

Centrifugal Fans for Petroleum, Chemical, and Gas Industry Services

API STANDARD 673
THIRD EDITION, DECEMBER 2014



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 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 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.

Users of this Standard should not rely exclusively on the information contained in this document. Sound business, scientific, engineering, and safety judgment should be used in employing the information contained herein.

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, 1220 L Street, NW, Washington, DC 20005.

Copyright © 2014 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.

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

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

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, 1220 L Street, NW, Washington, DC 20005. 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, 1220 L Street, NW, Washington, DC 20005.

Suggested revisions are invited and should be submitted to the Standards Department, API, 1220 L Street, NW, Washington, DC 20005, standards@api.org.

Contents

Page

1	Scope	1
2	Normative References	1
3	Terms and Definitions	6
4	General	11
4.1	Unit Responsibility	11
4.2	Unit Conversion	11
4.3	Nomenclature	12
5	Requirements	12
5.1	Dimensions	12
5.2	Statutory Requirements	12
5.3	Alternative Designs	12
5.4	Conflicting Requirements	12
6	Design	12
6.1	General	12
6.2	Fan Housing	20
6.3	Fan Housing Connections	21
6.4	External Forces and Moments	23
6.5	Rotating Elements	23
6.6	Shaft Sealing of Fans	24
6.7	Dynamics	25
6.8	Bearings and Bearing Housings	31
6.9	Lubrication	38
6.10	Materials	40
6.11	Nameplates and Rotation Arrows	43
7	Accessories	44
7.1	Drivers	44
7.2	Couplings	45
7.3	Belt Drives	47
7.4	Mounting Plates	47
7.5	Controls and Instrumentation	53
7.6	Piping	56
7.7	Inlet Trash Screens	60
7.8	Silencers	60
7.9	Insulation and Jacketing	60
7.10	Turning Gears	60
7.11	Special Tools	60
8	Inspection, Testing, and Preparation for Shipment	61
8.1	General	61
8.2	Inspection	61
8.3	Testing	63
8.4	Preparation for Shipment	65
9	Vendor Data	67
9.1	General	67
9.2	Proposals	68
9.3	Contract Data	70

Contents

	Page
Annex A (informative) Centrifugal Fan Datasheets	72
Annex B (informative) Terminology for Centrifugal Fans	80
Annex C (informative) Drive Arrangements	81
Annex D (normative) Lateral Critical Speed Analysis for Fans	84
Annex E (normative) Procedure for Determination of Residual Unbalance	89
Annex F (normative) Lubrication System Schematic for General Purpose Fans	97
Annex G (informative) Centrifugal Fans Vendor Drawing and Data Requirements	101

Figures

1 Fan Performance Terms	8
2 Fan Pressure Rise Terms	18
3 Fan Characteristic Curves	19
4 Rotor Response Plot	26
5 Threaded Connection for Vibration Transducer	39
6 Typical Mounting Plate Arrangement 1	49
7 Typical Mounting Plate Arrangement 2	50
8 Typical Mounting Plate Arrangement 3	51
9 Typical Mounting Plate Arrangement 4	52
D.1 Rotor Response Plot	84
D.2 Typical Mode Shapes	86
D.3 Calculated Rotor Response Plot for Unbalanced Response Analysis	88
E.1 (Blank) Residual Unbalance Worksheet	91
E.2 (Blank) Residual Unbalance Polar Plot Worksheet	92
E.3 Sample Residual Unbalance Worksheet for Left Plane	93
E.4 Sample Residual Unbalance Polar Plot Worksheet for Left Plane	94
E.5 Sample Residual Unbalance Worksheet for Right Plane	95
E.6 Sample Residual Unbalance Polar Plot Worksheet for Right Plane	96
F.1 Lube Oil System Schematic	98

Tables

1 Driver Trip Speeds	13
2 Common Hazardous Area Electrical Codes	14
3 Vibration Limits for Fans	29
4 Bearing Selection	31
5 Element Bearing Limiting $N_{dm}/1000$	32
6 Power Ratings for Motor Drives	45
7 Control Panel Plate Thickness	56
8 Minimum Requirements for Piping System Components	58
F.1 Lube Oil System Schematic	99

Introduction

Users of this standard should be aware that further or different requirements may be needed for individual applications. This standard is not intended to inhibit a vendor from offering, or the purchaser from accepting, alternative equipment or engineering solutions for the individual application. This may be particularly appropriate where there is innovative or developing technology. Where an alternative is offered, the vendor should identify any variations from this standard and provide details.

This standard requires the purchaser to specify certain details and features. A bullet (•) at the beginning of a paragraph indicates that either a decision by, or further information from, the purchaser is required. Further information should be shown on the datasheets (see Annex A) or stated in the quotation request and purchase order.

Centrifugal Fans for Petroleum, Chemical, and Gas Industry Services

1 Scope

1.1 This standard covers the minimum requirements for centrifugal fans for use in petroleum, chemical, and gas industry services. Fan static pressure rise is limited to differential usually not exceeding 130 in. (330 cm) of water equivalent air pressure from a single impeller or each impeller in a two stage fan. This standard does not apply to axial flow, aerial cooler, cooling tower, and ventilation fans and positive displacement blowers.

- 1.2 This standard covers equipment for both general purpose and special purpose applications. The purchaser shall determine which classification applies.

NOTE Refer to Section 3 for definition of the terms general purpose and special purpose.

1.3 Additional or overriding requirements applicable to special purpose applications are included at the end of each section (e.g. 6.7.5, etc.).

2 Normative References

2.1 The editions of the following standards, codes, and specifications that are in effect at the time of publication of this standard shall, to the extent specified herein, form a part of this standard. The applicability of changes in standards, codes, and specifications that occur after the inquiry shall be mutually agreed upon by the purchaser and vendor.

API Specification 5L, *Specification for Line Pipe*, Forty-Fifth Edition

API Recommended Practice 500, *Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Division 1 and Division 2*, Second Edition

API Standard 541, *Form-wound Squirrel-cage Induction Motors—500 Horsepower and Larger*, Fourth Edition

API Standard 546, *Brushless Synchronous Machines—500 kVA and Larger*, Third Edition

API Standard 547, *General-purpose Form-wound Squirrel Cage Induction Motors 250 Horsepower and Larger*, First Edition

API Recommended Practice 578, *Material Verification Program for New and Existing Alloy Piping Systems*, Second Edition

API Standard 611, *General-purpose Steam Turbines for Petroleum, Chemical, and Gas Industry Services*, Fifth Edition

API Standard 612, *Petroleum, Petrochemical and Natural Gas Industries—Steam Turbines—Special-Purpose Applications*, Sixth Edition

API Standard 613, *Special Purpose Gear Units for Petroleum, Chemical, and Gas Industry Services*, Fifth Edition

API Standard 614, *Lubrication, Shaft-sealing, and Control-oil Systems and Auxiliaries for Petroleum, Chemical and Gas Industry Services*, Fifth Edition

API Standard 670, *Machinery Protection Systems*, Fourth Edition

API Standard 671, *Special-purpose Couplings for Petroleum, Chemical, and Gas Industry Services*, Fourth Edition

API Standard 677, *General-purpose Gear Units for Petroleum, Chemical and Gas Industry Services*, Third Edition