

#### IV. STUDY OF PULSATION ACCORDING TO API 618 ANALYTICAL METHOD

According Design Approach 2 of API Standard 618 5<sup>th</sup> edition 2007, an acoustic simulation is required to evaluate and control pulsation in piping systems of reciprocating compressors. The pulsation report contains a summary of the pressure pulsations in the piping system as well as modifications proposed to reduce pulsation to the agreed level. The original system layout will be checked with respect to pulsation. All operating cases that are characterized by steady-state operating conditions will be checked, thus transient cases (e.g. start-up-cases) are excluded. Different gas properties and operation cases are considered. Valve unloading cases are considered as operation cases. Measures are proposed to reduce pressure pulsations, e.g. installation of orifices, changes in piping length or diameter. Shaking forces are used in the subsequent vibration study.

##### Used Documents for Pulsation Study

The exact gas data means gas composition and gas properties like velocity of sound, density, pressure, temperature flow for which compressor is going to use is considered for the pulsation simulation. Also the Isometric drawings of piping and compressors are used for the pulsation simulation.

Table : 4.1 — Gas Properties / Input Data for Pulsation Simulation

Case	Phase	Pressure bar	Temp. °C	Vel. of sound m/s	Density kg/m <sup>3</sup>	Pressure ratio	Flow rate m <sup>3</sup> /min	Flow rate m <sup>3</sup> /min
1	Normal operation	1.0	20	343	1.2	1.0	1.0	1.0
		1.1	20	343	1.2	1.1	1.1	1.1
		1.2	20	343	1.2	1.2	1.2	1.2
		1.3	20	343	1.2	1.3	1.3	1.3
		1.4	20	343	1.2	1.4	1.4	1.4
2	100% Valve unloading	1.0	20	343	1.2	1.0	1.0	1.0
		1.1	20	343	1.2	1.1	1.1	1.1
		1.2	20	343	1.2	1.2	1.2	1.2
		1.3	20	343	1.2	1.3	1.3	1.3
		1.4	20	343	1.2	1.4	1.4	1.4
3	Normal P-1	1.0	20	343	1.2	1.0	1.0	1.0
		1.1	20	343	1.2	1.1	1.1	1.1
		1.2	20	343	1.2	1.2	1.2	1.2
		1.3	20	343	1.2	1.3	1.3	1.3
		1.4	20	343	1.2	1.4	1.4	1.4
4	Normal P-2	1.0	20	343	1.2	1.0	1.0	1.0
		1.1	20	343	1.2	1.1	1.1	1.1
		1.2	20	343	1.2	1.2	1.2	1.2
		1.3	20	343	1.2	1.3	1.3	1.3
		1.4	20	343	1.2	1.4	1.4	1.4
5	Normal P-3	1.0	20	343	1.2	1.0	1.0	1.0
		1.1	20	343	1.2	1.1	1.1	1.1
		1.2	20	343	1.2	1.2	1.2	1.2
		1.3	20	343	1.2	1.3	1.3	1.3
		1.4	20	343	1.2	1.4	1.4	1.4

##### Calculation and Interpretation of Analytical Results

The study of the gas pulsation is carried out with the digital simulation program PULSIM which has been developed by the TPI/TPIE Institute in Gailf (G.L.). A system of pipes is built of several complicated parts and elements which must be simplified for calculations. For example volumes of a cylinder casing between valves and connecting flange, heat exchangers, separators, dampers, etc. The data of the gas might also change during operation. In order to take these uncertainties into account, we make several calculations at different velocities of sound. The range of variation is  $\pm 1.2\%$  and it is varied in steps of 2%. The results are presented in tables.

##### Admissibility limits

The main requirements of API 618 are as follows:

[API 618, section 7.6.4.2.5.2.2.2] "For systems operating at absolute line pressures between 3.5 bar and 350 bar (0.50-5.07 MPa), the peak-to-peak pulsation level of each individual pulsation component shall be limited to that calculated by eq. 54 using:"

# Api 618 5th Edition

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**The Language of Machines: Everything About Vibration Analysis** Fahri YILMAZ, This book is designed as a comprehensive resource for both engineers with field experience and interested engineering students While it covers advanced engineering topics no unfamiliar concepts are left unexplained The goal is to provide in depth technical information on vibration analysis while simultaneously providing a clear and fluent language that allows the reader to grasp the fundamentals of the subject From an engineer s perspective it may not always be possible to search for new literature or gather information from scattered sources in the daily routine of work this book will fill an important gap by combining all the necessary concepts and modern approaches to vibration analysis in one resource For engineering students the book aims to lay a solid academic foundation while demonstrating the real world application of theory through industrial application examples This will allow students to better understand how the theoretical knowledge they learn applies in practice The book encompasses technical topics that extend to graduate level but the language is carefully designed to make complex mathematical expressions and engineering terminology understandable Each chapter defines critical terms and concepts are supported with visuals and examples when necessary Throughout the book real world industrial case studies are included aiming to provide readers with not only theoretical knowledge but also practical experience Examples include how a generator failure at a power plant was diagnosed step by step by analyzing vibration data or how a maintenance plan was developed by analyzing vibration trends at a petrochemical plant Another important contribution of this book is its systematic compilation of current information scattered throughout the literature Vibration analysis and condition monitoring technologies are rapidly evolving in particular digital transformation the IIoT Industrial Internet of Things and machine learning based analysis methods are becoming increasingly integrated into industry The book will provide the reader with a perspective on future applications by addressing these new generation approaches as well as classical vibration analysis methods Designed with a balance between academic integrity and industrial practice the content is suitable for use both as a university textbook and as a reference guide for field engineers Furthermore summary points and references at the end of each chapter will direct readers to resources for more in depth research on topics of interest In conclusion Vibration Analysis This book on the subject will be a comprehensive guide from theory to practice for engineers and engineering students Upon completion the reader will understand how to interpret vibration data identify different types of failures from vibration patterns and implement an effective vibration based maintenance program in their own facility The subsequent chapters of the book advance these objectives Proceedings of First International Conference on Emerging Trends in Mechanical Engineering , *Condition Monitoring, Troubleshooting and Reliability in Rotating Machinery* Robert X. Perez, 2023-05-03 ROTATING MACHINERY This third volume in a broad collection of current rotating machinery topics written by industry experts is a must have for rotating equipment engineers maintenance personnel students and anyone else

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**Guidelines for Safe Storage and Handling of High Toxic Hazard Materials** Richard LeVine,Arthur D. Little, Inc,American Institute of Chemical Engineers. Center for Chemical Process Safety,1988      **Industrial Standardization** ,1947      *Dictionary Catalog of the Department Library* United States. Department of the Interior. Library,1967      *Machine*

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