

SAFETY ALERT

Near Miss **Paper Machine Primary Arm Clamp Failure**

On the 10th of February a partially built reel of paper fell from a paper machine to the floor while the machine was producing paper. The reel weighed approximately one (1) tonne and could have caused significant harm to people and equipment had the circumstances been different.

Background

This incident occurred during an automated reel change sequence. Reel changes occur on this paper machine approximately every 30 minutes. In the lead up to the incident approximately 35 reel changes had taken place with no indication of any problems.

18 hours prior to the incident the paper machine had undergone a planned maintenance shut. A large number of tasks were undertaken around where the incident occurred during this shut. However a review of the work undertaken does not indicate a connection between any of this work and the near miss.

Upon start up, the primary arm clamp on the back side was sticking and slower to operate than the front one. Oil was added to the lubricator on the air system feeding the primary arm cylinder on the back side, and the back side primary arm clamp was also lubricated. The clamp performed as expected after this work and this too is not considered to have been a direct contributor to the incident.

Description of Incident

Investigations to date have identified the following sequence of events leading to this incident.

- A reel change took place just prior to the incident. Ordinarily the primary arms lower the new spindle / core bar (spindle) to the rails during a reel change sequence. The spindle is clamped front and back by two (2) pneumatically operated clamps. The secondary arms (front and back) eject, along the rails, the full reel and return quickly to collect and secure the just lowered new spindle. Once the secondary arms have returned to secure the new spindle the primary arms release it, by first raising its clamps away from the spindle and then raising the arms themselves back to their home position to await the next reel change.

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- In this instance however, the clamps on the primary arms failed to release the new spindle. The new spindle commenced to wind on paper and build to its full diameter with both the primary arms and the secondary arms securing it. As the reel continued to build and grow in diameter the primary arm clamps were slowly pushed against their limit switch by the growing reel, which activated the primary arms to return to their home position above the reel drum. The partially built reel, still clamped in the primary arms, was lifted up the face of the reel drum until it connected with the Voith tail threading system (which is positioned directly above the reel drum) whereupon the reel was dislodged from the clamps and fell to the floor. 15 seconds prior to this incident an operator had been working through some standard and normal tasks in the same location where the fallen reel finally came to a stop.
- The operator, on the outside of the machine, had noticed that the primary arms were lifting the reel away from the rails but was unable to react quickly enough to prevent the reel from falling from the machine by shutting down the system.

Damage:

- Front portion of the Voith tail threader was bent.
- UTM guard bent.
- Spindle was taken out of commission until confirmation of no damage sustained.

Failure Analysis

It has not been possible to determine the specific root cause of this incident, however two (2) possible causes have been determined:

1. Air Hose off Fitting

Immediately following the near miss incident it was found that the air hose on the back side of the primary clamp cylinder had come off the fitting. This pipes the air, which in turn drives the primary arm clamp up and down, meaning the primary arm clamp could not release to return to its home position above the reel drum.

2. Air Valve

Subsequent to the incident it was observed during testing of the equipment that the front side primary arm clamp opened as it is designed to, but then almost immediately closed again. The primary arm clamp valve on the front side was found to be by-passing and was changed. It is feasible that once the reel was transferred from the primary arms to the secondary arms that the primary arm clamp closed again on the new spindle which ultimately led to the reel falling from the machine.

Feedback Loops

While this is not specifically a root cause of this particular failure, it offers a solution to the issue. It is possible to build in some intelligence to the reel change control process. Currently the system is passive in that it awaits the next limit in a sequence to be activated before the next activity is initiated. The control system for the reel-up system (which covers the primary, secondary and lowering arms) does not have any such feedback loops and therefore should a limit fail or not be made for any reason there is potential for catastrophe. Feedback loops looking at sequence completion and potential time-lag for task completion will be investigated.



Ejected reel on floor between the rails



Airline to B/S cylinder (to open primary arm clamp) came off fitting

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Corrective Actions

1. Ensure reel end control program (primary and secondary arms) in future operates using feedback from the different electronic devices to control itself.
2. Upgrade air hoses and connections on primary arm systems; front and back. In addition a rearrangement of the primary arm cylinder cover for the access of the air hose is required. The way the cover is currently set up there is a risk that the air hose will again loosen itself from the fitting.
3. Air valves on the front and back primary arm cylinders are obsolete. Replace with newer valves. Audit other plant across site to identify other valves that require replacing.
4. Operator did not use the emergency stop because he was not aware of what equipment would be crash shut by the e-stop. Identify e-stop more effectively with a sign and identification as to what equipment is halted by the e-stop.
5. By design it is necessary for operators to intervene periodically, through numerous small tasks, in the reel end area to ensure machine runability. Initially minimise but move to elimination of operator access to the reel end area.

For further information please contact:

Denise Campbell-Burns
National Coordinator
Pulp & Paper Industry
Occupational Health, Safety & Environment Unit

0419 591181

Pulp & Paper Industry

Occupational Health Safety & Environment Unit

148 - 152 Miller Street, West Melbourne 3003 Ph: (+61) 03 9274-9235 Fx: (+61) 03 9274-9284