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Wear Debris Analysis of Machines Using Ferrography

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Abstract: As machines turn out to be progressively mind boggling and indispensable to our lifestyle, any unsettling influence or disappointment of their appropriate working will in general have genuine outcomes. To counteract such disappointments, expanding consideration is being paid to methods for the checking of hardware condition. Of the numerous strategies accessible, examination of the ointment and any particles it contains shapes a reason for translation of the states of activity, and the rate and seriousness of corruption of the moving parts, in a machine. Numerous procedures of wear Debris analysis, for example, spectrographic oil investigation and ferrography, are accessible to show the piece, shape, size, and convergence of contaminants in an oil. This paper audits the essential parts of wear-debris analysis examining as a fundamental segment of hardware condition observing and gives a knowledge into the determination of suitable systems and the data that can be available.

Keywords: wear, ferrography, lubricating oil

I. INTRODUCTION

Since improvement of the world getting continuously, there is developing contribution in the investigations of state of hardware parts. More prominent apparatuses in industry are growing faster than their administrator. In this circumstance, developing significance of prescient upkeep drove us to the improvement of extensive number of machine condition checking methods. The inner mechanical parts which broadly add to significant breakdown in motors, On the other hand, oils are another factor to be considered as to guarantee the exhibitions of motors are inside ideal working conditions. Any unscheduled breakdown can build the support cost and can cause human setback. Along these lines to limit any unscheduled breakdowns, a legitimate support methodology and condition observing frameworks be basic to identify blames in the beginning periods what's more, offer mindful notice to inform the administrator. The abilities of Condition Monitoring Systems given that in the event that it has been led accurately it can expand the existence term of the motors. These could likewise diminish the upkeep use and avoid from disastrous breakdown to the motors. Significance of prescient upkeep prompts the advancement of a lot of machine condition checking procedures. Vibration and oil examination be the two distinct techniques in deciding mechanicals disappointments into normal parts of machines, for example, motors, gearboxes and generators. As it is hard to screen wear conditions by estimating vibration in light of its unpredictable sources, multi stage impedance and low recurrence, because of that oil examination turns into the fundamental strategy for checking different hardware parts. Oil examination can be ordered into three liquids investigation strategies that are property, liquid tainting and wear debris analysis. Condition observing of apparatus through examination of wear debris analysis is currently broadly connected as a device in symptomatic innovation. Wear debris examination is a strategy for foreseeing the soundness of machine in a non-meddling way by examining wear particles present in lubricating oil.

II. WEAR DEBRIS ANALYSIS

There are numerous procedures for investigating wear debris in lubricating oil Maybe a couple of these are given below:

- 1) Spectrometric oil investigation programs
- 2) Rotary molecule investor
- 3) Litmus paper test
- 4) Sulphur test
- 5) Filtergram investigation
- 6) Ferrography system

Ferrography is the most vital method for investigated wear particles in the lubricating oil. In this venture work just ferrography method utilized for wear debris analysis of inner ignition motor oil. Ferrogram D7690 is utilized for logical ferrography and D5185 is utilized for wear metals in grease oil. In explanatory ferrography by tiny examination we tell about size, shape, shading, surface and introduction and so forth.

III.FEROGRAPHY

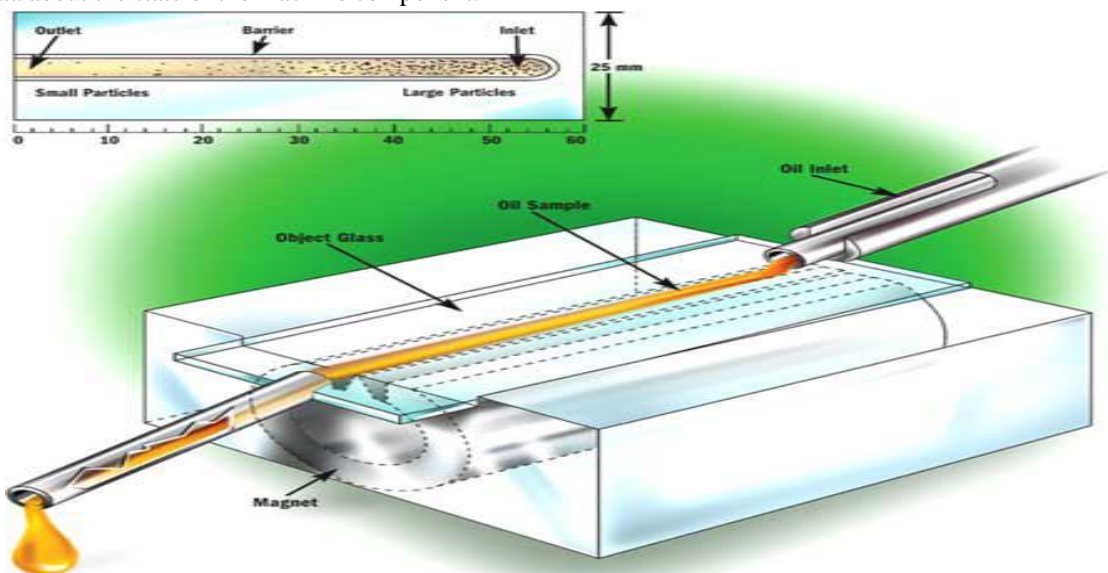
Ferrography is a powerful apparatus utilized for oil examination. It includes isolating out strong particles from an oil and looking at them under a magnifying instrument checking trademark like molecule estimate, fixation, organization, morphology and surface state of the ferrous and non-ferrous wear particles. This testing is usually called ferrography. It consists of following activities:

A. Quantitative Analysis

What is wear molecule fixation implies the count of number of particles unit volume of oil test is considered as wear particle focus concentration (WPC). We additionally offer weight particles in unit volume of oil tests for trending.

B. Qualitative Analysis

Investigative ferrography is among the most ground-breaking demonstrative devices utilized in oil examination now a days. The system of wear debris analysis (Analytical ferrography) is picking up ubiquity in the field of machine condition based support framework. To perform scientific ferrography the strong debris suspended in an ointment is isolated and efficiently kept onto a glass slide. The slide is analyzed under a magnifying lens to recognize molecule measure, shape, morphology and surface state of the ferrous and non-ferrous wear particles. The particles present in a greasing up liquid convey point by point and imperative data about the state of the machine component.



C. Details of Oil Samples

Examination works for this thesis are completed on Hero HF Deluxe bike. Following Table demonstrates the subtleties rundown all things considered or motor oil are utilized for the examination. It is to be noticed that vehicles runs are in guess.

TABLE I

Table 1: Detail of Samples

SAMPLE CODE	TOTAL RUNS (in Km)
1	520
2	2800
3	5156
4	9500
5	10144

D. Specification of vehicle

The specification of the HF delux Bike are given below in the table 2:

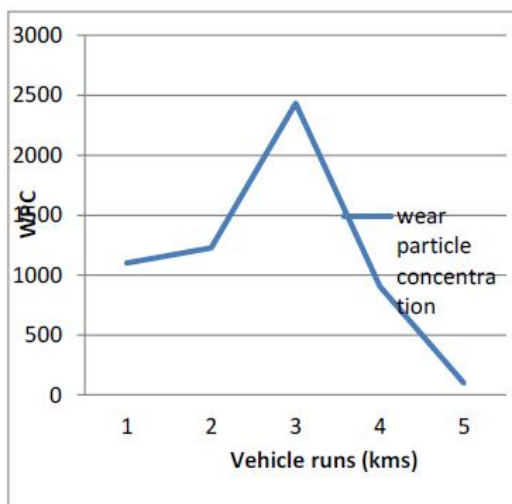
Table 2: Technical Specification

NAME	HERO HF DELUXE BIKE
Engine type	Air Cooled, 4-Stroke, Single Cylinder
Displacement	97.2 cc
Maximum Power	5.74 KW at 7500 RPM
Maximum Torque	8.04 N-m at 4500 RPM
Bore	50mm
Stroke	49.5 mm
Compression	9:1
Fuel Tank Capacity	10.5 Litres
Reserve	1.8 Litres
Oil Tank Capacity	1 Litre

IV. RESULTS AND ANALYSIS

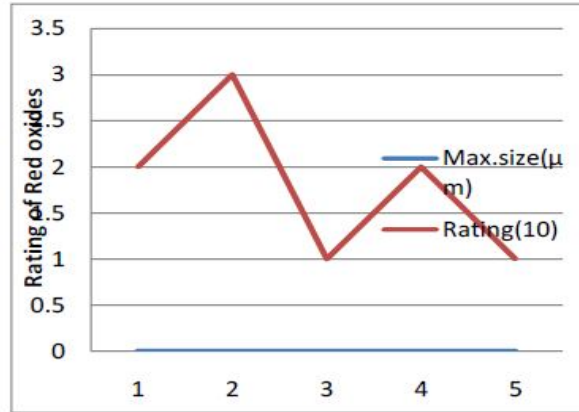
The accompanying outcomes are gotten after the wear debris investigation of lubricating oil for ferrous and non-ferrous wear molecule.

A. Ferrous Wear Molecules



Graph between WPC and Vehicle run

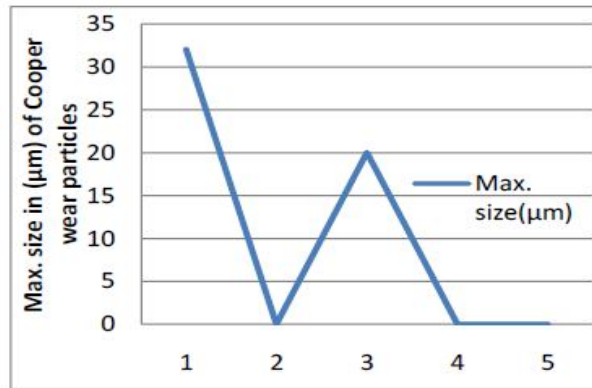
Wpc in sample2 and sample3 increments since in sample1 the wear debris max. estimate is expansive as observed 248 micron of case hardend steel , in next test this case hardened steel molecule max. estimate decreased uo to 60 micron and in sample3 little size of 30 micron seen which builds the fixation of wear molecule. Means as vehicle runs the particles measure is decreased and number of particles increments and after that as vehicle keeps running in sample4 and sample5 max. measure just as wpc is diminished.



Graph between red oxides and vehicle run

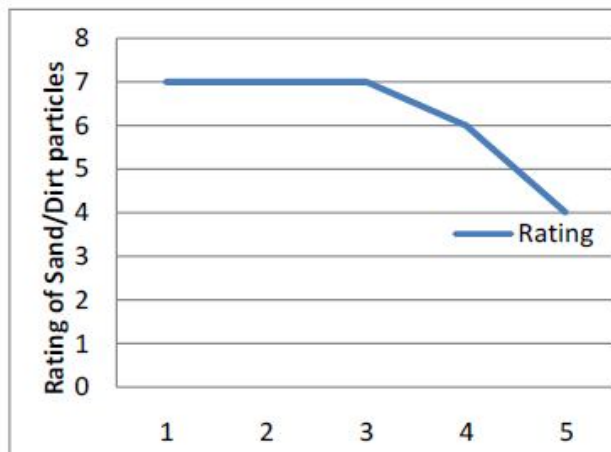
Red oxides (Rust) polarized light promptly distinguish the red oxides. Now and then they can be found in chains with alternate ferrous particles and once in a while they are arbitrarily stored on the slide surface. They generally shows up as a shoreline of red sand. Fine particles in ordinary rating are in oil tests.

B. Non-Ferrous Wear Molecules



Graph between max. size of cooper wear particle Vs Vehicle runs

Copper particles generally show up as brilliant yellow particles however the surface may change to verdigris after warmth treatment. These likewise will be arbitrarily kept over the slide surface with bigger particles are resting at passage purpose of the slide. Cooper wear molecule in sample1 are in little amount of max measure is 32 micron. In sample2, 4, 5 fine copper particles are seen.



Graph between sand/Dirt particles Vs vehicle runs



Sand/Dirt particles don't change in appearance after warmth treatment , they can show up as white gems and effectively distinguished by the transmitted light source, that is , they are to some degree straightforward. Contaminants show up haphazardly on the slide and are regularly dyed the chains of ferrous particles. These particles are seen in extensive amounts however as vehicle runs rating is change close basic to typical condition.

V. CONCLUSION

In the wake of taking the examples of lubricating oil in clean container. We broke down each example by ferrography strategy and presumed that the wear molecule concentration which is really the number of wear particles increments up to third example on the grounds that the molecule sizes are greater in starting example there after size of particles is decreased consequently number of little size particles are expanded. Be that as it may, at all load of wear particles is decreased with vehicle runs and after third example load of wear particles just as wear molecule concentration is diminished. It is seen that the most extreme size of wear molecule is 248 micron which indicates basic circumstance of wearing. This molecule is has a place with case hardened steel wear in minimal amount. Camshaft is put forth by defense solidified steel subsequently most wore part of the motor is camshaft in first example. There is no requirement for replacing oil after fourth example upto vehicle runs increasingly more than 12000 kilometers.

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