

## Failure Analysis of DIP SPM-01-Core Loader Cylinder Adjusting Screw

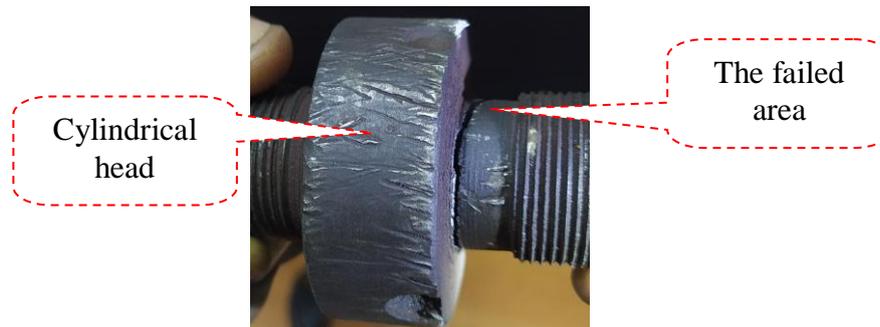
### **Abstract:**

The SPM-01 core loader cylinder was fitted on 7<sup>th</sup> December 2020 along with the new core loader. On 30<sup>th</sup>. January 2021 at about 7am. the machine stopped as the core loader assembly cylinder's adjusting screw broke . A spare screw was fitted and the machine was restarted after 1 hour of downtime. On analysis of the broken screw it was found that the screw broke from the collar as no stress relieving radii was given . The crack had initiated from a tool mark generated by the pipe wrench used by the technicians to adjust the screw.



This screw broke

Picture :1 Location of the broken screw.



Cylindrical head

The failed area

Picture:2 The failure zone

### **2: Observation:**

1. The core loader unit was changed on 7<sup>th</sup> May during monthly shut down.(picture :1)
2. After replacement it had one failure at the cylinder cushioning system.
3. The screw that failed had cylindrical head and not a hexagonal head, ( picture :2)
4. The length adjustment is done with a pipe wrench as the head is cylindrical.
5. There is very less space to accommodate the pipe wrench.

The broken screw was collected and cleaned for failure analysis.

### **3:Failure Analysis of the Damaged Parts**

(a)LH & RH cylindrical head screw:

RH & LH Screw	Observation	Analysis
	The macro analysis of the failure reveals an abrupt breakage . No evidence of fatigue failure	<u>This indicates that the screw material was not of ductile nature but brittle probably due to heat treatment of the screw.</u>

RH & LH Screw	Observation	Analysis
	Macro analysis shows the crack initiated at the root as shown in the picture,	<u>This is because no stress relieving radii were given during the screw machining.</u>

RH & LH Screw	Observation	Analysis
	There were no stress relieving radii was given during machining.	<u>This absence of radii has caused the initiation of the crack .</u>

RH & LH Screw	Observation	Analysis
	Deep tool mark on the screw. The tool mark is of the pipe wrench while adjusting the screw as per requirement.	<u>From the tool mark the crack has initiated and propagated.</u>

#### 4:Sequence of Failure:

1. Analysis (red letters) indicate that the LH/RH screw had failed from the sharp corner of the step down as no stress relieving radii were given during machining.
2. The crack initiated at the sharp corner through the tool marks generated by the jaw teeth of the pipe wrench that was abundantly used to adjust the screw length as instead of the normal hexagonal head the LH/RH screw had a cylindrical head.
3. The macro analysis shows that the failure was a brittle nature.. As soon as the crack had generated the screw failed immediately on load.

#### 5:Root Cause of Failure:

1: No radii were given during machining to the sharp corner at the step down to relieve the stress concentration at sharp edges.

2: As the screw had round head instead of hexagonal head tool marks from the jaw teeth of the pipe wrench had initiated the crack propagation.

#### 6:Recommendation:

1. In all sharp corners always provided the normal radii to avoid stress concentration.
2. Always have hexagonal head (see figure :3) for LH/RH screw for ease of adjusting with a standard SE/DE spanner
3. Check in all equipment specially in the core loader of the spinning machines that none of these round head screws without stress relieving radii are used. Replace them with hexagonal head properly machined screws.
4. Wherever possible use check nuts of appropriate width to suit at site.

5.

Figure:3

