

Prevention of Brittle Fracture of Pressure Vessels

API RECOMMENDED PRACTICE 920
FIRST EDITION, MARCH 1990

American Petroleum Institute
1220 L Street, Northwest
Washington, D.C. 20005



Documents
Document Sharing Hub

Prevention of Brittle Fracture of Pressure Vessels

Refining Department

API RECOMMENDED PRACTICE 920
FIRST EDITION, MARCH 1990

American
Petroleum
Institute



Documents

Document Sharing Hub

SPECIAL NOTES

1. API PUBLICATIONS NECESSARILY ADDRESS PROBLEMS OF A GENERAL NATURE. WITH RESPECT TO PARTICULAR CIRCUMSTANCES, LOCAL, STATE, AND FEDERAL LAWS AND REGULATIONS SHOULD BE REVIEWED.
2. API IS NOT UNDERTAKING TO MEET THE DUTIES OF EMPLOYERS, MANUFACTURERS, OR SUPPLIERS TO WARN AND PROPERLY TRAIN AND EQUIP THEIR EMPLOYEES, AND OTHERS EXPOSED, CONCERNING HEALTH AND SAFETY RISKS AND PRECAUTIONS, NOR UNDERTAKING THEIR OBLIGATIONS UNDER LOCAL, STATE, OR FEDERAL LAWS.
3. INFORMATION CONCERNING SAFETY AND HEALTH RISKS AND PROPER PRECAUTIONS WITH RESPECT TO PARTICULAR MATERIALS AND CONDITIONS SHOULD BE OBTAINED FROM THE EMPLOYER, THE MANUFACTURER OR SUPPLIER OF THAT MATERIAL, OR THE MATERIAL SAFETY DATA SHEET.
4. 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.
5. GENERALLY, API STANDARDS ARE REVIEWED AND REVISED, REAFFIRMED, OR WITHDRAWN AT LEAST EVERY FIVE YEARS. SOMETIMES A ONE-TIME EXTENSION OF UP TO TWO YEARS WILL BE ADDED TO THIS REVIEW CYCLE. THIS PUBLICATION WILL NO LONGER BE IN EFFECT FIVE YEARS AFTER ITS PUBLICATION DATE AS AN OPERATIVE API STANDARD OR, WHERE AN EXTENSION HAS BEEN GRANTED, UPON REPUBLICATION. STATUS OF THE PUBLICATION CAN BE ASCERTAINED FROM THE API AUTHORIZING DEPARTMENT [TELEPHONE (202) 682-8000]. A CATALOG OF API PUBLICATIONS AND MATERIALS IS PUBLISHED ANNUALLY AND UPDATED QUARTERLY BY API, 1220 L STREET, N.W., WASHINGTON, D.C. 20005.

FOREWORD

This recommended practice offers guidance in the selection of steels for new pressure vessels and the inspection and operation of existing pressure vessels to minimize the probability of brittle fracture. This recommended practice is aimed at preventing brittle fracture caused by low toughness at temperatures below approximately 120°F. Other mechanisms of deterioration are not addressed in this publication.

Both sections of this recommended practice are influenced by the improved toughness requirements voluntarily imposed by several companies for vessels used in refineries and by a few companies for petrochemical plants, natural gas processing plants, and transportation facilities. This recommended practice is also based on the toughness requirements included in the 1989 edition of Section VIII, Division 1, of the ASME *Boiler and Pressure Vessel Code*. The provision of API Standards 620 and 650 have also influenced the development of this recommended practice.

Little precedent exists for the specification of enhanced toughness for multiple duplicate (or mass produced) vessels, nor for those vessels used in natural resource services (see Section 6 of API 510 for a more complete definition of the latter).

API publications may be used by anyone desiring to do so. Every effort has been made by the Institute to assure 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 federal, state, or municipal regulation with which this publication may conflict.

Suggested revisions are invited and should be submitted to the director of the Refining Department, American Petroleum Institute, 1220 L Street, N.W., Washington, D.C. 20005.

CONTENTS

	Page
SECTION 1—SELECTION OF PRESSURE VESSEL STEELS TO PREVENT BRITTLE FRACTURE	
1.1 Introduction	1
1.2 Purpose	1
1.3 General Philosophy	1
1.4 Materials Selection	1
1.5 Referenced Publications	2
SECTION 2—TOUGHNESS EVALUATION OF EXISTING PRESSURE VESSELS	
2.1 Introduction	2
2.2 Purpose	2
2.3 Scope	2
2.4 General Philosophy	3
2.5 Criteria for Service	4
2.6 Importance of Condition	4
APPENDIX A—HYDROSTATIC TESTING	5
APPENDIX B—STEELS	7
APPENDIX C—INSPECTION	9
APPENDIX D—IMPACT TEST EXEMPTION CURVES	11
Figure	
D-1—Material Curves	12
Table	
D-1—Impact Test Exemption Temperatures for Bolting Materials	13