

# ENGINEERING REPORT

**Subject:** Oil Analysis for Oil Absorption Test  
**Date:** 3/23/17  
**Place:** International Training & Research Center  
**Present:** Danny Speranza  
Dave Nestor

## **Purpose:**

Evaluate different mineral oils for potential candidates as the oil for the oil absorption test.

## **Summary:**

Discovered there are different mineral oils used as an ingredient in lane oil. They have different viscosities, which have different oil absorption rates. After testing we concluded:

- Use Test Oil No. 1 as the mineral oil for the oil absorption test because it is used the most in different lane oils
- Use the 27-gauge needle dispenser because the smaller diameter keeps the low viscosity oil from flowing out of the needle when sitting in the dispenser
- Use the 27-gauge needle because the elapsed time gives the best resolution in an acceptable time
- Use the 27-gauge needle because it had a smaller standard deviation of oil absorption times during the initial testing

## **Data:**

Mineral oil is used in the oil absorption test, since it is the main ingredient in lane oils. We started by using a mineral oil from Walmart called Equate. We did not want to use a commercially available lane oil, since we do not know the ingredients. Plus, it might not be available in the future, if we need to purchase more for the oil absorption test.

During our trip to a lane oil manufacturer, they mentioned using different grades of mineral oil, and we saw different storage tanks for oil. They know a lot about different mineral oils. Therefore, we contacted them to get samples of mineral oil, feeling that, in the future, they would be better at supplying the same oil for our testing needs.

The first mineral oil they supplied for us to test was Test Oil No. 1, which was a medium viscosity oil. When put into our dispensing syringe, it flowed out of the needle tip by itself. Therefore, we changed to a smaller diameter tip which stopped the leaking. The size of the oil drop on the ball appeared to be about the same size as before with the original Equate mineral oil from Walmart, but we got faster oil absorption times. When the same 25-gauge color dispenser tip was used with Test Oil No. 1, the size of the oil drop was much larger on the ball. Because the viscosity and surface tension were much lower, the drop was larger and covered a noticeably larger area on the ball. The oil absorption time was much longer. Therefore, we concluded:

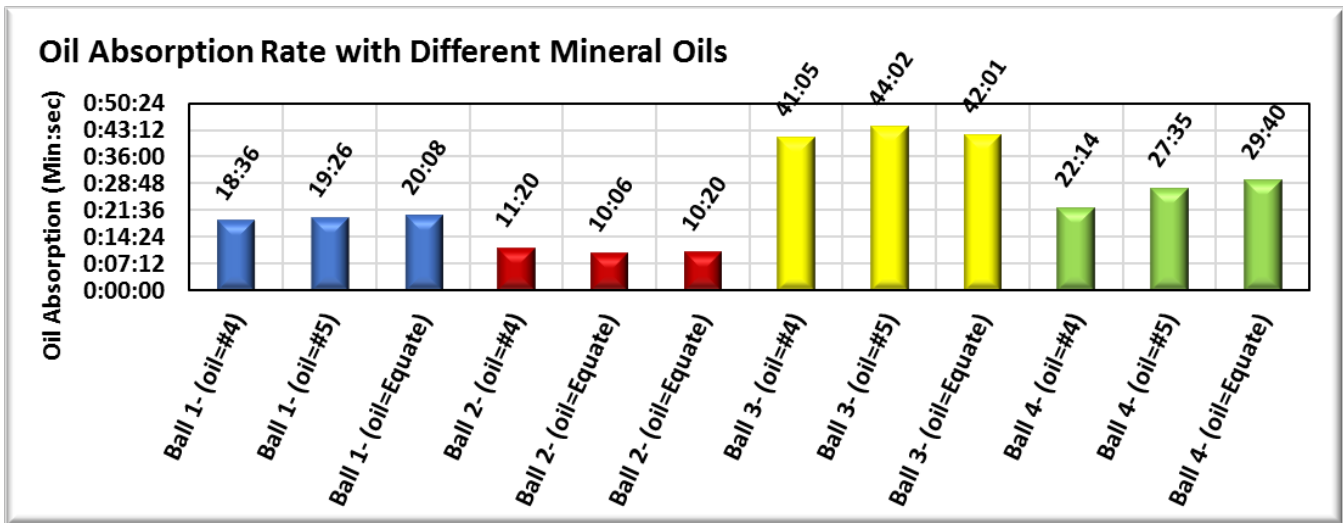
- Mineral oil is not all the same
- The viscosity and surface tension affect how the oil flows out of the dispenser needle
- The viscosity and surface tension affect how the drop "wets" out on the ball which affects the oil absorption time

Tested five different viscosities of mineral oil for us to test:

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Sample	Viscosity (cps)	Surface Tension (mN/m)	Comments:
Test Oil No. 3	low	med low	too thin- runs out of needle
Test Oil No. 2	med low	medium	too thin- runs out of needle
Test Oil No. 1	medium	low	too thin- runs out of needle
Test Oil No. 4	med high	high	higher viscosity
Test Oil No. 5	high	med low	higher viscosity
Equate MO USP	high	high	higher viscosity

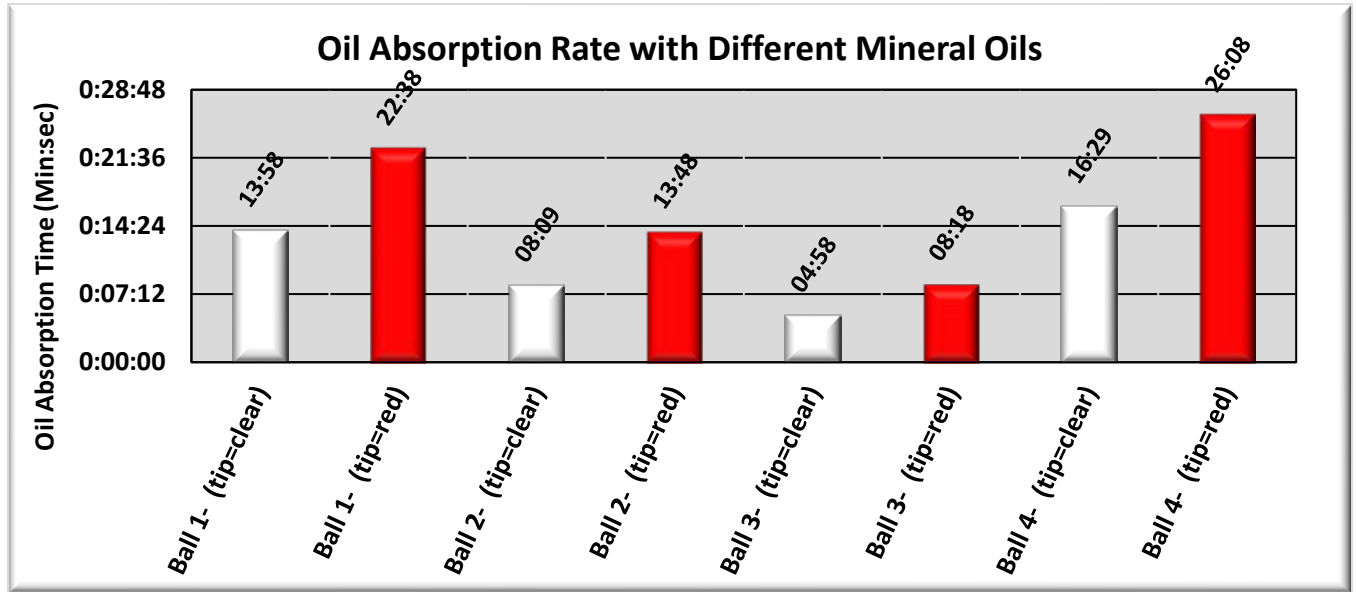
We started testing with the two highest viscosity mineral oils (No. 4 and No. 5) because the viscosities were closest to the Equate oil, and we could use the same 25-gauge dispenser needle. We found the oil absorption times were close to the Equate oil for four different balls:



We found that the Test Oil No. 5 was only used in one lane oil. Test Oil No. 4 is used more often but still in only a few lane oils. Test Oil No. 1 is used the most.

Knowing that the Test Oil No. 1 is used the most, we decided to use it for the mineral oil for the absorption testing, as that is what the balls are going to see the most on lanes. Since this low-viscosity oil tends to flow out of the 25-gauge needle dispenser, we evaluated oil absorption times with a few different dispenser needles. We tested oil absorptions times with the 25-gauge dispenser (red) tip (the one we used with the Equate oil) vs. a smaller diameter 27-gauge dispenser (clear) tip:

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The larger diameter 25-gauge needle had slower oil absorption times as expected. The 27-gauge dispenser needle was faster. In both cases, different balls had similar trends. The fastest absorbing ball was the fastest with either dispense and the slowest was the slowest with either needle. The data showed that the 27-gauge needle did have a smaller standard deviation for oil absorption times throughout the test (7 min :44 sec for 25-gauge vs. 4 min: 58 sec for the 27-gauge).

## Conclusion:

- Use the Test Oil No. 1 mineral oil because it is used the most in different lane oils
- Use the 27-gauge needle dispenser because the smaller diameter keeps the oil from flowing out of the needle as much when sitting in the dispenser
- The 27-gauge needle has faster oil absorption times
- The 27-gauge needle had a smaller standard deviation of oil absorption times during the initial testing