operator controlling pressure for the duration of the test. Analog type gauges must be compliant with ASME B40.100 Grade 3A, accurate to plus or minus 0.25 percent full scale, graduated over a range not less than 1-1/2 times nor more than four times the test pressure, and incremented no greater than 0.5 psi.

d. Digital type pressure gauge must be integral transducer type, compliant with ASME B40.100 Grade 3A, and accurate to plus or minus 0.25 percent full scale.

e. Provide digital contact thermometer incremented to 0.1 degree F or less. Memorialize pressure data with analog chart recorder. Transducers must have a range not less than 1.5 times and not greater than four times the pressure being tested.

f. Use calibrated continuous recorders (dataloggers) with adequate storage capacity to record temperature and pressure data. Synchronize temperature and pressure datalogger intervals.

g. Measure the volume of test medium with a calibrated meter.

3.10.1.2 Test Parameters

Maintain segment at a steady test pressure condition for a minimum of 15 minutes prior to initiation of examination for leakage. Examine piping, joints, and connections of accessible piping for leaks while maintaining test pressure. Leakage of temporary gaskets and seals, installed for the purpose of conducting the hydrostatic test and which will be replaced later, is permitted unless the leakage rate precludes maintenance of system test pressure for the required duration. Personnel performing the examination for leaks must be qualified for visual examination. Extend the test interval as needed to ensure positive reconciliation of test data. Monitor temperature and pressure. Analyze consistent error, inconsistent error, the magnitude of any lost volume, and pressure versus

temperature data trends.

Measure test medium temperature independent of the environment. Provide instrument with output resolution of at least 0.1 degree F for water as the test medium. Ensure instrument accuracy exceeds the uncertainty required to achieve acceptance criteria.

Account for an accurate determination of fluid volume during a test. Provide volume measurements to the nearest fluid ounce.

3.10.1.3 Test Report

Provide test results and engineered analysis. Provide certification from the engineer the piping segments are either pass or fail. Inconclusive results are not acceptable. Submit Hydrostatic Test Report in accordance with Section [01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES][01 33 00 SUBMITTAL PROCEDURES].

]3.11 VALVES

Verify isolation and control valves are suitable and serviceable. Verify operation of valve appurtenances including motor and hand-operated equipment, pilot controls, body cavity relief, and position indicators.[Pursuant to [Project Program][Statement of Work] requirements, clean, recondition, test, and commission isolation valves and actuators back into service.]

3.12 GAS TEST HOLE REPAIR

****

NOTE: If Section 33 01 50.75 REPAIR OF FIELD FABRICATED FUEL STORAGE TANKS is being used in the contract concurrent with this Section, use repair of gas test hole requirements in Section 33 01 50.75.

If Section 33 01 50.75 REPAIR OF FIELD FABRICATED FUEL STORAGE TANKS is not being used in the contract, then repair must be performed pursuant to this Section.

****

Repair all gas test holes pursuant to Section 33 01 50.75 REPAIR OF FIELD FABRICATED FUEL STORAGE TANKS. Fill every gas test hole with weld metal. Temporarily plug the gas test holes between inspection and repair phases.

[3.13 DESTRUCTIVE TESTING

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NOTE: Use this paragraph should it be expected that confirmation of inspection NDE will be useful or required, if there are questions about weldability, or if metallurgical properties of the material need to be established. Do not use destructive testing unless warranted and repairs are programmed.

****

After scanning has been performed and backside corrosion data reviewed, remove [two][five] 6 in diameter coupons of tank material for testing.

Coupon locations will be identified by Government. Remove coupons with a straight, neat, distortion-free cutline and in accordance with Section 33 01 50.75 REPAIR OF FIELD FABRICATED FUEL STORAGE TANKS.

Mark coupon product side to identify orientation. Document coupon front and back side conditions with photography in accordance with paragraph PHOTOGRAPHIC DOCUMENTATION. Prepare samples and submit to laboratory for testing. In-situ testing is not acceptable as a substitute for laboratory testing. Use the services of an accredited laboratory to perform testing.

Repair holes from coupons pursuant to Section 33 01 50.75 REPAIR OF FIELD FABRICATED FUEL STORAGE TANKS.

][3.14 TANK CALIBRATION TABLE

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NOTE: Strapping is not commonly required for inspections. Include this paragraph if existing strapping charts are believed to be inaccurate by the Government or if the tank under inspection is being returned to service. If Section 33 01 50.75 is being used concurrently, defer tank calibration requirements to that Section.

****

Calibrate tank in accordance with paragraph TANK CALIBRATION METHOD. Provide two hard copy laminated capacity tables, one in English units and one in SI units. Tables must show the volume of product at all liquid levels, from the lowest point of the tank bottom to the level of overflow. Include unit conversion notes on each table.

English unit table must show the volume of product in gallons and barrels, and the corresponding level of product in 1/16 inch increments. SI unit table must show the volume of product in liters and in cubic meters, and the corresponding level of product in 2.0 mm increments.

Volume calculations must be made in the smaller units. Larger units may be obtained by rounding. Use the top of the datum plate as level zero. Show levels below the top of the datum plate, including nozzle piping, in negative units. Tables must not include tank volume above the level of overflow.

On the calibration table (strapping chart), identify level points coincident with automatic tank gauge action or alarm settings.

Provide Electronic Tank Calibration Table on electronic media compatible with the Electronic Automatic Tank Gauging System. Also provide tables identical to the master gauge table in format compatible with Microsoft Excel. Contact Contracting Officer for direction on required format.

3.14.1 Tank Calibration Method

Calibrate storage tank in accordance with the API Manual of Petroleum Measurement Standards using the [API MPMS 2.2A][API MPMS 2.2B][API MPMS 2.2C][API MPMS 2.2D] method.

]3.15 DATABASE

Manage the indications database in a secure, auditable, and organized

manner. Record visual and API inspection findings and associated geometric data in the system. Limit edit rights to individuals with a specific need.

3.16 INSPECTION REPORT

3.16.1 Preliminary Report

Upon completion of the inspection for each tank, prepare a preliminary report for the Government Technical Team. Identify mandatory and recommended repairs in itemized lists. Use a unique identifier (not bullets) for each item. State the methodology used to determine MRT. Submit Preliminary Inspection Report in accordance with Section [01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES][01 33 00 SUBMITTAL PROCEDURES]. Preliminary report contents are:

a. Tank ID, location, product service, and inspection date.

b. Suitability for service analysis pursuant to paragraph SUITABILITY FOR SERVICE, suitability for service statement identifying whether the tank is suitable for continued operation, reduce capacity, or complete removal from service. If tank is unsuitable for service or operating at a reduced capacity, provide a concise description of the reason(s).

c. Inspector of Record name, certification number, and date.

d. Summary of tank, nozzle, and appurtenance conditions.

e. Analysis of bottom examination and corrosion growth.

f. API Std 653 and DoD Tank Features List.

[g. Storage Tank Engineer name, profession engineer's license number, [API Std 653 certification number]and date.]

3.16.2 Full Inspection Report

Deliver a full report of inspection findings to the Contracting Officer. The report must include a record of NDE findings with drawings depicting plate layout and thickness measurement locations. Incorporate engineering analysis, suitability for service analysis pursuant to paragraph SUITABILITY FOR SERVICE, corrosion rate determinations, and remaining service life calculations. Include electronic appendices with inspection and geometric data. Provide separate report for each tank inspected. Provide Tank Inspection Summary Sheet for each tank inspected. Define all terms including adjectival descriptions. In addition, provide the NDE data as an electronic file as required in the paragraph DATA MANAGEMENT. Submit Inspection Report in accordance with Section [01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES][01 33 00 SUBMITTAL PROCEDURES].

3.16.2.1 Executive Summary

Provide a one page summary of the condition of the tank and concise recommendations for repairs.

3.16.2.2 Suitability for Service Statement

Statement must be a one page document. Specify the due date for the next inspection. Include the API Std 653 inspector of record certificate

number and signature[as well as the tank engineer's seal and signature]. Provide a statement for each tank inspected. In the event the statement cannot be made, document the reason(s) and recommend corrective measures.

3.16.2.3 Wind or Rising Water Load Analysis

Pursuant to [Project Program][Statement of Work] requirements, perform a wind load calculation to determine the minimum ballast fill height required to withstand a severe wind event (i.e., to prevent overturning, sliding, buckling, or uplift) consistent with UFC 3-301-01 and ASCE 7-16. Review historical weather records applicable to the location.

3.16.2.4 Seismic Load Analysis

Pursuant to [Project Program][Statement of Work] requirements, perform a seismic load calculation to determine the maximum fill height and freeboard required to prevent overflow during a seismic event. Calculate loads consistent with UFC 3-301-01 using Risk Category III, unless notified otherwise by the Contracting Officer.

3.16.2.5 Tank History

Establish the known historical record of the tank. The record must include as much information as possible and include:

a. Nameplate information

b. Products previously and currently stored in the tank

c. List of previous inspections

d. List and describe significant environmental (earthquake, hurricane, flooding) or operational (over-pressure, vacuum, mechanical damage, fire, settlement) events

e. List and describe repairs or alterations performed (include significant drawings and executive summaries from other repair reports in the report appendices)

f. Other pertinent facts and data

3.16.2.6 Inspection Methodology

Provide a detailed description of the inspection methodology for each tank component inspected. Identify type of inspection, equipment, and methods. Discuss corrosion rates, MRT, remaining service life[, and hydrostatic testing methodology]. Explain how statistical significance was addressed and meaningful data were obtained.

3.16.2.7 Findings

Describe inspection and NDE findings for each region. Present corrosion rates, minimum thickness, and remaining service life calculations. Discuss all findings. Summarize NDE data in the report body and provide complete NDE data in appendices.

3.16.2.8 Recommendations

Report recommendations based on policy, criteria, standards, and

regulations separately from those related to hydraulic and structural integrity.

3.16.2.9 Data

Include all data collected during the inspection. Data must be electronic, in tabular form, and be registered with tank geometric data.

3.16.2.10 Checklist/Features List

Prepare API Std 653 Appendix C and DoD Tank Features List. Annotate items which are not applicable. Provide checklist, features list, field notes, and measurements taken by the tank inspector. Provide the DoD Tank Features List in both portable document and spreadsheet formats.

3.16.2.11 Sketches

Include tank bottom, shell, and roof plate sketches depicting orientation, indications, appurtenances, nozzles and their purpose, manways, and other significant tank features. Include the sizes, dimensions, and lengths of significant tank features.

[For ASTs, include sketches of the dike, piping in the dike, locations of supports, stairs, ladders, cathodic protection stations, and monitoring wells. Include the sizes, dimensions, and lengths of significant dike features.

][For USTs, include sketches of the pumphouse and pits associated with the UST, piping in the pumphouse, information of piping and equipment in the pumphouse and pits, locations of supports, stairs, ladders, etc. Include the sizes, dimensions, and lengths of significant UST pumphouse and pit features.

]3.16.2.12 Photographs

Provide full resolution well-lit electronic color photographs which depict the area of interest. Provide a photoguide which contains descriptive caption for the photographs.

3.16.2.13 Calculations

Provide calculations consistent with API Std 653. Provide calculations for corrosion rates, MRT, next inspection date, settlement, seismic and wind load analysis, and estimated remaining service life. Provide a sample calculation for each determination along with assumptions and references used.

3.17 TANK RETURN TO SERVICE

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NOTE: If Section 33 01 50.75 is being used concurrently, use return to service requirements in that Section.

Use first bracketed option for NAVFAC if tank is being returned to service after inspection.

Use second bracketed option for Army or Air Force.

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[In order to return a storage tank to the operator fit for service, comply with NAVFAC Red Zone requirements in Section 01 45 00.05 20 DESIGN AND CONSTRUCTION QUALITY CONTROL, and requirements of UFC 3-460-03. Minimum return to service requirements are:

a. Inspection Report

b. Tank Suitability for Service Statement

c. List of Identified Repairs

d. List of Recommended Repairs

e. List of Pending (Actual) Repairs

f. Calibration (Strapping) Charts

g. Signed statement which declares custody of the tank is returned to the Activity and items a through f above have been provided to the Contracting Officer

][In order to return a storage tank to the operator fit for service, comply with requirements of UFC 3-460-03 and Section 01 45 00 QUALITY CONTROL.

] Provide adequate time for curing of coating. Use new gaskets on manway and flanged connections which were opened during the work. Replace fasteners which were removed during the work and are unsuitable for re-use. Verify the vents are not covered and are operating properly. Verify any temporary gas test hole plugs have been removed and all gas test holes have been repaired pursuant to paragraph GAS TEST HOLE REPAIR. Test valves to ensure they operate and cavities do not contain liquid. Tank cannot be returned to the operator until the suitability for service statement has been provided.

3.17.1 Cleanliness

3.17.1.1 Tank

After completion of the work, clean interior surfaces of the tank to remove all foreign matter such as blast material, dirt, debris, grease, and oils. Provide interior surfaces free from sources of product contamination, fit for service in [F-76][JP-5 / JP-8 turbine][_____] fuel storage, and to the satisfaction of the Contracting Officer. After removal of protective coverings, inspect motors, pumps, impellers, risers, floating roof, and gauges to ensure contamination or damage has not taken place. Should damage or contamination be found, remedy the finding to the satisfaction of the Contracting Officer.

3.17.1.2 Piping

Clean the interior of piping to ensure surfaces are free of contamination or foreign matter, and fit for [F-76][JP-5 / JP-8 turbine][_____] fuel service.

-- End of Section --