Air Control Industries

Air Knives & Reciprocators

Installation, Operation & Maintenance Instruction Manual

Air Control Industries
Ref: Air knives 2014/Iss1

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ACI Air Knife Systems:

1. WHAT IS AN AIR KNIFE?

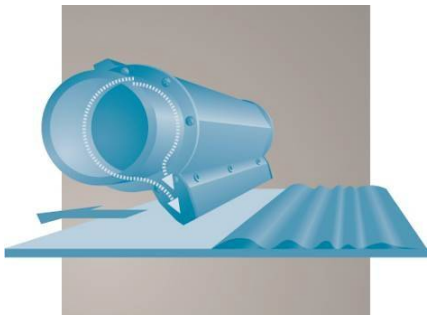
An Air knife is an air delivery tool that provides a continuous laminar air stream that may be utilized for many applications. Typical applications include:

- Surface drying
- Unwanted product removal – such as swarf and/or shavings
- Air curtains
- Cleaning conveyors
- Film control

The design and shape of the Air knife determines the overall exit air efficiency and therefore the ability to solve a particular application. The slot (air exit point) width and the effective slot length are typically the only required parameters for an Air knife. The plenum (internal shape and volume) also contributes to the efficiency of the system.

Air knives accomplish their work in a two stage process:

- First, a high velocity air stream is directed to roll the liquid or material back, creating a standing wave at the point of shear and leaving a thin, residual layer.
- Second, as the "point of impact" of the impinging airflow passes over the residual layer, this layer (if liquid) is shattered or atomized to form minute liquid droplets, which are carried away by the air stream to leave a clean, dry surface. Non-liquids are also removed in this second phase.



Each Air knife System is designed taking into consideration the exact material characteristics and processing requirements of the application involved. Although Air knife systems powered by compressed-plant-air are used in a variety of industrial applications, blower-powered Air knives are a proven cost-effective alternative reducing energy use by 70-95% for the majority of applications. In fact, compressed air is at its most inefficient when discharged into free air.

When compared to compressed air nozzle systems, blower-powered Air knife systems are:

- More cost effective to operate – running costs can be reduced by up to 90%
- Quieter – due to lower pressure operation the expansion ratio and turbulence of the air produced is reduced.
- Cleaner – the air from a centrifugal blower is both dry and oil free. No expensive additional filtration is required.
- Safer – centrifugal blowers operate on the principle of high velocity, low pressure air which presents no danger to operators, unlike compressed air

2. TYPES OF AIRKNIFE:

ACI Air knives designs are engineered profile plenum assemblies providing the maximum efficiency available for high velocity Air knife systems.
The design criteria of the ACI Air knife design is based on providing a highly concentrated air stream to impact the product surface.

ACI supply air knives in the following materials:

a. Aluminium Alloy (Sulphuric anodised extruded sections with stainless steel fixings)

- Anodised Aluminium Alloy AA25 with Stainless Steel Fittings (304)
- Two diameters available – 50mm (AK05) and 76mm (AK08)
- Available in 10mm increments, with a maximum length of 3.5 metres

- Various mounting options are available including studs/spigots and tapped holes
- Longer inlets are available & multiple inlets are required for longer Air knives
- AK05 = 0.11kg, plus 2kg per metre / AK08 is 0.5Kg, plus 3Kg per metre

b. Stainless Steel (304 and 316 options, fabricated / welded construction)

- Material Stainless Steel 304 S11 1-4307 BSI449. Fittings to the same specification

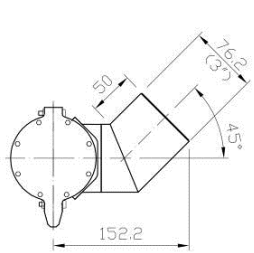
- Various mounting and inlet configurations can be supplied.
- Air knife lengths available in 10mm increments, up to a maximum of 4 metres
- Alternative positions for inlets.
- A variety of shapes such as chevrons, squares and multiple angles available
- Stainless Steel 316 and plastic Air Knives can also be offered.
- Air inlets are available through the endplate(s) and or along the length of both types of Air knives. See following page for all available inlet options:

3. AIR KNIFE SLOT ARRANGEMENT:

ACI designs each system to optimise electrical efficiency and drying performance. The effective gap size has been selected by ACI's sales engineers for each application and therefore should not have to be adjusted in the field.
If there is a valid reason to adjust the slot width of the Aluminium Air knives, loosen the endplate attachment screws and then adjust the blade clamp bolt to suit. The slot width on the stainless steel Air knives can be varied by adjusting the push/pull bolts along the length of the Air knife.
Air knife slot widths are typically set between 1.0 and 2.0mm. Care should be taken when setting widths in excess of 2.0mm as the cross sectional area of the slot may cause the back-pressure to drop giving an uneven distribution.
Care should always be taken with any slot adjustment as increasing the slot width may over load the supply blower.
It is recommended that you contact ACI or your nearest Distributor if any of these procedures lead to a change in the required performance.

SK99-757

DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED



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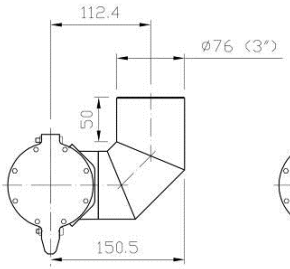

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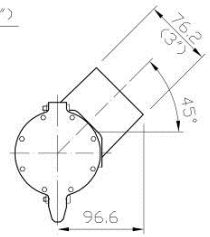

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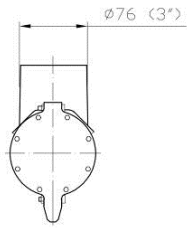

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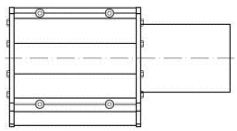
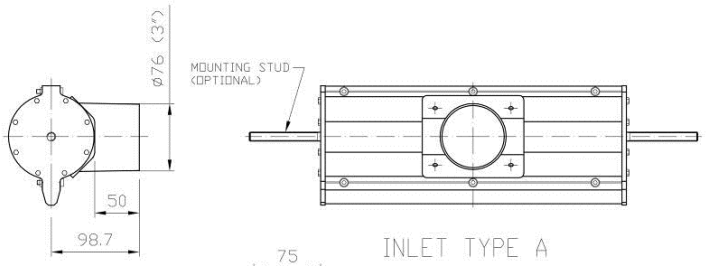


INLET TYPE F

STUDS
M6 X 40
M6 X 100
M8 X 40
M8 X 50
M10 X 50
M10 X 100
M12 X 65
M12 X 135

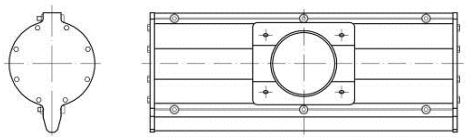
LENGTH A
50
100
150
200
250
300

CENTRE INLET + MOUNTING STUDS

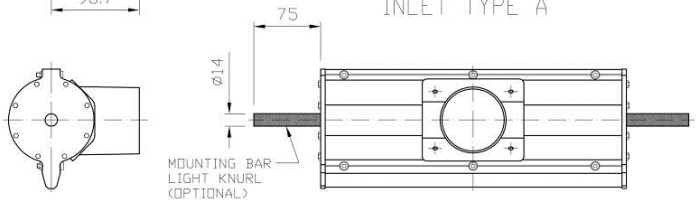


INLET TYPE A

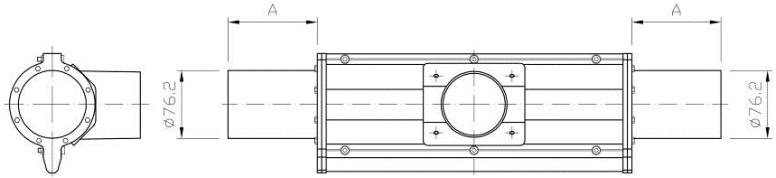
CENTRE INLET + BLANK ENDS

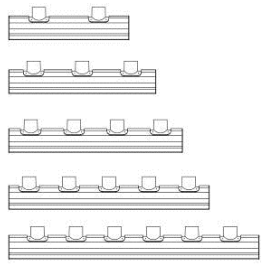


CENTRE INLET + MOUNTING BARS



CENTRE INLET + MOUNTING SPIGOTS





EXAMPLES OF MULTIPLE CENTRE INLETS

NOTES:
FOR ALL OTHER AIRKNIFE DIMENSIONS SEE OUTLINE DRAWING NO. SK92/297

11916	10788.	3094.	1815	ORG.ISSUE	APPROVED
5.	4.	3.	2.	1.	CHANGE No
01/08/12	28/10/09	05/10/06	16/04/02	27/4/99	ISSUE
					DATE

A3

AIR CONTROL INDUSTRIES LIMITED

SCALE 1:5 | DRAWN BY. CE | DATE 27/4/99 | 3rd ANGLE PROJECTION | CONFORMS TO BS308

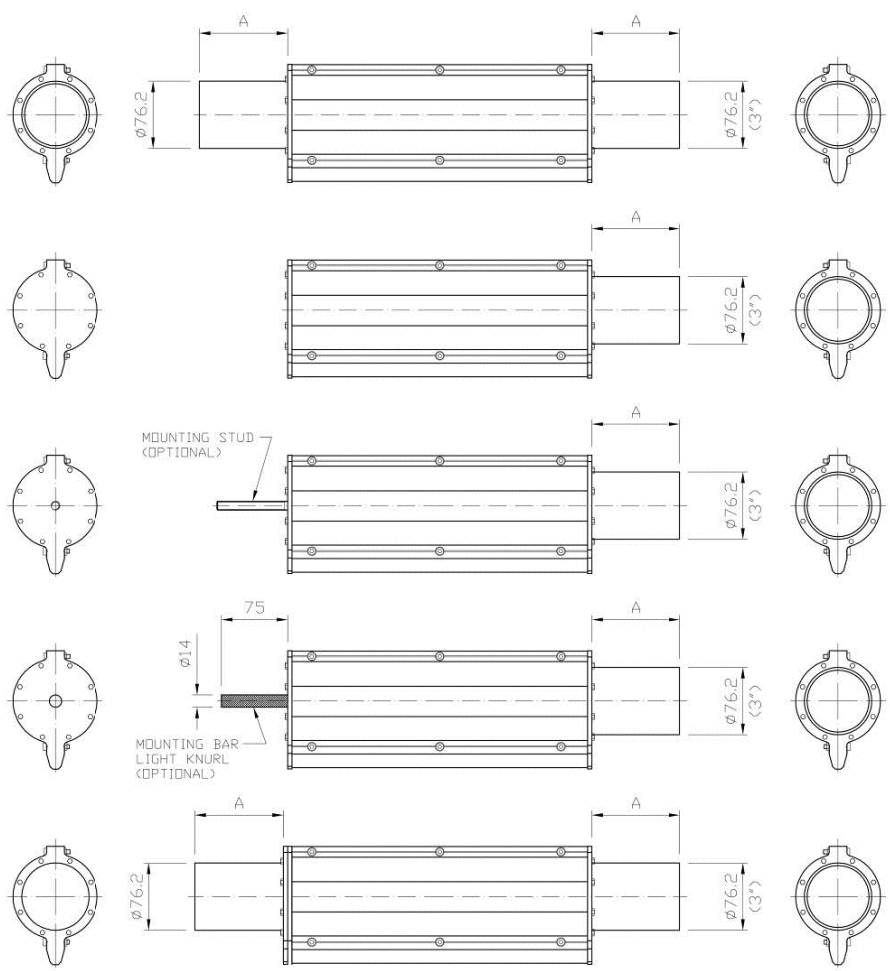
TITLE: OUTLINE AK08 INLET/MOUNTING OPTIONS

DRG No. SK99/757

SHEET 1 OF 2

SK99-757

DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED



STUDS
M6 X 40
M6 X 100
M8 X 40
M8 X 50
M10 X 50
M10 X 100
M12 X 65
M12 X 135

LENGTH A
50
100
150
200
250
300

NOTES:
FOR ALL OTHER AIRKNIFE DIMENSIONS
SEE OUTLINE DRAWING NO. SK92/297

11916	10788.	3094.	1815	ORG.ISSUE	CHANGE No
5.	4.	3.	2.	1.	ISSUE
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A3

AIR CONTROL INDUSTRIES LIMITED

APPROVED | SCALE 1:5 | DRAWN BY. CE | DATE 27/4/99 | 3rd ANGLE PROJECTION | CONFORMS TO BS308

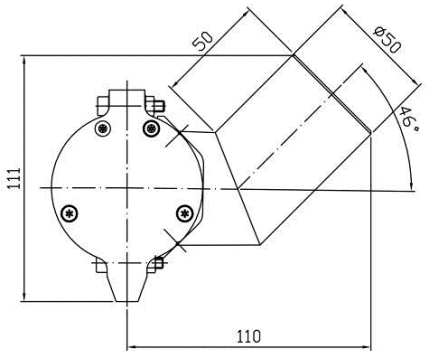
TITLE: OUTLINE AK08 INLET/MOUNTING OPTIONS

DRG No. SK99/757

SHEET 2 OF 2

DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED

SK03-1360



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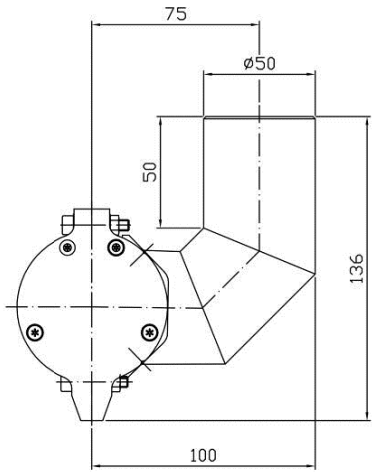
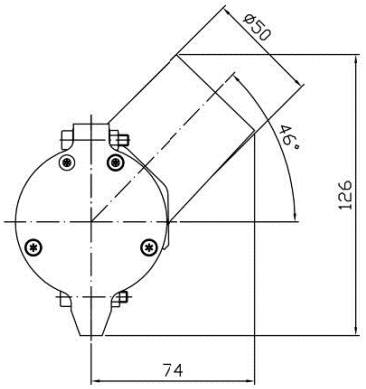
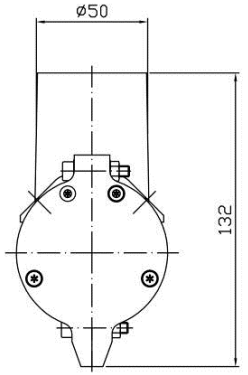


INLET TYPE C



INLET TYPE D



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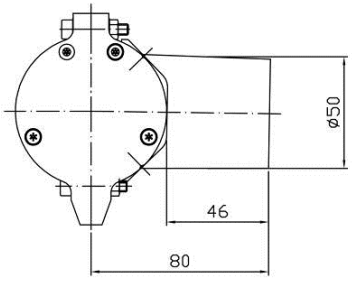
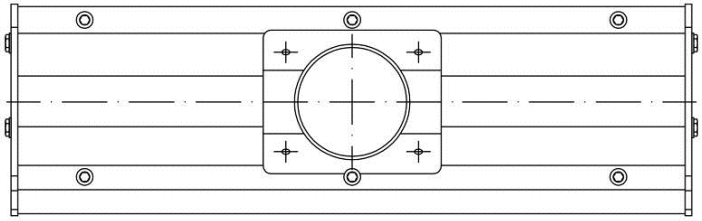


INLET TYPE A



NOTES:
FOR ALL OTHER AIRKNIFE DIMENSIONS
SEE OUTLINE DRAWING NO. SK95/433

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A3

AIR CONTROL INDUSTRIES LIMITED

SCALE	DRAWN BY.	DATE	3rd ANGLE PROJECTION	CONFORMS TO BS308
1:2	CE	17/12/03		

TITLE: OUTLINE AK05 CAST CENTRE INLETS

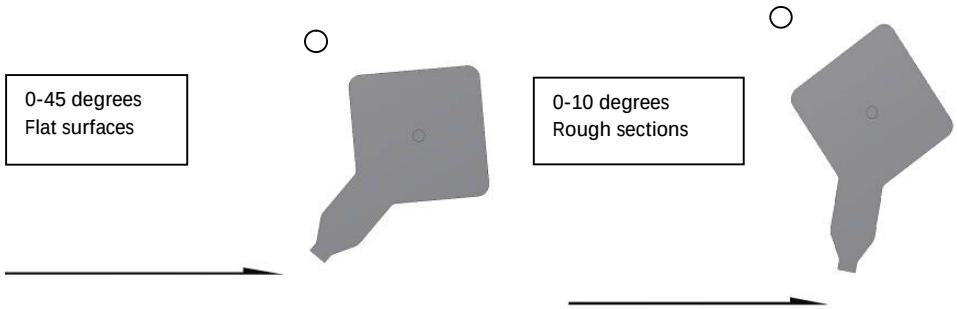
DRG No. SK03/1360

SHEET 1 OF 1

4. MOUNTING & EFFECTIVE AIR KNIFE POSITIONING:

Air knives need to be mounted as close to the product to be dried as possible for safe and efficient operation. For conveyor applications this may require a modification to the guide rails. In most instances a section of the guide rail will have to be cut and removed to allow the Air knife to be placed close to the product. The distance of the Air knife exit to the product dictates the pressures and airflow required to produce the required effect. The further the Air knife is from the product, the higher the airflow rate. This means a need for a larger blower which can then have a significant increase in power requirements.

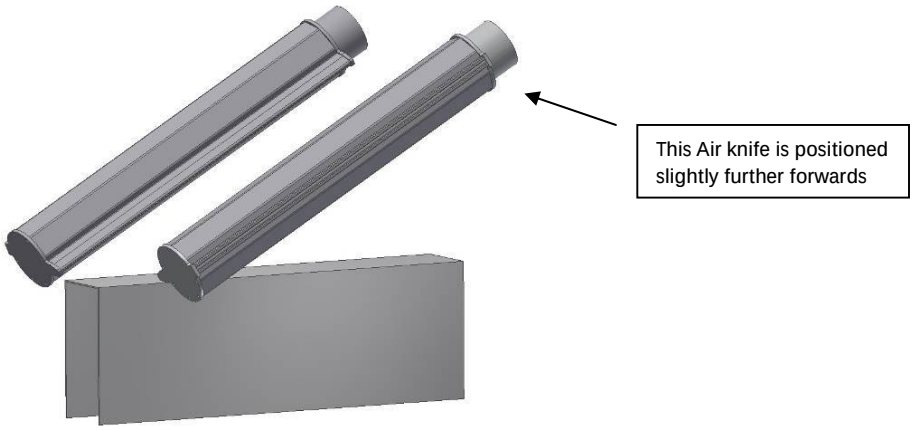
If you are unsure of the correct positioning, please contact ACI or your nearest Distributor.



Please note – all supplied ACI mounting brackets need to be solidly mounted to a fixed surface using the fixings/hardware provided.

5. AIR KNIFE NOISE LEVELS

Opposing Air knives can generate high noise levels. By simply offsetting the Air knives, this problem is normally avoided.



Please be aware that high-velocity air impinging on irregular shapes will also create high noise levels. If the noise levels cannot be reduced by changing the angle of the Air knife or the product itself then some form of acoustic screening may need to be considered. Please contact ACI or your nearest Distributor for further information/advise.

Please note – any tappings present on supplied air knives must remain capped if there are no nozzles are fitted.

6. AIR KNIFE ADJUSTMENTS

Once Air knife brackets are securely mounted, the Air knife must be adjusted to optimize performance. The final position of the Air knife is determined by the function that it serves.

All side air knives must be located as close to the product as possible. The side guide rails must be cut to allow airflow to contact the product unimpeded. The angle of the side air knives is dependent on the length of the Air knife and the height of the product. The Air knife effective slot should extend ½ inch (12 mm) above the product top to assure 100% contact with the product. On the low side of the product, the Air knife slot should also be positioned ½ inch (12 mm) above the conveyor to prevent depositing water back upon the product.

Side air knives should be staggered by approximately 1.5 inches (38 mm). This 1.5 inch (38 mm) staggering is required to assure front and trailing edge drying as well as providing opposing forces to maintain product position. An approximate 10° downturn of the air knives is recommended to force the direction of water down the product. The side air knives should be mounted in reference to the product direction. This forces the water from the top of the product to the bottom of the product. The top Air knife should be mounted before the side air knives to prevent re-depositing the water on the sides of the can.

7. ADJUSTABLE AIR KNIVES

Adjustable Air knives are fundamentally the same as the aluminium range. The difference being that the discharge area can be varied using a bar to block off a portion of the outlet. This is turn would give an increase in performance. This hybrid is particularly useful on bottle drying lines when different height bottles need to be dried on the same line. For further information please contact ACI or your nearest Distributor.

8. GENERAL AIR KNIFE MAINTENANCE:

ACI Air knives require very little maintenance as there are no moving parts. Nevertheless, any reduced performance from an Air knife will normally result from:

- Blocked or dirty inlet filters on the blower (The standard inlet filters have a filtration rate of 5-7 microns. We recommend that the filters are inspected at least every month and replaced every 6 months. Always refer to the supplied blower manual for further instructions on how to replace a filter. Actual timescales depend on the working environment.)

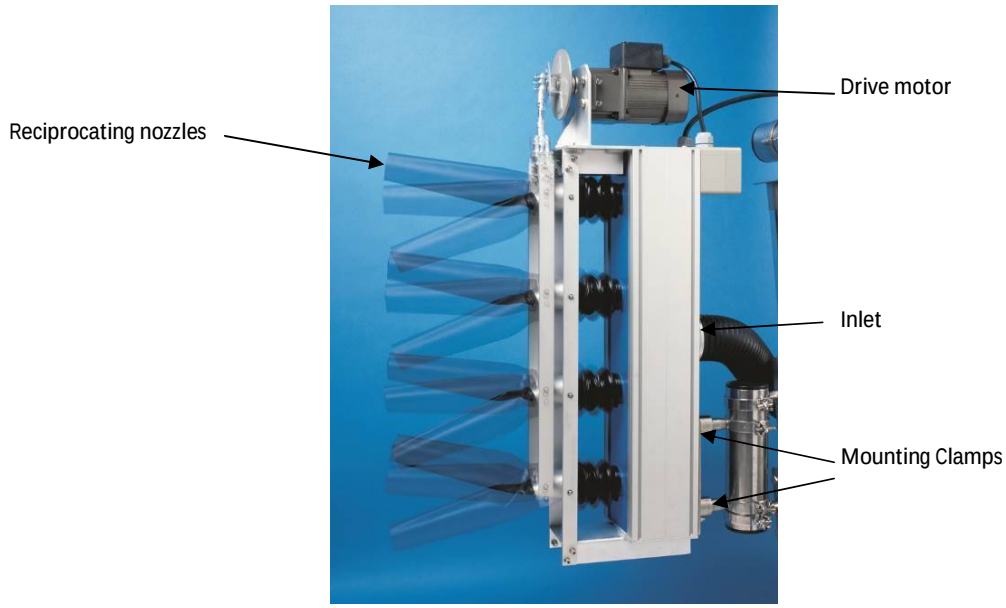
- Blocked Air knife slot (To remove blockages open up the Air knife slot and remove using a soft implement. Please note: never use a metal tool to remove blockages as this can result in damage to the Air knife blade). When all the embedded dirt has been dislodged it should be rinsed in clean water and allowed to drain before being re-fitted to the line.)

9. RECIPROCATOR SYSTEMS:

a. Mounting:

Reciprocators can be mounted on the side, back or bottom faces, with clamping arrangements to suit.

- Connect the reciprocator to the air and electric supplies.
- The optimum position of the reciprocator may be established during trials.



b. Adjusting the air-throw:

- Isolate the blower and the reciprocator from the supply.
- Remove the cam cover.
- Disconnect the throw arm from the cam.
- Reconnect the throw arm in a different position (Shorter throw – closer to the centre. Longer throw – closer to the outside edge).
- Replace the cam cover ensuring all fixings are tight.

c. Maintenance:

- Replacing flexible hose
  - Isolate the blower and the reciprocator from the supply.
  - Remove the Jubilee Clips
  - When the Jubilee Clips are removed, compress the flexible hose to release it.
  - To fit the new flexible hose repeat these instructions in reverse, making sure the Jubilee Clips are located over the rebates of the spigots.
- Replacing nozzles
  - Isolate the blower and the reciprocator from the supply.
  - Remove the hose clip. After the nozzle has been replaced re-tighten the clip.

Care should be taken not to overload the blower. If any holes develop within the nozzle, the nozzle should be changed immediately as the extra flow could overload the blower. For ant spare parts or any other problems, please contact ACI immediately, or your nearest Distributor.

10. DE-IONISATION SYSTEMS

Anti-static or Static Neutralisation Bars are added to airknife discharges and are available in 2 formats.

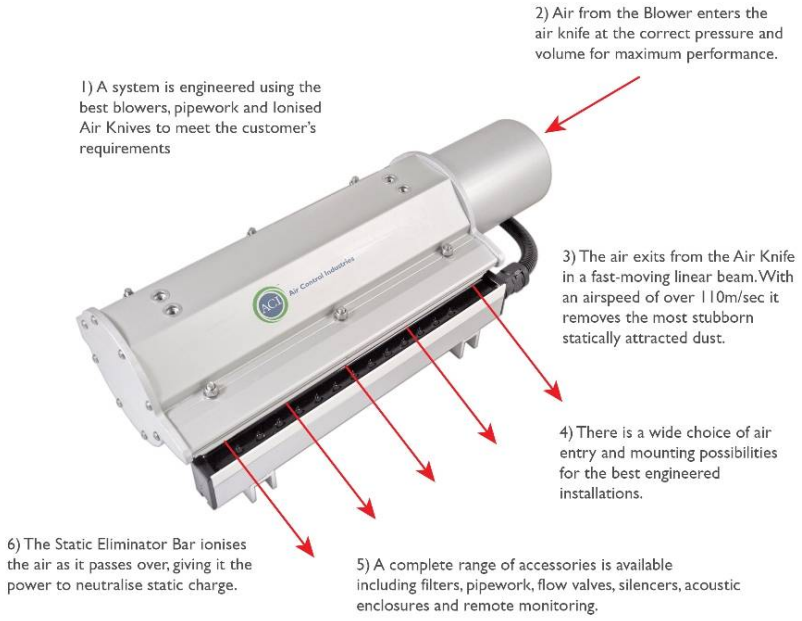
- Type EX Bars
- Type MEB (not included in this manual – please refer to the instructions given when purchasing the anti-static airknife & power supplies for this product.)

Specification:

Length:	From 60mm to 6m.
Construction:	Anodised aluminium, epoxy resin, PVC and hardened etched emitters.
Cable:	Hi-Flex PVC, 30kV screened cable with 70mm bend radius. Standard length is 2m - longer lengths can be specified at time of order, (subject to maximum load on power unit), 90° cable exit option. Bars may be supplied in series - joined by cable.
Power Unit:	Use with Fraser 5.5kV & 6kV Power Units - see datasheets.
Safety:	5mA maximum current from Power Unit. High voltage resistance inside bars further limits current below 50µA.
Mounting:	See sketches to show 1250 and 1250-S options. 200mm x 20mm steel fixing strips are supplied with each bar.
Environment:	60º maximum temperature. 70% rH non-condensing max.
Standards:	CE. UL (US and C) Listing is a free of charge option.

- How it works:
  They work by applying high voltage to an emitter in a controlled and safe way. The electric field around the emitters ionises the air - breaking it up into positive and negative ions. These ions neutralise static electricity by being attracted to charges of the opposite polarity. Unused ions quickly dissipate into the atmosphere.

- Positioning:
  - The best location is usually just before the place where static is causing a problem.
  - The material to be neutralised should be surrounded by free air and not be in contact with another surface as it passes through the static bar.
  - The static bar should be placed as close to the product as possible.



Under no circumstances should any part of the anti-static bars be covered (even partially) by metallic parts. All anti-static bars should be connected by a qualified electrician.

- Installation:
  For all installation instructions please refer to the details instructions supplied when purchasing the anti-static air knife & power supplies for this product. If you have any questions concerning this area please do not hesitate to contact ACI or your nearest distributor.

11. AIR KNIFE SYSTEM DUCTING
    The ducting between the blower and the Air knife always needs careful consideration and significant losses in pressure and performance can easily occur if the following simple rules are not followed:

    - Distance: The distance between the blower and the Airknife 'the duct run' should be kept to a minimum – ACI Technical Sales Engineers will need to be consulted.
    - Bends: The number of bends should be minimised. Bends should be generous and sweeping
    - Smooth Bore: Ducting should have clean, smooth bore and butt type joints should be used
    - Rigid Ducting: This should be used wherever possible. Flexible ducting should be kept to a minimum. If it has to be used, a type with the smoothest internal bore should be selected.
    - Diameter: the diameter of ducting should either be the same as or larger than that of the blower discharge. Sharp changes in cross section of the ducting should also be avoided.
    - Installation: ACI ducting is assembled using a flange and joint clamp arrangement. There is no need to cut any of the ducting to length as there are a series of telescopic sections which will take up any variations in lengths required.
    - Telescopic Sections: Care should be taken to assemble these in the correct orientation to avoid unnecessary turbulence and noise.
    - Joint Clamps: Ensure that the seal is fitted around one flange of a mating pair.

12. TROUBLESHOOTING:
    The following table is a list of common problems that may be encountered during installation/operation. If this information fails to solve the problem, please contact ACI directly or your nearest Distributor.

PROBLEM	ACTION
Little or no air pressure	• Check blower wiring • Check blower rotation direction • Check all ducting and connections • Check and clean blower filter
Inadequate drying/blowing performance	• Air knives too far from product • Air knives not positioned correctly • Incorrect Air knife gap set • Check blower wiring/rotation/filter
Excessive noise	• Air knives not staggered correctly • Acoustical screening / attenuation required

13. Warranty & Service Exchange:
    Air Control Industries Limited (ACI) warrants all products manufactured by ACI to be free of defects in material and workmanship for twelve (12) months from the date of shipment. The warranty does not apply to drive belts, filter elements or connecting hose, unless authorised by an officer of ACI. Also, not covered under the warranty is normal wear and tear, neglect or misuse of the equipment, operation in an application not approved by ACI, and alterations not performed by ACI.

    All items supplied by ACI that are manufactured by others shall be warranted under the respective manufacturer's policy. Motors and other items, for which a national service network is in place, should be sent directly to that manufacturer's representative for the most prompt service. ACI will provide any support required ensuring that warranty service by others in handled in a prompt and professional manner.

    The ACI warranty is limited to the repair or replacement of items shipped by ACI. At no time will ACI be liable for any of the costs to the buyer for labour, transportation or down-time resulting from defective equipment furnished by ACI, or our suppliers.

    To comply with the Warranty the complete fan unit must be returned to ACI. Disassembly of the fan will invalidate the warranty.

14. Manufacturer Service Address:
    Our products are manufactured in compliance with applicable international standards and regulations. If you have any queries regarding the use of our products, or if you are planning a special application, please contact the nearest ACI distributor or their main office:

    Air Control Industries Ltd
    Weycroft Avenue, Millwey Rise Industrial Est.
    Axminster, EX13 5HU, UK
    Tel: +44 (0)1297 529 242
    Fax: +44 (0)1297 529 241
    Email: sales@aircontrolindustries.com
    Web: www.aircontrolindustries.com