

Vapor Pressure of Heavy Petroleum Liquids for Estimating Emissions

API TECHNICAL REPORT 2582
FIRST EDITION, NOVEMBER 2024



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. 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.

Copyright © 2024 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.

Currently in preview, click buy full version

Contents

1	Scope	1
2	Terms, Definitions, Acronyms, and Abbreviations	1
2.1	Terms and Definitions	1
2.2	Acronyms and Abbreviations.....	1
3	Executive Summary.....	1
3.1	Statement of Purpose.....	1
3.2	Method for Predicting Vapor Pressure.....	1
4	Background.....	5
4.1	Earlier Study in API <i>MPMS</i> Chapter 19.4—Annex G	5
4.2	Subsequent International Liquid Terminals Association Testing	7
4.3	Subsequent Loss of Confidence in ASTM D2879.....	8
4.4	Consideration of ASTM D6378	8
5	Current Study	8
5.1	Initial Scope.....	8
5.2	Revised Scope	9
5.3	Brief Discussion of Simulated Distillation and Process Simulation	9
5.4	Development of the Method.....	10
6	Conclusion	13
	Annex A (informative) Method for Predicting Vapor Pressure from Simulated Distillation	14
	Annex B (informative) Schematic of Heavy Stocks in a Refinery.....	18
	Annex C (informative) Member Company Report on the Simulated Distillation Approach	19
	Annex D (informative) Member Company Report on Testing of Jet Fuel	24
	Bibliography	28
Figures		
1	Simulated Distillation Traditional Reporting Convention for the First 10 % Distilled	2
2	Simulated Distillation Results Reported in Small Increments for the First 10 % Distilled.....	3
3	Pseudo Components Assigned to Relatively Large Ranges of Temperature	4
4	Pseudo Components Assigned to Relatively Small Ranges of Temperature	4
5	No. 6 Fuel Oil—True Vapor Pressure (psia) versus Temperature (°F) Determined from ASTM D2879 Testing Conducted by the Phoenix Chemical Laboratory.....	7
B.1	Schematic of Heavy Stocks in a Refinery.....	18
D.1	Jet Fuel Vapor Pressure Correlation Data.....	25
D.2	Variation of Simulated Distillations for One Jet Fuel Sample	26
Tables		
1	No. 6 Fuel Oil in the First Study—True Vapor Pressure (psia) at 150 °F.....	6
2	Initial Set of No. 6 Fuel Oil Samples—True Vapor Pressure (psia) at 150 °F	12
3	No. 6 Fuel Oil with Additional Samples—True Vapor Pressure (psia) at 150 °F	12
4	Jet Fuel Comparison—True Vapor Pressure (psia) at 100 °F.....	12
A.1	Paired Data of Weight Percent and Boiling Point.....	14
C.1	Vapor Pressure Values from Various Methods.....	20
C.2	Paired Data of Weight Percent and Boiling Point Temperature.....	21
D.1	Measured Jet Fuel Reid Vapor Pressure	25
D.2	Comparison of Measured and Modelled Jet Fuel RVP.....	27

Introduction

This technical report will provide a methodology to predict the vapor pressure for heavy petroleum liquids (i.e. having vapor pressure below 1 psi) over a range of temperatures by evaluating the results of simulated distillation tests in process simulation software. The term “vapor pressure,” for purposes of this report, refers to the sum of the equilibrium partial pressures exerted by the components of a volatile organic liquid at a given temperature.

Currently in preview, click buy full version

Currently in preview, click buy full version

Vapor Pressure of Heavy Petroleum Liquids for Estimating Emissions

1 Scope

This technical report provides a methodology to predict the vapor pressure for heavy petroleum products over a range of temperatures by evaluating the results of simulated distillation tests in process simulation software.

2 Terms, Definitions, Acronyms, and Abbreviations

2.1 Terms and Definitions

There are no terms and definitions specified for the purposes of this document. Terms of more general use can be found in the API *Manual of Petroleum Measurement Standards (MPMS)* Chapter 11 *Terms and Definitions* online database.

2.2 Acronyms and Abbreviations

API	American Petroleum Institute
ASTM	American Society for Testing and Materials
EPA	US Environmental Protection Agency
GC	gas chromatograph
MPMS	<i>Manual of Petroleum Measurement Standards</i>
MW	molecular weight
RVP	Reid vapor pressure
SG	specific gravity
TBP	true boiling point
VOC	volatile organic compound

3 Executive Summary

3.1 Statement of Purpose

Currently, there are limited vapor pressure data available for use in estimating tank emissions for heavy petroleum liquids. The limited data provided in API *MPMS* Chapter 19.4 are likely outdated, as discussed in 4.3. As discussed in Section 4, a method is needed for obtaining more representative vapor pressure data over a range of temperatures to improve emissions estimation from tanks storing these heavy stocks.

This project was initially tasked with collecting and evaluating existing vapor pressure or distillation curve data for heavy (low volatility) petroleum liquids. However, collection of vapor pressure data was not successful because there was not a reliable test method available for determining vapor pressure for heavy stocks. The project then focused on developing a methodology for predicting vapor pressure of heavy stocks from distillation curve data.

This technical report presents methodology for predicting the vapor pressure of heavy stocks over a range of temperatures by evaluating the results of simulated distillation tests in process simulation software. The protocol for the method is provided in Annex A.

3.2 Method for Predicting Vapor Pressure

3.2.1 General

The method presented in this report for predicting vapor pressure of a stock involves the following steps.