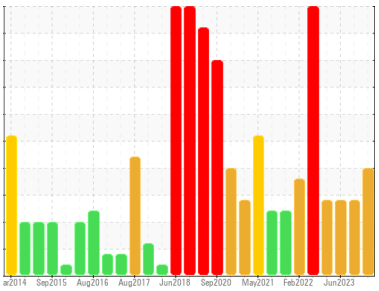
# PROBLEM SUMMARY

Sample Rating Trend

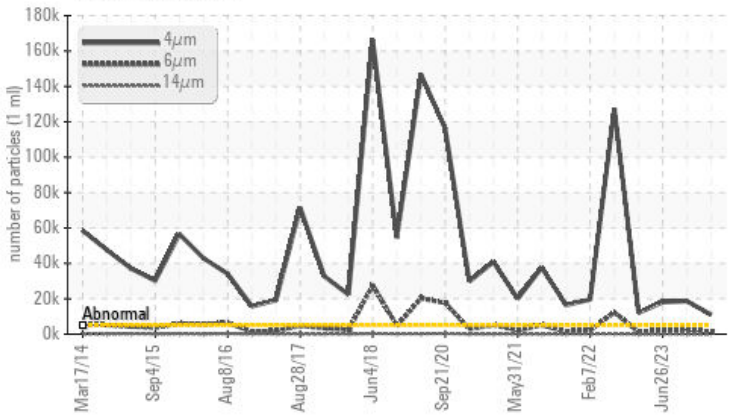


**WEAR PARTICLES**

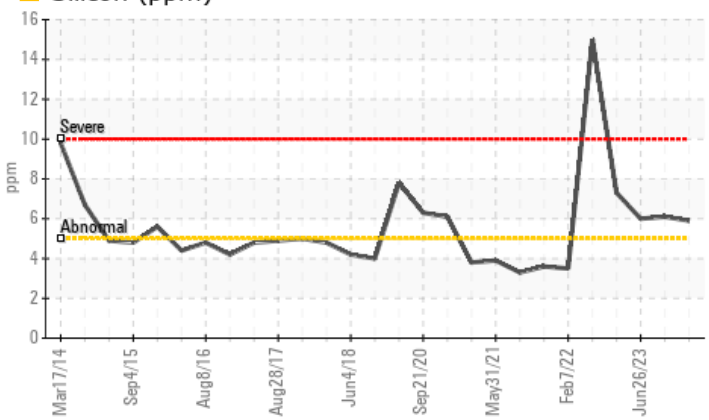
Area
## BRUCE A/0A/54600
Machine Id
## 0A-54600-SG3-Avon Level Gauge
Component
**Jet Turbine**
Fluid
**SHELL AEROSHELL 500 (--- GAL)**

## COMPONENT CONDITION SUMMARY

▲ Particle Trend



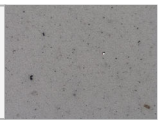

▲ Silicon (ppm)




## RECOMMENDATION

Check seals and/or filters for points of contaminant entry. We advise that you perform a filter service, and use off-line filtration to improve the cleanliness of the system fluid. We recommend an early resample to monitor this condition. NOTE: Please provide information regarding reservoir capacity, filter type and micron rating with next sample.

## PROBLEMATIC TEST RESULTS

| | | | | | | |
|---|---|---|---|---|---|---|
| Sample Status | | | | **ABNORMAL** | ABNORMAL | ABNORMAL |
| Ferrous Cutting | Scale 0-10 | ASTM D7684* | | ▲ **1** | | |
| Silicon | ppm | ASTM D5185(m) | >5 | ▲ **6** | ▲ 6 | ▲ 6 |
| Particles >4µm | | ASTM D7647 | >5000 | ▲ **11031** | ▲ 18077 | ▲ 18694 |
| Oil Cleanliness | | ISO 4406 (c) | >19/17/15 | ▲ **21/17/11** | ▲ 21/18/13 | ▲ 21/19/14 |
| PrtFilter | | | |  | *no image* |  |


**Customer Id:** BRUTIV
**Sample No.:** WC0650238
**Lab Number:** 02590977
**Test Package:** IND2+

*To manage this report scan the QR code*

*To discuss the diagnosis or test data:*
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Kevin.Marson@wearcheck.com

*To change component or sample information:*
Gloria Gonzalez +1 (289)291-4643 x4643
gloria.gonzalez@wearcheck.com

## RECOMMENDED ACTIONS

| Action | Status | Date | Done By | Description |
|---|---|---|---|---|
| Change Filter | --- | --- | ? | We advise that you perform a filter service, and use off-line filtration to improve the cleanliness of the system fluid. |
| Resample | --- | --- | ? | We recommend an early resample to monitor this condition. |
| Information Required | --- | --- | ? | NOTE: Please provide information regarding reservoir capacity, filter type and micron rating with next sample. |
| Check Seals | --- | --- | ? | Check seals and/or filters for points of contaminant entry. |
| Filter Fluid | --- | --- | ? | We advise that you perform a filter service, and use off-line filtration to improve the cleanliness of the system fluid. |

## HISTORICAL DIAGNOSIS

DIRT

**26 Jun 2023 Diag: Kevin Marson**

Check seals and/or filters for points of contaminant entry. We advise that you perform a filter service, and use off-line filtration to improve the cleanliness of the system fluid. We recommend an early resample to monitor this condition. NOTE: Please provide information regarding reservoir capacity, filter type and micron rating with next sample.All component wear rates are normal. The direct-reading & analytical ferrographic results are normal indicating no abnormal wear in the system. Silicon ppm levels are abnormally high. Particles >4µm and oil cleanliness are abnormally high. Particles >6µm are notably high. Elemental level of silicon (Si) above normal indicating ingress of seal material. The water content is negligible. The system cleanliness is above the acceptable limit for the target ISO 4406 cleanliness code. The AN level is acceptable for this fluid. The oil is still serviceable provided that the contaminant(s) can be reduced to acceptable levels.

view report

DIRT

**26 Jun 2023 Diag: Kevin Marson**

Check seals and/or filters for points of contaminant entry. We advise that you perform a filter service, and use off-line filtration to improve the cleanliness of the system fluid. We recommend an early resample to monitor this condition. NOTE: Please provide information regarding reservoir capacity, filter type and micron rating with next sample.All component wear rates are normal. There is a moderate amount of silt (particulates < 14 microns in size) present in the oil. Elemental level of silicon (Si) above normal indicating ingress of seal material. The water content is negligible. The system cleanliness is above the acceptable limit for the target ISO 4406 cleanliness code. The AN level is acceptable for this fluid. The oil is still serviceable provided that the contaminant(s) can be reduced to acceptable levels.

view report

DIRT

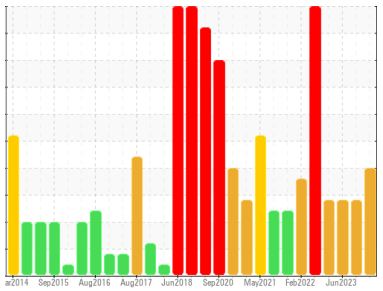
**06 Mar 2023 Diag: Kevin Marson**

Check seals and/or filters for points of contaminant entry. We advise that you perform a filter service, and use off-line filtration to improve the cleanliness of the system fluid. We recommend an early resample to monitor this condition.All component wear rates are normal. The direct-reading & analytical ferrographic results are normal indicating no abnormal wear in the system. Silicon ppm levels are abnormally high. Particles >4µm and oil cleanliness are abnormally high. Particles >6µm are notably high. Elemental level of silicon (Si) above normal indicating ingress of seal material. The water content is negligible. The system cleanliness is above the acceptable limit for the target ISO 4406 cleanliness code. The AN level is acceptable for this fluid. The oil is still serviceable provided that the contaminant(s) can be reduced to acceptable levels.

view report

# OIL ANALYSIS REPORT

Sample Rating Trend




**WEAR PARTICLES**

Area
## BRUCE A/0A/54600
Machine Id
## 0A-54600-SG3-Avon Level Gauge
Component
**Jet Turbine**
Fluid
**SHELL AEROSHELL 500 (--- GAL)**

## DIAGNOSIS

**Recommendation**

Check seals and/or filters for points of contaminant entry. We advise that you perform a filter service, and use off-line filtration to improve the cleanliness of the system fluid. We recommend an early resample to monitor this condition. NOTE: Please provide information regarding reservoir capacity, filter type and micron rating with next sample.

**Wear**

Wear particle analysis indicates that the ferrous cutting particles are abnormal. Cutting wear particles are caused by either hard protuberances (mis-aligned components, etc.), or abrasives entering the system and embedding themselves in softer materials (sand, etc.), and gouging out mating surfaces.

**Contaminants**

There is a moderate amount of silt (particulates < 14 microns in size) present in the oil. Elemental level of silicon (Si) above normal indicating ingress of seal material. The water content is negligible. The system cleanliness is above the acceptable limit for the target ISO 4406 cleanliness code.

**Oil Condition**

The AN level is acceptable for this fluid. The oil is still serviceable provided that the contaminant(s) can be reduced to acceptable levels.

Particle Filter (Magn: 200 x)

| SAMPLE INFORMATION | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Sample Number | | Client Info | | **WC0650238** | WC | WC0628175 |
| Sample Date | | Client Info | | **16 Oct 2023** | 26 Jun 2023 | 26 Jun 2023 |
| Machine Age | hrs | Client Info | | **0** | 0 | 0 |
| Oil Age | hrs | Client Info | | **0** | 0 | 0 |
| Oil Changed | | Client Info | | **N/A** | N/A | N/A |
| Sample Status | | | | **ABNORMAL** | ABNORMAL | ABNORMAL |

| WEAR METALS | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Iron | ppm | ASTM D5185(m) | >2 | **<1** | <1 | <1 |
| Chromium | ppm | ASTM D5185(m) | >1 | **0** | 0 | 0 |
| Nickel | ppm | ASTM D5185(m) | >1 | **0** | 0 | 0 |
| Titanium | ppm | ASTM D5185(m) | >5 | **0** | 0 | 0 |
| Silver | ppm | ASTM D5185(m) | >2 | **<1** | 0 | 0 |
| Aluminum | ppm | ASTM D5185(m) | >1 | **<1** | <1 | <1 |
| Lead | ppm | ASTM D5185(m) | >2 | **<1** | 0 | <1 |
| Copper | ppm | ASTM D5185(m) | >1 | **<1** | <1 | <1 |
| Tin | ppm | ASTM D5185(m) | >1 | **0** | 0 | 0 |
| Antimony | ppm | ASTM D5185(m) | | **0** | 0 | 0 |
| Vanadium | ppm | ASTM D5185(m) | | **0** | 0 | 0 |
| Beryllium | ppm | ASTM D5185(m) | | **0** | 0 | 0 |
| Cadmium | ppm | ASTM D5185(m) | | **0** | 0 | 0 |

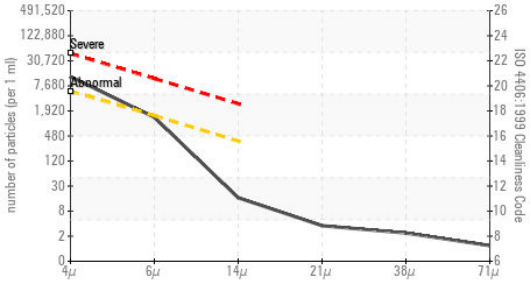
| ADDITIVES | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Boron | ppm | ASTM D5185(m) | 0 | **<1** | <1 | <1 |
| Barium | ppm | ASTM D5185(m) | 0 | **<1** | 0 | 0 |
| Molybdenum | ppm | ASTM D5185(m) | 0 | **0** | 0 | 0 |
| Manganese | ppm | ASTM D5185(m) | 0 | **0** | 0 | 0 |
| Magnesium | ppm | ASTM D5185(m) | 0 | **0** | 0 | <1 |
| Calcium | ppm | ASTM D5185(m) | 0 | **0** | <1 | 0 |
| Phosphorus | ppm | ASTM D5185(m) | 1000 | **1029** | 1068 | 1076 |
| Zinc | ppm | ASTM D5185(m) | 5 | **<1** | 1 | 1 |
| Sulfur | ppm | ASTM D5185(m) | 0 | **2** | 50 | 82 |
| Lithium | ppm | ASTM D5185(m) | | **<1** | <1 | <1 |

| CONTAMINANTS | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Silicon | ppm | ASTM D5185(m) | >5 | ▲ **6** | ▲ 6 | ▲ 6 |
| Sodium | ppm | ASTM D5185(m) | >5 | **<1** | <1 | <1 |
| Potassium | ppm | ASTM D5185(m) | >20 | **0** | <1 | <1 |
| Water | % | ASTM D6304* | >0.05 | **0.047** | 0.073 | 0.070 |
| ppm Water | ppm | ASTM D6304* | >500 | **471.3** | 730.1 | 708.4 |

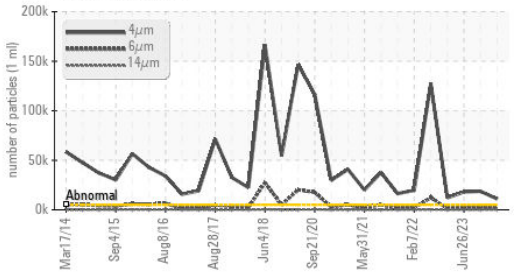
| FLUID CLEANLINESS | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Particles >4µm | | ASTM D7647 | >5000 | ▲ **11031** | ▲ 18077 | ▲ 18694 |
| Particles >6µm | | ASTM D7647 | >1300 | **1184** | ▲ 2226 | ▲ 2769 |
| Particles >14µm | | ASTM D7647 | >320 | **14** | 62 | 83 |
| Particles >21µm | | ASTM D7647 | >80 | **3** | 11 | 18 |
| Particles >38µm | | ASTM D7647 | >20 | **2** | 0 | 0 |
| Particles >71µm | | ASTM D7647 | >4 | **1** | 0 | 0 |
| Oil Cleanliness | | ISO 4406 (c) | >19/17/15 | ▲ **21/17/11** | ▲ 21/18/13 | ▲ 21/19/14 |

# OIL ANALYSIS REPORT

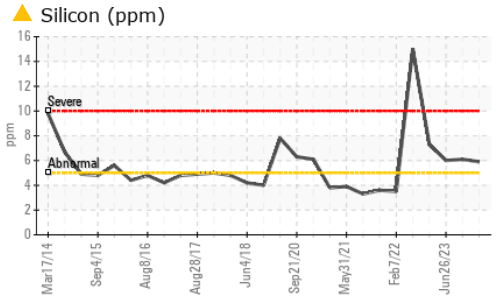
Particle Count



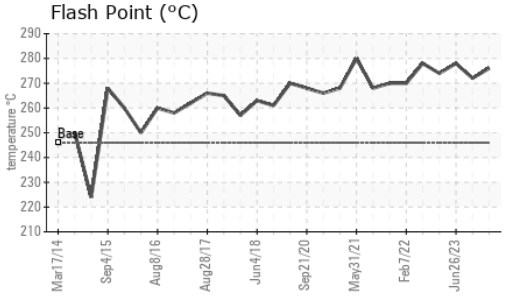

Particle Trend



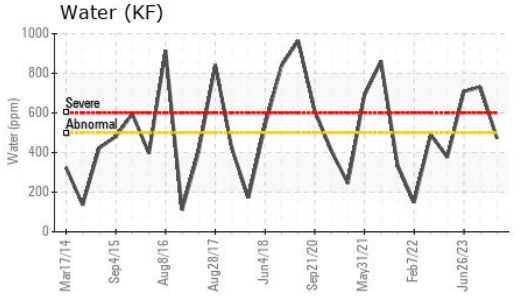

Silicon (ppm)




Flash Point (°C)




Water (KF)

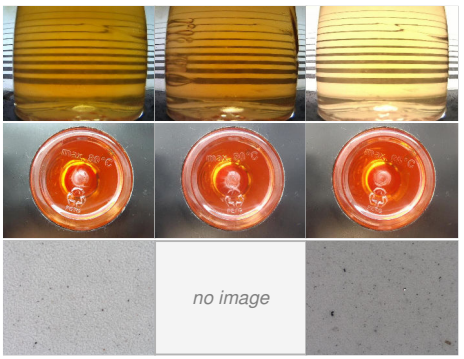



| FLUID DEGRADATION | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Acid Number (AN) | mg KOH/g | ASTM D974* | 0.11 | **0.09** | 0.17 | 0.05 |

| VISUAL | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| White Metal | scalar | Visual* | NONE | **NONE** | NONE | NONE |
| Yellow Metal | scalar | Visual* | NONE | **NONE** | NONE | NONE |
| Precipitate | scalar | Visual* | NONE | **NONE** | NONE | NONE |
| Silt | scalar | Visual* | NONE | **NONE** | NONE | NONE |
| Debris | scalar | Visual* | NONE | **NONE** | NONE | NONE |
| Sand/Dirt | scalar | Visual* | NONE | **NONE** | NONE | NONE |
| Appearance | scalar | Visual* | NORML | **NORML** | NORML | NORML |
| Odor | scalar | Visual* | NORML | **NORML** | NORML | NORML |
| Emulsified Water | scalar | Visual* | >0.05 | **NEG** | NEG | NEG |
| Free Water | scalar | Visual* | | **NEG** | NEG | NEG |

| FLUID PROPERTIES | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Visc @ 40°C | cSt | ASTM D7279(m) | 25.3 | **25.4** | 25.2 | 25.3 |
| Visc @ 100°C | cSt | ASTM D7279(m) | 5.2 | **5** | --- | 5.1 |
| Viscosity Index (VI) | Scale | ASTM D2270* | 141 | **125** | --- | 133 |
| COC Flash Point | °C | ASTM D92* | 246 | **276** | 272 | 278 |

| SAMPLE IMAGES | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|
| Color | | | | | |
| Bottom | | | | | |
| PrtFilter | | | | | |




ISO 17025:2017 Accredited Laboratory

**Laboratory** : WearCheck - C8-1175 Appleby Line, Burlington, ON L7L 5H9
**Sample No.** : WC0650238 **Received** : 23 Oct 2023
**Lab Number** : 02590977 **Diagnosed** : 27 Oct 2023
**Unique Number** : 5668056 **Diagnostician** : Kevin Marson
**Test Package** : IND2+ ( Additional Tests: A-FERR, BottomAnalysis, DR-FERR, PrtFilter, Spat, TAN Man, VI, Visual )

*To discuss this sample report, contact Customer Service at 1-800-268-2131.*
*Test denoted (*) outside scope of accreditation, (m) method modified, (e) tested at external lab.*
*Validity of results and interpretation are based on the sample and information as supplied.*

**Bruce Power - Bruce A PdM**
P.O.Box 1540, 177 Tie Road,, RM-222 U2 Column 2N11 615`
Tiverton, ON
CA N0G 2T0
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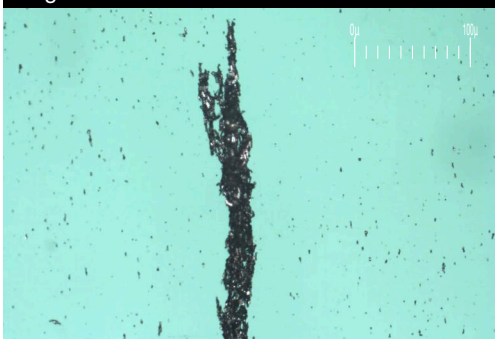
F:

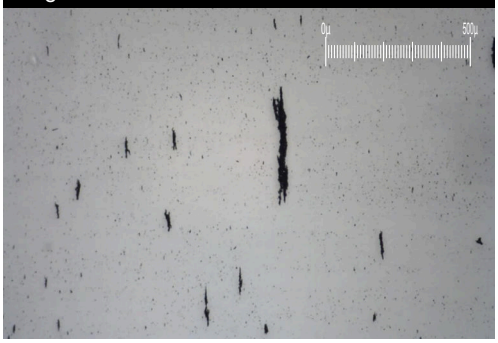
# FERROGRAPHY REPORT

Area
## BRUCE A/0A/54600
Machine Id
## 0A-54600-SG3-Avon Level Gauge
Component
**Jet Turbine**
Fluid
**SHELL AEROSHELL 500 (--- GAL)**

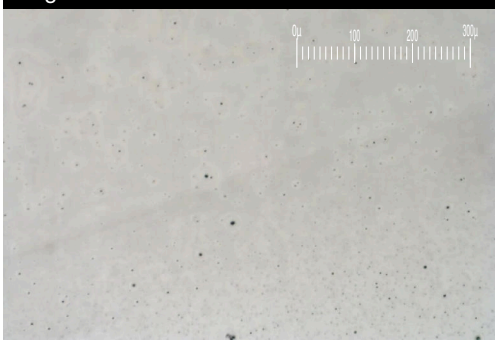
Magn: 200x Illum: BC



Magn: 50x Illum: RW



Magn: 100x Illum: RW

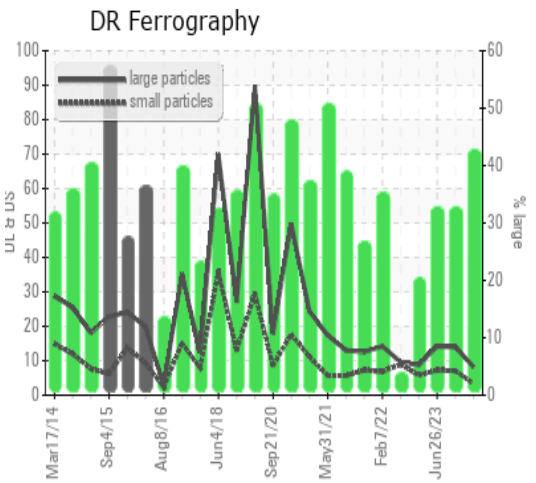


| DR-FERROGRAPHY | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Large Particles | | DR-Ferr* | | **8.2** | 14.2 | 14.0 |
| Small Particles | | DR-Ferr* | | **3.3** | 7.2 | 7.1 |
| Total Particles | | DR-Ferr* | >--- | **11.5** | 21.4 | 21.1 |
| Large Particles Percentage | % | DR-Ferr* | | **42.6** | 32.7 | 32.7 |
| Severity Index | | DR-Ferr* | | **40** | 99 | 97 |

| FERROGRAPHY | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Ferrous Rubbing | Scale 0-10 | ASTM D7684* | | **3** | 2 | |
| Ferrous Sliding | Scale 0-10 | ASTM D7684* | | | | |
| Ferrous Cutting | Scale 0-10 | ASTM D7684* | | ▲ **1** | | |
| Ferrous Rolling | Scale 0-10 | ASTM D7684* | | **2** | 1 | |
| Ferrous Break-in | Scale 0-10 | ASTM D7684* | | | | |
| Ferrous Spheres | Scale 0-10 | ASTM D7684* | | | | |
| Ferrous Black Oxides | Scale 0-10 | ASTM D7684* | | **1** | 1 | |
| Ferrous Red Oxides | Scale 0-10 | ASTM D7684* | | | | |
| Ferrous Corrosive | Scale 0-10 | ASTM D7684* | | | | |
| Ferrous Other | Scale 0-10 | ASTM D7684* | | | | |
| Nonferrous Rubbing | Scale 0-10 | ASTM D7684* | | | | |
| Nonferrous Sliding | Scale 0-10 | ASTM D7684* | | | | |
| Nonferrous Cutting | Scale 0-10 | ASTM D7684* | | | | |
| Nonferrous Rolling | Scale 0-10 | ASTM D7684* | | | | |
| Nonferrous Other | Scale 0-10 | ASTM D7684* | | | | |
| Carbonaceous Material | Scale 0-10 | ASTM D7684* | | | | |
| Lubricant Degradation | Scale 0-10 | ASTM D7684* | | | | |
| Sand/Dirt | Scale 0-10 | ASTM D7684* | | **1** | 1 | |
| Fibres | Scale 0-10 | ASTM D7684* | | | | |
| Spheres | Scale 0-10 | ASTM D7684* | | | | |
| Other | Scale 0-10 | ASTM D7684* | | **1** | 1 | |

### WEAR

Wear particle analysis indicates that the ferrous cutting particles are abnormal. Cutting wear particles are caused by either hard protuberances (mis-aligned components, etc.), or abrasives entering the system and embedding themselves in softer materials (sand, etc.), and gouging out mating surfaces.



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