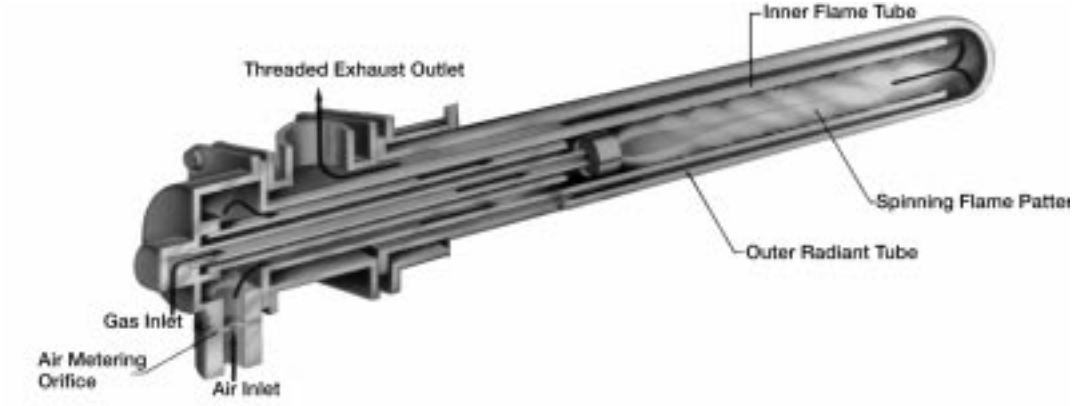
ECLIPSE THERM-THIEF AUTO-RECUPES



The Eclipse Auto-Recupe contains a nozzle mixing burner and recuperator coaxially mounted inside of a single-ended radiant tube (SER). Combustion air entering the Auto-Recupe is preheated in the recuperative section by waste exhaust heat, providing fuel savings from 35 to 55% over radiant tubes equipped with sealed ambient air burners. When used to replace atmospheric burners, an additional 8 to 10% fuel savings can be achieved. Auto-Recupes are available in four diameters from 3-1/4" to 7-1/2" (83mm-191mm). Radiant tube length is tailored to the application.

Eclipse also offers the Eclipse Silicon Carbide (SiC) Auto-Recupe. This contains a nozzle mixing burner and recuperator mounted inside high strength silicon carbide inner and radiant tubes, allowing higher heat dissipation rates and tube temperatures than those attainable with metallic tubes. In most cases, the silicon carbide radiant tubes also withstand corrosive environments better than metallic tubes. For further clarification, please refer to Information Guide 322.

CONTROL METHODS

The Auto-Recupe is designed for high-low firing. Because of the difficulty of controlling very small low fire inputs, high-off control for the 3-1/4" (83mm) size may be used, especially when chamber temperatures are above 1550°F (843° C). Control systems may use time proportional control. Modulating control may also be used.

FEATURES

- No hot air duct work required.
- Recuperative section is positioned in furnace wall for minimum heat loss.
- Even heat distribution down length of the radiant tube.
- Radiant tube life comparable to conventional radiant tubes.
- Integral air orifice meter simplifies adjustment.
- Easy installation, low maintenance. Air connection need not be disturbed for burner or flame tube maintenance.
- Sandwich flange construction eliminates bolt hole alignment problems.
- Multi-Fuel Capabilities.

PERFORMANCE DATA

FIRING RATES & EFFICIENCIES

Tube O.D. Ins.(mm)	Firing Rate Limits 1000's Btu/Hr. (kW)			Approximate High Fire Efficiency[3] For Various Tube Lengths Ins.(mm)							
	Low Fire[1]	High Fire[2]									
		Min.	Max.	24 (609.6)	30 (762)	36 (914.4)	50 (1270)	65 (1651)	74 (1879.6)	120 (3048)	160 (4064)
3.25 (82.55)	3 (.88)	12 (3.5)	50 (14.6)	.74	.73	.72	.70	—	—	—	—
4.5 (114.3)	5 (1.5)	15 (4.4)	75 (22)	—	.74	.73	.72	.71	.70	—	—
6 (152.4)	6 (1.8)	25 (7.3)	160 (46.9)	—	.74	.74	.73	.72	.71	.68	—
7.5 (190.5)	9 (2.6)	35 (10.3)	270 (79.1)	—	—	.74	.73	.73	.72	.70	.68

[1] 125% excess air required, or 12% O_2 in flue gas.
[2] Auto-Recupes burn cleanly with 10% excess air in this range.
[3] Based on 1650° F (900° C) furnace temperature and a "B" dimension (pg. 2) of 19" (483 mm).

Maximum Heat Transfer Rates — Metallic Tubes

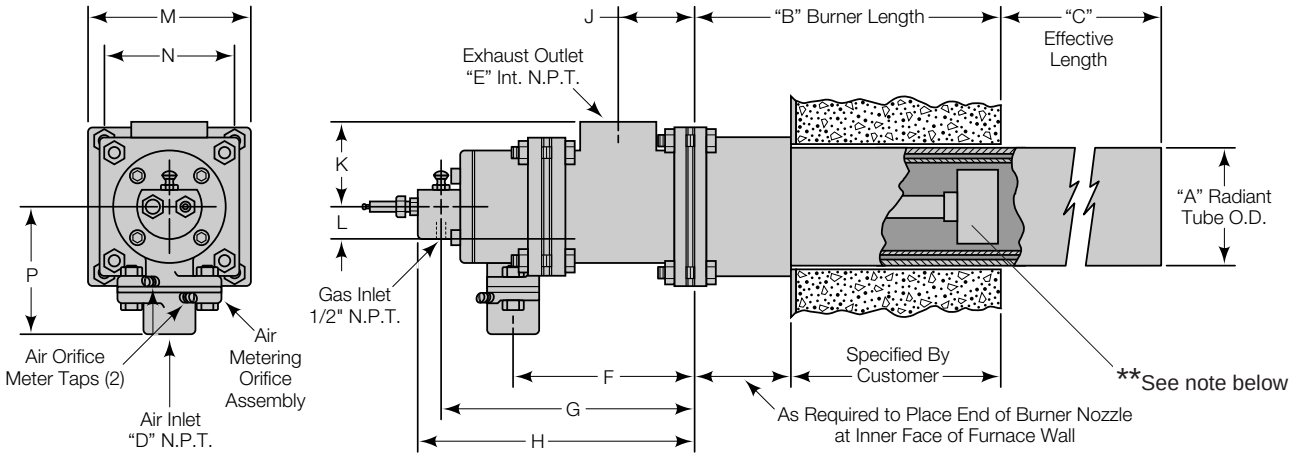
Furnace Temp, °F		1550	1650	1750	1850
Furnace Temp, °C		843	900	955	1040
Max. Heat Transfer, Btu/Hr./Sq. In.	Tube Free to Radiate on Three Sides	70	60	50	45
	Tube Enclosed on Three Sides	55	45	35	30
Max. Heat Transfer, Watts/cm2	Tube Free to Radiate on Three Sides	3.2	2.7	2.3	2.0
	Tube Enclosed on Three Sides	2.5	2.0	1.6	1.4

Maximum Heat Transfer Rates* — SiC

Furnace Temp, °F	1500	1700	1900	2100	2300
Furnace Temp, °C	815	927	1038	1149	1260
Max. Heat Transfer, Btu/Hr./Sq. In.	150	150	150	125	100
Max. Heat Transfer, Watts/cm2	6.8	6.8	6.8	5.7	4.5

* For Higher temperature or input contact Eclipse.

DIMENSIONS



****Propane and Butane burner nozzles are slightly different and must be designated at time of order as "Propane" or "Butane".**

Catalog Number	Dimensions in Inches														
	A	B	C* Min.	C* Max.	D	E	F	G	H	J	K	L	M	N	P
1314AR	3-1/4	14	24	50	1	2	7	9-7/8	10-3/4	3	3-1/2	1-1/4	5-1/2	5-1/2	5
1319AR	3-1/4	19	24	50	1	2	7	9-7/8	10-3/4	3	3-1/2	1-1/4	5-1/2	5-1/2	5
1814AR	4-1/2	14	30	74	1	2	7	9-7/8	10-3/4	3	3-1/2	1-1/4	6-1/2	5-1/2	5
1819AR	4-1/2	19	30	74	1	2	7	9-7/8	10-3/4	3	3-1/2	1-1/4	6-1/2	5-1/2	5
2414AR	6	14	30	120	1	3	9	11-7/8	12-3/4	4	4-1/2	1-3/4	9	7	5-5/8
2419AR	6	19	30	120	1	3	9	11-7/8	12-3/4	4	4-1/2	1-3/4	9	7	5-5/8
3014AR	7-1/2	14	36	160	1-1/2	3	9-1/4	12-1/2	13-3/8	4	5-1/4	1-3/4	10-1/2	8-1/2	6-3/8
3019AR	7-1/2	19	36	160	1-1/2	3	9-1/4	12-1/2	13-3/8	4	5-1/4	1-3/4	10-1/2	8-1/2	6-3/8

* Longer units can be supplied on special order.

Catalog Number	Dimensions in Millimeters														
	A	B	C* Min.	C* Max.	D	E	F	G	H	J	K	L	M	N	P
1314AR	83	356	610	1270	25	51	178	251	273	76	89	32	140	140	127
1319AR	83	483	610	1270	25	51	178	251	273	76	89	32	140	140	127
1814AR	114	356	762	1880	25	51	178	251	273	76	89	32	165	140	127
1819AR	114	483	762	1880	25	51	178	251	273	76	89	32	165	140	127
2414AR	154	356	762	3048	25	76	229	302	324	102	114	44	229	178	143
2419AR	154	483	762	3048	25	76	229	302	324	102	114	44	229	178	143
3014AR	190	356	914	4064	38	76	235	317	340	102	133	44	267	216	162
3019AR	190	483	914	4064	38	76	235	317	340	102	133	44	267	216	162

* Longer units can be supplied on special order.

SIZING

The length of an Auto-Recupe is usually determined by the physical dimensions of the furnace. Once the maximum heat release required from the tubes is known, sizing is simply a matter of choosing the tube diameter that will release the required heat while operating within its capacity range.

Example: The Auto-Recupes shown are to be used at a chamber temperature of 1650° F (900° C). The total heat release required is 400,000 Btu/Hr (117.2 kW).

Max. Heat Transfer (from page1):

Upper Tubes = 60 Btu/Hr./Sq. In. **(2.7 watts/cm^2)**

Lower Tubes = 45 Btu/hr./Sq. In. **(2.0 watts/cm^2)**

Using the 1819 AR with a tube O.D. of 4 1/2" **(11.4 cm)** and an effective length of 70" **(177.8 cm)**:

Surface Area = O.D. x π x Effective Length
= 4.5" x 3.14 x 70" = 989 Sq. In.
(11.4 cm X 3.14 X 177.8 cm = 6364 cm^2)

Efficiency (from page 1) = .70

$$\textbf{Max. Input} = \frac{\text{Heat Transfer x Surface Area}}{\text{Efficiency}}$$

$$\text{Upper Tubes} = \frac{60 \text{ Btu/Hr./Sq./In. x } 989 \text{ Sq. In.}}{.70}$$
$$= 84{,}770 \text{ Btu/Hr.}$$

$$\textbf{Upper Tubes} = \frac{\textbf{2.7 watts/cm}^2 \textbf{ X 6364 cm}^2}{\textbf{.70}}$$
$$\textbf{= 24,547 watts/cm}^2 \textbf{ = 24.5 kW}$$

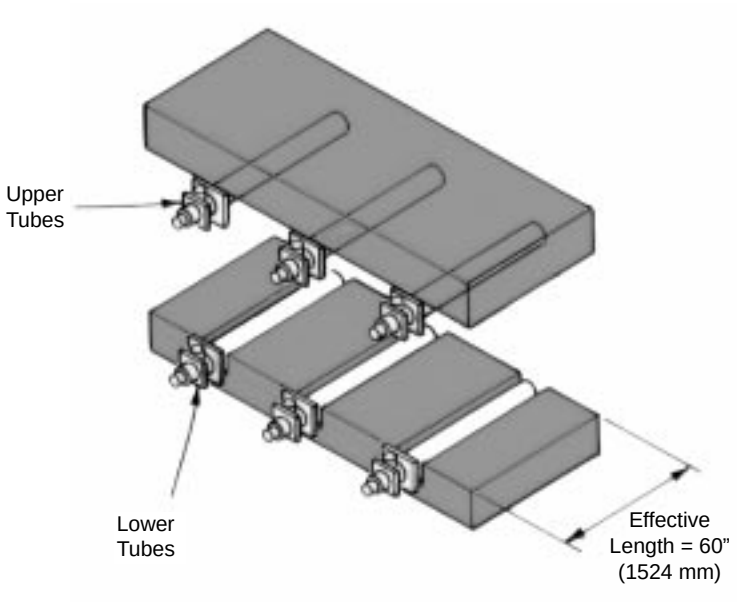
$$\text{Lower Tubes} = \frac{45 \text{ Btu/Hr./Sq./In. x } 989 \text{ Sq. In.}}{.70}$$
$$= 63{,}580 \text{ Btu/Hr.}$$

$$\textbf{Lower Tubes} = \frac{\textbf{2.0 watts/cm2 X 6364 cm}^2}{\textbf{.70}}$$
$$\textbf{= 18,183 watts/cm}^2 \textbf{ = 18.2 kW}$$

84,770 Btu/Hr. (24.5 kW) exceeds the maximum input rating for the 4 1/2" (11.4 cm) 1819 AR as shown on page 1. Maximum inut to the upper tubes would therefore be limited to 75,000 Btu/Hr. (22 kW)

Max. Heat Released = Maximum Input x Efficiency
Upper Tubes = 75,000 Btu/Hr. x .70 = 52,500 Btu/Hr.
Upper Tubes = 22 kW X .70 = 15.4 kW
Lower Tubes = 63,580 Btu/Hr. x .70 = 44,510 Btu/Hr.
Lower Tubes = 18.2 kW X .70 = 12.7 kW

With three upper and three lower tubes, the total maximum heat release is 291,000 Btu/Hr. (84.3 kW) Since the furnace requires 400,000 Btu/Hr., (117.2 kW) a larger diameter Auto-Recupe is needed. Repeating the calculations using the 2419 AR with a 6" (15.4 cm) O.D. gives a maximum upper tube input of 111,500 Btu/Hr. (32.8 kW) and a maximum lower tube input of 83,600 Btu/hr. (24.6 kW) Both are within the input range of the unit. Total maximum heat release would be 415,600 Btu/Hr., (120.5 kW) slightly more than enough to meet the furnace design requirements.



Upper tubes are free to radiate on three sides. Lower tubes are closely enclosed.

COMBUSTION AIR DATA

Each Auto-Recupe is supplied with two orifice plates installed between the air metering orifice flanges. The combustion air supply pressure at the inlet to the Auto-Recupe must be at least 3" w.c. (7 mbar) higher than the high fire metering orifice pressure drop shown in the graph below.

If supply pressure is high enough for the smaller of the two orifices supplied, leave both plates between the flanges. If supply pressure is too low for the small diameter orifice, loosen the flange bolts and slip out the smaller orifice plate, leaving the larger one in place.

Example: The 2419 AR's selected on the previous page have a 6" O.D. (154 mm) and are shipped with the .625" and .750" (16 mm and 19 mm) orifice plates as shown in the table below. An existing blower can supply a pressure of 14" w.c. (34 mbar) at the Auto-Recupe after piping and valve pressure drops are subtracted.

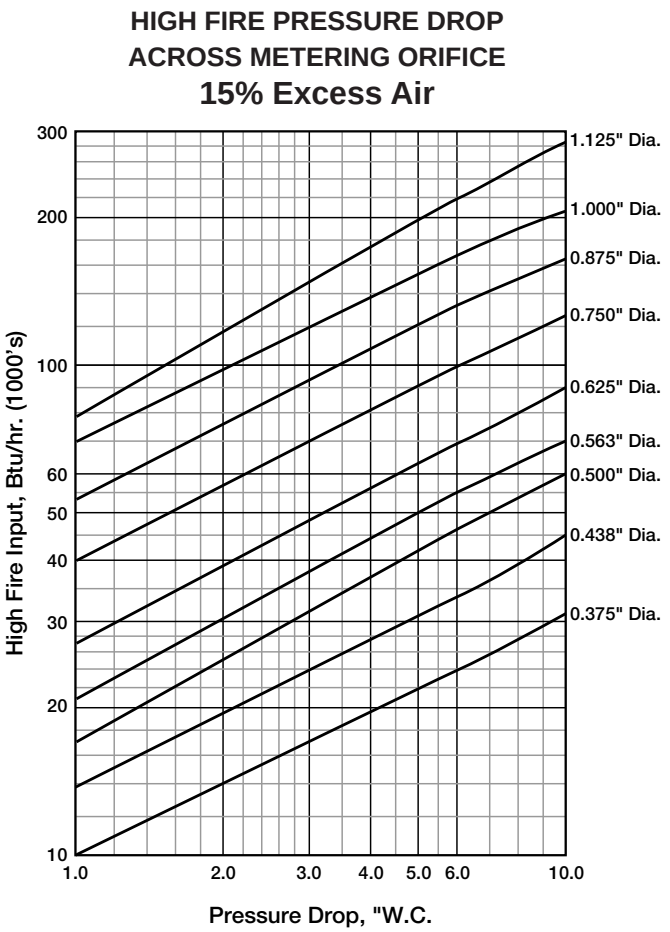
Upper Tubes: With an input of 111,500 Btu/Hr., (33 kW) the drop across the .750" (19 mm) orifice plate will be approximately 9.2"w.c. (10 mbar) This will require an air inlet pressure of 12.2"w.c., (17 mbar) within range of the existing blower. The .625" (16 mm) plate, however, would produce a pressure drop higher than the blower is capable of supplying. During installation, then, the .625" (16 mm) plate should be removed from the orifice meters of the upper tubes.

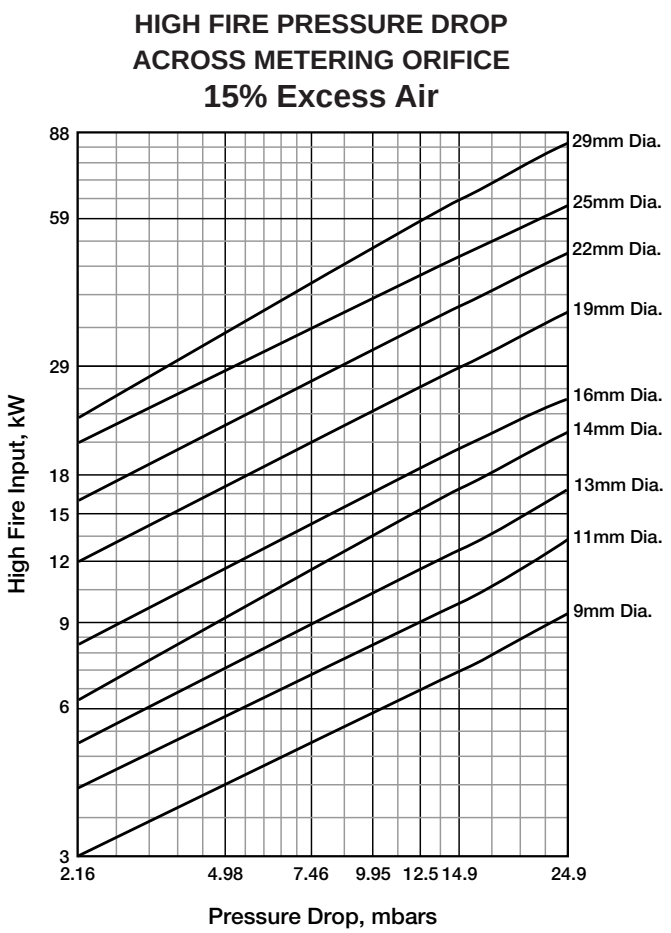
Lower Tubes: With an input of 83,600 Btu/Hr., (24.5 kW) the .625" (16 mm) orifice plate will have a drop of approximately 9.4"w.c. (23 mbar) The air supply required is thus 12.4"w.c. (30 mbar) Since the blower can supply this pressure, the .625" (16 mm) orifice plate need not be removed from the lower tubes.

Metering Orifice Plates Supplied With Auto-Recupes

Tube O.D. Ins./mm	Orifice Diameter (Ins./mm)								
	.375/9	.438/11	.500/13	.563/14	.625/16	.750/19	.875/22	1.000/25	1.125/29
3-1/4/83	X	—	X	—	—	—	—	—	—
4-1/2/114	—	—	X	—	X	—	—	—	—
6/154	—	—	—	—	X	X	—	—	—
7-1/2/190	—	—	—	—	—	—	X	—	X

Orifices not shown as standard can be supplied on request.





System Installation

IMPORTANT

The fitting of an Eclipse recuperative system is solely intended to save fuel, and not unless specifically stated is it intended to improve furnace production by increasing the net heat release.

Any increase in production will reduce radiant tube life.

If after conversion, it is found that on batch furnaces the recovery time has been reduced or, on continuous furnaces the burners are on high fire for less time than before, then steps should be taken to reduce high fire input to the burners.

On no account should the maximum dissipation rate for the radiant tubes be exceeded without consulting an Eclipse office.

Before starting installation of the auto recuperator assembly, it is important to check that the units supplied fit the furnace correctly.

When the old radiant tubes have been removed, recheck the distance from casing to hearth if vertically mounted, or far side brickwork if horizontally mounted. This should agree with dimension "A" on the engineering confirmation drawing which will have been approved. If the dimension is correct, the end of the Auto-Recupe outer tube will be at least 3" (76.2 mm) clear of the hearth brickwork if vertically mounted, or far wall if horizontally mounted and ensure that the Auto-Recupe is free to expand. Recheck the distance from casing to the insulation hot face. This should agree with dimension "B" on the engineering confirmation drawing and ensure that the burner is positioned correctly. If there is any discrepancy in the dimensions, the nearest Eclipse office should be notified before proceeding further.

Removing Existing Radiant Tubes (If applicable)

Remove burners, existing burners and radiant tubes. Check existing air and gas manifold to ascertain suitability for the new system. Sizes shown on the combustion system are the minimum size required, larger can be used.

If expansion glands or bellows were fitted to the casing for the old radiant tubes, these should be removed to leave a clear area for welding on the new mounting flange at the inlet end.

If the Auto-Recupe S.E.R. tubes are replacing straight through radiant tubes, the unused hole through the insulation should be filled in with ceramic fiber or insulation block. The hole in the casing should be sealed over by welding on or bolting on (with gasket), a blanking plate. This should be a gas tight seal.

Auto-Recupe SER Mounting

The Auto-Recupe S.E.R. should be installed into each position completely assembled with outer tube to insure that the inlet and outlets will be square with manifolds, etc. Before welding the mounting flange to the casing (or bolting to the existing mounting studs) check that the Auto-Recupe S.E.R. assembly is perfectly horizontal, or vertical whichever is applicable, and that the inlets are square to the furnace casing. If necessary, reposition the inlet connection by removing the bolts on the inlet casting and rotating casting to correct position.

Exhaust Connection

Extend exhaust using standard black iron pipe to clear the immediate area or connect to existing exhaust ducting.

Note: If exhaust fan is being used, ensure that there is adequate air break at the auto-recupe exhaust connection. Any negative pressure exerted on the auto-recupe burner could adversely affect its performance. Very long exhaust risers directly linked to the burner may create a sonic "howl".

Continued on Page 6

System Installation Continued

Air and Gas Manifolds

If new air and gas manifolds are required, they should be of at least the size indicated on the typical system on page 6, larger sizes can be used.

Using smaller sizes than those indicated will result in poor distribution of the air and gas flows. Holes in the manifold for the outlet connections should be drilled larger in diameter than the I.D. off the couplings to be welded on. Fit pressure test point on all gas and air manifolds.

Air and Gas Pipework at Burner

Position the air and gas manifolds alongside the burners. Temporary supports may be required.

Pipe the first and last burner back to the manifold including valves as indicated on the combustion circuit. Ensure that the valves are so positioned that there is access to the adjusting screws and shut-off valves can be operated without fouling pipework. Connect the remaining burners to the manifold in the same method and fit permanent manifold supports. If metering orifice plates are installed there should be at least ten (10) pipe diameters of straight pipe on the inlet side and five (5) pipe diameters on the outlet side to ensure accurate measurement.

Main Gas and Air Pipework

Connect from the gas and air manifolds back to the main and gas lines using pipe sizes and valving as indicated on the typical system (page 10). Reuse existing pipework where possible (large size pipe can be used).

Where possible, all valves fitted should be accessible from ground level.

Ignition Circuit

The Eclipse Auto-Recupe S.E.R. is designed for spark ignition with 6000 volt transformer at each burner. Individual transformers should be used, and these transformers should be mounted as close as possible to the burner with due regard to possible overheating from the exhaust housing, burner body and furnace casing. The transformers must be grounded.

Check the existing 120 volt isolating switch fuse protection and supply for capacity. If inadequate, an additional supply of sufficient capacity will have to be provided

Air Metering Orifice

Each Eclipse Auto-Recupe S.E.R. is supplied with 2 air metering orifice plates (sizes indicated on page one), installed in the air inlet casting. While both plates are fitted only the smaller sized plate is effective in measuring the flow. If during start-up it is discovered that insufficient air pressure is available, the smaller orifice plate should be removed. The larger remaining plate is then effective in measuring the flow.

Before starting any modifications to the furnace ensure that:

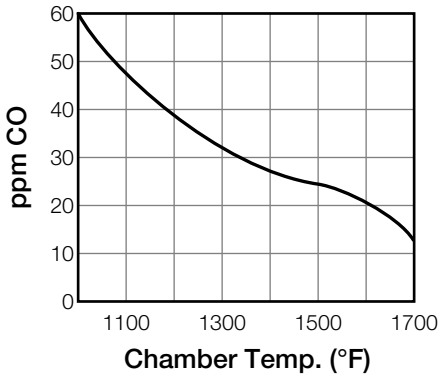
1. Gas supply is turned off at the main valve

2. Electric supply is turned off at main isolator and main fuses are removed.

3. If it is necessary to enter the furnace it is vital that all process gas has been completely purged out, adequate ventilation is provided, access doors are locked in the open position, and the “buddy” system is adopted.

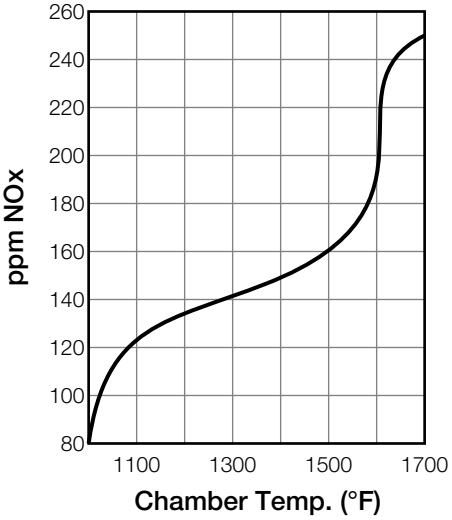
CO Estimates

(Based on 20% Excess Air Operation)
55 Btu/in.²/hr. Heat Flux



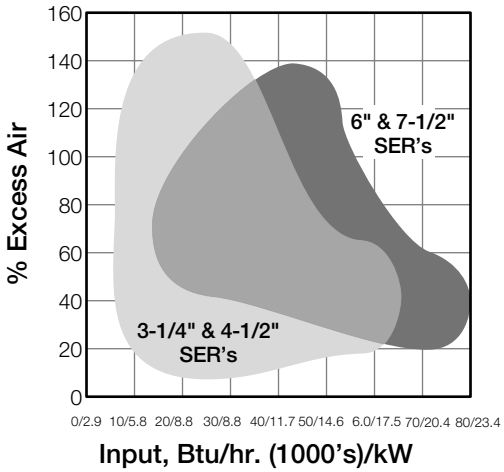
NOx Estimates

(Based on 20% Excess Air Operation)
55 Btu/in.²/hr. Heat Flux



Optimum Ignition Zones

(Stable Ignition is indicated by shading)



* Minimum Gas Pressures Required at Burner in "w.c. (Natural Gas)
(For Pipe Sizing Estimates Only)

Burner Size (Inches)	Btu/hr. Input in 1,000's					
	20	40	60	80	100	120
3-1/4	.8	2	—	—	—	—
4-1/2	1	3	5	—	—	—
6	1	2	4	5	6	10

* Minimum Gas Pressures Required at Burner in mbar (Natural Gas)
(For Pipe Sizing Estimates Only)

Burner Size (Millimeters)	Input in kW					
	6	12	18	23	29	35
83	2	4.98	—	—	—	—
114	2.49	7.46	12.5	—	—	—
154	2.49	4.98	9.95	12.5	14.9	24.9

* Minimum Gas Pressures Required at Burner in "w.c. (Propane)
(For Pipe Sizing Estimates Only)

Burner Size (Inches)	Btu/hr. Input in 1,000's					
	20	40	60	80	100	120
3-1/4	3	4	—	—	—	—
4-1/2	1	1.5	2	—	—	—
6	1	1	1.5	2	3	4

* Minimum Gas Pressures Required at Burner in mbar (Propane)
(For Pipe Sizing Estimates Only)

Burner Size (Millimeters)	Input in kW					
	6	12	18	23	29	35
83	7.46	9.95	12.5	19.9	24.9	—
114	2.49	4.3	4.98	7.46	9.95	—
154	2.49	2.49	4.3	4.98	7.46	9.95

* Minimum Gas Pressures Required at Burner in "w.c. (Butane)
(For Pipe Sizing Estimates Only)

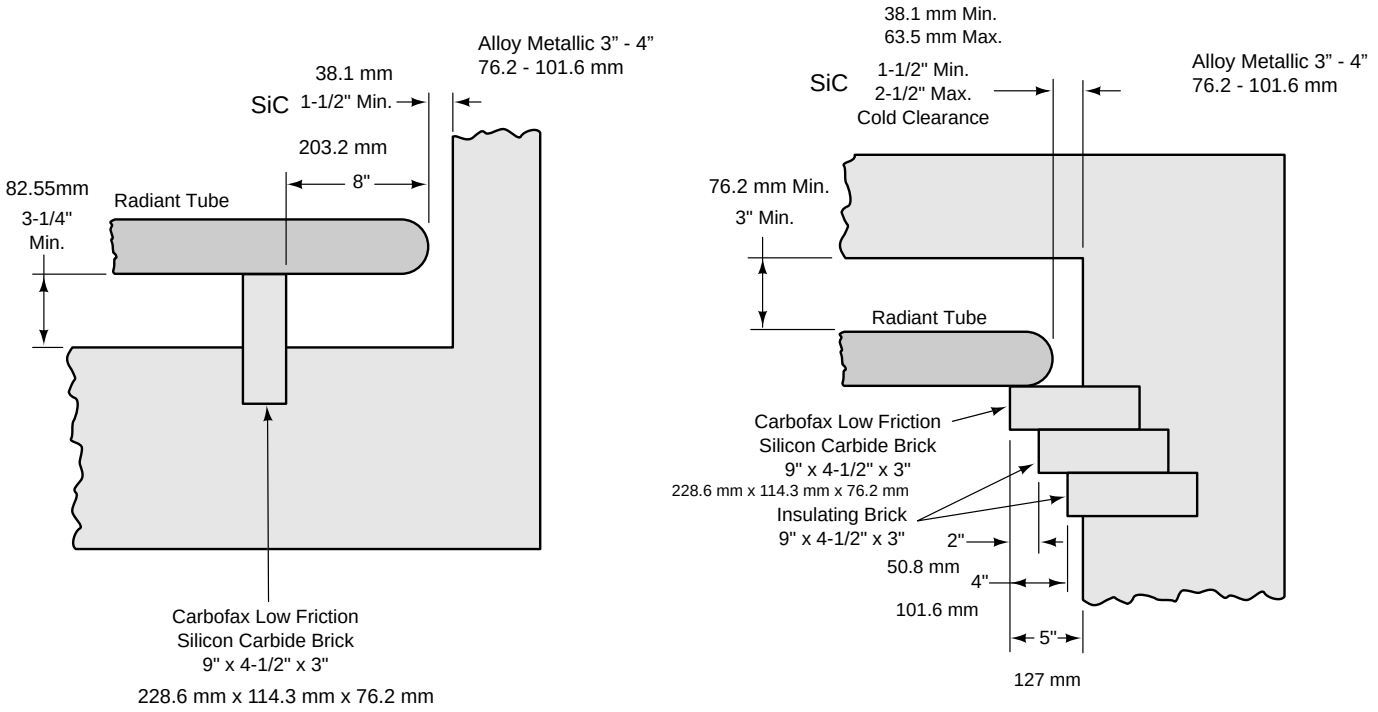
Burner Size (Inches)	Btu/hr. Input in 1,000's					
	20	40	60	80	100	120
3-1/4	9	12	15	18	—	—
4-1/2	4	5	10	14	—	—
6	2	3	5	6	8	12

* Minimum Gas Pressures Required at Burner in mbar (Butane)
(For Pipe Sizing Estimates Only)

Burner Size (Millimeters)	Input in kW					
	6	12	18	23	29	35
83	22.4	29.9	—	—	—	—
114	9.95	12.5	24.9	—	—	—
154	7.46	7.46	12.5	14.9	19.9	29.9

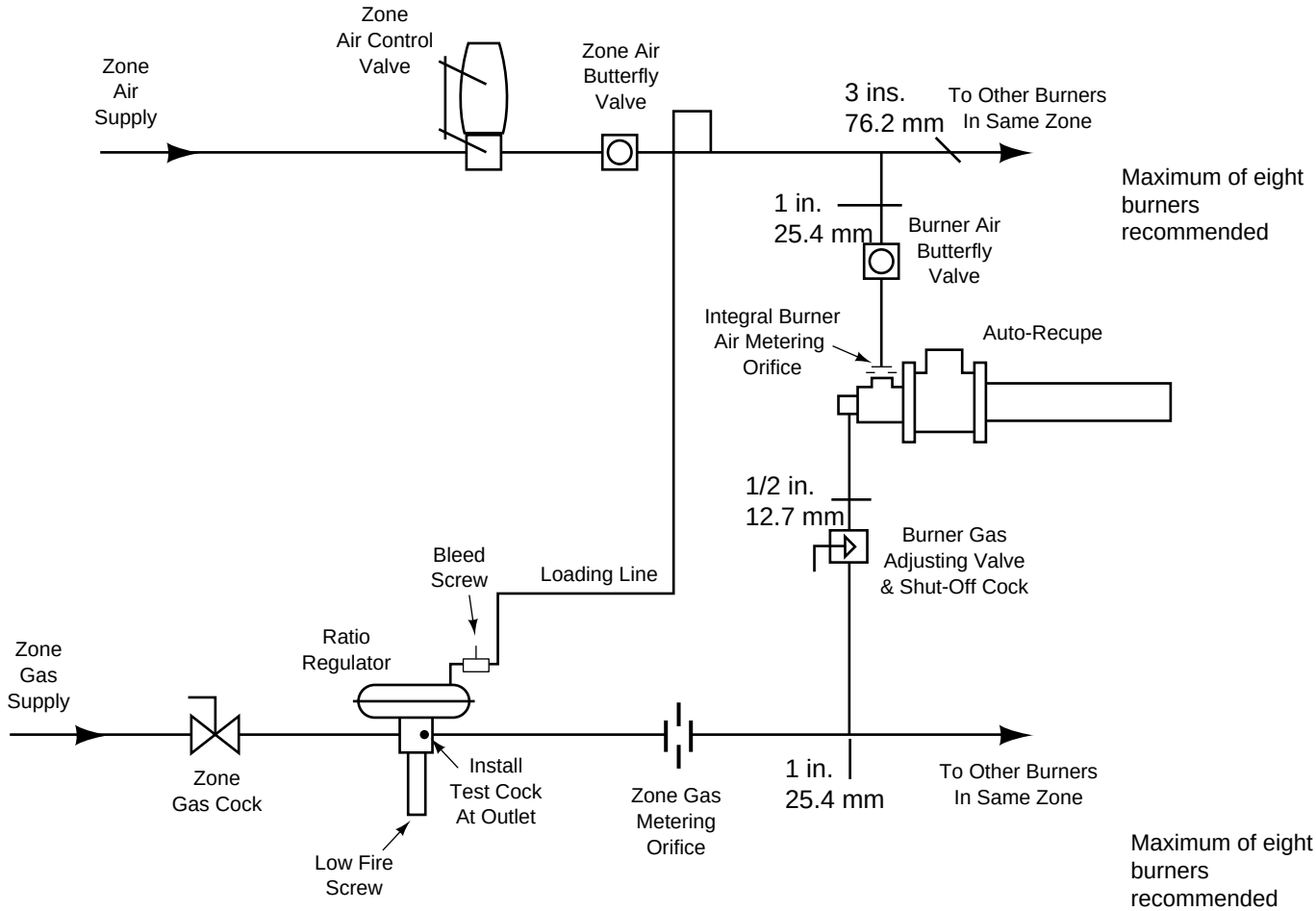
* Measure at Burner Side Pressure Tap of Gas Orifice Plate

Horizontal Tube Support



Note: Stub supports are available upon request

Typical System



General Precautions

1. Any new wiring required on the furnace must comply with local regulations.

2. Ignition transformer must be grounded

3. To insure against potential leaks, a quality grade sealing compound should be used on all joints in gas pipework.

4. To assist burner and recuperator removal, it is recommended that anti-seize compound be used on all S.E.R. bolts.

5. The spark rod provided for each burner should be kept in safe storage during installation of the equipment. When all plumbing is complete, remove the burner and refit the ignition rod such that the end of the spark rod is 3/8" through the air distribution plate on the burner in accordance with Eclipse specified dimensions.

6. All gas safety equipment, i.e. safety shut-off valves, supervising gas cocks, should be left in the circuit.

7. When ignition is energized, do not touch the sparkrod, ignition cable or transformer.

Although every effort has been made to ensure the list of items required for the installation is as complete as possible, it may be found that additional equipment is required. This should be reported to your local Eclipse representative.

Initial Start-Up

It is recommended that the initial start-up be carried out by Eclipse Combustion engineers. Incorrect setting of the burners will result in reduced burner efficiency, have a detrimental effect on tube life and could invalidate equipment guarantees.

If it is decided to use in-house personnel for the initial start-up, the following information may be of assistance.

Equipment required:

A.) Oxygen Analyzer

B.) Manometer

1. Fully open all of the air manual butterfly valves at the burners.

2. Set center adjusting screw on all adjustable gas cocks at burners, five (5) turns open. (Close completely then back off five (5) turns). Valve handle should be in the closed position.

3. Cycle zone gas valve to ensure that when heat is called for the valve is fully open and when low fire is required, valve is open slightly. Adjustment of the valve linkage may be required.

4. Start combustion blower, ensure all gas valves are closed, set control instrument for high fire. Automatic air butterfly valve should be fully open.

5. On the first burner, attach a manometer across the taps at the air metering orifice on the burner air inlet casting. Check the size of orifice fitted and from high fire pressure drop chart, adjust the manual butterfly valve in the main air supply to achieve the correct pressure drop for the desired rating. If correct pressure drop cannot be achieved it will be necessary to remove the smaller orifice. (see section entitled "Air Metering Orifice")

Note: If orifice plate is changed or removed, the same must be carried out on all burners to ensure balanced flows.

6. Cycle furnace to low fire.

Continued on Page 10

Initial Start-Up (*continued)*

7. Cycle furnace to high fire and recheck pressure drop at air metering orifice plate.

8. With control still at high fire, attach manometer to each burner in turn and check that the same pressure drop is obtained. If the pressure drops are significantly different, it will be necessary to adjust the manual butterfly valves at each burner to achieve a balance. For ignition, make sure the input range is within those shown on chart on page 5. Contact factory for input requirement not shown in chart.

9. Energize spark ignition (if automatic system fitted) or attach portable unit to first burner.

DO NOT TOUCH THE SPARK ROD, IGNITION WIRE OR TRANSFORMER WHILE THE IGNITION IS ENERGIZED.

10. Open main gas valve and safety shut-off.

11. Open zone gas cock if fitted.

12. Open adjustable cock at first burner. View down peepsight to check if burner has ignited. If burner has failed to ignite, experiment by opening and closing the adjusting screw in the gas cock to find position that will ignite the burner. Repeat for all burners.

13. Using analyzer check for free oxygen in exhaust. If between 3 and 6%, no adjustment is required at this time. If oxygen is less than 3%, reduce gas flow at the adjustable gas cock. If oxygen is above 6%, increase gas flow at the adjustable gas cock.

14. Repeat steps 12 & 13 until all burners are ignited.

15. Terminate spark ignition.

16. Allow burners to stabilize for 30 to 60 minutes and then recheck oxygen levels and adjust if required. This is only an initial setting. Final adjustments are to be made when furnace is at temperature.

17. Attach manometer across the gas metering orifice plate and compare reading with pressure drop on flow chart for desired rating.

18. A recheck on the oxygen levels at a few burners should be made to ensure correct combustion. Cycle furnace to low fire.

19. Low fire input should be as indicated on page 1 with oxygen levels in exhaust between 12 and 16%. The gas flow at low fire may be too low to measure at the gas metering orifice. The aim is to achieve a flow that will remain ignited with clean combustion and will not cause temperature to rise. Adjust the ABP to give proper O_2 levels.

    A. If burners go out.

        i. This indicates insufficient flow.

        ii. Re-energize spark ignition.

        iii. Increase gas flow by slightly opening the automatic zone air butterfly valve until burner re-ignites.

        iv. Terminate spark ignition.

        v. Check oxygen levels.

Initial Start-Up *(continued)*

B. Oxygen levels correct but temperature continues to rise above desired level.

i. Reduce flow by adjusting the low limit on the automatic zone air butterfly valve.

ii. Check oxygen level

RECHECK HIGH FIRE FIRING RATES AND OXYGEN LEVELS

iii. Terminate spark ignition.

20. Allow furnace to reach operating temperature

21. Recheck oxygen levels at each burner. Adjust gas flow at adjustable gas cocks to achieve 3 to 5% O_2 in exhaust.

22. Recheck gas flow at metering orifice. Adjust flow as required.

23. A careful check should be maintained over the next few days that the oxygen levels and flows do not change.

Shut-Down Procedure

1. Close gas cocks at each burner.

2. Close gas cocks on zone gas supply if fitted.

3. Close main gas valve.

4. Wait 10 minutes for gas to purge out of radiant tubes then turn off combustion air blower.

5. Ensure ignition is off.

Procedure complete.

Normal Start-Up

This assumes that standard shut-down procedure was followed and that no adjustment has been made to the combustion circuit.

1. Start combustion air blower.

2. Energize spark ignition. (If individual transformers fitted).

3. Open main gas cock.

4. Open main safety valve.

5. Open zone gas cock if existing.

6. Attach ignition units to first burner if portable units being used. Open gas cock. Do not touch spark rod ignition wire or transformer.

7. Verify burner has ignited by viewing down peepsight.

8. Repeat (6) and (7) for all burners.

Procedure complete.

Maintenance

The following is suggested maintenance to ensure trouble-free operation of the equipment and to identify problems before they affect the operation of the equipment.

1. Immediately after the equipment is installed and operating correctly, measure and record the following:

    a. Oxygen levels in exhaust on high.

    b. Pressure drop at gas metering orifice. (High and low fire)

    c. Gas pressure on outlet side of ABP.

    d. Air pressure drop at metering orifice at burner inlet casting. (High and low fire)

    e. Gas pressure at burner inlet casting.

    f. Air pressure at air manifold.

    g. Air pressure from combustion blower.

    h. Take note of the scale reading and mark scale at amount open on the zone gas manual butterfly valve and manual butterfly valve at each burner.

These measurements and notes will be of great assistance if the settings are disturbed for any reason.

2. Every month measure and record oxygen levels in exhaust on high.

3. Every month view down peepsights on burner to check for unusual flame or carbon build-up. If necessary remove burner to investigate.

4. At least every year, if possible every six months, remove burner and inner tube. Clean off any carbon build-up, check condition of burner, inner tube, outer tube and spark rod.

5. Every six months if possible, unbolt burner from inner and outer tube and rotate inner and outer tube through 180°. Bolt on burner.

Spare Parts List

To insure continued operation of the system, keep an appropriate quantity of the following spare parts in stock for immediate use. See your Eclipse representative for part numbers and recommended stocking levels.

- Ignition rod
- Ignition transformer
- Ignition cable
- Rajah connector
- ABP

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