GLOSSARY OF TERMS

Term	Definition
Age hardening	An ageing process which results in increased strength and hardness.
Ageing	Precipitation from solid solution resulting in a change in properties of an alloy, usually occurring slowly at room temperature (natural ageing) and more rapidly at elevated temperatures (artificial ageing).
Age Softening	Decrease in strength and hardness at room temperature in certain strain hardened alloys containing magnesium.
Alclad	An aluminium or aluminium-alloy coating that is metallurgically bonded to either one or both surfaces of an aluminium alloy product, and that is anodic to the alloy to which it is bonded, thus electrolytically protecting the core alloy against corrosion.
All-over marking	A method of identifying sheet, plate and strip by printing at close intervals over the surface the name or symbol of the manufacturer, the relevant specification number and, in some cases, the temper and thickness of the material.
Alloy	A substance having metallic properties and composed of two or more elements of which at least one is an elemental metal.
Alloying element	Metallic or non-metallic element which is controlled within specific upper and lower limits for the purpose of giving the aluminium alloy certain special properties.
Alumina	Aluminium oxide produced from bauxite by a chemical process. It is a white powdery material that looks like granulated sugar. Alumina is an intermediate step in the production of aluminium from bauxite, and is also a valuable chemical on its own.
Aluminium	A silver-white soft metal, noted for its lightness, high reflectivity, high thermal conductivity, non-toxicity, and corrosion resistance. It is the most abundant metallic element, comprising about 1/12th of the earth's crust. It is never found in nature as an elemental metal, but only in combination with oxygen and other elements. In ordinary commercial and industrial use, the word "aluminium" is often understood to mean aluminium alloy, rather than the pure metal.
Aluminium alloy	A metallic substance, consisting of an intentional admixture of elements, the predominant element being aluminium.

Term	Definition
Aluminium oxide	A chemical compound of aluminium with oxygen, which forms immediately on an unprotected aluminium surface exposed to air. Unlike iron oxide (the rust which forms on steel) aluminium oxide does not flake off, but forms a protective layer that blocks further oxidation and so protects the integrity of the metal. It is transparent and does not alter the appearance of the aluminium surface.
Angle	The relative orientation of two adjacent faces of a section generally measured over the full Length of both.
Angularity	Conformity to, or deviation from, specified angular dimensions in the cross section of a shape or bar.
Annealing, Anneal	Thermal treatment intended to soften a metal or alloy hardened by cold work or artificial ageing.
Annulus	A ring-like part; or, the orifice of a hollow die, through which extruded metal flows from the press.
Anodising	An electrochemical method of producing an integral oxide film on aluminium surfaces. The thickness and other film characteristics can be controlled to meet varied requirements for improved corrosion resistance, improved abrasion resistance, electrical insulation or as a pre-treatment for subsequently applied coatings.
Anodising quality material	Material with characteristics that make it suitable for decorative anodising after suitable preliminary treatment. As a general rule the purer the aluminium alloy the better it will anodise.
Aperture	In an extrusion die, the shaped opening through which the heat-softened metal is forced and which gives the extruded product its cross-sectional shape. Also called the "orifice."
Architectural anodizing	Anodizing to be used in permanent, interior, exterior and static situations where both attractive appearance and long life are essential.
Architectural finish	An architectural finish is a standard finish characterized by a uniformly good appearance. This finish is most often specified for "exposed" surfaces.
Artificial Ageing	See "Ageing."
Standards & Data	Aluminium Standards and Data published by The Aluminum Association: Aluminum Standards and Data | The Aluminum Association

Term	Definition
ASI	Aluminium Stewardship Initiative. The Aluminium Stewardship Initiative (ASI) is a global, multi-stakeholder, non-profit standards setting and certification organisation. It works toward responsible production, sourcing and stewardship of aluminium following an entire value chain approach. To this end, ASI launched its Performance Standard and Chain of Custody Standard in December 2017. The ASI works together with producers, users and stakeholders in the aluminium value chain to collaboratively foster responsible production, sourcing and stewardship of aluminium. ASI Home | Aluminium Stewardship Initiative (aluminium-stewardship.org)
As-quenched condition	The condition of an alloy during the time immediately following the quench and before the mechanical properties have been significantly raised by precipitation hardening.
Assembly fit	Refers to two parts designed for mating assembly and requiring exact dimensions and contours to assure a proper fit.
Back-end condition	A condition occurring in the last metal to be extruded. It is a result of the oxidised surface of the billet feeding into the extrusion.
Backer (back-up plate)	A "tool," or reinforcing part, which presses against the outer surface of an extrusion die, supporting it against the pressure of the extruding metal. The backer has an opening larger than the die aperture, allowing the extruded product to emerge without marring its soft surface.
Bar	A solid extrusion that is long in relation to cross section, which is square or rectangular (excluding plate or flattened wire) with sharp or rounded corners or edges; or is a regular hexagon or octagon; and in which at least one perpendicular distance between parallel faces is 9.5mm or greater. (Smaller sizes are classified as wire.)
Bar, Extruded	Bar brought to final dimensions by hot extruding.
Base metal	(1) The metal present in the largest proportion in an alloy. (2) the metal to be brazed, cut or welded. (3) after welding, the part of the metal that was not melted during the process.
Bauxite	Bauxite is the primary ore from which aluminium metal is extracted. It is an amorphous clayey reddish-brown rock consisting mainly of hydrous aluminium oxides and aluminium hydroxides along with silica, silt, iron hydroxides and clay minerals. Four-six tonnes of bauxite are required to produce two tonnes of alumina (or one tonne of aluminium).

Term	Definition
Bayer Process	A chemical process used to refine the aluminium ore bauxite into alumina (aluminium oxide) from which the aluminium metal may be extracted by smelting.
Bearing	The surface of the extruding aperture, at right angles to the die face, controls metal flow and, to some extent, speed of flow which is also the confirming surface along which the aluminium flows.
Bend Radius	The radius of curvature of the former around which a specimen is bent
Billet	The starting stock for the extrusion operation. Extrusion billet is a solid or hollow form, commonly cylindrical and is the length charged into the extrusion press cylinder. It is usually a cast product but may be a wrought product or powder compact.
Billet container	The part of an extrusion press into which the billet to be extruded is placed.
Binary alloy	An aluminium alloy containing a relatively large amount of only one other element.
Blank	A work-piece prepared for subsequent processing e.g. by forming, bending, cupping, drawing, impact extrusion, pressing etc.
Blister	A raised area on the surface of a rolled or extruded product due to subsurface gas expansion. This typically occurs during extrusion "or thermal treatment. Also a defect in a paint film usually caused by the expansion of air, solvent vapour, or moisture trapped beneath the film.
Bolster (die block)	A "tool," or reinforcing part, which supports the backer—which, in turn, supports an extruding die against the pressure of extrusion.

Term	Definition
Bow	Longitudinal curvature of rod, bar, profiles (shapes), and tube. Bow is measured after allowing the weight of the extrusion to minimize the deviation. Bow can be caused by a non-uniform extrusion rate across the cross section resulting in one portion of the extrusion being longer than the other or non-uniform contraction during quenching. Several types exist including: • Lateral—Deviation of a longitudinal edge from a straight line. Also called “Lateral Curvature.” • Longitudinal—Deviation from straightness in the plane of a flat product along the main axis, as measured by use of a baseplate on which the product is positioned so that its own weight minimizes the curvature. Also called “Longitudinal Arch” and “Longitudinal Curvature.” • Transverse—Curvature in the plane of a flat product perpendicular to the main axis. Also called “Transverse Arch.”
Brazing	Joining metals by fusion of nonferrous alloys that have melting points above 425°C but lower than those of the metals being joined. This may be accomplished by means of a torch (torch brazing), in a furnace (furnace brazing), or by dipping in a molten flux bath (dip or flux brazing).
Bridge	In extrusion: the part of an extrusion "bridge die" that supports a void-forming mandrel. During extrusion, the metal divides and flows around the bridge, reuniting as it is extruded through the die orifice. The resulting weld line can be detected upon microscopic examination, but the extrusion appears functionally and visually seamless.
Bright dipping	Chemical polishing of aluminium, often by treatment with a mixture of nitric acid and phosphoric acid, yielding a mirror-shiny (specular), highly reflective surface. It is almost always followed by anodising to protect the surface and provide some choice of colours.
Brinell hardness test	A test for determining the hardness of a material by forcing a hard steel ball of specified diameter into it under a specified load and measuring the resulting crater.
Broken Die	A deviation from the desired cross section due to the absence of a certain portion of the die used to extrude the profile (shape).
Buffing	A mechanical finishing operation in which fine abrasives are applied to a metal surface by rotating fabric wheels for the purpose of developing a lustrous finish.
Burr	A thin ridge of roughness is left by a cutting operation such as slitting, trimming, shearing, blanking or sawing etc.

Term	Definition
Butt end	The residual portion of an extrusion billet that is not forced through the die at the end of the extrusion cycle.
Butt weld	The welding of two sections that butt against each other, end to end.
CAD	Computer Assisted Design. The use of computer programs to generate, analyse and modify designs. Extrusion dies and their supporting tools, for example, may be designed with the aid of computers.
CAM	Computer Assisted Manufacturing. The use of computers to monitor, regulate and control manufacturing processes.
Cap	The outer part of a hollow die, which shapes the outside of a hollow extrusion.
Cast	To form a molten material into a desired shape by pouring it into a mould and letting it harden.
Casting alloy	An alloy formulated for casting.
Caustic	Sodium hydroxide, (NaOH and derivatives). The active ingredient in an alkaline bath, generally with a pH higher than 10, which removes aluminium from used extrusion dies by etching. The primary ingredient, Caustic soda (NaOH), dissolves the aluminium alloy by chemical reactions with no effect on the die steel.
Cell	In aluminium production: the electrolytic reduction cell, commonly called a "pot", in which alumina dissolved in molten cryolite is reduced to metallic aluminium. A series of cells connected electrically is called a "pot line".
Chalking	A white powdery deposit on the surface of the exposed paint film caused by weathering.
Chatter Mark	A surface defect consisting of alternating ridges and valleys at right angles to the direction of extrusion.
Chemical milling	Removing metal by controlled chemical etching.
Chemical polishing	Improving the surface lustre of metal by chemical treatment.
Circumscribing circle	The smallest circle that will completely enclose the cross section of an extruded shape.
Clad Material	Material that has a thin layer of aluminium or aluminium alloy metallurgically bonded to it usually by rolling, extruding or drawing. Most often it is used to provide a more corrosion resistant surface or to facilitate anodising.

Term	Definition
Clearance	(1) The gap between two mating parts (2) the space provided between the relief of a cutting tool and the surface being cut.
Coefficient of thermal expansion	The relative rate at which a substance expands on heating, compared to a standard rate.
Cold Sealing	Sealing of anodised surfaces at temperatures significantly below 100°C, but higher than room temperature.
Colour Anodising	1. Dyed – Metal with an anodic oxidation layer coloured by absorption of dye-stuff or pigments into the pore structure. 2. Electrolytically coloured – Metal with an anodic oxidation layer that has been coloured by the electrolytic deposition of a metal oxide into the pore structure. 3. Integral colour – Metal that has been anodised using an appropriate electrolyte which produces a coloured finish during the anodising process itself.
Composite joint	A joint that is both welded and joined mechanically.
Concavity	Inward curvature across the width of a flat product.
Concentricity	Conformance to a common centre as, for example, the inner and outer walls of round tube. The extent to which the inner and outer walls of round tube have a common centre of curvature. Strictly, this is the shift between the centres of the circles that are the Outside Diameter (OD) and Inside Diameter (ID/ Bore) of a round tube. Any such shift will cause a variation in wall thickness around the circumference of the tube, hence the tolerance on concentricity is determined by the wall thickness tolerance.
Conductivity	The ability of a substance to transmit heat or electricity. Aluminium has high electrical and thermal conductivity, making it useful in a wide range of electrical and heat-exchanging applications.
Container	In extrusion: The strong chamber in an extrusion press that holds the billet while it is extruded through a die at one end, under pressure from a ram entering at the other end.
Contour	That portion of the outline of a transverse cross-section of an extruded shape that is represented by a curved line or curved lines.
Conversion Coating	A chemical layer formed on the metal in the pretreatment process which aids in paint adhesion and corrosion resistance.
Convexity	Outward curvature across the width of a flat product.

Term	Definition
Corrosion	The deterioration of metal by chemical or electrochemical reactions with substances in its environment.
Creep	The strain in a metal that results from continuing stress.
Critical Quenching Rate	The minimum mean cooling rate from the solution treatment temperature necessary to retain the alloying constituents in solid solution and thus permit the alloy to meet specified mechanical property requirements in the precipitation hardened (aged) condition.
Crown	Difference in thickness between one of the edges and the centre of a rolled product.
Cryogenic	Pertaining to very low temperatures. Aluminium gains strength as temperature is reduced, making it an appropriate material for cryogenic applications.
Dead soft	Fully annealed; the softest form of a metal; the "0" temper of aluminium.
Deburring	Removing burrs, sharp edges, or fins from metal parts by filing, grinding, or tumbling.
Deep Drawing	The forming of deeply recessed parts (such as beverage cans and hollow-ware) by means of plastic deformation of the material. As deep drawing does not uniformly cold work the blank there will be variations in the hardness and annealing response around the final part.
Defect	A defect is anything that renders the aluminium unfit for the specific use for which it was ordered.
Deflection (toolage)	The distortion or bending of the die or components thereof. Insufficient support of die will cause it to deflect, lessening the effectiveness of the bearing, also termed dishing, caving and sagging.
Density	Weight per unit of volume (for example, kilograms per cubic metre). The density of aluminium is only about one-third that of steel, and this weight-saving characteristic is one of aluminium's best-known advantages.
Depth of fusion	The depth to which base metal melts during welding.

Term	Definition
Die	In extrusion: a tool with an opening through which heated aluminium is forced by pressure, taking on that cross-sectional shape. The hardened steel aperture through which a heated extrusion billet is pushed to form an extruded profile shape. There are 3 types of die: Flat Die – For extruding solid shapes Porthole Die – For extruding hollow shapes – This leaves one or two 'weld' seams along the length of the extrusion so tube produced in this way is called Welded Tube. Flat Die with Mandrel – For extruding seamless hollow shapes and seamless tube.
Die assembly	In an extrusion press, the die and its associated tooling.
Die drawing	A CAD drawing of the extrusion die showing exact detail of the shape of the profile.
Die face	The surface of an extrusion die facing the billet.
Die holder	A component of an extrusion press that holds the extrusion die and its components. It is located between the container and press platen.
Die lines	A longitudinal depression or protrusion formed on the surface of drawn or extruded material. Die lines are present to some degree in all extrusions and are caused by a roughening of the die bearing.
Die number	The number assigned to a die for identification and cataloguing purposes, and which usually is assigned for the same purpose to the product produced from that die.
Die ring	A cylindrical sleeve that holds the die and backer in axial relationship to each other.
Differential annealing	The localised heating of part of a blank so that only specific areas are annealed.
Diffusion (in clad material)	The migration of alloying elements from the core into the cladding layer during thermal treatment. This can be detrimental to the properties and behaviour of both the core and cladding.
Dimensional allowance	The specified difference in size between mating parts.
Dimensional stability	The ability or an object to retain its original shape under varying physical conditions.
Dip coating	Coating of parts by dipping them into a tank of continuously agitated paint and withdrawing them slowly to prevent tearing of the paint film or retention of drops on the edges.

Term	Definition
Direct extrusion	The extrusion process in which a preheated billet is placed in the container and is pushed by the ram through the stationary die to form the extruded section.
Directional properties	Deformation by cold working causes changes to the grain structure and, sometimes, variations in mechanical properties across and along a work-piece. Properties measured along the direction of deformation are described as longitudinal, whilst those measured at a right angle to the direction of working are called transverse.
Dove-tail	An interlocking connection frequently used for the assembly of interconnecting extrusions; it is assembled by a sliding action.
Drawing, cold drawing	The process of pulling material through a die to reduce the size, change the cross section or shape or harden the material.
Drawn tube	A hollow product of uniform wall thickness, produced by cold drawing.
Ductility	A property of elasticity that determines how easily a material can be shaped or manipulated. Aluminium has high ductility, allowing for significant bending and stretching without creating stress fractures during the production process.
Dummy block	A tight-fitting steel block placed between the ram and the billet in an extrusion press, to prevent metal from leaking backward along the ram during extrusion. See also “Fixed pad”.
Duplex ageing	A two stage age-hardening heat treatment conducted at different temperatures.
E.C. (or EC) alloy or grade	Electrical conductor aluminium, an alloy specifically formulated for good electrical conductivity; it is about 99.5 percent aluminium.
Eccentricity	Deviation from a common centre, as, for example, the inner and outer walls of a round tube. The difference between the mean wall thickness and minimum or maximum wall thickness at any one cross Section. The permissible degree of eccentricity can be expressed by a plus and minus wall-thickness tolerance.
Elastic deformation	A temporary dimensional change induced by stress. The body returns to its original dimensions when the stress is removed if its elastic limit has not been surpassed.
Elasticity	The ability of a material or body to return to its original shape and dimensions after being deformed by stress.

Term	Definition
Elastic limit	The maximum stress that a body can withstand without permanent deformation.
Electrical conductivity	The ability of a metal to conduct or allow an electrical current to pass through it. For aluminium, this capacity is expressed as a percentage of the International Annealed Copper Standard which has a conductivity of 58.108 megasiemens per metre (MS/m) at 20°C.
Electrochemical	Pertaining to chemical reactions induced by an electric current, such as electrolysis or electroplating.
Electrodeposition	Application of a coating by immersing the parts in a bath of water containing resin, electrolytic stabilizers and pigments; an electric current is passed through the bath, using the parts as anodes, plating them with resins and colour.
Electrolysis	The separation of a chemical compound into its components by passing an electric current through it.
Electrolyte	A dissolved or fused substance capable of conducting an electric current; examples include the molten solution electrolysed in an aluminium reduction cell, or the acid solution in a wet-cell battery.
Electroplating	Depositing a thin layer of a metal, usually copper, tin or silver, on the surface of another metal by electrifying the metal to be plated in an electrolyte containing the plating metal.
Electrostatic spraying	Application of a coating by applying a static electricity charge to the droplets of a spray and an opposite charge to the part being sprayed, which then attracts the droplets directly to its surface.
Elongation	The percentage increase in distance between two gauge marks that results from stressing the specimen in tension to fracture.
Embossing	A pattern mechanically impressed on a surface by rolling or pressure.
Embrittlement	Reduction in the normal ductility of a metal, due to physical or chemical change.
Emissivity	The relative ability of a material to radiate energy per unit of surface area, expressed as a ratio to the radiation rate of an ideal black body of identical area and temperature.
Etching	Shaping or texturing a metal surface by controlled corrosive action.
Extraction	The general process of separating a metal from its ore.
Extrude	To force material through a die by pressure. (See "Extrusion").

Term	Definition
Extruded shape	Any aluminium extrusion other than rod, bar or tube. Synonymous with extruded profile.
Extrusion	A product formed by pushing material through a die.
Extrusion billet	The starting stock for the extrusion operation. Extrusion billet is most commonly solid and cylindrical and the length is appropriate for the extrusion press container. Extrusion billet is cut from an extrusion log.
Extrusion butt	That portion of an extrusion billet that is left unextruded.
Extrusion die	Block of steel having one or more holes of the required contour through which a billet is forced.
Extrusion press	Machine consisting essentially of a container, a ram or other pressure-applying device, and a die, used for extrusion.
Extrusion ratio	The ratio of the cross-sectional area of the extrusion container to that of the extruded product.
Extrusion seam	Region in an extruded product where metal has been welded together in the extrusion die under high pressure and elevated temperature.
Fabricate	To work a material into a finished state by machining, forming, or joining.
Fatigue	The phenomenon leading to fracture of a metal under repeated stressing.
Fatigue strength	The maximum stress that a metal can sustain for a specified number of cycles without failure.
Faying surface	The surface of a piece of metal in contact with another to which it is, or will be, joined.
Feeder plate	A steel plate that is placed before the extrusion die in an extrusion press. The purpose of the feeder plate is to change the dimensions of an aluminium billet to produce a shape larger than the billet size.
Ferrous	Pertaining, derived from, or based on iron.
Filler metal	Metal added in making a brazed, soldered or welded joint.
Fillet	Generally, a concave junction where two surfaces meet.
Fillet weld	A weld, approximately triangular in cross section, joining two surfaces at right angles to each other.

Term	Definition
Finish	In extrusion, the condition, quality or appearance of the final aluminium surface. Aluminium can be finished in a very wide variety of textures and colours.
Fit	The range of clearance or interference between mating parts ranging from loose sliding fit to tight force fit.
Flexibility	The capability of a material to be curved, folded or bent.
Fixed mandrel	A device for producing hollow extrusions of regular cross section. The tapered mandrel is attached to the main extrusion ram and passes through the hollow billet. As the ram moves forward the mandrel passes, with the billet, through the die giving a product slightly tapering in wall thickness along its length. The mandrel is tapered to facilitate its removal when extrusion is complete.
Fixed pad	A tight-fitting steel block placed between the ram and the billet in an extrusion press, to prevent metal from leaking backward along the ram during extrusion. See also “Dummy block”.
Flatness	The property of having a horizontal surface without any slope, tilt, or curvature, i.e. that of a flat plane. In practice a perfectly flat surface is probably unobtainable so there will be a flatness tolerance.
Flatness tolerance	A three-dimensional geometric tolerance that controls how much a product surface can deviate from a flat plane. The permitted deviation will depend upon the thickness of the sheet or plate varying between 0.2% and 0.5% of its width and length, usually measured over a 1 metre length.
Floating mandrel	A tapered mandrel that is inserted into the hollow extrusion billet. It is not attached to the extrusion ram so is left free to centre itself in a hollow billet as it moves forward through the die as the ram advances and extrusion proceeds. The resulting product tapers slightly in wall thickness along the length.
Flow coating	Painting a part by directing streams of paint against it and letting excess paint drain into a tank for recirculation. Complicated shapes can be painted this way, but they must be correctly positioned for paint drainage.
Fluorocarbon	A stable carbon compound in which hydrogen has been replaced by fluorine coatings containing the fluorocarbon PVF2, among the most stable known, are applied by roll coating or spray.

Term	Definition
Fluxing	The removal of impurities from molten metal in a reduction pot or scrap remelting furnace by bubbling a mixture of gasses up through the melt. The combined chemical and mechanical action carries oxides and other impurities to the top of the melt, forming a scum or "dross" that is skimmed off.
Foil, tin foil, kitchen foil, cooking foil, Alfoil	Cold rolled aluminium flat product less than 250 microns in thickness. Usage includes kitchen foil (cooking foil) and foil trays for food. Kitchen Foil is often incorrectly referred to as Tin Foil.
Forging	Hot working using a forge with shaped tools that 'hammers' the work-piece into a predetermined shape.
Formability	The relative ease with which a metal can be shaped through plastic deformation.
Forming	Changing the shape of metal, except by shearing or blanking, without intentionally altering its thickness.
Fracture Test, Impact Test, Charpy Test, Izod Test	A test in which the test piece is notched and broken. The fracture surface examined to assess grain structure and freedom from defects. Also used to determine toughness, often at varying temperatures to establish at what reduced temperature the material becomes brittle.
Free machining alloy	An alloy designed to give, when machined, small broken chips, lower power consumption, better surface finish and/or longer tool life. Chemical composition and microstructure both influence this property.
Full heat treatment	For alloys in the 2xxx, 6xxx, 7xxx and 8xxx series this is the heat treatment cycle consisting of solution treatment followed by artificial age hardening.
Furnace solution heat treatment	heating an alloy to a suitable temperature in a furnace and holding for a sufficient time to allow one or more soluble constituents to enter into solid solution, where they are retained in a supersaturated state after quenching.
Galvanic corrosion	Corrosion associated with the current of galvanic cell consisting of two dissimilar conductors in an electrolyte or two similar conductors in dissimilar electrolytes. Aluminium will corrode if it is anodic to the dissimilar metal.
Gasket	A relatively soft sealer, often of cork, asbestos or rubber, placed in a joint between two metal parts to prevent leakage through the joint.

Term	Definition
Gauge length	In a tensile test this is the prescribed part of the cylindrical or prismatic portion of the test piece on which elongation is measured at any moment during the test. In particular, a distinction should be made between the following: ~ The original gauge length, i.e. the gauge length before the test is started. ~ The final gauge length – The gauge length after the test is completed and the test piece has fractured. The broken pieces are carefully fitted together to lie in a straight line so that it can be measured.
Grinding	Removing material from a workpiece with an abrasive wheel.
Hall Heroult Process, Smelting	The main process used for the production of Aluminium metal whereby Alumina is dissolved in a salt bath of molten cryolite and subject to an electrolysis process. Often referred to as Smelting, this process uses very large amounts of electricity. Named after two scientists who developed the process independently of each other at around the same time.
Hard coat anodizing	A combined electrical and chemical finishing process for aluminium that produces a hard, coloured, protective film on the surface.
Hardening	Increasing the hardness of metal by suitable treatment, usually involving heating and cooling.
Heat-affected zone	That portion of the base metal in welding, brazing or flame cutting whose microstructure and physical properties have been altered by the heat.
Heat-treatable alloy	An alloy which may be strengthened by a suitable thermal treatment. Alloys include the 2xxx, 6xxx and 7xxx series.
Heat treating	The thermal processing of a work-piece specifically to alter its mechanical properties. It includes: - 1. Annealing to soften and improve ductility. 2. Solution treatment and precipitation hardening to increase strength. It does not include heating before hot rolling, forging or extrusion etc.
Hinge joint	A joint which, when assembled, allows its parts to rotate relative to each other without separating; hinge joints are extruded as relatively "loose" slip-fit joints with an open-sided ball-in-socket design.
Hollow billet	A billet prepared for extruding tube or pipe. The outside diameter is scalped and the inside diameter is bored, to assure sound metal.
Hollow shape	An extruded shape any part of whose cross section completely encloses a void.

Term	Definition
Homogenisation	The structure of as cast semi-finished products e.g. slab, extrusion billet or forging blanks is invariably chemically segregated - that is the alloying elements are concentrated locally rather than uniformly distributed within the microstructure. Homogenising is a way of mitigating this as the work-piece is held at a suitably high temperature for sufficient time to eliminate, or at least decrease, chemical segregation by diffusion of the alloying elements.
Hot forming	Working operations, such as bending, drawing or forging, performed above the softening temperature of the metal.
Hot tears	Transverse surface scars or separations along the length of the extruded profile caused by excess speed and/or temperature.
Hot working	Plastic deformation of metal at such temperature and rate that strain hardening does not occur.
Hydraulic press	A press in which the ram is activated by fluid pressure.
Impact strength	The ability of a material to withstand shock loading.
Ingot	A cast product that may be various shapes including slab, billet, bloom or more complex shapes. Produced by pouring liquid aluminium into a shaped mould and allowing it to cool.
Insulator	A material that resists the flow of heat, sound, electricity or another form of energy.
Interference fit	The class of fit in which a mating part is deliberately made slightly oversize for the part into which it will be inserted.
Interlocking joint	A joint in which a curved projection on one part is inserted by a rotating motion into a similarly curved receiving groove on the other part. The parts cannot then be separated by straight-line motion.
Internal Scrap	This is scrap which is pre consumer and is remelted in the same company where it was generated. (Also known as fabricator scrap.)
Joint efficiency	The strength of a welded joint, expressed as a percentage of the strength of the unwelded base metal.
Kerf	The notch or slit made by a saw or torch when cutting.
Key-locked joint	A joint with two or more primary elements which are locked together only when an additional specialized part, the "key", is inserted to prevent them from separating.

Term	Definition
Kink	An abrupt deviation from straightness. A kink can be caused by handling.
Lamination	An internal crack or separation aligned parallel to the direction of major metal flow. It can be caused by contaminants that feed into the metal flow before it reaches the die opening or cracked billets. See also "Back End Condition."
Lap joint	A joint formed with one member overlapping the other: the simplest type of nesting joint.
Lapping	A method of finishing metal to produce a very smooth, highly accurate surface.
Log	The starting stock for extrusion billet. Extrusion log is usually produced in lengths from which shorter extrusion billets are cut.
Lüders Line	Strain marks in sheet which appear between 45° and 55° to the straining direction.
Machinability	The relative ease of working a metal with machine tools. Aluminium has good machinability.
Machining	Removing material from a workpiece with a machine tool.
Main cylinder	The chamber of an extrusion press into which hydraulic fluid is pumped to generate the desired ram pressure and movement.
Mandrel	The part of a hollow die which shapes the interior void of a hollow extruded product.
Mean diameter	The average of two measurements of the diameter at right angles to each other.
Mean wall thickness	The average of two wall thickness measurements taken on opposite sides of the void of a tube or hollow extruded product.
Mechanical working	Subjecting metal to pressure exerted by rolls, dies, presses or hammers to change its form or to affect its structure and its mechanical and physical properties.
Metal dimension	Any dimension, through a part of an extruded cross-sectional shape, whose length includes at least 75 percent metal, versus open space.

Term	Definition
Mill finish	1. Extrusion The finish obtained by standard extrusion practices and produced without the aid of any subsequent operations. This finish generally varies from a structural finish with surface imperfections to an architectural finish with uniformly good appearance. 2. Sheet The finish defined by the actual roll grinding and rolling conditions, without further specification from a customer or a standard. The finish of mill finish sheet can vary from sheet to sheet or within one sheet.
Milling	Removing metal with a machine tool something like a rotary chisel.
Modulus of elasticity	The ratio of stress to corresponding strain throughout the range where they are proportional. As there are three kinds of stresses, so there are three kinds of moduli of elasticity for any material—modulus in tension, in compression, and in shear.
Multi-hole Die	An extrusion die, with more than one hole, allowing multiple extrusions to be made simultaneously from one billet.
Natural oxide film	The oxide film that forms naturally on the aluminium surface and is relatively impervious to atmospheric attack.
Nesting joints	A general class of joints with mating elements that serve to align adjoining parts with little or no self-locking action.
Nonferrous	A term for metals other than iron and its alloys.
Non-heat-treatable alloys	An alloy which can be strengthened only by cold work.
Opaque	Impervious to the transmission of light. Aluminium is opaque; even a thin aluminium foil completely blocks the transmission of light.
Open space dimension	A dimension, across a part of an extruded cross-sectional shape which only partially encloses a space, whose length includes more than 25 percent space, versus metal.
Orifice	The opening in an extrusion die through which the material is extruded.
Ovality	Deviation from a circular periphery, usually expressed as the total difference found at any one cross section between the individual maximum and minimum diameters, which usually occur at or about 90 degrees to each other. Since ovality is the difference between extreme diameters, it is not expressed as plus or minus.
Overbending	Bending metal through a greater angle than that required in the finished part, to compensate for the tendency of the metal to spring part way back to its original shape.

Term	Definition
Oxide	A chemical compound of oxygen with another element. Hydrated (water-including) iron oxide is called rust; it does not cling tightly to the underlying metal, so the oxidation process is progressive and iron easily rusts away. Aluminium oxide is a hard, transparent compound which clings tightly to the underlying metal and protects it against further oxidation.
Parting Line	A condition unique to stepped extrusions where more than one cross section exists in the same extruded shape. A stepped shape uses a split die for the minor or small cross section and after its removal, another die behind it for the major configuration. Slightly raised fins can appear on that portion of the shape where the two dies meet.
Permeability	The passage or diffusion of a gas, vapor, liquid or solid through a barrier without physically altering it; the rate at which this diffusion or passage occurs. Aluminium is essentially impermeable, an important factor in its widespread use in containers and packaging.
Pigment	An insoluble colouring agent suspended in a fluid medium, as in inks, lacquers, and paints.
Pipe	Tube in standardised combinations of outside diameter and wall thickness, commonly designated by "Nominal Pipe Sizes" and "ANSI Schedule Numbers."
Plastic deformation	Distortion that remains after removal of the load that caused it.
Plasticity	The ability of a material to be deformed extensively without rupture.
Plastisol	A coating incorporating polyvinyl chloride (PVC), used mainly on such products as industrial building sheets and residential siding, and sometimes formulated for spraying. Plastisols require application of a special primer to achieve proper bonding to aluminium.
Plate	A hot rolled flat product of rectangular section, typically over 6mm thick. Control of surface finish is less rigorous than for sheet.
Polishing	Smoothing a metal- surface, usually by rubbing with fine abrasives.
Polymer	A chain-like compound of high molecular weight formed by the linkage of simple molecules (monomers) under suitable conditions. When two or more different monomers are involved, the product is called a copolymer.
Porosity	Fine pores or hollows within a body of metal.

Term	Definition
Porthole die	A die for the extrusion of hollow shapes, with one or more mandrels supported by legs attached to the die structure around which the metal must flow during extrusion.
Post-consumer scrap	This is material that has been used by the consumer and subsequently discarded. For example, used beverage cans, window frames, electrical cabling and car cylinder heads are all considered post-consumer scrap. Remelting of scrap (of any form) requires careful practice, process knowledge, technological and organisational safety barriers. Post consumer scrap typically needs special handling (including metal cleanliness) and/or sorting to ensure it can be safely and effectively remelted.
Pot	The common name for a single electrolytic aluminium reduction cell. (See "Cell".)
Powder coating	Application of a coating in the form of a finely ground powder of colouring agents, resins and additives; heating of the part, either before or after powder deposition, fuses the powder into a continuous coating.
Pre-consumer scrap	This is surplus material that arises during the manufacture and fabrication of aluminium products. This aluminium has not been used by the final consumer (end user). For example, offcuts of aluminium sheet or extrusions are considered pre-consumer scrap (Sometimes pre consumer scrap is known as new scrap.). Internal run-around scrap is not considered pre-consumer scrap.
Press, extrusion	The hydraulic machine which applies pressure to an aluminium billet inside a container, extruding it through the opening of a die.
Pressure test	A hydraulic or pneumatic test for tubes to prove that the material can withstand a specified pressure for a specified time without leakage or rupture.
Profile	The cross-sectional shape of an extrusion. *Note: The reader should be aware that the Aluminium Association, AEC, and ISO have adopted a different definition for this term which is equivalent to the definition of the term "shape" in this glossary. In this manual the term "profile" and "shape" are intended to be interchangeable.
Quenching	Controlled rapid cooling of a metal from an elevated temperature by contact with a liquid, a gas, or a solid.

Term	Definition
Radiation	Emission of energy as particles or waves. Aluminium in its ordinary form does not emit "nuclear" radiation. It is an excellent reflector—and a correspondingly poor emitter—of electromagnetic radiation, which includes light, radio and infrared (radiant heat) waves. This property makes aluminium useful as a reflector and as a radiant energy barrier. (See "Reflectivity".)
Ram	The part of an extrusion press that enters the container and applies pressure to the billet, through the dummy block.
Recyclable	Suitable for recovery after use and for reconversion into a useful form. Aluminium has excellent recovery value and is widely recycled, providing economic and environmental advantages. When recycling aluminium, the other alloys which have been used to produce the final form are often considered and sorted from each other, to optimise their reuse also. Remelting of scrap (of any form) requires careful practice, process knowledge, technological and organisational safety
Recycled aluminium	Aluminium ingot obtained from scrap is now referred to as recycled aluminium (formerly secondary aluminium). Recycled aluminium refers to the production of aluminium from traded post-consumer and pre-consumer scrap (also previously known as new and old scrap). Internal scrap (also known as fabricator scrap) is excluded.
Reduction	In metallurgy: the electrochemical process by which purified alumina (aluminium oxide) is broken down into its constituents, freeing metallic aluminium.
Reflectivity	The ability of a surface to reflect light and other electromagnetic radiation. Aluminium has high reflectivity: 80% or more for visible light, and 90% or more for infrared radiation.
Resilience	The ability of a material to regain its original shape after distortion. Aluminium is a resilient material.
Rivet	(1) To connect two or more pieces of material by inserting in a hole through them a metal pin with a head on one end of it, and then forming a second head on the other end (2) the connecting pin itself.
Rod	A solid product, long in relation to its cross section, which is rounded and 10mm or greater in diameter. (Smaller sizes are classified as wire.)
Run-out table	A series of roller conveyor elements following an extrusion press or hot mill, on which the hot product travels to allow it to cool. It may also incorporate carbon blocks to help protect the hot product.

Term	Definition
Scalping	Mechanical removal of the surface layer from a fabricating ingot or semi-finished wrought product so that surface imperfections will not be worked into the finished product.
Sealing	Hydrothermal processes carried out after anodising to close the pores of the anodic layer.
Seam	The junction line of metal that has passed through a hollow die, separated and rejoined at the exit point. Seams are present in all extruded hollows produced from the direct extrusion process and in many cases are not visible.
Seamless	A hollow product which does not contain any line junctures resulting from method of manufacture.
Secondary aluminium	See 'Recycled aluminium'.
Section	(1) A drawing showing an imaginary view through an item as though-it had been cut by a plane. (2) To cut through a piece of metal to 'expose an internal area for metallurgical examination.
Self-tapping screw	A hardened screw with a sharp point, so designed that its threads cut their own mating threads when inserted and rotated in an appropriately sized hole.
Semi-hollow shape	An extruded shape, any part of whose cross section partially encloses a void, the area of which is substantially greater than the square of the width of the gap.
Shape	A wrought product that is long in relation to its cross-sectional dimensions which is of a form other than that of sheet, plate, rod, bar, tube, wire, or foil.
Shear strength	The amount of stress or shear that material can bear or withstand without fracturing.
Sheet	Usually defined as cold rolled flat product in the thickness range 0.25mm up to 6.00mm.
Shot blasting	Projection of abrasive grit, e.g. sand, small particles of steel, glass, plastic beads or other materials, or a mixture of abrasive grit, water and air on a product in order to in order to obtain a roughened surface topography.

Term	Definition
Shrinkage	The reduction of the extrusion due to such factors as cooling and speed of extrusion.
Single-Hole Die	An extrusion die with one hole, therefore capable of producing just one extrusion per cycle.
Slip-fit joint	A joint assembled by sliding two mating parts together in the direction of their length.
Smelt	To fuse or melt ore, to extract or refine the metal it contains.
S-N diagram	In fatigue testing, a graph showing the relationship between stress and the number of cycles before failure.
Snap-fit joint	A self-locking joint whose mating parts exert a cam action, flexing until one part slips past a raised lip on the other part, preventing their separation.
Soaking	In metallurgy: the prolonged heating period during several methods of heat treating metals; soaking allows the heat to penetrate completely the mass of metal, and so permits the required metallurgical changes to take place.
Soldering	Joining metals by flowing a molten filler metal between the connecting surfaces at a melting range below an arbitrary temperature, usually about 425 degrees C (At higher temperatures, the process is called brazing.) The filler metal, called solder, may have any of a variety of compositions formulated for the different metals to be joined; the so-called "soft" or low-melting, solders are primarily of tin and lead.
Solid Shape	Any extruded shape other than a hollow or semi-hollow.
Solution heat treating	Heating an alloy at a suitable temperature for sufficient time to allow soluble constituents to enter into solid solution where they are retained in a supersaturated state after quenching.
Specific gravity	The ratio of the weight of a body to the weight of an equal volume of water under standard conditions.
Speed tear	A series of surface cracks perpendicular to the extruding direction. Speed tearing normally occurs in corner radii or extremities of a section and is caused by localized high temperature.
Spider die	An extrusion die for producing hollow shapes, whose mandrel is supported by multiple legs attached to the cap. Metal flows between the "spider's" legs and reunites before emerging through the die aperture.

Term	Definition
Standard tolerance	An established dimensional tolerance for a certain class of product. Aluminium extrusions are produced to standard dimensional tolerances, unless otherwise specified.
Straightening	Correcting operation of a drawn or extruded product, to fulfil the requirements concerning tolerances on form and dimension.
Straightness	The absence of divergence from a right (straight) line in the direction of measurement.
Strain	A measure of the change in size or shape of a body under stress, referred to its original size or shape. Tensile or compressive strain is the change, due to force, per unit of length in an original linear dimension in the direction of the force. It is usually measured as the fractional change of the object's length.
Strain hardening	Modification of a metal structure by cold working resulting in an increase in strength and hardness with loss of ductility.
Strength/weight ratio	The relationship between the structural strength of a material and its weight. The strength-to-weight ratio of structural aluminium alloys is about twice that of mild steel.
Stress	Force per unit of area. Stress is normally calculated on the basis of the original cross-sectional dimensions. The three kinds of stresses are tensile, compressive, and shear.
Stress relieving	The reduction of the effects of internal residual stresses by thermal or mechanical means.
Stretching	In extrusion: straightening an aluminium member by pulling. An average stretch increases the length by about one-half of one percent, and produces correspondingly a slight decrease in the cross-sectional dimensions, called "stretch-down".
Structural finish	A structural finish is a standard finish where surface imperfections are acceptable and appearance is not a requirement. This finish could be characterized by the term "non-exposed."
Structural shape	A profile in certain standard alloys, tempers, sizes, and sections, such as angles, channels, H-sections, I-beams, tees, and zees commonly used for structural purposes.
Surface bloom	A general term for any surface discolouration caused by thermal treatment or from exposure to moist atmospheres.

Term	Definition
Tearing	Cracks or separation due to high extrusion speed or extrusion temperature.
Temper	The condition produced by either mechanical or thermal treatment, or both, and characterized by a certain structure and mechanical properties.
Tensile strength	In tensile testing, the ratio of maximum load to original cross-sectional area. Also called "Ultimate Strength."
Thermal conductivity	The ability of a material to transmit heat through its bulk and, by direct contact, to other substances. Aluminium is a good heat conductor and is widely used in cookware and in radiators and other heat exchangers.
Tolerance	Allowable deviation from a nominal or specified dimension.
Tongue (of an extrusion die)	An area of a die surrounded on three sides by the extrusion aperture.
Tongue and groove joint	A joint in which one part has a groove which receives a projection (tongue) on the other part, shaped to fit snugly.
Tools or tooling	A term usually referring to the dies, mandrels, etc., used in the production of extruded or drawn shapes or tube.
Tool Rub	A surface area showing a scratch or abrasion resulting from contact of the hot extrusion with the press equipment or tooling or, in the case of multi-hole dies, with other sections as they exit the press.
Toxicity	The degree of poisonousness of a substance. Aluminium is non-toxic and is widely used in cookware and food preparation and packaging.
Transverse extrusion seam	Extrusion seam which is formed when two subsequent billets are welded together in the extrusion die.
Tube	A hollow wrought product that is long in relation to its cross section, which is symmetrical and is round, a regular hexagon or octagon, elliptical, or square or rectangular with sharp or rounded corners, and that has uniform wall thickness except as affected by corner radii.
Tumbling	Treatment of products in a rotating container in the presence of abrasives and water for deburring or to produce a variety of surface textures.
Twist	The extent to which a product is twisted around its longitudinal axis.

Term	Definition
Ultimate strength	See "Tensile Strength."
Ultrasonic test	A non-destructive test method using ultra high frequency sound waves to locate and assess the size of internal material defects.
Ultraviolet	Electromagnetic radiation at wavelengths shorter than violet light and just beyond the visible light spectrum. Sunlight includes ultraviolet radiation, which causes tanning or sunburn in human skin and which may cause chemical or structural changes in some commercial materials. Aluminium reflects ultra-violet radiation and is not damaged by it.
Unalloyed	Aluminium without alloying elements where the minimum aluminium content is specified to be greater than 99.00%. Unalloyed aluminium is often called “Aluminium”, i.e. the term “Aluminium” then does not include aluminium alloys. See “Aluminium Alloy.”
Vapour barrier	A material which prevents or impedes the passage of water vapor through the walls of a structure or container. Aluminium is an excellent vapour barrier.
Void	An empty space. In extrusion, the number, sizes, positions and forms of voids within a hollow shape influence the difficulty of production and the dimensional tolerances which can be assured.
Water staining	A residue left on aluminium that has been wet and allowed to dry naturally. This is very difficult to remove and cannot be improved by polishing or anodising.
Web	A connecting element between ribs, flanges, or bosses on profiles.
Weld	To join two pieces of metal by applying heat or pressure, causing them to melt in the welded area, mingle and resolidify, forming a single piece.
Wire	A solid wrought product that is long in relation to its cross section, which is square or rectangular with sharp or rounded corners or edges, or is round, a regular hexagon or a regular octagon, and whose diameter or greatest perpendicular distance between parallel faces (except for flattened wire) is less than 9.5 mm.
Workability	The relative ease with which various alloys may be mechanically shaped.
Work hardening	Modification of a metal structure by cold working resulting in an increase in strength and hardness with loss of ductility.

Term	Definition
Wrought product	A product that has been subjected to mechanical working by extruding, rolling, forging or other processes.
Yield strength	The stress at which a material exhibits a specified permanent set. The offset used for aluminium and its alloys is 0.2 percent of gauge length. For aluminium alloys the yield strengths in tension and compression are approximately equal.