SPALLING - The breaking off of the surface refractory material as a result of internal stresses resulting from an excessive temperature gradient.

SPRUNG ARCH - An arch in the form of a segment of a circle supported by skew-backs at the two ends.

STEAM-COOLED WALL - A wall partly or completely covered with superheater or reheater tubes.

STUD PLATE - A small steel plate welded to a tube to support refractory.

STUD TUBE WALL - A tube wall covered with refractory which is held in place by stud anchors attached to the tubes.

SUPPLY TUBE - A tube which carries water to the inlet water header.

SUSPENDED ARCH - An arch in which refractory blocks or shapes are suspended by metallic hangers.

SUSPENDED WALL - Same as Sectionally Supported Wall.

[redacted]

TANGENT TUBE WALL - See Tube-To-Tube Wall.

TAP - To remove molten slag from a slag tap furnace through a tap hole.

TAP HOLE - The opening through which molten slag is removed from a slag tap furnace.

TIE BAR - A structural member designed to maintain the spacing and alignment of furnace waterwall tubes.

TUBE-TO-TUBE WALL - A waterwall in which the tubes are substantially tangent to each other with practically no space between the tubes.

TWO-STAGE FURNACE - A multistage furnace consisting of a primary and a secondary furnace only.

[redacted]

WATER BACK - One or more horizontal watertubes located over and laterally across the ash discharge end of a stoker to prevent ash adhesion to the wall and to reduce air leakage from the ash pit into the furnace.

WATER COOLED BURNER THROAT - An opening in the furnace waterwall formed by bent tubes which are covered by refractory to the contour of the burner throat.

WATER COOLED WALL - A wall cooled by watertubes.

WATER SCREEN - A screen formed by one or more rows of watertubes spaced above the bottom of a pulverized fuel furnace.

WELDED WALL - A wall made up of closely spaced waterwall tubes welded together or to an intermediate fin so as to form a continuous air tight structure.

WET-BOTTOM FURNACE - See Slag Tap Furnace.

WING-BACK BLOCKS - Metallic blocks attached to the back side of waterwall tubes to form a furnace wall enclosure.

WING WALLS - Angled walls in the combustion chamber.

BOILER AND GENERAL TERMS

ABSOLUTE PRESSURE - Pressure above zero pressure, the sum of the gage and atmospheric pressures.

ACCUMULATOR (Steam) - A pressure vessel containing water and steam, which is used to store the heat of steam for use at a later period and at some lower pressure.

ACID CLEANING - The process of cleaning the interior surfaces of steam generating units by filling the unit with a dilute acid accompanied by an inhibitor to prevent corrosion, and by subsequently draining, washing, and neutralizing the acid by a further wash of alkaline water.

AFTERCOOLER - A device used for lowering the temperature of boiler blow-off discharge before it enters the building drain.

AIR PURGE - The removal of undesired matter by replacement with air.

AIR VENT - A valved opening in the top of the highest drum of a boiler or pressure vessel for venting air.

AMBIENT TEMPERATURE - The temperature of the air surrounding the equipment.

ARCH BAR - A cast iron or steel bar for supporting brickwork.

ASME BOILER AND PRESSURE VESSEL CODE - The boiler and pressure vessel code of the American Society of Mechanical Engineers with amendments and interpretations thereto made and approved by the council of the Society.

ASPIRATING AIR - Compressed air supplied at pressures sufficiently above furnace pressure to prevent flow of combustion gases from escaping the boiler.

AVAILABILITY FACTOR - The fraction of the time during which the unit is in operable condition.

BACKING RING - A ring of steel or other material placed behind the welding groove when joining tubes or pipes by welding to confine the welding material.

BAFFLE - A plate or wall for deflecting gases or liquids.

BAG - A deep bulge in the shell or furnace of a firetube boiler.

BASE LOAD - Base load is the term applied to that portion of a station or boiler load that is practically constant for long periods.

BATTERY SETTING - Describes a setting of two or more boilers with common division walls.

BEADED TUBE-END - The rounded end of a rolled tube where the tube metal is formed over against the sheet in which the tube is rolled.

BELLED TUBE-END - See Flared Tube-End.

BELLOWS SEAL - A seal in the shape of a bellows used to prevent air or gas leakage.

BLANK HEAD - A head, without a manhole, at the end of a boiler drum.

BLIND NIPPLE - A nipple, or a short piece of pipe or tube, closed at one end.

BLISTER - A raised area on the surface of solid metal produced by pressure thereon while the metal is hot and plastic due to overheating.

BLOW DOWN SEPARATOR - A vented and drained container equipped with internal baffles or an apparatus for the purpose of separating moisture from flash steam as it passes through the vessel.

BLOW DOWN VALVE - A specifically designed, manually operated valve connected to the boiler for the purpose of intermittently reducing the concentration of solids in the boiler or for draining purposes.

BLOW-OFF VALVE - See Blow Down Valve.

BOILER - A closed vessel in which water is heated, steam is generated, steam is superheated, or any combination thereof, under pressure or vacuum by the application of heat. The term does not include such facilities that are an integral part of a continuous processing unit but shall include units supplying heating or vaporizing liquids other than water where these units are separate from processing systems and are complete within themselves.

- **WATERTUBE** - A boiler in which the tubes contain water and steam, the heat being applied to the outside surface.
- **BENT TUBE** - A watertube boiler consisting of two or more drums connected by tubes, practically all of which are bent near the ends to permit attachment to the drum shell on radial lines.
- **HORIZONTAL** - A watertube boiler in which the main bank of tubes is straight and on a slope of 5 to 15 degrees from the horizontal.
- **SECTIONAL HEADER** - A horizontal boiler of the longitudinal or cross drum type, with the tube bank comprised of multiple parallel sections, each section made up of a front and rear header connected by one or more vertical rows of generating tubes and with the sections or groups of sections having a common steam drum.
- **BOX HEADER** - A horizontal boiler of the longitudinal or cross drum type consisting of a front and rear inclined rectangular header connected by tubes.
- **CROSS DRUM** - A sectional header or box boiler in which the axis of the horizontal drum is at right angles to the center lines of the tubes in the main bank.
- **LONGITUDINAL DRUM** - A sectional header or box header boiler in which the axis on the horizontal drum or drums is parallel to the tubes in a vertical plane.
- **LOW HEAD** - A bent tube boiler having three drums with relatively short tubes in a vertical plane.
- **FIRETUBE** - A boiler with straight tubes, which are surrounded by water and steam and through which the products of combustion pass.
- **HORIZONTAL RETURN TUBULAR** - A firetube boiler consisting of a shell, with tubes inside the shell attached to both end closures. The products of combustion pass under the bottom half of the shell and return through the tubes.
- **LOCOMOTIVE** - A horizontal firetube boiler with an internal furnace the rear of which is a tube sheet directly attached to a shell containing tubes through which the products of combustion leave the furnace.
- **HORIZONTAL FIREBOX** - A firetube boiler with an internal furnace the rear of which is a tube sheet directly attached to a shell containing tubes. The first-pass bank of tubes is connected between the furnace tube sheet and the rear head. The second-pass bank of tubes, passing over the crown sheet, is connected between the front and rear end closures.
- **REFRACTORY LINED FIREBOX** - A horizontal firetube boiler, the front portion of which sets over a refractory or water cooled refractory furnace, the rear of the boiler shell having an integral or separately connected section containing the first-pass tubes through which the products of combustion leave the furnace, then returning through the second-pass upper bank of tubes.
- **VERTICAL** - A firetube boiler consisting of a cylindrical shell, with tubes connected between the top head and the tube sheet which forms the top of the internal furnace. The products of combustion pass from the furnace directly through the vertical tubes.

  Note: Submerged Vertical is the same as the plain type above, except that by

use of a water leg construction as a part of the upper tube sheet, it is possible to carry the water-line at a point above the top ends of the tubes.

- **SCOTCH BOILER** - A cylindrical steel shell with one or more cylindrical internal steel furnaces located (generally) in the lower portion and with a bank or banks (passes) of tubes attached to both end closures.

  Note: In stationary service, the boilers are either of the Dry-Back, or Wet-Back Type. (See Boiler Dry-Back and Boiler Wet-Back.) In Marine Service, the boilers are generally of the Wet-Back Type. (See Boiler Wet-Back.)

BOILER ASSEMBLER - Means a corporation, company, partnership or individual who assembles a boiler which has been delivered knocked down in multiple pieces by bolting, threading, welding or other methods of fastening to produce a finished pressure vessel. A boiler assembler may also be a boiler installer.

BOILER BLOW-OFF PIPING - The piping connections from the boiler to the blow-off valves.

BOILER BLOW-OFF TANK - A vented and drained container into which water is discharged above atmospheric pressure from a boiler blow-off line.

BOILER CONVECTION BANK - A group of two or more rows of tubes forming part of a water boiler circulatory system and to which heat is transmitted mainly by convection from the products of combustion.

BOILER DRY-BACK - The baffle provided in a firetube boiler joining the furnace to the second-pass to direct the products of combustion, that is so constructed to be separate from the pressure vessel and constructed of heat resistant material (generally refractory and insulating material).

BOILER EFFICIENCY - The ratio of the net energy output of the boiler fluid divided by the input of the primary energy source(s).

BOILER ERECTOR - See Boiler Assembler.

BOILER, HIGH-PRESSURE - A boiler furnishing steam at pressure in excess of 15 pounds per square inch (103 422 Pa) or hot water at temperatures in excess of 250°F (121°C) or at pressures in excess of 160 pounds per square inch (1 103 168 Pa).

BOILER, HIGH-TEMPERATURE HOT WATER - A water heating boiler operating at a pressure exceeding 160 psig (1 103 168 Pa) or temperatures exceeding 250°F (121°C).

BOILER HORSEPOWER - The evaporation of 34 1/2 lbs. (15.648 kg) of water per hour

from a temperature of 212°F (100°C) into dry saturated steam at the same temperature. Equivalent to 33,472 Btu/hr (35291 203.20 joule).

BOILER LAYUP - Preparation and storage of an out-of-service boiler for an extended period of time.

BOILER, LOW-PRESSURE HOT-WATER AND LOW-PRESSURE STEAM - A boiler furnishing hot water at pressures not exceeding 160 pounds per square inch (1103 168 Pa) or at temperatures not more than 250°F (121°C) or steam at pressures not more than 15 pounds per square inch (103 422 Pa).

BOILER SLAG SCREEN - A screen formed by one or more rows of widely spaced tubes constituting part of, or positioned in front of, a watertube boiler convection bank, and functioning to lower the temperature of the products of combustion and to serve as an ash cooling zone.

BOILER WET-BACK - A baffle provided in a firetube boiler or water leg construction covering the rear end of the furnace and tubes, and is completely water cooled. The products of combustion leaving the furnace are turned in this area and enter the tube bank.

BOSS - A raised portion of metal of small area and limited thickness on flat or curved metal surfaces.

BUCKSTAY - A structural member placed against a furnace or boiler wall to limit the motion of the wall.

BUCKSTAY SPACER - A spacer for separating a pair of channels which are used as a buckstay.

BULGE - A local distortion or swelling outward caused by internal pressure on a tube wall or boiler shell caused by overheating. Also applied to similar distortion of a cylindrical furnace due to external pressure when overheated provided the distortion is of a degree that can be driven back.

BUMP - A raised or flattened portion of a boiler drum head or shell formed by fabrication, generally used for nozzle or pipe attachments.

BUTTSTRAP - A narrow strip of boiler plate overlapping the joint or two butted plates, used for connecting by riveting.

BYPASS - A passage for a fluid, permitting a portion or all of the fluid to flow around certain heat absorbing surfaces over which it would normally pass.

CAPACITY - The manufacturers stated output rate over a period of time for which the boiler is designed to operate.

CAPACITY FACTOR - The total output over a period of time divided by the product of the boiler capacity and the time period.

CASING - A covering of sheets of metal or other material such as fire resistant composition board used to enclose all or a portion of a steam generating unit.

CENTRAL STATION - A power plant or steam heating plant generating power or steam for sale.

CHEMICAL FEED PIPE - A pipe inside a boiler drum through which chemicals for treating the boiler water are introduced.

CIRCULATOR - A pipe or tube to pass steam or water between boiler drums or headers. Also used to apply to tubes connecting headers of horizontal watertube boilers with drums.

CLEANOUT DOOR - A door placed so the accumulated refuse may be removed from a boiler setting.

COGENERATION - The simultaneous production of steam (or hot water) and electricity for use by multiple users generated from a single source.

COMMERCIAL BOILER - A boiler which produces steam or hot water primarily for heating in commercial applications with incidental use in process applications. Commercial boilers come in a wide range of types, sizes, capacities, pressures and temperatures. They may also be supplied for more than one application.

CONDUCTION - The transmission of heat through and by means of matter unaccompanied by any obvious motion of the matter.

CONDUCTIVITY - The amount of heat (Btu) transmitted in one hour through one square foot of a homogeneous material 1 in. thick for a difference in temperature of 1°F between the two surfaces of the material (W/m-K).

CONTROL - Any manual or automatic device for the regulation of a machine to keep it at normal operation. If automatic, the device is motivated by variations in temperature, pressure, water level, time, light, or other influences. (See "Boiler and Fuel System Controls".)

CONVECTION - The transmission of heat by the circulation of a liquid or a gas such as air. Convection may be natural or forced.

CORE - A rod or closed tube inserted in a tube to reduce the flow area.

CRITICAL PRESSURE AND CRITICAL TEMPERATURE - That point of a substance at which the liquid and vapor states have identical properties.

CROSS BOX - A box-like structure attached to the longitudinal drum of a sectional heater boiler for connecting circulating tubes.

CROWN SHEET - In a firebox boiler, the plate forming the top of the furnace.

CUP CAP - A short blind nipple inserted into an opening to form a closure.

CYCLONE - A device which uses centrifugal action for separation of materials of different densities.

[redacted]

DAMPER - A device for introducing a variable resistance for regulating the volumetric flow of gas or air.

- **Butterfly Type** - A single blade damper pivoted about its center.
- **Curtain Type** - A damper, composed of flexible material, moving in a vertical plane as it is rolled.
- **Flap Type** - A damper consisting of one or more blades each pivoted about one edge.
- **Louvre Type** - A damper consisting of several blades each pivoted about its center and linked together for simultaneous operation.
- **Slide Type** - A damper consisting of a single blade which moves substantially normal to the flow.

DEAD-END TUBE - A tube with a closed end - for example, a tube in a porcupine boiler.

DESIGN LOAD - The load for which a steam generating unit is designed, usually considered the maximum load to be carried.

DESIGN PRESSURE - The pressure used in a design of a boiler for the purpose of determining the minimum permissible thickness or physical characteristics of the different parts of the boiler.

DESIGN STEAM TEMPERATURE - The temperature of steam for which a boiler, superheater or reheater is designed.

DIAGONAL STAY - A brace used in firetube boilers between a flat head or tube sheet and the shell.

DIAPHRAGM - A partition of metal or other material placed in a header, duct or pipe to separate portions thereof.

DIRECT-FIRED BOILER - Commonly used to denote a boiler and furnace fired by pulverized coal directly from the pulverizing mills.

DISCHARGE TUBE - A tube through which steam and water are discharged into a drum. Also a riser or relcaser.

DOUBLE FRONT - A boiler front consisting of two spaced sheets between which air is passed on the way to burners.

DOWNCOMER - A tube or pipe in a boiler or a waterwall circulating system through which fluid flows downward.

DRAIN - A valved connection at the lowest point for the removal of all water from the pressure parts.

DRUM - A cylindrical shell closed at both ends designed to withstand internal pressure.

DRUM BAFFLE - A plate or series of plates or screens placed within a drum to divert or change the direction of the flow of water or water and steam.

DRUM COURSE - A cylindrical section of a drum.

DRUM HEAD - A plate closing the end of a boiler drum or shell.

DRUM INTERNALS - All apparatus within a drum.

DRUM OPERATING PRESSURE - The pressure of the steam maintained in the steam drum or steam-and-water drum of a boiler in operation.

DRY PIPE - A perforated or slotted pipe or box inside the drum and connected to the steam outlet.

DRY-STEAM DRUM - A pressure chamber, usually serving as the steam offtake drum, located above and in communication with the steam space of a boiler steam-and-water drum.

DUSTING DOOR - A door located on a boiler wall to provide access for blowing dust off tubes by a hand lance.

[redacted]

EARTHQUAKE BRACING - Bracing between columns designed to withstand violent lateral motion of the structure.

EFFICIENCY - The ratio of output to the input. The efficiency of a steam generating unit is the ratio of the heat absorbed by water and steam to the heat in the fuel fired.

EJECTOR - A device which utilizes the kinetic energy in a jet of water or other fluid to remove a fluid or fluent material from tanks or hoppers.

ELECTRIC BOILER - A boiler in which electric heating serves as the source of heat.

ENTHALPHY - A thermal property of a fluid which is a function of state and is defined as the sum of stored mechanical potential energy and internal energy. It is generally expressed in Btu per pound of fluid (joule per kilogram).

EQUALIZER - Connections between parts of a boiler to equalize pressures.

EQUIVALENT DIRECT RADIATION (EDR) - A unit of heat delivery. 240 Btuh per square foot for steam, 150 Btuh per square foot for water surfaces.

EQUIVALENT EVAPORATION - Evaporation expressed in pounds of water evaporated from a temperature of 212°F (100°C) to dry saturated steam at 212°F (100°C).

EVAPORATION RATE - The number of pounds of water evaporated in a unit of time.

EXPANDED JOINT - The pressure tight joint formed by enlarging a tube end in a tube seat.

EXPANDER - The tool used to expand tubes.

EXPANSION JOINT - A joint to permit movement due to expansion without undue stress.

EXPLOSION DOOR - A door in a furnace or boiler setting designed to be opened by a predetermined gas pressure.

EXTENDED SURFACE - Metallic heat absorbing surface protruding beyond the tube wall.

EXTERNALLY FIRED BOILER - A boiler in which the furnace is essentially surrounded by refractory or water cooled tubes.