Surface plates provide a broad, smooth, flat reference surface that can be extremely useful for inspecting incoming, in-process, or finished parts. When used in combination with various gages and accessories, such as height gages, gage blocks, angle plates, and squares, they can be used to check a wide range of parameters, including length, flatness, squareness, straightness, angle, feature location, and runout. Surface plates are simple, and extremely versatile.

Surface plates come in a wide range of sizes, from about 12” x 12” to 6’ x 12’, and weighing up to 10 tons. Three grades are available, the flatness tolerances for each grade varying with the size of the plate: AA (laboratory grade); A (inspection grade); and B (toolroom grade). Many can be ordered with ledges and threaded inserts, both of which make it easier to clamp workpieces or accessories to the surface. Granite is the most common material used: it is harder and denser than steel, has very little internal stress, and is less subject to dimensional change due to temperature variations.

Care and maintenance is basic, but important. A surface plate is a piece of precision gaging equipment, not a storage table. Use it for measurement purposes only, and keep it clear and covered when not in use. Before use, wipe it down with a special surface plate cleaning solution. Make sure that workpieces and gage bases are clean and free of burrs before placing them on the plate. Don't drop anything on it.

Many uses of the surface plate are extremely simple. Some milled or ground parts can be checked for flatness by placing them on the plate and moving them around to see if any rocking motion is possible. If so, feeler stock can be used to find the high spots and measure the variation.

Most often, surface plates are used in conjunction with a portable height stand, supporting a dial or test indicator, or an electronic lever-type gage head. The height stand has a fine-ground base, which allows it to be slid across the surface without scratching. For a simple flatness or parallelism check, the gage is brought into contact with the part and zeroed out. Then the gage is moved around on the plate to "explore" the part surface for deviation. Since the surface plate is the reference, deviation may be errors of flatness, parallelism, or both.

The same setup can be used to check heights, using gage blocks as the height standard. A more sophisticated approach is to use a height master, which combines a permanent stack of blocks, staggered left and right, with a micrometer height adjustment: this allows the user to set both top and bottom heights anywhere from 0” to 12” in .0001” or .00001” increments.

“Smart” height stands can be used to substantially automate measurements on surface plates. Sometimes called “single-axis CMMs,” smart height stands consist of a vertical slide with a position encoder, a lever-type electronic gage head and/or touch probe, and an electronic keypad control. They can be programmed to measure many part features and dimensions, including diameters, lengths, and locations, in any desired sequence.
Aside from the measuring devices themselves, a number of positioning accessories extend the usefulness of surface plates. Vee blocks serve as simple holding devices for cylindrical parts. Placed on their sides, they become a clamping surface for shafts, in order to measure the flatness or squareness of the shaft ends. Vee blocks are particularly useful for measuring runout. A part is placed in the vee and rotated, while an indicator or gage head measures the variation in height. (Note that lobes on a round part may create an unstable axis of rotation)

If projecting features prevent a part from being placed flat on a surface plate, a parallel bar accessory may be used to bridge across those projections. Sine bars and sine plates are used to establish surfaces at precise angles from horizontal. Angled parts are placed on the angled surface, to check them for flatness, or to measure the angular accuracy of the machined surface.

The surface plate itself can be a gage. A hole is bored in the plate, and a gage head or air jet installed, to inspect flush surfaces for flatness without the use of a height stand. If desired, a second gage head in a height stand can be positioned directly above the one embedded in the surface plate, permitting independent measurements of flatness, thickness, and parallelism.

Surface plates provide a stable reference surface on a large scale, making a great many gaging setups possible on a single, simple piece of equipment. When a gaging application does not warrant the purchase of a special-purpose fixture gage, surface plates often provide an economical, all-purpose solution.