Gantrail products at high and low temperatures – behaviour of rubber components

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Users of cranes often experience service temperatures above or below the normal world-wide range of about -25 to 60ºC. The Gantrail brochure quotes a normal operating range for the steel reinforced Mark VII pad of -25 to 100ºC. For the discontinuous Mark II pad the figures are -25 to 75ºC. For service in environments outside these limits the general affects of high and low temperatures on the rubber components should be considered when specifying Gantrail products.
Gantrail pads and clips consist of both metal and rubber components. The metal can withstand a wide range of temperatures without difficulty, but the rubber behaves differently, as explained below. The rubber is strongly bonded to the metal to ensure the whole part behaves as a single entity.

ELASTICITY: FACTS OF LIFE
Materials exhibiting rubbery elasticity will only do so over a limited temperature range. At low temperatures the rubber will become brittle (all rubbers have a 'glass transition' temperature, below which their behaviour is no longer like a rubber but hard and brittle like a glass) and at high temperatures they will suffer from chemical breakdown of the structure, leading to loss of strength and loss of dimensional stability.

RUBBERS AT LOW TEMPERATURES
At temperatures below about 0ºC all rubber types will begin to stiffen (harden) in behaviour. As the temperature decreases further, each type of rubber will reach its characteristic glass transition point: below this point the material is much less elastic, and application of a load can cause the rubber to fracture. This point is normally below the lowest useful service temperature. However even below this temperature, relatively even loading will not cause problems. Rubber compounds are normally tested for stiffness increases at low temperatures, and a criterion for the lowest normal service temperature established. Should temperatures fall below this level, (provided the rubber is not fractured), when the temperature rises again the changes are reversed and the rubber will be unaffected by its experience. From experience try A = 165 mm i.e. soleplates for a heavy duty application.

RUBBERS AT HIGH TEMPERATURES
Temperatures above about 70ºC are 'high' for rubber. As temperature increases, the vulcanisation chemicals in the rubber can be activated, as well as these reactions with the environment (oxygen, ozone, sunlight and other agents) take place, these are generally irreversible and lead to a loss of elastic properties. The higher the temperature, the faster the reactions, the longer the time at any given temperature and the worse the overall effect.

MARK II PAD

This pad uses Ethylene Vinyl Acetate (EVA) as the rubbery or elastomeric component. It is oil resistant and is in common use world-wide for crane and railway applications. The EVA used can be described as a 'soft plastic' and can be satisfactorily used as low as -25ºC, but its high temperature performance is limited to 75ºC for continuous use, its maximum short term temperature should be limited to 100ºC, or dimensional changes will occur.

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MARK VII PAD & CLIP NOSE

The pad and clip nose also use oil resistant elastomer material, in this case Nitrile Rubber (NBR). It can be used normally down to about -25ºC, with care and when avoiding shock loadings. It can be used continuously at up to 100ºC. At temperatures of about 120ºC the lifetime of the pad will be shortened due to internal degradation reactions but life will still be considerable. Temperatures of over 120ºC will begin to permanently affect properties, the longer the time, and the higher the temperature, the worse the effect. The pad will be able to take 'spike' temperatures of up to 200ºC for short periods, but the lifetime will be reduced, as its physical properties will deteriorate, and the minimum performance limits reached earlier.

For specific applications and temperatures, Gantrail will provide detailed advice on the type of pad to select and an estimate of its expected service life.

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