1.0 INTRODUCTION

The FCS Power Plant generates steam using six boilers and two heat recovery steam generators (HRSGs). This system description describes Boilers No. 1, 2, & 3, which are package type boilers manufactured by Babcock & Wilcox. Boilers No. 5, 6, & 7 and the two HRSGs are covered in their respective system descriptions.

1.1 Purpose and Scope of the System

The primary function of Boilers No. 1, 2, & 3 is to convert the chemical energy in fuel to thermal energy in the form of saturated steam to supply high pressure, superheated steam to heat and cool various buildings throughout the University of Illinois campus and also supply steam to the turbine-generator units. A cutaway view of the Boilers No. 1, 2, & 3 is shown in Figure 1.

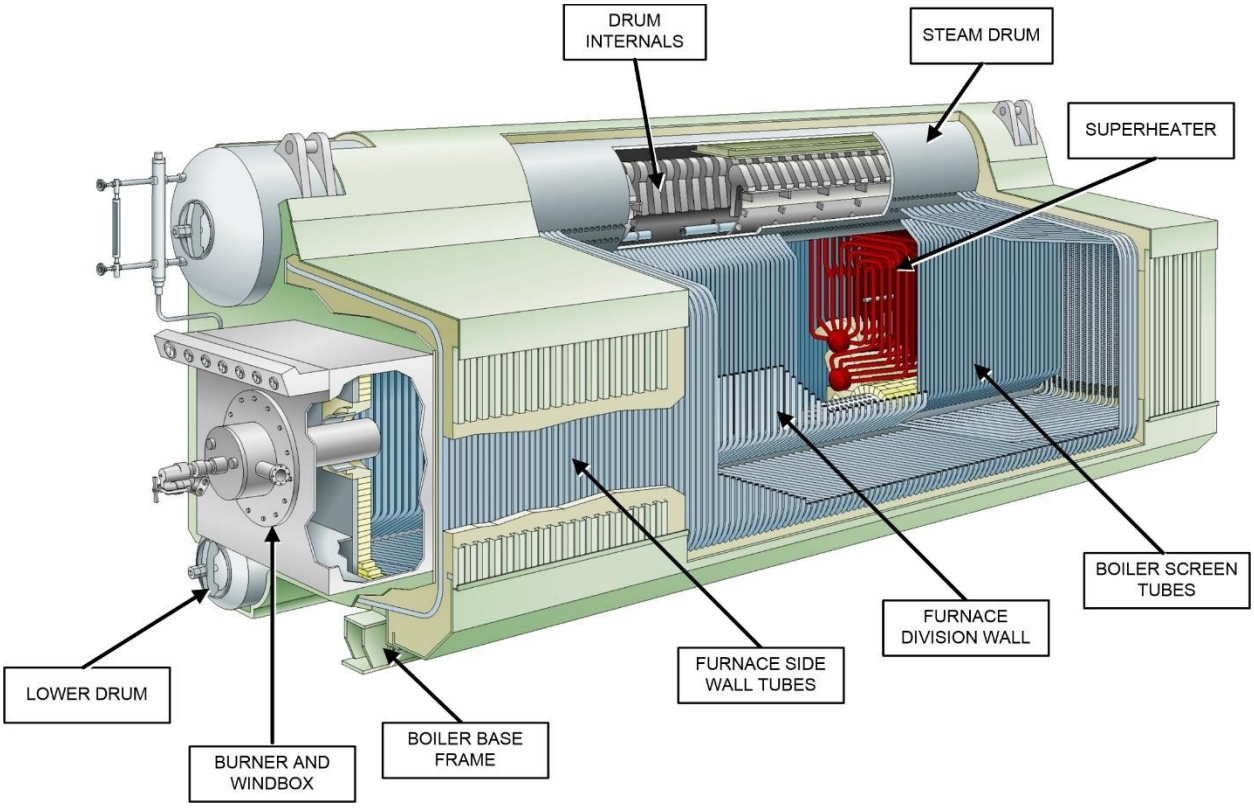

Figure 1 – Boiler No. 1, 2, & 3

Boilers No. 1, 2, & 3 are Babcock & Wilcox FM120 package boilers installed in the FCS Plant. These boilers are water tube, natural circulation boilers designed for firing oil and/or natural gas. Each boiler has a single burner, forced draft (FD) fan, flue gas recirculation (FGR) duct, economizer, and superheater. The boilers are designed, in

accordance with ASME Codes for Power Boilers, for continuous operation at 850 psig and a temperature of 740°F at the superheater outlet.

This system description will refer to Boilers No. 1, 2, & 3 collectively as the gas boilers, and generally describe Boiler 1 with the understanding that Boilers 2&3 are essentially the same. Differences between the boilers, if any, will be noted in each section. The purpose and scope of this System Description is to describe the flowpaths, major components, and controls associated with the gas boilers and supporting systems/equipment.

1.2 Primary Flowpaths

This section provides an overview of the gas boilers by detailing the primary flow paths and configuration. Each gas boiler is made up of four separate and distinct primary flow paths:

- Combustion air and flue gas
    - In the combustion air and flue gas flowpath, combustion air is mixed with fuel and burns; providing the heat to boil the water, and the combustion flue gasses flow past and over the boiler tubes through the economizer and exit via the stack.
- Water-steam
    - Feedwater is converted to steam in the water-steam flowpath.
- Fuel
    - The fuel flowpaths deliver natural gas and No. 2 fuel oil to the burner to be mixed with combustion air and burned.

1.2.1 Combustion Air and Flue Gas Primary Flow Path

The gas boilers are forced draft boilers consisting of a combustion air system and a flue gas system. Within the combustion air and flue gas (CA&FG) primary flow path, fuel is mixed with air supplied by the forced draft (FD) fan and burns. The result are combustion flue gasses, which flow over the boiler tubes, through the economizer and exit via the stack. The CA&FG flow path for the gas boilers is shown in Figure 2.

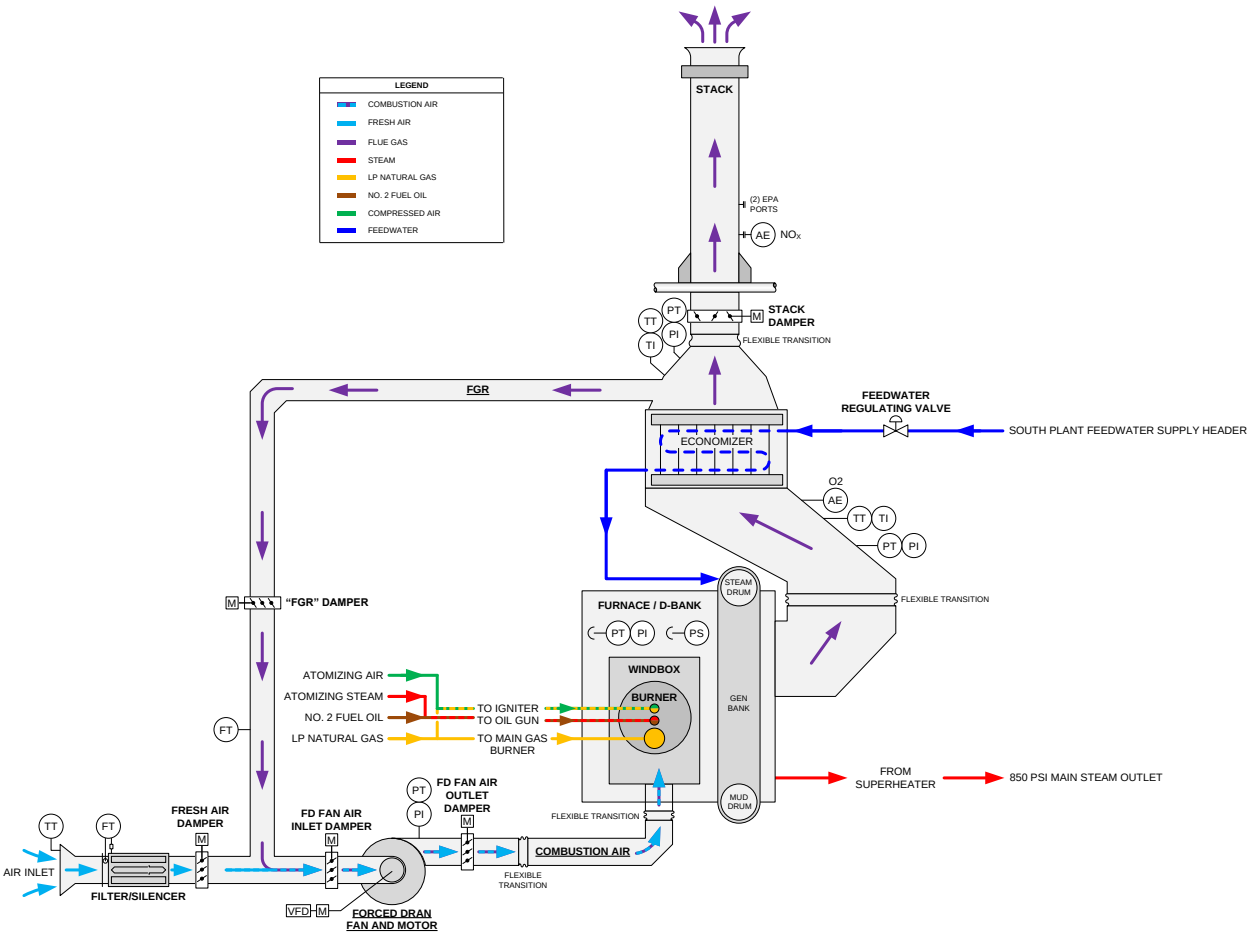

Figure 2 – Gas Boilers CA&FG Flow Path

Combustion Air System Flowpath

The combustion air system has a forced draft (FD) fan that draws in combustion air from the south plant basement through an inlet filter/silencer and delivers it to the boiler windbox. Combustion Air is provided to the boiler windbox and furnace area to provide oxygen required to support combustion of the primary fuels, natural gas and No. 2 fuel oil. For the fuel to burn efficiently, there must be an adequate supply of oxygen to support complete combustion in the furnace and proper velocity to transfer heat from the gases to the water and steam within the tubes.

Flue gas from the flue gas ductwork at the outlet of the economizer is also drawn into the FD fan suction. This flue gas is referred to as flue gas recirc (FGR) and is mixed with the fresh air being drawn into the suction of the FD fan. As a result, the combustion air supplied to the boiler windbox is a mixture of fresh air from the basement and FGR. The mixture of fresh air and FGR to the boiler windbox is used to help reduce NOx