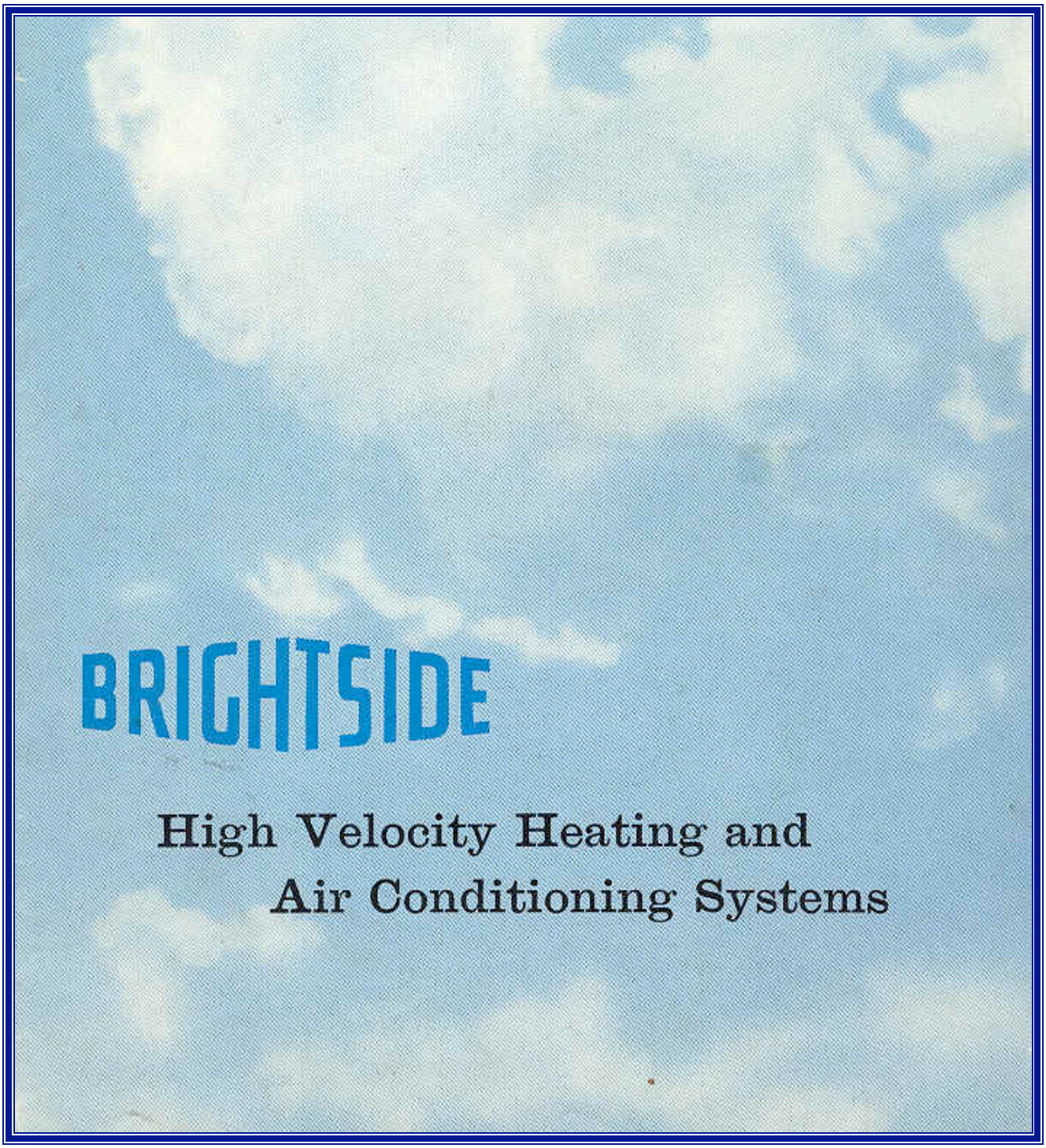


This booklet was written in 1961 by Brian Roberts, now Chairman of the CIBSE Heritage Group while he was Chief Air Conditioning Engineer of Brightside at a time when comfort air conditioning systems were beginning to be installed in the UK, the majority of installations up to that time being for industrial applications.

INTRODUCTION

Four types of system employing high velocity air distribution techniques are currently available. These are :

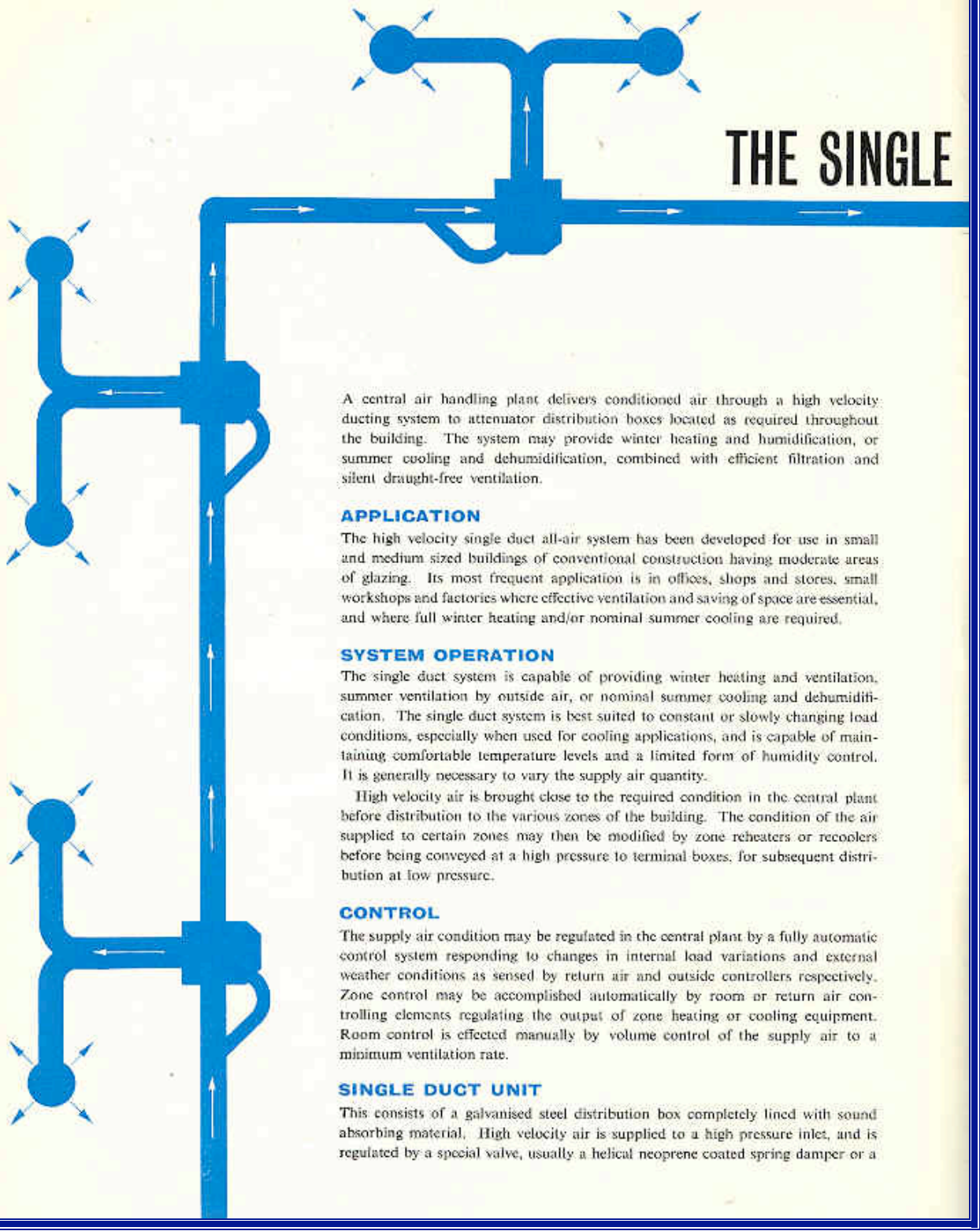
1. *The Single Duct All-Air System.*
2. *The Dual Duct All-Air System.*
3. *The Industrial All-Air System.*
4. *The Hi-Jet Induction System.*

The All-Air systems differ mainly in the type of high pressure air distribution terminal box employed. The Induction system makes use of both air and water in the Hi-Jet room unit.

The various systems are sometimes thought to be competitive, but rather they should be considered complementary to one another as each has been designed and developed to meet the special needs of a particular application. Therefore, before selecting a high velocity system for a given building it is necessary to carefully consider many factors, for example : building size, arrangement and construction, usage, required temperature and humidity conditions, method of control and permissible limits, ventilation needs, space available for plant and ducts, initial and running costs, and many others.

Thus, the single duct system is well suited to small and medium sized buildings of conventional construction where fairly constant loads exist, and where ventilation allied with heating or cooling is required. The dual duct system is more flexible and can cope economically with fluctuating loads in medium and large buildings of normal construction. It may be used for both exterior and interior areas and is very suitable for applications requiring individual control and full air conditioning. So is the induction system. This is essentially a perimeter system for use in the exterior zones of large multi-storey buildings of modern lightweight construction having very large areas of glazing. The best arrangement is often a combination of two or more of these systems, especially in larger buildings such as hotels, office blocks and flats.

The three systems previously described are generally used for commercial applications, but the industrial high velocity system has been specially developed for use in factories, stores and similar buildings, and provides an efficient and economical method of air treatment.



THE SINGLE

A central air handling plant delivers conditioned air through a high velocity ducting system to attenuator distribution boxes located as required throughout the building. The system may provide winter heating and humidification, or summer cooling and dehumidification, combined with efficient filtration and silent draught-free ventilation.

APPLICATION

The high velocity single duct all-air system has been developed for use in small and medium sized buildings of conventional construction having moderate areas of glazing. Its most frequent application is in offices, shops and stores, small workshops and factories where effective ventilation and saving of space are essential, and where full winter heating and/or nominal summer cooling are required.

SYSTEM OPERATION

The single duct system is capable of providing winter heating and ventilation, summer ventilation by outside air, or nominal summer cooling and dehumidification. The single duct system is best suited to constant or slowly changing load conditions, especially when used for cooling applications, and is capable of maintaining comfortable temperature levels and a limited form of humidity control. It is generally necessary to vary the supply air quantity.

High velocity air is brought close to the required condition in the central plant before distribution to the various zones of the building. The condition of the air supplied to certain zones may then be modified by zone reheaters or recoolers before being conveyed at a high pressure to terminal boxes, for subsequent distribution at low pressure.

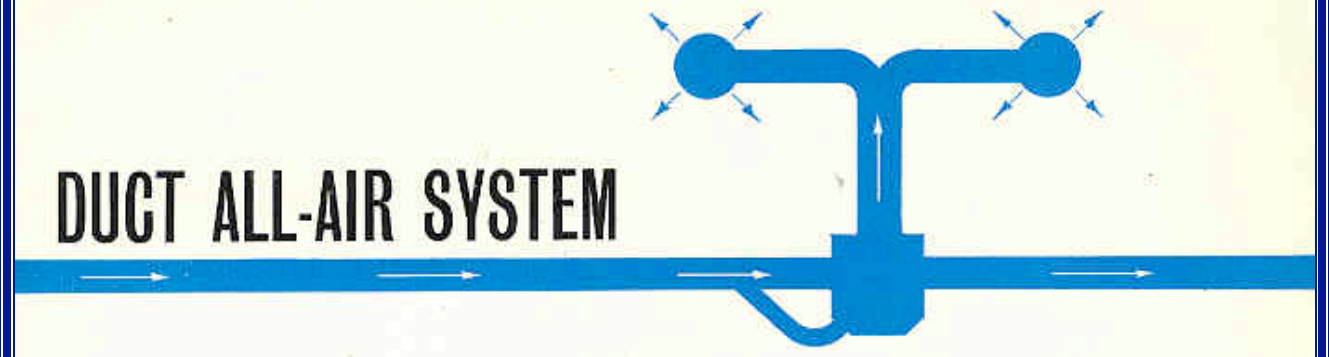
CONTROL

The supply air condition may be regulated in the central plant by a fully automatic control system responding to changes in internal load variations and external weather conditions as sensed by return air and outside controllers respectively. Zone control may be accomplished automatically by room or return air controlling elements regulating the output of zone heating or cooling equipment. Room control is effected manually by volume control of the supply air to a minimum ventilation rate.

SINGLE DUCT UNIT

This consists of a galvanised steel distribution box completely lined with sound absorbing material. High velocity air is supplied to a high pressure inlet, and is regulated by a special valve, usually a helical neoprene coated spring damper or a

DUCT ALL-AIR SYSTEM

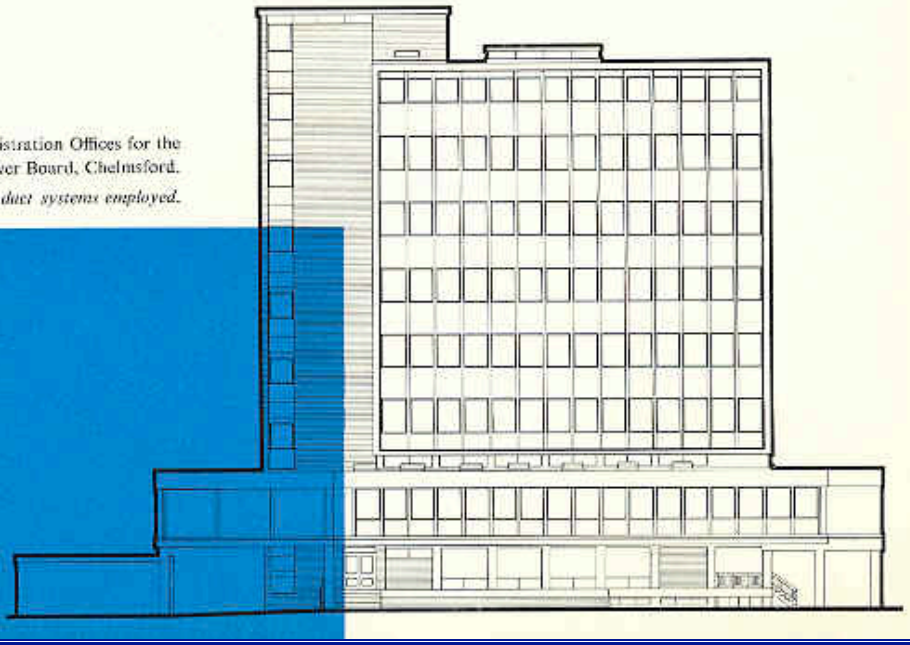


sealed neoprene bellows. With the spring damper unit, air volume may be varied by a remote wall mounted volume control or may be modulated by a room thermostat actuating an internally mounted air thruster motor. The bellows type of unit uses no motors or mechanical linkages and comprises a series of hollow vanes containing sealed bellows connected to control air. As air pressure is increased bellows inflate and vanes expand, constricting the free area and throttling the air flow. The bellows type of valve may be actuated by pneumatic thermostat or manual switch.

The unit is available as a ceiling diffuser model, or as an open end unit for supplying remote diffusers or grilles through low pressure ducting. Grille models supplying a directly connected grille or linear diffuser are available as ceiling, wall mounting or under-window units.

ADVANTAGES

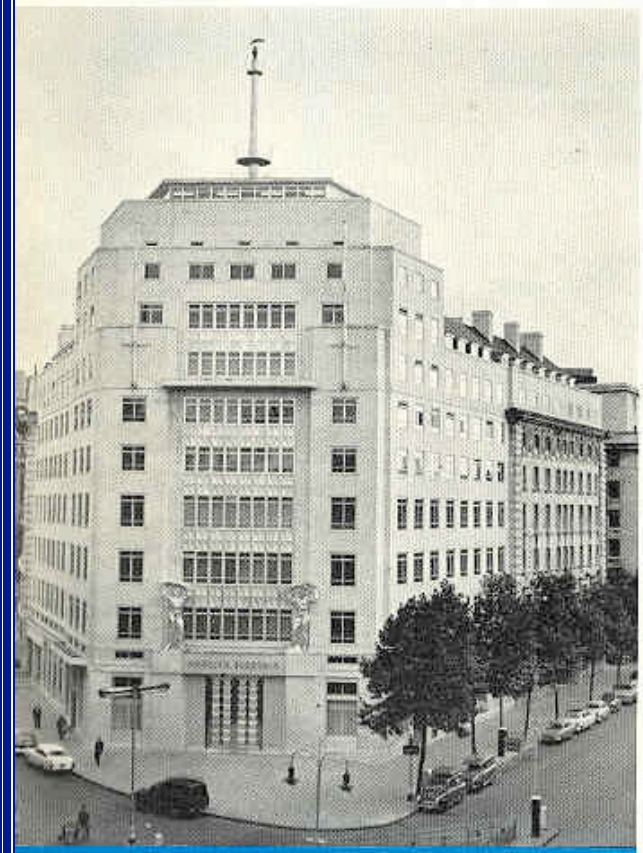
- Considerable space savings over conventional systems.
- Relatively low initial cost.
- Zone control available.
- Low operating noise level.
- Adaptable to changes in internal building partitions.



Administration Offices for the
Essex River Board, Chelmsford.
Single and dual duct systems employed.

Architects and Consulting Engineers:
E. R. Collister and Associates.

THE DUAL DUCT ALL-AIR SYSTEM



English Electric House, Gaiety Site, London
Architects: Adams, Holden and Pearson
Consulting Engineers: Oscar, Faber and Partners

A central air conditioning plant delivers two streams of air at different temperature levels through high velocity ductwork to attenuator mixing boxes located as required throughout the building. The system may provide winter heating and humidification, summer cooling and dehumidification, or full air conditioning all year round, combined with silent draught free ventilation and efficient filtration.

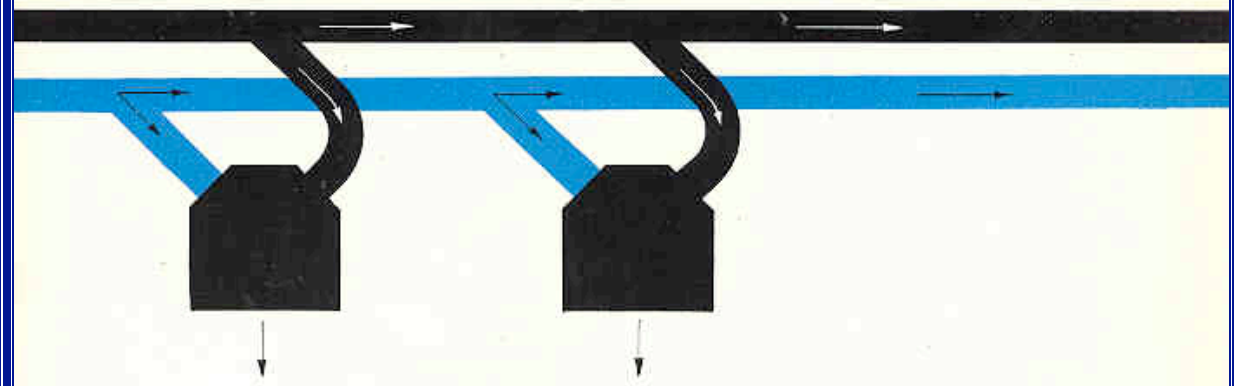
APPLICATION

The high velocity dual duct all-air system has been designed and developed for use in the perimeter areas of medium and large buildings having conventional structures with normal areas of glazing. Its most usual application is in office blocks, hotels, flats, schools, multiple stores and large shops. It is ideally suited also to interior zones of large buildings, public rooms, restaurants, bars and areas where effective ventilation and individual temperature control are required, and where saving of space is important.

SYSTEM OPERATION

The dual duct system is capable of meeting widely varying load conditions in separate areas both rapidly and economically. The dual duct system is extremely flexible in operation and is capable of maintaining accurate temperature conditions and comfortable humidity levels whilst providing constant air delivery.

High velocity air, at different temperature levels, is conveyed in twin ducts from the central plant to each distribution box. This ensures that a source of heating and cooling is available at each box, the air being mixed as required and supplied at low pressure to the various rooms. The air in the cold duct may be mechanically cooled or may be outside air for ventilation purposes.



CONTROL

The temperature levels in the twin supply ducts are regulated automatically according to outside weather conditions and changes in internal load. Under normal circumstances zoning is not required. Room control is usually accomplished automatically by a pneumatic system to maintain desired temperatures and constant air delivery by mixing the two supply air streams in correct proportions. With this system individual temperature control is provided to each room or area served by a mixing box.

DUAL DUCT UNIT

This consists of a galvanised steel distribution mixing box completely lined with sound absorbing materials. Two streams of high velocity air are supplied to high pressure inlets and are regulated by special valves operating in unison. These valves take the form of a helical spring damper or sealed neoprene bellows and operate as valves in single duct units, but mix high pressure air in correct proportions to offset the heating or cooling load of the space served. In the damper type units, air temperature is modulated by a room thermostat actuating an internal mounted air motor controlling the hot inlet.

A pressure regulator controls the cold inlet to maintain constant air delivery. The bellows type of valve may be actuated directly by thermostat, pressure regulator or manual switch.

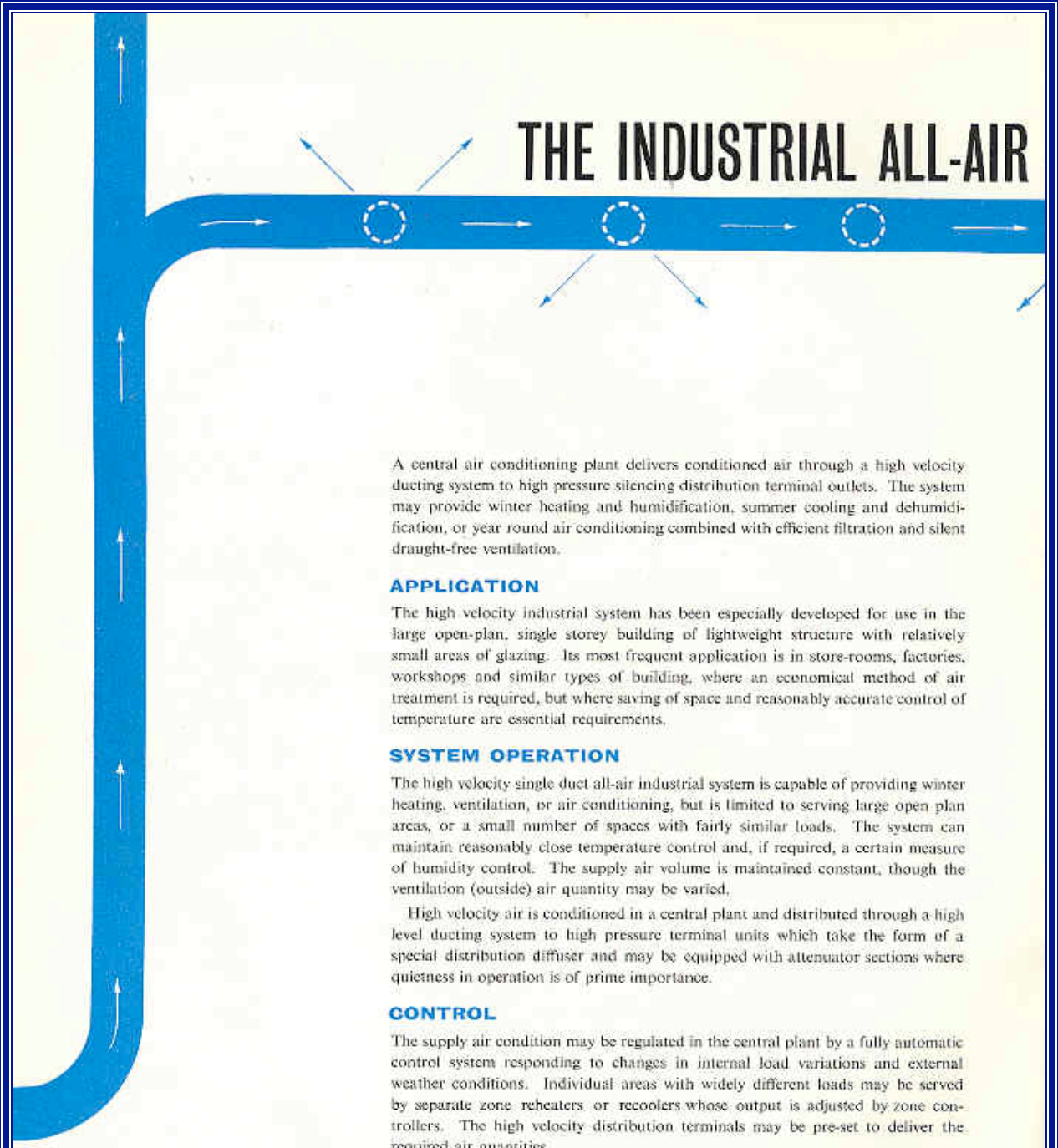
The unit is available as a ceiling diffuser model, or as an open end unit for supplying remote diffusers or grilles through low pressure ducting. Ceiling, wall mounting or under-window units feeding directly connected grilles or linear diffusers are also available.

Laboratory in new office building for Ley's Malleable Castings Co. Limited, Derby. *Architects* : Morrison and Partners.

ADVANTAGES

- Considerable space savings over comparable conventional systems.
- Economical in operation.
- Individual room control available.
- Low operating noise level.
- Zoning not required except in exceptional cases.
- Flexible in operation with rapid response to load changes.
- Adaptable to changes in internal building partitions.

THE INDUSTRIAL ALL-AIR



A central air conditioning plant delivers conditioned air through a high velocity ducting system to high pressure silencing distribution terminal outlets. The system may provide winter heating and humidification, summer cooling and dehumidification, or year round air conditioning combined with efficient filtration and silent draught-free ventilation.

APPLICATION

The high velocity industrial system has been especially developed for use in the large open-plan, single storey building of lightweight structure with relatively small areas of glazing. Its most frequent application is in store-rooms, factories, workshops and similar types of building, where an economical method of air treatment is required, but where saving of space and reasonably accurate control of temperature are essential requirements.

SYSTEM OPERATION

The high velocity single duct all-air industrial system is capable of providing winter heating, ventilation, or air conditioning, but is limited to serving large open plan areas, or a small number of spaces with fairly similar loads. The system can maintain reasonably close temperature control and, if required, a certain measure of humidity control. The supply air volume is maintained constant, though the ventilation (outside) air quantity may be varied.

High velocity air is conditioned in a central plant and distributed through a high level ducting system to high pressure terminal units which take the form of a special distribution diffuser and may be equipped with attenuator sections where quietness in operation is of prime importance.

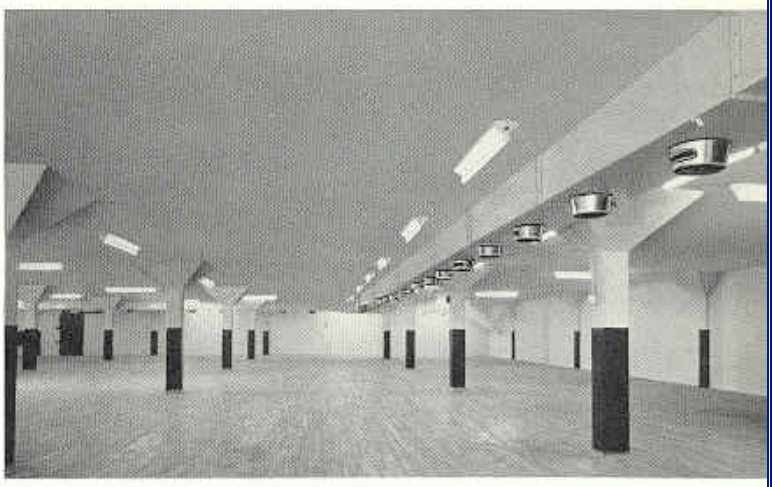
CONTROL

The supply air condition may be regulated in the central plant by a fully automatic control system responding to changes in internal load variations and external weather conditions. Individual areas with widely different loads may be served by separate zone reheaters or recoolers whose output is adjusted by zone controllers. The high velocity distribution terminals may be pre-set to deliver the required air quantities.

DISTRIBUTION UNITS

Two types are available. These are a slot model for exposed duct installations and a diffuser model for flush ceiling installation. The latter unit contains a plenum chamber and silencer section. Both models may be pre-set to give the required air quantities.

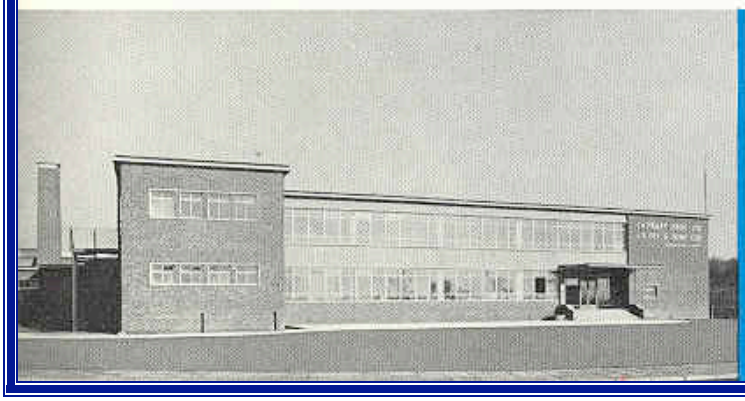
SYSTEM



A chocolate storage depot at Ilkeston

ADVANTAGES

- Considerable space savings.
- Economical in operation.
- Low operating noise level if required.
- Provides ventilation and filtered air for industrial applications.
- Quick response to load variations.

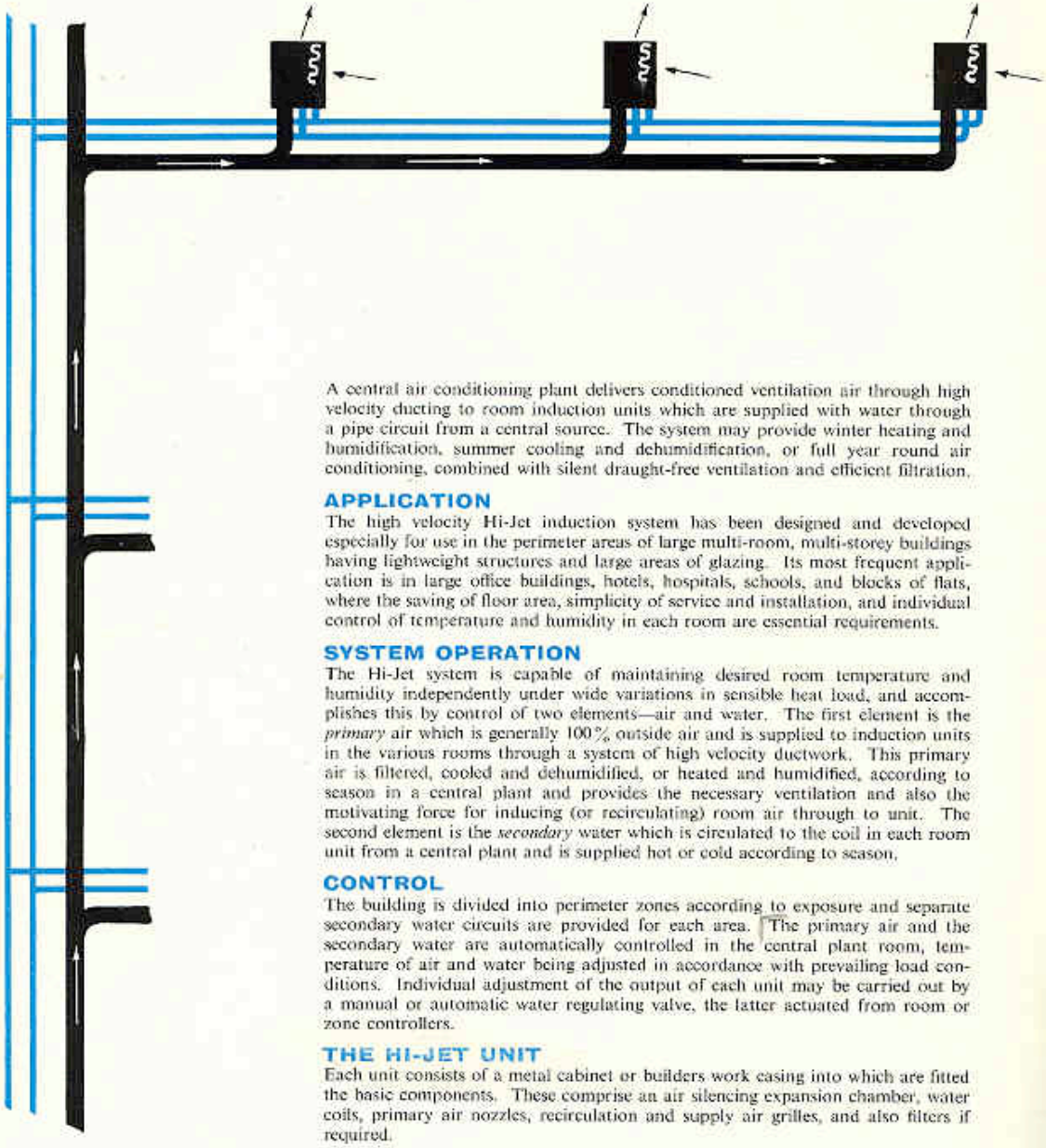


THE *Hi-jet* INDUCTION SYSTEM

Concealed or free-standing units of under-window or high level ceiling type are available.

ADVANTAGES

- Considerable space savings.
- Economical in operation.
- Reduced fan horsepower.
- Individual room control available.
- Low operating noise level.
- Particularly suitable for modular building layouts.
- Adaptable to changes in internal building partitions.



A central air conditioning plant delivers conditioned ventilation air through high velocity ducting to room induction units which are supplied with water through a pipe circuit from a central source. The system may provide winter heating and humidification, summer cooling and dehumidification, or full year round air conditioning, combined with silent draught-free ventilation and efficient filtration.

APPLICATION

The high velocity Hi-Jet induction system has been designed and developed especially for use in the perimeter areas of large multi-room, multi-storey buildings having lightweight structures and large areas of glazing. Its most frequent application is in large office buildings, hotels, hospitals, schools, and blocks of flats, where the saving of floor area, simplicity of service and installation, and individual control of temperature and humidity in each room are essential requirements.

SYSTEM OPERATION

The Hi-Jet system is capable of maintaining desired room temperature and humidity independently under wide variations in sensible heat load, and accomplishes this by control of two elements—air and water. The first element is the *primary* air which is generally 100% outside air and is supplied to induction units in the various rooms through a system of high velocity ductwork. This primary air is filtered, cooled and dehumidified, or heated and humidified, according to season in a central plant and provides the necessary ventilation and also the motivating force for inducing (or recirculating) room air through to unit. The second element is the *secondary* water which is circulated to the coil in each room unit from a central plant and is supplied hot or cold according to season.

CONTROL

The building is divided into perimeter zones according to exposure and separate secondary water circuits are provided for each area. The primary air and the secondary water are automatically controlled in the central plant room, temperature of air and water being adjusted in accordance with prevailing load conditions. Individual adjustment of the output of each unit may be carried out by a manual or automatic water regulating valve, the latter actuated from room or zone controllers.

THE HI-JET UNIT

Each unit consists of a metal cabinet or builders work casing into which are fitted the basic components. These comprise an air silencing expansion chamber, water coils, primary air nozzles, recirculation and supply air grilles, and also filters if required.

The primary air duct is connected to the silencing chambers and the conditioned air passes through the induction nozzles into the casing of the unit. The high velocity air creates a reduced pressure area behind the water coil and induces room air through the recirculation grille and across the water coil, where it is heated or cooled. The unit output is regulated by controlling the rate of flow and temperature of the secondary water. The induction nozzles are specially designed so that the ratio of induced to primary air may be as high as seven to one, thus providing an adequate and effective air circulation rate in the conditioned area.

Branch Offices :-

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BIRMINGHAM	17, Summer Row, 3 Telephone Central 6861
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BRISTOL	1, St. Nicholas Street, 1 Telephone 28454
EDINBURGH	5, Albany Street, 1 Telephone Waverley 4594/5/6
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LIVERPOOL	242, Upper Parliament Street, 8 Telephone Royal 3816
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MANCHESTER	105, Princess Street, 1 Telephone Central 4377
NEWCASTLE UPON TYNE	Lambton House, Lambton Road, 2 Telephone 81-3381
PORTSMOUTH	Anson Road, Milton Telephone 35337
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