

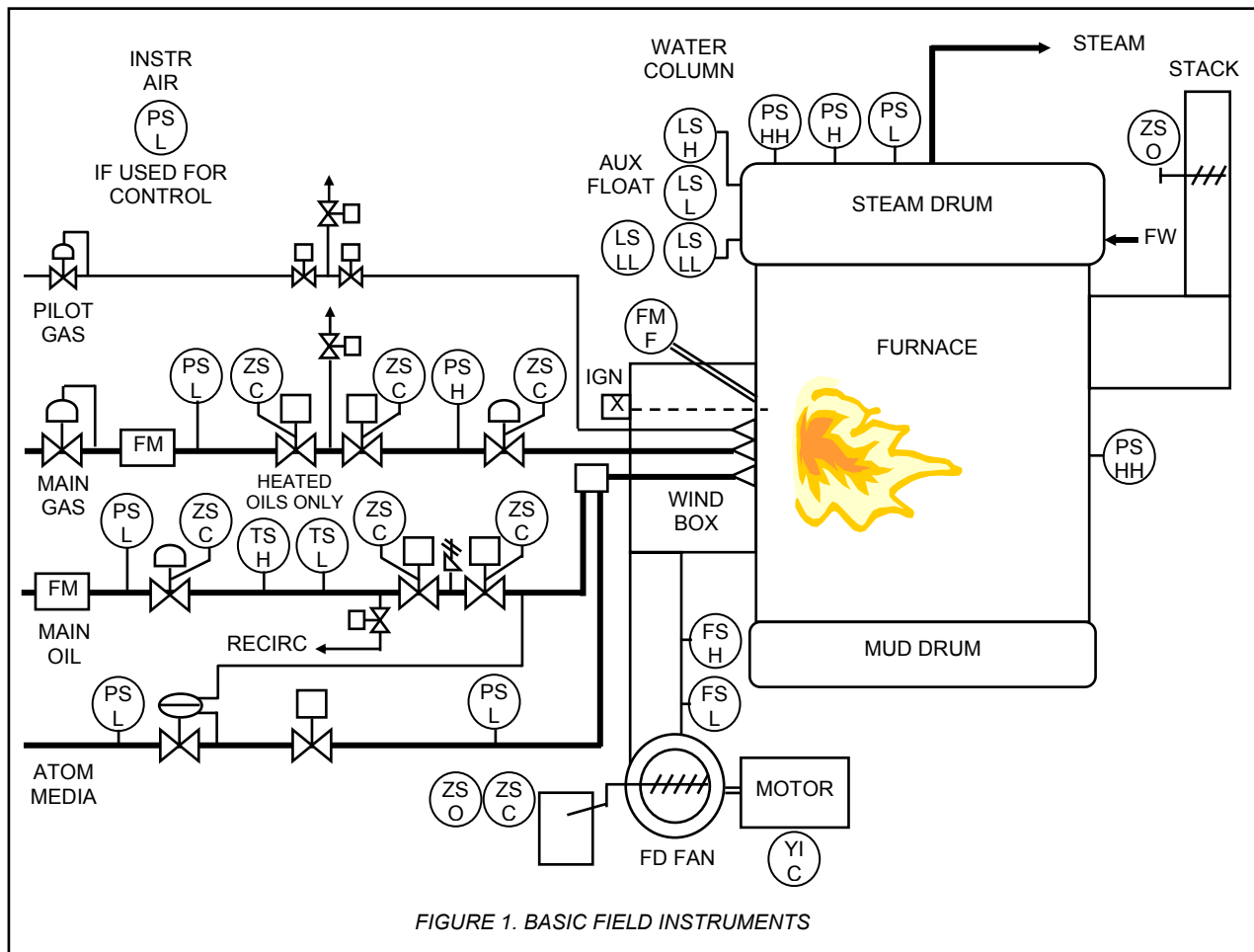
Burner Management Microprocessor Based Burner Management Systems (BMS)

Introduction

The National Fire Protection Association (NFPA) publishes national standards for safety systems. For boiler burner management systems, the applicable standard is NFPA 85: "Boiler and Combustion System Hazards Code". This document details specific requirements for devices used in burner management system logic. These requirements are addressed in this data sheet.

General Requirements

No single failure in the system will prevent an appropriate shutdown.



APPLICATION DESCRIPTION

The above diagram details the field instruments required for a system that meets minimum NFPA standards for automatic operation of a dual fuel, single burner package boiler. Each fuel train has double block valves with proof of closure limit switches to prevent a single point of failure. The gas trains also have vent valves in order to prevent leakage into the furnace. The oil trip valves require a pressure relief device between them to prevent the over-pressurization of trapped oil. The temperature switches on the oil train are only required for heated oils (i.e. No. 6 or No. 4 grades). The fuel train pressure switches prevent operation of the burner with fuel pressures that are outside the design range of the burner. Note that the flow control valves have limit switches to prove light off position during trial for ignition of the main fuels. When burning oil, two pressure switches, one on the supply and one at the burner, are required for

automatic operation of the atomizing media system. The opening of either switch will cause a safety shutdown.

Minimum and purge air flows can be proven by either flow switches or all damper open limit switches with windbox pressure switches. In addition the forced draft fan must be proven to be in service by starter contact closure. Note that the fan damper actuator has a limit switch to prove light off position during trial for ignition. A furnace pressure switch can prove an open flow path through the furnace or damper open limit switches on all dampers in the flow path.

Adequate drum water level is proven by a water column with level probes and conductivity relays as well as an auxiliary low water cut out switch, normally the float type. The loss of either will cause a safety shutdown. If instrument air is used to actuate control valves or damper actuators, an instrument air pressure switch must be provided. An excess drum pressure switch must also be provided. If the boiler is to be in recycling service i.e. automatically on/off, high and low steam pressure switches are required to start and stop the boiler.

Sequence Logic

The NFPA standard has specific requirements for the sequence of operation and for mandatory safety shutdowns. See Fig. 2 below for the sequence logic flow chart. There are two types of operation: recycling (automatic start/stop based on steam pressure) or non-recycling (manual boiler start/stop), which have essentially the same logic. The mandatory safety shutdown parameters are:

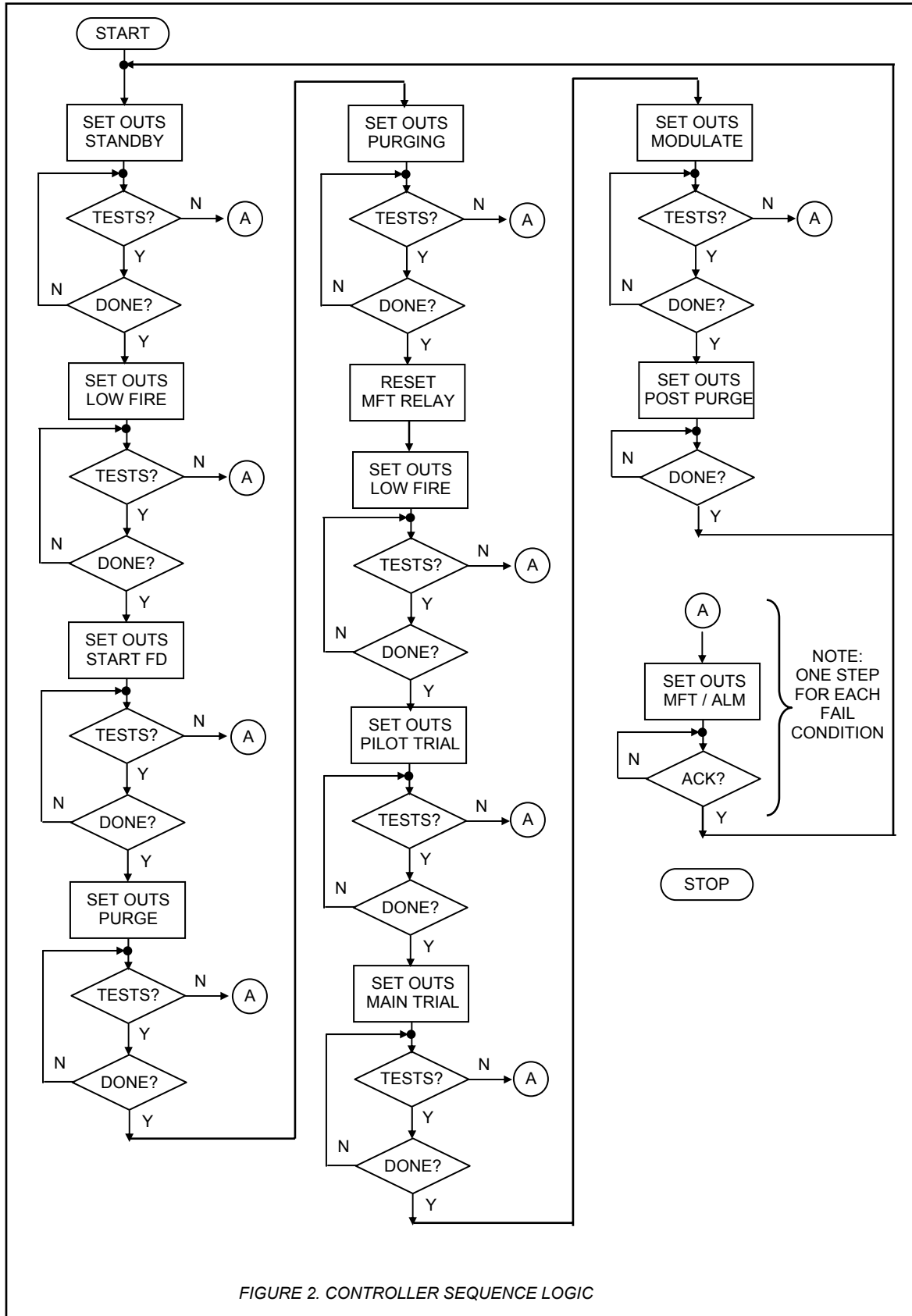
- Loss of control system actuating energy (Instrument Air if used)
- Power failure
- Low water level as determined by auxiliary low water cutout
- Excess steam pressure
- Loss of combustion air supply
- Loss or failure to establish flame

Additional for gas firing:

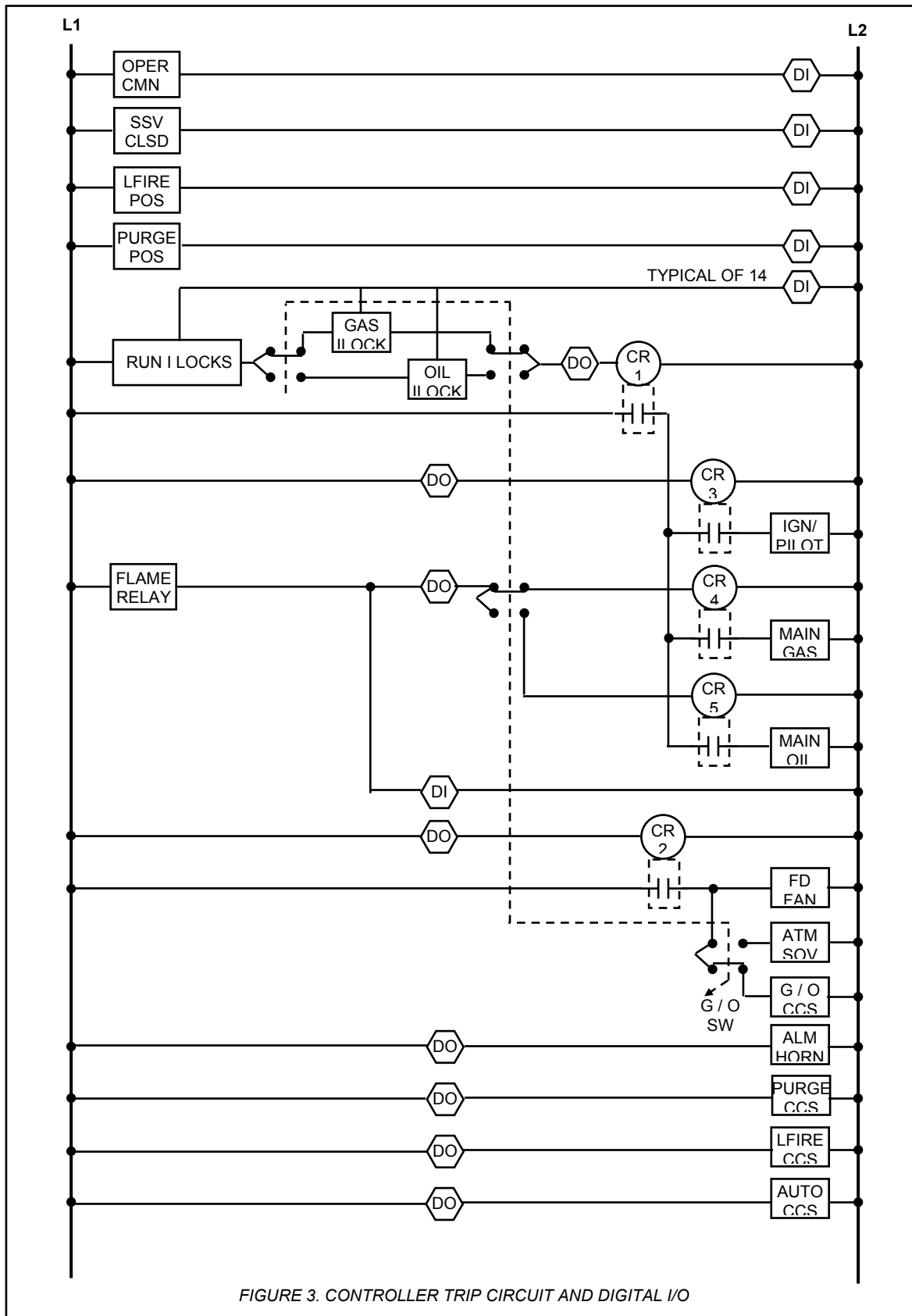
- High gas pressure
- Low gas pressure

Additional for Oil Firing:

- Low oil pressure
- High/Low oil temperature (Heated Only)
- Low Atomizing Media pressure (2)



Fault Tolerant Trip Circuit Design



The trip circuit wiring detailed in Fig. 3 above meets the requirement for no single point of failure. The interlocks are wired directly to the MFT relay in addition to the controller. This makes the controller a redundant trip device in addition to the hardwired interlocks because each output device also requires a contact from the controller to be actuated. Opening the MFT relay due to the opening of any interlock denies power to all fuel devices. Even if power is available at the MFT relay, each device must also have a device relay closed by the controller. The main fuel valves can only be opened if the flame relay detects flame. The flame should have been established in the igniter/pilot step for the main fuel valves to open. The controller serves as a purge timer and trial timer subject to diagnostic testing and defined failure states.

