Honeywell

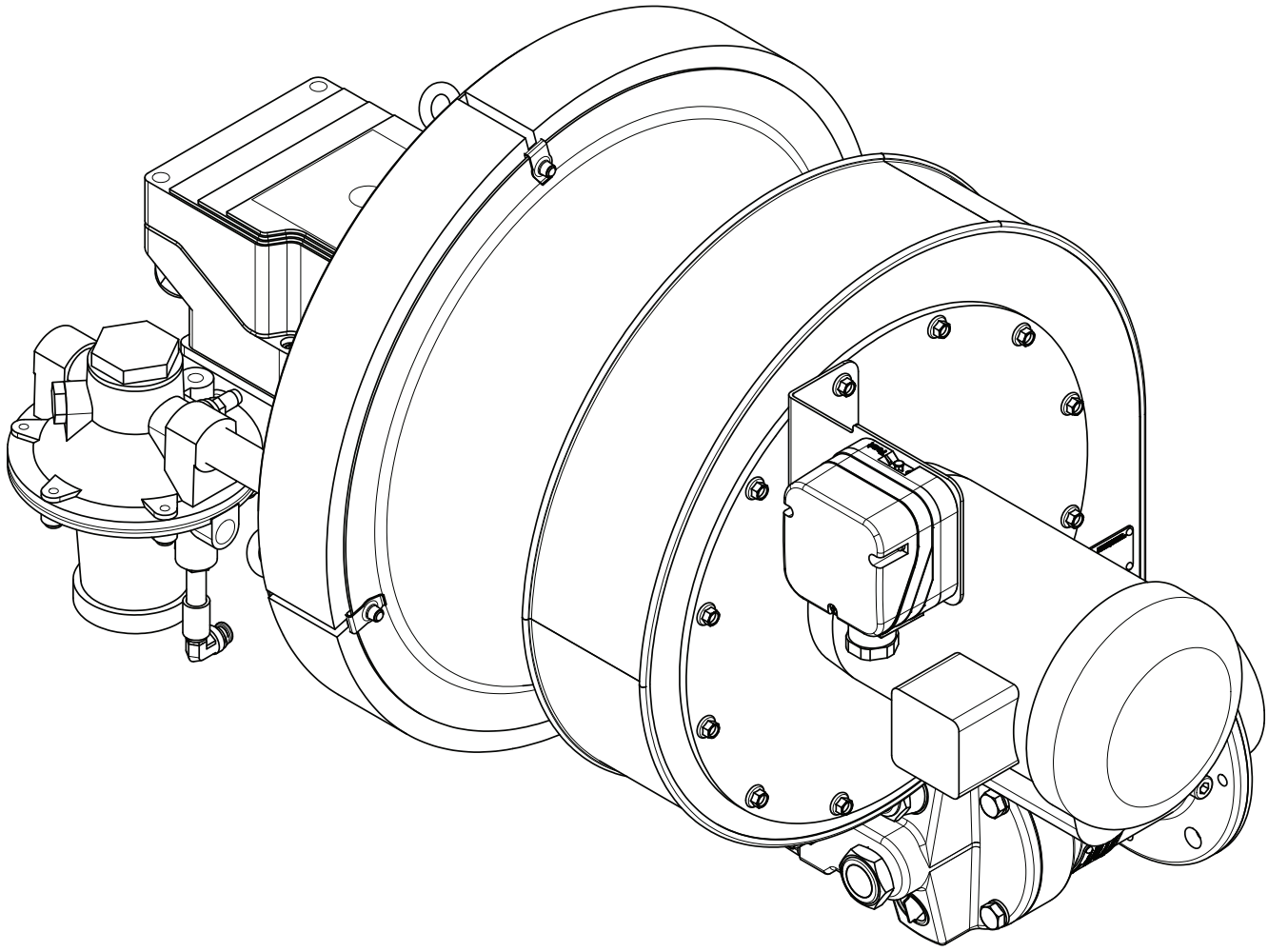
ECLIPSE

Eclipse ImmersoPak Burners

Model IP004 - 012

Technical Information Edition 09-16

Version 3



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Document Conventions

There are several special symbols in this document. You must know their meaning and importance.

The explanation of these symbols follows below. Please read it thoroughly.

How To Get Help

If you need help, contact your local Honeywell Eclipse representative. You can also contact Honeywell Eclipse at:

1665 Elmwood Rd.
Rockford, Illinois 61103 U.S.A.
Phone: 815-877-3031
Fax: 815-877-3336
http://www.eclipsenet.com

Please have the information on the product label available when contacting the factory so we may better serve you.

ECLIPSE Innovative Thermal Solutions www.eclipsenet.com
Product Name
Item #
S/N
DD MMM YYYY

	This is the safety alert symbol. It is used to alert you to potential personal injurt hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.
	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	Is used to address practices not related to personal injury.
NOTE	Indicates an important part of text. Read thoroughly.

Table of Contents

Introduction 1

Product Description

The ImmersoPak burner is a nozzle-mix burner with a packaged combustion air blower that is designed to fire on-ratio (proportional air/gas control) or fixed air on smaller models over a turndown of 10:1. Integral gas and air orifices are provided to ease burner setup.

The burner is designed for:

- efficient ratio controlled combustion
- reliable burner operation
- simple burner adjustment
- direct spark ignition
- multiple fuel capability

The wide variety of options and configurations are available due to the modular design of the burner.

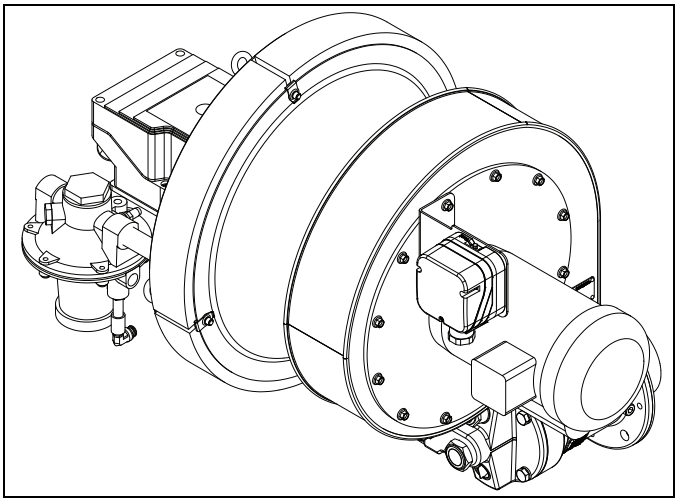


Figure 1.1 ImmersoPak Burner

Audience

This manual has been written for people who are already familiar with all aspects of a nozzle-mix burner and its add-on components, also referred to as “the burner system”.

These aspects are:

- Design / Selection
- Use
- Maintenance

The audience is expected to have previous experience with this type of equipment.

ImmersoPak Documents

Design Guide 360

- This document

Datasheet, Series 360

- Available for individual IP models
- Required to complete design and selection

Installation Guide 360

- Used with Datasheet to complete installation

Related Documents

- EFE 825 (Combustion Engineering Guide)
- Eclipse Bulletins and Info Guides: 684, 710, 732, 756, 760, 902, 930

Purpose

The purpose of this manual is to ensure the design of a safe, effective, and trouble-free combustion system.

Safety 2

Important notices which help provide safe burner operation will be found in this section. To avoid personal injury and damage to the property or facility, the following warnings must be observed. All involved personnel should read this entire manual carefully before attempting to start or operate this system. If any part of the information in this manual is not understood, contact Eclipse before continuing.

Safety Warnings

⚠ DANGER

- **The burners, described herein, are designed to mix fuel with air and burn the resulting mixture. All fuel burning devices are capable of producing fires and explosions if improperly applied, installed, adjusted, controlled or maintained.**
- **Do not bypass any safety feature; fire or explosion could result.**
- **Never try to light a burner if it shows signs of damage or malfunction.**

⚠ WARNING

- **The burner and duct sections are likely to have HOT surfaces. Always wear the appropriate protective equipment when approaching the burner.**
- **Eclipse products are designed to minimize the use of materials that contain crystalline silica. Examples of these chemicals are: respirable crystalline silica from bricks, cement or other masonry products and respirable refractory ceramic fibers from insulating blankets, boards, or gaskets. Despite these efforts, dust created by sanding, sawing, grinding, cutting and other construction activities could release crystalline silica. Crystalline silica is known to cause cancer, and health risks from the exposure to these chemicals vary depending on the frequency and length of exposure to these chemicals. To reduce the risk, limit exposure to these chemicals, work in a well-ventilated area and wear approved personal protective safety equipment for these chemicals.**

NOTICE

- **This manual provides information regarding the use of these burners for their specific design purpose. Do not deviate from any instructions or application limits described herein without written approval from Eclipse.**

Capabilities

Only qualified personnel, with sufficient mechanical aptitude and experience with combustion equipment, should adjust, maintain or troubleshoot any mechanical or electrical part of this system. Contact Eclipse for any needed commissioning assistance.

Operator Training

The best safety precaution is an alert and trained operator. Train new operators thoroughly and have them demonstrate an adequate understanding of the equipment and its operation. A regular retraining schedule should be administered to ensure operators maintain a high degree of proficiency. Contact Eclipse for any needed site-specific training.

Replacement Parts

Order replacement parts from Eclipse only. All Eclipse approved valves or switches should carry UL, FM, CSA, CGA and/or CE approval where applicable.

System Design 3

Design

The design process is divided into the following steps:

1. **Burner Model Selection:**
   - Determine net input required for the tank
   - Select tube efficiency
   - Calculate gross burner input required
   - Determine effective tube length
   - Compare gross burner input
   - Combustor Type
   - Select burner model
2. **Process Equipment Design Considerations:**
   - Tube design
   - Application Considerations
3. **Configurable Burner Options**
4. **Ignition System**
5. **Flame Monitoring Control System**
6. **Main Gas Shut-Off Valve Train**
7. **Process Temperature Control System**

Step 1: Burner Model Selection

Step 1 describes how to select burner options to suit an application. Use the ImmersoPak Price List and Datasheets, series 360 when following this selection process.

⚠ CAUTION

- **Consult EFE-825 Eclipse Engineering Guide or contact Eclipse if you have special conditions or questions.**

Determine the Net Input Required to the Tank

The net input to the tank is determined from heat balance calculations. These calculations are based on the heat-up and steady-state requirements of the process, and take into account surface losses, tank wall losses, and tank heat storage. Detailed guidelines for heat balance calculations are in the Eclipse Combustion Engineering Guide (EFE-825).

Select Tube efficiency

The efficiency of the tube is the net heat input to the tank divided by the heat input to the tube. Efficiency is determined by the effective tube length. The diameter of the tube has little influence on the efficiency. At a given burner input, the net input to the tank is higher for a longer tube than for a relatively short tube.

It is customary to size conventional immersion tubes for 70% efficiency, a reasonable compromise between fuel economy and tube length. Small diameter tubes, however, occupy less tank space than conventional tubes, so their length can easily be increased to provide efficiencies of 80% or more.

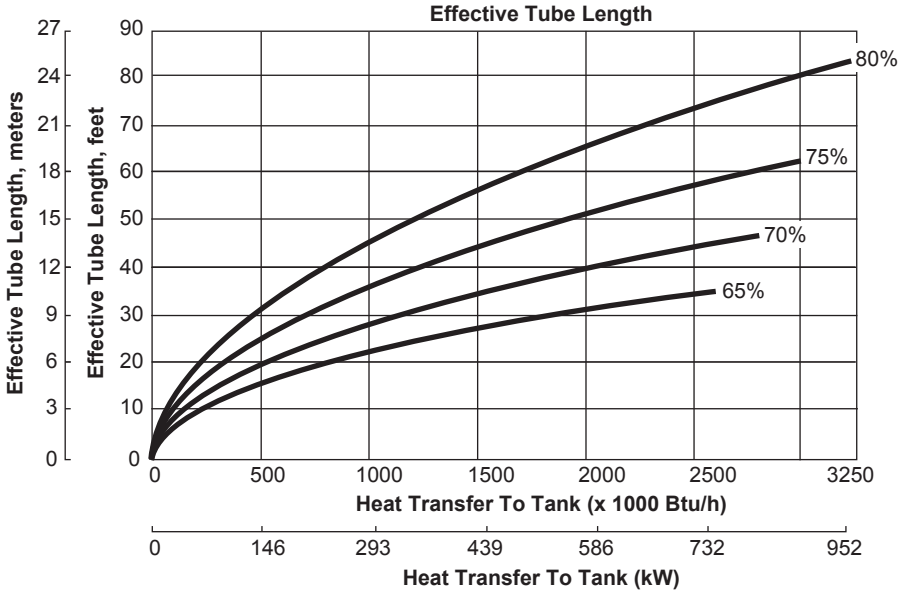
Calculate the Gross Burner Input

Use this formula to calculate gross burner input in Btu/h:

$$\frac{\text{net output to tank}}{\text{tube efficiency}} = \text{gross burner input}$$

Determine Effective Tube Length

Find the required effective tube length using the previously selected tube efficiency, net heat input values and the following graph. The effective length of a tube is the total centerline length of tube covered by liquid.



Compare the Gross Burner Input

Compare the gross burner input with the maximum tube input. If the gross burner input is greater than the maximum tube input from the table below, then the size of the immersion tube must be increased.

Maximum Tube Input

Tube ID, inches (mm)	Maximum Input, 1000 x Btu/h (kW)
4 (102)	300 (88)
5 (127)	600 (176)
6 (152)	1000 (293)
8 (203)	1750 (512)
10 (254)	2750 (805)
12 (305)	4000 (1171)

Exceeding these inputs may result in burner pulsation or other operational problems.

Sizing Example

Application Parameters

- Net heat release required to tank: 1,000,000 Btu/h
- Efficiency: 70%
- Effective tube length: 27 feet (see chart above)
- Gross burner input: 1,000,000 / 0.70 = 1,428,571 Btu/h
- IP008 ImmersoPak burner: 2,000,000 Btu/h maximum capacity
- Minimum Tube ID = 8 inches (see table)
- Tube Surface Area / in^2 = OD x π x L

  OD = 8.625

  π = 3.142

  L = total effective tube length in inches = (27 x 12) = 324 inches

  8.625 x 3.142 x 324 = 8780.3 in^2

- Btu/h/in^2 = Net heat release to tank / in^2 surface area

  1,000,000 / 8780.3 = 113.9 Btu/in^2/h

NOTE: If the medium to be heated in the above example was cooking oil, it would be necessary to either increase the tube length or select a larger tube. It is recommended that you not exceed 50 Btu/h/in^2 for cooking oil.

Select Burner Model

Choose a burner model with a maximum capacity greater than the gross burner input calculated previously. Refer to the table below.

Burner Model	Tube Size, inches (mm)	Maximum Capacity, Btu/h (kW)
004IP	4 (102)	275,000 (80)
005IP	5 (127)	600,000 (176)
006IP	6 (152)	875,000 (256)
008IP	8 (203)	2,000,000 (588)
010IP	10 (254)	2,750,000 (805)
012IP	12 (305)	4,000,000 (1171)

Additional considerations when selecting the burner size:

- **Power Supply Frequency:** Burner capacity will vary with power supply frequency (50 Hz or 60 Hz power)
- **Combustion Chamber Pressure:** Consider the effects that large or varying chamber pressures have on burner performance
- **Altitude:** the maximum burner capacity is reduced by approximately 3% each 1000 feet (300 meters) above sea level
- **Combustion Air Supply:** Combustion air should be fresh (20.9% O_2) and clean (without corrosives)
- **Combustion Air Temperature:** Changes in air supply temperature can affect the burner capacity. The combustion air supply temperature should not exceed 250°F.
- **Fuel Type:** Variation in calorific value and density will affect burner performance.

Step 2: Process Design Considerations

Tube Design

- Use no more than five elbows.
- Use standard or sweep elbows only; do not use miter elbows.
- The first elbow must be at least ten tube diameters from the burner face.
- The tube must be long enough to allow complete combustion before flue gases reach the exhaust stack. See Effective Tube Lengths chart for recommended lengths.

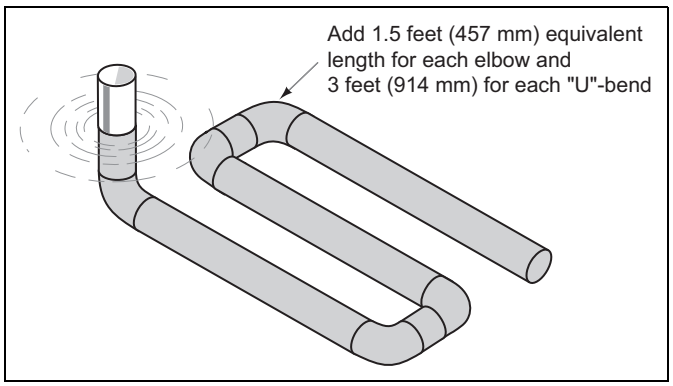


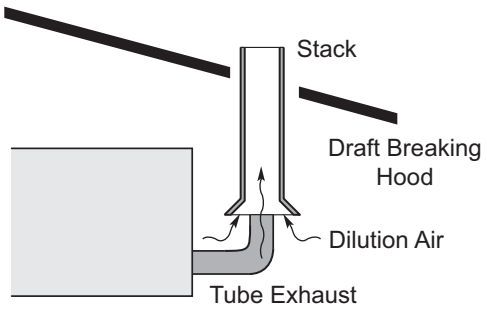
Figure 3.1 Typical Immersion Tube with Five Standard Elbows

NOTE: Tube length and elbow increase back pressure and can limit burner input.

Application Considerations

Stack

- Make sure the stack is large enough to handle the heated exhaust flow plus the dilution air.
- The stack must be at least one pipe size larger than the tube exhaust.



NOTE: If you use a common stack for more than one burner, make sure the stack is large enough to handle the exhaust flow plus any dilution air from all the burners. Detailed guidelines for flue sizing calculations are in the Eclipse Combustion Engineering Guide (EFE-825).

Draft Breaking Hood

A draft breaking hood is an open connection between the heater tube exhaust and the exhaust stack. It allows fresh dilution air to pass into the exhaust and mix with the exhaust gases.

The advantage of a draft hood are:

- the burner operation is less sensitive to atmospheric conditions
- the temperature of the exhaust gases is lower when they pass through the roof.

NOTE: Leave access between the draft hood and the tube exhaust. Install a damper plate if acoustic feedback occurs in the tube. Damper can increase back pressure limiting burner input.

Condensate provisions

If the immersion tube will operate at efficiencies less than 80%, the exhaust leg can be raised through the liquid surface. For efficiencies of 80% of higher, locate the exhaust stack outside of the tank and provide a drain.

NOTE: Regardless of the exhaust design, pitch the immersion tube down towards the exhaust so condensate will not collect at the burner.

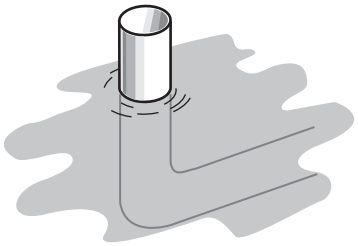


Figure 3.2 Efficiencies Less Than 80%

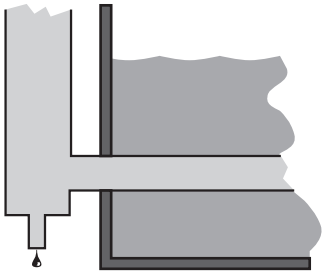


Figure 3.3 Efficiencies 80% or More

CAUTION

- **At efficiencies of 80% or greater, low exhaust temperatures will cause condensation to form in the tube at startup or during long idling periods. The higher the efficiency the more condensation will increase.**
- **To prevent condensation/corrosion from shortening tube life or disrupting burner operation, provide a condensate drain at the exhaust and slope the immersion tube downward, away from the burner.**

Tube Placement in Tank

The tube placement height in the tank should be high enough to avoid the possibility of sludge build-up on the bottom of the tank; however, it should be low enough to avoid tube exposure due to liquid level variations caused by evaporation or displacement. In the latter case use a liquid level switch to shut down the burner.

Applications Requiring Special Consideration:

Zinc Phosphate Solutions

High heat fluxes break down the phosphate, forming a heavy insulating sludge which can deposit on tube surfaces and can cause rapid tube burnout. To reduce early tube failure, make the immersion tub with electro-polished stainless steel. On models IP008 and IP010, restrict the maximum inputs to 1.80 MM Btu/h and 2.83 MM Btu/h respectively.

Iron Phosphate Solutions

These are susceptible to the same problem described above for zinc phosphate solutions. To reduce the likelihood of early tube failure, make the immersion tube with stainless steel; but it does not need to be electro-polished.

Cooking Oils

To avoid burning the oil, limit heat flux to 50 Btu/h per in^2 of the tube area.

Highly Viscous Liquids

All immersion systems depend on natural convection currents to carry heat away from the tube and throughout the tank. Convection is minimal in high viscosity solutions, such as asphalt, residual oil or molasses. This can severely overheat the liquid around the tube.

CAUTION

- **For highly viscous fluids, recirculation may be necessary.**

Step 3: Configurable Burner Options

Burner Model

Previously selected in Step 1.

Feature	Description	Option	Option Description	Model
1	Model	004	Model:IP004	
		005	Model:IP005	
		006	Model: IP006	
		008	Model: IP008	
		010	Model: IP010	
		012	Model: IP012	

Fuel Type

Fuel	Symbol	Gross Heating Value	Specific Gravity	WOBBE Index
Natural Gas	$CH_4$90%+	1000 Btu/ft^3 (40.1 MJ/m^3)	0.60	1290 Btu/ft^3
Propane	C_3H_8	2525 Btu/ft^3 (101.2 MJ/m^3)	1.55	2028 Btu/ft^3
Butane	C_4H_{10}	3330 Btu/ft^3 (133.7 MJ/m^3)	2.09	2303 Btu/ft^3
Btu/ft^3 at standard conditions (MJ/m^3 at normal conditions)				

If using an alternative fuel supply, contact Eclipse with an accurate breakdown of the fuel components.

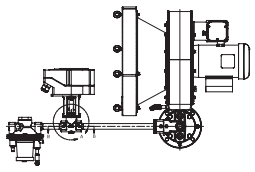
Feature	Description	Option	Option Description	Model
2	Fuel Type	B	Butane	ALL
		N	Natural Gas	ALL
		P	Propane	ALL

Air Supply

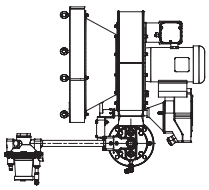
When a standard ImmersoPak V2 burner is ordered, a combustion air blower is supplied and mounted directly to the burner body.

Control Options

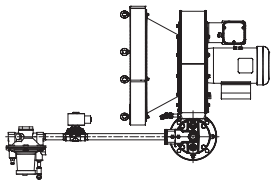
ImmersoPak burners are available with two different control systems: modulating air (ratio control) and fixed air. Fixed air models can be ordered to operate as modulating gas, high-low or on-off. Models IP006, IP008, IP010, and IP012 are available as modulating air burners only. Refer to illustrations at the left of page 14.



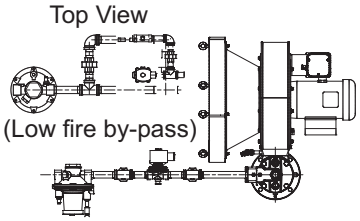
Option 1
Modulating Gas
(Fixed Air)



Option 2
Modulating Air
(Ratio Control)



Option 3
High-Off
(Fixed Air)

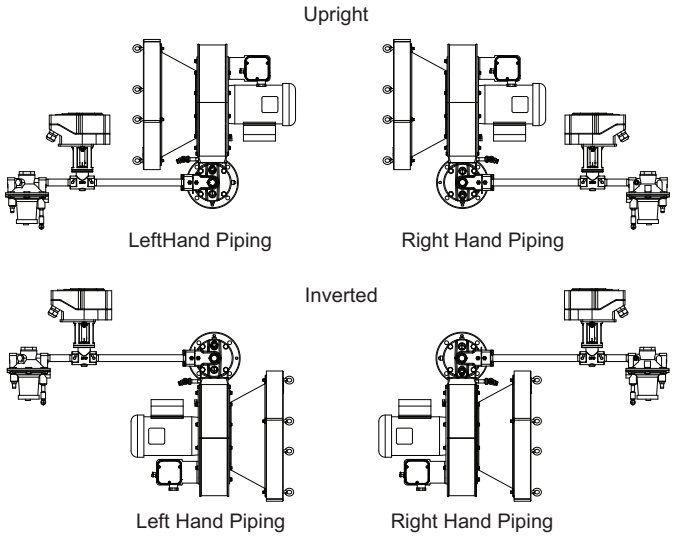


Option 4
High-Low
(Fixed Air)

Feature	Description	Option	Option Description	Model
3	Control Options	1	Modulating Gas Fixed Air	004, 005
		2	Modulating Air Ratio Control	ALL
		3	High / Off Fixed Air	004,005
		4	High / Low Fixed Air	004, 005

Burner Configuration

Select configuration. Refer to illustrations at the bottom of page 14.



Feature	Description	Option	Option Description	Model
4	Burner Configuration	B	Upright, Right Hand Piping	ALL
		C	Upright, Left Hand Piping	ALL
		D	Inverted, Right Hand Piping	ALL
		E	Inverted, Left Hand Piping	ALL

Gas Pipe Connection

Select the gas pipe connection thread type and loading line option.

The ratio regulator is threaded using the customer selected pipe thread option.

Feature	Description	Option	Option Description	Model
5	Gas Pipe Connection	B	BSP Piping	ALL
		D	BSP Piping with SST Braided LL	ALL
		E	NPT Piping with SST Braided LL	ALL
		N	NPT Piping	ALL

Control Motor - Modulating Air or Gas

Select a control motor. Standard control motor is the Kromschroder IC20, which Eclipse will mount to the burner. ImmersoPaks can be ordered with control motor bracket and mounting hardware only. Customer supplied control motors must conform to these specifications:

- rotation not to exceed 2 rpm
- minimum torque of 25 in-lb. (2,8 Nm)
- 90° stroke
- continuous modulating or high/low modulating control
- reversible direction of rotation

Feature	Description	Option	Option Description	Model
6	Control Motor	E	Kromschroder IC20 3-Pos Step 120V	ALL
		J	Kromschroder IC20 Electronic 120V	ALL
		F	Kromschroder IC20 3-Pos Step 230V	ALL
		K	Kromschroder IC20 Electronic 230V	ALL
		L	Bracket Only Kromschroder	ALL
		N	Bracket Only Honeywell	ALL
		Q	M7284 C1000	ALL
		V	Siemens SQM5	ALL
		W	Bracket Only Siemens	ALL
		X	Less Motor and Bracket	

Flame Supervision

Select a flame rod or an ultraviolet (UV) scanner. Both are available for use on IP004, IP005, and IP006. If a flame rod is selected, it will be factory mounted in the burner. If a UV scanner is selected, it must be ordered separately.

Feature	Description	Option	Option Description	Model
7	Flame Supervision	F	Flame Rod	004, 005, 006
		X	No Sensor	ALL

Air Pressure Switch

The air flow switch provides a signal to the monitoring system when there is not enough air pressure from the blower. If a switch is selected, it will be factory mounted.

WARNING

- **Eclipse supports the NFPA regulation requiring, as a minimum standard for main gas shut-off systems, the use of an air pressure switch in conjunction with other system components.**

Feature	Description	Option	Option Description	Model
8	Air Pressure Switch	C	Kromschroder DL 10AT 0.4-4 in. w.c.	ALL
		D	Kromschroder DL 50AT 1-20 in. w.c.	ALL
		E	Kromschroder DL 50K-3 2.5-50 mbar	ALL
		X	No Switch	

Limit Switch

A low limit switch is available for all models.

Feature	Description	Option	Option Description	Model
9	Limit Switch	A	High and Low Limit Switch	ALL
		B	High Limit Switch	ALL
		C	Low Limit Switch	ALL
		X	No Limit Switch	ALL

Blower Model

Feature	Description	Option	Option Description	Model
10	Blower Model	2	Size 2 Blower	004
		3	Size 3 Blower	005
		4	Size 4 Blower	006
		5	Size 5 Blower	008, 010, 012

Power Supply

Select the 50 Hz or 60 Hz option. The 50 Hz blower motors have IEC frames and are CE marked. The 60 Hz motors have NEMA frames.

Feature	Description	Option	Option Description	Model
11	Power Supply	1	60 Hz Blower	ALL
		2	50 Hz Blower	004, 005, 006, 008, 010
		X	None	ALL

Pressure and Flow

All models of the ImmersoPak V2 include a combustion air blower.

Feature	Description	Option	Option Description	Model
12	Pressure and Flow	2B	6 inches, 5500 cfh	004
		3A	6 inches, 8250 cfh	005
		4A	6 inches, 16,500 cfh	006
		5B	10 inches, 44,000 cfh	008, 010
		5D	15 inches, 44,000 scfh	012
		XX	No Blower	ALL

Blower Motor Type

Motor types include various options: voltages, single or three phase, TEFC or automotive duty enclosures.

Feature	Description	Option	Option Description	Model
13	Blower Motor Type	AA	115/208-230/1, TEFC (NEMA)	005, 006, 008, 010
		AB	208-230/460/3, TENV (NEMA)	005, 006, 008, 010, 012
		AC	575/3, TENV (NEMA)	005, 006, 008, 010, 012
		AD	115/1, TEFC (NEMA)	004
		AE	208-230/1, TEFC (NEMA)	004
		BA	230/460/3, AUTO (NEMA)	005, 006
		BB	460/3 AUTO TEFC (NEMA 60 Hz)	008, 010, 012
		CA	220-240/380-415/3, TEFC (IEC, 50 Hz)	004, 005, 006, 008, 010
		CC	230/1, TEFC (IEC, 50 Hz)	004, 005, 006
		CD	115/1, TEFC (IEC, 50 Hz)	004, 005, 006
		DB	208-230/460/3, TENV (NEMA)	004
		DC	575/3, TENV (NEMA)	004
		XX	No Motor	ALL

Blower Inlet

When selecting an inlet, consider the following:

- amount and size of particles in the air
- sound requirements
- space limitations
- cleanliness requirements of the process

Feature	Description	Option	Option Description	Model
14	Blower Inlet	A	Standard Grill	ALL
		B	Round Inlet Filter	ALL
		D	Filter Silencer	ALL
		X	No Filter	ALL

Blower Configuration

All ImmersoPaks are available with a left-hand or right-hand blower motor.

Feature	Description	Option	Option Description	Model
15	Blower Configuration	R	Right Hand Motor	ALL
		X	Not applicable	ALL

Step 4: Ignition System

For the ignition system you should use:

- 6000 VAC transformers
- full wave spark transformers
- one transformer per burner

DO NOT use:

- 10,000 VAC transformers
- twin outlet transformers
- distributor type transformers
- half wave spark transformers

ImmersoPak burners will ignite reliably at any input within the ignition zone shown in the appropriate burner datasheet. However, it is recommended that low fire start be used. Local safety and insurance requirements demand that you limit the maximum time that a burner takes to ignite. These time limits vary from country to country.

The time that a burner takes to ignite depends on:

- the distance between the gas shut-off valve and the burner
- the air/gas ratio
- the gas flow at start conditions

In the USA, with a time of 15 seconds to ignition, there should be sufficient time to ignite the burners. It is possible, however, to have the low fire too low to ignite within the time limit. Under these circumstances you must consider the following options:

- start at higher input levels
- resize and/or relocate the gas controls

Step 5: Flame Monitoring System

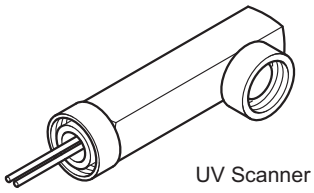
A flame monitoring system consists of two main parts:

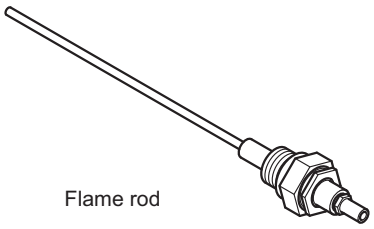
- a flame sensor
- flame monitoring control

Flame sensor:

There are two types that you can use for an ImmersoPak burner:

- UV scanner
- Flame rod





Flame Monitoring Control

The flame monitoring control is the equipment that processes the signal from the flame rod or the UV scanner.

For flame monitoring control you may select several options:

- flame monitoring control for each burner: if one burner goes down, only that burner will be shut off
- multiple burner flame monitoring control: if one burner goes down, all burners will be shut off

Other manufacturer's flame monitoring systems can be used with the burner if a spark is maintained for a fixed time interval and is not interrupted when a flame signal is detected during trial for ignition.

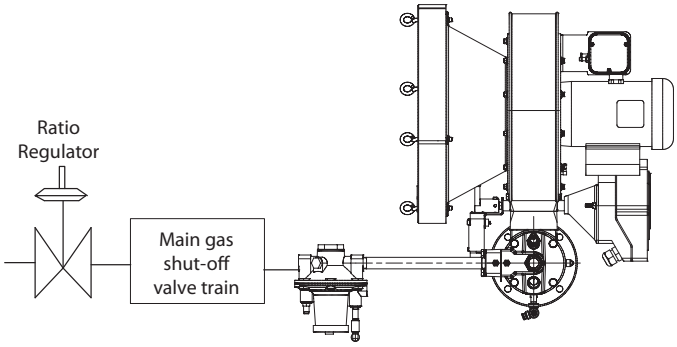
Step 6: Main Gas Shut-Off Valve Train

Consult Eclipse

Eclipse can help you design and obtain a main gas shut-off valve train that complies with the current safety standards.

The shut-off valve train must comply with all the local safety standards set by the authorities that have jurisdiction.

For details, please contact your local Eclipse representative.

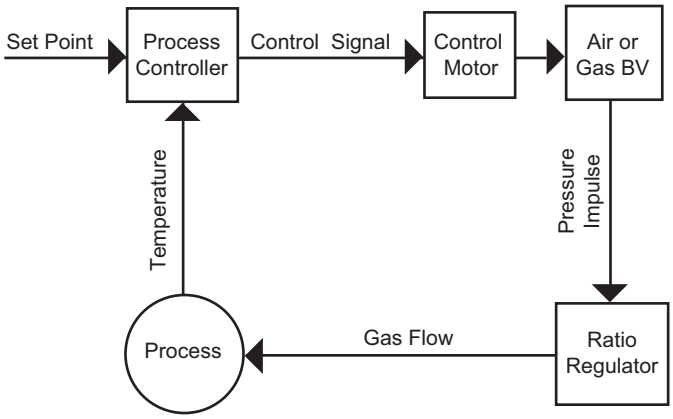


NOTE: Eclipse supports NFPA regulations (two shut-off valves) as a minimum standard for main gas safety shut-off systems.

Step 7: Process Temperature Control System

Consult Eclipse

The process temperature control system is used to control and monitor the temperature of the system. In a control system, a control signal is sent from a process temperature controller (sold separately) to the control motor (Refer to Bulletin 905C). The control motor modulates the air or gas butterfly valve (BV) which changes the input level and hence the temperature.



There is a wide variety of control and measuring equipment available. For details, please contact your local Eclipse representative.

Appendix

Conversion Factors

Metric to English

From	To	Multiply By
actual cubic meter/h (am^3/h)	actual cubic foot/h (acfh)	35.31
normal cubic meter/h (Nm^3/h)	standard cubic foot /h (scfh)	38.04
degrees Celsius (°C)	degrees Fahrenheit (°F)	(°C x 9/5) + 32
kilogram (kg)	pound (lb)	2.205
kilowatt (kW)	Btu/h	3415
meter (m)	foot (ft)	3.281
millibar (mbar)	inches water column ("w.c.)	0.402
millibar (mbar)	pounds/sq in (psi)	14.5×10^{-3}
millimeter (mm)	inch (in)	3.94×10^{-2}
MJ/Nm^3	Btu/ft^3 (standard)	26.86

Metric to Metric

From	To	Multiply By
kiloPascals (kPa)	millibar (mbar)	10
meter (m)	millimeter (mm)	1000
millibar (mbar)	kiloPascals (kPa)	0.1
millimeter (mm)	meter (m)	0.001

English to Metric

From	To	Multiply By
actual cubic foot/h (acfh)	actual cubic meter/h (am^3/h)	2.832×10^{-2}
standard cubic foot /h (scfh)	normal cubic meter/h (Nm^3/h)	2.629×10^{-2}
degrees Fahrenheit (°F)	degrees Celsius (°C)	(°F - 32) x 5/9
pound (lb)	kilogram (kg)	0.454
Btu/h	kilowatt (kW)	0.293×10^{-3}
foot (ft)	meter (m)	0.3048
inches water column ("w.c.)	millibar (mbar)	2.489
pounds/sq in (psi)	millibar (mbar)	68.95
inch (in)	millimeter (mm)	25.4
Btu/ft^3 (standard)	MJ/Nm^3	37.2×10^{-3}

Notes

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