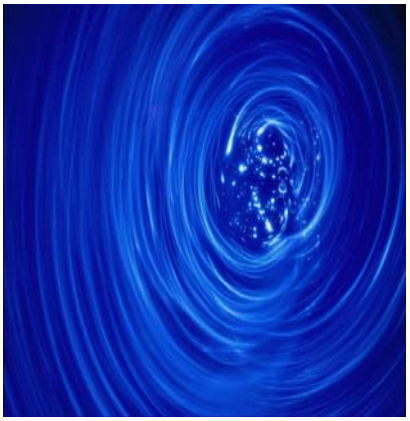
WATER TREATMENT NEWS

Understanding Terminology Key to Treatment Program Success

GLOSSARY



One of the keys to success of a boiler water treatment program is good communication between the water treatment professional and plant engineering and maintenance personnel. A vital aspect of this communication is the mutual understanding of the terms and terminology used in

boiler maintenance, boiler water service reports and laboratory water and deposit analysis reports.

The following Boiler Water Treatment Glossary of Terms will help water treaters and plant engineering and maintenance personnel get "on the same page" in discussing their boiler water treatment programs.

Cleaver-Brooks Firetube Boiler

OF TERMS

This Newsletter courtesy of:

CHEMTEX
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Boiler Water Treatment Glossary of Terms

Alkalinity: An expression of the total basic anions, including hydroxyl, carbonate and bicarbonate in a solution.

Allowable working pressure: The maximum pressure for which the boiler was designed and constructed; the maximum gauge pressure on a complete boiler and the basis for the setting on the pressure relieving devices protecting the boiler.

Amine: Chemical used to control corrosion in condensate systems. It is classified as neutralizing or filming.

Anion: A negatively charged ion.

Anode: The positive electrode of an electrochemical cell where electrons are donated and oxidation occurs.

Backwash: A stage in the regeneration cycle of a softener or other ion-exchange equipment during which water flow through the unit is directed upwards through the resin bed. This is done to clean and reclassify the bed following exhaustion.

Bottom blowdown: A portion of the boiler water that is intermittently sent to drain to remove sludge and other suspended matter.

Boiler horsepower: A rate of heat generation equivalent to 33,479 BTU per hour. A boiler operating at one horsepower (H.P.) load evaporates 34.5 pounds of steam per hour.

Boil out: The removal of oils, greases, etc. prior to normal operation or after major repairs by heating a highly alkaline solution in the boiler pressure parts.

British Thermal Unit (BTU): The quantity of heat required to raise the temperature of one pound of water one degree Fahrenheit.

Carbonic acid: A weak and unstable acid, H_2CO_3, existing only in solution. Carbonic acid is formed as carbon dioxide in steam dissolves in condensate. This is the primary cause of condensate system corrosion.

Carry-over: The entrainment of liquid water, along with dissolved impurities, in steam leaving a boiler. This results in loss of heat transfer, along with deposition in steam-using equipment.

Cathode: The negative electrode of an electrochemical cell where electrons are accepted and reduction occurs.

Cation: A positively charged ion.

Caustic embrittlement: Cracking of stressed steel in contact with concentrated alkali.

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Chelent: An organic compound that forms soluble complexes with certain metallic ions, especially calcium, magnesium, iron and copper.

Chloride: Soluble ionic form of the element chlorine, useful as a measure of cycles of concentration.

Condensate: The water that is formed when steam cools and changes from a gas to a liquid.

Conductivity: Represents the electrical current carrying capacity of a water. It is used as a means of indirectly measuring the total dissolved solids concentration of a water.

Corrosion: The destructive disintegration of metal by electrochemical means; measure in mils (one thousandth of an inch) per year (mpy).

Cycles of concentration: The ration of dissolved solids in boiler water to the dissolved solids in the feedwater or make-up water.

Deaerator: A device that physically removes dissolved oxygen from boiler make-up water. A properly operating deaerator will reduce the make-up water dissolved oxygen level to 10 parts per billion (ppb) or less.

Dealkalizer: An ion exchange unit designed to remove alkalinity from water. Alkalinity removal is performed with either a cation resin using sulfuric acid as the regenerant or an anion resin using sodium chloride for regeneration.

Deionization: The removal of all anions and cations from a water by ion exchange.

Deminerlization: Same as deionization.

Deposit: Accumulation of mineral or organic matter laid down on heat transfer surfaces.

Dissolved gases: Gases that are in solution in water.

Dissolved solids: Solids in true solution in ionic form in water that cannot be removed by filtration. The presence is due to the solvent action of water in contact with minerals in the earth. - expressed as total dissolved solids (TDS).

Dry steam: Steam containing no moisture. Commercially dry steam contains not more than 0.005% moisture.

End point: In water testing, the point at which titration reactions are completed and the indicator changes color.

Erosion: They physical wearing away of metal by the action of a liquid or gas.

Feedwater: Water introduced into a boiler during operation. It includes make-up and returned condensate.

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Feedwater heater: An apparatus for raising the temperature of feedwater by transferring some of the heat from exhaust steam to the feedwater. This may be of the direct type, sometimes called a sparger, where steam is discharged directly into the feedwater or the indirect type that utilizes a heat exchanger.

Filming amine: An organic chemical that forms a water repellent film on system metal when steam condenses. The film controls corrosion in the condensate system.

Firetube boiler: A boiler in which the hot combustion gases pass through tubes that are surrounded by water. Heat is transferred from the combustion gases into the water to produce steam.

Flash tank: A vented tank into which boiler blowdown is directed to allow latent steam to escape before the water is discharged to drain.

Flashing: Steam produced by discharging water at a temperature greater than the saturation temperature corresponding to the pressure of the space into which it is discharged.

Foaming: The formation of bubbles that have sufficiently high surface tension to remain as bubbles beyond the disengaging surface. This interferes with the natural steam disengagement process and can result in priming and carryover.

Fouling: The obstructing of the flow of water by matter that accumulates on pipe walls or in water-using equipment.

Galvanic corrosion: Generally results from the juxtaposition of two dissimilar metals, e.g. copper and steel, in an electrolyte. It is characterized by an electron movement from the metal of higher potential (anode) to the metal of lower potential (cathode), resulting in corrosion of the anodic metal.

Grains per gallon (gpg): A unit of concentration equivalent to 17.14 parts per million (ppm).

Handhole: An opening in a pressure part for access, usually not exceeding 6” in longest dimension.

Hardness: The total of a water’s calcium and magnesium ion content. The total concentration is reported as calcium carbonate. Hardness is sometimes referred to as carbonate and non-carbonate hardness. Carbonate, also referred to as temporary, hardness is that portion of the total hardness that combines with carbonate and bicarbonate ions. The remainder of the hardness is that which combines with sulfate or other anions and is know as non-carbonate or permanent hardness.

Indicator: In water testing, a substance that undergoes a color change when the end-point of a titration has been reached. The indicator does not enter into the reaction.

Inhibitor: A substance that selectively retards a chemical action, such as scaling or corrosion.

Ion: A negatively or positively charged atom or radical.

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Boiler Water Treatment Glossary of Terms

Ion exchange: A reversible process in which ions that are chemically attached to resin beads are exchanged for other ions that are in solution in a water. For example, in an ion exchange softener, sodium ions on the resin beads are exchanged for calcium and magnesium ions in the water passing through the softener.

M alkalinity: Also called total alkalinity. This is the measure of the total of bicarbonate, carbonate and hydroxyl ions in a water.

Make-up: The water added to a boiler system to compensate for that lost through exhaust steam, blowdown, leakage, etc.

Manhole: The opening in a pressure vessel of sufficient size to permit a man to enter. Also called a manway.

Neutralizing amine: An alkaline organic chemical that neutralizes the acidity of condensate to control corrosion.

Oxygen attack: Corrosion or pitting in a boiler system caused by dissolved oxygen.

Oxygen scavenger: A chemical added to boiler feedwater to remove dissolved oxygen.

P alkalinity: A measure of half the carbonate and all of the hydroxyl ions in a solution. It is determined through titration using phenolphthalein indicator.

pH: They hydrogen ion concentration of a water stated on a scale from 0 to 14 used to indicate the water's relative acidity or alkalinity. A pH of 7 is neutral; a pH below 7 indicates an acidic solution and a pH above 7 indicates an alkaline solution.

Phosphonate: An organic compound used to inhibit scale in boilers by distorting the crystalline structure of sludge particles, preventing them from agglomerating and forming a hard scale - also called organophosphonate.

Pitting: A concentration attack by oxygen or otherwise corrosive agents producing a localized depression in the metal surface

Polymer: An organic compound d used to control scale and deposition in boilers by dispersing sludge particles, allowing for their removal from the boiler through blowdown.

ppm: Abbreviation of parts per million. It is used in chemical determinations as a measure of the concentration of dissolved impurities in water.

Precipitate: To separate materials from a solution through the formation of insoluble matter by chemical reaction.

Pretreatment: Term frequently used to define mechanical treatment of water, e.g. softening or dealkalization, prior to its use in a process - also called external treatment.

Boiler Water Treatment Glossary of Terms

Priming: The discharge of steam containing excessive quantities of entrained water due to violent bubbling.

Rated capacity: The manufacturer's stated capacity rating for mechanical equipment, e.g., the maximum continuous capacity in pounds of steam per hour for which a boiler is designed.

Raw water: The water supplied to a plant or facility before external or internal treatment is applied.

Resin: Synthetic organic ion exchange material, such as the cation exchange resin used in water softeners. Formerly made of zeolite.

Safety valve: A spring loaded valve that automatically opens when pressure reaches the valve setting. Used to prevent excessive pressure from building up in a boiler.

Saturated steam: Steam at the pressure corresponding to its saturation temperature.

Saturation temperature: The temperature at which evaporation occurs at a particular pressure.

Scale: A dense, crystalline deposit form by precipitated material. It usually forms on boiler tube surfaces where heat transfer occurs.

Sequester: To separate and hold potential scale-forming materials in solution or suspension.

Sludge: A soft, water-formed sedimentary deposit that can usually be removed by bottom blowdown.

Sodium sulfite: The most commonly used oxygen scavenger in steam boiler systems.

Soft water: Water containing relatively low concentrations of calcium and magnesium ions (typically less than 5 ppm).

Softener: A device for removing hardness from water. Hot or cold process softeners operate by a chemical reaction of the hardness with lime, soda ash, caustic soda or phosphate, either alone or in combination. In addition to removing hardness, they also remove carbonate and bicarbonate alkalinity and in some cases, silica. Ion exchange softeners operate by exchanging sodium or hydrogen ions for calcium and magnesium ions. Ion exchange softeners do a more complete job of hardness removal and are now capable of producing a consistent supply of virtually zero hardness (less than 1 ppm) water.

Steam trap: An automatic valve designed to pass condensate while not allowing steam to escape. Used to discharge condensate from the steam-side of a system to the condensate side, allowing for its return to the boiler.

Suspended solids: Solids not in true solution in water, rather in particulate from capable of being removed through filtration.

Boiler Water Treatment Glossary of Terms

Threshold treatment: A technique of treating water by the addition of very low levels of chemicals, usually phosphonates and/or polymers that will temporarily inhibit the formation of scale.

Total dissolved solids (TDS): The total of all substances dissolved in ionic form in a water.

Tuberculation: Irregular, protruding mounds of corrosion product that form over corrosion sites on steal and cast iron that has been exposed to oxygenenated water. The tubercle height may be as much as 30 times the metal loss depth below.

Turbidity: Cloudy appearance of water imparted by the presence of suspended or colloidal particles.

Volatile: Capable of being rapidly vaporized at relatively low temperatures.

Water column: A boiler fixture consisting of a cylindrical piece to which are attached the water gauge and the gauge cocks. The top and bottom have outlets that connect it with the boiler above and below the water level.

Water gauge: A glass tube mounted on the water column that will permit observation of the water level in a boiler, also called a gauge glass.

Water hammer: The banging and clanging of steam pipes and steam using equipment usually caused by live steam coming in contact with condensed steam that has not properly drained from the system. In high pressure installations, it is capable of rupturing fittings or pipes. The "shock pressure" caused by water hammer is considerably higher than that normally encountered in the system and can therefore readily cause damage.

Water tube boiler: A boiler in which water circulates through tubes between a "mud drum" and a "steam drum". Hot combustion gases surround the water tubes heating the water inside to produce steam.

Wet steam: Steam containing entrained boiler water.

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