



NEW ERA Engineering Corporation

Placer Mining and Small Hydro Specialists

71 Fireweed Drive, Whitehorse, Yukon, Canada Y1A 5T8, 867-668-3978

Thank you for purchasing a rod mill.

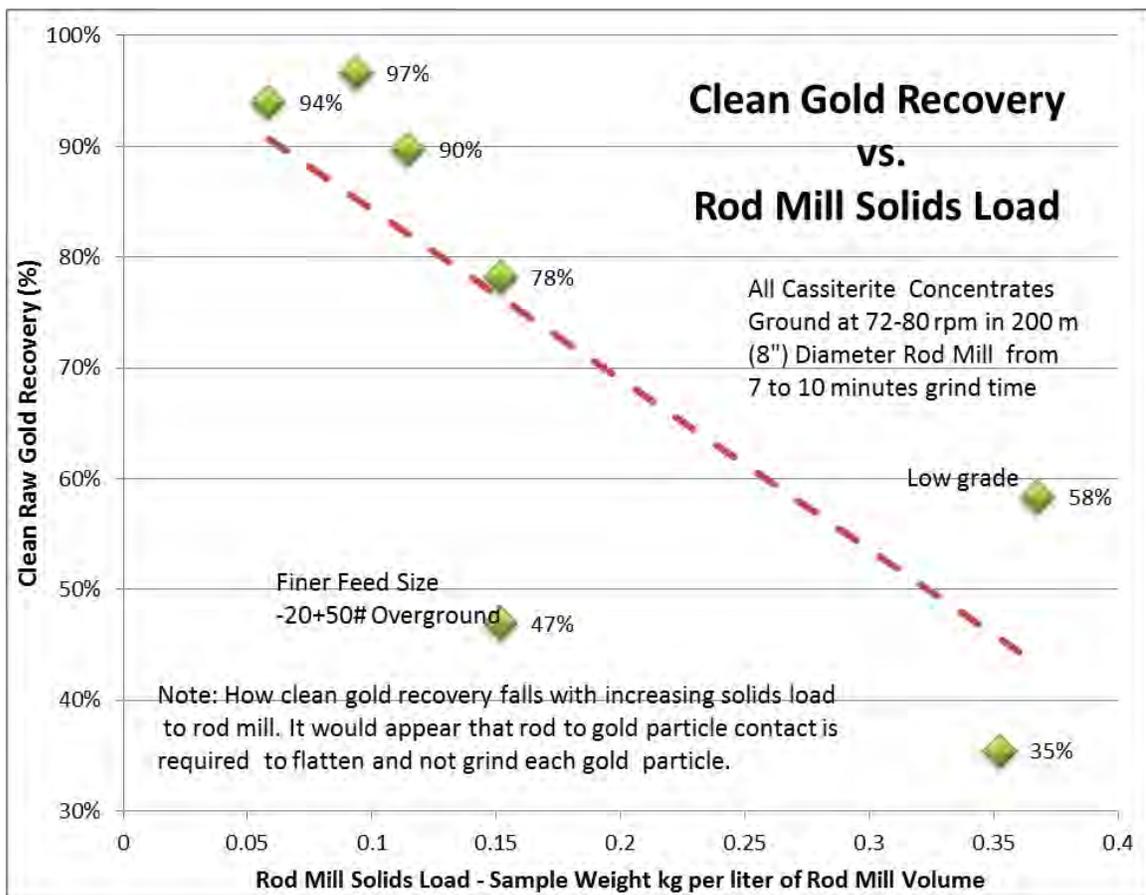
Operation:

This rod mill is for upgrading difficult gold-bearing concentrates, such as table, jig or wheel middlings or tailings, which have already been processed in at least one secondary upgrading attempt and are difficult to upgrade further. It is not intended for use with pay dirt or unprocessed sluicelike concentrates. The mill is to be used in addition to concentrating tables and wheels, and is not meant to replace them.

1. Sieve concentrate materials to at least -8# (2.3 mm) before processing with mill, -16 or -20# is better. This mill is not designed to grind a mix of fines and gravels coarser than 8#. You can try to grind coarser gold middlings (gravels) if you remove the fines.
2. Load the mill with concentrate in small <1 – 2 kg batches, or approximately 1/3 to 2/3 liters and add an equal amount of water.
3. Once lid is placed and sealed, stand the frame so that the mill is level.
4. For the first grind and every new type of material, grind in 2 minute intervals, stop to size the grind products over a 30# (595 μm) or 50# (297 μm) sieve. Use a magnet to remove magnetic minerals. Repeat until the material remaining on top of the sieve is 90% gold flakes. Note the total grind time. This is the ideal grind time for the same type of concentrate. Total grind time typically does not exceed 8 minutes.
5. -50# (<297 μm) fines that pass through the screen can be collected, combined and reground separately with the rod mill and sorted with a finer sieve, such as 70# (210 μm) and/or 100# (150 μm). Gold particles too small to be recovered on the coarser sieve can then be recovered. Determining grind times for these fines is the same as described in step 3.
6. For fast cleanup, tilt the mill back from level slightly, place a large basin below it, run it with the lid off and hose out the ground concentrates from the rods as they rotate within the mill. Use a large basin below the opening to catch the washed out material. This avoids needing to remove and rinse the rods for every batch. Do this with extreme caution, and ensure the mill is level or tilted slightly uphill to avoid rods pouring out during rinsing.
7. The limited amount of fine gold that passes through the finer sieves on the final grind should respond to further upgrading with a shaking table if necessary.

AVOID:

- Overloading the mill. Grinding mills need 85-90% of the interior volume empty to perform properly.
- Loading with low grade unprocessed materials such as primary sluice concentrates. These materials are too high volume and too low grade, making processing in small batches tedious and ineffective. Only load materials which cannot be further upgraded by more conventional gold processing techniques.
- Overgrinding. If more than 90% of the material settling on the sieves is gold flakes, the grind time is likely too long and gold particles are being fractured and passing through the sieves.
- Grinding coarse gravels mixed with fines. Separate out the fines (-8 or -16#) and process them separately from the coarse gravels.



Gavin Clarkson and the Portable Rod Mill Designed for Field Testing.



Note: Loading the rod mill with concentrate & rods & water in the vertical position

Note: Leveling the mill prior to grinding in the horizontal position to ensure an even grinding action.

Note: The portable rod mill was constructed using a portable cement mixer on a dolly to support, rotate and allow easy movement of the heavy rod mill & rods.

The mill is tipped up for loading with rods, solids and water. It is leveled for grinding, usually 6 to 9 minutes. It can then be tipped up to remove the lid and lift out the rods for cleaning. Then the mill can be tipped forward to wash it out into a basin. Further details on the construction of the rod mills are shown in Appendix 6.

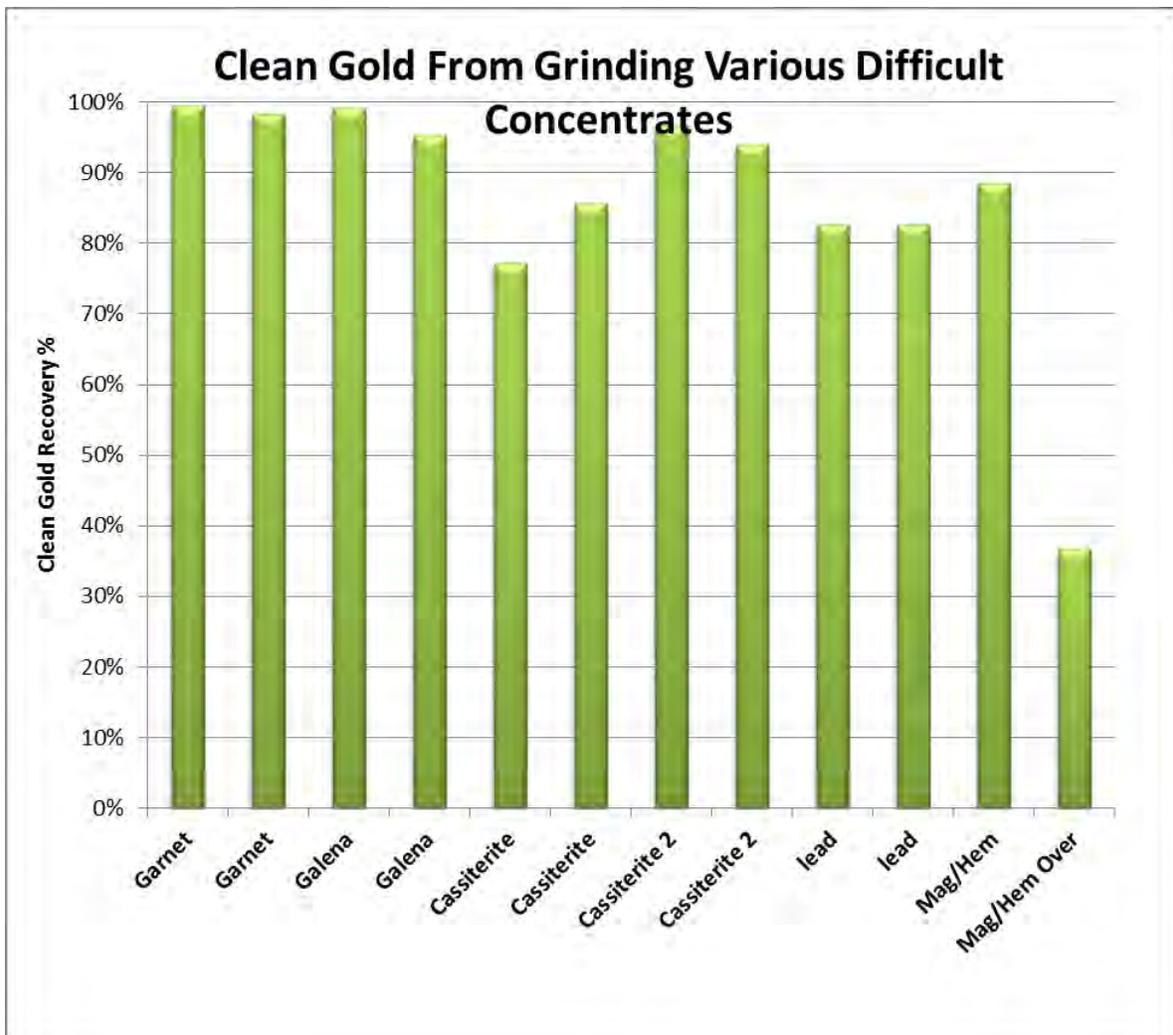
Clean +30# Raw Gold.

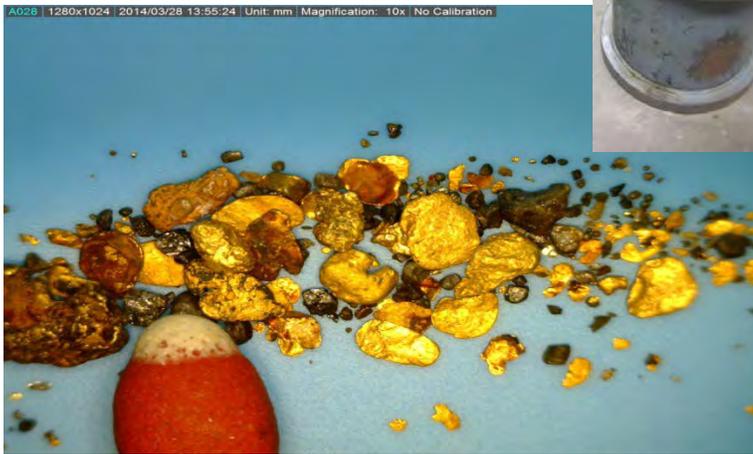
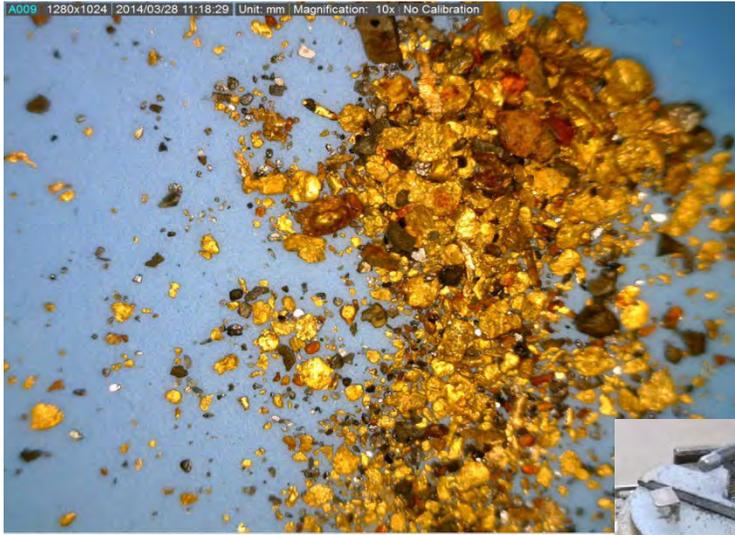


Clean -30+50 Gold.



Summary of Clean Gold Recovery from Various Difficult Concentrates.





Gold before and after grinding at low solids loads in a rod mill.

Over time, the rods and inside surface of the rod mill will have pits in the steel in filled with gold (figure 89 below). To remove and recover the gold, a 1 kg sample of quartz sand is ground in the mill for 10 – 15 minutes. Then the slimes can then be sieved and/or panned or tabled to recover the smeared gold.

Rod with pits in filled with gold.



Do NOT Overload a Rod Mill.



Do not overload the Rod Mill. Grind less than 1 kg (2.24 lbs.) of concentrate (middlings) for a 200 mm (8") diameter rod mill. Or 1-2 kg in a 10" rod mill. If the rod mill is overloaded gold particles will be ground instead of flattened.

Recommended Difficult Concentrate (Middlings) Upgrading Procedure

Figures 93-96



1) Pre-concentrate very low grade gravels on a long tom or hydraulic jig



2) Pre-concentrate middlings on a shaker table to reduce the volume prior to grinding



3) Grind up to 1 kg (2.24 lbs.) of tabled concentrate with 50% water and 40% rod volume for 6-10 minutes at 72 rpm in a 200 mm (8" diameter by 12") rod mill.

Don't Overload the Rod Mill it won't work!

Screen the ground up concentrate on 20, 30, 50 or 70 mesh sieves. Use a magnet to take out the magnetics. If the gold on the 30 or 50 mesh screen is 90% clean pan the sample to clean it further. If the gold on the screen is dirty then reduce the weight of the sample ground or increase grind times. If there is a lot of gold in the screen undersize reduce the sample weight or reduce grind times.



Feeder for Keene ST1 Shaking Table

Figure 97 - Simple Feeder for Table



Note: Every shaking table works best with a feeder. This is a simple design using a plastic funnel, a small piece of drilled aluminum plate to support the funnel, a modified PVC pipe connector to lower and raise the funnel to decrease or increase the feed rate, and most importantly a thin stainless plate that fits snugly in the corner of the table underneath the funnel to prevent wearing a hole in the bottom of the table. Keep a small amount of water dripping into the funnel to keep the material flowing. **Do not operate this feeder without a stainless steel plate on the table surface or you wear a hole thru.**



Figure 98 - Aluminum Plate Support

Note: This support design will vary with each type of table it is attached to. It is approximately 178 mm (7") x 127 mm (5") and 6 mm (1/4") thick.



Figure 99 - Stainless Steel Deck Protector

Note: Don't forget this item or your table won't last the day. This is for a Keene ST1 table. It measures about 152 mm (6") long by from 76 mm (3") to 89 mm (3.5") wide. The edges should be custom ground so that it has a snug fit in the corner of the table but can be gently pried out to clean underneath it occasionally.



Figure 100 - Height adjuster.

Note: This is an adapted 50 mm (2") PVC pipe connector which has been cut shorter and the center reamed out with a file to hold and to raise and lower the funnel and thus adjust the feed rate to the table. Almost any threaded fitting that you can raise or lower easily will work for this purpose.

Specifications for Fabricating and Operating Pilot Scale Rod Mills

Detailed Photos of 200 mm (8x12") Rod Mill



Note: This rod mill is 200 mm (8") inside diameter and 300 mm (12") long inside the mill.



Note: The original pulleys need to be changed from a 6" to a 4.5" on the gearbox and from 1.75" to a 4" diameter adjustable pulley on the motor to increase the speed from 25 rpm to 72 rpm (for 200 mm, 8") rod mills.

Note: A 200 mm (8") mill needs the following 292 mm (11.5") long cold rolled steel round rods: 12 mm (1/2") = 17 only; 18 mm (3/4") = 14 only; 25 mm (1") = 9 only

A large diameter rod mill could be used provided it is 1.5 times as long as the diameter the rpm is adjusted, and the portable cement mixer is able to support it.



Note: This is a close up of the 24 mm metric female adaptor which screws onto the horizontal drive of the MultiQuip MixNGo Model MC3PEA two cubic foot portable cement mixer. It has to be machined. The threaded end is welded onto the back of the rod mill as shown in the center photo.