HELP IS ON HAND FOR PIPE WELDERS

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The chemical, pharmaceutical, oil and gas handling facilities need reactor, storage and transmission vessels that allow the containment of solids and fluids without risk of contamination. Whilst welded joints made for the processing industries are not generally subjected to the high mechanical demands made by eg aerospace and power-engineering applications therefore there is an overriding need to meet the requirements of extreme cleanliness and smooth profile.

Welding accessory companies work hard to help fabricators meet the welding specifications on cleanliness and smooth profile. One range of products in particular which has proved to be extremely successful is directed specifically at ensuring that an inert gas atmosphere is created and maintained below the joint during welding. These products, referred to as *gas purge systems*, have witnessed significant development and improvement over recent years.

The concept is to use inflatable bladders *(Figs 1, 2, 3, 4)* on either side of a joint to create a contained, leak tight volume that can be filled with an inert gas, normally argon. Welding can then be carried

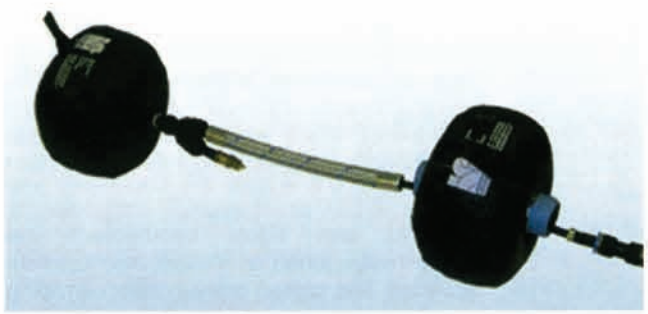

Fig 1: Multi-exhaust pipe purging system
150 mm - 900 mm (6" - 36")
Uses Less Inert Gas: The volume to be purged is localised. For a typical pipe run, the volume of gas used is less than 2% of that required for a conventional purge.
Faster: The system is quick and easy to install and position accurately. Purging time is a fraction of that required to purge by most other methods.
Easy to Use: Simplifies the process of inert gas purging with minimal training.

Fig 2: Quick Purge - Pipe Purging Systems
200 mm - 2100 mm (8" - 84").
In cases where purging is required to be fast as well as reliable, the Quick Purge Systems can be used. These will typically purge 36" pipe diameters to below 0.1% oxygen in less than 10 minutes and all smaller pipes, correspondingly faster.

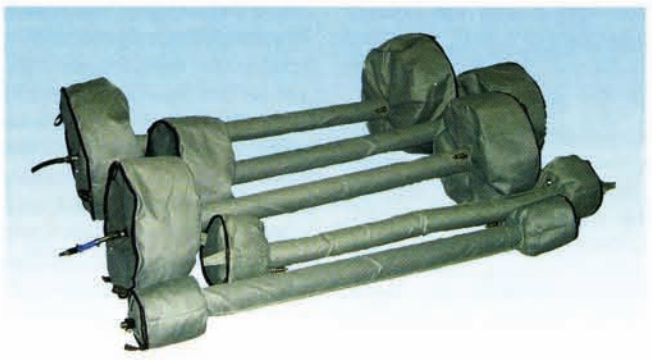

Fig 3: Heat resistant inflatable pipe purging applications
150 mm - 900 mm (6" - 36").
Can be used on pre- and post- weld heated applications.

Fig 4: Cross section of inflated Quick Purge system inside pipe showing gas paths and oxygen sampling port

out in the confidence that the weld root is protected against oxidation by the presence of the inert gas.

PURGING GASES

The most commonly used purging gas in Europe is commercial quality argon. Purge gas flow rate and pressure need to be established and once selected they should be included in the formal welding procedure.

Variation in purge gas quality may arise during welding and it may be desirable to apply continuous gas monitoring, especially to control oxygen and moisture content. For this purpose dedicated oxygen weld purging monitors are available commercially *(Fig 5)*.

Fig 5: Weld Purge Monitor.
The sensitive monitor measures the content of oxygen in the purge gas to indicate when it is safe to carry out a weld. This type of monitor indicates oxygen levels as low as 0.01% (100 parts per million - ppm) and measures accurately down to 0.1%

PURGING PROCEDURE

The first requirement is to provide gas entry and exit points. Gas is fed through one end seal with an exit hole at the other end to prevent an undesirable build-up of pressure. Argon has a greater density than air and the gas inlet should be at a lower elevation than the bleed end so that air is expelled effectively from the pipe bore.

INERT GAS INFLATABLE SYSTEMS

By far the most efficient purge gas containment method is to use specially designed inflatable pipe purging systems.

The systems are manufactured from rubber with a protective nylon cover. One is placed on each side of the joint and inflated using the purge gas itself. Such systems are much preferred since they obviate any difficulties, which might arise from water contamination of the weld zone from less suitable materials and of air entering the weld zone from air inflatable systems.

THE PRE-PURGE PROCESS

A pre-purge is used to displace air present in the dam volume. Numerous factors control the pre-purge time such as pipe diameter, purge volume and maximum permitted oxygen level. A common misconception is that increasing the purge flow rate will reduce the purge time. This is fallacious. Increase in flow rate increases turbulence and results in unwanted mixing of purge gas and air and can actually extend the purge time. As a general rule the pre-purge flow rate and time should allow for about five volume changes in the pipe system or dam volume but a typical gas flow rate will be in the region of 20 l/min.

Weld joints which require a root gap or which exhibit bad end matching, both of which characteristics provide an unwanted leak path for the purge gas, can be sealed by taping that can be removed progressively during the welding operation.

Oxygen and moisture levels in the purge gas should be checked using appropriate equipment at the gas outlet point.

Whilst 0.1% residual oxygen is a suitable working level for materials such as stainless steels, the level needs to be as low as 0.01% when welding the more sensitive alloys based on titanium and other reactive metals.

THE WELD PURGE PROCESS

Once the quality of the gas in the dammed volume has reached the required level, gas flow can be reduced to about 5 l/min for the welding operation. On a more practical level it should just be possible to feel the gas flow from the exit point. Excessive flow can cause the internal pressure in the pipe to rise and create concavity in the weld root geometry and in more extreme cases can cause complete ejection of the molten weld pool.

On joints, which are not closed properly a higher flow, rate may be necessary to avoid

contamination. Towards the end of the weld run however, as the joint becomes permanently sealed, the gas flow rate will need to be reduced to avoid over-pressurisation.

PROCESS COSTS

Providing precise data on unit joint costs is difficult, not least because the pipe diameter and wall thickness have a profound influence on the cost. However, users report that gas usage can be reduced by as much as 90% and purging times are of the order of a few minutes on 1 metre diameter pipes.

It is clear from this basic analysis that where several welds have to be made on similar pipe diameters there can be genuine cost savings when using inflatable pipe purging systems as the sealing medium. Add this to the technical advantages of reliable sealing and ease of use and the inflatable purge system concept can be seen to offer significant attractions.

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