AMERICAN PETROLEUM INSTITUTE

API RP 575 – Inspection Practices for Atmospheric and Low-pressure Storage Tanks

BALLOT COVER PAGE

Ballot ID: 6526

Title:	**API 575, Annex D**
Purpose:	Adopt the latest 653 verbiage into API 575
Impact:	Documents the move of Annex G from API 653 to API 575 Annex D.
Rationale:	SCAST and API 653 leadership proposed the movement of Annex G from 653 to 575 in the Fall 2023 meeting in Chicago. A poll of those in attendance approved the measure. The API 653 task group had recently made updates to this Annex prior to the Fall 2023 meeting. The latest of these was via ballot 6160, which has been resolved and incorporated into this ballot. Since this entire annex is considered for adoption by SCIMI, this ballot is open for comment. SCIMI is the voting member and SCAST is invited to comment. ***If you vote NEGATIVE on this ballot, please denote which comments are the basis for your negative vote. All technical comments will need to be defended, in-person or by proxy, during the ballot resolution.***
Technical Reference(s):	

Primary Sponsor:	*Name:* Robert Sladek *Company:* Becht *Phone: (281) 686-4259* *E-mail:* rsladek@becht.com
Cosponsors:	*Name/Company: Mark Kachelmyer/mark.kachelmyer@plains.com* *Name/Company: Joseph Krynicki/joseph.w.krynicki@exxonmobil.com*

Tracking Status					
Submitted to Task Group		**Submitted to SCIMI**		**Submitted to Master Editor**	
Date	***Resolution***	***Date***	***Resolution***	***Date***	***Added***

Proposed Changes and/or Wording *{attach additional documentation after this point}*

BALLOT COVER PAGE

Date of Issue: XXXXXX, 2024
Affected Publication: API Recommended Practice 575, *Inspection Practices for Atmospheric and Low-pressure Storage Tanks,* 5th Edition, September 2024

Addendum 1

The following definitions shall be added to section 3.1 and the section renumbered.

blind zone
Inspection area that is inaccessible by tank bottom scanner.

bottom scan
The use of equipment over large portions of the tank bottom to detect corrosion. One common type of bottom scanning equipment is the magnetic flux leakage (MFL) scanner, while other NDE methods (e.g., electromagnetic, UT, etc.) may be used.

essential variables
Variables in the procedure that cannot be changed without the procedure and scanning operators being re-qualified.

non-essential variables
Variables in the procedure that can be changed without having to re-qualify the procedure and/or scanning operators.

prove-up
The activity that is used to accurately determine the remaining bottom thickness in areas where indications are found by the bottom scanning equipment. This is often accomplished using the UT method and/or pit gauge.

qualification organization
The qualification organization may be either the tank owner/operator, authorized inspection agency, or may be a third party designated by with consent of both parties.

qualification test
The demonstration test that is used to prove that the tank bottom examination procedure /examiner /equipment combination can successfully find, size (if required by owner/operator), and prove-up tank bottom metal loss, with respect to the essential variables. Comprehensive testing of the scanning equipment is beyond the scope of this document. The scanning and prove-up qualification tests may be given collectively or separately.

scanning operator
The individual that operates bottom-scanning equipment.

scanner sizing
The activity that is used to quantitatively determine the remaining bottom plate thickness or metal loss by bottom scanner. This activity may be accomplished by automatic sizing algorithms. Prove-up may be used to verify and improve the sizing algorithm and/or supplement the scanning equipment result.

tank bottom examination
The examination of a tank bottom using special equipment to determine the remaining thickness of the tank bottom. It includes the detection, scanner sizing (if required by owner/operator) and prove-

up of the indications. It does not include the visual examination that is included in the internal inspection.

tank bottom examination procedure
TBP
A qualified written procedure that addresses the essential and non-essential variables for the tank bottom examination. The procedure can include multiple methods and tools, i.e. bottom scanners, hand scanners, and UT prove-up.

tank bottom scanning operator qualification record
TBSOQ
A record of the qualification test for a specific scanning operator.

tank bottom scanning procedure qualification record
TBSPQ
A record of the qualification test for a tank bottom examination procedure.

variables or procedure variables
The specific data in a procedure that provides direction and limitations to the scanning operator. Examples include plate thickness, overlap of adjacent bottom scans, scanning speed, equipment settings, lift-off, cleanliness, etc.

The following acronyms and abbreviations shall be added to section 3.2:

TBP tank bottom examination procedure

TBSOQ tank bottom scanning operator qualification record

TBSPQ table bottom scanning procedure qualification record

Section 8.5.5.2, paragraph 4 shall be updated to the following:

Experience demonstrates considerable variability in the effectiveness of tank bottom scanning inspection and UT prove-up. When conducted by qualified personnel, equipment, and procedures, scanning inspection can be highly effective. Refer to Annex D for qualification of personnel and procedures. The owner-operator should consider the benefit in conducting a performance demonstration for personnel involved in tank bottom scanning and UT prove-up.

The following annex shall be added:

Annex D
(informative)

Qualification of Tank Bottom Examination Procedures and Personnel

D.1 Introduction

D.1.1 This annex provides guidance for qualifying both tank bottom examination procedures and individuals that perform tank bottom examinations. Owner/operator may elect to either apply this annex as written or modify it to meet their own applications and needs. Specific agreements and requirements for qualification of tank bottom examination procedures and tank bottom examiners should be established between the owner/operator and the authorized inspection agency. This

annex may be used for MFL, and other NDE bottom scanning methods as approved by owner/operator. Bottom scanners may be manual, semi-automated, or fully automated, given the specific requirements of the inspection have been established by the owner/operator and the authorized inspection agency.

D.1.2 There have been many NDE tools developed for examining tank bottoms. Most of these tools are complex and require the scanning operator to have a high level of knowledge and skill. The effectiveness of these examinations may vary greatly depending on the equipment used, the examination procedure, and the skill of the examiner.

MFL is an electromagnetic non-destructive testing technique used to detect volumetric metal loss in ferromagnetic materials. When using MFL scanner, tank bottom plates are magnetized close to saturation under an applied magnetic field. The magnetic leakage field due to metal loss is detected by the MFL scanner. Some scanners may quantitatively determine the remaining bottom plate thickness or metal loss.

Often the owner/operator will not have the ability to easily determine if the tank bottom examination has been effective in assessing the actual condition of the tank bottom. The guidelines in this annex will provide the owner/operator additional assurance that the tank bottom examination will find significant metal loss, if it exists. Owner/operator should determine metal loss extent that is considered "significant" and specify "reporting threshold" for qualification examination. Owner/operator should also specify if scanner sizing is required for qualification examination. This annex includes guidance for assessing both detection and sizing of metal loss features. The demonstration of bottom scanner with sizing capability is not the intent to fully replace prove-up.

D.2 Tank Bottom Examination Procedures

D.2.1 Each authorized inspection agency performing tank bottom examinations is responsible for developing, having and using a tank bottom examination procedure (TBP). These procedures provide directions for an examiner performing tank bottom examinations. A procedure also allows the owner/operator or authorized inspector to verify whether the examiner is correctly performing the examinations.

D.2.2 Each TBP should address essential and non-essential variables. Section D.4.4 provides guidance for determining appropriate TBP essential and non-essential variables. Each procedure should specify limits on appropriate variables, e.g. plate thickness range.

D.3 Tank Bottom Examination Personnel

D.3.1 An examiner needs only to be qualified for the work they do in the field. For example, a scanning operator who only uses the bottom scanning equipment and does not prove-up the flaw with a follow-up method (e.g. UT, pit gauge) needs only be qualified for the scanning operation.

D.3.2 The purpose of qualifying the tank bottom examiner is to determine if the examiner is capable of satisfactorily using a qualified procedure and equipment to identify and report the condition of the tank bottom.

D.3.3 Each authorized inspection agency is responsible for training, testing and qualifying each scanning operator and examiner they employ using prove-up techniques. Qualifications gained through one authorized inspection agency are not necessarily valid for any other authorized inspection agency.

D.3.4 The authorized inspection agency is responsible for training each scanning operator they employ. Each scanning operator should receive no less than the recommended level of MFL training per ASNT guidelines (28 hours) or additional training of up to 40 hours or more as required by the tank owner/operator. This training should include:

a) instruction on the NDE principles/methods used by the bottom scanner, limitations and application of the specific scanning equipment and procedure, scanning equipment calibration and operation, key scanning equipment operating variables, etc.

b) hands-on operation of the bottom scanner under the direct supervision of a qualified scanning examiner familiar with the bottom scanning equipment.

When hiring an experienced examiner, the authorized inspection agency should verify and document previous examiner training and provide any additional training if necessary. An experienced examiner should be provided training regarding specific procedural requirements and equipment utilized by the new employer.

D.3.5 The authorized inspection agency is responsible for testing each examiner by written examination. The authorized inspection agency should determine the personnel involved in inspection (e.g., data collection personnel, data analyst, etc.) and the requirements of written examination. The test questions should be appropriate for the scanning method to be used. The authorized inspection agency should establish the passing score for the written examination.

D.3.6 The authorized inspection agency is responsible for qualifying each examiner they employ and providing or verifying their NDE certifications. Each examiner (scanning operator and examiner performing prove-up on the indications) should be qualified by performing an examination on test plates as specified in D.4 by the owner/operator approved qualification organization. The examiner is qualified if the acceptance criteria specified in D.4.2 have been met.

Each examiner performing prove-up of indications using ultrasonic testing methods should be qualified in accordance with ASME Section V Article 5 and supplemental requirements given in this annex.

D.3.7 During the qualification test, a tank bottom scanning operator qualification record (TBSOQ) shall be completed for each examiner. The TBSOQ is a record of the variables used during the qualification test. On the TBSOQ, the qualification organization shall record:

a) all essential variables from the qualification test.

b) the qualification test results.

c) number of hours the individual has been trained.

d) test score from the written training examination.

The TBSOQ should be certified (signed) as accurate by a representative of the authorized inspection agency and a representative of the company facilitating the test.

D.3.8 The TBSOQ may be written in any format that contains all the required information.

D.3.9 The examiner (scanning operator and/or UT examiner) should be re-qualified after 3 years, or when any of the following apply:

a) when the examiner is not qualified to the TBP that is to be used at the owner/operator facility.

b) when the authorized inspection agency changes the TBP, and that change requires the procedure to be re- qualified.

c) when the authorized inspection agency or owner/operator has reason to question the ability of the examiner.

d) when an examiner changes to a new employing authorized inspection agency that uses

procedures with essential variables that are different from the previous employer's procedures.

D.4 Qualification Testing

D.4.1 Qualification Test Requirements

The qualification organization should determine qualification test requirements including the following parameters:

a) Reporting threshold.

b) Reporting template including required data (e.g. feature location, feature depth/length/width, top vs bottom side, etc.).

c) Maximum testing and reporting time.

d) The extent of UT prove-up utilized during qualification examination should be consistent with D.4.2.1 and similar to the percentage of prove-up during actual bottom scanning. Owner/operator may provide a limited area with representative features for scanner sizing algorithm adjustment and calibration/setup as suggested in D.4.2.1.

D.4.2 Qualification Test Plates

D.4.2.1 The qualification test will be performed on sample tank bottom plate(s) with designed flaws. The sample tank bottom plate(s) should have a minimum total area of 14 m^2 (150 ft^2) to provide space for the designed flaws. The material used to fabricate sample plates may be either a new plate or a naturally corroded plate. It should be noted that the results obtained during qualification tests might not be indicative of the results of examinations performed on other plates of differing quality or permeability. When naturally corroded plate is utilized for qualification purposes, the qualification test acceptance standards recommended in D.4.3 may not be appropriate. The owner/operator should establish its own acceptance standards in such cases.

The sample tank bottom can be one single plate or multiple plates. The sample tank bottom should contain the following:

a) Each plate is marked with "0" origin point and x, y direction accordingly.

b) Each plate should have at least two 90-degree corners to provide easy reference for scanner encoder.

c) Plate(s) should have at least one lap weld area. Lap weld(s) can be simulated by welded or bolted on strips.

d) Depending on the type of scanning equipment, consider the use of a prove-up area to allow examiner to verify and improve the scanner sizing algorithm through prove-up. The prove-up area can be limited to 1.3m (4 ft) X 1m (3 ft) in size. The area may contain simple machined flaws such as round bottom holes and grooves, as well as flaws that are representative of flaws found in the rest of sample tank bottom. The number of flaws for prove-up should be determined by owner/operator with minimum of 10 features.

D.4.2.2 The qualification test plate should contain flaws from all four types of flaw classifications (pinhole, pitting, grooving, general corrosion) as defined in Table D.1. Additional considerations should include representative flaws beyond those mentioned above to provide a comprehensive tank bottom feature population.

Table D.1—Flaw Classifications

Flaw class	Dimension
Pinhole	W < 6mm (0.24in.) and L < 6mm (0.24in.)
General Corrosion	W > 50mm (2in.) and L > 50mm (2in.)
Pitting	6mm (0.24in.) < W < 50mm (2in.) and 6mm (0.24in.) < L < 50mm (2in.) and 0.5< L/W <2
Grooving	W <= 25mm (1in.) and L >= 50mm (2in.)
NOTE L: flaw length and W: flaw width	

D.4.2.3 The minimum number and types of underside (bottom side) flaws located on the test plates are described in Table D.2:

Table D.2—Minimum number and types of bottom side flaws

Flaws	Remaining Bottom Thickness (t)[f]	Minimum number of flaws
Isolated Pitting [a]	60%T<=t<80%T	1
	40%T<=t<60%T	1
	1.3mm (0.05in.) < t < 40%T	2
	t<=1.3mm (0.05in.)	2
Pitting Cluster [a] [b]	60%T<= t[c] <80%	2
	40%T<=t[c] <60%T	2
	1.3mm (0.05in.) < t[c] < 40%T	3
	t[c] <= 1.3mm (0.05in.)	3
Pinhole	t < 30%T	4
General Corrosion [d]	40%T <=t<=60%T	2
Grooving[e]	40%T<=t<=60%T	1

NOTE where:
T is nominal bottom thickness.
t is the remaining bottom thickness at test plate flaws.
[a] Test pits should generally be hemispherical having a depth-to-diameter ratio of from 20 % to 50 %. Test pits should not be flat bottom holes since examiners may interpret these as a lamination. Also, machined conical holes should not be used since they are difficult to size with UT methods.
[b] Pitting cluster defines as a group of individual pits (more than two pits) within a 76mm (3in.) diameter area. The pits can be all top side, all bottom side, or a mixture of top and bottom side. The positions of top and bottom pits should not overlap or be too close to each other. The clusters should be separated adequately to ensure scoring is unambiguous. The individual pit can have various dimensions (depth/width/length). When the pitting cluster is specified in bottom side table A.2, the deepest pit in the cluster needs to be on bottom side. When the pitting cluster is specified in the top side table in A.3, the deepest pit in the cluster needs to be on the top side.
[c] t is the minimum remaining thickness within the cluster.
[d] General corrosion should avoid sharp edge transitions and have depth profile with a radius of curvature 152 mm (6in.) or greater.
[e] Grooving is placed near and parallel to lap weld within 25mm (1in.) of edge (e.g.,

weld toe). Note not all scanners are capable of detecting this type of flaw due to geometry and location. The owner/operator should specify whether grooving is required for qualification examination.
[f] As-built flaw dimension should be verified and recorded.

D.4.2.4 The minimum number and types of product side (top side) test flaws located on the test plates are described in Table D.3.

Table D.3—Minimum number and types of top side flaws

Flaws	Remaining Bottom Thickness (t) [f]	Minimum number of Flaws
Isolated Pitting [a] [b]	60%T<=t<80%	1
	40%T<=t<60%T	1
	1.3mm (0.05in.) < t < 40%T	2
	t<= 1.3mm (0.05in.)	2
Pitting Cluster [b]	60%T<= t[c] <80%	2
	40%T<=t[c] <60%T	2
	1.3mm (0.05in.) < t[c] < 40%T	3
	t[c] <=1.3mm (0.05in.)	3
General Corrosion [d]	40%T <=t<=60%T	1
Grooving[e]	40%T<=t<=60%T	1

NOTE where:
T is nominal bottom thickness.
t is the remaining bottom thickness at test plate flaws.
[a] Test pits should generally be hemispherical having a depth-to-diameter ratio of from 20 % to 50 %. Test pits should not be flat bottom holes since examiners may interpret these as a lamination. Also, machined conical holes should not be used since they are difficult to size with UT methods.
[b] Pitting cluster defines as a group of individual pits (more than two pits) within a 76mm (3in.) diameter area. The pits can be all top side, all bottom side, or a mixture of top and bottom side. The positions of top and bottom pits should not overlap or be too close to each other. The clusters should be separated adequately to ensure scoring is unambiguous. The individual pit can have various dimensions (depth/width/length). When the pitting cluster is specified in bottom side table A.2, the deepest pit in the cluster needs to be on bottom side. When the pitting cluster is specified in the top side table in A.3, the deepest pit in the cluster needs to be on the top side.
[c] t is the minimum remaining thickness within the cluster.
[d] General corrosion should avoid sharp edge transitions and have depth profile with a radius of curvature 152 mm (6in.) or greater.
[e] Grooving is placed near and parallel to lap weld within 25mm (1in.) of edge (e.g., weld toe). Note not all scanners are capable of detecting this type of flaw due to geometry and location. The owner/operator should specify whether grooving is required for qualification examination.
[f] As-built flaw dimension should be verified and recorded.

D.4.2.5 When examining blind zone with hand scanner, the owner/operator should consider placing additional flaws near the plate edge or simulated lap weld, i.e. less than 50 mm (2in.) from the edge, and near the plate corners, i.e. within 152 mm (6in.) X 152 mm (6in.) of corner, to determine if such flaws can be detected by authorized inspection agency procedures. Any flaws placed closer than 50 mm (2in.) to the plate edge and within 152 mm (6in.) X 152 mm (6in.) of corner should be in addition to those shown above and should not be included in determining qualification unless specifically required by an owner/operator and such defects are stated as being detectable in authorized inspection agency procedures.

D.4.3 Qualification Test Acceptance Standards

D.4.3.1 The following acceptance criteria shall be met when qualifying either an examination procedure or an examiner. If all the acceptance criteria are met, the procedure or examiner should be

considered qualified. Owner/ operator may substitute alternative acceptance criteria, either more or less conservative, based on their specific needs and requirements.

D.4.3.2 Flaws detected should have a coordinate accuracy of ± 50 mm (2in.) from plate datum.

D.4.3.3 It is advised to limit allowable scanning time to 90 mins, and UT prove-up time to 60 mins for 14 m^2 (150 ft^2) tank test plate. The allowable time can be adjusted accordingly for larger test plate.

D.4.3.4 When qualifying either a procedure or a scanning operator, the operator shall be able to detect the minimum numbers of flaws per Table D.4.

Table D.4—Minimum detected flaws

Flaws	Remaining Bottom thickness (t)	Minimum % of Flaws Detected
Pitting [a]	60%T<=t<80%T	30%
	40%T<=t<60%T	60%
	1.3mm (0.05") < t < 40%T	80%
	t<=1.3mm (0.05")	90%
Pinhole		75%
Area of general corrosion		100%
Grooving		Specified by owner/operator

[a] A pitting cluster is considered detected when at least one pit on the same side of the deepest pit within the cluster is detected.

D.4.3.5 When qualifying either a procedure or an examiner who proves up the indications, the examiner shall be able to determine the flaw depth per Table D.5:

Table D.5—Prove-up accuracy requirements

Type of Tank Bottom	Prove-up (Flaw Depth)
Not coated	± 0.5mm (0.02in.)
Thin coating ≤ 0.5mm (0.02in.)	± 0.76mm (0.03in.)
Thick coating > 0.5mm (0.02in.)	Per agreement with Owner/operator

The owner/operator should determine if additional flaw dimensions shall be addressed in the qualification process.

Owner/operator should recognize that UT prove-up through coatings (especially glass reinforced plastic / fiberglass reinforced plastic) for existing equipment may be very difficult to achieve without coating removal, and supplemental prove up strategies should be considered.

D.4.3.6 While false calls, also referred to as over-calls, tend to be more of an examination efficiency issue than a tank bottom integrity issue, the owner/operator should determine if they should be addressed in the qualification process.

D.4.3.7 When qualifying either a procedure or an operator that uses a scanner capable of sizing, the scanner sizing accuracy should be within +/-20%T and achieved in at least 80% of total detected features, where T is nominal bottom thickness. If a scanner does not have sizing capability or is not capable of meeting above scanner sizing criteria, owner/operator should establish different qualification levels that satisfy the intent of inspection.

D.4.3.8 Robotic scanners (onstream and out-of-service) may have limited opportunities for validation and prove-up. Owners/operator should consider performance limitations (e.g., inability to clean

inspection area, minimum thickness that can be reliably measured by UT, etc.) and determine acceptability during qualification and tank testing.

D.4.3.9 The testing results shall be recorded on the TBSOQ or TBSPQ, as applicable.

D.4.4 Qualification Test Variables

D.4.4.1 Essential variables will have a significant effect on the quality of the examination if they are changed from those used during the qualification test.

D.4.4.2 Table D.6 lists suggested items that may be considered as essential variables for the qualification test when qualifying either a tank bottom examination procedure or a tank bottom examiner. Essential variables may be different for different types of tank bottom scanners. Authorized inspection agencies are responsible for determining what additional variables should be considered essential variables for each tank bottom scanner.

D.4.4.3 All essential variables and the values shall be recorded on the TBP, TBSOQ, and tank bottom scanning procedure qualification record (TBSPQ).

D.4.4.4 Non-essential variables are those items that will have a lesser effect on the quality of the examination. Non- essential variables may be different for different types of tank bottom scanners.

Table D.6—Suggested Essential Variables for Qualification Tests

Essential Variable	Used During Test	Qualified
Scanner Equipment	As tested	Same as tested
Prove-up Equipment	As tested	Same as tested
Prove-up Procedure	As tested	Same as tested
Plate Thickness (T)	T	T + 0.13 mm (0.005in.) – T – 3.3 mm (0.13in.)
Coating Thickness (t_c) [(a)]	No coating used	0 mm (0in.) [(b)]
	0.025 mm (0.001in.) < $t_c \leq$ 0.76 mm (0.03in.)	up to 1mm (0.04in.) [(b)]
	0.76mm (0.03in.) < $t_c \leq$ 2mm (0.08in.)	0.5 mm (0.02in.) to 2.29 mm (0.09in.) [(b)]
	t_c > 2 mm (0.08in.)	1.78 mm (0.07in.) to t_c [(b)]
Distance from Shell (d_s)	d_s	Lesser of 203 mm (8in.) or d_s
Critical Equipment Settings	As tested	Per manufacturer
Scanning Threshold Settings in Wall Loss (T_h)	T_h	<= T_h [(c)]
Calibration or Functional Check	As tested	Same as tested

[a] Coating condition and composition should be representative of the tested tank.
[b] Maximum qualified coating thickness should be within the range of scanner specifications.
[c] Owner/operator should recognize that lower scanning threshold may result in more false positive calls.

D.4.4.5 Non-essential variables shall be listed on the TBP but need not be addressed on the TBSPQ or the TBSOQ. The following is a list of examples of items that might be considered as non-essential variables. Equipment manufacturers and authorized inspection agencies are responsible for determining what additional factors should be considered non-essential variables:

a) scanner speed.
b) scanning pattern.
c) height limitations.
d) overlap between scans.
e) plate cleanliness.
f) non-critical equipment settings.
g) Coating condition.
h) Lift-off.

NOTE Some of the listed non-essential variables may be essential variables for specific types of tank bottom scanning equipment.