

Economic and safe pumping of material with a high concentration of dry solids

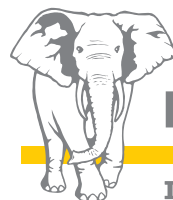
Common methods of tailings disposal have the disadvantage of excessive land consumption and a considerable impact on the environment. This can be avoided by significantly increasing the dry solids content of material and delivering it by high-density solids pumps, specially designed for the material and application needed.

The rising demand for metal resources is forcing mines to seek for poorer and deeper deposits. This trend leads to an increasing amount of waste material being produced. In the surrounding areas of many mines, the waste from ore processing is often taken to a dedicated disposal site. The large volumes of processed material when stockpiled, however results in a rapid consumption of land and a considerable impact on the environment.

Alternative solutions are now available: By using high density solids pumps you can meet the requirement of pumping material with a dry solids content. The results are a controlled process that cuts down on land consumption and a saving on water and energy.

1. Introduction

In the past, the systems used for the transportation of tailings were often discontinuous, whereas today there has been a shift towards the almost exclusive use of continuously operating pumps in conjunction with pipeline networks. The hydraulic transportation of tailings in closed systems, regardless of the type of pump used, is the most environmentally friendly and efficient method of conveying large volumes of material to a nearby disposal site.



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2. Material properties of tailings

The high density substances produced during processing differ greatly in their material properties – depending on the material processed and the processing method. The non-recyclable byproducts of processing are in fact a mixture of liquid and solid constituents, which differ from each other greatly in their characteristic, physical and chemical attributes, such as specific gravity, dry solids content, maximum grain size, and in their thixotropic, abrasive and adhesive state.

Not every type of tailing that needs to be transported to a disposal site is pumpable. A pumpable high-density substance has to be saturated, i.e. the pour volume of the solids should contain a sufficient intrinsic grain concentration in order to ensure grain-on-grain contact. The blend of solid and liquid constituents in a high-density substance must be composed in such a way as to produce an elastically ductile mass flow.

3. Selecting a high-density solids pump

In the selection of pumps, a few factors need to be taken into consideration:

1. **The properties of the material to be pumped**
2. **The solids content**
3. **The grain size and the water content**

In response to the movement of a piston or rotor, the material is drawn into the pump and positively displaced into the pipeline.

The disadvantage of centrifugal pumps, however, is that they are fast wearing due to the high internal flow rate and having a low efficiency of below 60 %. Eccentric screw pumps can be used for dry solids contents of 20 % and delivery pressures up to 30 bar. They are suitable for transportation of aqueous to thick-bodied tailings containing no coarse foreign bodies.

4. Conveying requirements

During the hydraulic pumping of tailings, it must be ensured that the material retains its elastic properties and that no separation occurs between the carrier fluid and the solid material. A “dewatering” of the solid material in the pipeline has to be avoided if the material is to be successfully conveyed over long distances with low water content and no segregation.

4.1 Hydraulically driven piston pumps

The main type of pump used to pump high-density substances left over from processing is the hydraulically driven piston pump. It is designed to pump high-viscosity, solids-based materials or extremely dry materials. Putzmeister has developed a variety of high-density solids pumps for pumping these materials, which are being used all over the world with great success.

4.2 Valve controlled pumps – HSP

If the material to be conveyed is a very fine, pasty medium with a dry solids content of up to 70 %, the hydraulically controlled seat valve pump (HSP pump) is particularly suitable.

Seat valve pumps of this series are designed for pressure of up to 150 bar and for delivery rates of up to 400 m³/h. The need to pump even higher material flow rates in conjunction with higher pressures has led to the development of a special pump type.

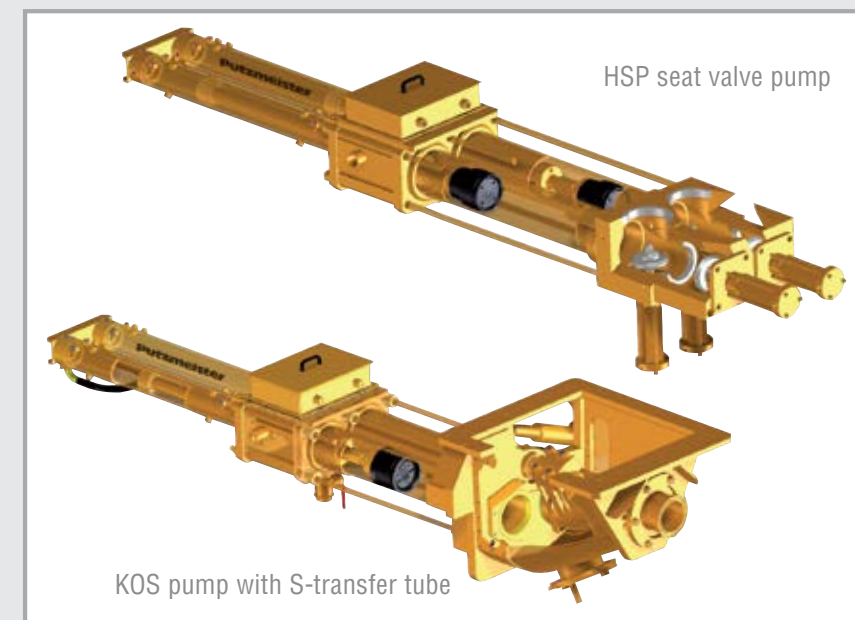
4.3 Transfer tube controlled pumps – KOS

So far, this article has focused only on fine-grained material that need to be pumped to disposal sites. However, there may be materials that have a larger grain and, therefore, cannot be pumped using seat valve piston pumps.

The characteristics of the KOS series is the S-transfer tube. With this pump system, the alternating intake and pressure strokes of the pistons in the cylinders guarantee almost constant operation during which the conveyed medium can pass through the cross section of the cylinders unimpeded. At the same time, materials with a particle size of up to 70 % of the outlet diameter can be occasionally pumped along too. This plain and simple design of the KOS pumps with only a few moving parts keeps the number of wear parts to a minimum and, for this reason, is the best option for conveying large volumes of material to disposal sites.



KOS 25200 Mammoth Pump



Thanks to the Putzmeister tailings transport method less and smaller pipelines are necessary (red line on the far right) For comparison: Three conventional large diameter delivery pipelines plus a water recirculation pipeline



HSP 25100 HP - High performance pump for mining tailings and fly ash



KOS 2180 HP piston pump with mixer and Jumbo Trough

5. Reduced water consumption

The use of the high-density solids pumps described above for the transportation of tailings is also becoming ever more important from an environmental protection and water consumption point of view. If, in the past, the often tremendous rate of water consumption (approximately 80 % water per 20 % solid materials) of the pumps received little scrutiny, this has certainly changed in recent years. Material can be pumped with high-density solids pump with a 30 % water content, which is much less than the conventional methods used.

If the material is too dehydrated trucks or conveyors must be used, resulting in a significant impact on the environment, higher maintenance and transportation costs.

6. Case study “Bulyanhulu Gold Mine”

The flexibility in the way tailings can be transported is a good example at the Bulyanhulu gold mine in Tanzania, which began operations in 2000. The ore extracted in civil engineering is processed by a flotation plant and the ensuing tailings are then pumped to the disposal site.

The paste-like material has a dry content of around 75 %. The pumping process requires a delivery pressure of 80 bar. The material is conveyed hydraulically over a distance of over 2500 m by the two pumps and the 315 kW hydraulic power packs.



Backfill plant at Bulyanhulu, Tanzania

7. Conclusion

Since water is one of our most important resources and is not always freely available in many mining regions, today's mining companies are certainly facing stiff challenges. This is because existing disposal technologies need to be adapted and the solids content in the material to be conveyed significantly increased, while at the same time reducing the

water content (and therefore also the consumption of water). The various Putzmeister high-density solids pumps with outputs of up to 400 m³/h and appropriate delivery pressures have been designed with these tasks in mind, and can provide a viable technical solution in the industry.



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