

**Technical Catalog** 

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#### PRODUCT DESCRIPTION

Typical MAXON quality and reliability is found in the M-PAKT<sup>®</sup> Ultra Low NOx Burners, which provide the world's lowest levels of NOx and CO. NOx is typically single digits in most applications. The M-PAKT<sup>®</sup> low NOx burner is suitable for industrial air heating for ovens and dryers for paint finishing, paper making, food bakings, the production, grain drying, and make-up air heating.

M-PAKT<sup>®</sup> burners substantially reduce emissions in oxidizers, incinerators, heat exchangers and process heaters.

## **FEATURES AND BENEFITS**

- Produces extremely low emissions of NO<sub>x</sub> and CO
- Burns natural gas or propane
- Flame contained almost entirely inside the discharge sleeve
- Compact packaged design with a variety of control methods
- Durable steel outer construction with stainless steel internals

## TYPICAL EMISSIONS

The M-PAKT® Ultra Low Emissions Burner produces NOx and CO emissions up to 95% less than conventional burners. Without exotic alloys or fragile ceramics, the burner reduces NOx with a patented, advanced flame stabilization. The M-PAKT® burner's advanced anchoring of the flame reduces prompt NOx while thermal NOx is suppressed with an extremely uniform mixture.

In application, the M-PAKT<sup>®</sup> Ultra Low Emissions Burner produces single digit NOx corrected to 3% oxygen. In most installations, CO production is limited to extremely low levels. Exact emissions performance may vary in your application. Contact MAXON for information on installation specific estimates or guarantees. No guarantee of emissions is intended or implied without specific written guarantee from MAXON.

Factors that can affect emissions:

- Process air direction, temperature and velocity
- Process all direction, temperature and velocity
  Process stream constituents, especially nitrogen bearing compounds
  Combustion air quality, relative humidity and filtration
  Burner location and installation
  Fuel quality and heating value

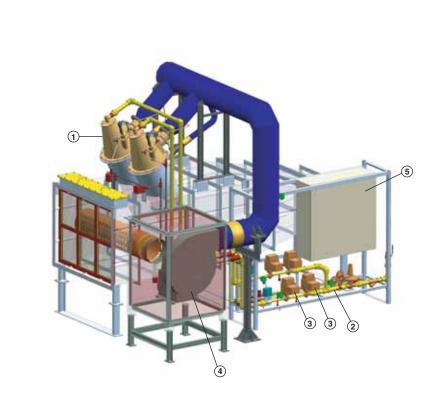
- Emissions instrument calibration and testing protocol

### APPLICATION EXAMPLE OF M-PAKT® GAS BURNER

- 1) M-PAKT® Ultra Low NOx Burner 2) Pipe train constructed
- authorities MAXON Shut-off Valves
- Combustion air blower

for required codes and

System control panel

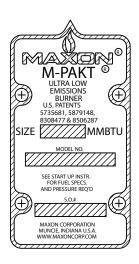


A typical air heater incorporating M-PAKT burners

32M-01007E

## **MODEL NUMBERS**

A coded model number is provided on the nameplate of all M-PAKT® Burners to provide an instantaneous method to identify the configuration of the product. This model number ensures accuracy in identifying your product, ordering replacement parts or communicating capabilities.



Special (S if special, blank if not)	Burner type	Size	Blower	Discharge sleeve	Mechanical gas control	Switches	Filter/ silencer	Future options
S	MPB	1	1	R	S	F	N	AAA

 Burner type
 Blower

 MPB - M-PAKT® burner
 1 - 240/3/50 2 - 575/3/60

 Size
 3 - 110/1/60 4 - None

 1 - 0.4M
 4 - None

 2 - 0.9M
 Discharge sleeve

 3 - 1.5M
 Proproduction of the property of

F - EB7

Switches F - None

Filter/silencer
F - Filter only
S - Filter/silencer
N - None

## SPECIFICATIONS OF M-PAKT® BURNERS

#### Typical burner data

Fuel: natural gas at  $15^{\circ}$ C with  $10.9 \text{ kWh/Nm}^3$  HHV - sg = 0.6 [1] Combustion air:  $15^{\circ}$ C -  $21^{\circ}$ C 0<sub>2</sub> -  $50^{\circ}$  humidity - sg = 1.0 [1]

Stated pressures are indicative. Actual pressures are a function of air humidity, altitude, type of fuel and gas quality.

	F	Packaged Bur	ners										
Size		0.4M	0.9M	1.5M	2.5M	3.5M							
Maximum Capacity HHV [4]	kW	120	265	468	732	1025							
Minimum Capacity HHV		20	38	60	110	145							
Turndown	N/A	5.9:1	7:1	8.5:1	7:1	7.4:1							
Pilot Capacity	kW	6 -23	6 -23	6 -23	6 -23	6 -23							
Natural Gas Pressure [3]	mbar	10	26	21	26	36							
Inlet Gas Pressure	mbar	20	64	47	92	82							
Combustion Air Pressure [5] [6]	mbar	22	22	25	26	26							
Combustion Air Flow	m <sup>3</sup> (st)/h	197	433	770	1203	1685							
Fan Horsepower	hp	1.5	1.5	2	3	3							
Burner Sound Levels [2]		86.1	86.3	87.2	89.3	89.5							
With Silencer		82.0	82.2	84.0	82.0	82.0							

- [1] sg (specific gravity) = relative density to air (density air = 1.293 kg/Nm<sup>3</sup>)
- [2] Sound pressure level, Lp, measured at 1 meter from the burner
- [3] Gas pressure measured differentially at burner gas pressure test connection.
- [4] Capacity displayed assumes blower operation on 60Hz electrical supply. Gross output will be reduced by 17% if operated on 50Hz. Fuel and air pressures should be reduced by 30% while motorpower will reduce 40% with 50Hz operation.
- [5] Air differential pressure measured between chamber pressure test port and burner air test connection.
- [6] Allow at least 10% more pressure at air valve inlet.

Contact MAXON for operating pressures for burners produced prior to May 2007.

#### Typical burner data

Fuel: natural gas at  $15^{\circ}$ C with  $10.9 \text{ kWh/Nm}^3 \text{ HHV} - \text{sg} = 0.6 [1]$ Combustion air:  $15^{\circ}$ C -  $21^{\circ}$ C O<sub>2</sub> -  $50^{\circ}$ 6 humidity -  $8^{\circ}$ Fig. 1.0 [1]

Stated pressures are indicative. Actual pressures are a function of air humidity, altitude, type of fuel and gas quality.

otation procedures are introduction. Actual procedures are a famount of all familiarity, antitude, type of facility.												
Exte	rnal Blowe	r Burners										
	EB2	EB3	EB4	EB5	EB6	EB7						
۲۱۸۷	235	500	800	1320	1700	2460						
KVV	21	38	60	110	145	264						
N/A	11.4:1	13.3:1	13.5:1	12.2:1	11.6:1	9.1:1						
kW	6 - 23	6 - 23	6 - 23	6 - 23	6 - 23	6 - 23						
mbar	30	93	60	81	92	149						
mbar	37	121	87	157	114	194						
mbar	74	74	70	82	68	68						
m <sup>3</sup> (st)/h	386	819	1300	2166	2791	4044						
	kW N/A kW mbar mbar mbar	External Blowe   EB2   235   21	External Blower Burners   EB2   EB3	External Blower Burners   EB2   EB3   EB4	External Blower Burners           EB2         EB3         EB4         EB5           kW         235         500         800         1320           21         38         60         110           N/A         11.4:1         13.3:1         13.5:1         12.2:1           kW         6 - 23         6 - 23         6 - 23         6 - 23           mbar         30         93         60         81           mbar         37         121         87         157           mbar         74         74         70         82	External Blower Burners           EB2         EB3         EB4         EB5         EB6           kW         235         500         800         1320         1700           21         38         60         110         145           N/A         11.4:1         13.3:1         13.5:1         12.2:1         11.6:1           kW         6 - 23         6 - 23         6 - 23         6 - 23         6 - 23           mbar         30         93         60         81         92           mbar         37         121         87         157         114           mbar         74         74         70         82         68						

- [1] sg (specific gravity) = relative density to air (density air = 1.293 kg/Nm<sup>3</sup>)
- [2] Gas pressure measured differentially at burner gas pressure test connection.
- [3] Gas differential pressure required at burner inlet when using control method 'E'
- [4] Air differential pressure measured between chamber pressure test port and burner air test connection
- [5] Capacity displayed assumes blower operation on 60Hz electrical supply. Gross output will be reduced by 17% if operated on 50Hz. Fuel and air pressures should be reduced by 30% while motorpower will reduce 40% with 50Hz operation.
- [6] Allow at least 10% more pressure at air valve inlet.

Contact MAXON for operating pressures for burners produced prior to May 2007.

## MATERIALS OF CONSTRUCTION

The M-PAKT Ultra Low NOx burner is constructed from durable, industrial steel and stainless steel components.

Burner Part	Material
Housing	1010 steel
Gas nozzle	304 stainless steel (1.4301)
Cone	330 stainless steel (1.4333)
Discharge sleeve	330 stainless steel (1.4333)
Impeller	Aluminum
Fan case	Steel

#### SELECTION CRITERIA

M-PAKT® BURNER VERSIONS
M-PAKT® Ultra Low NOx Burners are available as packaged burners with integral blower and fuel/air ratio control valves.

M-PAKT® may also be ordered as an EB model for use with a remote blower. EB M-PAKT® burners also include required fuel/air ratio control valves.

#### **APPLICATION DETAILS**

M-PAKT<sup>®</sup> Ultra Low NOx burner is suitable for use in industrial air heating, drying, baking and curing applications. The burner produces extremely low levels of NOx and CO for air quality compliance and end product sensitivities.

The M-PAKT® may be used in applications up to 538°C. Consult page 1-1.7-15 for guidance on selecting proper burner configurations.

#### PROCESS FLOWS AND OXYGEN CONTENT

M-PAKT® burners may be applied in inert process streams as the burner supplies all the required air for combustion and the flame is fully contained in its discharge sleeve.

Process flows up to 12 m/s are allowed perpendicular to the discharge sleeve although this will affect emissions performance. For best emissions performance, limit the flow velocity at the burner's discharge to < 5 m/s. Protection plates or secondary sleeves are acceptable to limit the cross velocity.

#### PROCESS BACK PRESSURE

Packaged burner models with integral fan may be applied to applications with pressures between -10 mbar and +5 mbar.

EB models may be used for extended capacities or for higher application pressures. Consult MAXON for assistance with high back pressure applications.

#### **PILOTING AND IGNITION**

Ignition of M-PAKT® burners should be restricted to the pilot. While direct ignition may be possible, it is not recommended.

The M-PAKT® burner is provided with an independent pilot burner. The pilot should only be operated as interrupted or intermittent. Standing pilots are not permitted as the flame scanner will not distinguish between the pilot and main flame.

In low oxygen or high moisture applications, an air feed for the pilot may be used. Consult pages 1-1.7-8 to 1-1.7-12 for location and size of pilot air connections. Pilot air is not required in most applications.

#### **RATIO CONTROL**

For greater assurance of optimal emissions or for less stable application pressures, MAXON suggests the use of parallel positioning actuator systems. MAXON's SMARTLINK<sup>®</sup> MRV and Honeywell ControLinks<sup>™</sup> provide high resolution control of the air and fuel valve for absolute control of air fuel ratio. The external control option allows the M-PAKT<sup>®</sup> burner to be used with an external air/fuel ratio control system such as SMARTFIRE ...

Unlike inferior pressure regulators, high resolution parallel positioning provides absolute control even during transient conditions. This type of absolute control has proven to optimize efficiency while minimizing emissions of industrial burners.

M-PAKT® is not recommended for use with hi/lo or on/off control schemes.

#### **COMBUSTION AIR CONTROL AND PIPING**

Do not rotate combustion air blowers on packaged M-PAKT® burners. EB M-PAKT® burners require combustion air to enter the burner parallel to the burner's long axis.

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M-PAKT® burners provide low NOx performance on natural gas and propane only. Other clean fuel gases may be used in the burner, but performance and emissions may change.

#### **EXPECTED EMISSIONS**

In typical applications with specified excess air, the M-PAKT® Ultra Low NOx burner will produce only 5% to 10% of the NOx of conventional burners. CO is controlled to extremely low levels but varies according to the specific application parameters of each installation.

**FLAME DEVELOPMENT**The flame of the M-PAKT<sup>®</sup> is entirely contained within the discharge sleeve of the burner making the effective flame length zero. Avoid locating the discharge of the burner close to walls, equipment or product as the exiting gases may be 1500°C or higher.

#### **DISCHARGE SLEEVE RECOMMENDATIONS**

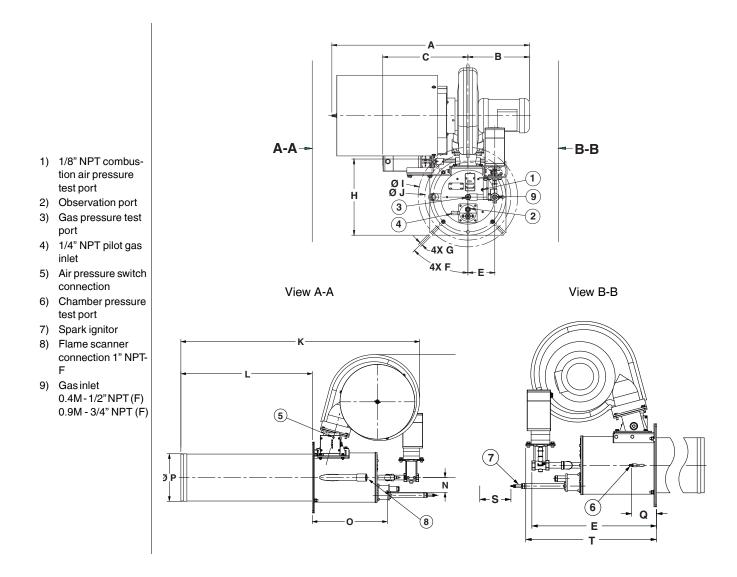
Desired Excess Air	Application Temperature						
Adjustment	< 530°C	530°C - 760°C					
55 - 70%	OK	OK					
40 - 55%	OK	Not recommended					

#### FILTER/SILENCER

Optional round or square filter/silencer assemblies are available. Burner sound levels with and without silencer can be found in table on page 1-1.7-5. For dimensions, refer to pages 1-1.7-8 through 12.

## **DIMENSIONS**

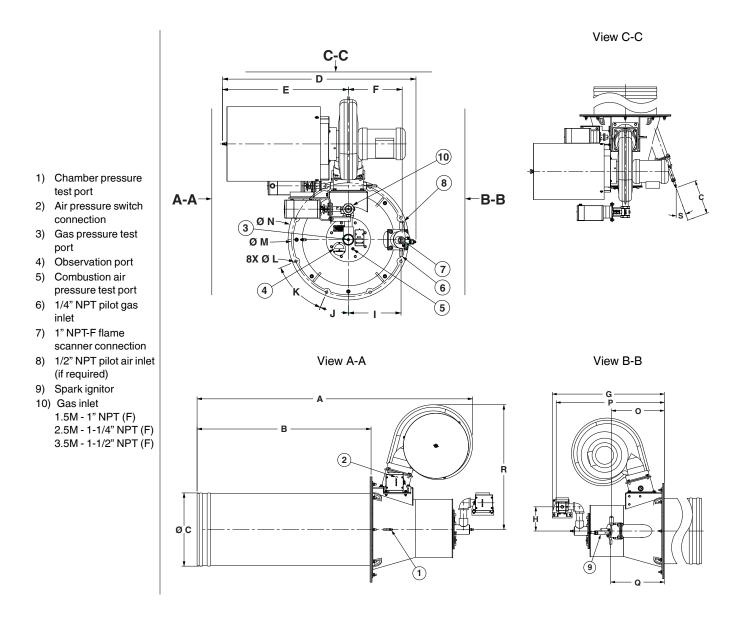
## 0.4M & 0.9M Packaged Burners - gas control method "S"



Dimensions in mm unless stated otherwise													
A B C D E F G slot H square I Ø J Ø													
1020 318 440 139 592 45° 15 393 514 444													

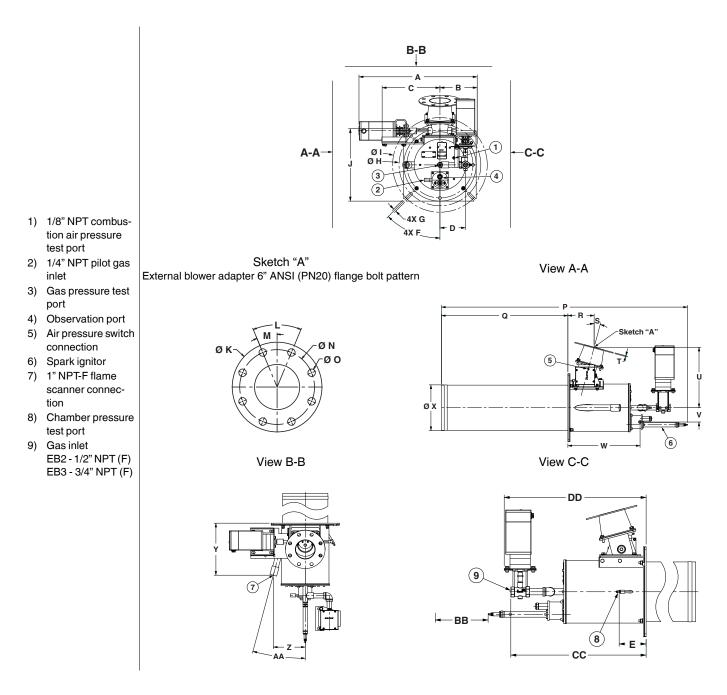
	Dimensions in mm unless stated otherwise													
K	K L M N O PØ Q S T													
1325	730	683	82	417	264	117	711	622						

## 1.5M, 2.5M and 3.5M Packaged Burners - gas control method "S"



Dimensions in mm unless stated otherwise																	
Α	В	СØ	D	Е	F	G	Н	ı	J	K	LØ	ΜØ	NØ	0	Р	Q	R
1761	1117	468	1082	703	300	784	170	294	22.5°	45°	14	635	673	366	756	372	797

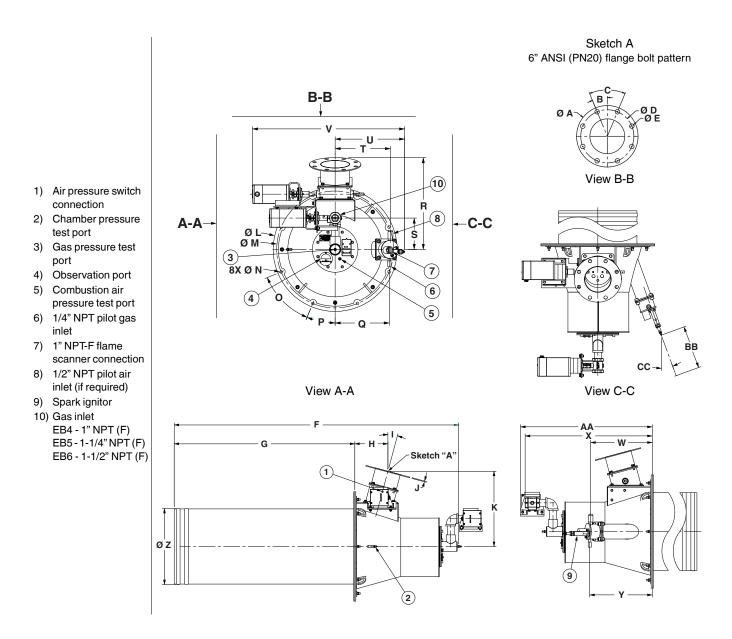
## EB2 and EB3 (External Blower) Burners - gas control method "S"



	Dimensions in mm unless stated otherwise														
A B C D E F G HØ IØ J KØ L M NØ OØ P											Р				
642	203	314	139	116	45°	15	444	514	393	228	45°	22.5°	190	19	1420

	Dimensions in mm unless otherwise stated													
Q	Q R S T U V W XØ Y Z AA BB CC DD													
730	152	15°	4	349	82	417	264	300	184	15°	711	590	620	

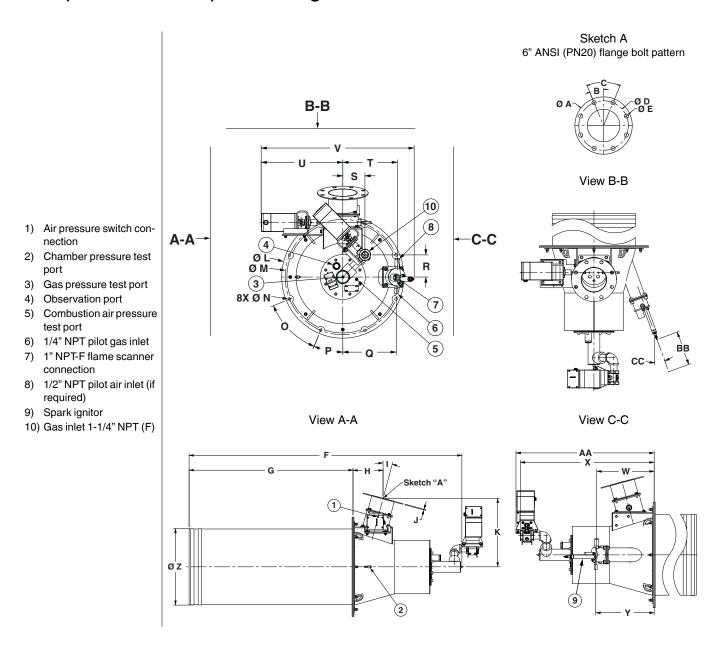
## EB4, EB5, & EB6 (External Blower) Burners - gas control method "S"



	Dimensions inmm unless stated otherwise													
ΑØ	AØ B C DØ EØ F G H I J K LØ MØ NØ O												0	
279	22.5°	45°	241	20	1752	1117	204	15°	4	463	673	635	14	45°

	Dimensions in mm unless stated otherwise												
Р	Q	R	S	Т	U	V	W	X	Υ	ΖØ	AA	BB	CC
22.5°	294	500	170	300	378	827	364	29.78 756	370	468	784	711	20°

## EB7 (External Blower) Burners - gas control method "S"



Dimensions in mm unless stated otherwise											
AØ B C DØ EØ F G H I J K LØ MØ NØ O											0
280 22.5° 45° 240 20 1850 1118 204 15° 5 463 673 635 15 45°											

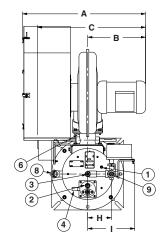
	Dimensions in mm unless stated otherwise												
Р	P Q R S T U V W X Y ZØ AA BB CC												
22.5°	295	122	122	300	452	843	365	853	370	518	880	711	20°

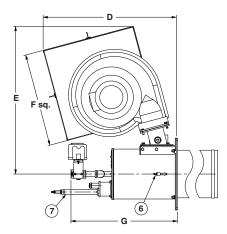
## Alternate gas control methods - gas control method "C"

#### 0.4M & 0.9M HONEYWELL CONTROLINKS ACTUATOR WITH SQUARE FILTER/SILENCER OPTION

- 1/8" NPT combustion air pressure test port
- 2) Observation port
- 3) Gas pressure test port
- 4) 1/4" NPT pilot gas inlet
- 5) Air pressure switch connection
- 6) Chamber pressure test port
- 7) Spark ignitor
- 8) Flame scanner connection 1" NPT-F
- 9) Gas inlet

0.4M - 1/2" NPT (F) 0.9M - 3/4" NPT (F)



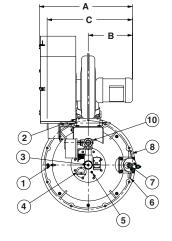


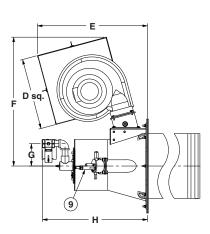
	Dimensions in mm unless stated otherwise										
A B C D E F square G H I											
675	318	592	729	810	508	584	130	258			

#### 1.5M, 2.5M & 3.5M HONEYWELL CONTROLINKS ACTUATOR WITH SQUARE FILTER/SILENCER OPTION

- Chamber pressure test port
- Air pressure switch connection
- 3) Gas pressure test port
- 4) Observation port
- 5) Combustion air pressure test port
- 6) 1/4" NPT pilot gas inlet
- 7) 1" NPT-F flame scanner connection
- 8) 1/2" NPT pilot air inlet (if required)
- 9) Spark ignitor
- 10) Gas inlet

1.5M - 1" NPT (F) 2.5M - 1-1/4" NPT (F) 3.5M - 1-1/2" NPT (F)





Dimensions in mm unless stated otherwise										
A B C D square E F G H										
668	318	612	508	787	922	160	752			

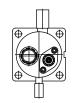
32M-01007E Honeywell

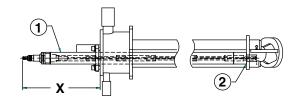
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## **Accessories and options**

#### **SPARK IGNITOR**

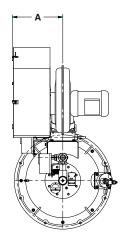
- 1) Spark ignitor
- Spark ignitor does not thread into this item. Slip fit.

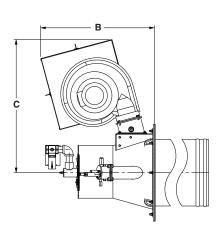




Dimensions in mm unless stated otherwise							
Burner size	Dimension X						
0.4M & 0.9M	262						
1.5M	226						
2.5M	105						
3.5M	148						

#### FILTER/SILENCER





Dimensions in mm unless stated otherwise								
Α	A B C							
350	786	923						

# INSTALLATION AND OPERATING INSTRUCTIONS FOR M-PAKT® BURNERS

## **Application Requirements**

#### **VIEW PORT**

A view port to observe burner flame is essential to inspect flame aspect. Locate the view port downstream of the flame, looking back to the burner block. Make sure the complete flame can be evaluated.

#### SUPPORT BURNER AIR AND GAS PIPING

The M-PAKT®Burner shall not be used as support for the piping to the burner. Gas and air piping shall be supported in such a way that no additional loads will be created on the burner.

#### **BURNER MOUNTING FLANGE LOADS**

Check burner weight and reinforce burner mounting flange or combustion chamber/furnace back wall if necessary to take complete burner weight.

#### **RATIO CONTROL**

M-PAKT® burners may be operated with 40 to 70% excess air. Consult page 1-1.7-7 for required sleeve materials per application.

MAXON recommends the use of characterized fuel/air ratio control through SMARTLINK MRV<sup>®</sup> or Honeywell ControLinks™. Consult MAXON for specific recommendations based upon the burner application and performance requirements.

#### FLAME SUPERVISION

M-PAKT® Burners require the use of UV or IR flame scanners. Some models of flame sensor may not respond well to ultra low NOx flame signatures. Consult sensor manufacturers for specific recommendations.

#### **FUELS**

M-PAKT® Burners are designed to operate on natural gas, propane and butane. Specific emissions performance can be affected by fuel. Contact MAXON for recommendations on alternative fuels.

#### **Installation Instructions**

#### STORAGE OF M-PAKT® BURNERS

M-PAKT® Burners shall be stored dry (inside).

#### HANDLING OF M-PAKT® BURNERS

M-PAKT® Burners are shipped as complete units. Handle burners with care during unpacking, transport, lifting and installation. Use proper equipment. Any impact on the burner could result in damage.

#### FLANGE THE BURNER TO THE INSTALLATION

Bolt the burner to the installation's burner mounting flange. Use proper gasketing. Tighten the flange bolting with correct torque. Retighten all bolts after first firing and regularly after commissioning.

#### **CONTROL MOTOR INSTALLATION**

Prior to control motor installation, remove the flexible coupling and place on control motor shaft. Mount control motor to bracket and air

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# START-UP INSTRUCTIONS FOR M-PAKT® BURNER

Read complete instructions before proceeding, and familiarize yourself with all the system's equipment components. Verify that your equipment has been installed in accordance with the original manufacturer's current instructions and complies with all applicable codes and standards.



CAUTION: Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry, and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating MAXON burner take precedence over these provided by MAXON. If MAXON instructions conflict with any codes or regulations, contact MAXON before attempting start-up. Use only an interrupted pilot with the M-PAKT® burner. Do not use M-PAKT® burners with main gas shut off valves having extended opening times (> 6 seconds). Delayed introduction of main fuel can create strong light offs and thermal damage to burner internals.

#### TYPICAL IGNITION SEQUENCE

- · Pre-purge of burner and installation, according to the applicable codes and the installation's requirements.
- · Combustion air control valve shall be in the minimum position to allow minimum combustion air flow to the burner.
- · Pre-ignition (typically 2 seconds sparking in air).
- Open pilot gas and continue to spark the ignitor (typically 5 seconds).
- · Stop sparking, continue to power the pilot gas valves and start flame check. Trip burner if no flame from here on.
- Check pilot flame stability (typical 5 seconds to prove stable pilot).
- Open main gas valves and allow enough time to have main gas in the burner (typical 5 seconds + time required to have main gas in the burner.
- Close the pilot gas valves.
- · Release to modulation (allow modulation of the burner).

Above sequence shall be completed to include all required safety checks during the start-up of the burner (process and burner safeties). Locate one pilot gas valve as close as possible to the pilot burner gas inlet to have fast ignition of the pilot burner.

#### SETTING APPROPRIATE FUEL PRESSURE AT ANY POINT

#### Step 1:

To properly adjust the fuel/air ratio of the M-PAKT® Burner at any firing rate, first measure the differential air pressure between the burner air test connection and the firing chamber.

#### Step 2:

Then multiply the air pressure value by the appropriate pressure factor, m, shown in the tables below.

#### Step 3:

Next, measure the fuel pressure differential between the burner fuel test connection and the firing chamber and adjust the fuel pressure with characterized fuel control valve at that point to the value calculated in Step #2.

#### Example:

On a 2.5M M-PAKT® Burner near half-fire, the differential air pressure reading is 5.5 mbar. To figure the appropriate fuel pressure, multiply 5.5 mbar by the m factor 0.99. The result is 5.4 mbar. Set the differential fuel pressure to 5.4 mbar.

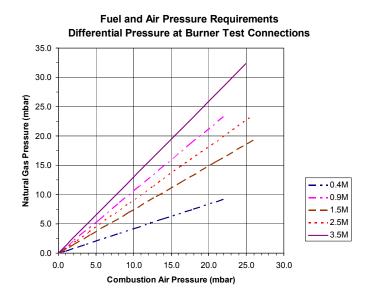
Packaged Burners										
Size		0.4M	0.9M	1.5M	2.5M	3.5M				
Max Capacity	kW/h	120.2	263.8	468.9	732.7	1025.7				
Max Fuel Pressure	mbar	10.2	25.9	21.4	26	35.9				
Min Fuel Pressure	mbar	3.5	3.6	4.98	4.98	4.7				
Max Air Pressure	mbar	21.9	21.9	25.2	25.9	25.7				
Min Air Pressure	mbar	1.0	1.0	1.0	1.0	1.0				
m		0.47	1.18	0.85	0.99	1.4				

EB Burners										
Size	Size		EB3	EB4	EB5	EB6	EB7			
Max Capacity	kW/h	234.2	497.8	790.6	1317.6	1698.3	2459.6			
Max Fuel Pressure	mbar	30.1	92.7	60	81.2	92.2	149.5			
Min Fuel Pressure	mbar	1.49	0.99	1.53	1.52	1.74	1.74			
Max Air Pressure	mbar	73.2	73.98	70	81.95	68.5	67.75			
Min Air Pressure	mbar	1.0	1.0	1.0	1.0	1.0	1.0			
m		0.41	1.25	0.86	0.99	1.35	2.21			

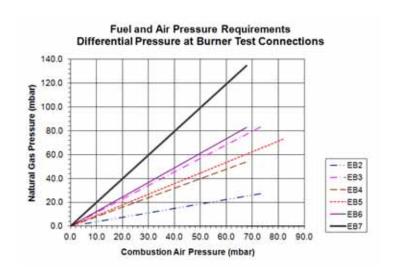
32M-01007E Honeywell

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# Fuel/Air Relationships - Packaged M-PAKT® Burner



# Fuel/Air Relationships - EB M-PAKT® Burner



## MAINTENANCE AND INSPECTION INSTRUCTIONS

#### **SAFETY REQUIREMENTS**

Regular inspection, testing and recalibration of combustion equipment according to the installation manual is an integral part of its safety. Inspection activities and frequencies shall be carried out as specified in the installation manual.

#### VISUAL INSPECTIONS

Regular visual inspection of all connections (air and gas piping to the burner, bolting of the burner to the furnace) and burner flame size and aspect are essential.

#### **SPARE PARTS**

Keep local stock of spark ignitor. It is not recommended to keep local stock of other burner parts. Consult installation manual for burner spare parts and system accessories.

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