O P E R A T O R ' S M A N U A L

NO. STE-1

4500 HP

STEAM TURBINE ELECTRIC

FREIGHT LOCOMOTIVE

WITH DYNAMIC BRAKING

NORFOLK AND WESTERN RAILROAD

NO. 2300

BALDWIN-LIMA-HAMILTON CORPORATION
PHILADELPHIA 42, PA.

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BOILER - GENERAL

INTRODUCTION

The boiler is a special natural circulation, water-tube longitudinal drum, low head locomotive type. Cyclone steam separators are used in the boiler drum to provide dry steam to the superheater and solid water to the generating tubes. All generating tubes extend between the top drum and a connected closed circuit of bottom headers (large pipes). The generating tubes form the boiler walls and arch, and are also arranged in the gas path as convection surface. A steel casing is attached to the wall tubes, forming a gas tight enclosure. External supply tubes connect between the boiler drum and lower headers to deliver steam free water from the cyclone separators. A submerged type feed pipe is used to deliver the feed water to the drum. The drum is not exposed to the furnace gases. Tubes of 3", 2-1/2" and 1" OD are used to form the various boiler components. A superheater, economizer and air heater are incorporated for maximum efficiency.

Coal is delivered to the furnace by a modified type-BK locomotive type stoker. The grate is a travelling type, permitting continuous discharge of ash at the firing end of the grate. Grate speed is approximately 10 feet per hour. The ash so discharged is spread in the ash pan by intermittent blowing of steam jets automatically timed.

Combustion air is supplied under pressure by a turbine driven propeller type blower. The gas air heater is used to preheat air (and cool exit gases) to 350° F. at full load. Auxiliary stack jets are available for supplying induced air flow for firing up or low load operation when desired.

Water is pumped from the tender by a cold pump, through a zeolite type softener and turbine

oil cooler to the contact type deaerating feed water heater. A booster pump delivers deaerated hot water to the main feed pump, which delivers water through the boiler economizer to the boiler drum. Steam for auxiliaries is taken from the boiler drum and/or superheater to suit conditions of individual machines. All steam used forward of the boiler is reduced to 250 lb. pressure in order to permit utilization of standard coal handling and air compressing equipment. The booster and main feed pumps and blower are turbine driven and exhaust to the deaerating feed water heater. Continuous blowdown from the boiler drum is flashed and the steam so generated is returned to the feed water heater, in which 12-15% condensate is recovered. For emergency operation, a standby feed pump is mounted on the rear span bolster. This pump delivers cold water directly from the tender to the boiler.

The boiler and auxiliaries are automatically controlled by pneumatic type controls. Air supply for boiler controls is filtered in two stages and reduced to 30 psig. Remote hand operation of boiler controls is permissible if the operating crew so desire. All valves and controls necessary for operation on the road are located at the engineman's or fireman's station. Additional hand valves for firing up are located on the boiler front.

AUTOMATIC CONTROL & PROTECTIVE DEVICES

Automatic control of the boiler is achieved by use of four instruments called Controllers, mounted on the boiler front. They measure:

a. Steam Pressure b. Steam Flow
c. Drum Water Level d. Air Flow

and produce a control air pressure proportional to the amount measured. These control pressures pass through one of three selector valves:

a. Feed Water - On engineman's control stand.
b. Boiler Blower - On fireman's console.
c. Stoker - On fireman's console.

There is a transfer switch on each selector valve which can be turned to either "Hand" or "Automatic" as desired. Several combinations of settings may be used, as described on pages 27-29.

On "Hand" position, the controls are operated and respond like conventional controls.

On "Automatic", the controllers send the control air pressure through the selector valve to operate diaphragm valves and hold preset conditions of steam pressure, water level, air flow and coal feed.

When the transfer switch is on "Automatic", pneumatic interlocks will act to stop the coal feed if:

a. Low water level is indicated by drum level controller.
b. Air flow through boiler stops.

If the transfer switch is left on "Automatic", coal feed will not start again unless the condition corrects itself and reset procedure is followed. By switching the transfer switch to "Hand", the above interlocks can be cut out, and the crew can proceed without interlock protection by setting the necessary control pressure on the selector valves to maintain pressure and/or water level.

A direct operated whistle, located on the engineman's water column, sounds an alarm on either high or low water level. (See page 31.)

An additional pneumatic interlock will shut the feed pumps down if high water level occurs. The pumps will automatically start again when the level drops below the center of the glass. Having the feed water selector valve on "Hand" does not cut out this interlock. It can be by-passed only by holding in the emergency pump emergency button.