

- *Drive fit*: H7–n6. This is a tighter grade of transition fit than the H7–k6. It gives a tight assembly fit where the hole and shaft may need to be pressed together.
- *Light press fit*: H7–p6. This is used where a hole and shaft need permanent, accurate assembly. The parts need pressing together but the fit is not so tight that it will overstress the hole bore.
- *Press fit*: H7–s6. This is the tightest practical fit for machine elements. Larger interference fits are possible but are only suitable for large heavy engineering components. The H7–s6 is used for tight-fitting components such as bearing bushes.

Surface finish

Surface finish, more correctly termed 'surface texture', is important for all machine elements that are produced by machining processes such as turning, grinding, shaping or honing. This applies to surfaces which are flat or cylindrical. Surface texture is covered by its own technical standard, BS 1134 *Assessment of surface texture* (ref. 3) whilst the relevant drawing symbols are also given in BS 308 mentioned previously. Surface texture can affect the way that mating or locating parts such as holes/shafts or plane surfaces fit together so it has important links with the accuracy of hole/shaft tolerance grades. It is measured using the parameter R_a which is a measurement of the average distance between the median line of the surface profile and its peaks and troughs, measured in micrometres (μm). There is another system from a comparable standard, **DIN ISO 1302** (ref. 4) which uses a system of N-numbers – it is simply a different way of describing the same thing. Details are shown in Fig. 6.9. As a 'rule of thumb', a rough turned surface, with visible tool marks, is about grade N10 ($12.5 \mu\text{m } R_a$) and a reasonably smooth machine surface is likely to be about grade N8 ($3.2 \mu\text{m } R_a$). Surfaces which mate with other static surfaces, or provide a datum surface, will usually be specified as grade N7 ($1.6 \mu\text{m } R_a$) or better. Surfaces which incorporate a relative movement or bearing function vary from grade N6 ($0.8 \mu\text{m } R_a$) down to the finest 'normal' surface grade N1 ($0.025 \mu\text{m } R_a$). Finer finishes can be produced but are more suited for precision application such as instruments. It is good practice to specify the surface finish of close fitting surfaces of machine elements, as well as other BS 308 parameters such as squareness and parallelism.

General tolerances

One sound principle of engineering practice is that of general tolerances. In any machine design there will actually only be a small number of *toleranced features*