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**White Paper**



**FINDING  
FRAC  
SAND**

**How to Determine if You Have  
HYDRAULIC FRACTURING SAND**

# Finding Frac Sand: How to Determine if You Have Hydraulic Fracturing Sand

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# Table of Contents

[Do you have frac sand?](#)

[Sieve Analysis](#)

[Sphericity and Roundness Test](#)

[Acid Solubility Test](#)

[Turbidity Test](#)

[Crush Resistance Test](#)

[Conductivity Test](#)

[How to get affordable testing for your sand](#)

## Do you have frac sand?

A modern day gold rush is on to find frac sand! This is due to the increased drilling for oil in shale.

Shale that was often left alone in the past can now be drilled using a process called hydraulic fracturing. The slang term is “fracking,” and the process uses water, chemicals, and sand.

The sand is called a “proppant” because it “props” open the shale after it has been fractured at high pressure in the well. The oil and gas flow up the well, through the propped open cracks.

The sand is usually mined in the United States for use in wells here, although proppant can be artificially produced from ceramic. An additional method uses a resin coating on mined sand, in order to increase its strength.

Frac sand needs to be round and hard to be used in the high pressure fracturing process, and it must also be of a certain size.

Much of the sand currently comes from Wisconsin, although sand producers are all over the United States. Some of the ceramic proppant manufacturers are in China.

Let’s go through the tests required to figure out whether or not you might have frac sand.

## Sieve Analysis

The sieve analysis is a test performed to see how what size the sand is, and then seeing how much of the sand falls into what I will call “frac sand sizes.”

The popular frac sand sizes are referred to by their sieve mesh size. Some of these popular frac sand sizes are 16/30, 20/40, 20/70, 30/50, 30/70, 40/70.

This test is performed by taking a sample of sand and sending it through many sieves. Each sieve has a mesh, and the mesh openings get smaller and smaller as the mesh number gets bigger.

So, the sand either is retained by the sieve mesh or it falls through to the next one.

A sieve shaker shakes and taps the stacked sieves so that the sand falls through it.



**Here is a sieve shaker that shakes and taps  
to sort the sand into its different sizes**

While there is no “pass or fail” with this test during initial exploration, having a small amount of marketable sand not a good indicator. Luckily, there are many different sizes of sand that can be brought to the market.

If someone is testing washed and sized sand that is being sold for fracturing, then the sand needs to sieve out at 90% or higher “in size” for the size of sand that is being sold.

## Sphericity and Roundness Test

The sphericity and roundness test examines individual particles of sand to determine whether or not they are round and spherical enough to be used for fracturing. Remember that frac sand needs to be round? We determine that with this test.

This test is “old school,” but is still in use today.

The lab technician looks at individual grains of sand under a microscope, and then compares them to a chart.

The technician is looking for how close to a circle the particles are (sphericity) and then how pronounced the corners are (roundness).

Frac sand needs to be close to a circle in shape and have very rounded corners, if any.

The technicians looks at 20 or more individual particles, and then gives a sphericity and roundness rating for each particle. Then the ratings are averaged.

The American Petroleum Institute recommends that both roundness and sphericity be 0.6 or greater when compared to the chart. You can see looking at the chart that means only the upper right four grain pictures are 0.6 and higher in both roundness and sphericity. It is a difficult requirement to meet for most sand explorers!

This test takes some practice for the technician to become proficient. The technician needs to be careful when splitting down the sample, as poor splitting techniques could ruin the results.

The technician also needs to carefully focus the microscope, and use graphic programs as an aid to keep track of the individual grains of sand when performing the comparison to the chart.

## Acid Solubility Test

High quality frac sand sand should be very pure silica sand. This means it should have few impurities in it. These impurities can be found by using different acids to try and dissolve them.

The frac sand needs to hold up in an acidic environment, because acid is used as part of the mixture of fluids added to the water during the fracturing process. Acid is used in order to dissolve minerals and it also aids in the fracturing process because it helps to initiate cracks in the rocks.

The acid solubility test is simple in concept, but it is complicated to do in reality because of the hazards involved with hydrofluoric acid and the heating and cooling of the sample.

The big picture with this test is to weigh the sand, then apply acid. Some particles in the sand may dissolve in the liquid acid. Then a filter is used to separate the sand and liquid. The filter is dried and weighed.

When you compare the before and after weights, you can determine what percentage of the sand are contaminants that can be dissolved in acid.

For sand sized 6/12 through 30/50, the maximum solubility is 2.0%.

For sand that is sized 40/70 through 70/140, the maximum solubility is 3.0%.



## Turbidity Test

The turbidity test is similar to the acid solubility test because it detects undesirables in the sand.

Testing for turbidity is straightforward. You take the sand, put it into a transparent beaker, add water, and shake them together. Then you measure to see how much light flows through the suspension.

Frac sand does not have many particles that suspend very easily in the water. So, if there are a great deal of particles suspended in the water, less light will shine through the beaker. And the higher the turbidity will be.

The American Petroleum Institute recommends that turbidity of frac sand should be 250 FTU or less. The FT stands for Formazin Turbidity Units.

## Crush Resistance Test

This is what I like to call the “daddy” test. If the conductivity test is the “granddaddy” test, this crush resistance test is his proud son.

Crush resistance is a very important test to perform, because it shows how strong the sand is, and how well it holds up under high pressures.

There are two ways to perform a crush resistance test.

The first is to “guess” with the help of the API standard, and perform one crush on the sand at a recommended pressure. For example, the API standard recommends that 20/40 sand be crushed at 4,000 psi with the expectation that it have less than 14% fines produced during the crush.

The basic process is to use a hydraulic press to crush a small amount of sand, and then perform a sieve analysis on the crushed sand, to see how many crushed “fines” are produced. This shows you how strong your sand is.



**This is a Carver press used to crush the sand during a crush resistance test**

The second way to do a crush test is to crush the sand at several, increasing pressures and then you can find a “K value,” which is the pressure at which 10% of the sand is crushed fines.

If you look at the frac sand marketing websites (like [www.DownHoleTrader.com](http://www.DownHoleTrader.com)), you will see a “K value” listed for each type of sand being sold. Typical K values are 5k-7k for silica sand, and much higher for ceramic proppants.

## Conductivity Test

This is the “grand daddy” of all frac sand testing. It is the final evaluation to determine whether sand can be used for hydraulic fracturing.

This test involves pressure, heat, and flowing liquid through a bed of sand that is “sandwiched” between samples of sandstone.

The conductivity test is used to simulate how a proppant will work under actual down hole conditions.

This test takes a week to perform, and is quite expensive to do.

## How to get affordable testing for your sand

Multiple tests need to be performed on your sand to determine whether or not it can be considered for hydraulic fracturing.

First, I always recommend to my clients that a sieve analysis be done to see if any of the sand “falls out” into the popular frac sand sizes.

Next, roundness and sphericity tests should be performed on the sand that has fallen out in the popular sizes. This is often a “go/no go” test for sand suppliers, as the roundness recommendation of 0.6 or greater can be difficult to achieve for most producers.

From there, if it looks like the sand is passing the sphericity and roundness tests, it can be further tested with crush, acid, and turbidity tests.

If the results of those tests are promising and the sand continues to track with the standards, an expensive conductivity test can be performed to measure the flow through a packed sample of the sand.

It’s a long road of testing, but well worth it for the producer, as he can make a great deal of money from a large supply of frac sand.

If you would like to perform testing on your sand, but want to do it quickly and affordably during exploration, consider using our laboratory.

### **Our lab is *clean***

We are constantly cleaning everything in the lab, which is important for you as a customer. This ensures that your sand stays separate, and you know that when you get the results, the results are for *your* sand.

I often joke that our lab is like your grandmother’s kitchen. We clean as we go, and we believe that a tidy and neat lab space is good for our clients and our own sanity.

### **Our lab is *timely***

Because we only accept a few clients at one time, we can turn results around very quickly. Our lab gets results back to customers within 10 business days.

Clients needing ultra-fast test turnaround can request a “rush delivery” option and get results within 7 days.

## ***Our lab is affordable***

We operate with very little overhead. We are a lean company, and don't have a top heavy support staff. Our lab technicians receive the samples in the mail themselves, open the boxes themselves, and perform the testing themselves.

Our technicians call the clients and give them the results, and prepare the final reports.

This lean operating philosophy allows us to perform testing at lower rates, which we pass on to our clients.

For instance, you can get initial "go/no-go" testing done for your sand. This includes sample washing, sieve analysis, sphericity and roundness testing, and acid solubility testing.

You can get an entire suite of API and ISO standards testing done for less than \$2,500, complete.

We can do all the American Petroleum Institute and ISO tests in-house, with the exception of conductivity testing (which I can supervise for you at the local university, Montana Tech). Montana Tech is world renowned for its petroleum and geological engineering programs.

If you are interested in learning more, you can contact us directly:

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