

Palabora Copper buys two more 3.5MW York CYK chillers from Johnson Controls as it reaches 1,650m

Palabora Copper (Palabora) has acquired two more 3500kW York CYK Compound Centrifugal chillers from Johnson Controls. The latest purchase is part of Phase II of PC's ventilation and cooling strategy to facilitate expansion of its operations to 1,600 meters, an initiative that commenced in 2012 and will extend the life of the mine to 2030.

Says Gavin Meredith, Manager – ventilation, cooling and water handling at Palabora Copper: “As of February 2015 we are working 450 meters below the 1,200 meter lift where the first two CYK chillers were installed in 2013 and 2014. These next two chillers will also be installed at 1,200m, providing us with the cooling capacity we need to safely develop and mine the new level.”

The CYK chiller installation at Palabora is the first of its kind in Africa, and the first underground installation globally. By installing the chillers underground, the mine reduces the need to pump water to the surface for cooling. Upcast air is used to reject heat in underground cooling towers and cool air is blown down to the work face from 1,200m. But the operation also distinguishes itself in other ways.

Says Meredith: “Palabora is a pioneer in terms of copper mining, firstly because of the depth at which we are mining, and secondly in terms of the hard rock block cave mining method we employ - the composition of the rock being unusually hard for this type of mining which impacts operations and conditions underground. Our ventilation and cooling strategy – and the performance of the chillers – is instrumental in allowing us to achieving safe development of the mine at this depth. To date, the performance of the chillers has been above faceplate specification.”

The CYK chiller technology was a key deciding factor for Palabora Copper in its selection of a solution. At 1,650m, 50m deeper than initially targeted, virgin rock temperatures in the mine are 52

degrees Celsius. This environment requires chillers to operate beyond the limits found in typical air-conditioning applications. The YORK CYK water-cooled centrifugal chillers are designed using two centrifugal compressors arranged in series to handle conditions outside the range of typical centrifugal chillers.

Explains Russell Hattingh, Branch Manager Engineered Systems at Johnson Controls Building Efficiency, South Africa: “Extreme conditions are characterized by leaving chilled fluid temperatures below 2°C, leaving condensing fluid temperatures above 41°C, or a combination of both. When the leaving chilled fluid or leaving condenser fluid temperature exceeds standard limits, the lift on the compressor increases dramatically. The compressor must develop higher differential pressure on the refrigerant gas in the compression phase, which results in higher head pressure. The CYK chiller overcomes these compressor-design challenges by using the principle of compounding. A compound design arranges two individual compressors in series. By flowing the refrigerant gas through two compressors, the pressure ratio becomes the sum of the two individual centrifugal compression ratios. The result is a much higher total lift pressure available to the system, which is able to handle the high head demanded by extreme conditions.”

Notes Meredith: “Johnson Controls was the only company that could offer us a high head, high capacity, industrial type machine fit for the mining environment with additional customised features like specialised PLC technology that integrated with our SCADA system.”

The first chiller has been operational for just over a year and has performed well, the second is due to be commissioned in July 2015. The next two chillers will be assembled and commissioned in early 2016 by a Johnson Controls team, with a Palabora team taking over maintenance.