Abstract

Incineration is an everlasting field of activity by a diverse group of consulting engineers, manufacturers, suppliers, builders and users. This lexicon has been compiled to aid them, by developing a common and clear language. The report was compiled from many sources, in the hope that it will lead to a uniform lexicon, which will be adopted by all interested groups. The author will, therefore, welcome any additions and refinements.

Introduction

Incineration is a combustion process for reducing the volume, and weight of refuse, which usually comprises a wide range of combustibles, and at a single installation, a variability of considerable magnitude. To meet this condition, and the considerations of capacity, cleanliness, efficiency, and low cost, a certain variety of incinerators is available.

The Incinerator Institute of America (IIA) has categorized the types of refuse and the classes of incinerators as part of a systematic approach to incinerator application and engineering. The types of refuse have received a large measure of acceptance since they were promulgated. They are as follows.

Types of Refuse:

Type 1: A mostly dry refuse, primarily rubbish, containing up to 25 per cent moisture and up to 10 per cent incombustible solids; with a heating value of 6500 Btu per pound as fired.

Type 2: An evenly mixed refuse, of rubbish and garbage, containing up to 50 per cent moisture and up to 7 per cent incombustible solids; with a heating value of 4300 Btu per pound as fired.

Type 3: A mostly wet refuse, generally garbage, consisting of up to 70 per cent moisture and up to 5 per cent incombustible solids; with a heating value of 2500 Btu per pound as fired.

Type 4: Human and animal remains of various sizes, consisting of up to 85 per cent moisture and up to 5 per cent incombustible solids; with a heating value of 1000 Btu per pound as fired.

Type 5: By-product waste, gaseous, liquid, or semi-liquid, from industrial operations; having variable content and Btu values.

Type 6: Solid by-product waste from industrial operations, otherwise unclassified and having little or no moisture; with variable content and Btu values.
To consume divergent types of refuse, a wide range of incinerator designs and capacities have been developed, together with different methods of charging classified by the IIA as follows:

Classes of Incinerators:

Class I: Portable, packaged, direct fed incinerators, with a capacity of up to 25 pounds per hour of Type 1 or Type 2 refuse.

Class IA: Portable, packaged or site assembled, direct fed incinerators, with a capacity of from 25 to 100 pounds per hour of Type 1 or Type 2 refuse.

Class II: Chute-fed apartment house incinerators, where the refuse chute also acts as the flue for the products of combustion.

Class IIA: Chute-fed apartment house incinerators, having a separate refuse chute and a separate flue for the products of combustion.

CLASS III: Direct-fed incinerators with a burning rate of 100 pounds per hour or more, suitable for Type 1 or Type 2 refuse.

Class IV: Direct-fed incinerators with a burning rate of 75 pounds per hour or more, suitable for Type 3 refuse.

Class V: Municipal incinerators, with a burning rate of 1 ton per hour or more.

Class VI: Crematory and pathological incinerators, suitable for only Type 4 refuse.

Class VII: Incinerators designed for specific Type 5 or Type 6 by-product waste.

The definitions that follow are intended to have general applicability for the classes of incinerators and the various types of refuse. The reader will also find it helpful to consult the standard dictionary and engineering handbooks for terms not defined in this lexicon.

For convenience, the definitions have been divided into categories as follows:

Refuse and Products of Incineration

General Design

Refractories and Furnace Construction

Grates - Manual and Mechanical

Materials Handling

Burners and Instruments

Miscellaneous

Refuse and Products of Incineration

Ash Solid mineral remains after complete burning of refuse.

Ashes Residue from solid-fuel fires used for cooking, heating, and on-site incineration, usually containing some combustible constituents. (When collected with municipal refuse, ashes are part of the refuse charged to municipal incinerators.)

Bulky refuse or bulky waste Large dimensional waste unsuitable for charging into conventional incinerators.

Calorific value See Heating Value.

Carbonaceous matter Carbon compounds or pure carbon associated with the fuel or residue of a combustion process.

Clinker Hard, sintered or fused pieces formed in the fire by agglomeration of ash, but including metals, glass and ceramic from residue.

Combustion gases The mixture of gases and vapors produced in the furnace and combustion chamber.

Construction waste Scrap lumber, pipe, and other discarded materials from new construction and remodeling.

Demolition waste Construction materials from the razing of buildings and structures.

Effluent The gas vapor and particulates that reach the atmosphere from the burning process.

Fixed carbon The ash-free combustible matter remaining in a sample of refuse after the sample has been heated by a prescribed method to red heat in a closed crucible.

Flue gas Combustion gases which may contain water vapor and excess or dilution air added after the combustion chamber.

Fly ash All solids including ash, cinders, dust, soot, charred paper, or other partially incinerated solids, carried in the gas stream of the incinerator and stack.

Fumes Minute solid particles resulting from the condensation of vapors from solid matter after volatilization in the molten state, or generated by sublimation, distillation, calcination, or chemical reaction when these processes create air-borne particles.

Garbage Vegetable and animal food wastes from the preparation, cooking, and serving of food, market wastes, wastes from handling, storage, and sale of produce.

Gases Normally formless fluids which occupy the space of enclosure and which can be changed to the liquid or solid state only by the combined effect of increased pressure and decreased temperature.
Heating value The British Thermal Units (Btu) liberated per pound of refuse when burned completely and the products of combustion are cooled to the initial temperature, as in a calorimeter.

Lipids The oils, greases, fats and waxes in a refuse sample as determined by Soxlet extraction with anhydrous ethyl ether.

Moisture content of refuse The weight loss on drying a sample to constant weight under standard conditions, tentatively 75 C for refuse.

Odorant A gaseous nuisance which is offensive or objectionable to the olfactory senses.

Particulate matter Material which is suspended within or discharged to the atmosphere in finely divided liquid or solid form at atmospheric temperature and pressure.

Putrescible matter in residue Unburned organic matter in the residue that is fermentable, or capable of decaying, or of assimilation by animals and micro-organisms.

Refuse All waste composed of garbage, rubbish, liquids, gases, and non-combustibles.

Residue Solid materials remaining after burning, comprising ash, metal, glass, ceramics and unburned organic substances.

Rubbish All solid waste having combustibles, exclusive of garbage.

Smoke The effluent from a chimney that is visible because of suspended particles of soot, tarry droplets, fumes and fine ash.

Trash Waste materials small enough for conventional incineration.

Vapor plume The stack effluent consisting of flue gas made visible by condensed water droplets or mist.

Vapors The gaseous form of substances which are normally in the solid or liquid state and which can be changed to these states either by increasing the pressure or decreasing the temperature alone.

Volatile matter of refuse The weight loss of a dry sample on heating to red heat in a closed crucible.

Volatile solids The sum of the volatile matter and fixed carbon of a refuse sample, as determined by allowing a dried sample to burn in a heated and ventilated furnace.

General Design

Air The natural atmospheric mixture of nitrogen, oxygen, water vapor, carbon dioxide, argon, neon and small quantities of other rare gases; standard air being at 60 F. and 29.92 inches mercury absolute pressure. See also Excess Air, Primary Air, Overfire Air Jets, Secondary Air, and Theoretical Air.
Charging chute A passage through which waste materials are charged into an incinerator from above by gravity.

Chimney A vertical passage for conducting products of combustion to the atmosphere, usually originating at ground level and lined with refractory. See also Stack.

Combustion chamber Municipal incinerators: The chamber immediately following the furnace, in which gaseous and suspended particles continue to burn. Other incinerators: The furnace or primary combustion chamber.

Cooling air Ambient air added to the combustion gases for cooling by dilution. Also called "tempering air".

Cooling sprays Water sprays directed into the flue gases for the purpose of cooling the gases and, in most cases, to effect a partial separation of fly ash from the gases.

Commercial incinerator A predesigned, shop-fabricated unit, possibly shipped assembled as a package, for general refuse.

Continuous feed incinerator An incinerator into which refuse is charged in a nearly continuous manner so as to maintain a steady rate of burning. Lb/hr.

Damper A manually or automatically controlled device to regulate draft, or the rate of flow of air or combustion gases.

Destructive distillation The heating of organic matter when air is not present, resulting in the evolution of volatile matter and leaving solid char consisting of fixed carbon and ash.

Destructor An incinerator meeting the requirements of Class III, Class IV, Class VI, or Class VII incinerators.

Down pass Chamber or gas passage placed between two chambers to carry the products of combustion in a downward direction.

Draft The pressure difference existing between the incinerator, or any of its component parts, and the atmosphere which causes a continuous flow of air and products of combustion through the gas passages of the incinerator to the atmosphere.

Draft controller An automatic device to maintain a uniform furnace draft by regulation of an internal damper.

Excess air The air supplied to burn a fuel or refuse in addition to that theoretically (stoichiometrically) necessary for complete combustion usually expressed as percent of theoretical air, as "130\% excess air."

Expansion chamber See Settling Chamber.

Flareback A burst of flame from a furnace in a direction opposed to the normal flow, usually caused by the ignition of an accumulation of combustible gases.

Flue A passage for conducting combustion gases in an incinerator installation. Also, used synonymously with chimney in a building.

Flue fed incinerator Incinerators for multiple occupancy units in which refuse is charged thru openings on each floor into a flue, depositing the refuse into a combustion chamber below.

Forced draft The pressure above atmospheric created by the action of the fan or blower that supplies the primary air.

Furnace The chamber of the incinerator into which the refuse is charged, ignited and burned. The primary combustion chamber.

Furnace volume The cubical space of the furnace above the grate. Cu ft.

Guillotine damper An adjustable blade installed vertically in a breeching and arranged to move vertically across the breeching; usually counterbalanced for easy operation.

Hearth A stationary surface within the furnace upon which wet waste material is deposited for drying, prior to burning.

Heat balance An accounting of the distribution of the heat input and output, usually on an hourly basis.

Heat release rate The amount of heat liberated during the process of combustion and expressed in Btu per hour per cubic foot of the internal furnace volume in which such combustion takes place, based on the higher heating value of the fuel or refuse. Btu/(cu ft) (hr). The rate may also be expressed as Btu/(sq ft) (hr) of grate area.

Hot drying hearth A surface upon which wet material is placed to dry by the action of hot combustion gases that pass successively over the wet material and under the hearth.

Incineration The process of burning solid, semi-solid, or gaseous combustible wastes to an inoffensive gas and a sterile residue containing little or no combustible material.

Incinerator An arrangement of chambers and equipment designed for incineration, and connected to a chimney.

Induced draft The pressure below atmospheric created by the action of a blower, or ejector, which is located between the incinerator and the stack, or at the stack exit. Inches of water column. In. w.c.

Industrial incinerator A specifically designed, site-erected unit for disposal of a particular industrial waste.

Material balance An accounting of the weights of material entering and leaving a process, such as an incinerator, usually on an hourly basis.
Mixing chamber  A chamber usually placed between the furnace and the secondary combustion chamber where thorough mixing of the products of combustion is accomplished by turbulence created by increased velocities of the gases, checkerwork and/or turns in direction of the gas flow.

Municipal incinerator  A specifically designed, site-erected unit for disposal of refuse collected from residential, commercial, and industrial sources.

Natural draft  The negative pressure difference created by a stack or chimney due to its height and the temperature difference between the flue gases and the atmosphere.

Overfire air jets  Streams of high velocity air issuing from nozzles in the furnace enclosure, to provide turbulence and oxygen to aid combustion, or to provide cooling air.

Peep door  A small door usually provided with a shielded glass opening through which combustion may be observed.

Peep hole  A small observation port with cover on an incinerator door.

Primary air  Any air controlled with respect to quantity and direction, forced or induced, supplied through or adjacent to the fuel bed, for the purpose of promoting the combustion of combustible materials in the fuel bed.

Primary combustion chamber  See Furnace.

Puff  A minor combustion explosion within the furnace or setting.

Residential incinerator  A predesigned, shop-fabricated unit, shipped assembled as a package for individual dwellings.

Rubbish chute  A pipe, duct or trough through which waste materials are conveyed by gravity from the upper floors of a building to a storage room preparatory to burning.

Secondary air  Any air, controlled with respect to quantity and direction, supplied beyond the fuel bed, for the purpose of completing the combustion of combustible materials in the gases from the fuel bed, or to reduce the operating temperature within the incinerator.

Secondary combustion chamber  A chamber where unburned combustible materials from the furnace, usually gases and suspended particles, are burned.

Separation chamber  A chamber beyond the combustion chamber in which particulate matter may be removed from the gas stream by gravity and reversal of gas flow.

Settling chamber  A chamber designed to reduce the velocity of the combustion gases to promote the settling of fly ash from the gas stream.

Settling velocity  The velocity at which a given dust will fall out of dust-laden gas under the influence of gravity only. Also known as "terminal velocity".

Sliding damper  An adjustable blade installed and arranged to move in a horizontal plane across a duct, breeching, flue connection or stack to control the flow of flue gases.

Spark arrester  A screen-like device to prevent sparks, embers, or other ignited material above a given size from being expelled to the atmosphere.

Stack  A chimney or a vertical steel flue for conducting cooled products of combustion from a process to the atmosphere, sometimes via an induced-draft fan.

Steam  Water evaporated to the gaseous state. Water vapor. Produced by the combustion of hydrogen to \( \text{H}_2\text{O} \) evaporation from refuse, or produced in a boiler.

Theoretical air  The exact amount of air (stoichiometric air) required to supply the oxygen necessary for the complete combustion of a given quantity of a specific fuel or refuse.

Tipping floor  Unloading area for vehicles that are delivering refuse to an incinerator.

Thermodynamics  The science which deals with the mechanical actions or relations of heat.

Underfire air  Any air controlled with respect to quantity and direction, that is supplied beneath the grate and that passes through the fuel bed.

Velocity of flow  The rate of movement of a gas passing a given point in a unit time, such as feet per second, fps.

Refractories and Furnace Construction

Abrasion  Wearing away of refractory surfaces by the scouring action of moving solids, such as refuse, residue, or fly ash.

Absorption  The ratio of the weight of water a refractory can absorb to the weight of the dry refractory. The ratio is expressed as a percentage.

Abutment  In furnace construction, the structural member which withstands the thrust of an arch. In general, an abutment consists of a brick skewback and a steel supporting member.

Alumina  \( \text{Al}_2\text{O}_3 \), the oxide of aluminum. In combination with \( \text{H}_2\text{O} \) alumina forms the minerals bauxite, diaspore and gibbsite. In combination with \( \text{SiO}_2 \), alumina forms kaolinite and other clay minerals.

Anchor  A metal or refractory device inserted between the outer supports and the refractory wall, arch or roof to hold the refractory lining in place.

Arch  The roof of a furnace, chamber or flue.
**Bonded arch:** A sprung arch in which the transverse joints are staggered to tie the construction together.

**Flat arch:** An arch in which both outer and inner surfaces are horizontal.

**Ignition arch:** A refractory roof over or in a furnace near the zone of fuel entrance which promotes ignition by reflection of heat.

**Jack arch:** A flat arch held in place by compressive forces from the edges, similar to a sprung arch.

**Sprung arch:** An arch which is supported by abutments at the sides or ends only. A cross section of a sprung arch, taken at right angles to its axis, usually consists of a segment of a circular ring, in which the inner and outer arch surfaces are represented by arcs of concentric circles.

**Relieving arch:** A sprung arch in a wall to reduce the gravity load over a section below.

**Ring arch:** A sprung arch formed of separate courses or rings not bonded together.

**Wall arch:** A relieving arch or an arch over a door opening, port, or the like, in a wall.

Batter The decrease in thickness of a wall as it ascends. Also, the slope of the face of a wall; the angle at which the face of a wall slopes from the vertical.

**Body:** (1) A ceramic shape; (2) the blend of raw materials used for the production of a ceramic shape; (3) more specifically, the most important mineral constituent of a ceramic shape.

**Bond**

- **Ceramic bond:** The mechanical strength developed by a heat treatment which causes cohesion of adjacent particles.
- **Hydraulic bond:** The mechanical strength developed in a ceramic material by the combination of water with the mineral to form hydrate crystals.

**Burn** The degree of heat treatment to which refractory brick are subjected in their manufacture.

**Buckstays** Pairs of vertical steel beams, one on each side of a furnace or flue, and connected near the top, for the purpose of sustaining the thrust of a sprung arch.

**Calcining** The heat treatment of raw refractory materials for the purpose of eliminating volatile chemically combined constituents and for reducing volume changes.

**Castable refractory** A hydraulic-setting refractory, suitable for casting, ramming, or gunniting into heat-resistant shapes or walls.

**Checkerwork** A pattern of multiple openings in a refractory wall through which the combustion gases pass as a turbulent mixture.

**Cold set** The hardening or "setting" of a mortar which takes place at room temperature. See Mortar, Air setting.

**Conductivity, thermal** The specific rate of heat flow per hr. through refractories, expressed in Btu per sq ft of area, for a temperature difference of one degree Fahrenheit, and for a thickness of one inch. Btu/(sq ft) (hr) (deg. F) (in.)

**Corbel** In a wall, the projection from the vertical formed by placing each course beyond the course just below.

**Course** A horizontal layer or row of bricks in a structure.

- **Header course:** A course laid flat with the longest dimension of the bricks perpendicular to the face of the wall.
- **Row lock course:** A course laid on edge with the longest dimension of the bricks perpendicular to the face of the wall.
- **Soldier course:** A course with bricks set vertically.
- **Stretcher course:** A course laid flat with its length parallel to the face of the wall.

**Crown** The highest point of an arch. Also, a furnace roof that is dome shaped.

**Curtain wall** A partition wall between chambers under which the combustion gases pass.

**Dehydration** The removal of chemically combined water from clay minerals, as by heat.

**Devitrification** The change from a glassy to a crystalline condition.

**Dome** See Crown.

**Dry-press process** A method of forming brick from slightly moistened granular materials by charging the materials into molds and compressing by machines into rigid shapes.

**Dutch oven** A combustion chamber built outside of and connected with a furnace.

**Erosion** The wearing away of refractory surfaces by the washing action of moving liquids, such as molten slags or metals; or the action of moving gases.

**Expansion**

- **Thermal expansion and contraction:** Enlargement upon heating and contraction on cooling, with return to the initial dimensions upon returning to the initial temperature.
- **Permanent or secondary expansion:** The property exhibited by some refractories of developing permanent enlargement or growth at temperatures within their useful range.

**Firebrick** Refractory brick of any type.
Fire clay  A sedimentary clay containing only small amounts of fluxing impurities, but high in hydrous aluminum silicates, and therefore capable of withstanding high temperature.

Fireclay brick  A refractory brick manufactured substantially or entirely from fire clay.

Alumina - Diaspore Fireclay Brick:  Brick made essentially of diaspore or nodule clay, and having an alumina content of 50, 60 or 70 per cent plus or minus 2% per cent.

Low Duty Fireclay Brick:  Fireclay brick which have a PCE not lower than Cone 19.

Intermediate Duty Fireclay Brick:  Fireclay brick which have a PCE not lower than Cone 29, or which deform not more than 3 per cent at 2460 F (1350 C) in the standard load test.

High Duty Fireclay Brick:  Fireclay brick which have a PCE not lower than Cone 31 - 32, or which deform not more than 1.5 per cent at 2460F (1350 C) in the standard load test.

Super Duty Fireclay Brick:  A fireclay brick having a pyrometric cone equivalent not lower than Cone 33 on the fired product, and not more than 1 per cent linear shrinkage in the permanent linear ASTM change test, Schedule C (2910 F) and not more than 4 per cent loss in the panel spalling test (preheated at 3000 F).

Fireclay refractory  Brick, shapes or specialties made principally or entirely of fire clays.

Flux  A material or mixture of materials that causes other minerals with which it comes in contact to fuse at temperatures lower than their normal fusion temperatures.

Fusion point  The temperature at which a particular complex mixture of minerals becomes sufficiently fluid to flow under the weight of its own mass. As most refractory materials have no definite fusion points, but soften gradually over a range of temperatures, the conditions of measurement have been standardized by the American Society for Testing and Materials. See Pyrometric Cone Equivalent.

Grog  Calcined fire clay or clean broken fireclay brick, ground to suitable fineness. It is added to a refractory batch to reduce shrinkage in drying and firing.

Grout  A type of mortar. See under Mortar.

Gunniting  The placement of hydraulic setting refractory concrete at a high velocity by compressed air.

High-alumina refractories  Refractory products containing 47.5 per cent more of alumina.

Insulation  A material having a low thermal conductivity used on the exterior of heated constructions and capable of withstanding the temperatures to which it is subjected.

Insulating (Back-up) Block:  A shaped product having a very low thermal conductivity and a bulk density of less than 70 pounds per cubic foot, suitable for lining industrial furnaces.

Insulating firebrick:  A firebrick having a low thermal conductivity and a bulk density of less than 70 pounds per cubic foot, suitable for lining industrial furnaces.

Plastic insulation:  Insulation, plastic enough when mixed with water, to adhere to outer furnace walls or to be placed over arches.

Jamb  The vertical or upright structural member forming the side of a door or other opening in a furnace wall. Also a brick shape with one short edge rounded.

Joint  Buttered joint:  In laying up firebrick, a joint formed by troweling mortar on the faces of the brick.

Dip Joint:  In laying up firebrick, a joint formed by dipping the brick into the mortar and either rubbing or tapping the brick into place.

Expansion joint:  An open joint left for thermal or permanent expansion of refractories. Also, small spaces or gaps built into a refractory structure to permit sections of masonry to expand and contract freely and to prevent distortion or buckling of furnace structures from excessive expansion stresses. These joints are built in such forms as to permit movement of masonry but to limit or prevent air or gas leakage through the masonry.

K-Factor  The thermal conductivity of a material, expressed in Btu per hr (sq ft) (deg. F) (in.).

Key  In furnace construction, the uppermost or the closing brick of a curved arch.

Lintel  A horizontal structural member spanning an opening to carry a super-structure.

Load-bearing resistance  The resistance of a refractory to deformation when subjected to a specified compressive load at a specified temperature for a specified time.

Lumnite cement  A tri-calcium aluminite with hydraulic setting properties.

Mineral wool  An artificial product composed of fine, fused, silicate fibers, used as insulation and soft packing.

Modulus of rupture  A measure of the transverse or cross-breaking strength of a material to which a load is applied vertically to the top surface of a test piece in accordance with a standardized procedure.

Monolithic lining (or construction)  A refractory lining or construction made in large sections on the site without the conventional layers and joints of brick construction. The lining or construction may be formed by casting, gunniting, ramming, or sintering of a granular material into place.
Pyrometric cone equivalent (PCE) An index to the refractoriness of material obtained by a test which provides the number of a standard Pyrometric Cone that is closest in its bending behavior to that of a pyrometric cone made of the material, when both are heated in accordance with the ASTM Standard Method of Test for Pyrometric Cone Equivalent of Refractory Materials.

Air-setting refractory mortar: A finely ground refractory material that forms a wet mortar that will, upon drying, develop a strong air-set bond between refractory shapes and maintain a bond when heated to working furnace temperatures.

Cold-setting refractory mortar: Same as air-setting refractory mortar.

Fireclay mortar: A mortar of high-fusion-point fire clay and water, often used to fill joints to stop air or gas leakage without forming a strong bond.

GROUT: A mortar thin enough to flow into unfilled joints in firebrick construction.

Heat-setting refractory mortar: A mortar in which the bond is developed by relatively high temperatures. The hardening of the mortar is the result of the vitrification of part of its constituents.

Hot-setting refractory mortar: Same as heat-setting refractory mortar.

Hydraulic-setting mortar: A mortar that hardens or sets as a result of hydration, a chemical reaction with water. As the working furnace temperature is applied the water evaporates and a ceramic bond develops.

Nine-inch equivalent The unit volume of measurement of brick quantities in the refractories industry, equal to the volume of a standard 9 in. x 4½ in. x 2½ in. (straight) brick.

Penetration of slag The action of slag on soaking into a refractory.

Plastic refractory A blend of ground fireclay materials in plastic form, suitable for ramming into place to form monolithic linings or special shapes. It may be air-setting or heat setting, and is available in different qualities of heat resistance.

Porosity The ratio of the volume of the interstices in a body to the total volume, usually expressed as a percentage.

Power pressing The forming of refractory brick shapes in molds by means of high pressures applied vertically, from ground refractory material containing an optimum amount of added water.

Pyrometric cone equivalent (PCE) An index to the refractoriness of material obtained by a test which provides the number of a standard Pyrometric Cone that is closest in its bending behavior to that of a pyrometric cone made of the material, when both are heated in accordance with the ASTM Standard Method of Test for Pyrometric Cone Equivalent of Refractory Materials.

Ramming mix A ground refractory material which is mixed with water to a stiff consistency and rammed or hammered into place to form monolithic furnace linings or patches.

Refractory (Refractories) Non-metallic substances capable of enduring high temperatures and used in linings of furnaces. While their primary function is resistance to high temperature, they are usually called upon to resist one or more of the following destructive influences: abrasion, pressure, chemical attack and rapid changes in temperature.

Silica SiO₂, the oxide of silicon, a major constituent in fireclay refractories, alone or in chemical combinations.

Silicon carbide SiC, a refractory material of high melting point, high density, and high thermal conductivity, also having a high resistance to abrasion.

Sintering A heat treatment which causes adjacent particles of material to cohere at a temperature below that of complete melting.

Skewback The course of brick or a special shape having an inclined face, and from which an arch is sprung.

Slag A liquid mineral substance formed by chemical action and fusion at furnace operated temperatures.

Slagging of refractories Destructive chemical action upon refractories at high temperatures, resulting in the formation of slag. Also, the coating of refractories by ash particles, which form a molten or viscous slag on the refractories.

Spalling of refractories The breaking or crushing of a refractory unit due to thermal, mechanical or structural causes, thus presenting newly exposed surfaces of the residual mass.

Mechanical spalling: That spalling resulting from stresses caused by rapid heating of wet refractory, abuse in removing slag and clinkers, no provision for expansions, pinching, etc.

Thermal spalling: That spalling caused by stresses set up in a refractory body during heating and cooling, vitrification, contamination by slags and fluxes, tightness of joints, degree and uniformity of reversible thermal expansion.

Structural spalling: That spalling caused by materials in joints, degree of burning and shrinkage.

Panel spalling test: A standardized test to provide an index to the spalling behavior of refractories.

Span The horizontal distance between the supports of an arch.

Spring line The line of contact between the under surface of an arch and the skewback.

Thermal shock resistance The ability to withstand sudden heating or cooling or both without cracking or spalling.
Vitrification  A process of permanent chemical and physical change in a ceramic body at high temperatures, with the development of a substantial proportion of glass.

Wall  A vertical side or end of a chamber, including refractory, insulation, brick and steel.

Air-cooled wall: A wall in which there is a lane for the flow of air directly in back of the refractory.

Battery wall: A double or common wall between two incinerators, both faces of which are exposed to heat.

Bridge wall: The furnace wall which separates the fuel-burning portion from the rest of the furnace or system. Also, a partition wall between chambers over which the combustion gases flow.

Core wall: In a battery wall, those courses of brick, none of which are exposed on either side.

Gravity wall: A wall supported directly by the foundation or floor of a structure.

Insulated wall: A wall in which insulation is placed directly behind the refractory.

Supported wall: A furnace wall that is anchored to and has its weight transferred to a structure (usually steelwork and castings) outside of the high temperature zone.

Unit suspended wall: A furnace wall or panel which is supported by hanging from overhead steel.

Workability The combination of properties that permits refractory mortars, plastic refractories and ramming mixes to be placed or shaped with a minimum of effort.

Grates – Manual and Mechanical

Chain-grate stoker  A stoker which has a moving chain as a grate surface; the grate consisting of links mounted on rods to form a continuous surface that is generally driven by sprockets on the front shaft.

Dead plate grate A stationary grate thru which no air passes.

Dead plates Castings supporting walls and extending into door openings to provide sills.

Drag plate A plate beneath a traveling or chain-grate stoker used to support the returning grates.

Dump plate An ash-supporting hinged plate from which ashes may be discharged by rotation from one side of the plate.

Fixed grate A grate which does not have movement. A stationary grate.

Grate A surface with suitable openings, to support the burning refuse bed and permit the passage of air through the burning refuse.

Incinerator stoker  A mechanically operable moving grate arrangement for supporting, burning and transporting the refuse in a furnace and discharging the residue. A mechanical stoker for the burning of refuse in an incinerator.

Ledge plate  A form of plate which is adjacent to, or overlaps, the edge of a stoker.

Oscillating grate stoker  A stoker of which the entire grate surface oscillates to move the refuse and residue over the grate surface.

Reciprocating grate A forced-draft grate whose sections move continuously and slowly, forward and rearward, for the purpose of agitating, compressing, moving and burning refuse material from the charging to the discharge ends of an incinerator furnace.

Rocking grate An incinerator stoker with moving (and stationary) grate bars which are trunnion supported. In operation, the moving bars oscillate on the trunnions, imparting a rocking motion to the bars, and thus agitating and moving the refuse and residue along the grate.

Stationary grate A grate with no moving parts. A fixed grate.

Traveling grate stoker  A traveling grate stoker consists of an endless grate similar to a chain grate, but with grate keys mounted on transverse bars. The lead nose of each key on one bar overlapping the rear end of the keys on the preceding bar. The transverse bars are mounted on chains and are driven by sprockets.

Tuyeres Air openings or ports in a forced-draft grate.

Windbox A chamber below the grate or surrounding a burner, through which air under pressure is supplied for combustion of the fuel.

Materials Handling

Apron conveyor A conveyor with steel pans suspended between two strands of chain with rollers, having fixed vertical sides inside the extended chain side bars to contain the material.

Ash gate A horizontal gate used to close the bottom of ash hoppers; normally supported on rollers. Some ash gates have a special drain arrangement to allow quenching water to be retained to provide an air seal for furnace.

Ash pit A pit or hopper located below a furnace where residue is accumulated and from which it is removed at intervals.

Auxiliary girder A girder on a crane (parallel to the main girder) for supporting the platform, motor base, operator’s cab, control panels, etc., to reduce the torsional forces such loads would otherwise impose on the main girder.
Bridge That part of an overhead crane consisting of girders, trucks, end ties, walkway and drive mechanism, which carries the trolley and travels in a direction parallel to the runway.

Camber The slight vertical curvature given to girders to compensate partially for deflection due to hook load and weight of the crane.

Charging cutoff gate A modification of charging gate used in continuous-feed furnaces which do not have high temperatures near the charging hopper. It consists of a steel cutoff plate at bottom of charging hopper which closes on a machined seat at the top of the charging chute.

Charging gate A horizontal moving cover that closes the charging opening on top-charging furnaces. It usually consists of a steel cutoff plate for sealing the charging hopper, a refractory-lined cover which fits into the frame in top of furnace, and mechanical means for opening and closing.

Charging ram A reciprocating device to meter and force refuse into a furnace.

Clearance Minimum distance from the extremity of a piece of equipment to the nearest obstruction.

Closing motion The hoist motion that closes and opens the bucket or grapple and also is used in raising and lowering the load.

Collectors Contacting devices for collecting current from the runway or bridge conductors on a traveling crane.

Crane stop A block secured to the runway to limit movement of the crane.

Drag conveyor A conveyor normally used for residue, consisting of vertical steel plates known as flights, fastened at intervals between two strands of chain.

Electric overhead traveling crane An electrically operated machine for lifting, lowering and transporting loads, consisting of a movable bridge carrying a fixed or movable hoisting mechanism and traveling on an overhead runway structure.

End truck The unit consisting of truck frame, wheels, bearings, axles, etc. which supports the bridge girders of a crane.

Flight conveyor A conveyor often used as a drag conveyor, but having rollers interspersed in the chains to eliminate friction.

Girder The principal horizontal beam of the crane bridge which supports the trolley and is supported by the end trucks or end ties.

Grab bucket The container used for picking up the refuse and conveying same. The bucket is of steel with lips, and can be with or without teeth.

Grapple Used for the same purpose as the Grab Bucket, but has long times for better digging action.

Hydraulic fly-ash handling A system using water-filled pipes or troughs in which fly ash is conveyed by means of gravity water jets or centrifugal pumps.

Lift Maximum safe vertical distance through which a crane bucket can move.

Main line collectors The collectors mounted on the bridge of a crane used to transmit current from the runway conductors.

Operator's cab The operator's compartment from which movements of the crane are controlled.

Pneumatic ash handling A system of pipes and cyclone separators which conveys fly ash or floor dust in an air stream to a bin.

Rated load The maximum load which a crane is designed to handle safely.

Residue conveyor A conveyor, usually drag or flight type, running in a water-filled trough that quenches and dewateres as it elevates the residue to a discharge point.

Resistor rating Rating established by NEMA which classifies resistors according to per cent of full load current on first point and duty cycle.

Runway The rails, beams, brackets and framework on which the crane operates.

Runway conductors The conductors mounted on or parallel to the runway and which supply current to the crane.

Runway rail The rail supported by the runway beams, on which the bridge of the crane travels.

Span Distance between the centerlines of the two rails of a crane runway.

Torque, full load The torque necessary for a motor to produce its rated horsepower at full-load speed.

Trolley The unit that carries the crane-hoisting mechanism and which travels on the bridge rails.

Wheel load The load on any crane wheel with the trolley and lifted load (rated capacity) positioned on the bridge to give maximum loading.

Burners and Instruments

Alarm An audible or visible signal indicating an off-standard or abnormal condition.

Automatic (recycling) burner A burner which is purged, started, ignited, modulated, and stopped automatically and which recycles on a preset operating range.
Available heat The quantity of useful heat per unit of fuel available from complete combustion after deducting dry-flue-gas and water-vapor losses.

Balancing relay A relay with an armature pivoted on one end and swinging between two electro-magnetic coils.

Burner A device for the introduction of fuel and air into a furnace at the desired velocities, turbulence and concentration to establish and maintain proper ignition and combustion of the fuel.

CO₂ Recorder An instrument for continuously monitoring the percentage volume concentration of carbon dioxide in the flue gas.

Combustion The rapid reaction of the combustible material with oxygen, with the resultant generation of heat.

Complete combustion The complete oxidation of the fuel, regardless of whether it is accomplished with an excess amount of oxygen or air or just the theoretical amount required for perfect combustion.

Controller A device for regulating in a pre-determined way the power delivered to a motor or other equipment.

Control point The value of the controller variable which the controller operated to maintain.

Explosive mixture A flammable mixture in a confined space.

Extension wire A matched pair of conductors for use with thermocouples, having an insulation designed to meet the service needs of a particular installation.

Fuel oil Any liquid petroleum product which may be used for the generation of heat. (Fuel oil may be crude petroleum or products and by-products from the distillation of crude petroleum or blends.)

Gage pressure The pressure above atmospheric pressure.

High gas pressure switch A pressure actuated device arranged to effect a safety shutdown of the burner or prevent it from starting when the gas supply pressure exceeds a predetermined high pressure.

Interlock A device which senses a limit or off-limit condition or improper sequence of events and shuts down the offending or related piece of equipment or prevents proceeding in an improper sequence in order to prevent a hazardous condition.

Limit switch A device designed to cut off the power automatically at or near the limit of travel.

Low gas pressure switch A pressure actuated device arranged to effect a safety shutdown of a burner or prevent it from starting when the gas supply pressure falls below a predetermined low supply pressure.

Manometer A u-shaped tube or an inclined tube filled with a liquid used to measure pressure difference.

Manual burner A burner which is purged, started, ignited, modulated, and stopped manually.

Master switch A manually operated device which serves to govern the operation of contactors and auxiliary devices of an electric system.

Natural gas A gaseous fuel occurring in nature consisting mostly of a mixture of organic compounds of carbon or hydrogen (normally methane, butane, propane, and ethane). The Btu value of natural gases varies, between 700 and 1500 Btu per cubic foot, the majority averaging 1000 Btu.

O₂ Recorder An instrument for continuously monitoring the percentage oxygen content of flue gas.

Orsat An apparatus used for analyzing flue gases volumetrically by measuring the amounts of carbon dioxide, oxygen, and carbon monoxide.

Overload protection (overcurrent) A device operative on excessive current to cause and maintain the interruption or reduction of current flow to the equipment governed.

Pilot A burner smaller than the main burner, which is ignited by a spark or other independent and stable ignition source, and which provides ignition energy required to immediately light off the main burner.

Pilot establishing period That interval of time during light-off of a burner during which a safety control circuit permits the pilot-fuel safety shutoff valves to be opened before the flame safeguard is required to prove the presence of the pilot flame.

Pilot tube An instrument which will sense the total pressure and the static pressure in a gas stream. It is used to determine gas velocity.

Potentiometer A temperature-measuring device made of a number of turns of resistance wire wound in a cylindrical form and constructed with three connections; the center connection being a movable finger or wiper which rides over the length of the coil completing the circuit wherever it touches.

Proportional band The range of values of a proportional positioning controller through which the controlled variable must pass to move the final control element through its full operating range. (Commonly used equivalents are “throttling range” and “modulating range”).

Proportioning The maintenance of the desired ratio between fuel and air supply over the operating range of the burner, or the modulation of a control over a preset range.

Purge Scavenging of the furnace and boiler passes with air. Purge air flow must reach not less than 70 per cent of the air flow required at maximum continuous capacity of the unit and be sufficient for at least eight air changes.
Pyrometer
- An instrument for measuring and/or recording temperature.

Radiation pyrometer
- A pyrometer which determines temperature by measuring the intensity of radiation from a hot body.

Hugelmann chart
- A series of four rectangular grids of black lines of varying widths printed on a white background, and used as a criterion of blackness for determining smoke density.

Set point
- The value on the controller scale at which the controller indicator is set.

Smoke eye
- A device consisting of a light source and photovoltaic cell which measures the light obscuration of smoke in flue gas.

Thermal efficiency
- The ratio of heat utilized usefully to total heat generated; or in other words, it is the heat output divided by the heat input.

Thermocouple
- Two lengths of wire, made from different homogeneous metals, connected to form a complete electric circuit which develops an electromotive force (emf) when one junction is at a different temperature than the other.

Viscosity of liquid
- The measure of a liquid's resistance to flow, generally measured in terms of Saybolt Universal of Saybolt Furol Seconds.

Miscellaneous

Blower
- A fan used to force air under pressure.

Dust loading
- The amount of dust in a gas, usually expressed in grains per cubic foot or pounds per thousand pounds of gas.

Electrostatic precipitator
- A device for collecting dust from a gas stream, by placing an electrical charge on the particle and removing that particle onto a collecting electrode.

Fan performance
- A measure of fan operation in terms of volume, total pressures, static pressures, speed, power input, mechanical and static efficiency, at a stated air density.

Filter, oil
- Usually mounted externally on the reservoir for easy access, the filter prevents harmful particles from entering the pump suction port.

Flexible coupling
- Between a fan or pump, and motor, the coupling absorbs side thrust which would otherwise be transmitted between pump and motor by slight misalignment between the two (not over 0.004 in.)

Flue-gas washer
- Equipment for removing fly ash and other objectionable materials from the products of combustion by means of sprays, wet baffles, etc.

Fly-ash collector
- Auxiliary equipment designed to remove fly ash in dry form from the products of combustion.

Forced-draft fan
- A fan supplying air under pressure to the fuel-burning equipment.

Gas washer
- Auxiliary equipment designed for wet removal of pollutants from the products of combustion.

Grains per cu ft
- The term for expressing dust loading in weight (grains) per unit of gas volume (cu ft). 7000 grains equals one pound.

Induced-draft fan
- A fan exhausting hot gases from the heat-absorbing equipment, dust collector or scrubber.

Micron
- A measure of dust-particle size equal to 1/1,000 of a millimeter or 1/25,400 of an inch.

Mists
- Suspended liquid droplets generated by condensation from the gaseous to the liquid state or by breaking up a liquid into a dispersed state, such as by splashing, foaming, and atomizing.

Multicyclone
- A dust collector consisting of a number of cyclones, operating in parallel through which the volume and velocity of gas can be regulated by means of dampers in order to maintain dust-collector efficiency over the load range.

Particle size
- A measure of dust size, expressed in microns of percent passing through a standard mesh screen.

Pressure-compensated pump
- A rotary-vane pump with variable displacement by means of a pressure compensating governor which enables the pump to maintain relatively constant pressure from zero to rated volume capacity without the use of a relief valve or other bypass arrangement.

Scrubber
- Auxiliary equipment designed for wet removal of pollutants from the products of combustion.

References

[7] Definitions from TA-3 Committee of the Air Pollution Control Association.

Acknowledgment

The Special Technical Subcommittee and the author are indebted to numerous individuals associated with the ASME Incinerator Committee for definitions, and for reviewing and improving the manuscript. It is the wish of the author that additions and refinements will be offered by the reader for a future edition.