Additional secondary steelwork will be required in the machine room, and a lifting beam will be required for use during lift installation and maintenance. As with all secondary steelwork, clear limits of responsibility, at the design, construction and possibly testing stages, must be defined and understood by all parties. A lack of clarity can lead to conflict, and possible delays to the construction programme.

The structural designer must consider deflections of the supporting frame under loading from the lift car. BS 5655: Part 9([84]) specifies deflection limits for the rails and supporting structure, under specified levels of guide rail loading. For example, guide rails for a lift with a rated capacity of 1000 kg must be designed to resist a force of 0.65 kN perpendicular to the plane of the wall, and the supporting structure must deflect less than 3 mm. Allowable deflections are less for a high speed lift([63]). Excessive deflections in service would compromise the functioning of the lift.

Tolerances on the plan dimensions of the lift shaft are given in BS 5655: Part 6. The tolerance on excess width and depth varies between 25 mm to 50 mm, depending on the height of the lift shaft. Tolerances for verticality of the shaft are the same as for the steel columns (see Section 8). For low rise buildings, connections at the guide rail interface generally provide sufficient adjustment to accommodate tolerances for verticality of the rails. Special tolerances for column verticality adjacent to the lift shaft may need to be specified by the structural designer for higher buildings.

**ACTIONS - Lift installation**

The design of interface elements will normally be undertaken by the lift manufacturer, but the structural designer should:

- allow for increased frame loads in the locality of the lift shaft if non-structural shaft walls are used
- simplify as far as possible the details of any secondary steelwork used for support
- be aware of the onerous tolerance requirements for the interface members, and design any secondary steelwork such that these can be satisfied
- communicate and cooperate with the lift manufacturer.

## 7.3 Metal cladding

Cladding is used to provide weather protection and insulation, and has a big influence on the appearance of the building. The choice of cladding should reflect not only the levels of erection and service loading, but also a need for sufficient robustness to avoid damage during transportation and site handling. Responsibility for the choice of cladding will vary according to the procurement process for a given project. However, all parties should be aware of the need for connection details which will accommodate the different tolerance requirements of the steel frame and the cladding.

Several different systems are available, some of which are shown in Figure 7.2. The characteristics of these options are described below. The choice of cladding

system depends on the required performance, appearance and cost. An important performance criterion which must not be forgotten is durability, which should be achieved through correct specification and detailing.

### *Single skin*

Single skin cladding is the least expensive option. It may be suitable for buildings which do not require heating (agricultural sheds), or which are self heating (foundries). The designer should be aware that without insulation, condensation on the inside of the cladding (i.e. at the warm/cold interface) may lead to durability problems.

### *Insulated*

Insulated cladding is the most common choice, because it is suitable for a wide range of buildings. The outer panels, insulating layer and inner steel liner panels are assembled on site.

### *Concealed fix*

A concealed fixing system may be used to avoid perforations of the outer panel of insulated cladding (thus reducing the potential for leaks), and improve appearance. A typical concealed fix detail is shown in Figure 7.3a.

### *Standing seam*

A standing seam system also avoids perforations of the outer panel, and permits significant 'longitudinal' movement. The latter characteristic means that longer panels can be used, since greater thermal expansion can be accommodated (see Figure 7.3b). Because the connections allow 'longitudinal' movement, the cladding may not provide full lateral restraint to the purlins.

### *Composite*

Composite cladding is delivered to site as one unit, comprising two skins of steel with a foamed core. The skins and core act together structurally. Concealed fix or standing seam systems may be used for fixing.

### *Liner tray systems*

Liner trays can be used to eliminate most sheeting rails and some purlins. The outer sheets are fixed either directly or through an insulating strip.

### *Flat panels*

Flat panels with tongue and groove joints must be erected within very onerous tolerances, so that the joints can be made, and the finished surface is sufficiently 'planar' to meet architectural requirements. A means of adjustment between the primary steel frame and the panel support structure is therefore particularly important, so that any allowed deviation of the frame can be accommodated.