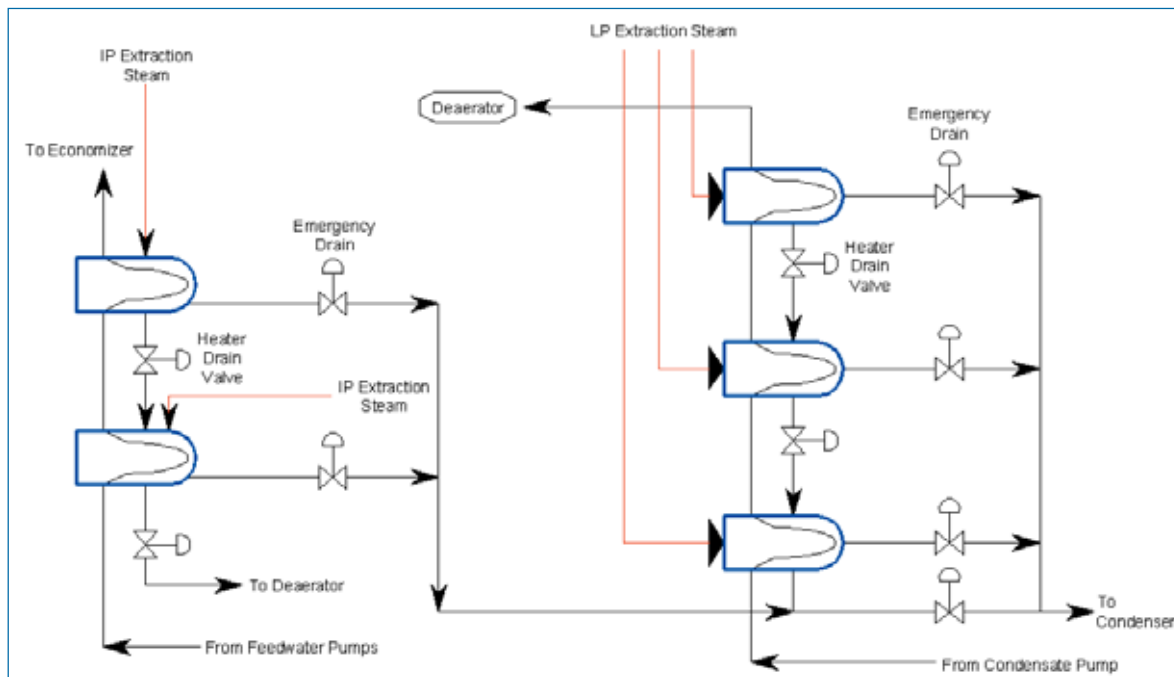


# Feedwater Heater Electronic Level Switches

Feedwater heaters are essentially shell and tube heat exchangers that are used to improve power plant efficiency. They are also used to raise the feedwater temperature to a sufficient value to avoid thermal shock to the boiler drum metal.

The number, type and size of feedwater heaters depends on the plant operating pressure and megawatt output capability. Heaters are available in various types and designs including high pressure, low pressure, closed and open. They are also available in both vertical and horizontal configurations.

Feedwater heaters utilize steam to heat the feedwater as it returned back into the boiler drum. The heaters are cascaded together in series. The condensate has considerable energy and is also returned to other heaters to heat the feedwater. The condensing steam must be drained from the feedwater heater properly for maximum efficiency and safety. The recommendations for level controls are described in ASME TDP-1-1998. The diagram below shows a typical power plant HP and LP heater arrangement.



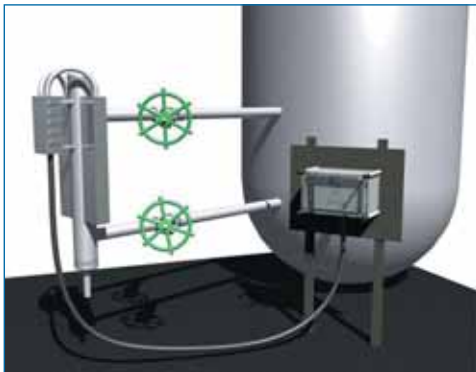
The Aquarian conductivity probe level measurement instrument is used to detect abnormal high or low levels within the feedwater heater steam section. Typically, three or four point level measurements are required. The Aquarian Level instrument provides critical alarm and trip functions for the feedwater heater. If the condensate level in the heater is too high, the heater will not operate at maximum efficiency, and could cause the steam safety valve to open. If the condensate level is too low, steam is discharged directly into the next heater, also reducing efficiency. As the diagram above shows, this is a complex control system, especially when power plant load changes.

# Feedwater Heater Electronic Level Switches

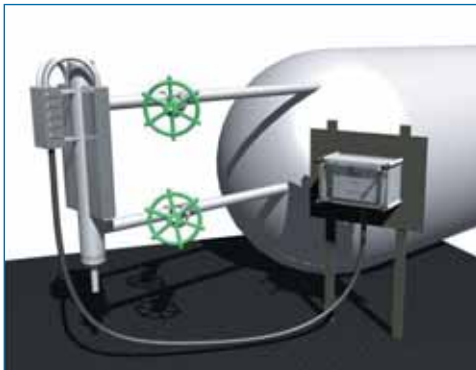
## MAJOR COMPONENTS

1. Connecting piping.
2. Column Isolation valves.
3. Probe column: Normally configured with 3 or 4 probes at the critical alarm and trip levels. Can be supplied with or without a probe wire junction box.
4. Probe column drain.
5. Electronic Control Unit: Normally located within 100 feet of the probe column. The Aquarian model AQ1000P allows for inputs from up to 4 probes. This unit provides local indication, and a SPDT output relay for each probe that is wired to the control room and used for alarm/trip purposes.

The diagram below shows typical Aquarian level switch installations for both the vertical and horizontal heater configurations.



VERTICAL HEATER



HORIZONTAL HEATER

## REFERENCES

1. ASME TDP-1-1998 Recommended Practices for the Prevention of Water Damage to Steam Turbines used for Electric Power Generation
2. Emerson Process Management, Application Discussion AD106, Heater Drain, June 2003
3. Aquarian 1000P Brochure, PN 9340-1101

## FEEDWATER HEATER INSTRUMENTATION OVERVIEW

The heating of the feedwater in this heat exchanger is controlled by the steam pressure. In addition to the high/low level switches, other instruments and control valves are used to indicate and control the condensate level. These include visual level gauges and magnetic level indicators and transmitters. ASME TDP-1-1998 Recommended Practices for the Prevention of Water Damage to Steam Turbines used for Electric Power Generation section 3.7 discusses in detail the instrumentation system design, installation and testing of this equipment. The photos below show an original installation with float type level switches, and the simplified installation after conversion to electronic level switches.



ORIGINAL FLOAT SWITCH INSTALLATION



NEW AQUARIAN ELECTRONIC PROBE SYSTEM

Four float switches with associated piping, valves and flanges were replaced by one Aquarian 4 Probe column.



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