

## ➤ Seals Designed to Withstand an Overpressure of 50 psi

The following types of seals have been approved by MSHA under the 50-psi seal strength criterion:

- **Precision Reinforced-Concrete Seal:** This seal was approved for use in openings up to 8 feet high and up to 21 feet wide. The 20-inch thick seal consists of 6,000 psi compressive strength shotcrete and steel reinforcement. The reinforcement consists of steel bars and a 3-dimensional welded-wire space frame. Vertical steel reinforcement is provided by two sets of #7 bars on not more than 10 inch centers. Horizontal reinforcement consists of two sets of #5 bars on not more than 12 inch centers. Stirrups are used for shear reinforcement. Anchorage is provided by #8 bars grouted into the roof, ribs and floor on 10-inch centers around the perimeter of the seal. The perimeter steel must have sufficient anchorage to develop the full tensile strength of the bar. A sheet metal form on the inby side of the seal contains the shotcrete during construction.

(Contact information: Precision Mine Repair, 705 W. Main Street, Ridgway, IL. Phone: 618-272- 7220)

- **MICON Reinforced Polyurethane/Gravel Seal:** This seal has a reinforced polyurethane and gravel core that is placed between two, dry-stacked and surface-coated concrete block walls. The seal's core is 48 inches thick. The seal can be installed in entries up to 10.5 feet high and 20 feet wide. The polyurethane foam must have a minimum density and an average density specified in the engineering calculations. In order for the polyurethane to cure to the intended strength and density, steps must be taken prior to construction to remove moisture from the seal construction site and to limit the moisture content of the gravel used in the core. It is imperative for this type of seal that the gravel be bagged and dry so that it does not affect the foam density and strength.

The central core is reinforced with two grids of steel reinforcing bars. The horizontal and vertical spacing and the grade and diameter of these bars are variable and listed in the design specifications. The vertical bars are embedded and grouted into the mine roof and floor; the horizontal bars are not required to be embedded into the ribs. The bars must be embedded into the roof and floor to a depth sufficient to develop the full yield strength of the bar. The required embedment depth is to be determined at each mine via in-mine pull tests.

(Contact information: MICON, 25 Allegheny Square, Glassport, PA 15045. Phone: 412-664-7788)

- **Minova “Tekseal” Cementitious Seal:** This plug-type seal is constructed using “Tekseal,” a lightweight, pumpable cement product. The compressive strength of the “Tekseal” must average at least 400 psi, with no quality-control samples testing at less than 300 psi. “Tekseal” designs have been provisionally approved for seals subject to little or no convergence, and for seals which will experience significant convergence. For each of these two seal types, the seal thickness is a function of the height and width of the mine opening. Minova has developed tables showing the required seal thickness for the two cases. For example, for a 7-foot high by 20-foot wide mine opening, a seal which will not be subjected to significant convergence is required to be at least 8.6 feet thick, while a seal which will be subjected to significant convergence is required to be at least 7.2 feet thick. (To date, provisional approvals of Minova seals have been contingent upon Minova conducting additional material testing and engineering analyses to further validate the 50-psi design.)

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