Failure Report

Toromont Compressor

52-340-KC-001B

Rev.	Date	Issued by	Checked by	Approved by
0	29/03/2010	MEM	PM	PM

FAILURE REPORT NO: GMS-ME-FR-183

1 EQUIPMENT

Description: Screw Compressor

Model and Manufacturer: HOWDEN

Area: D2

Functional Unit: 340 Gas HC Dew Point Control

2 HISTORY

Compressor 52340KC001B was scheduled for 8000 running hour's preventive maintenance under work order MPM24246 dated on March 18th, 2003. After the idle end was opened for inspection several internal components were found damaged. Further inspection conducted to ancillaries associated to the compressor package revealed severe damage in lube oil pumps 52340PC002C and D.

Prior to the inspection, GMS Mechanical Department was informed that the compressor had oil leakage through the mechanical seal.

3 FAILURE DESCRIPTION

The inspection of the damaged components showed the following results:

3.1 SLIDE VALVE

Deep radial oriented scratches and pitting were found at the active side (rotor side). The most severe pitting is located in the central area, and its shape gradually decreases at the suction side. Deep axial scratches are also found at the passive side (casing side).

3.2 MALE AND FEMALE SCREW ROTORS

There are deep scratches caused by the contact between both elements and foreign metallic particles; this material was smashed by the rotors' surfaces. The sealing contact face between the slide valve and housing were also worn out along this area.

Clearance between male rotors and housing was measured at 0.2 mm using a filler gauge.

3.3 COMPRESSOR HOUSING

Its outer edge appears to be sharpened by the contact with the rotors.

3.4 RADIAL BEARINGS

Dismantling and inspection of radial bearings are not part of the yearly scheduled maintenance, but were done in order to clarify the equipment's failure. In order to make a proper assessment of their conditions, the bearing from the drive end side of the male rotor was removed and inspected. It was found dirty, covered by a deposited layer of a black substance that is presumed to be burned oil. Also, the babbitt layer has deep radial scratches, without pitting, possibly caused by the abrasive nature of the black deposited substance.

A radial clearance of 3 mm was measured using filler gauge; this value is within tolerance limits. Dye penetrant test did not show cracks in the babbitt layer, therefore the bearing should be re-installed.

3.5 BALANCE PISTON

There is a light scratch on the balance piston. It should be re-installed.

3.6 MECHANICAL SEAL

Hard agglomerate was found deposited on the sealing rings their failure. Burned, deteriorated oil could be the origin of this substance. The mechanical seal has been replaced. The probable origin of the deposit has been thoroughly explained through failure report GM-ME-FR-178 "Mechanical Seal – 52340KC001A", issued on February 2010. In this document process conditions and modifications made to the lube oil system are exposed, pin pointing the main probable causes of damage to the mechanical seal assembly.

3.7 SUCTION AND DISCHARGE STRAINERS

Both Compressor Suction Strainers (Suction and Propane Injection Line) are in good condition

3.8 C_3- LUBE OIL SEPARATOR

No defects were found. Filter cartridges have been replaced. It is reminded that there are no sparer cartridges in the warehouse.

3.9 LUBE OIL PUMPS

Both lube oil pumps show damage, although pump PC002C was very badly damaged.

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Oil Pump PC002C

The pump showed severe damage. Not driven end (NDE) bearing of the driving rotor was smashed; both rotors are damaged; a significant amount of material has been scraped off from its casing and adaptor as metal chipping. A new pump should be provided.

Oil Pump PC002D

Both NDE bearings show good condition, but there is a deep mark product of axial contact between the rotor and the adaptor. Due to the fact that there are no available spares for the spring washer, the pump can not be repaired properly.

Suction strainers of oil pumps.

Metal chips were found in the line and strainer. These elements could contaminate oil separator through the recirculation line.

Lube Oil Filters.

Filters cartridges were replaced. Metal chips were found in the housing. It is reminded that there no additional spares are found in the warehouse.

Oil Cooler

Should be inspected and cleaned.

As a preventive measure all propane compressors packages should be inspected regarding the lube oil quality to detect any similar damages in bearings. Pump PC002C has been so severely damaged that it is advised to consider it useless and only the not affected elements could be used as spares. Pump PC002D should be repaired as soon as possible, replacing the spring washer assembly.

The reasons to consider one of the pumps not suitable for service are:

- Damaged contact surfaces in both rotors that do not allow proper sealing and therefore the fluid pressure could not be held.
- Scratches on casing's inner surface that allows a huge clearance and increase inflow and decrease in pressure (fluid).

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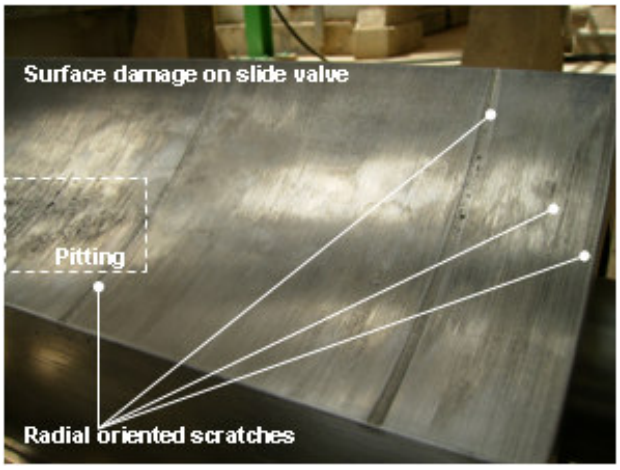

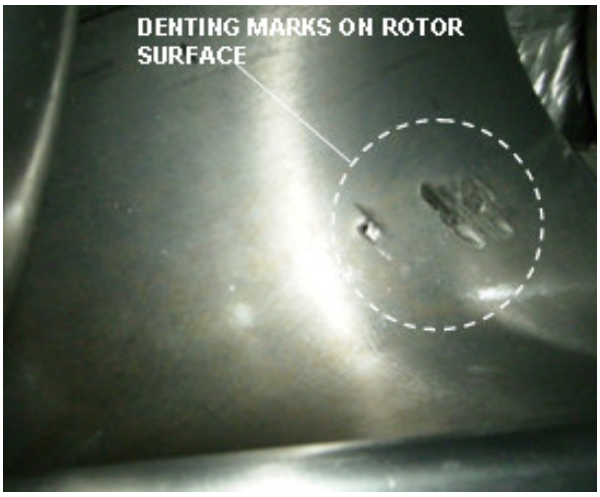

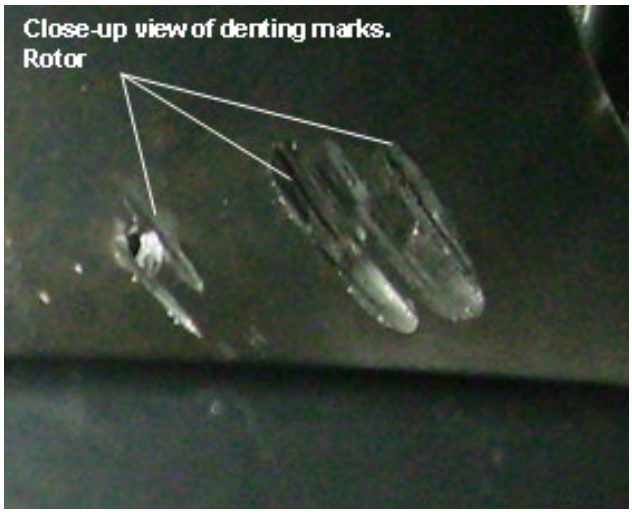

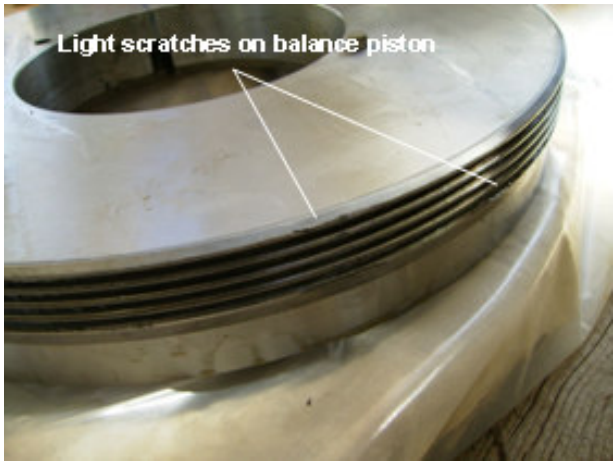

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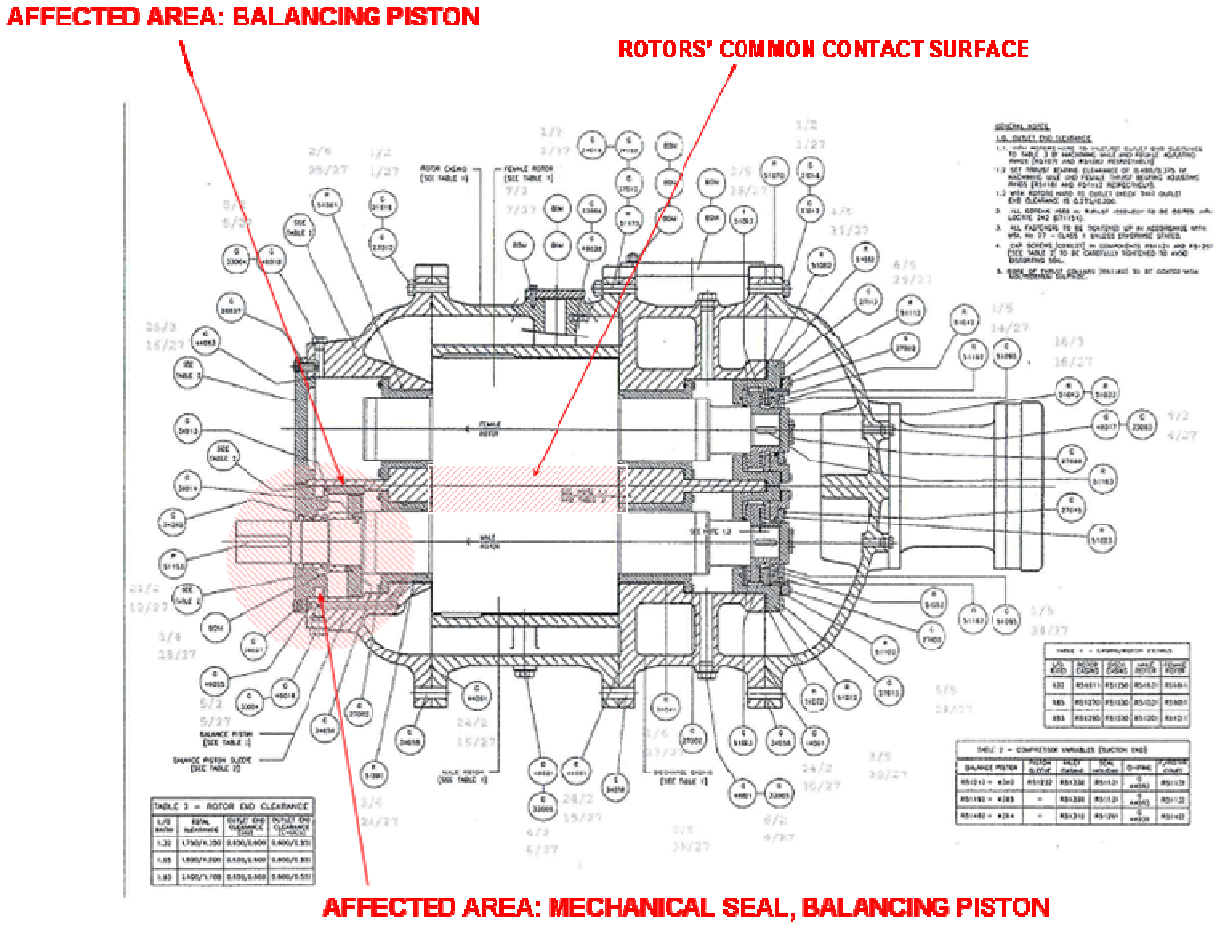

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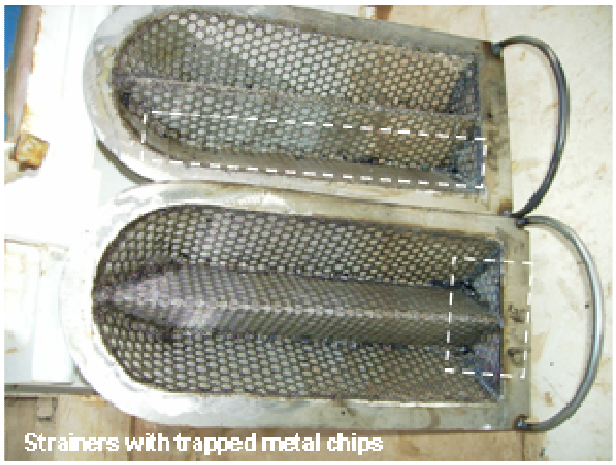

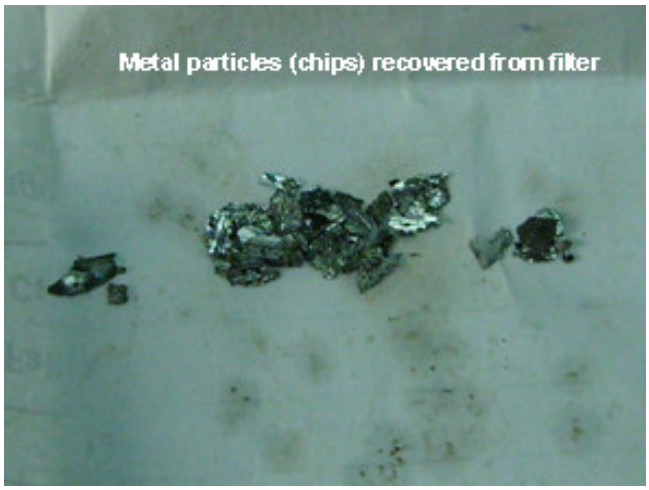

4 FAILURE DESCRIPTION OF PUMPS

Pumps tagged as 52340PC002A and B were damaged by the horizontal sliding movement of the roller type bearings attached to both rotors. In pump “A” the damage was very severe, causing the lateral bearing covers to break releasing the rollers from the inner race. These elements were crushed by the rotors, which also slid against the pump’s casing. The lateral movement of the rotor assembly described before also originated contact between it and the adaptors. This issue can be observed through the radial markings carved on the adaptors´ surfaces. All the facts already mentioned could have been triggered by a gradual decrease in compression load of the curved plates that makes up the spring washers. As the proper load lowered its value, the axial forces would drive the bearings against the adaptors surface without opposition from the spring washers; therefore the axial equilibrium was lost. The continuous pounding destroyed the bearings.

Although, as by means of probability is very seldom to happen, some of the metal chips, the smallest ones, trapped by the filters CK001C and D, could have passed through the woven material mesh and found their way to the compressor. This could explain the denting marks along the contact surface of the compressors´ rotors. However, it is most likely that being work order MPM24246 the first major maintenance service to the equipment, the actual internal damage to the screw rotors and slide valve could have occurred in the start up period, years ago. Small amount of data has been retrieved from start up and commissioning times, therefore this supposition remains valid.

5 GMS RECOMMENDATIONS

It is advised to follow these recommendations:

- Take oil samples from similar compressors and their associated lube oil filters in order to detect any metal particles.
- Contact the compressor’s vendor company to communicate the problem related to the roller bearing and spring washers and ask for alternative equipment that incorporates a different bearing assembly design.
- Pump PC002D should be replaced and PC002C could be repaired by changing the spring washer assembly.

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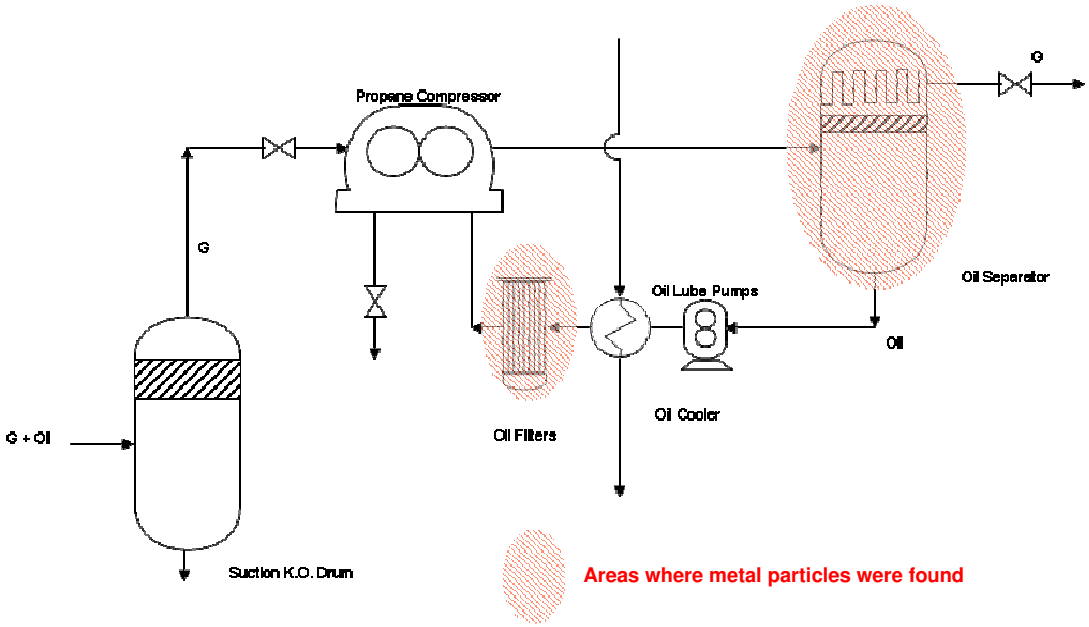
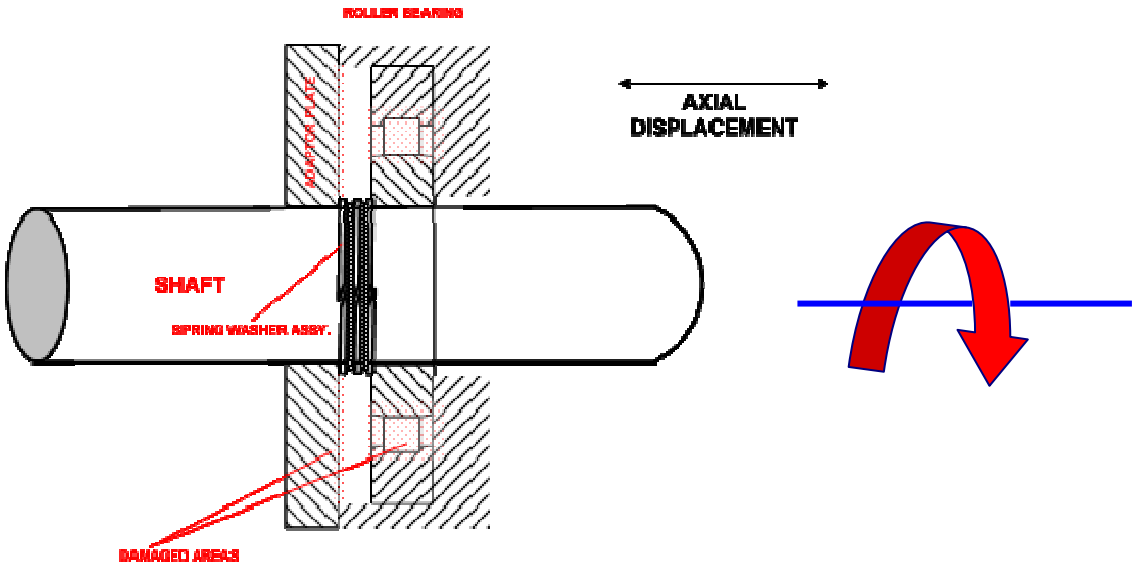
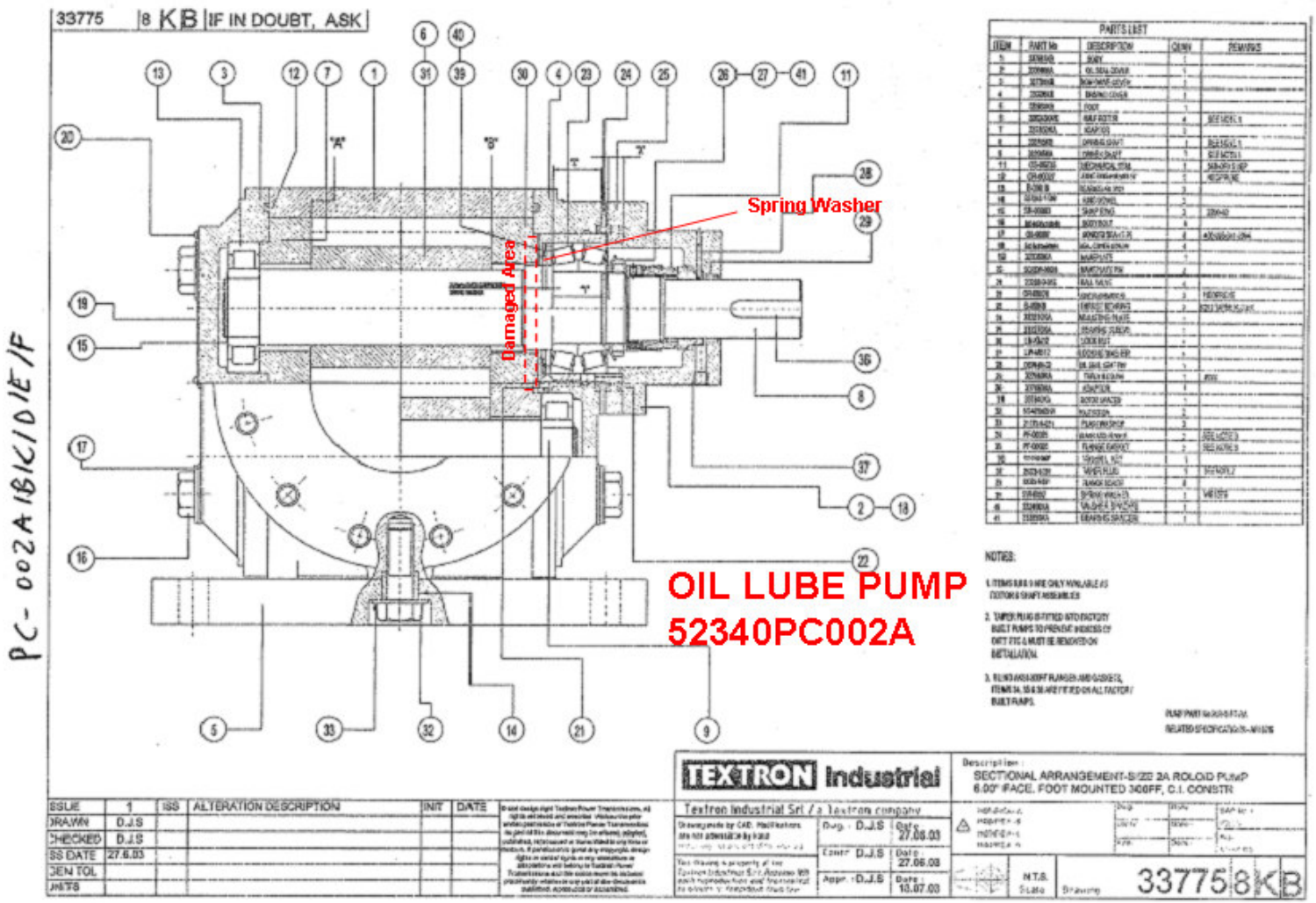




SCHEMATIC VIEW OF SPRING WASHER AND ROLLER BEARING

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