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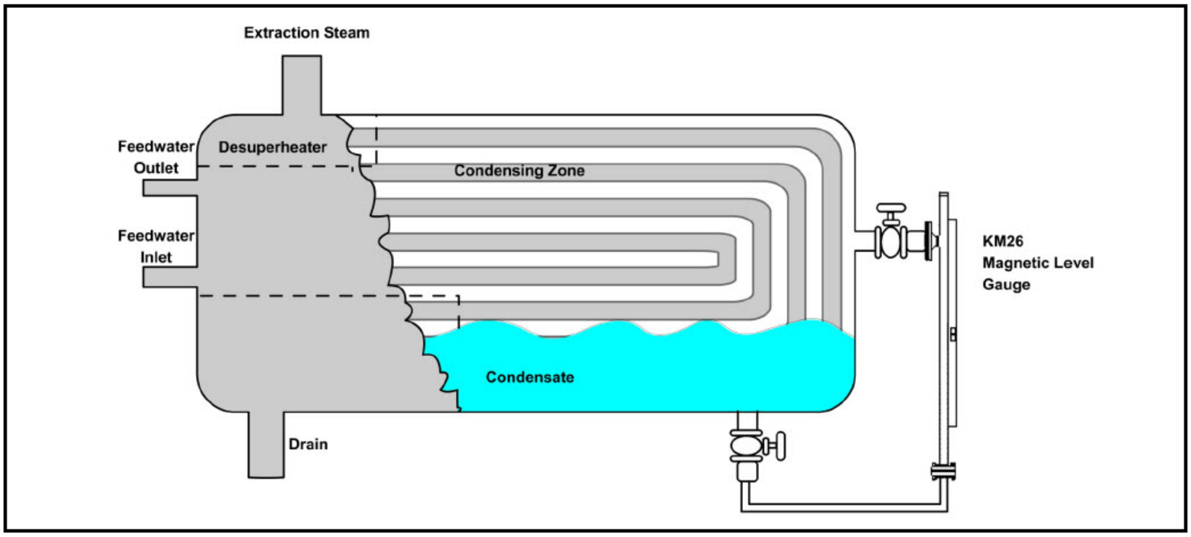
KM26
Power plant feedwater heater level control
KTEK products

Feedwater Heaters are used to “pre-heat” feedwater before it is fed to the steam drum or boiler to be converted to steam. The feedwater heater is a larger shell & tube heat exchanger through which condensate returns and any makeup water is pre-heated prior to being sent to the boiler for conversion to steam. This “pre-heating” means that less energy (fuel) is required to flash the water into steam.



The feedwater heater, simply described, is a series of tubes carrying feedwater through a tank shell. Steam is injected into the shell and heat is transferred to the feedwater inside the tubes. The steam condenses in the shell, creating a liquid level of condensate in the heater. The level is controlled to create a seal and prevent blow through of steam. The maximum thermal transfer between steam and the feedwater takes place when the largest tube area is exposed to the steam without allowing steam blow through. Condensate is allowed to drain from the shell through the normal drain. When the tubes become submerged in condensate, heat is transferred to the condensate rather than the tubes with the feedwater inside, resulting in poor heater efficiency. A relatively small increase in condensate level (2-4 inches) over the minimum greatly reduces the heat rate (fuel efficiency) of the boiler. Thus tight level control is required.

Historically, mechanical, displacement type level systems with mechanically driven pneumatic controllers have been used. There are two basic issues with these types of controllers. The mechanical nature of these level controllers require high maintenance due to seal and bearing failures, and air supply issues. In fact, one plant used maintenance costs and an average 5-year life of the equipment as cost justification for an upgrade of the level systems. Second, the varying liquid density of both the water and the steam in a feedwater heater creates significant errors in the measurement with a displacer. A change of only 0.1 SGU in the liquid will result in a 12.5% error, and as more commonly seen a change of 0.2 SGU will create a 25% inaccuracy with a displacer. With the ranges for these heaters typically being 48” to 120” it is common to see the heater level change 6” to 8” without a change of feed or extraction rate. Most power plants compensate for this by simply controlling the level at a point above the maximum inaccuracy of the displacer. Typically, this point is 8” to 10” above the drain. This greatly impacts the heater efficiency. Another point is that “displacers” are typically pneumatic and cannot be easily tied into a DCS, and therefore the advantages of varying heater level to control temperature with load cannot to be realized. Early upgrades used “hydrostatic” level transmitters, which proved unsatisfactory due to their inaccuracies caused by changes in the condensate density due to temperature, thermal expansion and contraction of the shell.

To solve these problems, numerous major power producers in the US and International locations have applied the KM26 and AccuTrak 200 Magnetostrictive Level Transmitter to their feedwater heaters.

The rugged, yet simple, design of the KM26 Magnetic Level Gauge, which can be certified to ANSI / ASME B31.1 “Power Plant Piping requirements”, includes a magnetically coupled float level indicator for local visual indication. Its float design and magnet technology provides very high magnetic flux density at the measurement point to prevent “decoupling” of the indicator on high-pressure heaters.

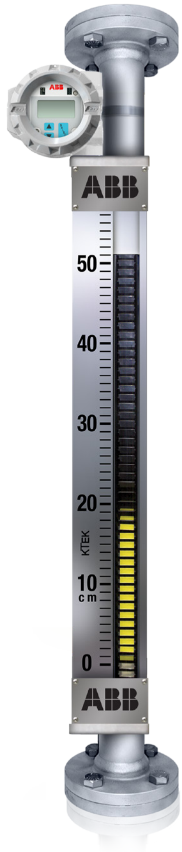
To eliminate the maintenance problems with mechanical transmitters and controllers, the K-TEK AT200 MAGNETOSTRICTIVE transmitter is utilized. The AT200 is a very accurate (1/32”) level transmitter that is actuated by the magnetic field in the KM26. It is simply strapped to the outside of the KM26 Housing. (Magnetic Level Switches can also be mounted in this fashion with the KM26). The AT200 is a loop powered, 4-20 mA transmitter. HART and Foundation Fieldbus versions are also available. With the AT200 transmitter mounted on the outside of the heater, maintenance is very low, since it is not exposed to the internal temperatures and extremes of the heaters.

The accuracy and repeatability of the AT200 are key in this situation. The performance and reliability of the AT200 transmitter allow the level of the condensate in the heater to be controlled precisely (usually at a point 2” to 3” above the drain). When the level is controlled as low as possible more tube area within the feedwater heater is exposed and additional feedwater can be heated for the same energy input to the heater. This increases heater throughput and efficiency; the accuracy and reliability of the K-TEK system prevent steam blow through. Typical system accuracy is 1”.

To further enhance performance of the K-TEK level system, a thermocouple and thermowell can be installed in the KM26 to measure condensate temperature. The density of condensate will change with temperature. The density change causes a small change in the buoyancy of the float that affects the accuracy of the reading. Through the use of the temperature measurement in the DCS, a simple correction can be made. This correction allows the use of an even lower condensate level in the heater, and provides even more efficiency.

The real money is in the improved control. With the old displacer, level fluctuations ran 4 to 5 inches with a lot of hysteresis. This poor performance coupled with frequent failures, caused operators to control at much higher levels than were optimal. One of our customers is now controlling from the K-TEK systems with their DCS to a level set point of 9 inches. They tell us, “With the K-TEK system, 9 inches is 9 inches.” Using this precision level control, they are able to maintain a 5 degree differential on their heaters. In addition, says the customer “...and we are getting about 6% more efficiency! That is BIG BUCKS!”

Several power facilities around the world have found the K-TEK System so economical that redundant systems were installed on each heater. They simply do not want to run without this system in place. Discussions with several plant engineers have indicated a payback in less than 6 months on efficiency gains alone. Additionally, plant operators have reported huge maintenance savings since sightglass repairs are eliminated.



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