elongating the floor plan. Since sun control devices are less effective on the east and west façades, the solar penetration through the east- and west-facing glazing can cause a problem with glare and is usually shaded in the retail environment. This can be done by reducing the area of glazing, reducing the SHGC, or preferably both. Thus, the area of glazing on the east and west façades times their respective SHGCs should be less than the area of glazing on the north and south façades times their respective SHGCs. If each façade has a different area or SHGC, the formula becomes: ((W window area × W SHGC) + (E window area × E SHGC)) < ((N window area × N SHGC) + (S window area × S SHGC)). For buildings where a predominantly east-west exposure is unavoidable, or if the application of this equation would result in SHGCs of less than 0.25, then more aggressive energy conservation measures may be required in other building components to achieve an overall 30% energy savings.

Warm Climates

EN29 *Glazing* (Climate Zones: ❶ ❷ ❸ ❹)

For north- and south-facing windows, select windows with a low SHGC and an appropriate visible light transmission. Certain window coatings, called *selective low-e*, transmit the visible portions of the solar spectrum selectively, rejecting the nonvisible infrared sections. These glass and coating selections provide superior view and daylighting while minimizing solar heat gain. Window manufacturers market special "solar low-e" windows for warm climates. For buildings in warm climates that do not utilize daylight-responsive lighting controls, glazing should be selected with a SHGC of no more than 0.44. All values are for the entire fenestration assembly, in compliance with NFRC procedures, and are not simply center-of-glass values. For warm climates, a low SHGC is much more important for low building energy consumption than the window assembly U-factor. Windows with low SHGC values will tend to have a low center-of-glass U-factor, however, because they are designed to reduce the conduction of the solar heat gain absorbed on the outer light of glass through to the inside of the window.

EN30 *Glazing* (Climate Zones: ❺ ❻ ❼ ❽)

For more northerly locations, only the south-facing glass receives much sunlight during the cold winter months. If possible, maximize south-facing windows by elongating the floor plan in the east-west direction and relocate windows to the south face. Be careful to install blinds or other sun-control devices for south-facing glass to allow for passive effects when desired but prevent unwanted glare and solar overheating. Glass facing east and west should be significantly limited. Areas of glazing facing north should be cautiously sized for daylighting and view. During site selection, preference should be given to sites that permit elongating the building in the east-west direction and that permit orienting more windows to the south. See also DL5.

Although higher SHGCs are allowed in colder climate zones, continuous horizontal overhangs are still useful for blocking summer sun. Window manufacturers market low-e glazing with higher SHGCs for cold climates.

EN31 *Obstructions and Planting* (Climate Zones: all)

Adjacent taller buildings and trees, shrubs, or other plantings are effective for shading glass on south, east, and west facades. For south-facing windows, remember that the sun is higher in the sky during the summer, so shading plants should be located high above the windows to effectively shade the glass. The glazing of fully shaded windows can be selected with higher SHGC ratings without increasing energy consumption. The solar reflections from adjacent buildings with reflective surfaces (metal, windows, or especially reflective curtain walls) should be considered in the design. Such reflections may modify shading strategies, especially on the north façade.

EN32 ***Passive Solar*** **(Climate Zones: all)**

Passive solar energy-saving strategies should be limited to non-sales and non-office spaces, such as lobbies and circulation areas, unless these strategies are designed so that workers and customers do not directly view interior sun patches or see them reflected on merchandise or work surfaces. Consider heat-absorbing blinds in cold climates or reflective blinds in warm climates. In spaces where glare is not an issue, the usefulness of the solar heat gain collected by windows can be increased by using massive thermally conductive floor surfaces, such as tile or concrete, in locations where the transmitted sunlight will fall. These floor surfaces absorb the transmitted solar heat gain and release it slowly over time, to provide a more gradual heating of the structure. Consider low-e glazing with exterior overhangs.

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LIGHTING

Daylighting

Good Design Practice

DL1 ***Savings and Occupant Acceptance*** **(Climate Zones: all)**

Daylight in buildings can save energy if the electric lighting is switched or dimmed in response to changes in daylight levels in the store. Automatic lighting controls increase the probability that daylighting will save energy. It is also important that heat gain and loss through glazing be controlled. In addition, glare and contrast must be controlled so occupants are comfortable and will not override electric lighting controls. See additional comments related to skylight design and placement (EN23 and EN24).

DL2 ***Surface Reflectance*** **(Climate Zones: all)**

The use of light-colored materials and matte finishes in all daylighted spaces increases efficiency through interreflections and greatly increases visual comfort. See EL5.