Admixture Technical Sheet – ATS 12
Pumping admixtures

1 Function

Modern pumps are able to cope with the majority of well-designed concrete mixes, but difficulties can be experienced in the following situations:

Concretes that are produced with aggregates that are poorly graded, elongated or flaky, can lead to blockages or segregation within the pipeline. Such mixes can be improved by a controlled level of air-entrainment together with water reduction.

Pumping for long distances or to vertical heights can lead to very high pump pressures and the need for improved lubrication within the lines. The addition of a polymer based pumping aid can modify the cement paste viscosity to help provide this enhanced lubrication.
Pumping aids can also provide better workability retention for long pumping distances and can be particularly effective if there is likely to be delays or brakes in the pumping when segregation or stiffening in the line could prevent a restart.

Many synthetic lightweight aggregates are produced by the firing and expansion of clays, shales or ashes and are porous with water absorption much higher than normal aggregate. Pumping these concretes presents unique problems, particularly if the aggregates are not pre-soaked and fully saturated. The pump pressure drives water into the aggregate causing the mix to dry out and block the lines. Specifically designed pumping aids are available to assist in the pumping of lightweight aggregate concretes by reducing the amount of water which gets absorbed and allowing partially saturated aggregate to be used.

Pumping aids can offer the following benefits:

- Reduced pump pressure
- Act as a lubricant, assisting the flow through the lines.
- Reduced wear and tear on pumps and lines
- Reduced segregation and bleeding which can lead to aggregate blockages
- Faster pumping
- Pumping of harsh or lightweight materials
- Pumping over longer distances

2 Conformance Standards

These classes of admixture are covered by the requirements of BS 8443 Specification for establishing the suitability of special purpose admixtures. The specific requirement for this admixture type is stipulated in Tables 1 and 6.

3 Materials

The principal chemicals are polymer viscosity modifying agents of various types including starches, celluloses, polysaccharides and ethylene oxides. Surfactants similar to those used for air-entrainment are also used in some pumping admixtures. The surfactants are usually blended with water-reducing admixtures, which allow slightly increased workability without compromising other properties. The polymers may be supplied as powders or are dispersed in a non-aqueous water miscible solvent

4 Mechanism

The long chain polymers control water movement and prevent bleeding and water loss. They help to maintain a layer of cement paste around the coarse aggregate particles and to produce a lubricant layer at the concrete / pipe interface. Surfactants increase paste volume, reducing aggregate interlock.
Where lightweight aggregates are being used, the polymer types control water movement, and significantly reduce water absorption into the porous aggregate under pumping pressures

5 Use

5.1 Dose

Dosage varies significantly between grades depending on the polymers used and whether they are supplied as a powder or a liquid. As with all concrete admixtures it is strongly recommended that site trials are conducted to establish dosage rate and performance.

5.2 Overdose

Overdosing can lead to air entrainment and strength loss with most types of pumping aid. Some may also increase the setting time and significantly increase cohesion leading to a loss of workability.

6 Effects on properties of concrete

6.1 Strength

The compressive strength of concrete is not normally changed by the addition of polymer pumping aids unless they entrain some additional air. If air-entraining types are used without water reduction, some loss of strength may occur.

6.2 Workability

The concrete may appear slightly sticky, more cohesive and less workable. However, it normally compacts more easily under light vibration.

6.3 Slump loss

The concrete may appear to stiffen due to the improved cohesion. However, provided it is given slow agitation, it normally retains its workability longer than plain concrete and some types can give a significantly slower rate of slump loss.

6.4 Setting time

The setting time of the concrete is not significantly affected by the addition of most pumping aids.

6.5 Air entrainment

At normal dosages there is no significant air-entrainment with most polymer types.
Where the air-entraining types are based on surfactants, the increase in air content is normally restricted to 2 to 3% as above this compression of the air bubbles in the pump can result in reduced output.

6.6 Bleeding

This is significantly reduced or eliminated, as is any tendency to segregation.

6.7 Hardened properties

Creep and drying shrinkage are not generally altered significantly from that of plain concrete and durability is unchanged.

7 Health and Safety of Admixtures

Most admixtures are non hazardous and pose no abnormal health and safety risk but as with all forms of chemical it is essential that the material safety data sheets are read and understood before use. Risk assessments should be conducted to ensure all users are provided with a safe means of use and relevant PPE.

8 Other information

Other CAA information sheets are available including Environmental Product Declarations, use of admixtures in drinking water applications, sustainability, storage and dispensing. These are available at www.admixtures.org.uk under the ‘Publications’ tab.