Polyamides or nylons were first obtained by hydrolytic condensation or condensation polymerisation. These nylons formed the basis of the textile industry. Continued research and development resulted in nylon being produced from anhydrous lactam (no moisture present) in conjunction with a strong alkaline catalyst. However reaction rates were slow, around 24 hours. Further development, and the addition of activators to the anhydrous reaction, produced reaction rates that made cast nylon what it is now; a commercial prospect.

The process of reacting extremely pure caprolactam in the presence of a catalyst and activator is termed activated anionic lactam polymerisation. This is also known as ionic polymerisation, or high-speed polymerisation and hence the term monomer casting was developed. Monomer cast nylon is simply a nylon that can be cast into moulds, much the same as metal components.

Ionic polymerisation or monomer casting produces an extremely high molecular weight and highly crystalline polymer or plastic. This means that cast nylon is very rigid and wear resistant setting it apart from other nylons. It has the added processing advantage of being able to be cast into moulds leading to greater flexibility of its use. Despite the fact that cast nylon was developed over 50 years ago, understanding of the processing advantages and superior engineering properties over other nylons is not widely known.

Cast nylon is produced from caprolactam with a density equal to 1.0, comparable with water. Caprolactam is melted in exact proportion with catalyst and activator, mixed and cast into heated moulds. A rapid reaction follows and a density change during polymerisation results in a highly crystalline plastic with a density of 1.15. As a result, shrinkage of 15% occurs enabling the casting to be stripped from the mould.

*Figure 1 - Bulk Caprolactam storage and dispensing tanks within our production plant.*
Processing cast nylon requires exact measured quantities of the two-melt components, careful mixing and then filling into a mould for polymerisation to occur. The polymerisation process of casting nylon is exothermic. This means that when the polymerisation reaction takes place heat is generated. This exothermic reaction is also common in other plastics reactions such as epoxy reins, i.e. fibreglass and epoxy glues. However, it is the internal heat build up that results in internal stresses in cast nylon, which need to be relieved following cooling. Stress relieving is accomplished by soaking the casting at an elevated temperature and controlled cooling.

At McNeall Plastics, AustLon® monomer cast nylon is manufactured by several techniques each tailoring a casting to meet its requirements.

**GRAVITY CASTING**

Gravity casting involves dispensing mixed caprolactam into a mould, not under pressure. This means that moulds are significantly cheaper to produce than injection moulds, which need to be robust to withstand high injection pressures and cost tens of thousands of dollars. McNeall Plastics is able to supply our customer’s basic shapes such as blocks, rods and discs from low cost moulds. McNeall can also produce semi finished complex castings in much the same form as the more widely known metal casting process.

**CENTRIFUGAL CASTING OR SPIN CASTING**

With centrifugal casting caprolactam is filled into a mould rotating about a single axis. McNeall Plastics manufacture thin and thick wall tube via this method, similar to the steel equivalent of hollow bar or concrete spun pipes. We are able to spin cast large bush sleeves up to ø1000 mm, crane rope sheaves, rollers and gear rings using the centrifugal casting method. Our oven capacity enables us to produce these large diameter sleeves in lengths up to 2.4 metres.

Please request a tube availability list from your local sales representative.

Our flexible manufacturing techniques enable our customers to consider low quantity production runs 5-20 items. This is not achievable from other plastics that can offer performance-engineering properties. Non-symmetrical shapes or custom castings are available minimising machining of large amounts of material from otherwise basic billet shapes.