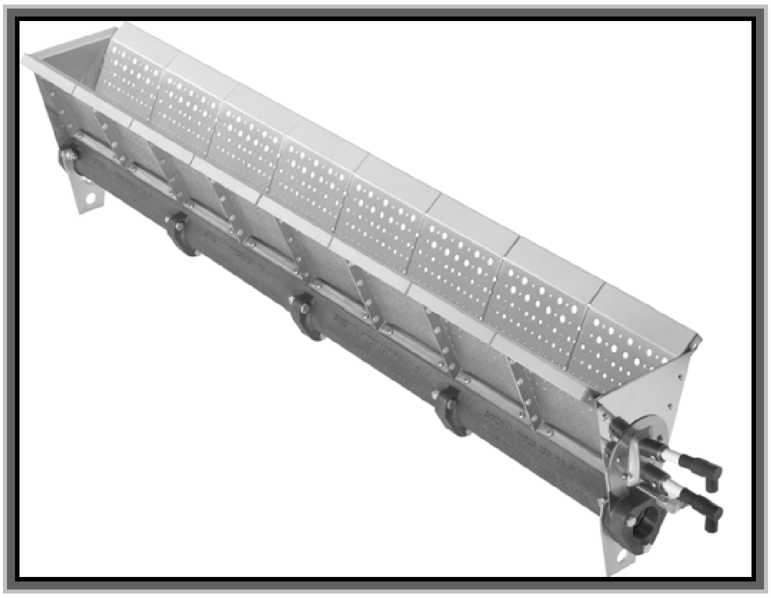
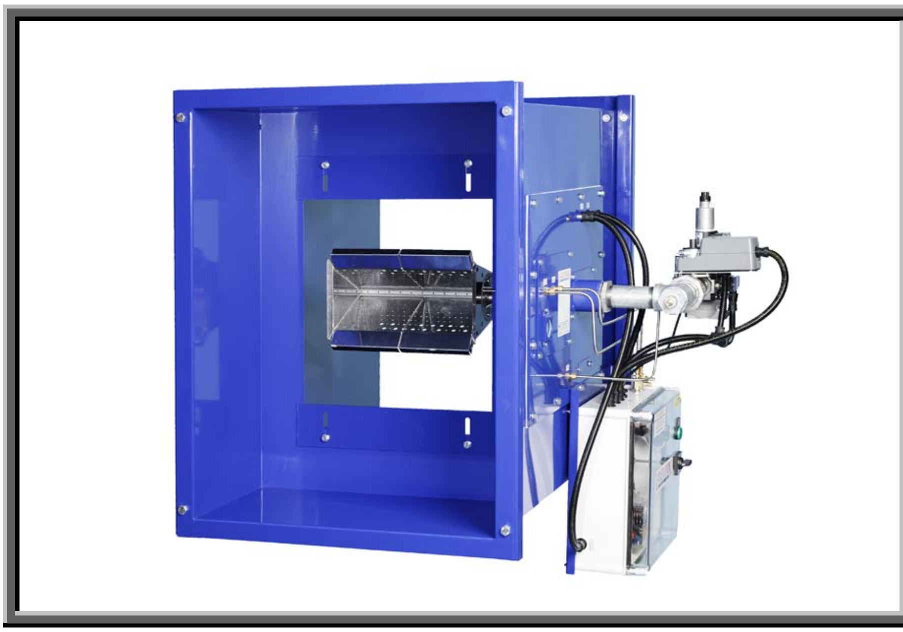
LANEMARK INTERNATIONAL

Lanemark Midco HMA2A Series Air Heating Burner and DB Duct Burner System Application Manual

HMA2A Burners



DB Duct Burner Systems



Quality ISO 9001 SAI GLOBAL

UKAS QUALITY MANAGEMENT 018

Registered Address: Lanemark House, Whitacre Road, Nuneaton, Warwickshire, UK, CV11 6BW
Tel: +44 (0) 24 7635 2000 Fax: +44 (0) 24 7634 1166
E-mail: info@lanemark.com Web site: http://www.lanemark.com
Company Registration No. 1561589 VAT No. GB 307 5790 48
Place of Registration: England & Wales
Directors: P.R. Collier, J.S. Foster, A.E. Thompson

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Section 1 Introduction

Lanemark HMA2A series Air Heating Burners and DB Duct Burner systems are designed to provide a high efficiency, high turndown, low emission solution for air replacement or "make-up" air heating applications.

They are ideally suited to offer precise temperature control for applications such as:

- ***Paint spray booth air heating - spray and bake cycles***
- ***Parts dryers***
- ***HVAC air replacement schemes for factories, warehouses, distribution centres …***
- ***Crop dryers***

Lanemark HMA2A series burner assemblies can either be supplied as:

A. Individual units for integration into "customer" designed air heating modules.

or within

B. DB Duct Burner systems which also incorporate a duct mounting plate, modulating gas valve train & control box.

or as

C. Complete air heater assemblies, built to client specifications to include a DB Duct Burner and an air circulation fan.

Lanemark HMA2A series burner assemblies operate directly within the heated air flow and can be located either upstream or downstream of the main air supply fans.

Specifications

Firing rates	-	up to 220 kW (750,000 Btu/h) per 12 inch (305 mm) burner length
Process air velocity range	-	7.5 to 18 m/s (1500 to 3500 ft/min)
Differential air pressure range	-	0.5 to 3.0 mbar (0.2 to 1.2 in w.g). (across the burner)
Turndown	-	up to 30:1
Efficiency	-	100% based on LHV* (92% based on Gross CV**)
Burner head gas pressure range	-	Natural Gas : 6 - 20 mb at full output Propane : 2 - 8 mb at full output
Burner head orientation	-	Either horizontal or vertical parallel to air flow
Burner head configuration	-	Straight (standard) "H" or "I" arrangements (on request)
Flame lengths	-	Natural: 280 – 405mm (11 – 16in) Propane: 205 – 330mm (8 – 13in)
Emissions	-	<5 ppm CO and <0.5 ppm NO_2 up to 65ºC temperature rise across the burner
Process Air Temperatures	-	up to 100ºC (standard) (for higher temperatures please consult Lanemark)
Construction	-	Either : aluminium burner casting + stainless steel baffles or : cast iron + stainless steel baffles

*Lower Heating Value (gas)
** Gross Calorific Value (gas)

Section 2 Design Calculations

Lanemark's DbCalc© software is available to determine burner ratings and to specify minimum duct dimensions/ profile plate designs.

Input data required:

A. Airflow (Nm^3/h or scfm)

B. Minimum "air on" temperature (ºC or ºF)

C. Maximum "air off" temperature (ºC or ºF)

D. Preferred firing rate (kW or Btu per ft (305 mm) section)

DbCalc© will calculate:

1. Heat input required (kW or Btu/h)
2. Burner length (mm or inches)
3. Minimum duct width & height (mm or inches)
4. Profile plate dimensions (mm or inches)
5. Burner turndown (& minimum achievable heat input)
6. Required air pressure drop across the burner
7. Burner head gas pressure for either natural gas or propane

Please refer to Appendix A for examples of ***DbCalc©*** results printouts.

Please refer to Appendix B for ***DbCalc©*** Calculation Method & Examples

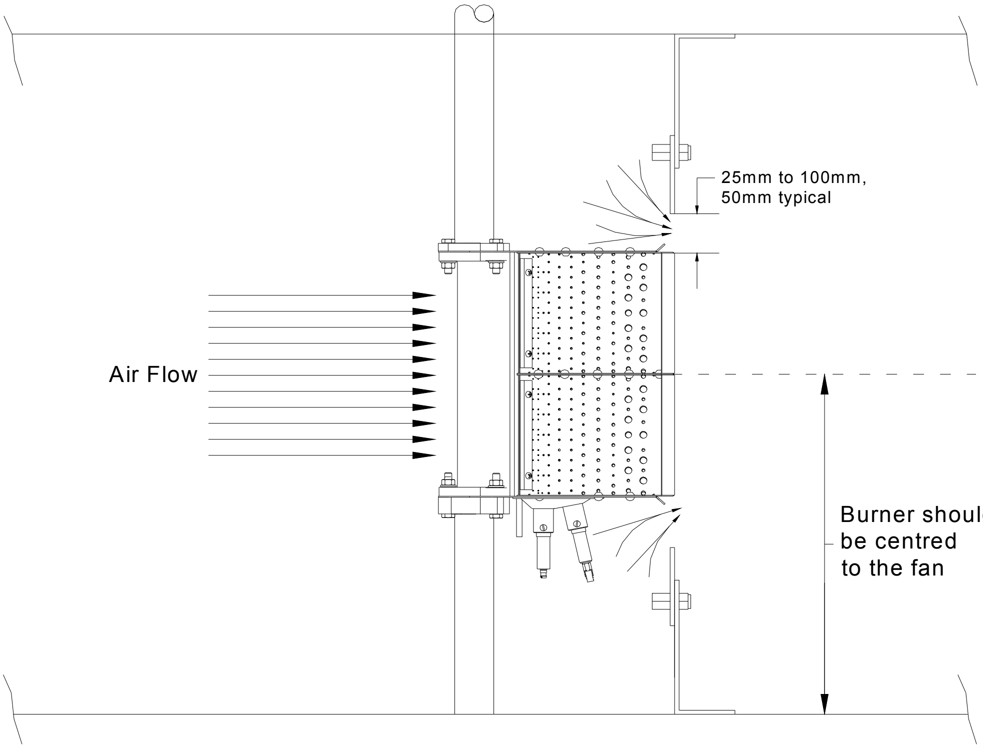
Section 3 Burner Mounting Arrangements

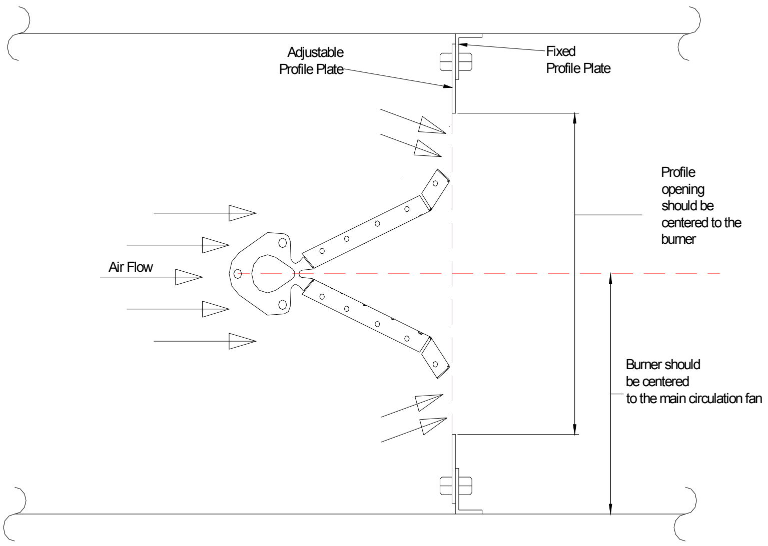
For “make-up air” or “air replacement” heating applications, Lanemark Midco HMA2 burners normally operate with 100% fresh air.

For spraybooth, dryer or process oven applications it is important that adequate fresh air is available at all times to meet the combustion requirements of the burner. (Refer to Appendix C for combustion air flow calculation details)

It is important to maintain a laminar airflow around the burner and should be located in the centre of the profile. (Any reinforcements used in the profile construction should be located on the downstream side of the profile).

The profile plate should be constructed such that the width is fixed but adjustments incorporated above and below the burner (+/- 2” – 50 mm is typical).

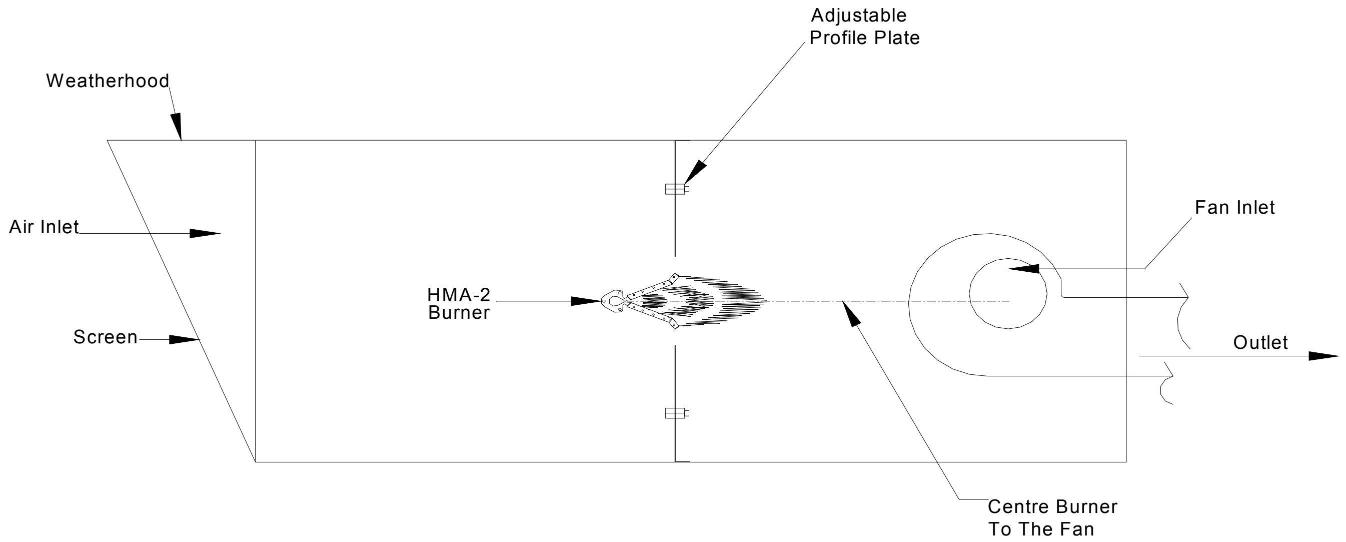




The burner can be mounted horizontally or vertically.

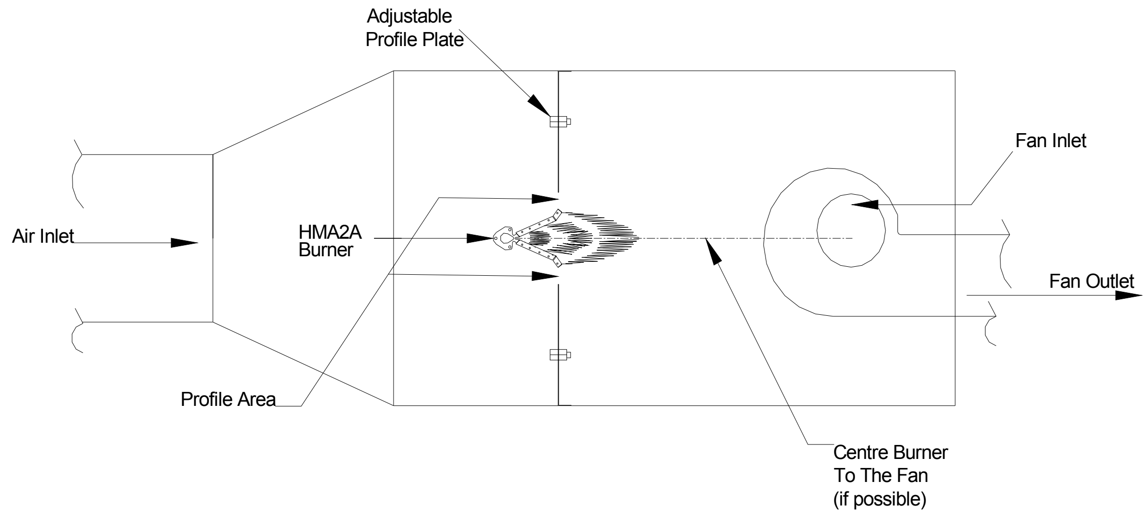
The preferred method of operation is for the burner to be located upstream of the main circulation fan so that the fan acts as a mixing device, eliminating any temperature stratification at the outlet of the heating unit.

Heater Installation



Duct Installation

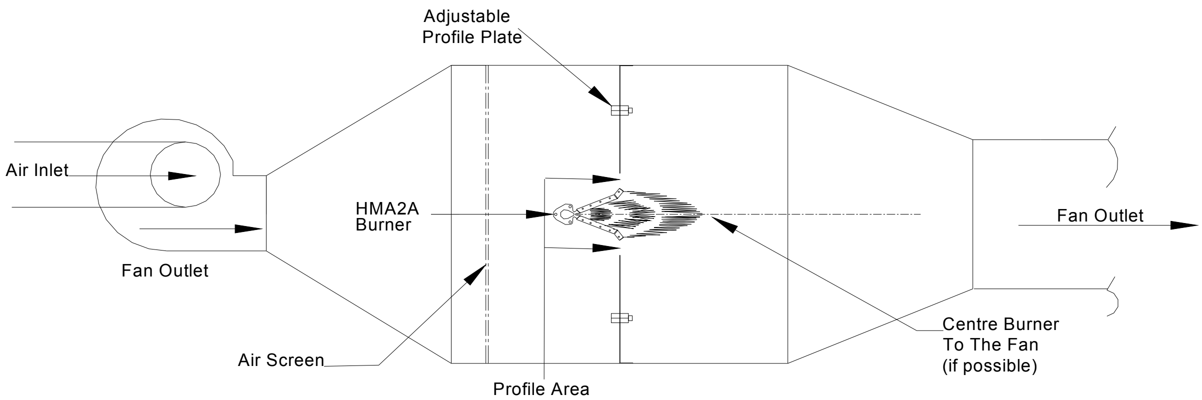
Pull-Through Arrangement



Push-Through Arrangement

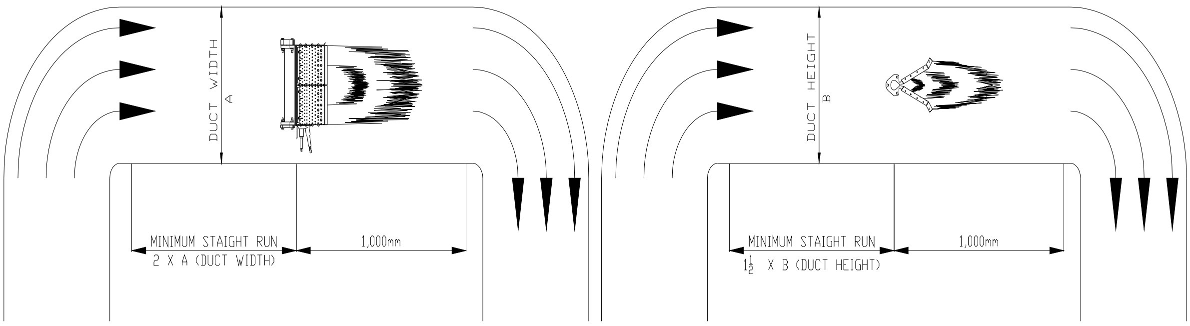
The HMA2A burner will also operate satisfactorily when located downstream of the circulation fan.

For these applications an "air screen" (see example below) can be located before the burner, to create the required laminar flow.



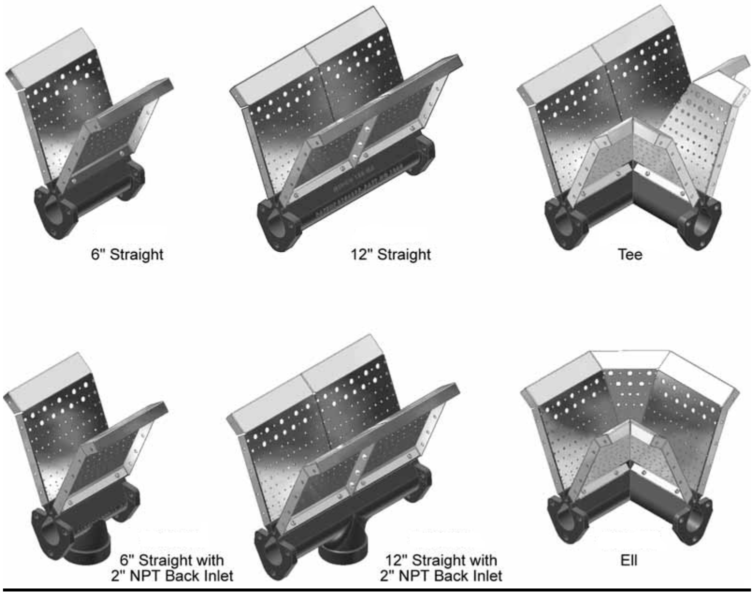
Duct Elbow/Bend Considerations

The diagrams below should be used as a guide to the minimum distances that should be allowed to/from outlet/inlet duct bends.



Burner Configurations

HMA2A burners can be configured using a combination of components assemblies as shown below

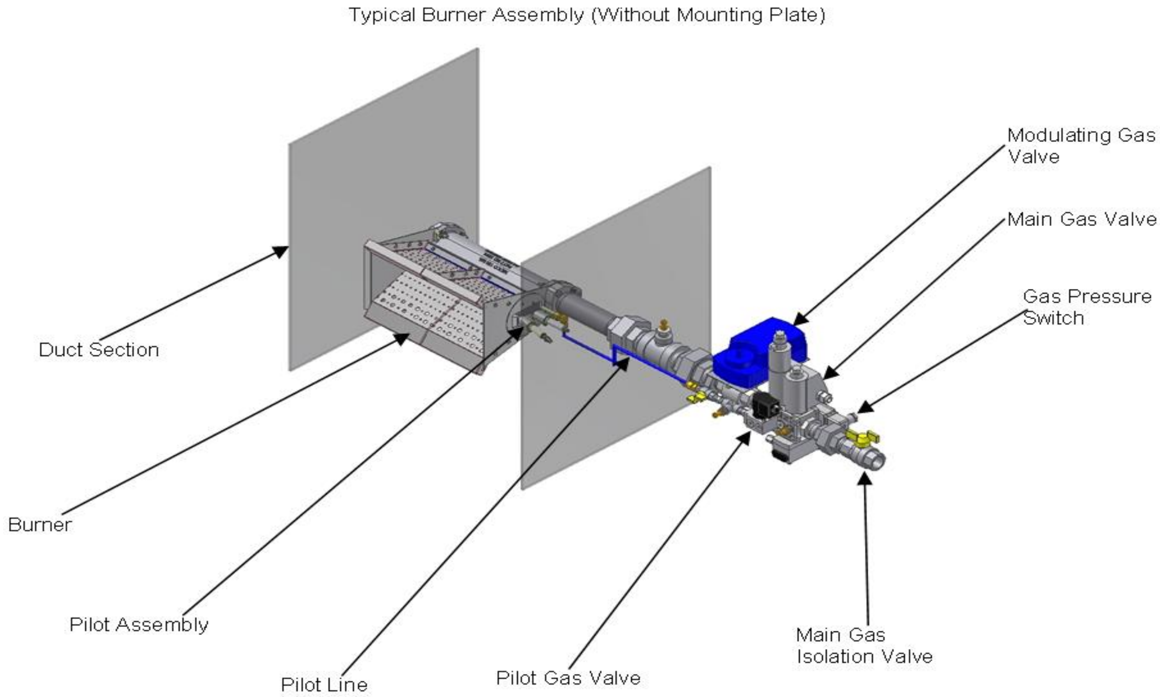


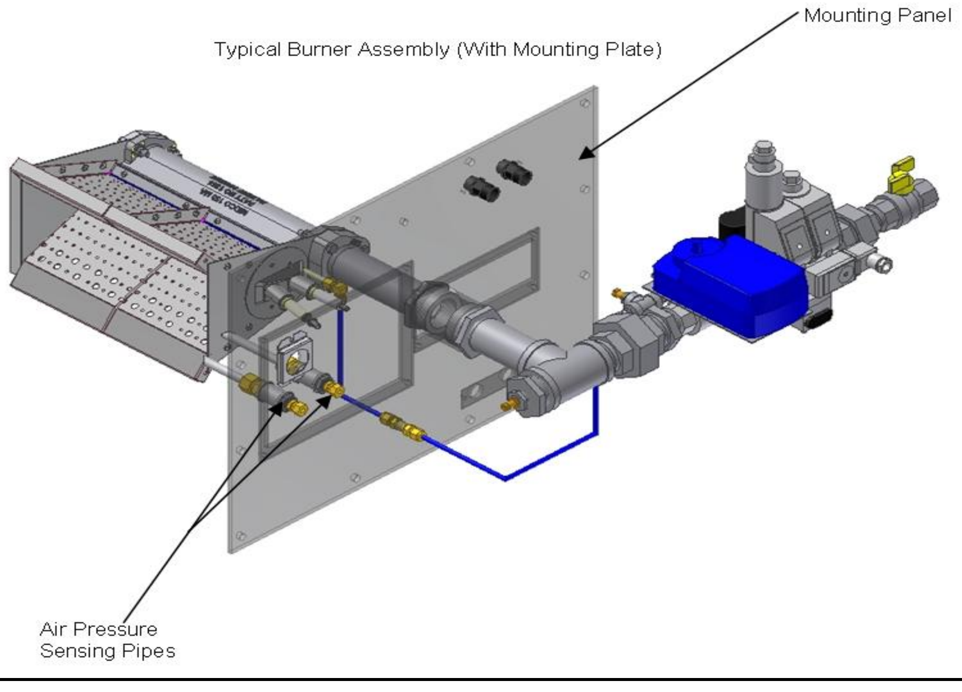
Gas Manifold Requirements

Maximum length of burner	**:**	**End inlet (1.5”)**	**:**	**48” (1220 mm)**
		Rear Inlet (2”)	**:**	**78” (1980 mm)**

For burner lengths > 78” (1980 mm) multiple rear inlet connections will be required – refer to Lanemark for suitable gas manifold design arrangements.

Typical Gas Valve Train Arrangement





Circulation Air Fan Specification Requirements

When selecting a circulation fan the available air pressure must take account of the required pressure drop across the burner in addition to all other system requirements.

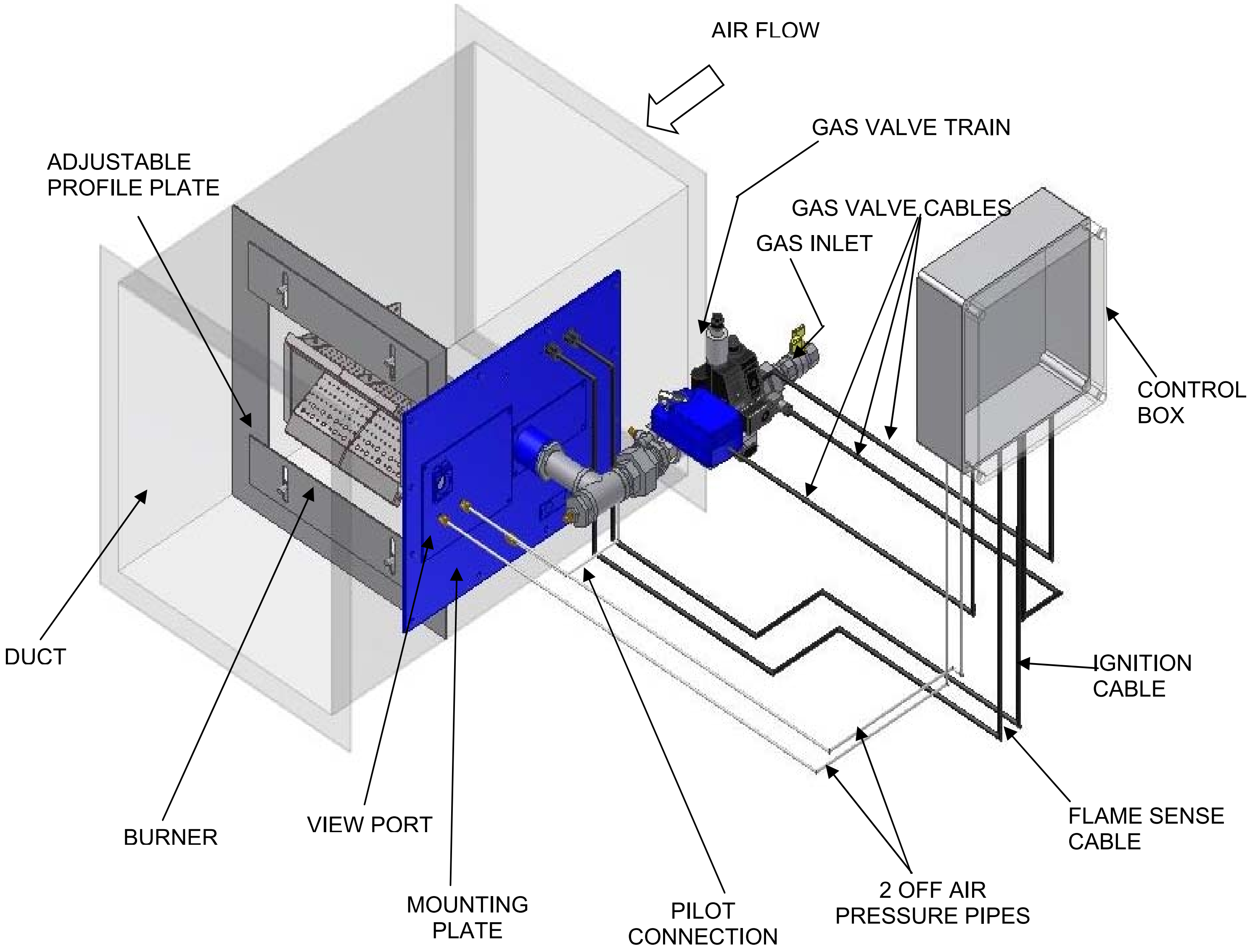
Firing Rate per 305 mm Section Natural Gas	**Air Δp over burner head at STP**
147 kW	125 Pa
162 kW	150 Pa
176 kW	175 Pa
191 kW	200 Pa
206 kW	225 Pa

Firing Rate per 305 mm Section Propane Gas	**Air Δp over burner head at STP**
147 kW	175 Pa
162 kW	200 Pa
176 kW	225 Pa
191 kW	263 Pa
206 kW	300 Pa

Firing Rate per ft Section Natural Gas	**Air Δp over burner head at STP**
500,000 Btu/h	0.5 in w.g
550,000 Btu/h	0.6 in w.g
600,000 Btu/h	0.7 in w.g
650,000 Btu/h	0.8 in w.g
700,000 Btu/h	0.9 in w.g

Firing Rate per ft Section Propane Gas	**Air Δp over burner head at STP**
500,000 Btu/h	0.7 in w.g
550,000 Btu/h	0.8 in w.g
600,000 Btu/h	0.9 in w.g
650,000 Btu/h	1.0 in w.g
700,000 Btu/h	1.2 in w.g

Typical Lanemark Duct Burner Assembly



APPENDIX A *DbCalc©* Calculation Printout Example

Duty:	**Airflow**	**:**	**10 Nm^3/s**
	Fuel	**:**	**Natural Gas**
	Inlet Temperature	**:**	**-5ºC**
	Outlet Temperature	**:**	**25ºC**

HMA2A DbCalc® DUCT BURNER SIZE & PROFILE CALCULATIONS

Enquiry/Quotation Ref	**Example 1**	
Customer	**Any Co Ltd**	
Application Ref	**Demonstration**	
Fuel	**Natural Gas**	
Air Flow in **Nm^3/s** (m^3/s at 0ºC)	**10.0**	
Inlet temperature in ºC	**-5.0ºC**	
Outlet temperature in ºC	**25.0ºC**	
ΔT in ºC	**30.0ºC**	
Permissible rise in mild weather in ºC *(Std = 2.5)*	**2.5**	
Desired burner capacity	**600 ,000 Btu/h/ft**	*176.0 kW/ft*
Design Profile velocity	**14.7 m/s**	
Actual Profile velocity	**14.6 m/s**	

Calculated Data

Duct Burner Model Reference	**DB05 -N**	
Maximum Burner capacity	440 kW	
Calculated Required Burner Rating (net to process)	362 kW	(net)
Calculated Burner Rating (gross)	394 kW	(gross)
Turndown ratio required	14.6 to 1	
Calculated number of 6" burner sections required	5.0	
Design Air Δp over burner head at STP	1.75 mb	
Burner Head Gas Pressure	12.5 mb	
Burner CSA	0.151 m^2	
Calculated net profile area (excluding burner)	0.682 m^2	
Calculated total profile area (including burner)	0.833 m^2	
Calculated width of profile opening	870mm	
Minimum duct width	1,070mm	
Calculated height of profile opening	960mm	
Height of profile opening	960mm	
Minimum duct height	1,170mm	

APPENDIX A ***DbCalc***© **Calculation Printout Example (continued)**

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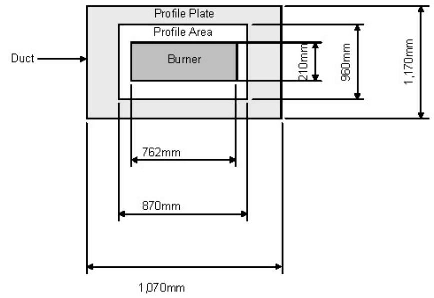
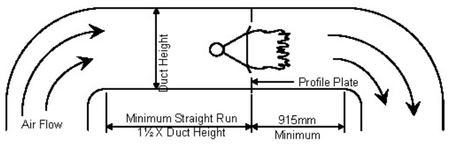
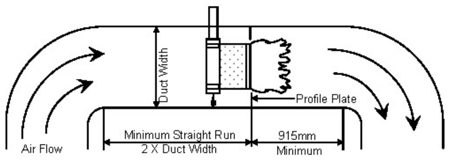
HMA2A DbCalc® DUCT BURNER DIMENSIONS Example 1 Any Co Ltd Demonstration



INSTALLATION IN DUCT





APPENDIX B ***DbCalc©*** Calculation Method & Examples

Lanemark's DbCalc© software will use the following formula to calculate the required net heat input:

Q (kW) = Airflow (Nm^3/s) x **Temperature rise** (ºC) **x Air Density** x **Specific Heat of Air**

or

Q (Btu/h) = Airflow (**scfh)** x **Temperature rise** (ºF) **x Air Density** x **Specific Heat of Air**

The required gross gas input = Required net heat input/0.92

The gross gas input ÷ firing rate per 12" (305 mm) section will determine the required burner length.

Minimum section length = 6" (150 mm).

Example:

A. Airflow = 5 Nm^3/s

B. "Air on" temperature = -5 ºC

C. "Air off" temperature = 25 ºC

D. Preferred firing rate = 600,000 Btu /176 kW) per 12" (305 mm) section

Required net heat input = 181 kW

Required gross gas input = 197 kW

Number of 6" (152.5 mm) sections = 197 ÷ 176 = 1.12 x 2 = 2.24 which is "rounded up" to 3.

Total burner length = 3 x 6" = 18" (or 3 x 152.5 mm = 458 mm)

The required net profile area (excluding the burner) = Airflow/Profile velocity (determined by burner firing rate)

Firing Rate/12" section	***Profile Velocity***
500,000 Btu/h	12.4 m/s
550,000 Btu/h	13.6 m/s
600,000 Btu/h	14.7 m/s
650,000 Btu/h	15.7 m/s
700,000 Btu/h	16.6 m/s

Net Profile Area (excluding burner) = 5 $Nm^3/s/14.7\ m/s = 0.34\ m^2$

Total Profile Area (including burner) = Net Profile Area + Burner Profile Area (0.03 m^2 / 6" burner section)

= 0.34 + 0.09 = 0.43 m^2

Required width of the profile opening = Total burner length + 100 mm (4") = 558 mm (rounded to 560 mm)

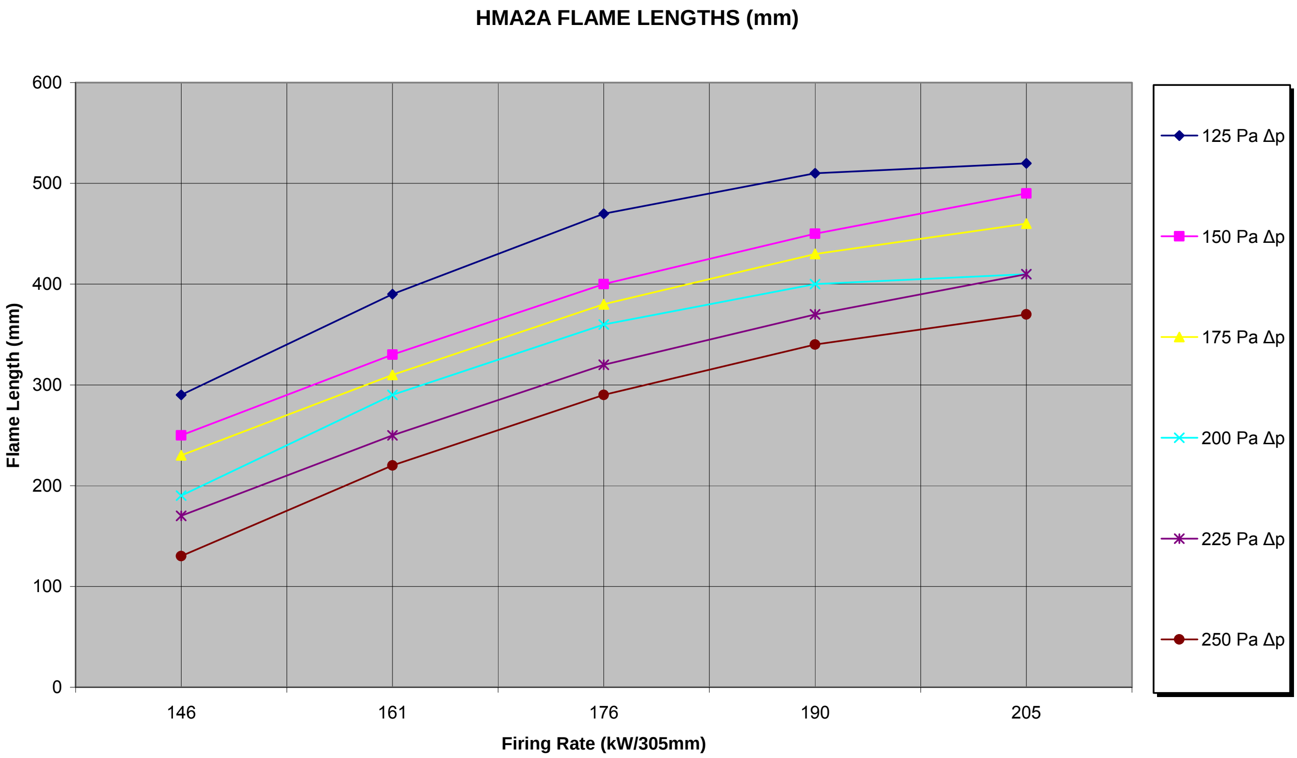
Required height of the profile opening = Total Profile Area/Required Width of Profile Opening

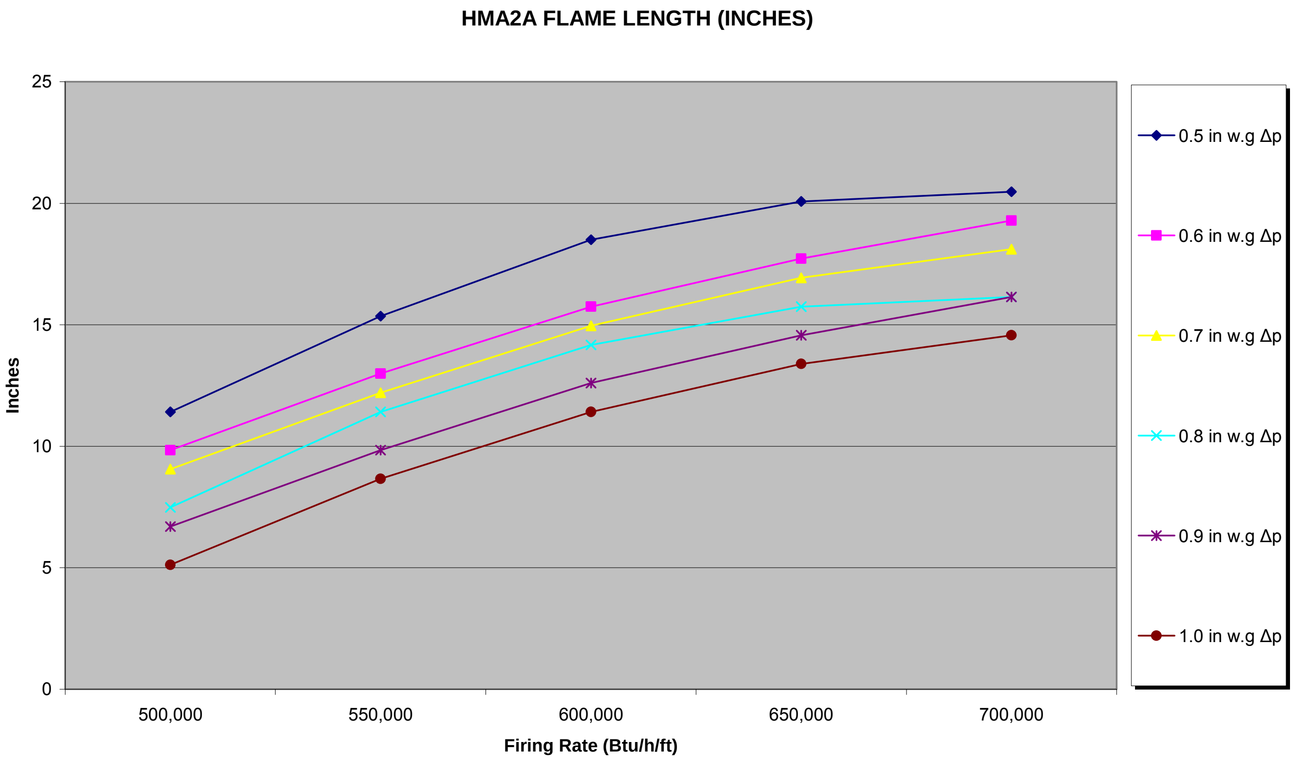
= 0.43 x 10^6/558 = 770 mm

Minimum duct width = Burner length + 305 mm (152.5 mm at either side) = 763 mm (rounded to 770 mm)

Minimum duct height = Height of profile opening + 200 mm (8") = 970 mm

APPENDIX C   Flame Lengths





APPENDIX D Combustion Air Flow Calculations

Lanemark Midco HMA2A burners typically operate with 100% fresh air.

For applications where a percentage of the heated air is to be re-circulated the **a minimum volume of fresh air must pass across the burner.**

As a “rule of thumb” the volume of air required for operation at 20% excess air is given by:

Air_{VOL} = (Q/CV) x SAGR x 1.2

where	Air_{VOL}	=	Air Volume per hour (m^3/h or ft^3/h)
	Q	=	Heat Input (kW or Btu/h)
	CV	=	Gas Calorific Value (kWh/m^3 or Btu/ft^3)
	SAGR	=	Stoiciometric Air/Gas Ratio (m^3_{AIR}/ m^3_{GAS} or ft^3_{AIR}/ ft^3_{GAS})

Typical Calorific Values for Natural Gas and Propane are:

Natural Gas	=	10 kWh//m^3 or 1000 Btu/ ft^3
Propane	=	25 kWh//m^3 or 2500 Btu/ ft^3

Stoiciometric Air/Gas Ratios (SAGR) for Natural Gas and Propane are:

Natural Gas	=	10
Propane	=	25

Example 1

Heat input	**=**	**200 kW**
Fuel	**=**	**Natural Gas**

Air_{vol} **(m^3/h)** = **(**200 /10) x 10 x 1.2 = 240 m^3/h

Example 2

Heat input	**=**	**1,000,000 Btu/h**
Fuel	**=**	**Natural Gas**

Air_{vol} **(ft^3/h)** = **(**1,000,000/1000) x 10 x 1.2 = 12,000 ft ^{3}/h

Example 3

Heat input	**=**	**400 kW**
Fuel	**=**	**Propane Gas**

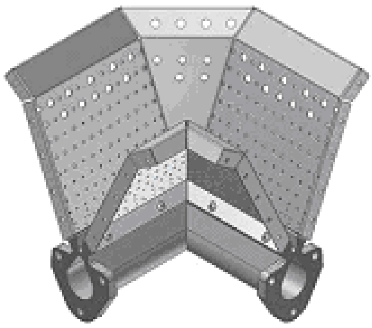
Air_{vol} **(m^3/h)** = **(**400 /25) x 25 x 1.2 = 480 m^3/h

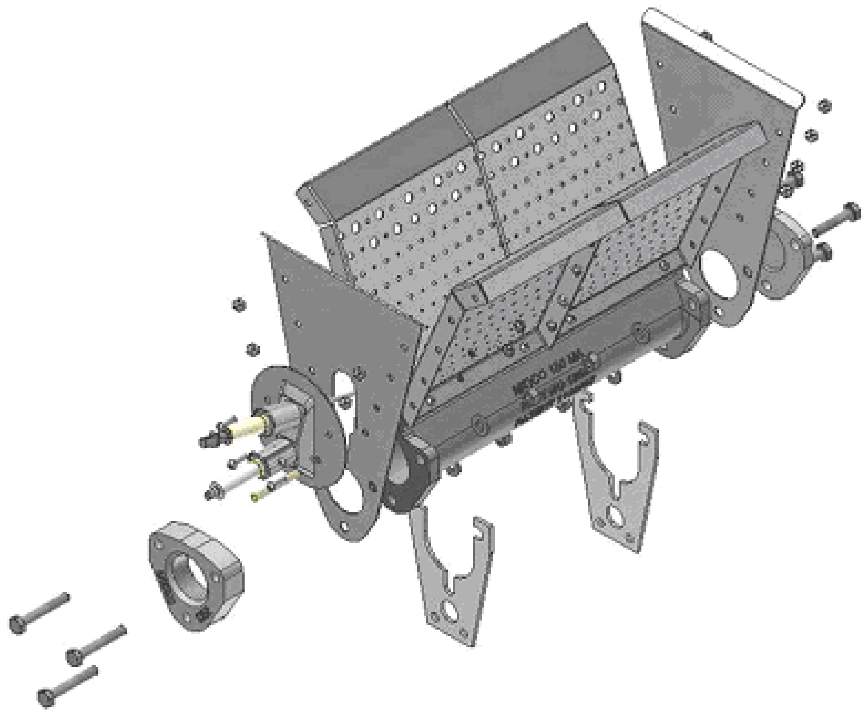
Example 4

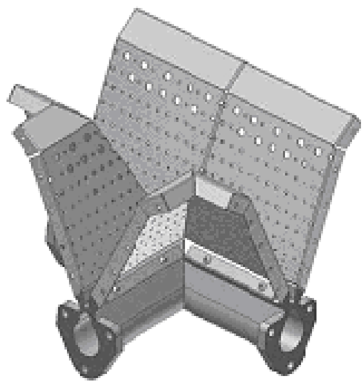
Heat input	**=**	**1,500,000 Btu/h**
Fuel	**=**	**Propane Gas**

Air_{vol} **(ft^3/h)** = **(**1,500,000/2500) x 25 x 1.2 = 18,000 ft ^{3}/h

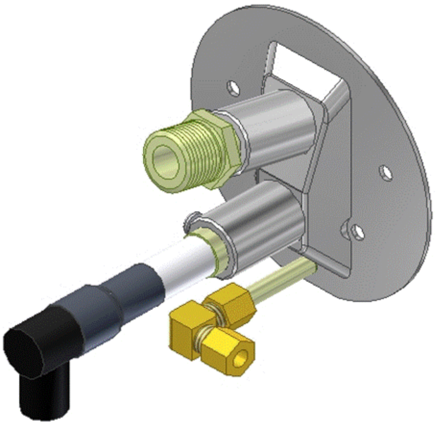
APPENDIX E Burner Assembly Parts – Isometric Views



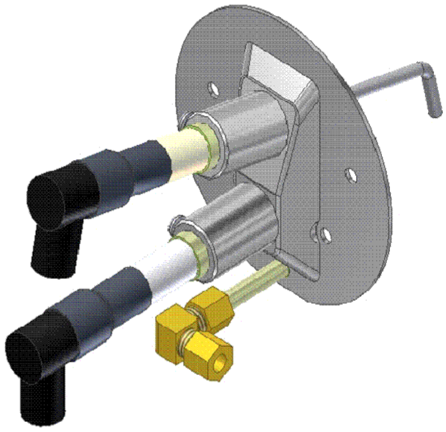




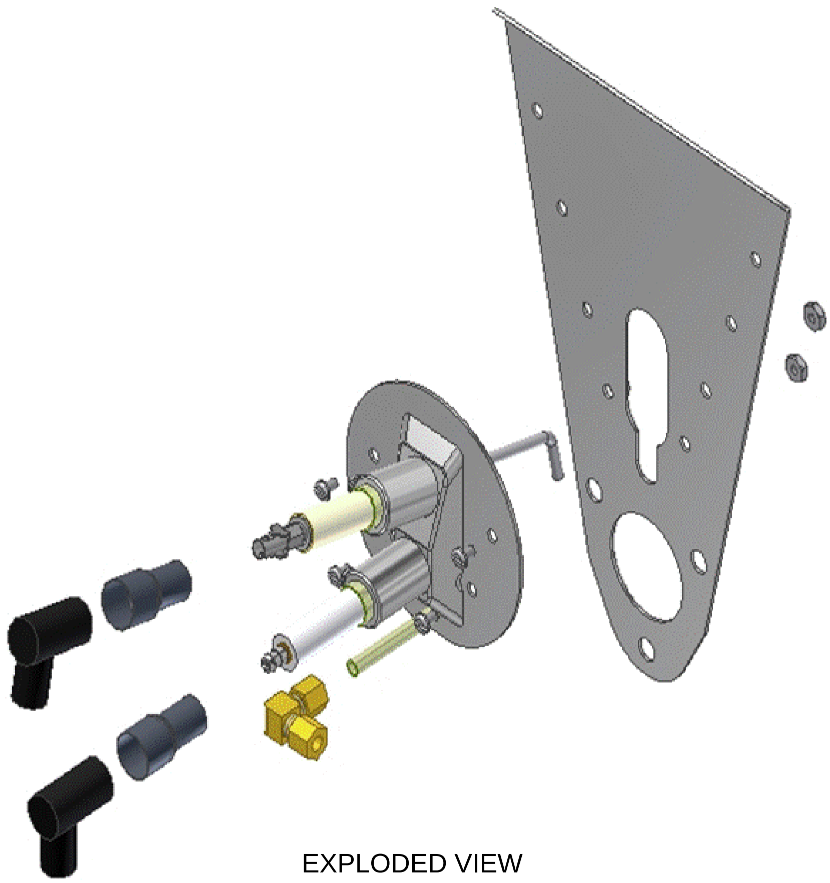
APPENDIX F Pilot, Ignition & Flame Sensing Options



HMA2A ‘UV’ BRUTE PILOT ASSEMBLY
NATURAL: M1200350
PROPANE: M1200450



HMA2A ‘FLAME ROD’ BRUTE PILOT ASSEMBLY
NATURAL: M1190850
PROPANE: M1190950



EXPLODED VIEW

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