USE OF FLASHBACK ARRESTOR AGAINST BACK FIRE IN TORCH, REGULATOR, MANIFOLD & PIPELINE

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COMMON FLAME PROBLEMS

There is substantial ignorance within the welding industry about flame instability and therefore many people misunderstand the function of a flashback arrestor. It is critical that a stable and useful flame is obtained at all times when using a gas welding and cutting system. Unstable flames not only reduce productivity, but also place the operator (and other people) in a potentially unsafe situation. It is therefore important to be able to identify the different types of flame instability and what should be done to correct these undesirable flame conditions.

There are FOUR COMMON FLAME PROBLEMS that can be associated with oxy-fuel gas process.

Flame snap out

This is when the flame at the tip or nozzle is inadvertently extinguished, usually by touching the tip or nozzle on the work. Flame snap-out is normally associated with a sharp pop, and is not dangerous within itself. It is normally a matter of simply relighting the flame and continuing on with the job. If the condition continues, then the system should be immediately checked for possible causes.

Backfire

A backfire sometimes follows a flame snap-out, but in this case the flame momentarily retreats into the blowpipe and then normally reignites on the end of the tip or nozzle. Backfiring is not a serious condition unless allowed to continue. Backfiring is normally due to a restriction or interruption to the gas supply, and if allowed to continue can lead to a potentially unsafe condition. Repetitive backfiring can cause a blowpipe to become extremely bot, which in turn can cause the mixed gases to ignite within the blowpipe (preignition). This condition is known as SUSTAINED BACKFIRE.

Sustained Backfire

A sustained backfire is when the flame retreats inside the blowpipe and continues to burn within the blowpipe. This is a very serious condition, often caused by incorrect pressure settings, or excessive pressure drop through the system, occurring anywhere from the regulator to the tip or nozzle. A sustained backfire can also be caused if welding, cutting or heating with a grossly overheated tip or nozzle. In this condition, the mixed gases are pre-ignited before reaching the end of the tip or nozzle.

This condition must be immediately corrected by first turning off the blowpipe oxygen valve, followed by the blowpipe fuel valve. The blowpipe assembly should then be quenched in water. Before relighting, the blowpipe, cutting attachment or welding/heating attachment should be checked for signs of damage, and repaired if required.

After checking and/or repairing, tests for gas leaks and correct operation should be made before putting the equipment back into service.

Flashback

The most serious flame problem that can be associated with oxy-fuel gas processes, is a FLASHBACK. This is characterised by a flame snapping out and passing back through the system into the hoses and

regulators. The flashback can travel at speed of up to 2,250 km/hr - faster than the operator can turn off the cylinders !

The condition is normally identified by a loud bang followed by a high pitched whistling. This condition can cause fire or explosion of the hoses, regulators or in severe cases the cylinders. The explosive force generated can be up to 100 times the starting pressure ! CARBON MAY BE PRESENT IN THE BLOWPIPE, THE REGULATOR OR EVEN ALL THE WAY THROUGH THE SYSTEM.

Flashback is the flame problem that should be avoided at all costs.

A flashback is caused by mixed gases forming within the system, normally upstream of the blowpipe, which are caused to ignite. To create this condition, backflow (or backfeeding) of either gas must occur.

Backfeeding or the reverse flow of gases can be caused by any of the following reasons :

1. Incorrect operating system.
2. Incorrect purging of the system.
3. Blocked or undersized tip or nozzle.
4. Blocked gas passageways in the blowpipe, cutting attachment, welding attachment or heating attachment.
5. Kinked or restricted welding hoses.

The two conditions which can greatly contribute to the likelihood or not of flashbacks, are gas supply and operating pressures. The correct operating pressures must always be used, and an adequate supply of both gases must be available for the task to be performed. Low operating pressures and inadequate gas supply will increase substantially the likelihood of flame instability occurring.

Thus, a flashback occurs when the exit velocity of the gas from the welding tip or cutting nozzle, is lower than the flame speed.

Gas velocity will fall if :

1. Pressures are too low.
2. Hoses are kinked.
3. Incorrect nozzle is used
4. Blowpipe is blocked.
5. Cylinders are emptying.

Flame Speed will increase if :

1. The mixture has too little fuel.
2. The gases are heated.
3. Turbulence is present.
4. Pressures are high.

INCIDENCE OF FLASHBACK

Statistics in the U.K. state that 12% of all regulators returned for repair have carbon in low pressure chamber. Some manufacturers report a figure of 15-20%. Whatever the figure is, it probably works out that about one flashback in a thousand is reported. They do not get reported because the operators do not know what happened or because they do not want to be blamed for damaging the equipment. If possible,they will generally simply get the equipment replaced by the stores.

CHECK VALVES VERSUS FLASHBACK ARRESTORS

Check valves (or non return valves) were originally designed to prevent the occurrence of flashbacks within a gas welding system, by preventing the reverse flow and therefore mixing of oxygen and fuel gas upstream of the blowpipe.

Check valves were normally fitted between the welding hoses and inlet connection of the blowpipe. A check valve is a lightly spring loaded, soft seat valve which works on the principle of allowing the flow of both gases from the hoses to the blowpipe, but shutting off if either of the gases attempt to backfeed into the opposite welding hose.

Stopping backfeeding, prevent the build up of mixed gases in either of the welding hoses, which could ignite if exposed to a source of ignition (i.e. a "flashback").

However, as time went by, it was discovered that check valves were not as effective as first thought in preventing flashbacks. Check valves were found to be effective in preventing the backfeeding of gases, however they were found to be ineffective in protecting the system against a flashback when it occurred.

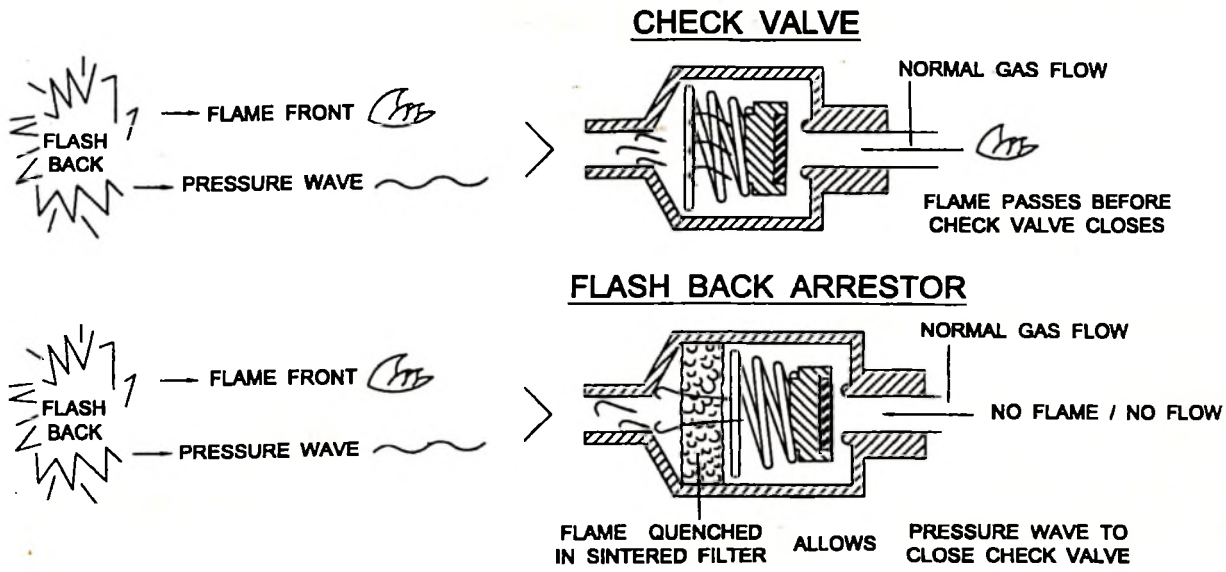

Fig. 1

It was established that a flashback consisted of 2 elements. These being a "FLAME FRONT" and a "PRESSURE WAVE". Even though the checkvalves initially halted the presure wave, it was established that the flame front went straight through the device. The flame front also destroyed the check valve seat, which in turn took away the ability of the non return device to prevent backfeeding. As a result of the ineffectiveness of the check valves to provide protection against flashbacks (and backfeeding), the need arose for equipment which would provide the required level of protection against both conditions.

This need was satisfied by the emergence of the flashback arrestor. In basic terms, a flashback arrestor is a check valve in series with a porous sintered filter on the downstream side. The purpose of the sintered filter is to quench the flame front generated as a result of a flashback, and in doing so protect the soft rubber seat of the check valve. Refer figure 1. The check valve is then able to perform its intended function which is to close off, thereby preventing the pressure wave from travelling further upstream.

As arrestor technology evolved, other features in addition to these two basic elements developed. These features include pressure activated cut-off valves, temperature activated cut-off valves and pressure relief valves.

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