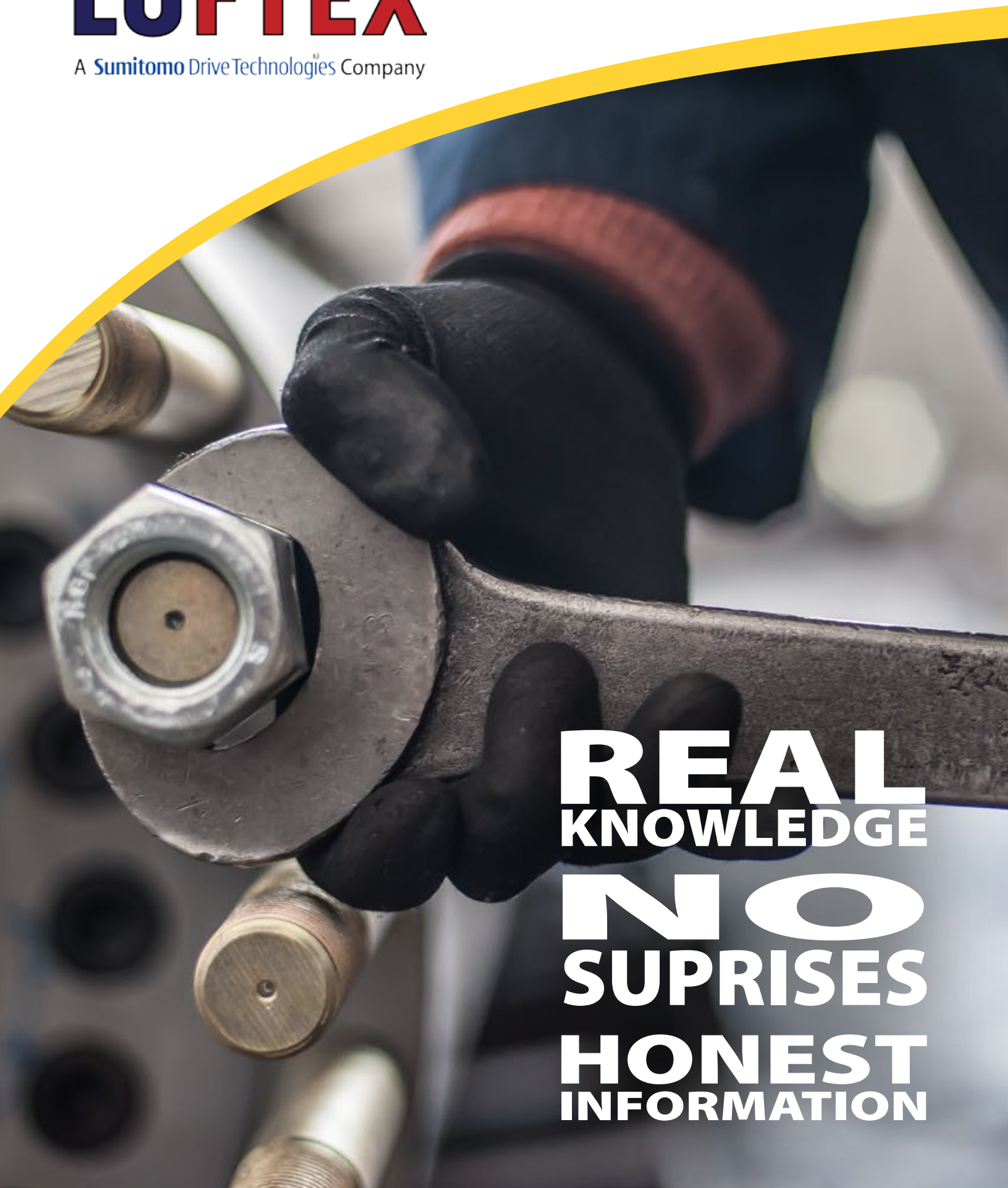
LUFTEX

A Sumitomo Drive Technologies Company

Inspection Report



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Protect Your Operation!

It's no surprise that consistent maintenance and taking care of your power transmission equipment can keep your operation performing at optimal levels - while keeping your customers and stakeholders happy.

A quality field inspection is the first step in keeping yourself informed on the condition of your investment.

Field Inspections

- **Real Knowledge**
  Through our field inspections, you'll gain actual knowledge of the condition of EACH of your critical gearboxes!

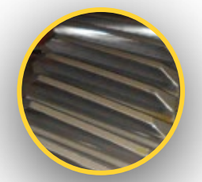
- **No Surprises**
  Not all surprises are nice ones. With your gearboxes, surprises can cause you to lose money. They often result in expensive and embarrassing lapses in production and service. Regular inspections and condition monitoring eliminate most surprises to optimize efficiency.

- **Honest Information**
  We have the ability to provide reliable, mechanical systems and suggestions that will allow all of your essential production goals to be met or surpassed!

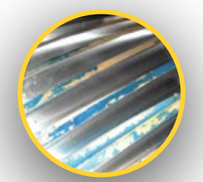


You need a partner who is familiar with your units and their operating conditions. Shipping a unit is sometimes out of the question, so you also need a partner who can provide high-quality repair service ON-SITE or in a specialized repair shop.

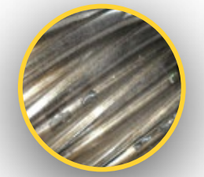
That partner is us.



Normal
Everything looks as it should



Monitor
Time to make recommended changes



Priority 1
Failure is occurring or is imminent

Rest easy knowing that we have degreed engineers using state-of-the-art software to analyze gearing, lubrication, bearings, and shafting. We will identify what failed, why it happened, and what needs to be done to prevent it from happening again!

Other repair shops will only address the symptoms and let the underlying cause destroy your machine.

The following is an example of the information that can be provided in your report.

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INSPECTION REPORT

Report # | Sample

Author | Albert E Stokley Jr.
Co-Author | None
Date | 08/18/2018

Direct Customer |
Indirect Customer |
Customer PO |
Type of Plant |

Jobsite Contact |
Phone |
Purpose of Visit | Plant Inspection
Site Date or Dates |

SAMPLE

Inspection Location | Mixing Center

Equipment Identification | Mixing Line

Equipment	Model	Serial Number	Priority for Repairs	Observation
Mixer Reducer	Lufkin DF 1175	11211158-01	**Monitor**	Possible Run Out
Auxilliary Reducer	No Tag	No Tag	**Priority 1**	Wear/Chipped Teeth
Extruder	Farrel	No Tag	**Monitor**	Wear Issue

1. Mixing Line | Mixer Reducer | Lufkin DF1175, S/N 11211158-01



Exhibit 1 Right Helix



Exhibit 2 Left Helix

High Speed Pinion | Exhibit 1, Exhibit 2

The contact appears to be 100% in length and area across both helixes with normal wear present. There is polishing present across both helixes.

Signature | Signature

Customer PO | Sample

Page | 1

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Co-Author | None
Date | 08/18/2018



Exhibit 3 Left Helix

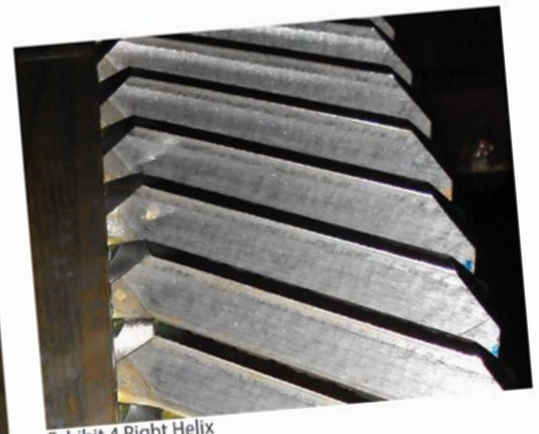


Exhibit 4 Right Helix

High Speed Gear | Exhibit 3, Exhibit 4

The contact appears to be 100% in length and area across both helixes with light wear present. There appears to be some light frosting with polishing present across the helixes.



Exhibit 5 Left Helix

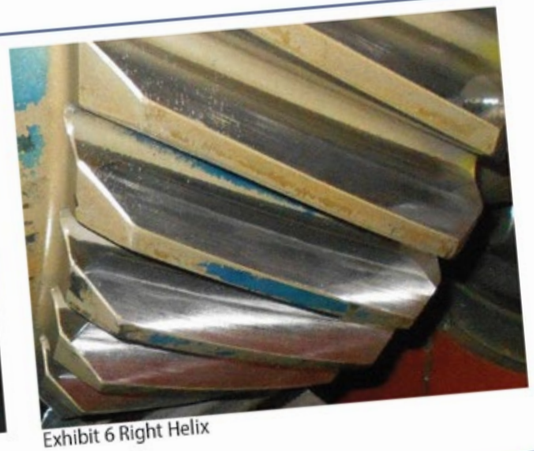


Exhibit 6 Right Helix

Low Speed Gear | Exhibit 5, Exhibit 6

The contact appears to be 100% in length and area across both helixes with normal wear present. There is polishing present across the helixes.

Signature | Signature

Customer PO | Sample

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Co-Author | None
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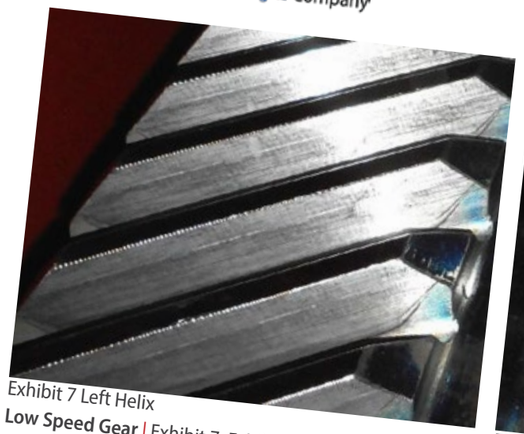


Exhibit 7 Left Helix

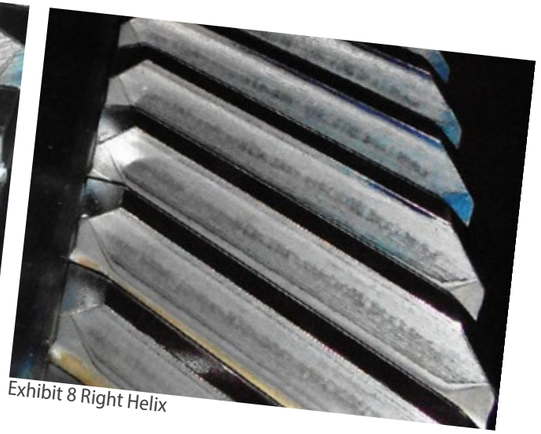


Exhibit 8 Right Helix

Low Speed Gear | Exhibit 7, Exhibit 8

The contact appears to be 100% in length and area across both helixes with light wear present. There is drosting and abrasive wear present across the helixes with possible signs of run out present. This can be seen in the photos above with the tooth engagements. However, this would need to be confirmed.

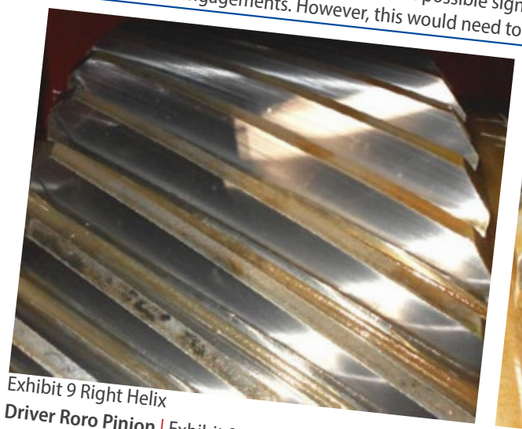


Exhibit 9 Right Helix



Exhibit 10 Left Helix

Driver Roro Pinion | Exhibit 9, Exhibit 10

The contact appears to be 100% in length and area across both helixes with normal wear present. There is polishing present across the helixes.

Signature | Signature

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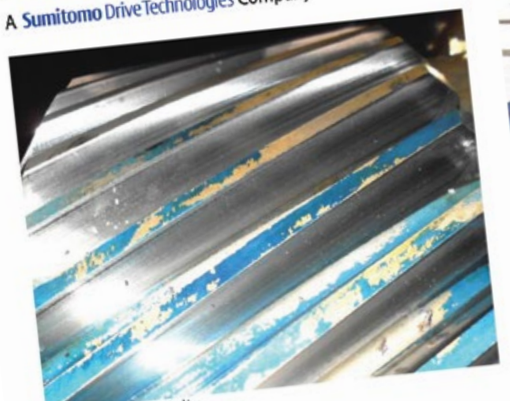


Exhibit 11 Left Helix

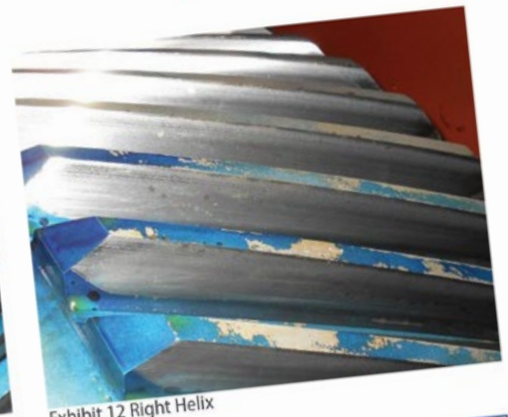


Exhibit 12 Right Helix

Driven Roto | Exhibit 11, Exhibit 12

The contact appears to be 100% in length and area across both helixes with normal wear present. There is polishing present across the helixes.

Overall Findings and Recommendations | Priority for Repairs - **Monitor**

The inspection found no real issues with most of the rotating elements. However, we did find what appears to be run out present on the low speed gear and the surface finish is very rough. This can be seen in exhibit 13 below. The run out needs to be confirmed as it could cause long term issues with wear on the low speed gear. There are a couple of options with how this can be done depending on weather the bearings are in carriers or just sitting in the housing bores. **There was no visible change in the rotating elements from 2016 to 2017 inspection. The line of contact as seen on exhibit 13 is still present and it is more pronounce now. There were oil leaks now present on the unit that were not present during the 2016 inspection.**
I have removed this from monitor as there appears to be no change in the wear that is present.



Exhibit 13 Low Speed Gear Surface Finish

There are 2 different contact lines on the teeth as seen in this exhibit.

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2. Mixing Line | Auxuliary Extruder Reducer | No Tag

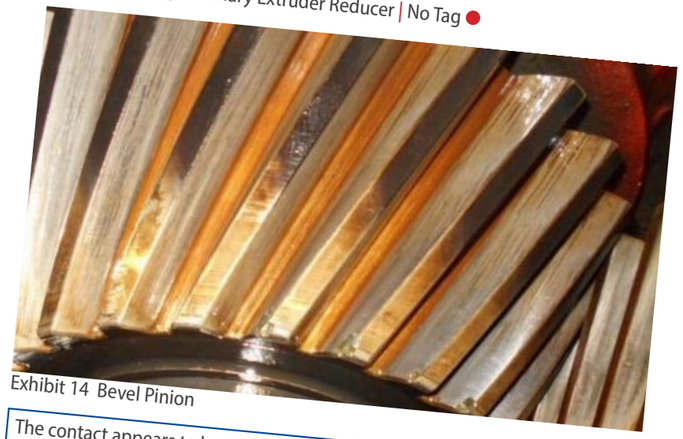


Exhibit 14 Bevel Pinion

The contact appears to be normal and full length of the teeth with some signs of polishing present. There are some chipped teeth that need to be addressed before they continue to break in sections.



Exhibit 15 Ring Gear

The contact appears to be normal and full length of the teeth with some signs of polishing present.

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Exhibit 16 Left Helix

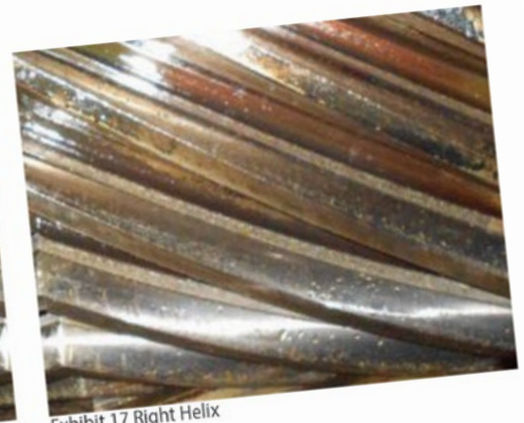


Exhibit 17 Right Helix

Low Speed Pinion | Exhibit 16, Exhibit 17

The contact appears to be 100% in length and area across both helixes with light to moderate wear present. There is undercutting present in the dedendum at the root with frosting and pitting present. There is frosting and abrasive wear now present in the addendum with signs of plastic flow in the beginning stages.

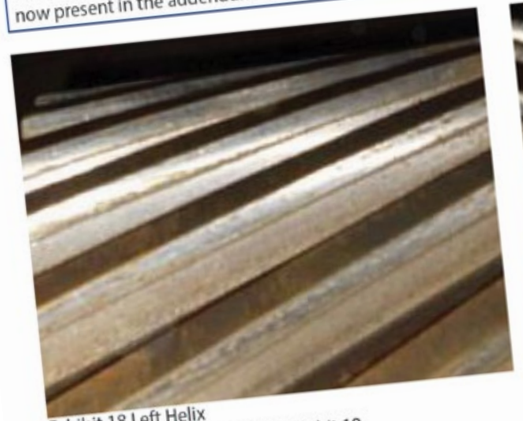


Exhibit 18 Left Helix

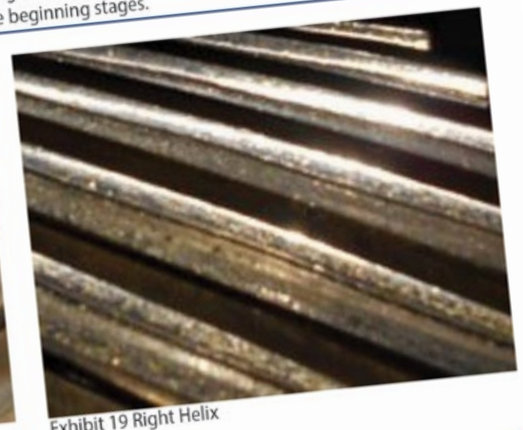


Exhibit 19 Right Helix

Low Speed Gear | Exhibit 18, Exhibit 19

The contact appears to be 100% in length and area across the helixes with light to moderate wear present. There is undercutting present thru the dedendum into the addendum with frosting and pitting present. The remaining area of the addendum has plastic flow present.

Signature | Signature

Customer PO | Sample

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Report # | Sample

Author | Albert E Stokley Jr.
Co-Author | None
Date | 08/18/2018

Overall Findings and Recommendations | Priority for Repairs - **1**

The inspection found no issues with the bevel gear set. The low speed set had destructive type wear present with the undercutting and plastic flow present. The unit will continue to run however, the wear will progress and over time it will need to be address. Presently, just the low speed set needs to be replaced at some point. The life of the present set can be extended by de-burring the edges to stop cracks from forming and this will give you more time to address the issue of replacement of the gear set. There are chipped teeth present on the bevel pinion. These should be de-burred as soon as possible to avoid any further breaks.
The unit was not inspected in the 2017 inspection. Wanted to include this based on the condition.

3. Mixing Line | Extruder Reducer | Farrel | No Tag

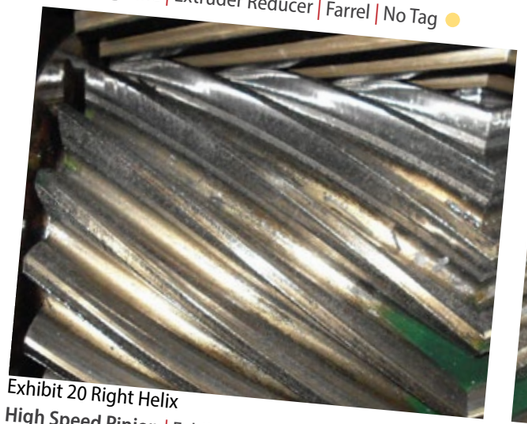


Exhibit 20 Right Helix



Exhibit 21 Left Helix

High Speed Pinion | Exhibit 20, Exhibit 21

The contact appears to be 100% in length and area cross both helixes with light to moderate wear present. There is undercutting present in the dedendum at the root and signed of plastic flow in the beginning stages in all other areas.

Signature | Signature

Customer PO | Sample

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Co-Author | None
Date | 08/18/2018



Exhibit 22 Left Helix

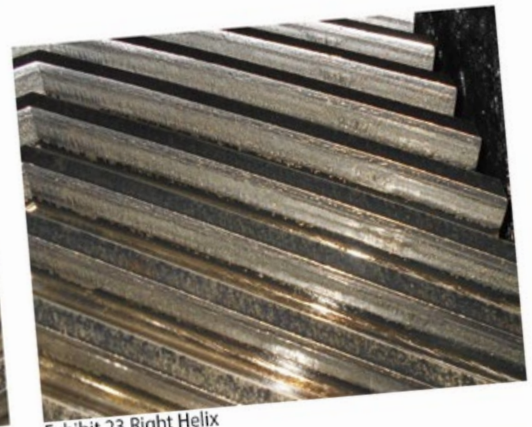


Exhibit 23 Right Helix

Low Speed Gear | Exhibit 22, Exhibit 23

The contact appears to be 100% in length and area across both helixes with light to moderate wear present. There is undercutting present in the dedendum thru most of the addendum with frosting and pitting present. The tip area of the addendum as plastic flow present.

Overall Findings and Recommendations | Priority for Repairs - **Monitor**

The inspection found destructive wear patterns present on a very old gear set. The wear that is present is fairly normal for a set of gears that has the lubrication applied in the manner of this gear set and for the fact that it is very dirty. The wear will continue to progress and we can monitor the wear and we can, at times, de-bur the edges of the gear and pinion to help extend the life of the elements. At some point, plans will need to include the replacement of the gearing which would not be difficult. At this time, the low speed gear can possibly be re-cut with a new pinion made that would save cost over a new set. Continue to monitor during the yearly inspection.
There was no visible change from the 2016 to the 2017 inspection.

Conclusions

The above report covers the mixing line # 9. There has been no real visible major changes from the 2016 inspection. This includes the mixer reducer which still have the lines present but no real change in the wear that was present. There were oil leaks now present on the unit that were not present during the 2016 inspection.
None: This will be used when there are no real issues found during the inspection. However, just because this is used does not mean we will not put some recommendations in the comments such as "oil is dirty and units needs to be cleaned." In some cases, we will list a unit as monitor if the dirty oil is at the extreme levels.
Monitor: This will be used when there are issues in the unit that we feel could progress if certain things are not completed.

Signature | Signature

Customer PO | Sample

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INSPECTION REPORT

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Author | Albert E Stokley Jr.
Co-Author | None
Date | 08/18/2018

We will list the items that need to be addressed which we feel will help the issues that we have found. In some cases, this will be used where there are destructive wear patterns and there are no corrective actions and we feel the failure is out past 2 years.
Priority 1: This is used when we feel that failure could occur within one year or less and in some cases, there are no repairs that can made to the unit that will stop this failure from occurring. In some cases, when we use the priority one condition there are repairs that can be completed that will remove the unit out of the priority one condition and some cases these are very simple actions that can be taken. When we find units with broken teeth they will always be listed as a priority one level as we feel they can fail at any time even if they may last longer the one-year period. We will also list units with any form of destructive wear as priority one as these units can also have a failure that may occur at any time. The listing is used to give the plant time to make plans for the replacement of the unit and to get parts for repairs.

Recommendations

Based on the findings we need to keep monitoring the units during the yearly inspection.
Thanks for allowing us to perform the work.
Albert Stokley

Signature | Signature

Customer PO | Sample

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