

# SAFETY BULLETIN

DATE: NOVEMBER 2021

## Threaded fasteners – Diesel engines systems in underground coal mines

This safety bulletin provides safety advice for the NSW mining industry.

### Issue

The NSW Resources Regulator received two notifications involving failure of the explosion protection characteristics of explosion protected diesel engine systems. Both incidents involved the loss of clamping force of a fixed joint.

### Incident 1

#### Circumstances

A leak was discovered during a pre-use inspection. Upon removal of the exhaust manifold, the bolt removed had some visible damage and part of a 'Heli-coil' threaded insert was found to be sitting proud of the cylinder head surface.

#### Investigation

Investigation of the thread repair revealed that it was installed as per the supplier's recommendations. The Heli-coil was installed without the use of thread locking compound and passed thread form checks. There was no record of structural assessment for suitability for this type of repair recorded in the Code D report but it did however pass edge distance and flatness requirements.

Figure 1: 'Heli-coil' insert



## Recommendations

Wherever practicable internal (female) threads should not be repaired, and the components should be replaced with a new part.

Where it is not practicable to replace the component with a new part, ExDES (RSF) workshops should develop and implement a documented process for thread repairs including the:

- guidance steps in AS3584.3-2012, cl 3.5.7.3 for internal thread repairs
- methods to assess and test the structural integrity of the part
- additional supervision provisions for the structural assessment, thread repair and reassembly of the bolted connections
- distance below the surface coil type inserts are installed and post-machining when using blind plug inserts
- identification of competent personnel involved in all steps of the process
- record keeping of the above steps including photos of the final repair.
- Sample (type) testing or proof testing that considers:
  - maximum expected thread torque plus a margin (i.e. 10%)
  - pre and post thread form tests (i.e. go/no go gauges)
  - durability – repeated applications to determine how the insert behaves and estimate lifecycle recommendations
  - installation depth below the machined surface for coil type inserts
  - flatness check of the surface after the bolt tension has been removed.

## Incident 2

### Circumstances

An RSF conducted an offsite Code D overhaul on the ExDES of an LHD. One week after returning to service, a maintenance fitter removed the positive flame trap (item 7 in figure 2) for cleaning and inspection. On reassembly, the fitter identified two fasteners failing to apply effective clamping force to the fixed connection.

## Investigation

A third-party maintenance firm conducted an investigation to determine the cause and found the following:

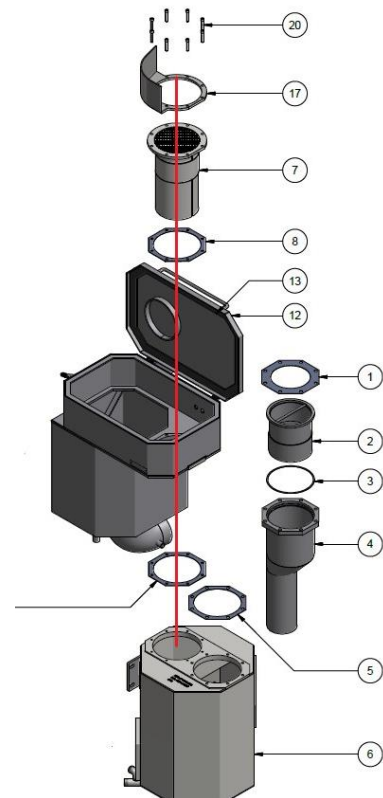
- evidence that the ends of the bolts were tapered
- the fastener grade was found to be equivalent to Class 12.9 instead of the standard the OEM supplied Class 8.8
- the exhaust conditioner top flange blind holes had not been adequately tapped following a repair but was however sufficiently close to allow fasteners to be installed, torqued, and tested for gas tightness without presenting obvious cause for concern.

## Recommendations

It is recommended that ExDES (RSF) licenced workshops:

- verify that reference documents identify the minimum required thread depth of blind holes
- verify procedures, include checking the thread tolerance and effective depth of blind holes
- verify that optional components, affecting the length of fasteners required for an assembly are identified and included in measurements when calculating fastener lengths
- verify that instructions to repairers (internal or external) include details for checking the final depth of blind threaded holes
- verify that workshop reports and procedures include methods to verify:
  - the thickness of all components to be assembled (e.g. gaskets, flanges, washers)
  - fastener length is sufficient to provide effective clamping force and not too long to bind in the bottom of blind holes
- verify correct fastener material grades are being used. (Note: Use of OEM supplied components is one way to ensure the correct material grade of fasteners)
- competent personnel and trades working on ExDES are provided with training to emphasise the importance of using fasteners of the correct material grade and foreseeable errors in relation to blind threaded holes.

Figure 2: Bolted connection assembly



It is recommended that OEMs of ExDES:

- identify the minimum service thickness of individual components and correct fastener lengths for the thickness range where blind holes are used
- clearly identify the minimum thread depth of blind holes
- clearly identify part codes for the fasteners and optional part codes for shorter fasteners, where required, for assemblies approaching minimum service thickness.

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