

# Shut that door!

Unnecessary air changes – often little more than a euphemism for doors left open – are one of the biggest causes of heat losses in industry says Gordon Payne. A factory door open to even a modest breeze could be wasting 200 KW or more. There are plenty of ways of saving this energy. The route to economy lies in choosing the right door for your application.

Quite properly, there has always been great emphasis on heat losses through the roof, walls and floors of industrial buildings and on the benefits to be derived from improved thermal insulation. But there is now a growing awareness that unnecessary air changes are also one of the principal causes of heat loss – ignored in the past, no doubt, partly because of the difficulty of quantifying them.

The number of air changes per hour needed to ensure satisfactory working conditions depends, of course, on a number of factors, including the number of people and the processes carried on within the building. Useful data for air-conditioned spaces is given in the CIBs Guide, part A1, (Environmental criteria for design.) Part A4 covers air infiltration rates for design purposes, but, as the guide readily admits, both air infiltration and natural ventilation are at the mercy of natural forces and cannot be relied upon to provide guaranteed rate of air interchange. Ideally we should control air changes mechanically and try to minimise the uncontrolled ones.

In industry, where a minimum air change of once per hour is sufficient in many instances if no fumes or dust are produced, the problem is usually one of limiting excessive air changes rather than providing replacement air. In most factory buildings one or two changes of air per hour occur without any assistance, each hourly change being equivalent to a heat loss of  $0.33W\ m^3$  for every  $^{\circ}C$  difference between inside and outside temperature.

Some of the main contributors to excessive air changes are external doors and loading bays, especially in multi-storey buildings where the natural buoyancy of warm air

within the building produces a chimney effect that aggravates losses if the upper storeys are not air-tight. Uncontrolled airflow through open doorways wreaks havoc, too, with balanced heating and air-conditioning systems which may be incapable of responding to the call for extra heat in one particular zone of a building near an open doorway. A  $300ft^2$  open doorway subjected to a mere 8mph wind needs 7 000,000 Btu/h (200KW) to raise the incoming cold air by, say,  $30^{\circ}F$ .

A balance must be struck between the facility that large open doorways provide and the high heat losses that their use inevitably causes. All too often, industrial doors are fitted with little regard to their daily pattern of use or the incidental benefits or penalties associated with particular types. Loads, fragility, cleanliness, security, speed of operation and so on all make their own particular demands which need to be considered and met. The route to energy economy lies in the careful examination of the precise purpose of each and every door. If we are to choose the best door for each application we need to consider the:

- size and type of vehicles passing;
- size and type of loads carried;
- size of opening actually needed;
- pedestrian use;
- average duration of opening;
- frequency of opening;
- likelihood of accidental damage;
- standard of internal heating;
- maintenance facilities available;
- special safety, security or hygiene features.

As an aid to monitoring door usage a device may be fitted – temporarily or permanently –



to record the number of door openings and aggregate open time. Clark Doors market such a device, appropriately named the "Energy Sentry".

## Door control.

In some instances, solid and flexible doors, often existing ones, prove perfectly satisfactory if their operation is automated. Automatic doors are often preferred in factories where transport is well managed and adequate maintenance is available. Hinged and sliding doors can be actuated by signals from a wide range of sensors – from driver-operated push buttons to vehicle-detecting induction loops embedded in the floor. Generally, however, traffic needs to be fairly heavy to justify this sort of sophistication. For doors that are less frequently opened and where the speed of operation is not significant, various wind-tight roller, overhead and folding doors are available which may be operated manually or by means of geared motor drives, which encourage closing when the doors are not in use.

Folding, sliding and roller shutter doors need be opened only the distance needed to match the traffic required. They occupy very little internal space compared with swing doors and they can readily be supplemented by strip curtains, if desired. Rigid section doors can also incorporate thermal insulation. Although this will reduce heat losses, the effectiveness of the door perimeter seal and the frequency and duration of opening are usually much more significant factors in minimising losses.

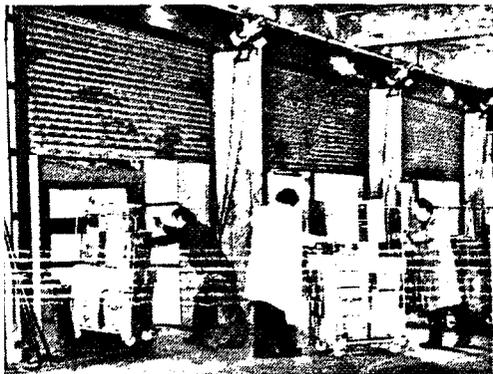
**Flexible doors.** For more rugged conditions and non-fragile loads, especially indoors, hinged flexible doors are commonplace. They may be opened by the trucks pushing

ENERGY MANAGER

Left. Well protected loads on pallets and good driver discipline allow non-automatic hinged doors to be used satisfactorily. The diagonally-split windows enable the doors to flex naturally as the load is pushed through. (Harefield Rubber)

Circle 203

Right. Sensible use of roller shutters to reduce the door aperture to the minimum necessary. Conversion of these doorways to electric operation has led to better



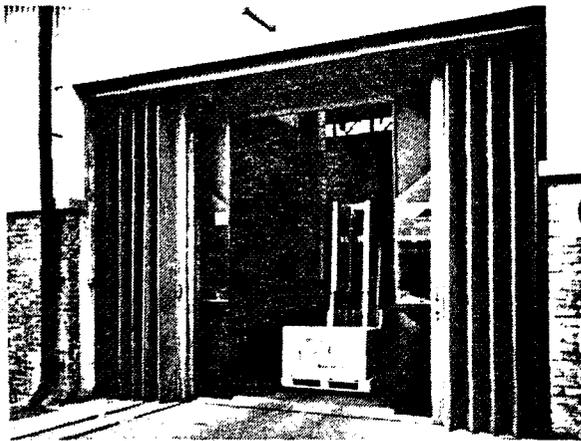
utilisation, with reduced heating bills and improved working conditions. (Pollards Industrial Doors)

Circle 201



Above. The angled slot on an ambient air curtain at Rank Xerox distribution centre, Slough, projects the air stream upwards forming a protective barrier over the doorway. (Bahco)

Circle 202



Left. When fragile loads are carried and doors are opened frequently, automatic sliding doors provide an ideal solution. They also maximise internal storage space and, as at this bottled wine and spirit store, they may be supplemented by folding security doors. (Harefield Rubber Co.)

Circle 200

through or automated with pneumatic thrusters. Improvements in door materials to resist heavy usage and larger sizes have been apparent in recent years. As an aid to safety, such doors now often incorporate a complete transparent section, though windows are still satisfactory in some situation.

**Strip doors.** These are a cheap and practical solution in many instances where traffic is moderately heavy but where the standard of heating within the buildings served is not high enough to justify automated doors, eg. warehouses and stores. They are also useful where vehicles have to straddle doorways for long periods. They have the advantage that individual strips can readily be replaced if they are badly scuffed or torn and no particular skill is required to do this. Drivers of trucks without enclosed cabs may need guards to protect them from the edges of the strips and personnel on foot should be discouraged from using doorways fitted with strips. The strips should have smooth, rounded edges to minimise the risk of cutting. A curved form also assists sealing against adjacent strips.

As well as keeping in warm air, strip curtains are useful, also, for retaining cold air in refrigerated areas and for general internal use to reduce draughts and isolate particular areas. Most manufacturers can supply special grades of material for low-temperature applications and also for gas and arc-welding bays.

The formation of the Strip Curtain Suppliers' Association (235 Regent Street, London W1R 8JU) is evidence of the recent rapid expansion in this type of door treatment. The Association has an important role to play in promoting acceptable

standards for strip curtains.

**Loading bays.** If these can be isolated from other working areas, and especially if through draughts can be prevented, conditions can be improved and heat saved. Whenever possible, vehicles being loaded and unloaded should be completely enclosed within the loading area or, if they are reasonably uniform and rear-loaded, reversed against purpose-built flexible dock shelters. These can be combined with dock levellers to facilitate direct truck loading. Most loading bays benefit from a separate personnel door which reduces the likelihood of the main doors being left open for casual use.

**Air curtains.** It is important to differentiate between door heaters – off-the-shelf fan-assisted convectors for mounting adjacent to doors – and properly-designed air curtains that project air (heated or ambient) across doorways to keep out cold outside air. Ambient air curtains fitted inside door openings usually draw air from high level, thus providing some measure of recirculation within the building.

Heated air curtains, especially, must be carefully designed to ensure that all the heated air enters the building and that no more heat is supplied than is necessary. Pressure differences across doorways vary with wind conditions so this is not easy and the design of such curtains should be entrusted only to experienced manufacturers of proven ability.

Air curtains are the ideal choice where doors have to remain open for extended periods or where traffic is especially heavy. Even so, main doors should be closed whenever possible, particularly in high

winds. Air curtains cannot generally oppose wind speeds much above 20 mph.

**Door sealing.** Even with doors firmly closed, heat losses around the perimeter may still be significant, especially in well-heated buildings. Various flexible seals and weatherhoods are available, as well as nylon brush strips (up to 3in. deep) for which a sealing efficiency of over 95% is claimed by manufacturers.

**Ease of use.** Whatever types of doors are used, one of the most important ways to reduce heat losses is simply to have them open for the minimum periods possible. This is greatly aided when they are easily operated. Openings too should be minimised. A recent development by Trace Cleveland provides a 3ft 9in wide centre section in a wider door which slides away automatically to allow the passage of a standard truck, the driver of which then has an unobstructed view. Occasional loads wider than 4ft push away the side strips in the normal way.

Automatic doors need regular and skilled maintenance, however brief, and non-automatic doors that are properly lubricated and balanced are more likely to get closed than those that are stiff or heavy to move.

After physical strain and noise, draughts are rated the next most serious hazard to health by Swedish workers. UK conditions may not be comparable, but cold draughts are still one of the major irritations to the workforce in many industries. To remove such encouragement to absenteeism and at the same time to cut the cost of energy must be attractive to even the most backward managements. Enlightened managements have already found that good doors are one of the big energy savers. □