# Environmental conditions

## Cold weather

Plastic piping systems generally work well in low temperature conditions. The tensile strength increases as temperature decreases. However, the impact strength of most thermoplastics decreases at low temperatures, and brittleness can develop. This is most evident in systems manufactured from PVC-U or PVC-C, where impact strength is significantly reduced at temperatures below 5°C. Other thermoplastic piping performs particularly well in cold conditions - even at temperatures as low as -40°C.
When PVC-U or PVC-C are installed in a low temperature environment, or if they are to handle fluids at low temperature, they should be installed in a position where the risk of impact is minimized. In addition, every precaution should be taken to minimize hydraulic shock in the system by paying particular attention to fluid velocity, valve opening and closing times, and pump start-ups.
Many standard cold weather piping design and installation practices can be used to protect plastic piping systems from freezing, including pipe insulation, anti-freeze solutions, and trace heating. However all products should be checked for compatibility with plastic piping prior to use.

## Weatherability

Exposure to weather generally has minimal effect on thermoplastic pipes installed outdoors. In extreme conditions, wind carrying solids may result in erosion, and high humidity may contribute to hydrolysis leaching. However these situations are very rare, and when considering the weatherability of any installation, consideration should of course be given to the geographical location - determining if extreme weather may be a possibility.

## Warm weather and exposure to UV

All plastic piping is subject to limitations on use at upper temperatures. This is because the tensile strength of the material decreases as the temperature rises. Care should therefore be taken to ensure that the environmental temperature does not cause the pipe to exceed the safe operating pressure. Refer to the section dealing with pressure and temperature for more information.
In the majority of exposed installations, sunlight (UV radiation) is the factor that will require most consideration. UV radiation is known to cause colour change in most plastics, a slight increase in tensile strength, a slight increase in the modulus of tensile elasticity, and a slight decrease in impact strength. UV radiation can also potentially introduce stresses from unexpected thermal expansion or contraction. When surface degradation occurs, it only affects the material that is directly exposed to UV radiation, and only to extremely shallow penetration depths (usually less than 0.025mm). UV degradation does not continue when the exposure to UV is terminated.
PVC-U, PVC-C and Black Polyethylene contain natural UV inhibitors, and are generally resistant to the effects of UV radiation, although some surface discoloration may occur. Clear PVC-U is not resistant to UV, and therefore should not be used in exposed conditions. Polypropylene and ABS are more affected by UV radiation to varying degrees dependent upon the conditions. Natural Polypropylene is not resistant to UV radiation and must be protected if used outdoors. PVDF has excellent resistance to UV radiation, but it should be noted that UV radiation can penetrate the translucent wall and may affect the fluid being handled.

Plastic piping exposed to UV radiation may be protected by painting with a light coloured acrylic or latex paint, or with a coating specifically manufactured for this purpose, such as AGRUCOAT. Oil based paints must not be used. The use of any other type of coating is not recommended except when compatibility has been confirmed with the paint or coating manufacturer.