AQUACRETE

HOW DO YOU USE AQUACRETE?

Aquacrete can be sprayed from 2 to 6 metres away onto most surfaces including Hessian, Brattice, Plasterboard, Timber, Masonite, Mud Stone, Rock, Coal and existing Stops, Seals and Bulkheads. Aquacrete can be shot blasted to any thickness in one application to create a fully tested gas/air barrier or an explosion Rated ventilation device. Aquacrete sets very quickly, enabling it to build upon itself without the slumping effects found in other sprayed concrete products. Aquacrete is a stand-alone product i.e. no requirement for additives such as re-enforcement, aggregates or chemicals. It can be pumped up to 200 metres applying a strong, fast setting versatile product that is both economical and quick to apply.

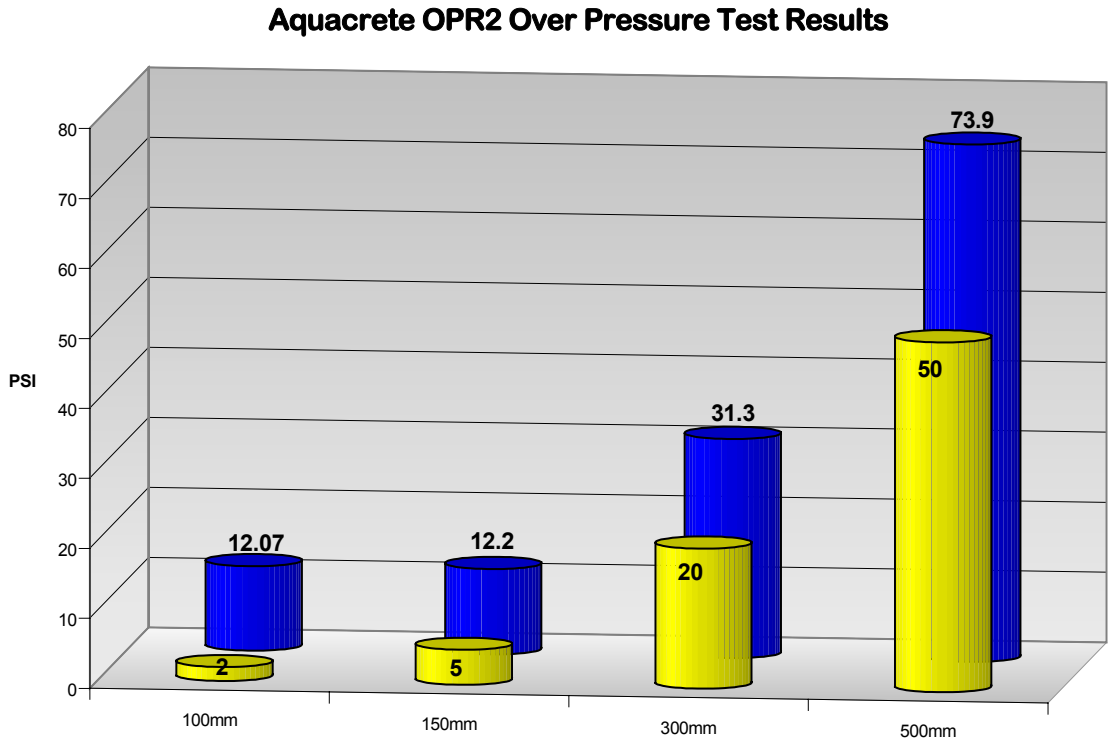
PRODUCT DEVELOPMENT

OPR2 EXPLOSION RATED STOPS AND SEALS

The Aquacrete Company's Technical Division was asked to design a product able to withstand 2 P.S.I, 5 P.S.I, 20 P.S.I and 50 P.S.I explosion-induced over pressures. By incorporating various modifications to the production process, a new product has been produced and extensively tested.

Aquacrete is proud to present that new product: OPR 2. It was specifically developed for the Coal Mining Industry to satisfy the mining regulation objectives to have all Ventilation Devices over pressure rated to an International Standard.

We are now capable of producing an internationally recognized explosion rated wall. It covers the 2 psi to 50 psi. This is achieved by simply varying the thickness of the shot blasted wall. These ventilation devices were tested in a working underground mine, creating a genuine testing environment.



	100mm	150mm	300mm	500mm
PSI Required for Rating	2	5	20	50
PSI Aquacrete OPR2 Tested to	12.07	12.2	31.3	73.9

Graph No. 1
AQUACRETE OPR2 OVER PRESSURE TEST RESULTS

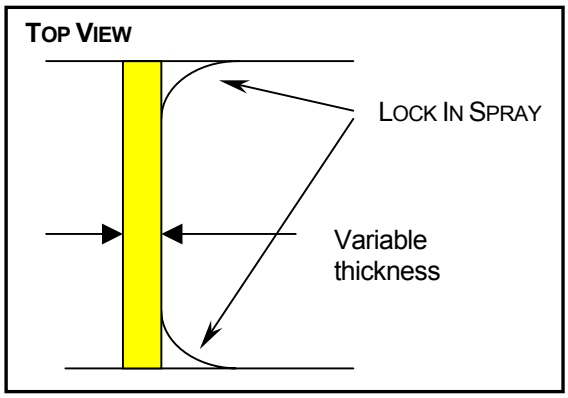
VENTILATION STOPPINGS

PERFORMANCE OF AQUACRETE

Aquacrete OPR2 is a “stand alone” product that, “when mixed with water under pressure,” has the ability to build onto itself and bond to any surface or fissure. It is this characteristic that enables Aquacrete to produce a cornice effect (fillet or lock in effect) which eliminates the need for attachment points such as Rock Bolts and W straps to produce the same over pressure resistance.

AQUACRETE SEALS & STOPPINGS

TYPICAL AQUACRETE SPRAYED SEAL

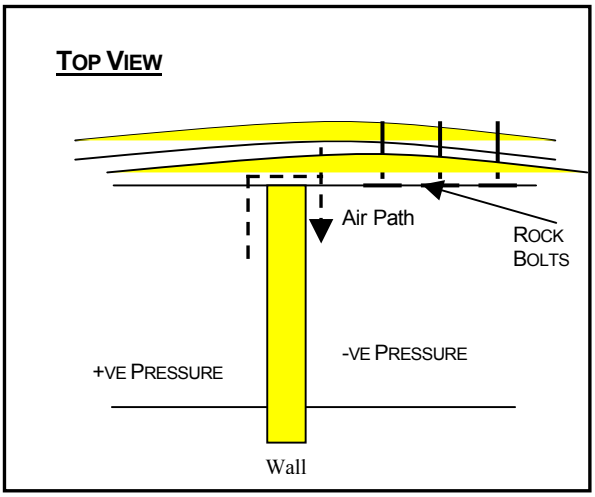


A seal can be constructed using the same formwork as a stopping; it is just shot blasted to a greater thickness. Aquacrete not only offers an explosion rated wall, but a package that will minimize the leakage of air by “shot blasting” the wall edges back to a distance as determined by the condition of the backs and ribs.

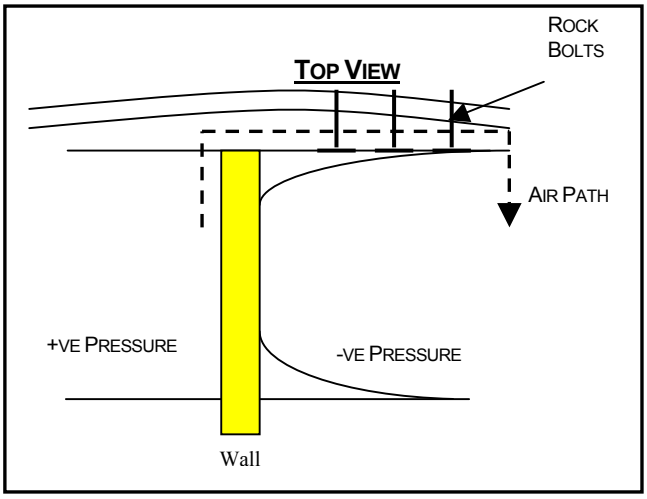
As can be seen by the accompanying diagrams, for air to pass over and around an Aquacrete wall it must permeate through the walls at a distance much greater than that of a typical wall.

This distance can be increased easily by spraying in further down the drive. This practice is used extensively in areas where a high degree of bed separation has taken place or the wall permeates air through the backs or ribs. This “spraying in” technique can achieve a permeation of less than two liters per second of air over an average of 15 m^2 of wall.

TYPICAL VENTILATION SEALS – WITH AIR/GAS



AQUACRETE OPR2 SEAL – WITH AIR/GAS



TECHNICAL INFORMATION

Strength Properties of Aquacrete (7 Days from Spraying)

TEST	CONFINING PRESSURE	Results	
		Peak	Residual
UCS	0MPa	13MPa	-
TRIAXIAL	0.5MPa	13.7MPa	4.7MPa
TRIAXIAL	1.0MPa	16.6MPa	9.8MPa
TRIAXIAL	1.5MPa	19.8MPa	11.5MPa
POISON'S RATIO	-	0.23	-
Young's Modulus	-	12GPa (Note: Giga Pascal's)	-

NOTE - *Residual is also called post failure.*
- UCS is normal compression test.

Following is a table of permeation figures for Aquacrete OPR2 Stoppings and Seals. These tests were conducted at Curtin University of Technology (Australia) to international standards.

Aquacrete Diffusivity Specifications at Δp = 6psi, 15^0C

WALL THICKNESS (MM)	LITRES FOR A 15M² AREA
50	9.46
100	4.87
190	3.60
270	1.97

Test reports ref: 4186, Curtin University of Technology, August 1998

The use of Aquacrete easily accommodates doors, fans, piping etc without compromising the strength of the seal. Doors built and installed by Aquacrete are guaranteed to the same specifications as the structure they are inserted into. All Aquacrete walls are guaranteed and ready to perform just 24 hours after they are erected. All tests that have been conducted on ventilation devices are no older than 24 hours.

A Material Safety Data Sheet (MSDS) is available, as are more specific technical information upon request.

SUMMARY ON TEST OF METHANE DIFFUSIVITY THROUGH AQUACRETE

The diffusivity of methane gas through different length of Aquacrete core sample was tested by Curtin University August 1998.

The core samples were sealed inside PVC tubing with araldite and rate of gas diffusing through each core was measured. Tests were conducted primarily with a 6psi (40kpa) pressure drop across each core, which is the largest pressure difference between methane in the coal body and the atmospheric pressure in the mine.

A complete set of data is shown in Appendix A and has been converted to diffusivity for a $15m^2$ wall as shown on table below. A comprehensive test report is available on request.

CORE LENGTH	**DIFFUSIVITY K AT PRESSURE DIFFERENTIAL 6psi, 15° C**	
M/m	CORE – L/s	RELATIVE $15M^2$, L/s
50	0.0045	9.45 + -0.18
100	0.0023	4.87 = -0.12
190	0.0017	3.60 + -0.08
270	0.0009	1.97 + -0.08

AIR LEAKAGE IN MINES

It is normal in mines that a significant quantity of ventilating air is “lost” due to leakage through poorly constructed or inadequately maintained stoppings.

This situation is accepted as “inevitable” by most mining officials since the costs involved in repair are perceived to be too great.

A ventilation survey at a mine found that although there was sufficient ventilating quantity available at the entry to the hazardous zones there was a loss of air due to leakage in outbye intake roadways amounting to 46 cubic metres per second.

This volume represented 23% of the total quantity passing through the fan.

The area in which this “loss” occurred had 40 stoppings between the main intake roads and the main returns.

Cracked brickwork, inadequate perimeter sealing and normal scrimmed “plasterboard” stoppings accounted for the majority of this air wastage.

Annual cost for power to run the main fan was in the order of $340,000.

It can be assumed from this information that approximately $78,000 (23% of costs) is spent every year to pay for the circulation of “air” that is not performing any useful purpose.

By referring to the basic FAN LAWS relating to fan speed it was proven that there was a significant economic gain to be made by eliminating some of this leakage.

FAN LAWS

1. **Flow rate varies directly as the speed.**
2. **Pressure varies as the square of the speed.**
3. **Power and Cost vary as the cube of speed.**
4. **Efficiency is constant.**

The ventilation survey proved that the average leakage resistance value for each stopping was about 1,000 Ns^2/m^8 (gauls).

It was decided that leakage at each stopping could be reduced considerably by spraying Aquacrete directly onto the existing structures.

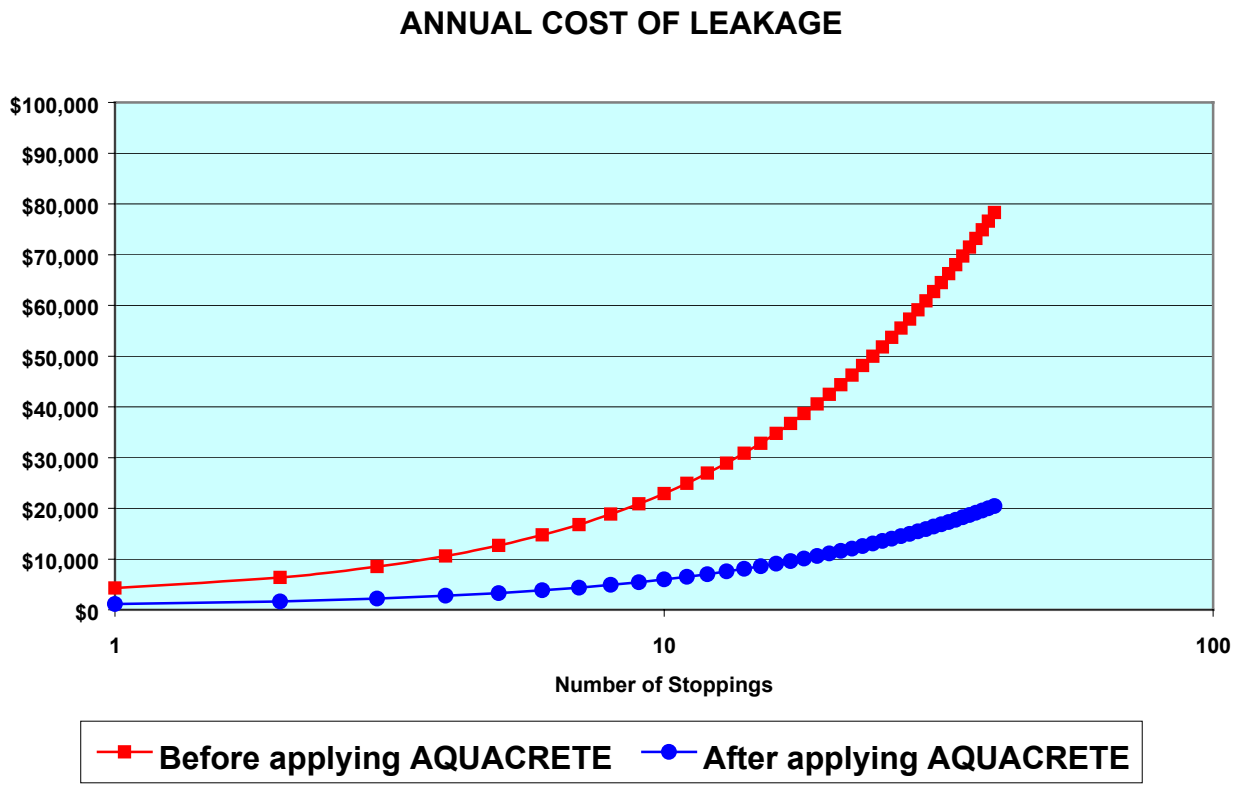
Later measurements indicated that total leakage in the area had been reduced to less than 13 m^3/sec, and that the average resistance value per stopping was increased to over 12,000 Ns^2/m^8. (Almost all of the remaining leakage was attributed to poor sealing of manholes and machinery accessible double doors).

As a result of this reduction in leakage there was an increase in total mine resistance which resulted in a reduction in total airflow and an increase in ventilating pressure but the quantities now flowing into the hazardous zones were in excess of what was required.

This positive result proved that the speed of the main fan could be reduced by some 10% with significant saving in power consumption.

The exercise, to improve the quality of a proportion of the mine stoppings, incurred a cost of between $500 to $800 per stopping (area dependant) but resulted in an overall saving of about $60,000 in the next year and will continue to save this amount annually.

This positive result was achieved in a main road area of the mine but may be equally applied to any longwall gateroad, cut and flit panel or in fact anywhere in a mine between intake and return.



The saving of $75,000 was due to reducing the fan speed by some 10% due to the efficiency of the Aquacrete stoppings providing a higher ventilation pressure.

LEAKAGE OF AIR