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TO: Chairmen of Councils of Defense

FROM: Dr. A. C. Marts, Executive Director

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AIR RAID PRECAUTIONS FOR THE PROTECTION OF WINDOWS

by

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The experience and extensive research of the British have shown certain methods for the protection of windows against bombing to be particularly effective. A survey of air raid casualties shows that a large proportion of personal injuries is caused by splinters of flying glass. The primary objective of this discussion is to outline methods for reducing injuries of this type. There is no method of preventing the fracture of window or plate glass under blast or impact. Certain types of flat glass, such as tempered glass, laminated safety glass, and wire glass enjoy greater resistance than ordinary glass and should be considered in making replacements in locations which it is important to keep glazed. When a pane breaks under severe blast, pieces may be scattered violently, although it is impossible to predict whether they will be thrown inward or outward.

Plate glass in internal partitions, show cases and similar locations is almost as liable to fracture and to dangerous scattering as glass in external windows. Plate glass in doors, and in sliding or hinged windows, is somewhat less vulnerable than in fixed windows, provided the door or window allows some degree of movement. The decrease in risk does not warrant the omission of protective measures, except in the case of tempered glass. It is desirable to fasten all doors, whether containing glass or not, wide open during air raids and generally to open windows.

Since it is not practicable to prevent entirely the fracture of commercial glass in fixed openings, efforts should be directed towards minimizing the results of breakage. This may be accomplished in various ways. In all cases, whatever protective means is used should also be securely fastened to the frame or other construction supporting the glass.

An adhered-fabric treatment does not make the breakage of glass less likely, but, if appropriate to the weight and size of glass, it affords a useful measure of protection against the scattering of fragments. A suitable adhesive, such as cellulose nitrate lacquer, may be brushed on the glass and when it has become tacky, a sheet of fabric or strong textile netting is pressed into the adhesive so that the whole glass area is covered; the fabric should also overlap the frame and be fastened to it. When the material is thoroughly set, a coat of lacquer or varnish is applied over the whole. To retain a reasonable amount of transparency, but at some sacrifice to protection, textile strips can be used. Strips should be not less than 1-1/2 inch wide and interspaces between strips should not be more than 2 to 4 inches each way. The ends of the textile strips or tape should be securely fastened to the frames. The stronger the textile and adhesive, the better the results. Almost any reasonably strong textile fabric such as cheesecloth, muslin or lace netting will afford the requisite minimum degree of protection if well stuck to the glass and also to the surrounding frame. No adhered-fabric method is suitable for rough or configurated glass surfaces.

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Sodium silicate adhesives or water glass should never be used, because, although they give excellent adhesion, the glass will be permanently etched when the coating is removed. For the same reason, animal glue should not be used. Various adhesives have been used with greater or less success. Cellulose nitrate lacquer is very satisfactory and readily available. Varnish has been used as an adhesive to a considerable extent, but it has been found to lose its adhesiveness and hence protective value in a few months. Rubber latex adhesives suffer a similar deterioration.

A good degree of protection is afforded by the use of sheets or strips of transparent plastic provided that adequate thickness is used and that it is suitably stuck in place. Plastic film should be at least 0.002 inch thick. A mucilage of gum arabic containing 10 to 15 per cent of glycerine is satisfactory with cellulose film. Cellulose film needs to be varnished after application to make it waterproof and mildew resistant. A fair adhesive for cellulose acetate film is composed of rosin plasticized with about 50 per cent of castor oil and suitably thinned with methanol.

Liquid coatings and paper strip are not recommended because of their lack of strength in resisting flying glass fragments.

Protection of external plate glass of a storefront where the display spaces are backed by wooden panelling, if this is substantial and well braced and extends to the top of the glass, is effective. If greater protection and transparency are desired, a well framed and supported wall of glass block gives adequate protection. The maximum protection will be obtained by installing a solid masonry wall. Boarding up external display windows on either side affords protection against the weather and pilfering. Since boarding on one side only gives little protection against the scattering of glass fragments on the opposite side, this treatment is inadequate.

Wire netting of 1/2 inch mesh will stop all but the smallest fragments of broken glass. Expanded metal of similar size mesh gives equal protection, but less transparency. The netting must be securely fastened, that is by firm stapling or strongly nailed battens either to the window frame or preferably to removable wooden frames. Maximum protection is afforded if these frames are hung freely so that they may swing away from the glass and thus lengthen the time during which they are absorbing the blow. The netting should be as close to the glass as possible without touching it. Netting of larger mesh than 1/2 inch has much less effect in arresting flying glass fragments and should not be used.

Curtains give only a moderate degree of interior protection against flying glass fragments. Two or three layers of burlap hanging loosely or attached to a swinging frame may be employed instead of more expensive curtain material.

A bracing device to prevent vibration of the glass may increase liability of fracture. An important objection to a brace is that it may give the owner a sense of false security, blinding him to the need for providing against the danger of flying glass. This danger is in no way eliminated by a bracing device.

Factory roof glazing requires adequate protection because of shutdown which might be required by destruction of blackout or exposure of the plant to the weather. External treatment of the glass with burlap and bitumen maintains temporary weather protection after the glass is fractured. If the glass is also supported by wire mesh close underneath or by metal or wood transverse supports at about 2 foot intervals touching the glass, weather protection is permanent.

Cordially yours,



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