

 DESIGN PRACTICES	<i>FIRE HEATERS</i> INERT GAS GENERATORS		Section	Page
			VIII-L	1 of 5
			December, 2001	

Changes shown by ↗

CONTENTS

Section	Page
SCOPE	2
BACKGROUND	2
DESIGN CONSIDERATIONS	2
DESCRIPTION OF INERT GAS DESIRED	2
COOLING WATER CONSIDERATIONS	2
TYPE OF SERVICE	3
CONTROL SYSTEMS	3
FUEL CONSIDERATIONS	3
UTILITY AND OWNER OPTIONS	3
TABLE	
Table 1 Check List For Inert Gas Generator Duty Specifications	4
FIGURE	
Figure 1 Typical Inert Gas Generator and Post-Treatment Equipment	5

Revision Memo

12/01	Removed material specification to Cooling Water Consideration paragraph. Editorial revision to Control System paragraph. Editorial revision to Utility and Owner Options paragraph.
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Section VIII-L	Page 2 of 5	<i>FIRED HEATERS</i> INERT GAS GENERATORS	 DESIGN PRACTICES
December, 2001			

SCOPE

This section provides technical information and guidelines for preparing duty specifications for combustion-type inert gas generators. It is restricted to complete package units which can be shop tested and demonstrated before shipment. Such units are generally limited in size to about 100,000 SCFH (800 dm³/s). Design specifications for large, field-erected units, or units combining subassemblies which cannot be demonstrated before delivery, must be developed from individual component technology as any other process unit.

BACKGROUND

Inert gas generators are infrequently specified, and there is a strong economic incentive to purchase off-the-shelf, vendor standard units. Therefore, this type of equipment should be procured via duty specification, rather than design specification. To assure acceptable equipment quality, we normally specify two procurement safeguards:

- Equipment must be purchased from vendors who have demonstrated satisfactory operation with similar units.
- A complete shop test of the specific unit being purchased is required. Combustion-type inert gas generators (see **Figure 1**) produce an inert gas mixture consisting mainly of nitrogen and carbon dioxide, with less than 5% volume oxygen and unburned hydrocarbons, by burning a gas or light, clean liquid fuel at near-stoichiometric fuel/air ratios. Depending on the quality of gas required, these relatively inert products of combustion can be used as produced, or they can be compressed, dried, and treated in auxiliary equipment to achieve any desired gas quality. Naturally, the more treatment, the higher the investment and operating costs. The following table describes typical combustor gas qualities obtainable without any post-treatment:

TYPE OF FUEL	MINIMUM O ₂ CONTENT (VOL%) IN EFFLUENT
Liquid (kerosene)	1.0
Gas (average)	0.2 to 0.5
Gas (high quality)	0.1 to 0.2

Package units include all controls, the combustor, compressors, filters, dryers, and auxiliary treatment facilities. Such units can be shop tested and preset for the desired operating conditions. **Table 1** is a checklist of the items normally specified by the design engineer.

DESIGN CONSIDERATIONS

DESCRIPTION OF INERT GAS DESIRED

The quantity of inert gas required should be stated in volumetric units on a wet (saturated) or a dry basis. One alternative available is to specify two or more smaller package units which can be used together to provide the required total gas volume. This arrangement provides a necessary degree of reliability, and assures partial capacity during downtime of one unit for maintenance.

The quality of inert gas required must be clearly specified, as detailed in **Table 1**. It is not necessary to specify the inert gas composition at a unique stoichiometric ratio; only the allowable limits for each constituent are required. The vendor determines which items establish the constraints for his equipment.

COOLING WATER CONSIDERATIONS

Cooling water is required both to cool the combustion chamber and to cool the effluent gas from the combustor. The combustor water jacket design assumes a clean, low resistance heat path from metal surface to the water. Fouling of the water side can cause distortion and eventual failure of the combustor. High quality water can be conserved by provision of a closed cooling water loop circulating through an auxiliary exchanger designed to be cooled by lower quality water.

The concentration of oxygen in the generator effluent gas is affected by the type of aftercooling used. If direct contact cooling is used, the oxygen concentration in the generator effluent can be higher than in the combustor effluent because the gas picks up oxygen from the cooling water. If deaerated water is used, the increase may be as low as 50 to 100 ppm. However, if cooling tower water or similarly aerated water is used, the increase can be as high as 600 ppm.