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Standard Terminology of Glass and Glass Products[1]

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1. Scope

1.1 This terminology defines terms generally used in C14 standards with related additional terms from the glass industry.

1.2 In some cases in which a usage is specific to a certain industry, that is spelled out within the definition. For completeness and historical purposes, terms that are outdated are listed as being archaic. The reader is cautioned that some companies or industries may define or use terms differently than the way these terms are defined within this terminology.

1.3 Other sources of glass glossaries are *National Glass Association's GANA Glazing Manual,*[2] *NGA Engineering Standards Manual for Tempered Glass,*[2] *Laminated Glass Design Guide,*[2] and ASTM Committee C-14 standards.

2. Referenced Documents

2.1 *ASTM Standards:*[3]

C148 Test Methods for Polariscopic Examination of Glass Containers

C336 Test Method for Annealing Point and Strain Point of Glass by Fiber Elongation

C338 Test Method for Softening Point of Glass

C598 Test Method for Annealing Point and Strain Point of Glass by Beam Bending

C813 Test Method for Hydrophobic Contamination on Glass by Contact Angle Measurement

C1048 Specification for Heat-Strengthened and Fully Tempered Flat Glass

C1172 Specification for Laminated Architectural Flat Glass

3. Terminology

Abbé value—the reciprocal dispersive power, a value used in optical design, expressed mathematically as:

$$\textbf{Abbé value} = (n_d - 1)/(n_F - n_C)$$

where n_d is the refractive index for the helium line at 587.6 nm and n_F and n_C are the refractive indices for the hydrogen lines at 486.1 nm and 656.3 nm, respectively. See synonymous term *nu-value* and related term **dispersion**.

abraded—describes a test specimen that has at least a portion of the area under test subjected to an operationally defined procedure for mechanical abrasion. The severity and uniformity of abrasion should be sufficient to ensure origin of failure substantially in the region of maximum stress.

absorption—a magnitude reduction of electromagnetic energy of neither transmission nor reflection, such as sunlight being absorbed by tinted glass.

acid polishing—the polishing of a glass surface by acid treatment.

acoustics—the science of sound and sound control.

air bells—bubbles of irregular shape formed generally during the pressing or molding operations in the manufacture of optical glass.

alabaster glass—a milky-white glass that diffuses light without fiery color.

alcove—a narrow channel to convey molten glass from refiner to forehearth or to the revolving pot where it is gathered by the Owens machine.

alkali—an industrial term for the oxide of sodium or potassium; less frequently of lithium.

ampoule—a glass container designed to be filled and sealed by fusion of the glass neck.

analyzer—a polarizing element, typically positioned between the specimen being evaluated and the viewer.

anisotropy—a strain pattern inherent in all heat-strengthened and fully tempered glass. This strain pattern may be visible under certain lighting conditions. It is a characteristic of heat-treated glass and should not be mistaken as discoloration, nonuniform tint or color, or a defect in the glass. The strain pattern does not affect any physical properties or performance values of the glass. Also known as *iridescence*.

[1] This terminology is under the jurisdiction of ASTM Committee C14 on Glass and Glass Products and is the direct responsibility of Subcommittee C14.01 on Nomenclature and Definitions.

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[2] Available from National Glass Association (NGA), 344 Maple Ave. West, Unit 272, Vienna, VA 22180. http://www.glass.org.

[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

anneal—to attain acceptably low stresses, or desired structure, or both, in glass by controlled cooling from a suitable temperature.

annealed glass—describes glass subjected to the annealing process.

annealing—a controlled cooling process for glass designed to reduce residual stress to a commercially acceptable level and modify structure.

annealing lehr—an on-line, controlled heating/cooling apparatus located after the glass is formed and before the glass is cooled. Its purpose is to anneal the glass product.

annealing point (A.P.)—that temperature corresponding either to a specific rate of elongation of a glass fiber when measured by Test Method C336, or a specific rate of midpoint deflection of a glass beam when measured by Test Method C598. At the annealing point of glass, internal stresses are substantially relieved in a matter of minutes.

annealing range—the range of glass temperature in which stress in glass can be relieved at a commercially practical rate. For purposes of comparing glasses, the annealing range is assumed to correspond with the temperature between the annealing point (A.P.) and the strain point (St.P.)

antimony—an industrial term for an oxide of antimony.

applied color label (ACL)—a ceramic-glass enamel/ink applied to and fired on a glass surface for the purposes of decoration and labeling. Also called Applied Ceramic Label.

arch, *n*—a part of a glass melting furnace; a crown.

arch, *v*—to heat a pot in a pot arch.

architectural glass, *n*—a general term applied to glass used in the building industry.

arrest mark—see **dwell mark**.

arsenic—an industrial term for an oxide of arsenic.

autoclave—a vessel that employs pressure and heat, used to produce a permanent bond between glass and interlayers suitable for this process, creating a laminated glass product.

aventurine—{archaic} glass containing colored, opaque spangles of non-glassy material.

back wall—the wall at the charging end of a glass melting furnace.

baffle—a mold part used to close the delivery or baffle hole in a blank mold.

baffle mark—a mark or seam on a bottle resulting from a mold joint between blank mold and baffle.

baffle wall—a wall used to deflect gases or flames in a glass melting furnace.
See **shadow wall**.

baghouse—a chamber containing bag filters for the removal of particles from a process exhaust stream.

bait—the tool dipped into molten glass to start any drawing operation.

barrel, glass container—{archaic} see **sidewall, glass container**.

base—{archaic} the bottom of a bottle.

basic fiber—unprocessed glass fibers directly from the forming equipment.

batch—(*1*) the recipe of batch ingredients.
(*2*) the raw materials weighed but unmixed.
(*3*) the raw materials, properly proportioned and mixed, for delivery to the furnace.

batch charger—a mechanical device for introducing batch to the glass melting furnace.

batch feeder—see **batch charger**.

batch house—the place where batch materials are received, handled, weighed, and mixed.

bath—synonymous with **float bath**.

bead—(*1*) an enlarged, rounded raised section on a glass article.
(*2*) a small piece of glass tubing bonded around a wire lead.
(*3*) in fiber glass, a tear drop-shaped glass mass which forms as a result of the interruption of the fiber forming process below an orifice.

beam bending viscometer—a device used to determine the viscosity of glass by viscous bending of a loaded beam.

bearer arch—see **rider arch**.

bearing surface—the outside surface of an item of glassware on which it rests when in its normal upright position.

beltmarks—see **chain marks**.

bench—see **siege**.

bending stress—a continuously and linearly changing stress across the thickness of a glass body, varying from compression on one surface to tension on the opposite surface.

bent glass—previously flat glass that has been configured in an out-of-plane manner by a method such as heating followed by cooling into a new self-sustaining form, or the application of external sustained load.

beveling—the process of edge finishing flat glass to a beveled angle.

bicheroux process—{archaic} an intermittent process for making plate glass, in which the glass is cast between rolls, onto driven conveyer rolls, or a flat moving table.

binder—(*1*) for a continuous filament process, a constituent of a fiber glass sizing that couples the fiber to the composite matrix.
(*2*) for insulation, material applied to glass fibers to hold them in a desired arrangement.

bite—the dimension by which the framing system overlaps the edge of the glazing infill.

blank—(*1*) a preliminary shape from which a finished article is further formed, molded, or cut.
(*2*) a semi-finished piece of glass for making an optical element, such as a lens or prism. Also known as a pressing.

blank mold—the metal mold that first shapes the glass in the manufacture of hollow ware.

blanket feed—a method for charging batch designed to produce an even distribution of batch across the width of the glass melting furnace.

blending-batch—{archaic} stepwise changes in batch composition to arrive at the final change in finished glass.

blister—a relatively large gaseous inclusion in glass.

bloach—{archaic} an imperfection resulting from incompletely grinding plate glass, caused by a low place in the plate which retains part of the original rough surface.

blocking—(*1*) shaping a gather of glass in a cavity of wood or metal.
(*2*) *archaic,* promoting mixing and fining of glass by immersion of a wooden block or other object to create bubbles.
(*3*) reprocessing to remove surface imperfections.
(*4*) *archaic,* mounting of glass for grinding and polishing.
(*5*) *archaic,* idling a furnace at reduced temperatures.
See **hot hold**.

block mold—a one-piece mold.

block reek, rake—{archaic} a scratch imperfection caused by cullet lodged in the felt in the polishing operation.

bloom—(*1*) a visible surface film resulting from attack by the atmosphere or from the deposition of particulate or vapor condensates. (See also **smoked**.)
(*2*) a blemish in float glass appearing on the bottom (tin contact) surface after reheating as a result of the presence of tin diffused into the surface.

blow-and-blow process—the process of forming hollow ware in which both the preliminary and final shapes are formed by air pressure.

blower—one who forms glass by blowing. (See also **gaffer**.)

blow head—part of a forming machine serving to introduce air under pressure to blow any hollow glass article.

blow-over—the thin-walled bubble formed above a blow mold in hand-shop operation to facilitate bursting-off.

blowpipe—the pipe used by a glassmaker for gathering and blowing by mouth.

blowing iron—see **blowpipe**.

blown glass—glassware shaped by air pressure, as by compressed air or by mouth blowing.

blow mold—the metal mold in which a blown glass article is finally shaped.

body—the attribute of molten glass, associated with viscosity and homogeneity, which is conducive to workability.

boil—turbulence caused by gases escaping from the melting batch.

boil (bubble)—in laminated glass, a gas pocket in the interlayer material or between the glass and the interlayer.

boost melting—see **electric boosting**.

boot—a suspended enclosure in the nose of a glass melting furnace protecting a portion of the surface and serving as a gathering opening.

borax glass—vitreous anhydrous sodium tetraborate ($Na_2B_4O_7$).

borosilicate glass—a silicate glass with B_2O_3 content above 4 weight percent, characterized by a moderate to low thermal expansion, long in viscosity versus temperature, and low in density.

bow—a condition in which a lite of flat glass departs from a true plane.

bowl—see **spout**.

breast wall—(*1*) the entire side wall of a glass melting furnace between the flux block and the crown, but not including the ends.
(*2*) refractory wall between pillars of a pot furnace and in front of or surrounding the front of a pot.

breezing—{archaic} buckwheat anthracite coal or coarse sand spread on the siege before setting of pots.

bridge—the structure formed by the end walls of the adjacent melter and refiner compartments of a melting furnace and the covers spanning the gap between the end walls.

bridge cover—see **bridge wall cover**.

bridge wall cover—refractory blocks spanning the space between the bridge walls.

bridgewall—that part of a glass melting furnace forming a bridge or separation between melter and refiner.

bruise—synonymous with **percussion cone**.

bulb edge—the heavy rounded edge or bead of glass, for example, the extreme lateral edge of the ribbon of flat glass as drawn.

bull's eye—(*1*) a tempered solid cylindrical sight glass.
(*2*) the glass left by the punty in the center of a flat disk of glass made by the hand blown crown process.
(*3*) in flat glass, an optical distortion that arises from a polishing depression or a solid inclusion trapped between layers of laminated glass.

bump check—see **percussion cone**.

burner block—a refractory block with one or more orifices through which fuel is admitted to a furnace.

burn-off—the process of severing an unwanted portion of a glass article by fusing the glass.

burnt lime—calcined limestone (CaO · MgO, dolomitic), or CaO (calcitic), or a mixture of these.

bursting-off—the breaking of the blowover.

bushing—(*1*) a liner in the feeder orifice for molten glass.
(*2*) a precious metal or refractory/metal structure with single or multiple hole(s) through which glass flows and is attenuated into fiber(s).

butterfly bruise—see **percussion cone**.

cabal glass—a glass consisting primarily of the oxides of *ca*lcium, *b*oron, and *al*uminum.

campaign—the working life of a melting furnace between major cold repairs.

canal—that part of a melting furnace leading from the fining area to the forming area. See **channel** and **forehearth**.

cane—solid glass rods.

cap, *n*—(*1*) another name for crown.
(*2*) a type of bottle closure.

cap, *v*—{archaic} to cut off the ends of a glass cylinder.

carnival glass—glass having an iridescent coloration obtained by firing metallic salts applied onto a colored glass body. See **lusters**.

carry-in—manual lehr loading.

cased glass—glassware whose surface layer has a different composition from that of the main glass body.

casehardened—a term sometimes used for tempered glass. (See **tempered glass**.)

cast glass—glass cooled in the pot in which it was melted.

casting—a process of shaping glass by pouring molten glass into molds.

cat eye—an imperfection; an elongated bubble containing a piece of foreign matter.

cat scratch—streak(s) on the surface of glass containers which has a slightly different chemical composition than the base glass typically resulting from refractory dissolution by molten glass and resembling the marks of a cat's claws. Also referred to as "surface cord", "mare's tail", or "feeder streak".

centering—an operation on lens elements wherein the element is optically aligned with the axis of rotation and the edges ground concentric with the optical axis.

ceramic glass decorations—ceramic glass enamels applied to and fused to glass at the enamel melt temperatures to produce a decoration.

ceramic glass enamel (also ceramic enamel or glass enamel)—a functional and/or a decorative, usually colored, coating for bonding to glass at melt temperatures typically composed of glass frit, inorganic pigments and an organic medium.

chain marks—marks made on the bottoms of glass articles as they ride through a lehr on a chain belt.

channel—(*1*) in container glass, that part of a forehearth which carries the glass from the melter to the flow spout and in which temperature adjustments are made.
(*2*) in fiber glass, the structure to deliver glass from the melter to the refiner or forehearth.

charge, *n*—see **batch (3)**.

charge, *v*—to add batch to a glass melting furnace.

chatter sleek—{archaic} see **frictive track**.

check—an imperfection; a surface crack in a glass article.

checkers—(*1*) an open structure of firebrick serving as a heat exchanger.
(*2*) slang for regenerators of this type.
(*3*) slang for refractory brick used in such a construction.

chemical durability—the lasting quality (both physical and chemical) of a glass surface. It is frequently evaluated, after prolonged weathering or storing, in terms of chemical and physical changes in the glass surface, or in terms of changes in the contents of a vessel.

chemical vapor deposition (CVD)—a process in which a gaseous chemical mixture is brought in contact with the hot glass substrate and a pyrolytic reaction occurs at the surface of the substrate leading to the deposition of a coating which bonds to the glass.

chemically strengthen—conducting ion exchange of constituent alkali ions in a glass product by immersing it in a bath of molten salt containing larger alkali ions. Penetration of the larger ions into smaller host sites produces a layer of compression on the surface which strengthens the glass.

chemically strengthened glass—glass that has been strengthened by ion-exchange to produce a compressive stress layer at the treated surface.

chill mark—a wrinkled surface condition on glassware resulting from uneven cooling in the forming process.

chip—an imperfection due to breakage of a small fragment out of an otherwise regular surface.

chipped glass—a decorative glass article with chipped surface produced intentionally.

chipping—the process of removing thin extra glass prior to grinding.

choke—an imperfection consisting of an insufficient opening in the finish and neck of a container.

chopped fiber—fiber glass strand which has been chopped to specified lengths.

chunk glass—{archaic} optical glass obtained in breaking open a pot of transfer glass.

cleavage crack—damage produced by the translation of a hard, sharp object across a glass surface. This fracture system typically includes a plastically deformed groove on the damaged surface, together with median and lateral cracks emanating from this groove.

Colburn sheet process—{archaic} manufacture of sheet glass by bending the vertically drawn sheet over a roll which establishes the definition of draw.

cold top melter—an all electric melting furnace in which a thermally insulating layer of batch is maintained on top of the molten glass.

compact—to treat glass in a manner, such as by heat treatment, to approach maximum density.

contact stress—the tensile stress component imposed at a glass surface immediately surrounding the contact area between the glass surface and an object generating a locally applied force.

continuous filament—a single glass fiber of sufficiently small diameter to be flexible enough for textile uses and of great or indefinite length.

continuous furnace—synonymous with **glass melting furnace**.

cooling-down period—{archaic} (*1*) the time elapsing after a covered pot is opened before the glass is cool enough to work.
(*2*) period between fining stage and the removal of the glass from the furnace.

cooling rate—see **setting rate**.

cord—an attenuated glassy inclusion possessing optical and other properties differing from those of the surrounding glass.

corrugated glass—glass rolled to produce a corrugated contour.

crack-off—the process of severing a glass article by breaking, as by scratching and then heating.

crackled—glassware, the surface of which has been intentionally cracked by water immersion and partially healed by reheating before final shaping.

crescent crack—damage having the appearance of a crescent, produced in a glass surface by the frictive translation of a hard, blunt object across the glass surface. The crescent shape is concave toward the direction of translation on the damaged surface.

crizzle—an imperfection in the form of a multitude of fine surface fractures.

Crookes glass—a glass having low transmission for ultraviolet light, and containing cerium and other rare earths.

cross-fired furnace—see **side-fired furnace**.

crown—the top or roof of a glass melting furnace.

crown optical glass—see **optical crown glass**.

crown process—{archaic} a method of making flat glass by blowing a large bulb, opening it, and then spinning it flat.

crush—pitted condition with a dull appearance.

crystal glass—(*1*) colorless, highly transparent glass which is frequently used for art or tableware.
(*2*) colorless, highly transparent glass historically containing lead oxide.

cullet—a collection of broken glass that may be processed and sorted based on color and/or chemistry. It may be reintroduced as an essential ingredient in the raw batch in glass making to facilitate melting.

cullet cut—synonymous with **block reek**.

cut glass—glassware decorated by grinding figures or patterns on its surface by abrasive means, followed by polishing.

cut-off scar—a mark on the base of a glass bottle caused by the cutting of the gob in the Owens process.

cut size—glass ordered cut to its final intended size.

cutting—scoring glass with a diamond, steel wheel, or other hard alloy wheel and breaking it along the score. Other methods of cutting glass include water jet and laser.

cycle—the firing period in a regenerative furnace.

cylinder process—{archaic} manufacture of window glass wherein molten glass is blown and drawn into the form of a cylinder, which is subsequently split longitudinally, reheated in a flattening kiln, and flattened.

Danner process—a mechanical process for continuously drawing glass cane or tubing from a rotating mandrel.

day tank—a periodic melting unit, which supplies glass for small volume applications.

dead anneal—jargon for a state of negligible residual stress.

dead plate—*in automatic production of molded glass,* a stationary plate receiving a glass article awaiting transfer.

debiteuse—a slotted, floating clay block through which glass issues in the Fourcault process.

decolorizing—the process of producing a colorless appearance in glass.

deflection—displacement of the glass lite perpendicular to the plane of the glass surface.

deformation point—see **dilatometric softening point**.

delamination—(*1*) separation of a glass laminate into constituent layers.

(*2*) the formation of lamellae or flakes in drug products due to specific and localized corrosion of glass vials.

delivery—(*1*) the final act of any glass-forming unit on a particular article; consisting of motion to remove the article from the mold.
(*2*) the process or equipment used for directing charges or gobs of glass to a forming machine.

dense—a term used for optical glass having a high index of refraction.

density—the mass of a unit volume of a material at a specified temperature.

detergent resistance—the degree of resistance to the chemical action of detergents.

devitrification—crystallization of glass.

dice—the more or less cubical fracture typical of fully tempered glass.

dig—a deep scratch in the glass surface.

dilatometric softening point—the temperature at which the viscous sag of the glass specimen exactly counteracts the expansion as thermal expansion measurements proceed during heating.

direct-fired furnace—a melting furnace having neither recuperator nor regenerator.

dirt—a small particle of foreign material imbedded in or stuck to the surface of the glass.

dispersion—the variation of refractive index with wavelength of light. See related term **Abbé value**.

distortion—alteration of viewed images caused by variations in glass flatness or inhomogeneous portions within the glass.

distribution—the thicknesses of the walls of a glass article over its entire area.

document glass—{archaic} an ultraviolet absorbing glass used for protecting documents.

doghouse—a protrusion in or near the back wall through which batch is introduced into the melter.

dolomite—a double carbonate of lime and magnesium having the general formula $CaCO_3 \cdot MgCO_3$. See also **limestone**.

dope—slang for mold lubricant.

*double-cavity mold—*see **multiple cavity mold**.

*double-cavity process—*see **multiple cavity process**.

double glazing—insulating glazing that incorporates two lites separated by a gap.

*double-gob process—*see **double-cavity process**.

down draw—process of continuously drawing glass downward from an orifice.

down-tank—the direction in a glass melting furnace from the batch feeding end toward the exit.

dragade—{archaic} see **drag ladle**.

drag ladle—{archaic} to produce cullet by ladling glass from the melt into water.

*draw—*see **pull**.

draw bar—a refractory member submerged in molten glass that defines the position of the sheet in a drawing process.

draw gang—{archaic} people employed to cut and handle glass as it comes from the lehr.

drawn glass—glass made by a continuous drawing operation.

draw line—a mild linear striation parallel to the direction of travel of a glass ribbon.

dropping—{archaic} forming by heating in a mold without the use of pressure.

*drop throat—*see **submerged throat**.

dross—a mixture of metal oxide and metal on the surface of a float bath.

dry chop—dried fiber glass strand which has been chopped. See **chopped fiber** and **wet chop**.

dry gage (drigage), *v*—to form cullet by running a stream of molten glass into a water bath. (See synonymous term **frit, v**.)

dummy—a mechanical device, operated by the blower's feet, for wetting, raising, opening and closing the paste mold in mouth-blowing glassware.

*durability—*see **chemical durability**.

dwell mark—a fracture surface marking representing the site of a fracture discontinuity caused by a sudden shift in the stress distribution or by a fracture stopping for some length of time; also known as an arrest line.

edging—grinding the edge of flat glass to a desired shape or finish. See also **centering**.

electric boosting—an auxiliary method of adding heat to the glass in a gas- or oil-fired melter by passing electric current through the molten glass.

emissivity—the relative ability of a surface to reflect or emit heat by radiation.

end-fired furnace—a glass melting furnace with fuel supplied from the back wall.

*end-port furnace—*synonymous with **end-fired furnace**.

engraving—the process of carving figures, letters, etc., upon glass by abrasive means.

equilibrium contact angle—the angle observable immediately after a liquid droplet is increased in size.