Near-miss: Failure of gas quad fitting

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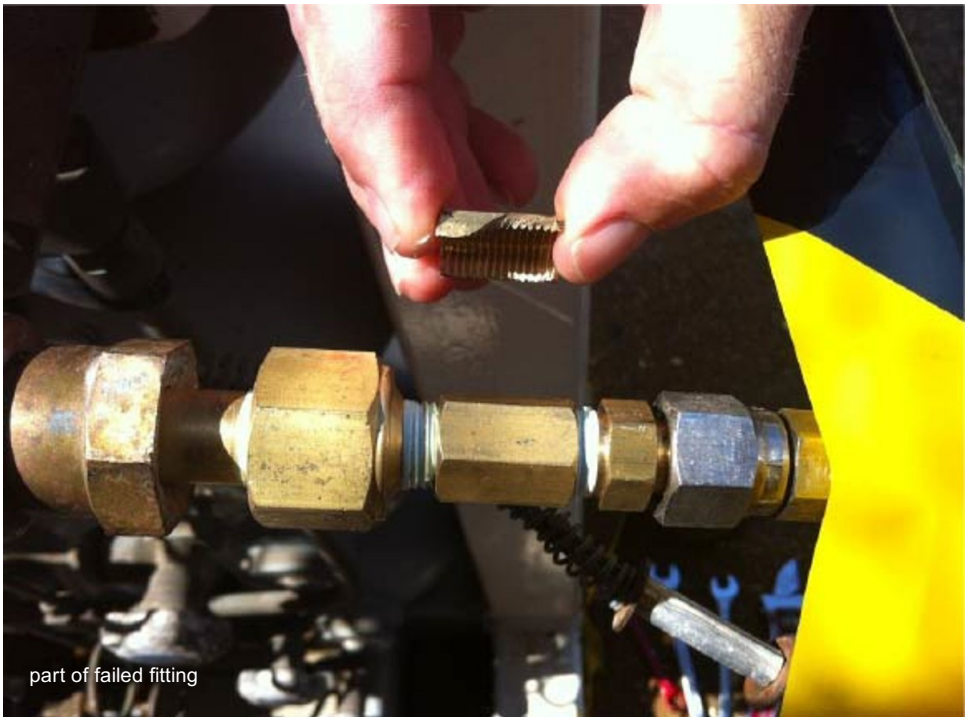
A member has reported an incident in which there was a potentially catastrophic failure of a high pressure fitting on a gas quad.

What happened

The incident occurred in a yard ashore when crew were carrying out pre-mobilisation equalisation transfer between banks on mixed gas DIV64 quad pack using high pressure (HP) hose. The wrong fitting (incorrect thread and low pressure (LP) rather than HP) was used to connect the HP whip to the king valve on the quad. The fitting failed due to a hairline crack as the gas transfer was being conducted between the HP banks.

The LP fitting failed such that it split into two pieces. One piece was found in the immediate vicinity; the other was found 20m away from the point of failure. It was later discovered that this piece had travelled with such force that it had hit and chipped an internal brick wall within a nearby workshop. The trajectory of this second piece would have crossed the main general workshop area in the facility at a height of approximately 3 metres where an estimated 10 other persons had been working. There were no injuries.



part of failed fitting

hose damage resulting from inadequate whip check

The company concerned noted that the following safety precautions were in place:

- A risk assessment on the immediate work area had been carried out prior to starting work.
- A permit to work had been completed, signed and displayed by the operator and immediate supervisor.
- Adequate bunting and warning signage had been erected to alert surrounding work areas of HP activities.
- The worker conducting the task had reviewed and signed a job hazard analysis for high pressure filling.

Findings

During investigation, the following points were noted:

- In order to complete this task in equalising gas between the mixed gas DIV64 internal banks, use was made of NPTT (tapered) adapter fittings from both the HP king valve stem connection ports and adapting to the HP transfer hose, and in this incident both the thread type and the choice of material were incorrect. Low pressure fittings were used rather than high pressure fittings.
- Whip checks had been installed at each end of the transfer hose and secured to the DIV64 frame prior to equalisation operations being conducted. However, the hose end at the point of failure did not adequately choke or restrict the hose to a point where by it should have prevented the uncontrolled movement. This resulted in the hose also being damaged and ripped at the section where the stainless steel hose crimp is machine fitted (see photo).
- An identical ¼” NPTP brass socket fitting arrangement had been used on the other end of the hose; upon inspection, a hair-line crack was found in the material.

- Additionally the first section of the brass fitting had clear visual evidence of heavy condensation, and icing on the exterior of the other associated adapter fittings at the point of the pressure drop which would have further contributed to reducing the structural integrity of material under high pressure.

What were the causes?

The following **root causes** were identified:

- Pressure of circuit was above the coupler's capacity.
- Crimped swivel fittings not suited to pressure of this level.
- Crew were not aware of different thread types.
- Whip checks insufficient.
- Valves open more then they needed to be.
- Regulator not used.
- Pressure not monitored.
- Over-tightening on coupler resulted in hairline stress cracks.

It was also noted that there was no specific process or procedure in place for the task, and that the time allowed for the task was not sufficient.

Lessons learnt

The following lessons were learnt:

- Equipment should be of sufficient pressure rating.
- Improved training and information were required on this task.
- Risk assessment for this task needed to be more detailed.
- Hose securing – whip checks – should be improved.
- Consider increasing size of restricted access area during high pressure work.
- Real-time measurement of high pressure should be in place.
- Time allowed for this work should be realistic.
- Complacency is to be guarded against.

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