

29th August 2007
Issue Number 0707

Failure of 5T Crane Unit

The Incident

Background

On Friday 20th of July 2007 as part of standard maintenance procedures, a 3.9 Tonne three phase 3,300V AC electric motor was being removed from the Comer pulper. The motor is mounted vertically and the operation involved safely slinging the load so that once lifted it could be re-positioned into a horizontal position.

The task was being undertaken using a 5T Street Crane, with 5 Tonne endless slings, correctly rated shackles and a set of 3 Tonne Yale pull lifts were used to take the lift with the Street crane (model NX22-8FN supplied in 1992) being used to take the entire weight of the load. All the lifting tackle had been recently inspected under the regular 6 monthly insurance inspections.

As part of the mill's continuous improvement plan this infrequent operation was being photographed and risk assessed to create a safe system of work and lifting plan.

Incident

The motor is mounted some 4 metres above the ground so the area below the lift was cordoned off whilst work was in progress.

The motor coupling was disconnected and the load taken by the Street crane, as the operator used the raise control for the crane the load dropped to the floor uncontrollably.

The load ended up on the floor in the cordoned off area below. The motor impacted the floor with the drive end of the motor hitting first and then the motor twisted and came to rest in a horizontal position. The motor was written off due to the force of the impact.

The mill uses an external provider to undertake routine service and safety checks on all its motorised lifting equipment. The Street crane that failed was part of a 3 monthly inspection process and at its last inspection there were no safety related problems reported.

Initial Investigation

A competent engineer was supplied by the service and safety check provider to assist the mills engineers with a strip down of the unit to ascertain the cause of failure.

On strip down it was found that the fixing of the ring gear mounted within the wire rope drum had failed and the ring gear was able rotate freely within the rope drum.

The crane manufacturers were contacted and they advised that Loctite 638 is used as the primary fixing mechanism between the push fit of the rope drum and the drive ring gear. Their engineers had also added two 8mm roll pins drilled into the fit between the ring gear and the rope drum. (See photo attached).

Remedial Action

The wire rope drum and ring gear were taken to one of the manufacturer's workshops where a competent engineer was asked to re-insert the ring gear. The crane was then re-assembled on site, with the help of a competent engineer, and then proof load tested the crane and re-certified it as safe to use on loads up to 5 Tonnes.

Consideration will be given to the design of the crane and how this chemical fixing can be inspected to prevent an occurrence of this type of failure.

Recommendations

Sites using cranes are advised to bring this information to the attention of the competent persons who carry out crane inspection and servicing. Consideration need to be given to how the potential for a similar failure could be identified and crane manufacturers should be approached to establish what fixing mechanism is used between the push fit of the rope drum and the drive ring gear.

The following notes can be used to help establish an effective system for the maintenance and management of lifting equipment:

Crane Designer/ Manufacturer

The Manufacturer must clearly identify wearing parts; this is a relevant factor in considering the design life and application of all cranes. An investigation needs to establish if this interface was identified as a wearing part.

The manufacturer must be able to demonstrate that the component is "Fit for purpose". Work equipment should be constructed or adapted to be suitable for the purpose for which it is used or provided. Those Designing and Manufacturing the crane should assess the criticality of the winch motor joint interface in relation to its intended purpose (i.e. raising and lowering of a load).

The Manufacturer may choose to address matters by either of the following approach

- Reduce the criticality of the component, by installing additional safeguards, or
- Stipulate regular inspections of that component. (The time period between inspections should be based on calculations of the anticipated loads, stresses and strains, corrosion, deterioration and safety factors used in the design process i.e. fit for purpose.) Identify recommended methods to achieve adequate inspection (i.e. NDT testing methods).

Those Carrying out Thorough Examination

How detailed are the "thorough examinations" of individual components forming the winch on any crane? Is the examination based on assumption that the equipment has been designed correctly and has been 'maintained' under PUWER?

British Standard BS7121-1 (1989) Code of practice for safe use of cranes

Clause 13.1.3 includes reference; "When considered necessary by the competent person, visual examination can be supplemented by methods of non-destructive testing that determine the condition of any part of the crane without causing any detrimental change to the materials".

Employer

The Employer has the primary duty to demonstrate that equipment is "Fit for application" and that it has been maintained for use. Any maintenance and inspection regime should be based on the manufacturers' recommendations, and it is advised that you approach them for this information. You will still need to make a risk assessment, taking into account the intensity of use, operating environment and variety of operations i.e. fit for application. Depending upon the manufacturers' recommendations, maintenance may involve more detailed testing of components (e.g. non-destructive testing) and not placing sole reliance on a visual inspection.

LOLER and pre-use checks ARE NOT a substitute for maintenance.

Further information

Further investigations continue and any additional information will be shared through the CPI, when available.