USE OF
RESIDUAL PRESSURE VALVES

AIGA 063/09

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Acknowledgement

This document is adopted from the European Industrial Gases Association IGC 064/05 ‘Use of residual pressure valves’. Acknowledgement and thanks are hereby given for permission granted for the use of the document.

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1 Introduction

The concept of a cylinder valve that retains a small positive pressure in a gas cylinder has been considered for many years. It is only in the past few years that such valves have improved sufficiently for the gases industry to realise their benefits. Such benefits include preventing the possibility of back contamination, improving the cylinder fill operation, maintaining a high gas quality and reducing internal cylinder maintenance.

Local requirements for medical and food gases may mandate the use of Residual Pressure Valves (RPV).
Industry data indicate that approximately 30% of all cylinder incidents reported were the result of internal corrosion. This is one of the reasons why gas companies are introducing Residual Pressure Valves, to avoid internal contamination.

One of the issues facing the gases industry is that despite warning notices on gas cylinders and customer information, gas users do not always follow good operating practice for gas cylinders. For example by leaving a small positive pressure in the gas cylinder of several bars, by closing the cylinder valve after use etc. The benefit of the latter is that it ensures that the internal condition of the cylinder is kept free from atmospheric contamination.

Also, when the cylinders are connected to a customer's installation it is possible for liquids to enter the cylinder, resulting in internal corrosion when it contains gases such as oxygen or carbon dioxide.

2 Scope and purpose

2.1 Scope

This document is intended for use by gas industry members and customers and provides guidelines for the use of Residual Pressure Valves (RPV) and gives definitions for the different principles. The valves are also known as Minimum Pressure Retaining (MPR) valves or Back Flow Prevention (BFP) valves. This document does not describe any type test or retest procedures.

2.2 Purpose

The purpose of this document is to give guidance on the selection, installation and operation of these valves, such that common practices are established across the gas industry, so that these valves are of benefit to both the user and operator of gas cylinders.

3 Definitions

There are currently two main types (A or B) of Residual Pressure Valves.

Use of either Type A or Type B is dependent upon operational and gas quality requirements.

3.1 Residual Pressure Valve Type A (RPV Type A)

Type A only leaves a small positive or residual pressure in the cylinder.

3.2 Residual Pressure Valve Type B (RPV Type B)

The Type B is the valve concept, which not only leaves a small positive pressure, but it also incorporates a non-return valve to prevent back-flow of fluids into the cylinder from a higher pressure source.

Type B requires either a special filling connector or a manual adjustment to overcome the non-return valve for filling, whereas Type A usually only requires the filling pressure in the manifold to fill the cylinder.

One difficulty of the operation of the Residual Pressure Valve is the fact that the special cylinder filling connectors may vary between manufacturers of such valves. The result of this is that there is no guarantee that an RPV from one manufacturer will be able to be filled through a filling connector from another manufacturer.

The other difficulty is to ensure that the special filling connectors are compatible with both kinds of valves i.e. conventional valves and those incorporating Type B RPV technology, where gas companies use both valve types in the same traffic.
Care shall be taken if mixed populations of cylinders with both RPV and conventional valve are filled together on the same manifold, as this can result in the transfer of potentially impure gas from those cylinders fitted with conventional valves to those that are protected in use by an RPV. One measure that could be taken to avoid such a contamination is to vent cylinders without RPV before connecting to the manifold.

4 Residual Pressure Valve

4.1 Selection and design

There exists International Standard 15996 "Residual pressure Valves- General requirements and type testing", which should be used as a basis for Residual Pressure Valves.
For an ISO standard Valve, incorporating a Residual Pressure Device it shall be designed, constructed and tested in accordance with published European or ISO Cylinder Valve Standards. In particular the applicable standards are:

EN 629-1 and 2 - Transportable Gas Cylinders - 25E taper thread for connection of valves to gas cylinders
Part 1: Specification, Part 2: Gauge inspection

ISO 13341 -Transportable Gas Cylinders – Fitting of valves to gas cylinders

ISO 5145 – Cylinder valve outlets for gases and gas mixtures – Selection and dimensioning

ISO 10297 - Gas Cylinder Valves - Specification and Type Testing

ISO/ 15996 – Gas Cylinder – Residual pressure valves – General requirements and Type Testing

ISO 14246 - Gas Cylinder Valves - Manufacturing and Batch Tests

Additional tests to verify specific performance parameters such as the closing and opening pressure of the residual pressure device (nominal value plus tolerance), fatigue life, flowrate, leakage rate, gas/material compatibility tests etc. should be performed. These are described in ISO 15996, .

In addition, other standards for valve stem threads (e.g. EN 629-1 and 2) and outlet connections (e.g. ISO 5145) will apply.

4.2 Use

Whenever there is the possibility of internal corrosion, e.g. with steel cylinders due to ingress of a fluid, industry has in the past, developed different methods to avoid such corrosion. One possibility is the fitting of RPVs in such gas service, e.g. marine service, beverage dispense etc. In this case the Type B type with non return function is more useful.

RPVs are also used for other applications, e.g. for gas quality reasons - high purity argon or for medical or food gas products.

4.3 Fitting

Valves incorporating Residual Pressure devices shall be fitted in accordance with established operating procedures for valve fitting, (see ISO 13341). In all cases, immediately prior to any cylinder

valve being fitted, an internal inspection of the cylinder shall be carried out to ensure that the cylinder is in good condition and free of all visible moisture.

4.4 Filling of cylinders with residual pressure valves

The filling of cylinders fitted with Residual Pressure Valves should be no different from that of filling cylinders with conventional valves. However as part of the pre-fill procedure, a check should be made on the functionality of the Residual Pressure device. This may take a number of ways depending upon the type of the Residual Pressure Valve. In the case of a Type B Residual Pressure Valve the use of a specific filling connector is sometimes necessary.
Type A RPVs are sometimes not able to be vacuumed prior to filling, as they are usually top-filled.

The functionality of the RPV device of every valve shall be checked. Any cylinder fitted with a RPV that does not have any pressure in the cylinder at the time of the pre-fill inspection shall be isolated and investigated to ensure that the cylinder has not been contaminated.

Note: The above does not apply to cylinders which have been fitted with RPV valves but have not yet been filled with gas

4.5 Removal of residual pressure valves from cylinders

As for all devalving operations care needs to be taken to ensure that the cylinder contains no pressure. With the removal of Residual Pressure Valves from cylinders, an additional verification is required to ensure that the cylinder does not contain retained pressure and that the RPV device has not been jammed which may lead the operator to believe that a cylinder under pressure is empty.
The use of a special device is normally required for complete depressurisation of such cylinder and to ensure that the gas passage through the valve is not blocked.

5 Customer information

Gas Suppliers should consider whether or not they wish to advise users of this different type of valve. There have been occurrences reported of customers interfering/tampering with the Residual Pressure Valve mechanism.