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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 14513.3-2020

Pneumatic fluid power - Determination of flow-rate characteristics of components using compressible fluids - Part 3: Method for calculating steady-state flow-rate characteristics of systems

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Foreword

GB/T 14513 "Determination of flow characteristics of compressible fluid components for pneumatic use" is divided into the following three parts.

---Part 1.General rules and test methods for steady-state flow;

---Part 2.Alternative test methods;

--- Part 3.Calculation method of system steady-state flow characteristics.

This part is Part 3 of GB/T 14513.

This section was drafted in accordance with the rules given in GB/T 1.1-2009.

The translation method used in this section is equivalent to ISO 6358-3.2014 "Determination of flow characteristics of compressible fluid components for pneumatic use.

Part. Calculation method of system steady-state flow characteristics".

The Chinese documents that have a consistent correspondence with the normatively cited international documents in this section are as follows.

---GB/T 17446-2012 Glossary of fluid transmission systems and components (ISO 5598.2008, IDT)

This part is proposed by China Machinery Industry Federation.

This part is under the jurisdiction of the National Hydraulic and Pneumatic Standardization Technical Committee (SAC/TC3).

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Introduction

In pneumatic systems, power is transmitted and controlled by compressed air in a closed loop. The components that make up the circuit have a solid

Some resistances, therefore, need to define and determine their flow characteristics to describe their performance.

ISO 6358.1989 is based on the contraction nozzle model and is used to determine the flow characteristics of pneumatic valves. The method includes two features

Characteristic parameters. sonic conductance C and critical pressure ratio b, which are used in the calculation of the recommended numerical approximation of flow characteristics. The method is based on static pressure testing

The results describe the flow characteristics of pneumatic valves, ranging from congestion to subsonic flow. GB/T 14513.1-2017 considers the gas flow

The effect of dynamic speed on pressure measurement uses stagnation pressure to replace the original static pressure.

Experience shows that many pneumatic valves with contraction-expansion characteristics do not fit well with the ISO 6358.1989 model. this

In addition, pneumatic components other than pneumatic valves also need to apply this method. However, for congested flow and subsonic flow regions, it is now necessary to use

Four parameters (C, b, m and deltapc) are used to define the flow characteristics.

This section uses a set of four flow characteristic parameters obtained from the test results. These parameters are described in order of decreasing priority

as follows.

---Sonic velocity conductance C is the most important parameter, which corresponds to the maximum flow rate (choked flow). This parameter is determined by the upstream stagnation condition.

- The critical back pressure ratio b, which represents the boundary between congestion flow and subsonic flow, is the second most important parameter. Its definition is different

The definition of the critical pressure ratio in ISO 6358.1989, which characterizes the ratio of downstream stagnation pressure to upstream stagnation pressure.

---Subsonic velocity index m, when necessary, can more accurately represent the characteristics of subsonic flow. For elements with fixed flow channels, m

The value is about 0.5.In this case, only two characteristic parameters C and b are needed. For other m with a large range

For components, the values of C, b, and m need to be determined.

---deltapc is the opening pressure. This parameter only applies to those pneumatic components that open with increasing upstream pressure, such as check valves and single valves

Directional valve.

In order to overcome the obvious violation of the compressible fluid theory, GB/T 14513.1-2017 made some changes to the test equipment. include

Increase the intake pressure measuring tube to meet the assumption that the inlet speed is ignored during the test and allow direct measurement of the inlet stagnation pressure.

Increase the outlet measuring tube to directly measure the downstream stagnation pressure to meet different pneumatic components. The difference between the upstream and downstream stagnation pressure of the element

Taste the loss of pressure energy.

In order to test components with a larger nominal diameter, as well as shorten the test time or reduce energy consumption, you can apply ISO 6358-2.2013

Specified methods, which include two alternative test methods. deflation test and inflation test.

This section specifies a method that uses simple numerical calculations, using the components and piping that make up the system without measurement

Flow characteristics to estimate the flow characteristics of the entire system. Normally, the flow characteristic parameters of the element are composed of Part 1 and Part 2

Certain; however, the flow characteristics of some components are not expressed according to the parameters defined in ISO 6358.This section has given the approximate equivalent flow

Math formula.

Pneumatic use of compressible fluid element flow

Characterization Part 3.System steady-state flow

Calculation method of characteristics

1 Scope

This part of GB/T 14513 specifies a method that uses simple numerical calculations.

The flow characteristics of traditional components and pipelines to estimate the flow characteristics of the entire system.

The formulas used in this section are used to describe the flow characteristics of compressed air through the element under subsonic flow and choked flow.

Note. The conductance of the tube, muffler and filter are affected by the inlet pressure, and their C and b values are only valid at the determined inlet pressure.

This section also applies to the calculation of equivalent flow characteristics of components not specified in GB/T 14513.

2 Normative references

The following documents are essential for the application of this document. For dated reference documents, only the dated version applies to this article

Pieces. For the cited documents without date, the latest version (including all amendments) applies to this document.

GB/T 14513.1-2017 Determination of flow characteristics of compressible fluid components for pneumatic use Part 1.General of steady-state flow

Rules and test methods (ISO 6358-1.2013, IDT)

ISO 5598 Fluid Power Systems and Components Vocabulary (Fluidpowersystems and components-Vocabulary)

3 Terms and definitions

The terms and definitions defined in ISO 5598 and GB/T 14513.1-2017 apply to this document.

4 Symbols and units

The symbols and units used in this section shall comply with the provisions of GB/T 14513.1-2017 and Table 1.

Table 1 Symbols and units

Symbol description unit

bpipe Critical back pressure ratio for pipes or hoses-

Cpipe tube or hose sound velocity conductance m3/(s.Pa)(ANR)

d Inner diameter of pipe or hose m

L Length of pipe or hose m