

Catastrophic failure of a pipework clamp connector

Health and Safety Executive - Safety Alert	
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Target Audience:	Offshore Chemical Processing and production
Key Issues:	This Safety Alert highlights the issue of inadequate material properties of small diameter clamp connectors and the potential for sudden brittle failure.

Introduction and background:

An incident occurred on an offshore production platform in December 2014 where a 1" diameter Vector 'Techlok' pipework clamp connector catastrophically failed causing a gas release. The failure was caused by poor heat treatment during the manufacturing process, which led to failure by cracking as shown:



Cracking caused by poor heat treatment during manufacturing process

Further enquiry has revealed similar failures on other small-sized (1", 1½" and 2" diameter) clamp connector segments.

Reasons for failure:

The primary cause of failure of the clamp was due to hydrogen cracking. Evidence from this clamp and others checked later indicates that high hardness, with values in excess of 48-50HRC (Rockwell hardness value), being the underlying cause. High hardness increases the material's susceptibility to cracking in general from reduced ductility.

Investigations revealed that prior to 2010 the clamps, which require quench and temper heat treatment, were not subject to 100% hardness testing. Hence the quality controls were not sufficient to detect components that had received improper heat treatment and lacked ductility.

Clamp connector segments are produced by a forging process in a number of foundries in the UK and are manufactured from AISI 4140 alloy steel with a recommended Rockwell hardness value of 22HRC.

To date all defective clamps found were produced by one manufacturer (George Dykes) and supplied to Vector Technology Group (Techlok) up until 2010. These were limited to 2" diameter clamps and below. It has subsequently been established that the similar 'G' clamp supplied by Destec Engineering, was also manufactured by George Dykes. A Destec 'G' clamp is also known to have failed in service in 2014.

The confirmed numbers of failed clamps is low and they appear to be random and not batch related, therefore it is not possible to identify them through heat numbers or heat treatment records.

Action required:

Duty Holders should identify if they have in use any 2" or below Techlok or Destec 'G' clamp connectors supplied before 2010, or have the potential to be used (for example spares kept in stores) on any of their installations and to verify their fitness for service.

Verification could be established from supplier records whereby the material properties of the clamps are fully certified, or by appropriate NDT inspection and hardness tests.