

Construction of seals

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Background

If workers remain underground in an explosive atmosphere where there is a possibility of spontaneous combustion, incendive spark or other ignition source, the Underground Mine Manager must ensure that any seal installed is, as a minimum, a type D [s. 32(1)(b) of the Coal Mine Safety and Health Regulation 2001].

Schedule 4 of the Regulation-Ventilation control devices and design criteria-stipulates that the design of the seal must make it capable of withstanding an overpressure of 345kPa. As it is impossible to test these seals in place, their reliability is being determined by checking the properties of the construction materials and by digital modelling through 3D stress analysis.

Certain measures taken (i.e. installation of pipes, tubes and doors), designed to (a) obtain information on the atmosphere behind the seal, (b) control the inertisation process, (c) prevent water build-up and (d) increase the life of the seal, have also increased the complexity of the design. For example, a recently used seal included three hatches to control the flow of goaf gases into the return as part of the inertisation process. While the seal structure and the hatches were separately rated at 345 kPa, there were concerns that the overall construction did not achieve that rating.

Under section 172 of the *Coal Mine Safety and Health Act 1999*, the Chief Inspector of Coal Mines authorised an independent engineering study of the seal arrangement. This study showed that, while the seal arrangement was capable of withstanding the 345kPa overpressure, it could sustain damage that would render it unfit for further use as a seal.

Considerations when constructing seals

The study highlighted these points, which should be taken into account when constructing seals:

- **Design criteria**-Changes to a seal's design can diminish its overall strength. A registered professional engineer, therefore, should approve any changes (see Schedule 4 of the Regulation).
- **Strength of materials**-It is not advisable to rely on a supply docket to indicate the type and strength of the material used in the construction of a seal. A sample of the material should be tested to ensure that when the material sets it is at the required strength.
- **Placement of seals**-Seals in a roadway should be positioned so as to allow a second seal to be erected, if required. Also, the impact of the cross-sectional area of the seal face, on the inbye and outbye faces of the seal, when close to a junction should be considered. Seal sites should be chosen to ensure optimum contact between the seal and the strata, with the seal adequately secured to the roof, floor and ribs. This can be facilitated by using bolts and by proper site inspection and preparation.
- **Placement and number of sampling tubes**-This depends on the size and type of area to be sealed. Consideration should also be given to the need to sample as much of the sealed area as possible while maintaining the integrity of the sampling tubes and guarding against damage. Recognised Standard 09 'The Monitoring of Sealed Areas' (available on the departmental website) should be consulted.
- **Tying in hatches**-Cement grout filling should be used between hatches to prevent leakage between steel and steel

- interfaces. Bolts should be used to ensure that the hatches are tied in at least 250mm to the surrounding material.
- **Service pipes**-These should be positioned at least 300mm from edges and corners. Holes should be at least 2 diameters from each other.

Recommendations

Seals are usually constructed by contractors, with the Underground Mine Manager and Ventilation Officer being the 'customers'. It is recommended, therefore, that the Underground Mine Manager and Ventilation Officer:

1. review the quality control of the installed product
2. validate the engineering integrity of the seal by an engineering review
3. periodically review the relevant Safety and Health Management System documentation.

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