

Recommended Practice for Source Inspection and Quality Surveillance of Fixed Equipment

API RECOMMENDED PRACTICE 588
FIRST EDITION, JULY 2019



AMERICAN PETROLEUM INSTITUTE

Special Notes

API publications necessarily address problems of a general nature. With respect to particular circumstances, local, state, and federal laws and regulations should be reviewed.

Neither API nor any of API's employees, subcontractors, consultants, committees, or other assignees make any warranty or representation, either express or implied, with respect to the accuracy, completeness, or usefulness of the information contained herein, or assume any liability or responsibility for any use, or the results of such use, of any information or process disclosed in this publication. Neither API nor any of API's employees, subcontractors, consultants, or other assignees represent that use of this publication would not infringe upon privately owned rights.

API publications may be used by anyone desiring to do so. Every effort has been made by the Institute to ensure the accuracy and reliability of the data contained in them; however, the Institute makes no representation, warranty, or guarantee in connection with this publication and hereby expressly disclaims any liability or responsibility for loss or damage resulting from its use or for the violation of any authorities having jurisdiction with which this publication may conflict.

API publications are published to facilitate the broad availability of proven, sound engineering and operating practices. These publications are not intended to obviate the need for applying sound engineering judgment regarding when and where these publications should be used. The formulation and publication of API publications is not intended in any way to inhibit anyone from using any other practices.

Any manufacturer marking equipment or materials in conformance with the marking requirements of an API standard is solely responsible for complying with all the applicable requirements of that standard. API does not represent, warrant, or guarantee that such products do in fact conform to the applicable API standard.

All rights reserved. No part of this work may be reproduced, translated, stored in a retrieval system, or transmitted by any means, electronic, mechanical, photocopying, recording, or otherwise, without prior written permission from the publisher. Contact the Publisher, API Publishing Services, 200 Massachusetts Avenue, NW, Suite 1100, Washington, DC 20001-5571.

Foreword

Nothing contained in any API publication is to be construed as granting any right, by implication or otherwise, for the manufacture, sale, or use of any method, apparatus, or product covered by letters patent. Neither should anything contained in the publication be construed as insuring anyone against liability for infringement of letters patent.

The verbal forms used to express the provisions in this document are as follows.

Shall: As used in a standard, “shall” denotes a minimum requirement to conform to the standard.

Should: As used in a standard, “should” denotes a recommendation or that which is advised but not required to conform to the standard.

May: As used in a standard, “may” denotes a course of action permissible within the limits of a standard.

Can: As used in a standard, “can” denotes a statement of possibility or capability.

This document was produced under API standardization procedures that ensure appropriate notification and participation in the developmental process and is designated as an API standard. Questions concerning the interpretation of the content of this publication or comments and questions concerning the procedures under which this publication was developed should be directed in writing to the Director of Standards, American Petroleum Institute, 200 Massachusetts Avenue, Suite 1100, Washington, DC 20001. Requests for permission to reproduce or translate all or any part of the material published herein should also be addressed to the director.

Generally, API standards are reviewed and revised, reaffirmed, or withdrawn at least every five years. A one-time extension of up to two years may be added to this review cycle. Status of the publication can be ascertained from the API Standards Department, telephone (202) 682-8000. A catalog of API publications and materials is published annually by API, 200 Massachusetts Avenue, Suite 1100, Washington, DC 20001.

Suggested revisions are invited and should be submitted to the Standards Department, API, 200 Massachusetts Avenue, Suite 1100, Washington, DC 20001, standards@api.org.

Contents

	Page
1 Scope/Purpose	1
2 Introduction	1
3 Normative References	1
4 Definitions, Abbreviations, and Acronyms	2
5 Training and Certification	11
5.1 General	11
5.2 Levels of Training and Experience	12
6 Source Inspection Management Program	13
6.1 General	13
6.2 Activities	13
6.3 Other References	13
7 Project-specific Source Inspection Planning Activities	14
7.1 General	14
7.2 Equipment Risk Assessment	15
7.3 Development of a Source Inspection Project Plan	16
7.4 Development of Inspection and Test Plans	16
7.5 Selection of an Inspector	18
7.6 Coordination of Inspection Events	18
7.7 Report Review	18
8 Source Inspection Performance	18
8.1 Inspector Conduct and Safety	18
9 Review of Project Documents	18
9.1 General	18
9.2 Contractual Agreements	19
9.3 Performing the Source Inspection	25
9.4 Source Inspection Work Process Scheduled Planning Events	26
9.5 Report Writing	27
9.6 Nonconformances/Deviations	27
9.7 Source Inspection Project Continuous Improvement	30
9.8 Source Inspector Continuous Improvement	30
10 Examination Methods, Tools, and Equipment	30
10.1 General	30
10.2 Review and Confirmation of Materials of Construction	31
10.3 Dimensional Inspections	32
10.4 Visual Inspections	32
10.5 Nondestructive Examination (NDE) Techniques	32
10.6 Destructive Testing	33
10.7 Pressure/Leak Testing	33
10.8 Performance/Functional Testing	34
10.9 Surface Preparation/Coatings Inspections	34
10.10 Final Acceptance	35

Contents

	Page
11 Manufacturing and Fabrication Processes	36
11.1 General.....	36
11.2 Welding Processes and Welding Defects.....	37
11.3 Casting	37
11.4 Forging	38
11.5 Machining	38
11.6 Assembly.....	39
11.7 Metallurgy Issues Associated with Manufacturing and Fabrication Processes	39
12 Pressure Vessels.....	40
12.1 General.....	40
12.2 Vessel Methods of Construction	41
12.3 Vessel Materials of Construction	41
12.4 Vessel Internal Components	42
12.5 Vessel Design and Construction Standards	42
12.6 Dimensional Check of Pressure Vessels.....	43
12.7 Heat Exchangers	44
13 Piping	45
13.1 General.....	45
13.2 Valves.....	45
13.3 Flanges.....	46
13.4 Fittings.....	47
14 Structural Components.....	48
Annex A (informative) Most Common Types of ASME and NB Code Symbol Stamps.....	50
Annex B (informative) Types of Tools for Use by the Source Inspector	51
Annex C (informative) Different Types of Bolted Flange Connections	57
Annex D (informative) Chemical Symbols	59
Annex E (informative) Websites Useful to the Source Inspector.....	60
Figures	
1 Work Process	1
A.1 ASME and NB Code Symbol Stamps	50
B.1 Source Inspection Tools (1).....	51
B.2 Source Inspection Tools (2).....	52
B.3 Source Inspection Tools (3).....	53
B.4 Source Inspection Tools (4).....	54
B.5 Source Inspection Tools (5).....	55
B.6 Source Inspection Tools (6).....	56
C.1 Different Types of Flange Faces (Sealing Surfaces)	57
C.2 Different Flange Types	58

Contents

	Page
Tables	
D.1 Chemical Symbols.....	59
E.1 Useful Websites.....	67

Currently in preview, click buy full version

Introduction

This recommended practice has been developed to provide information for source inspectors (SI) for the purpose of providing a consistent method of supplier/vendor (S/V) quality surveillance for the oil, petrochemical, and gas industries. It is intended as a resource for individuals studying to take the API Source Inspector Certification examination. Other references contained herein and in the published body of knowledge (BOK) will also be necessary for individuals to become familiar with to pass the examination and to perform satisfactorily in the source inspection.

Currently in preview, click buy full version

Recommended Practice for Source Inspection and Quality Surveillance of Fixed Equipment

1 Scope/Purpose

This recommended practice (RP) covers the process of specifying the necessary quality surveillance of materials, equipment, and fabrications being supplied for use in the oil, petrochemical, and gas Industry, including upstream, midstream, and downstream segments. This RP may be used as the basis for providing a systematic approach to risk-based source inspection to provide confidence that materials and equipment being purchased meet the minimum requirements as specified in the project documents and contractual agreements. The activities outlined in this RP *are not* intended to replace the manufacturer's/fabricator's own quality systems, but rather are meant to guide SIs acting on behalf of the purchaser to determine whether manufacturer's/fabricator's own quality systems have functioned appropriately, such that the purchased equipment and materials will meet contractual agreements.

This RP focuses primarily on pressure-containing and structural equipment (fixed equipment), including but not limited to vessels, columns/towers, heat exchangers, piping, valves, pressure-relief devices, tubulars, and supporting structural fabrications. The principles of the document can be applied to other equipment disciplines. This document assumes that suppliers/vendors (S/V) have been pre-qualified by a systematic quality review process of their facilities and quality processes to determine if the facility has the ability to meet the requirements of the contractual agreements. That process generally leads to a list of pre-approved S/Vs deemed acceptable to the supply chain management of the purchaser who are capable of meeting the requirements of the contract prior to it being placed. S/Vs on such a list will normally have an acceptable quality process already in place that meets the requirements of the contract. An approved S/V list may also indicate that S/Vs have the technical skills and can meet the SCM commercial terms and conditions. The purpose of source inspection in such a case is simply to verify that the S/V quality processes are working as they should and to verify that certain critical steps in the inspection and test plan (ITP) have been satisfactorily accomplished prior to fabrication completion and/or shipping.

The primary purpose of this RP is to summarize the basic body of knowledge that the source inspector typically needs to know to perform as a source inspector for fixed equipment. A secondary purpose is to assist candidates intending to take the API Source Inspection Examination to become certified source inspectors. This RP outlines the fundamentals of source inspection and may be useful to all personnel conducting such activities to perform their jobs in a competent and ethical manner. For more information on how to apply for Source Inspection Certification, please visit the API website at www.api.org/si and follow the work process shown in Figure 1.

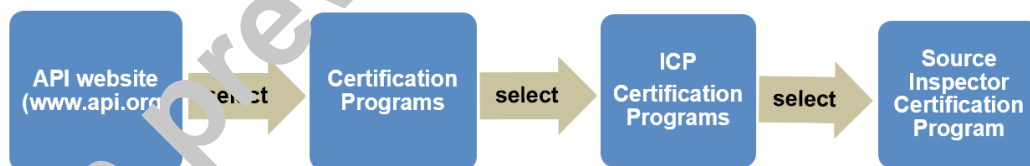


Figure 1—Work Process

2 Introduction

The source inspection work process follows the Plan–Do–Check–Act circular process first popularized in the 1950s by Edward Deming. The “Plan” part of source inspection is covered in Sections 6 and 7 of this RP and involves the source inspection management systems, source inspection project plan, and the inspection and test plan (ITP). The “Do” part is covered in Sections 8, 9, and 10, and involves implementing the ITP, participating in scheduled source inspection work process events, filing nonconformance reports (NCRs), and source inspection report writing. The “Check” part, covered in Section 9.7, involves reviewing all the source inspection activities that occurred in the “Plan” and “Do” parts to see what went well and what should be improved based on the results of that review. Finally, the “Act” part (sometimes called the “Adjust” part), covered in Section 9.8, involves