Track tensioning - HSE Incident report following fatality from a hydraulic injection injury

WHAT HAPPENED

HSE Incident report issued following fatality of operator from a hydraulic injection injury whilst greasing a tracked vehicle – Ref STSU 2-2017 issued 12th June 2017.

Do not refit/reuse hydraulic components that have detached from the hydraulic system under pressure. An operative died from hydraulic injection injury sustained whilst tensioning the track of an item of construction plant. The grease nipple became detached from the track adjustment mechanism permitting the release of grease under high pressure. This alert reminds those involved in the adjustment and maintenance of hydraulic machinery of the potential for such injury during this type of work.

The purpose of this safety alert is to raise awareness of the risks from reuse of hydraulic components that have become detached while under pressure. The detachment event may occur without anyone present or within range and components may not appear visibly damaged. Where this occurs with personnel close to the point of detachment there is a risk of penetration injuries from both the released component and/or the high pressure fluid which can result in hydraulic injection injury.

Please scroll down for to view graphics.

The tracks on tracked vehicles (Fig 1) are tensioned by adjusting the position of the idler wheel. On the majority of these machines a coil spring compresses or extends to take up normal small changes in track tension during operation (Fig 3). However initial set up and wear adjustment is achieved by a short stroke hydraulic cylinder filled with grease (Figs 2 & 4). The piston of this is extended using a hand held grease gun. This compresses the coil spring which in turn drives the idler wheel to the desired position and holds it there under retained grease pressure. While this operation was being carried out on the track of a piling rig, the nipple connecting the grease gun to the track mechanism detached, permitting the grease (under significant stored energy) to release, injecting the fitter and causing fatal injuries.

A previous HSE safety bulletin (FOD 4-2014) was issued at an early stage of the investigation into the track adjustment fatal incident. It addressed the risk of hydraulic injection injury in general terms and reminded readers that hydraulic injection injury can occur at pressures as low as 7bar. Tests on simple hand-pumped grease guns have achieved pressures of over 600bar.

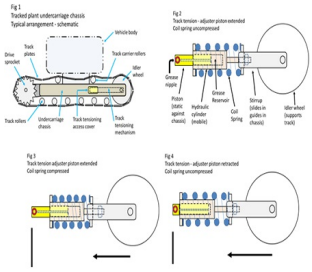
Further investigation has shown that components could fail or become weakened due to over pressurisation within the track tension adjustment assembly while the machine is being operated. This has the potential for components (the grease nipple in particular) to be ejected from the assembly either during machine operation or, more seriously, while the tracks are being tensioned using a grease gun. HSE has also been informed of separate incidents - not involving injury - where the connection between a track tensioning grease nipple and the hydraulic cylinder assembly has failed or become significantly weakened by over-pressurisation. Testing at the Health and Safety Laboratory has demonstrated that pressures in excess of those normally expected within tensioning assemblies are required to cause failure of new-condition parts.

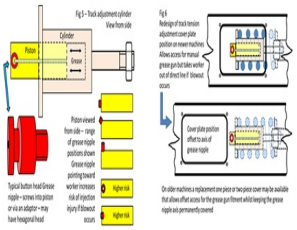
The precise mechanism which may cause over pressurisation has not been confirmed but is suspected to result from a sudden increase in the loading on the tensioner assembly. This is most likely to result as the track drive or idler sprocket attempts to engage with a track chain that is contaminated with debris such as stones or set concrete. These contaminants change the radius of the track/chain around the sprocket which results in a pressure increase in the tensioning cylinder. This is most severe once the coil spring has become fully compressed.

Components ejected during operation of the machine should be retained within the body of the track carriage assembly provided access hatches are correctly fitted. But there is a concern that components weakened by an over pressurisation during machine operation may fail at lower pressures during the track tensioning process when access covers are removed - with the operator of the grease gun at greatest risk. This is particularly relevant on machinery on which the grease nipple axis is perpendicular to the tensioner cylinder and not in line with it as is the case on many machines. See Fig 5.

Some manufacturers are now offsetting the hatches such that the opening is not in line with the axis of the grease nipple - so that in the event of failure, the nipple and grease jet should not be ejected outside of the track undercarriage. Some manufacturers now provide a replacement hatch cover that either contains a slot – offset from the grease nipple - to allow the grease gun to be attached and used; or has a separate, small, offset cover mounted on top of the main cover. See Fig 6.

The tensioner assemblies on some manufacturer's tracked vehicles are fitted with a pressure relief valve which limits the maximum pressure within the assembly, thus preventing pressure excursions that could result in damage or detachment. The settings on such valves must not be adjusted without use of specialist equipment to accurately set their opening pressure.





LEARNING POINTS / ACTIONS TAKEN

Track tension on tracked plant must be kept within the limits set by the manufacturer. Track that loses tension repeatedly must not be over-tensioned to compensate. The cause of repeat loss of tension must be investigated by a competent person (eg experienced plant fitter) to identify and rectify the root cause. If necessary assistance should be sought from the manufacturer or their local representative.

While tracked machinery is being operated, the hatch covers which provide access to the track tensioning grease nipple must be in place and secured in line with the manufacturer's instructions.

The tracks, including the chain, should be cleaned on a daily basis, and the tracks, rollers, idler wheel and sprocket on each side of the vehicle should be visually checked, as far as possible, and any trapped debris removed. The tracks must not be parked up standing in wet concrete.

Tensioning of tracks on tracked plant should only be carried out by a person who has received training in how to correctly do this. The training should include how to identify faults and who to report them to. Each time track tensioning is carried out an entry should be made in the operators' inspection and maintenance log kept with the machine. The reason for any need for excessive adjustment should be assessed by a person competent to do so.

When tensioning the tracks on vehicles where the grease nipple is perpendicular to the tensioner cylinder (ie where the axis of the nipple and/or any other parts of the tensioner assembly is pointing toward the grease gun operator), as a precaution the operator must ensure they are not positioned in front of or in-line with the nipple. This is so as to avoid injury should it break free of the tensioner assembly. On vulnerable machines, if the manufacturer provides a retrofit cover that allows the grease nipple to be permanently shielded this should be installed.

If a hydraulic component is ejected, the component must not be re-used, since it is likely to have sustained damage during such an event. Where a threaded component has detached, both the male and female thread involved must be scrapped and not reused. Partially stripped threads may not appear visibly damaged but will be unable to sustain their design load/pressure. The integrity of the union between any replacement components and the assembly must be verified by a competent person. If there is any doubt, seek advice/guidance from the original equipment manufacturer or supplier. Scrapped components should be destroyed to prevent inadvertent reuse.

LOCATION:	**MOBILE PLANT**	**ALERT STATUS:**	**Normal**
ACTIVITY:	**MAINTENANCE & HOUSEKEEPING**	**DATE ISSUED:**	**14/06/2017 13:20:57**
SUB ACTIVITY:	**N/A**	**INCIDENT No:**	**01457**