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## **FLOW SORT X-RAY DIAMOND RECOVERY MACHINES**

### **TRAINING MATERIAL**

This is the story about feeding; feeding a FLOW SORT DIAMOND RECOVERY MACHINE that is!

Well, what is there to say about such a simple, basic subject you may ask?

Let me start off by giving you a bit of history.

By now I am in the electronic sorting business for 35 years. Coming from an electronic background, I have learned very quickly that an electronic sorting machine would only **sort as well as its feed presentation!** And this principle held true throughout my career in electronic sorting. It was not the sophistication of electronic systems, the design and selection of appropriate sensors, the precision and speed of ejection devices or the writing of clever algorithms that made for a good sorter. Yes, all these devices and systems are important in the design of an electronic sorting machine, but no matter what sorting problem I had to tackle (Uranium, Gold, Scrap-Metal, Limestone, Talcum, Coffee Beans, Nuts, Beans, Diamonds, and so on...) I only succeeded to produce a successful sorter if I was able to feed the material in a "satisfactory manner".

"Satisfactory manner" means different things for different sorting tasks.

In many sorting applications it is important to feed the material in strict **single files** of discrete particles (pearl-string formation). This feeding principle for instance is required for a diamond re-concentration machine.

In some applications it is even necessary to not only feed particles in a **single file** but also to ensure that **minimum gaps** are maintained between the particles. (Measuring the natural gamma radiation emission from uranium bearing rock particles as required for uranium sorting is an example)

In less demanding applications it is only necessary to ensure that the material to be sorted is fed through the sorter in a **single (mono) layer**. This means that it is to be ensured that no discrete particle in the feed-material may be positioned above or below another

particle (no masking). All Flow Sort X-ray Diamond Recovery Machines require a “mono-layer” feed presentation!

So there we are: **Ensuring that the feed material passes through your Flow Sort Machine in a single layer of material is the most important factor for good diamond recovery!**

1. First of all it is important to ensure that a Flow Sort Diamond Recovery Machine receives in its feed hopper the correct feed material. “Correct” means feed material which the sorter is designed to sort:
  - a. The material has been **properly sized**. (No oversized and / or undersized material)
  - b. The material is as **clean** as possible. (Removing of mud and fines).
  - c. For wet material sorters it is important that the material does not carry a lot of excess water. (Dewatering of feed material)
  - d. The feed hopper must **not be allowed to run empty**. (Bin level probes). Only run the feed hopper if you have to. (Change over to a different size, complete a specific batch run etc.)
  
2. The next point to check (to ensure) is that the sorter not only receives the **correct amount** of feed material but also that the feed material is fed to the sorter in such a way that it forms an even flowing monolayer. Let me explain:
  - a. The sorters vibrating feeder must be set to “high” vibration amplitude. A typical setting of the feeder control dial is above “7” (seven). This ensures that the feed material flows in a thin, fast-moving layer from the feed hopper to the top of the sorters feed-slide.
  - b. The sorters feed gate must be opened just enough to allow the correct amount of feed-material to pass. This feed-gate controls the amount of feed-material (feed-rate) from the feed-hopper onto the vibrating feeder).
  - c. Never try to control the feed-rate of a Flow Sort Diamond Recovery Machine by means of adjusting the vibrating feeder amplitude!
    - i. The setting of the feed-gate must control the feed-rate.
    - ii. The amplitude of the vibrating feeder must ensure an even, fast flow of feed-material which is of utmost importance for achieving a monolayer of feed-material within the sorter. **A monolayer is absolutely essential to avoid small diamonds from being masked by larger stones!**

3. The point where the material drops from the feeder tray onto the top-end of the feed-slide is yet another **very important point** for achieving a good feed through the sorter.
  - a. Flow Sort X-ray diamond recovery machines use water as the transport media for the material passing through the sorter. It is thus of great importance that the mixing of feed material and transport water is done properly.
  - b. The ultimate aim is a monolayer of material passing over the optic window (where the diamonds are detected) at the same speed as the transport water stream.
    - i. This goal is achieved by **adding water exactly** at the point where the feed material comes off the vibrating feeder tray.
    - ii. Don't allow water to spray into the feeder tray.
    - iii. Don't allow feed material to drop onto the feed slide upstream of the point where the transport water stream hits the feed-slide.
    - iv. The larger the feed material to be sorted the more transport-water is required to achieve the goal as set out in Para b.) above!
      1. Note however that if too much water is being added to small sized feed material it will ultimately lead to poor diamond recovery! As a rule of thumb note; a flow rate of 20 l/min produces a transport water depth of approx. 1 mm.
      2. In some extreme cases transport water flow rates of 80 l/min produced excellent results. Not only giving good diamond recovery efficiency but also eliminating blockages!
      3. The optimum water flow has to be found for the material size to be sorted as well as for the material type (kimberlitic, alluvial, marine gravel etc.).
4. As the feed-material mixed with transport water passes down the sorter's feed slide it is important that all the feed particles settle down and pass over the sorter's optical window in a mono layer of discrete particles, all of which are traveling at approximately the same speed.
  - a. There are feed-stabilizing curtains positioned above the feed slide which ensure that any bouncing particles are 'calmed down' and rejoin the steady material flow.
  - b. It is important that you ensure that all the sorters feed-stabilizing curtains are in place and that they can move freely

5. Now we come to the final ‘rapids’ of our material / transport-water flow.
  - a. The transition from the feed-slide **down** onto the upper section of the window frame.
  - b. The transition **down** onto the optic-window.
  - c. The curvature of the **optic window** caused by **wear**.
  - d. The transition from the optic window **down** onto the lower section of the window frame.
  - e. The transition from the lower section of the window frame **down** onto the discharge-lip of the feed frame.
  - f. The sharpness and **damage free** discharge-knife-edge of the feed slide. (A damaged edge causes lots of “fines” and water reporting to the concentrate chute!
  - g. PLEASE TAKE NOTE OF “DOWN...DOWN...DOWN...this is of utmost importance as any “UP-STEP” in the feed path causes CHAOS
6. Well, if you adhere to these ‘feeding-guidelines’ you have gone a long, long way towards getting optimal performance out of your Flow Sort Diamond recovery machine!
7. And the most important lesson of it all; the next time you are not happy with the performance of your Flow Sort machine, check the feed-system of your sorter **before** you start changing sorter settings and **before** you start fiddling with the electronics of your sorter!

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