Removal of NO_x and CO from a Burner System

Abstract

This paper presents the development of an emissions-controlling technique for oil burners aimed especially to reduce oxides of nitrogen (NO_x). Another emission of interest is carbon monoxide (CO). In this research, a liquid fuel burner is used. In the first part, five different radial air swirler blade angles, 30°, 40°, 45°, 50°, and 60°, respectively, have been investigated using a combustor with 163 mm inside diameter and 280 mm length. Tests were conducted using kerosene as fuel. Fuel was injected at the back plate of the swirler outlet. The swirler blade angles and equivalence ratios were varied. A NO_x reduction of more than 28% and CO emissions reduction of more than 40% were achieved for blade angle of 60° compared to the 30° blade angle. The second part of this paper presents the insertion of an orifice plate at the exit plane of the air swirler outlet. Three different orifice plate diameters of 35, 40, and 45 mm were used with a 45° radial air swirler vane angle. The fuel flow rates and orifice plate's sizes were varied. NO_x reduction of more than 30% and CO emissions reduction of more than 25% were obtained using the 25 mm diameter orifice plate compared to the test configuration without the orifice plate. The last part of this paper presents tests conducted using the air-staging method. An industrial oil burner system was investigated using the air staging method in order to reduce emission, especially NO_x. Emissions reduction of 30% and 16.7% were obtained for NO_x and CO emissions, respectively, when using air staging compared to the non-air-staging tests.

Language of Original Document

English

Index Keywords

Air staging; Blade angle; Burner system; CO emissions; Emissions reduction; Equivalence ratios; Exit planes; Fuel flow rates; Orifice plate; Oxides of nitrogen; Staging-method; Swirler vane angles; Swirlers; Test configurations

Engineering controlled terms: Carbon monoxide; Emission control; Fuels; Leakage (fluid); Oil burners; Orifices; Turbomachine blades

Engineering main heading: Reduction

EMTREE drug terms: carbon monoxide; fuel oil; kerosene; nitrogen oxide; nitric oxide

GEOBASE Subject Index: air sampling; carbon monoxide; combustion; emission control; fuel; nitrogen oxides; pollutant removal

EMTREE medical terms: air; article; controlled study; field emission; flow rate; isolation and purification

MeSH: Carbon Monoxide; Nitric Oxide
Medline is the source for the MeSH terms of this document.