

Portable pump flown into African gold mine to help dewater the site

The Iduapriem gold mine in Tarkwa, Ghana, in western Africa, is situated in an area that has the highest annual rainfall figures for the whole of Ghana. This presents the operators, Taywood Mining, who run the site on behalf of Ghanaian Australian Goldfields, with a considerable dewatering problem and also means that the facility is continually under threat from flooding. In response to a recent bout of heavy rainfall, the company needed some extra high head dewatering pumps to handle the excess amount of rainwater at the site and they needed them fast. The pumps were also required to ensure that the dewatering capacity at the gold mine could cope with extremely wet conditions in the future. Two pumps were flown out to the site within a week and the mine is now operating normally.

Godwin Pumps responded to the challenge presented by Taywood Mining's urgent need for dewatering pumps at its Iduapriem gold mine in Tarkwa, Ghana. Within a week, Godwin Pumps of America Inc, based in Brideport, New Jersey, had built a high head Dri-Prime® pump and air freighted it to the facility. The company's UK factory, Godwin Pumps Limited, based in Quenington, Cirencester,

in the Cotswolds area of England, matched the achievement and also air freighted a matching pump unit, both weighing in at a total of 9,100 kg (20,000 lbs) to the Iduapriem gold mine in Ghana. The speedy delivery of the pumps was an essential component in the award of the contract. Another Dri-Prime pump from the Quenington factory in England followed shortly afterwards as well and it too has been installed on a dewatering duty. The possibility of flooding was soon rescinded with the new pumps in place and the site now has extra capacity for the future.

Each of the three Godwin HL6/TS2 Dri-Prime pumps can handle a maximum flow of up to 432 m³/hr (1,900 USgpm) and heads of up to 143 m (470 ft), which was more than enough to deal with the excess rainwater at the site and provides a large amount of spare dewatering capacity for the gold mine in the future. The large portable pumps are powered by Caterpillar C9 engines that provide 275 hp, more than enough to meet the operational requirement for a dynamic head of 119 m (390 ft) and a maximum dewatering flow rate of 295 m³/hr (1300 USgpm).

High head requirements were not the only dewatering challenge at the Iduapriem gold mine. Distance was another important consideration. The mine has level distances of up to 2,500 m (8,200 ft) in some places so the pumps also had to be capable of transferring water over large distances. Godwin's HL Series of Dri-Prime pumps managed to meet this demand thanks to the high head characteristics of the units which overcame the friction loss encountered in the long discharge pipes at the mine. The portability of the pumps and hardwearing construction materials were also deciding factors in the award of the contract.



In preparation for dewatering, installers set in place a 6" x 4" Godwin high head Dri-Prime® pump which will move up to 295 cubic metres per hour or 1,300 US gallons of water per minute.

High-pressure portable pumping in deep hole excavations

Dewatering deep hole excavations in aging quarries leaves mining engineers with few portable pumping options, none of them good. Traditionally, the choice comes down to tandem pumping or running a single pump at a severe duty point. The development of a new generation of portable diesel-powered high-pressure pumps could provide the solution. Peter Snow, training manager at Godwin Pumps, explains.

The old phrase 'two heads are better than one' may be fine when trying to generate new ideas, but in pumping terms, using two pumps in line to create sufficient discharge head has always had its share of problems. Unfortunately, this was one of the few options available to quarry engineers faced with removing water from deep hole excavations.

Take for example, a gold mine in Australia faced with moving water at a flow of over 250 m³/hr with a total dynamic head of 150 m from a deep hole excavation. Initially, pumps in tandem (primary and booster) were being used to move the water to the delivery point. As with any tandem system, balancing the flow of the primary pump into the booster pump is a delicate process. In addition, the potential for equipment breakdown is doubled when two pumps are used in a single system. Another pumping option utilized was a single stage ISO pump that operated at the far left of the pump curve (low flow, high resistance) causing discharge cavitation issues and shortening the life expectancy of the pump. In both pumping scenarios, closed impellers were used making solids handling an added concern. What was needed was a portable pump that was built for the construction/mining market and was capable of producing high discharge head.

Enter Godwin Pumps Limited of Quenington, UK. Godwin had already developed a complete line of high head pumps for the mining and industrial markets. When contacted by the Australian

gold mine about the dewatering application, the first thought was to tackle it with an existing Godwin High Lift (HL) pump. Upon further study of the application, however, the duty point (flow and head) didn't seem to fit any existing pump curve at a 'best efficiency point' (BEP). The gold mine application was projected to run on a continuous basis. Therefore, the pump chosen for the application needed to function in the BEP on the curve, to help reduce mechanical failures due to extreme operating conditions. The answer was to go to the proverbial drawing board and design something new.

New Pumps

In 2001, research at Godwin Pumps began on a new design of high head pumps with delivery pressures exceeding anything currently available in the portable pump market. With the Australian gold mine application in mind, engineers at Godwin initially considered a two-stage impeller design, improving on the total dynamic head capabilities of the HL6 T/S2 pump. However early on in the design phase, consideration was given to a single-stage open impeller that would provide better solids handling capabilities.



feature pumping at high pressures

As Dave Braithwaite, Godwin's Director of Engineering, explains: "The benefits of a single-stage impeller design include less bearing stress, shorter overhang of impeller to shaft and better overall stability." The challenge was to achieve the high delivery heads with the single-stage impeller.

Through some creative engineering, a new impeller design emerged with a diameter of a whopping 508 mm. A pump volute was forged to house the impeller and the resulting prototype was mated to an existing bearing bracket assembly borrowed from the Godwin HL250M pumpset. Thus, the HL125M was born with a 150 mm suction flange and 100 mm discharge flange.

Spring of 2002 brought the first tests of the new HL125EHH (Extra High Head) pump. Godwin's engineers had hoped for delivery head to be in the 180 m range with flows to 310 m³/hr. To their utter surprise and delight, the pump achieved the anticipated delivery head and in addition it was capable of reaching flows in excess of 400 m³/hr, well above what had been expected. This brought about a curious dilemma. The pump was designed with a 100 mm discharge flange connection, but the flow production of the HL125EHH warranted a larger connection (150 mm).

The end result was that the HL125EHH ultimately became two pumps: (1) the HL130M [150 mm x 100 mm] and (2) the HL160M [200 mm x 150 mm]. The original impeller design was fitted into a newly forged volute with 200 mm x 150 mm flange connections and powered by a Caterpillar C-15 Tier 2 compliant diesel engine. The flow production of the HL160M pump far exceeded anything that Godwin engineers had expected.

With the finishing touches put on the HL160M design, attention returned to what now had become the HL130M (150 mm x 100 mm) pump. Wanting to reduce the power requirements of the HL130M, Godwin engineers faced a decision – trim the impeller diameter to



The heart of the beast – the massive 508 mm impeller is the heart and soul of the new HL130M and HL160M Godwin high head pumps. A single impeller is now delivering heads to 183 m with flows up to 350 m³/hr.

reduce the head; or decrease the width of the impeller to reduce flow capabilities. The original goal of the pump was to create discharge head, so the decision was made to reduce the width of the impeller, thereby reducing the flow capabilities. Testing on the HL130M ensued, powered by a Caterpillar C-9 diesel engine, with heads reaching 180 m and flow approaching 340 m³/hr.

All that remained was a field test of the pumps under actual site conditions. The gold mines in Kalgoorlie, Australia, offered the perfect opportunity to put the newly designed pumps to work. Once on site, the process of positioning the pump and installing the suction and discharge lines began. When the piping system was in place, the HL130M pumps were started and testing began. The resulting production was 252 m³/hr at 152 m of total dynamic head.

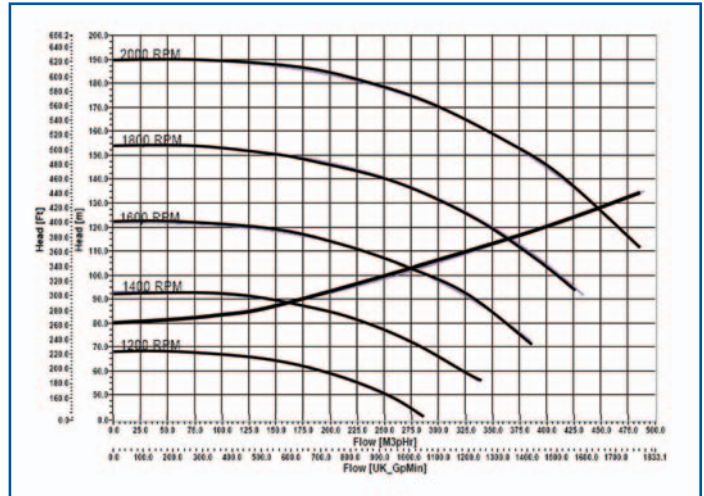
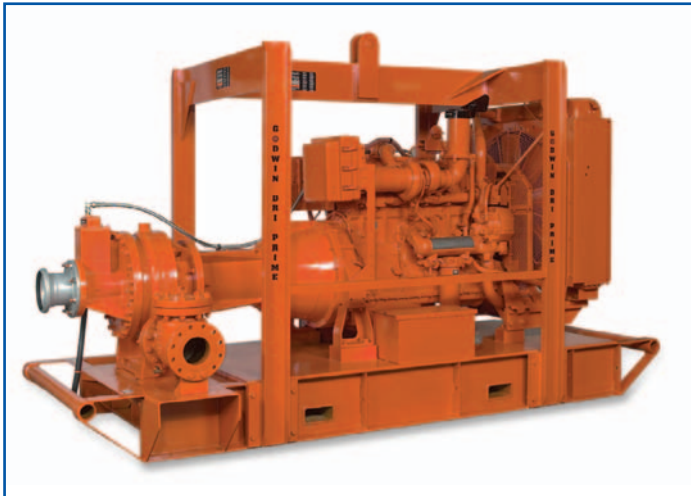
The Caterpillar C-9 diesel engine was turning at 2,090 rpm. Vibration was at a minimum and the system worked successfully. The new HL130M had passed its first test. Others would soon follow.

Scottish coal mine

A coal mine in Glasgow, Scotland, became the next field test for the new high head portable pump. The Scottish mine had been struggling with dewatering issues as the excavation grew deeper and deeper. Godwin Pumps was contacted through their UK distributor, SLD Pumps, to provide a pump to achieve 230 m³/hr at 130 m of total dynamic head. Due to the changing excavation patterns, the pump system would need to be moved from place to place in the quarry as coal mine production continued. An extremely high head portable pump was exactly what was needed.

Godwin engineers chose the HL160M to tackle the application, which included a 700 m run of discharge pipe with a vertical elevation difference of 80 m from the pump to the delivery point. The 200 mm inlet by 150 mm outlet HL160M pump was installed using twin 150 mm discharge lines to achieve the required flow. After plotting a system curve the decision was made to run the application at 1,600 revolutions per minute (rpm). Dewatering began at the coal mine on 30 June 2003 and continues to the present.

feature pumping at high pressures




Left: High head portable pumping reaches a new level with the advent of the Godwin Dri-Prime® HL130M and HL160M pumps. Pictured left is the HL160M Dri-Prime® single stage high head pump, which can achieve heads to 183 m.
 Right: The system curve for the HL160M Dri-Prime® pump application at GM Mining in Glasgow, Scotland.

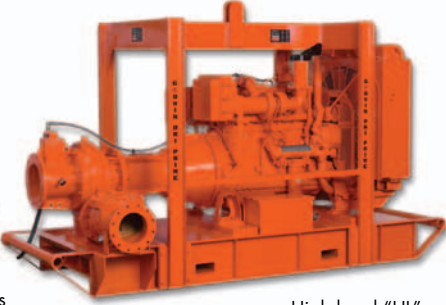
Since those first installations of the HL130M and HL160M pumps, numerous applications have followed in the United States and around the world. To take another old saying 'Build it and they will come' has quite literally come true in Godwin's case as international customers have selected the company's

new pumps. The HL130M and HL160M models have now been installed on some of the most challenging high head applications ever seen in the portable pumping market and are operating successfully, offering new choices to mining engineers around the globe. ■


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