Elements of a Fixed Equipment Mechanical Integrity (FE MI) Program

API BULLETIN 592
FIRST EDITION, JUNE 2025



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. The use of API publications is voluntary. In some cases, third parties or authorities having jurisdiction may choose to incorporate API standards by reference and may mandate compliance.

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 utilized. 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.

Copyright © 2025 American Petroleum Institute

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.

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

Contents

Page

1 Scope ... 1
1.1 General ... 1
1.2 Purpose ... 1
1.3 Limitations ... 1

2 Normative References ... 1

3 Terms, Definitions, Acronyms, and Abbreviations ... 1
3.1 Terms and Definitions ... 1
3.2 Acronyms and Abbreviations ... 4

4 Fixed Equipment in an MI Program ... 5
4.1 Pressure Vessels ... 5
4.2 Storage Tanks ... 6
4.3 Piping and Pipelines ... 7
4.4 Pressure Relief Devices ... 8
4.5 Fired Equipment ... 9
4.6 Critical Utility Systems ... 9
4.7 Equipment that Combines Fixed Equipment (FE) and Other Equipment Types ... 9
4.8 Other Fixed or Periphery Equipment ... 10

5 Written Guidance ... 11
5.1 General ... 11
5.2 Policies, Processes, and Systems ... 12
5.3 Programs ... 12
5.4 Procedures ... 13
5.5 Detailed Work Instructions ... 14

6 Training and Qualifications ... 15
6.1 General ... 15
6.2 Certifications ... 16
6.3 Experience ... 16
6.4 Local Process and Safety Training ... 16
6.5 Documentation ... 16

7 Inspection and Testing ... 16
7.1 General ... 16
7.2 ITPM Tasks ... 16
7.3 ITPM Methodology and Frequency ... 17
7.4 Inspection Documentation (Inspection/Test Report Templates) ... 17

8 Deficiency ... 18
8.1 General ... 18
8.2 Equipment Deficiency Management Process ... 19
8.3 Program Deficiency Management Process ... 20

9 Quality Assurance ... 21
9.1 General ... 21
9.2 QA for Design and Fabrication of New Equipment (Prior to Installation) ... 21
9.3 QA for Receiving, Storage, and Retrieval ... 21
9.4 QA for Construction and Installation ... 22

Contents

Page

9.5 QA for In-service Inspections, Repairs, Alterations, and Rerating 22
9.6 QA for Temporary Installations and Repairs 23
9.7 QA for Reuse of Decommissioned or Purchased Equipment 23
9.8 QA for Spare Parts 23
9.9 QA for Contractor Supplied Equipment 24

10 Roles and Responsibilities Associated with MI 24

11 Process Safety Information 25
11.1 General 25
11.2 PSI Management Program 26

12 Repair Organizations 27
12.1 Qualified Repair Organizations 27
12.2 Repair Stamps 28
12.3 Repair Data Reports (Forms) 28
12.4 Repair Inspection Reports and Records 29

13 Pre-startup Safety Review (PSSR) 30
13.1 General 30
13.2 Description 30
13.3 Checklist 30
13.4 Documentation 30

14 Management of Change 30
14.1 General 30
14.2 Creating a MOC Process 30
14.3 When to Initiate a MOC 31
14.4 MOC Review and Approval 31
14.5 Updating MOC Associated Documentation and Closure 31

15 Integrity Operating Windows (IOWs) 31
15.1 General 31
15.2 Establishing IOWs 32
15.3 Management of IOWs 32

16 Key Performance Indicators 32
16.1 General 32
16.2 Challenges Associated with KPIs 33
16.3 Mistakes Associated with KPIs 33
16.4 Reporting 33

17 Program Audits 34
17.1 General 34
17.2 Audit Scope 34
17.3 Audit Team Members 34
17.4 Audit Activities 35
17.5 Site Organization and Leadership 35
17.6 Continual Improvement 35

18 Safe Work Practices 36

Contents

Page

19 Inspection Data Management Systems (IDMS) 37
19.1 General 37
19.2 Benefits 37
19.3 Roles and Responsibilities 37
19.4 Types of IDMS 38
19.5 Selecting an Inspection Data Management System 38

20 Managing Codes and Standards Updates and Revisions 38
20.1 General 38
20.2 Selection, Application, and Revisions 39

21 Pressure Equipment Integrity Incident Investigation 39

Annex A (informative) Example Fixed Equipment Codes, Standards, and Useful Documents Web Diagram 41

Annex B (informative) Examples of FE MI PSSR Items 43

Annex C (informative) Examples of Codes and Standards Technical Bodies 45

Bibliography 48

Figures

1 Example of a Company Written Document Framework 12
A.1 Example Fixed Equipment Codes, Standards, and Useful Documents Web Diagram 42

Tables

1 Example Deficiency Types 19
2 Mechanical Integrity Roles and Responsibilities 25
3 Typical PSI for Fixed Equipment 26

Elements of a Fixed Equipment Mechanical Integrity (FE MI) Program

1 Scope

1.1 General

Mechanical integrity (MI) is a key pillar in safe operation of any process facility. The term mechanical integrity (or asset integrity) applies broadly to all equipment types including fixed equipment, rotating equipment, mitigation equipment (lower explosive limit, deluge, gas detector, suppression), and instrumentation/controls. Inspection, testing, and preventive maintenance tasks for each equipment type are crucial for safe operation and reliability of a process facility.

1.2 Purpose

The purpose of this document is to provide information on the MI program for the different types of fixed equipment. Other process equipment, such as rotating equipment and instrumentation/controls, are not covered in this document. Development of MI programs in various industries involves interpretation of regulations and case-by-case decision making, depending on the complexity of the equipment. The contents of this document are intended to assist in determination of:

— the key elements and considerations in developing a fixed equipment MI program based on process safety management (PSM) guidelines/principles (or best practices);

— how API documents and other codes, standards, and guidance documents fit into the MI program.

1.3 Limitations

The principles outlined are intended to be used by owner-operators for fixed equipment in their facilities to align with construction codes, inspection codes, standards, or other prevailing requirements. This document is not used as a substitute for a complete Mechanical Integrity Program as defined by applicable local regulations (e.g. OSHA[1] 1910.119) but only as a compendium of principles and common industry practices by which such a program is established.

Local regulatory or jurisdictional requirements may be in contradiction with some of the suggestions provided in this document or some of the referenced codes and standards. In these cases, local regulatory or jurisdictional requirements take precedence.

2 Normative References

No other document is identified as indispensable or required for the application of this publication. A list of documents associated with API 592 is included in the bibliography.

3 Terms, Definitions, Acronyms, and Abbreviations

3.1 Terms and Definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1
aboveground storage tank
A vertical, cylindrical structure built above ground level and designed to hold a liquid or gas, but other shapes are also used.

[1] U.S. Department of Labor, Occupational Safety and Health Administration, 200 Constitution Avenue, NW, Washington, DC 20210, www.osha.gov.