



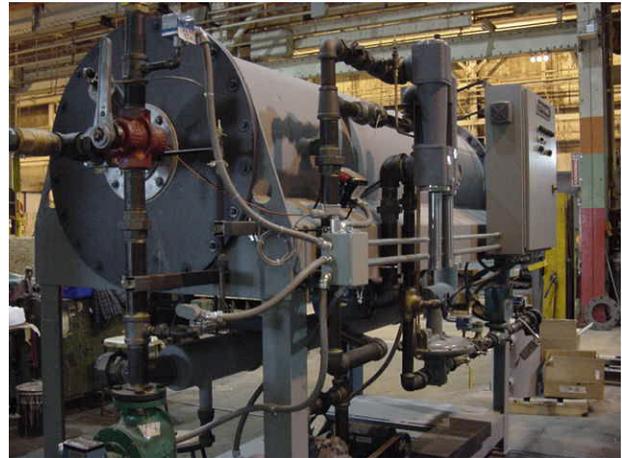
# Exogas™ Exothermic Generators

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*Indirect-chilled Exothermic Atmosphere for Annealing, Brazing, Normalizing, Drawing & Tempering*

Exogas atmosphere generators produce a low-cost exothermic gas for various surface treatment applications. The generator burns fuel gas and air under controlled conditions to provide an exothermic gas containing hydrogen, carbon monoxide, carbon dioxide, water and nitrogen.

After start-up, operation is virtually automatic. Only minimum supervision is needed. Exogas generators produce a protective atmosphere which can be used for many processes including annealing, brazing, and normalizing.



## **Automatic Ratio Control**

Pressure regulators automatically adjust the input of fuel gas and air so that the air-gas ratio remains constant (within design range) regardless of changes in the rate of flow.

## **Adjustable Gas Analysis**

The output gas can be adjusted to the desired analysis by varying the input air-gas ratios, which are then automatically maintained. Note: Actual output gas must be routinely verified.

## **Flexibility**

Exothermic atmospheres can be produced from any fuel gas such as coke-oven, natural, propane, or butane. The generator can be converted from one gas to another by merely substituting the correct burner and flowmeters.

## **Automatic Fire Check**

The automatic fire check gives positive protection from all backfiring. It meets all safety requirements and is provided on premix units only.

## **Easy Installation**

Atmosphere generators are shipped completely assembled; ready for immediate connection to gas, power, and water supply lines.



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### **Low Maintenance**

There are fewer components, easy accessibility, and a minimum of moving parts thereby reducing maintenance.

### **Continuous Operation**

Generators require few shutdowns for daily inspection having continuous 24 hour service day after day.

### **Safety Features**

All SECO/WARWICK equipment adheres to the latest NFPA standards regarding industrial furnaces and equipment.

### **Construction Features**

All components of SECO/WARWICK's Exogas atmosphere generators are designed to assure maximum performance and efficiency. Compare the features of these components which are built into our equipment.

**Combustion Chamber**—The Exogas generator combustion chamber consists of a shell fabricated of heavy sheet steel with a removable gasketed cover that is bolted on at both ends. The inner lining of the combustion chamber consists of the best quality, iron-free, high temperature refractory. The combustion chamber is filled with a catalyst (rich only) especially developed to promote rapid reaction of the air-gas mixture and to break down the more complicated hydrocarbon components. Uniformity of gas composition is assured by the construction of the combustion chamber that prevents channeling of gases as they pass through the combustion chamber. This also assures thorough mixing and complete reaction of the gases. A port for observation of the combustion chamber is also provided. The combustion chambers of all lean units are water cooled. The combustion chambers of rich units are water cooled except the 500 and 1000 cfh (14, 28 cmh) sizes.

**Automatic Ratio Control**—Provision is made for automatically maintaining the air-gas ratio at any set value within the minimum and maximum output capacity of the gas generator. This is accomplished by means of sensitive pressure regulators that keep the ratio of air flow to gas flow at a fixed value even when the total output is widely varied. This control is accurate, has no moving parts to require attention, and is not affected by dust particles or other impurities in the air and gas. Ratios can be adjusted or changed if desired while the unit is in operation. A combustible controller for critical atmosphere applications can be supplied at nominal additional cost.

**Cooler**—A shell and tube type gas cooler is provided to cool the processed gas. The removable tube bundle type cooler is furnished as standard.



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**Combustion System**—Two flowmeters, mounted on the side of the combustion chamber, indicate the flow of air and gas input to the generator. All rich units plus the 500 and 1000 cfh (14, 28 cmh) lean units use a premix type burner with refractory burner block and spark ignited pilot. A three-way, two port valve is installed in the mixture line to the burner so that the air-gas mixture may be diverted to the outside vent while the pilot burner is being adjusted. The premix units include an approved automatic type fire check assuring positive protection against possible backfiring and meets all safety requirements of the NFPA. The burner on lean units larger than 1000 cfh (28 cmh) is a nozzle mix type with refractory burner block and spark ignited pilot.

**Pump**—The mixing pump on the premix unit is a positive displacement type and is designed so that its lubrication cannot mix with the air and gas stream. The air pump on the nozzle mix systems is a positive displacement type also. In both cases the pump is equipped with a bypass regulator which maintains constant pressure at any output, pressure being adjustable from 1 to a maximum of 3 psi (52 to 155 mm Hg). The pump is mounted on a base plate which also supports a standard open drip proof type motor. Nozzle mix units require a fuel gas pressure of 3 psi (15 mm Hg). Smaller units utilizing the premix design require fuel gas pressure from .1 to 1 psi (5 to 52 mm Hg). Gas pressures higher than stated will require service regulators while gas pressures lower than stated will require the addition of a gas booster.

**Safety Equipment**—Safety equipment is included to shut off the raw gas supply in event of gas pressure or power failure; stop gas pump motor if gas pressure or power fails, or stop unit if flame failure occurs.

## Process and Gas Cost

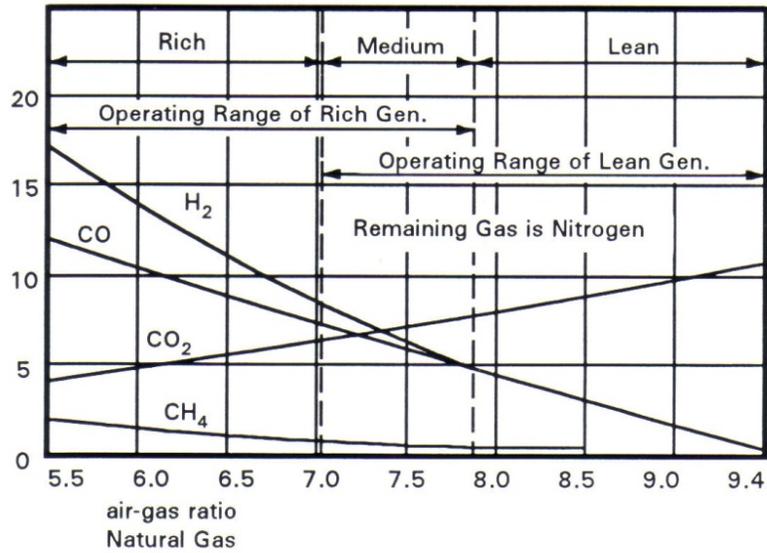
An exothermic atmosphere is produced at a low cost from any regular fuel gas. Call SECO/WARWICK for a production cost estimate using your current utility prices.

### Operating range

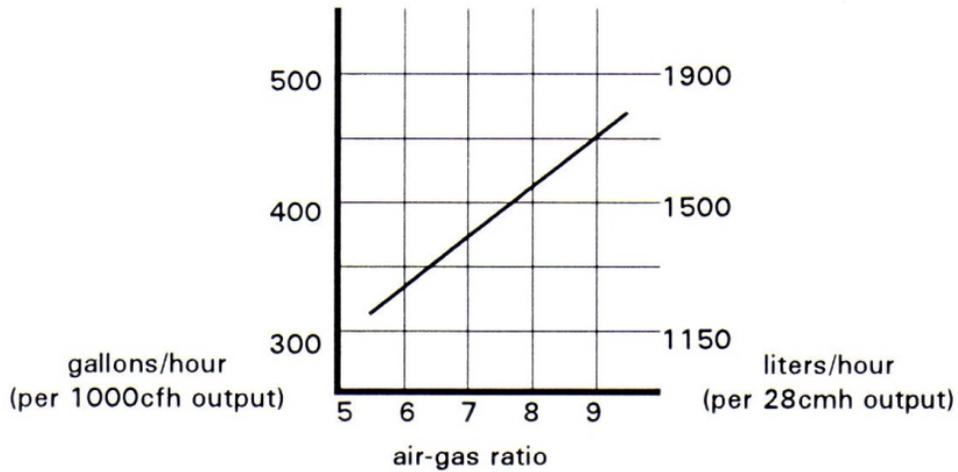
Type	Operating Range at 100% Capacity	Capacity at Complete Combustion (9.4:1)
Rich	Air-Gas Ratio 5.5 to 7.8	60%
Lean	7.0 to 9.4	100%



### Atmosphere Composition



### Cooling Water





**Gas Consumption**

Model No.	Output		Gas Consumption			
			Natural Gas		Propane	
			6:01		15:01	
Rich	cfh	cmh	cfh	cmh	cfh	cmh
EX-5	500	14	76	2	32	1
EX-10	1000	28	152	4	64	2
EX-20	2000	57	304	8	128	4
EX-30	3000	85	456	13	192	5
EX-40	4000	113	608	17	256	7
EX-60	6000	170	912	26	384	11
EX-80	8000	225	1216	34	512	14
EX-100	10000	283	1520	43	640	18
Lean			9.5:1		23:1	
EX-5	500	14	58	2	24	0.7
EX-10	1000	28	115	3	49	1.4
EX-20	2000	57	230	7	98	3
EX-30	3000	85	345	10	147	4
EX-40	4000	113	460	13	196	6
EX-60	6000	170	690	20	294	8
EX-80	8000	225	920	26	392	11
EX-100	10000	283	1150	33	490	14

**Rich Exothermic Atmosphere**

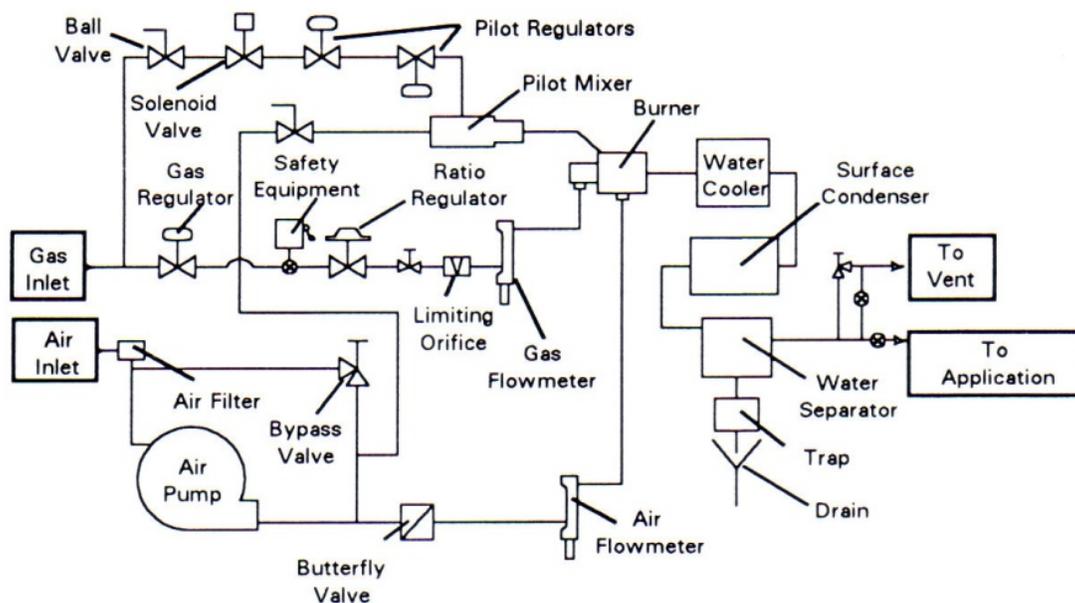
When fuel gas is mixed properly with air, it may be burned under controlled conditions to form CO<sub>2</sub>, CO, H<sub>2</sub> and H<sub>2</sub>O with N<sub>2</sub>. If combustion is carried out under a slight deficiency of air, no oxygen will be present in the resultant atmosphere. In the rich Exogas generator, sufficient heat is generated to form these reducing gases without adding external heat, but the heat generated is considerably less than for the lean exothermic atmosphere. For this reason, the rich Exogas generator is not self-starting, but must first be thoroughly heated by operation at a lean air-gas ratio. After the unit is heated, the mixture may be enriched to produce a rich Exogas atmosphere. The following reaction is typical (for a 5.7 to 1 air-gas ratio using methane as the fuel gas): CH<sub>4</sub> + 1.2O<sub>2</sub> + 4.5N<sub>2</sub>—> 1/3CO<sub>2</sub> + 2/3CO + H<sub>2</sub> + H<sub>2</sub>O + 4.5N<sub>2</sub>

## Lean Exothermic Atmosphere

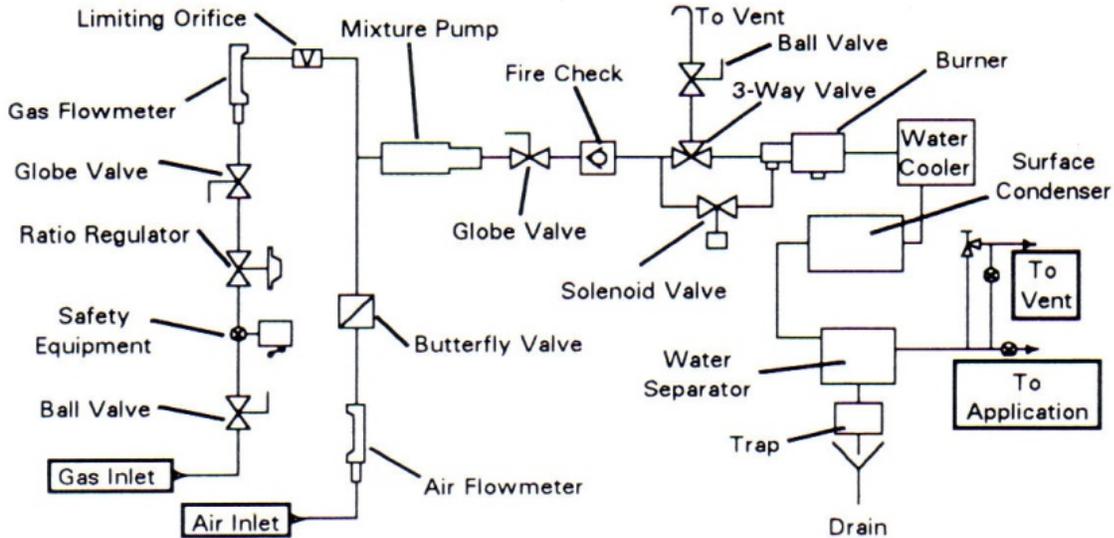
The chemical reaction is similar to that for rich exothermic atmospheres except that leaner air-gas ratios are used and the products of combustion contain only very small quantities of hydrogen and carbon monoxide. This reaction corresponds to an operation ratio near the line representing complete combustion.  $CH_4 + 2O_2 + 7.52N_2 \rightarrow CO_2 + 2H_2O + 7.52 N_2$

## Simplified Schematic Flow Diagrams

### Lean Exogas



### Rich Exogas



### How It Works

Combustion air is furnished by a positive displacement air pump drawing air through a filter. The air flows through a manual air valve and a flowmeter to the burner. Fuel gas flows through a safety valve, a ratio regulator, manual shutoff valve and a flowmeter before entering the burner. The air and gas mixture is ignited at the burner face and is passed through the combustion chamber. The processed gas leaving the combustion chamber is quickly cooled by a water cooled shell and tube gas cooler. A water separator then removes additional water vapor so that the final processed atmosphere has a dew point corresponding with a temperature of about 10°F (5.6°C) above the inlet temperature of the cooling water.



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## Sizes and Dimensions

Model No.	Output		Approximate Minimum Output		Approximate Dimensions						Length for Tube Removal		Gas Pump Motor Rating		Approximate Shipping Weight	
					Width		Height		Length							
Rich	cfh	cmh	cfh	cmh	ft	mm	ft	mm	ft	mm	ft	mm	hp	kw	lbs	kg
EX-2	250	7	125	3.5	2'-7"*	790	6'	1830	2'-7"	790	5'	1520	.5	.4	1300	590
EX-5	500	14	250	7	3'*	910	8'-3"	2510	3'	910	6'	1830	.75	.6	1875	850
EX-10	1000	28	500	14	3'-5"*	1040	9'-8"	2950	3'-5"	1040	7'	2130	1.5	1	2900	1330
EX-20	2000	57	1000	28	3'-10"*	1170	7'-9"	2360	8'-7"	2620	16'-7"	5050	1.5	1	4500	2060
EX-30	3000	85	1500	43	3'-10"	1170	7'-9"	2360	10'-11"	3330	19'	5790	2	1.5	5500	2500
EX-40	4000	113	2000	57	4'-8"	1420	8'	2440	11'-6"	3511	20'	6100	3	2	6120	2715
EX-60	6000	170	3000	85	4'-9"	1460	9'	2740	11'-8"	3560	21'	6400	3	2	6400	2900
EX-80	8000	225	4000	113	5'	1520	9'	2740	11'-9"	3580	21'	6400	5	4	7000	3175
EX-100	10000	283	5000	142	6'	1830	9'-8"	2950	13'-8"	4170	23'	7010	5	4	8000	3625
EX-150	15000	425	7500	212	6'-3"	1900	8'	2440	14'-5"	4390	25'	7600	5	4	20000	9075
EX-200	20000	565	10000	283	7'	2130	8'	2440	15'-2"	4620	20'	6100	7.5	5.5	37000	16800
<b>Lean</b>					* indicates vertical combustion chamber. All other models have horizontal chambers.											
EX-2	250	7	100	3	2'-9"*	840	5'-2"	1590	2'-9"	840	-	-	.5	.4	1300	590
EX-5	500	14	200	6	2'-9"*	840	6'-10"	2080	2'-9"	840	-	-	.75	.6	1875	850
EX-10	1000	28	400	11	3'*	910	9'	2740	3'-8"	1120	-	-	1.5	1	2900	1330
EX-20	2000	57	800	23	3'-6"	1070	6'-1"	1850	9'-4"	2840	16'-6"	5030	1.5	1	4500	8060
EX-30	3000	85	1200	34	3'-9"	1140	6'-4"	1930	9'-10"	3000	22'-8"	6910	2	1.5	5500	2500
EX-40	4000	113	1600	46	4'	1220	6'-6"	1980	11'-8"	3560	24'-6"	7470	2	1.5	6120	2715
EX-60	6000	170	2400	68	5'	1520	6'-11"	2110	13'-4"	4060	26'-2"	7980	5	4	6400	2900
EX-80	8000	225	3200	91	5'	1520	7'-4"	2240	13'-9"	4190	26'-7"	8100	5	4	7000	3175
EX-100	10000	283	4000	113	5'	1520	7'-4"	2240	13'-9"	4190	26'-7"	8100	5	4	8000	3625
EX-150	15000	425	6000	170	7'-4"	2240	8'-8"	2640	14'-2"	4010	23'-2"	7060	5	4	20000	9075
EX-200	20000	565	8000	226	7'-4"	2240	8'-10"	2690	16'-5"	5000	26'-2"	8000	10	7.5	37000	16800



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### Industrial Services

A wide range of services are available for our equipment. These include rebuild projects, field service, spare parts, equipment supply, control and combustion upgrades, and fabrication services. As a result of these services, we have provided our customers improved performance, lower emissions, better efficiency and enhanced product temperature uniformity.

*The latest design, materials, and equipment specifications should be obtained from the company before any reliance is placed on this standard bulletin since changes may occur due to product improvement.*

### About SECO/WARWICK

The SECO/WARWICK Group provides industrial metal heat treatment furnaces used in a variety of processes for material finishing and component manufacturing applications. We supply furnaces to customers involved with steel, titanium and aluminum production as well as aluminum recycling, forging, automotive, aerospace, commercial heat treating, HVAC/R, electronics, wind energy, medical equipment and nuclear industries.

The SECO/WARWICK Group produces vacuum furnaces, atmosphere furnaces, controlled atmosphere aluminum brazing furnaces (CAB), aluminum process furnaces and vacuum metallurgy equipment in manufacturing sites in Poland (SECO/WARWICK Europe), the United States (SECO/WARWICK Corp., RETECH Systems LLC), India (SECO/WARWICK Allied Ltd.), China (SECO/WARWICK RETECH Mfg. Tianjin Co., Ltd.) and Brazil (SECO/WARWICK do Brasil Ltda.). Sales, service & spare parts offices in Germany (SECO/WARWICK Services GmbH) and Russia (SECO/WARWICK Russia) complete the worldwide customer care network. Visit our website below for more information.