

Regulator Selection, Installation, and Operation

减压阀的选择、安装和操作

The primary function of a regulator is to reduce high-pressure gas in a cylinder or process line to a lower, usable level as it passes from the cylinder to a piece of equipment. A regulator is not a flow control device. It is used to control delivery pressure only.

减压器的主要功能是，当钢瓶或过程管道内的高压气体从钢瓶流向设备时，把压力降到较低的可用的水平。调整器不是流量控制装置。它只能用来控制输出压力。

Since there are numerous hazards associated with specialty gases—hazards that vary with the gas, the equipment used, and with the particular application—it is necessary to take the proper precautions to assure safety in high-pressure gas control.

因为同特种气体相联系的危险很多，而且随气体、使用的设备和特定的应用而变化，有必要采取适当的措施来确保高压气体控制的安全。

Before performing any operation with which you are not familiar, seek the advice of an experienced individual. In addition to adhering to the safety and operating rules provided here, the user should be aware of the additional safe operating practices peculiar to each piece of equipment and each application. Consult sales office when in doubt about correct handling procedures.

在进行任何你不熟悉的操作之前，找有经验的人咨询一下。除了坚持这里提供的操作规则以外，使用者还应该了解设备的每一部分和每个用途特有的其它安全操作惯例。当对正确的操作程序有疑问是，请向销售部门咨询。

Never use any regulator for gases other than those for which it is intended.
禁止使用不是用于该气体的任何调整器。

The following is applicable to pressure regulators used with flammable, oxidant, corrosive, inert, or toxic gases, when it is necessary to reduce cylinder supply pressure to a lower use pressure.

当有必要把钢瓶供应压力降到较低的使用压力时，下文对于用于易燃、氧化剂、腐蚀性、惰性或毒性气体的压力调整器是可以适用的。

How Regulators Work

减压器怎样工作的

Single-Stage Regulators

单级减压器

High-pressure media enter the regulator through the inlet into the high-pressure chamber (see Fig. 1). When the adjusting knob is turned clockwise, it compresses the range spring and exerts a force on the diaphragm, which pushes the valve stem open. This releases gas into the low-pressure chamber, exerting an opposing force on the diaphragm. An equilibrium is reached when the spring force on the diaphragm is equal to the opposing force of the gas in the low-pressure chamber.

高压介质通过入口进入高压腔（见图1）。当调节钮顺时针方向旋转时，它压缩距离弹簧，从而对隔膜施加了一个力，推开了阀杆。这就把气体放进了低压腔，对隔膜施加了一个反方向的力。当弹簧施加在隔膜上的力等于低压腔内气体的反作用力时，就达到了平衡。

In a single-stage regulator, delivery pressure increases as cylinder pressure decays, because there is less gas pressure exerted on the valve stem. Thus, frequent adjustment of the control knob is required to maintain constant delivery pressure. This does not pose a problem, however, with pipelines and liquefied gas products where inlet pressure is maintained relatively constant.

在单级减压器里，输出压力随钢瓶压力的减小而增大，这是因为施加在阀门系统上的气体压力减小了。因此经常要调整控制钮，以维持恒定的输出压力。但是，对于入口压力相对恒定的管道和液化气体产品而言，这不是一个问题。

Two-Stage Regulators

两级减压器

A two-stage regulator functions similarly to two, single-stage regulators in series. The first stage reduces inlet pressure to a preset intermediate pressure, typically 350 to 500 psig. By adjusting the control knob, the second stage reduces the intermediate pressure to the desired delivery pressure.

两级减压器的运转同两个单级减压器串联是一样的。第一级把入口的压力降到预定的中间压力，该压力典型值为350到500 psig。通过调整控制钮，第二级把中间压力降到需要的输出压力。

Like the single-stage regulator, outlet pressure from the first stage of the two-stage regulator rises as cylinder pressure decreases. However, instead of passing out of the regulator, the gas flows into the second stage where the pressure is moderated. Thus, delivery pressure remains constant even as cylinder pressure decays, eliminating the need for frequent control knob adjustment.

同单级减压器一样，两级减压器的第一级的出口压力随钢瓶压力的降低而升高。但是，气体不是排出减压器，而是流入第二级并得到缓和。因此，即使钢瓶压力下降，减压器的输出压力保持恒定，从而不需要经常调整控制钮。

Selecting the Proper Regulator

选择合适的减压器

Line and Cylinder Regulators

管道和钢瓶减压器

Line regulators are typically point-of-use regulators serving low-pressure pipelines. They are also used in conjunction with high-pressure cylinder regulators that limit the inlet pressure to 250 to 400 psig.

管道调整器是典型的用于低压管道的调整器。它们还和把入口压力限制在250到400 psig之间的高压钢瓶调整器联合使用。

Cylinder regulators are available in either single-stage or two-stage models for high-purity, general purpose, or special service applications.

钢瓶调整器既有单级的又有两级的，可以用于高纯度、通用或者特殊设施应用。

High-Purity Regulators

高纯度减压器

High-purity regulators are designed and constructed to provide diffusion resistance and easy cleanup. Metal diaphragms and high purity seats and seals minimize or eliminate outgassing and inboard diffusion.

高纯度调整器设计和制造得能够提供扩散阻力和容易净化。金属隔膜和高纯度座和密封将漏气和内部扩散减到了最小或彻底消除。

General Purpose Regulators

通用减压器

General purpose regulators are designed for economy and longevity. They are recommended for noncorrosive general plant, pilot plant, and maintenance shop applications where diffusion resistance is not required.

通用调整器设计得既经济又寿命长。推荐用于对扩散阻力没有要求的无腐蚀性的一般工厂、试验工场和维修厂。

Regulators for Oxidizers

用于氧化剂的减压器

Because oxidizers change the chemistry of fire, a material that does not burn in air may ignite or react violently in an oxidizer atmosphere. Equipment used in oxidizer service should be selected with materials of construction that minimize the probability of ignition and the risk of fire or explosion. This equipment must be cleaned to remove any contaminants such as oils or grease. Care must also be taken to eliminate any residual cleaning agents. Regulators used in oxygen service should be maintained exclusively in oxidizer service. If a regulator is used in other types of service, it may no longer meet oxidizer clean requirements.

由于氧化剂改变了起火的化学性质，在空气中不能燃烧的材料在氧化剂气氛中可能能够点燃或剧烈反应。用于氧化剂设施的设备应选用能够最大程度减小点燃的可能性和起火或爆炸的危险的建材。必须清洁系统，以去除任何污染物，如油或润滑脂。还要注意去除任何残留的清洁剂。用在氧设施里的调整器应该一直用在氧化剂设施里。如果调整器用于其它类型设施，它可能不再满足氧化剂清洁的要求。

Special Service Regulators

特殊设施减压器

Special service regulators are specifically constructed for special applications including oxygen, acetylene, and fluorine service and high-pressure, ultra-high-pressure, and corrosion service.

特殊设施调整器是特殊制造的，用于特殊的应用，包括氧、乙炔和氟设施和高压、超高压和腐蚀性设施。

To make your selection easier, consult Air Products' Specialty Gas and Equipment Catalog, which lists the proper regulator for almost every gas, pressure, and situation. Simply look up the gas or mixture for your application and you will find the appropriate regulator listed under "Recommended Equipment." CGA valve outlets are also noted for each gas and gas mixture. The regulator must be equipped with the appropriate CGA connection for the cylinder valve outlet.

为了让你的选择更容易，请参考Air Products的“特种气体和设备目录”。它列出了几乎所有气体、压力和场合下的合适的调整器。仅仅查找用于你的应用的气体或混合物，你就会找到列于“推荐设备”下的合适的调整器。对于每种气体和气体混合物还附注了CGA的阀门排气口。调整器必须配备有用于钢瓶阀门排气口的合适的CGA接头。

Putting the Regulator into Service

把减压器用于设施

1. Identify the regulator. Check the label and the inlet and outlet gauges. Ascertain that the high-pressure gauge is suitable for the pressure of the cylinder or source system. 鉴别减压器。检查商标和入口和出口的量表。确定高压量表对钢瓶或源系统是适合的。
2. Inspect the regulator. Check the regulator for evidence of damage or contamination. If there is evidence of physical damage or foreign material inside the regulator, contact your customer service representative for return or repair information. 检查减压器。检查调整器是否有损伤或污染的迹象。如果有物理损伤的迹象或内部有不相干的物质，联系你的用户服务代表，以得到返还或维修的信息。
3. Inspect the cylinder valve. Check the cylinder valve for evidence of damage or contamination. Remove any foreign material before attaching the regulator. 检查钢瓶阀门。检查钢瓶阀门是否有损伤或污染的迹象。再连接调整器之前，排除任何不相干的物质。
4. Attach the regulator. Fasten the regulator to the cylinder and tighten the inlet nut securely. 连接减压器。把调整器紧固在钢瓶上，安全地上紧入口螺母。
5. Close the regulator. To close the regulator, turn the adjusting knob to the full counter-clockwise position. The regulator must be closed before opening the cylinder valve. 关闭减压器。要关闭减压器，把调整钮逆时针旋死。在开启钢瓶阀门之前，必须关闭减压器。

Safety-Checking the System

系统的安全检查

With the regulator adjusting knob turned fully counterclockwise, place both hands on the cylinder valve and open it slowly, allowing the pressure to rise gradually in the regulator. Stand as shown (see Fig. 2) with the cylinder valve between you and

the regulator. When the high-pressure gauge indicates maximum pressure, open the cylinder valve fully.

减压器的调节钮逆时针旋死后，两只手放在钢瓶阀门上，慢慢地开启，使减压器内的压力逐渐增加。站得使钢瓶阀门在你和减压器之间。当高压量表指示为最大压力时，彻底打开钢瓶阀门。

Always close the cylinder valve when product delivery is not needed. Do not leave it open when the equipment is unattended or not operating.

当不需要产品输出时，总是关闭钢瓶阀门。当设备无人照管或没有运转时，不要让阀门开着。

Adjusting the Pressure

调整压力

Turn the adjusting knob clockwise and establish the required use pressure by referring to the low-pressure gauge. Make sure that the cylinder valve is easily accessible.]

顺时针旋转调整钮，通过查看低压量表建立要求的使用压力。确认钢瓶阀门容易接近。

Precautionary Measures

防范措施

- Never exchange the discharge (low-pressure) gauge for one of lower pressure. The gauge may rupture if the adjusting knob is unintentionally turned too far.禁止把排出量表换成更低压力的量表。如果无意中把调整钮旋的太远的话，量表会破裂。

- Check diaphragm regulators for creep (leakage of gas from the high-pressure to the low-pressure side when the adjusting knob is turned fully counterclockwise).检查隔膜减压器是否有漂移（如果调整钮逆时针方向旋死的话，会出现从高压端到低压端的气体泄漏）。

- Provide check valves. Back-pressure protection is needed to prevent damage to the regulator. Gas from a high-pressure system can flow back into the regulator.提供止回阀。需要回压保护，以防止损坏减压器。来自高压系统的气体可能回流到减压器。

Removing the Regulator from Service

从设施上取掉减压器

1. Close the cylinder valve.

关闭钢瓶阀门。

2. Vent the gas. Vent the gas in the regulator and/or system, or isolate the system, and vent the gas in the regulator by turning the adjusting knob clockwise so that no pressure is trapped inside the regulator. If the gas is flammable, corrosive, toxic, or an oxidant, take appropriate measures to render it innocuous by employing a suitable disposal system before venting the gas to the atmosphere.

排出气体。排出减压器和/或系统内的气体，或者把系统隔离开再通过顺时针旋转调整钮排出减压器内的气体，这样减压器内就没有截留的压力。如果气体易燃、有腐蚀性、有毒或是氧化剂，采取合适的措施通过在把气体排入大气之前使用适当废弃物处理系统使它变得无害。

3. Close the regulator. After relieving all the gas pressure, turn the adjusting knob counter clockwise as far as it will go.

关闭减压器。在释放了所有的气体压力之后，逆时针旋死控制钮。

4. Disconnect low-pressure equipment. All low-pressure equipment connected to sources of high pressure should be disconnected entirely or, if not, independently vented to the atmosphere as soon as the operation is either over or shut down for an extended period of time.

断开低压设备。所有连接到高压源的低压设备都要彻底断开或者，如果不这样的话，一旦操作结束或关闭了较长时间，就单独排入大气。

5. Disconnect the regulator.

断开减压器。

6. Protect the regulator. If the regulator is to remain out of service, protect the inlet and outlet fittings from dirt, contamination, or mechanical damage.

保护减压器。如果减压器一直不工作，要保护入口和出口，防止污垢、污染或机械损伤。

7. Replace the cylinder outlet seal and valve cap.

替换钢瓶排气口密封和阀门帽。

Safety Measures for Pressure-Reducing Regulators

减压器的安全措施

Failure to take appropriate safety measures, including those listed below and the measures outlined in safety information provided with each product, may result in asphyxiation, fire and explosion, chemical burns, cold burns, poisoning, and system over pressurization. Any of these may result in serious injury or death.

未能采取合适的安全措施，包括下列的和随每个产品提供的的安全资料里概括的措施，可能导致窒息、起火和爆炸、化学烧伤、冻伤、中毒和系统过压。这些里的任何一个都会导致严重伤害或死亡。

The following general safety measures should be taken when using pressure-reducing regulators. These measures are applicable for typical applications only. They are not comprehensive. Before operation, special consideration must be given to pressure limitations, system containment, purging requirements, etc., to determine if additional safety measures are required.

当使用减压减压器时，应当采取下列一般安全措施。这些措施仅适用于典型的应用。它们并不全面。在操作前，必须对压力极限、系统容积、净化要求等专门考虑，以决定是否要求额外的安全措施。

1. Always keep the regulator clean.

总是保持减压器干净。

2. Always pressurize a regulator slowly, while standing with the cylinder valve between you and the regulator.

总是站得使钢瓶阀门位于你和减压器之间，对减压器慢慢加压。

3. Never swap gauges or inlet fittings, and never change gas service.禁止交换量表或入口配件，禁止改变气体设施。

4. Never lubricate a regulator or use pipe dopes. This includes inlet fittings which are intended to be installed dry.

禁止润滑调整器或使用管道油。这包括打算要干燥地安装的入口配件。

5. Never reverse flow through a regulator or rely upon it to act as a check valve. It will not perform this function.

禁止通过减压器倒流或依靠它作为止回阀。它不允许执行这个功能。

6. Always depressurize a regulator before closing the adjusting knob and removing the regulator from the cylinder. This is especially important in two-stage regulators that can trap high-pressure gas in the first stage. Such trapped gas can vent spontaneously at any time, releasing hazardous gas or projectiles.

在关闭调整钮和从钢瓶上断开减压器之前，总是使减压器减压。这对于能够把高压气体截留在第一级的两级减压器特别重要。这些截留气体随时会自发排出，释放出危险气体或抛射体。

7. Replace your regulators before they are worn out. The operation of a compressed gas regulator to the point of failure is a false economy. Regulators should be inspected for wear and overhauled or replaced on an established schedule.

在减压器老化之前替换它。把压缩气体调整器一直用到它失效是伪节约。要按照确定的计划检查调整器是否老化，修理或替换它。

8. In the case of oxidant regulators, it is preferable to replace, rather than overhaul, the regulator. Cleaning an oxygen regulator is usually more expensive than the purchase price of a new unit. In recent years, superior fire-resistant materials have been used in many regulators. Some new models are specifically designed to resist and manage ignition, should it occur. Thus, the inherent safety of a new regulator can be a significant improvement over that of an older, rebuilt regulator. Changes in regulators through the years have included the use of new materials, such as Teflon[®] and Viton[®], and design changes such as internal flame shields, heavy heat-sink components, minimally-sized polymer components, and substitutions of metals for polymers.

对于氧化剂减压器，替换，而不是修理调整器是更可取的。清洁氧减压器通常比买个新的更贵。近年来，在许多减压器里使用了高级防火材料。一些新型的减压器经过特别设计，可以抵抗和应付着火，如果它发生的话。因此新的减压器的固有安全性同旧的整修的调整器相比是一个重大的改进。这些年来减压器的变化包括新材料的使用，如特氟纶和氟化橡胶，和设计的变化，如内部防火罩、强散热元件、最小尺寸的聚合物元件和用聚合物替代金属。