height above ground, cladding size and a statistical factor for building design life. These are all covered by BS 6399-2 along with the derivation of pressure coefficients and wind loads for calculating uplift forces.

- **Snow**
  The loads stated in BS 6399-3 allow for the effects of snow. The basic snow load for undrifted snow in an unsheltered area at an assumed ground level datum of 100 m above sea level may be modified according to the site altitude, surrounding topography or redistribution of snow due to drifting or removal. The Building Regulations Approved Document A gives simplified values of snow load for most small housing construction.

To derive a design load for checking the resistance of a roof component, both dead and relevant imposed loads from the above must be considered in likely combinations. Individual loads are factored according to the combination and the most onerous combination is used for design.

From the three types of imposed loading highlighted above, it is necessary for designers to consider fully the action of loads on roof structures and to design for both strength and rigidity accordingly. Typical designs for roofs in Scotland commonly adopt roof sarking as part of their design against wind loading.

3.4 Minimum allowable load levels

American plywood comes in various grades and thicknesses to provide a suitable product for the loads it is intended to resist in its function as either roof sarking or decking. Permissible values for Grade Stress and Modulus are given in BS 5268-2 along with section properties for the variety of thicknesses available. Design loads, which the roofing must resist, are provided in BS 6399-1, -2 and -3.

For American plywood used as sarking in pitched roofs, the minimum thickness for resisting vertical loads is 9.0 mm as stated in BS 8103-3. This thickness is sufficient to provide full bracing to rafter members. Additional thickness may be necessary for other construction cases or to meet the durability requirements.

Thicknesses of American plywood for decking in flat roof construction are given in Table 5.

These values should be used for low-rise domestic buildings, as described in BS 8103-3 provided that:

- Orientation of the grain of and face of the board is perpendicular to supports
- Boards span three or more joists
- Access to the roof is for maintenance and inspection only for the case of no permanent access
- Fixing of the boards is carried out in accordance with recommendations in section 5.2 of this guide

Table 5 Thickness of plywood for flat roof decking

Plywood type	Maximum centres of support members		
	400 mm	450 mm	600 mm
No permanent access to roof			
American construction and industrial plywood: C-D Exposure 1, C-C Exterior grade or Sturd-I-Floor (underlayment)	12.0 mm	12.0 mm	15.0 mm
Access provided to roof			
American construction and industrial plywood: C-D Exposure 1, C-C Exterior grade or Sturd-I-Floor (underlayment)	15.0 mm	15.0 mm	18.0 mm

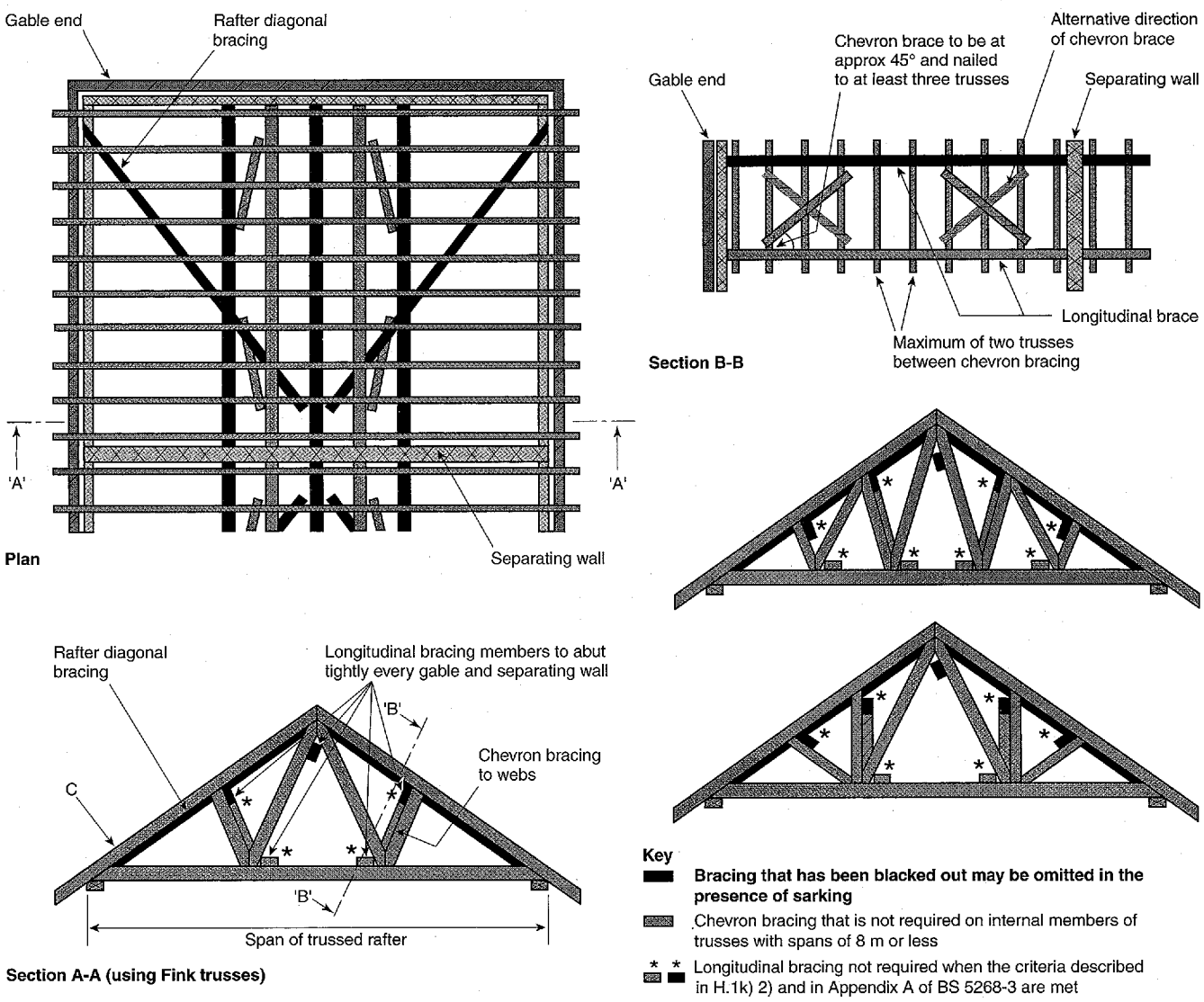

Figure 2 Bracing requirements for pitched roofs with sarking: bracing in BS 8103-3 that may be omitted is shown blacked out
(Original drawings from BS 8103-3:1996 are reproduced with the permission of BSI under licence number PD\ 1999 0792. Complete copies of the standard can be obtained by post from BSI Customer Services, 389 Chiswick High Road, London, W4 4AL)

3.5 Bracing in pitched roofs

The provision of plywood as sarking in pitched roof construction negates the requirement for a number of bracing members normally found as standard members in pitched roofs. It is possible to omit the diagonal bracing, chevron bracing and longitudinal bracing but only at rafter level as shown in Figure 2. In order to ensure the integrity of the plywood sarking, the following conditions must be met:

- The plywood must be directly fixed to the top face of the rafter members
- Adjacent sheets should be laid with staggered joints and nailed, at not more than 200 mm centres, to every truss that they cover.
- Galvanised round wire nails (3 mm diameter by 50 mm long) should be used to fix the plywood to rafters. These may be either common smooth or ring shank. If splitting of the rafters occurs, nailing should be in a staggered pattern between plywood sheets and driven in a skew direction.

The plywood sarking must be moisture resistant with a required minimum thickness of 9 mm. Suitable plywood to meet this recommendation would need to be grade C-C (CDX for flat roofs) or better and have a nominal sanded or unsanded thickness of at least 9.5 mm.