

BS 499-1:2009



BSI Standards Publication

Welding terms and symbols

Part 1: Glossary for welding, brazing and thermal cutting

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Summary of pages

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Foreword

Publishing information

This part of BS 499 is published by BSI and came into effect on 31 December 2008. It was prepared by Technical Committee WEE/1, *Definition and symbols for welding*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This part of BS 499 supersedes BS 499-1:1991, which is withdrawn.

Relationship with other publications

This standard has been aligned, as far as is practicable, with existing European and international lists of terms and definitions for welding, including BS EN 1792:2003, PD CEN/TR 14599, BS ISO 857 (all parts) and BS EN 13622. There might not be full agreement with standards that have not been adopted as British Standards. Where it was felt that an existing definition needed clarification, this has been done while striving to not contradict the existing definition. As far as practicable, the numbering system used in this standard follows that of BS EN 1792:2003 with new numbers allocated to terms that are not in the European standard.

Where definitions are based on those in a European or international standard, the identifier of the original standard is given in square brackets after the definition.

BS 499 is published in two parts, with a supplement to this part:

- Part 1: Glossary for welding, brazing and thermal cutting
- Part 1, Supplement: Definitions for electric welding equipment
- Part 2c: European arc welding symbols in chart form

NOTE 1 BS 499-1, Supplement is a reproduction of IEV 50 (851):1991.

NOTE 2 BS 499-2c is based on BS EN 22553.

Information about this document

This is a full revision of the standard, and introduces the following principal changes:

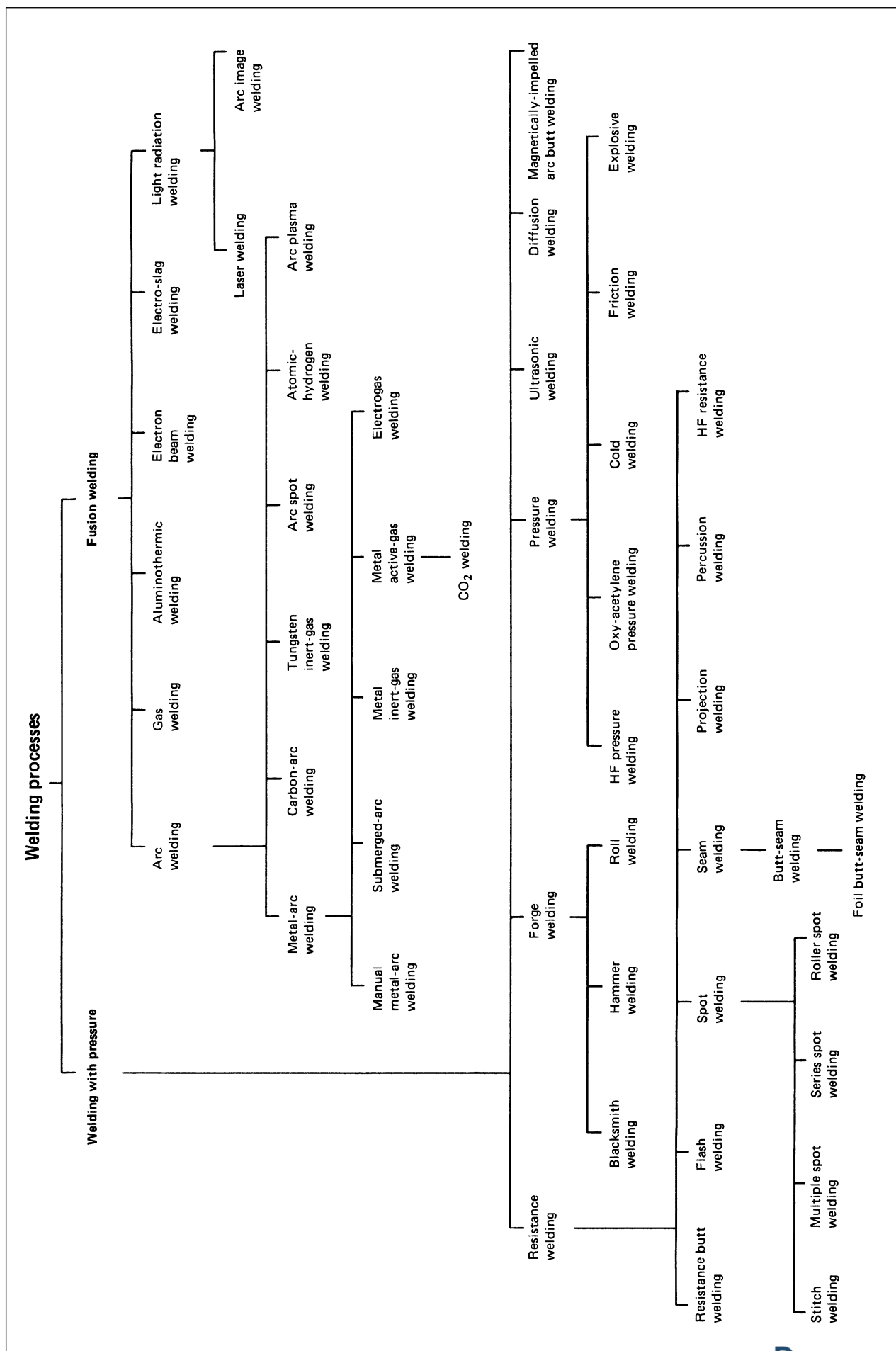
Charts showing the derivation of welding, cutting and allied processes are given in Figure 1, Figure 2 and Figure 3.

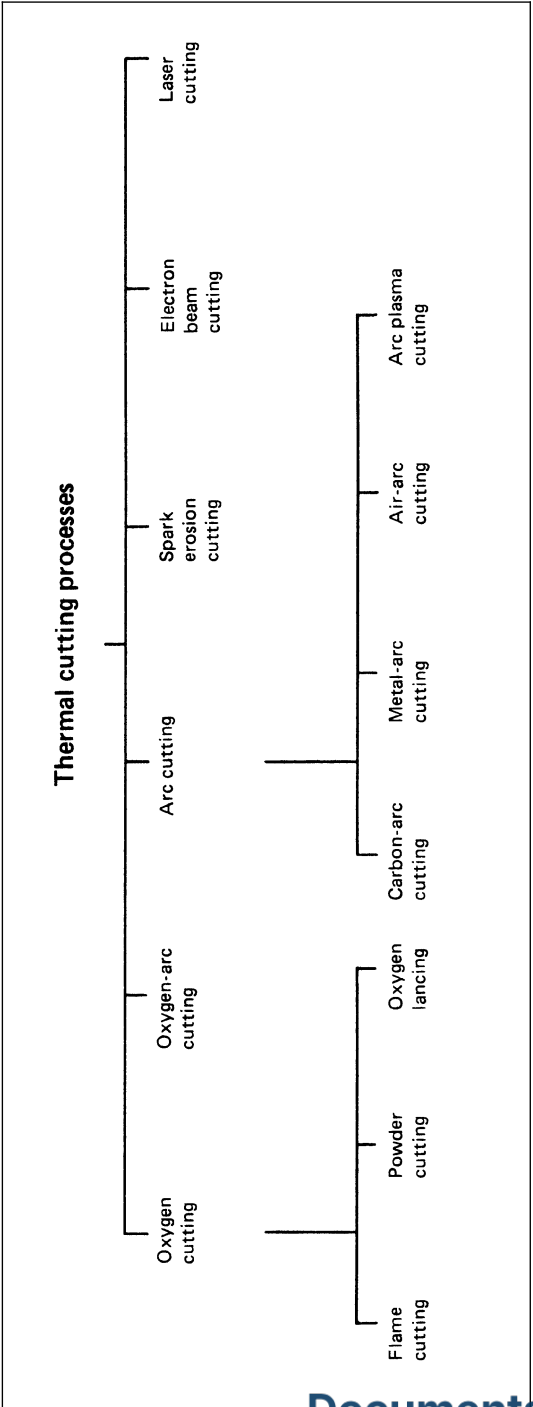
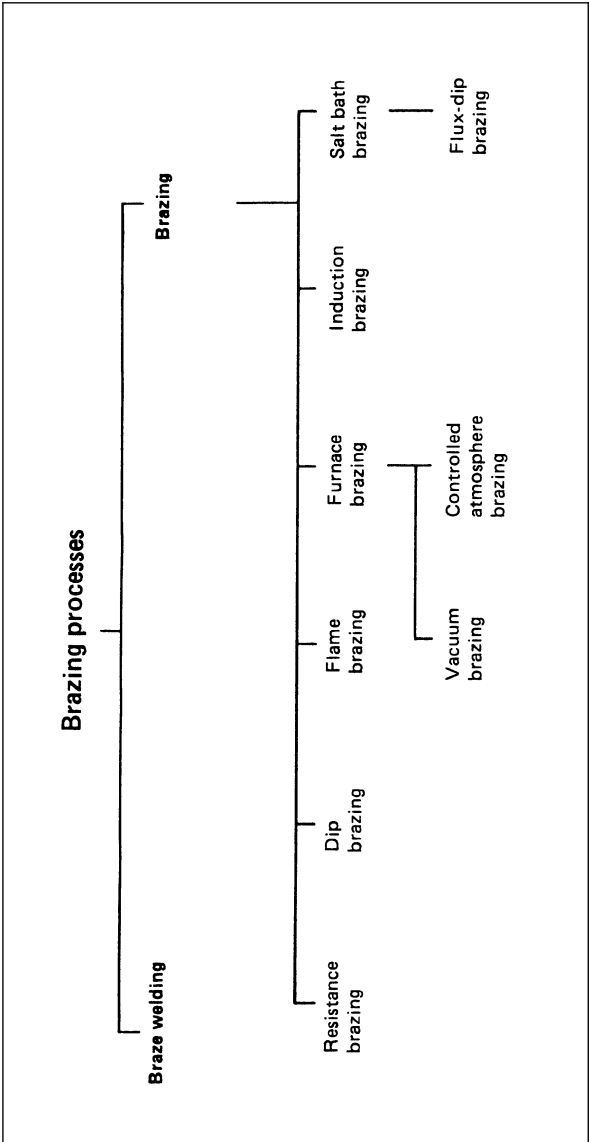
Commonly used friction stir welding terms are included in the new Section 27.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.





1 Scope

This standard provides terms, symbols and definitions for welding, brazing and thermal cutting of metals. Some definitions might also apply to non-metals.

It does not cover mechanically fastened or adhesive bonded joints.

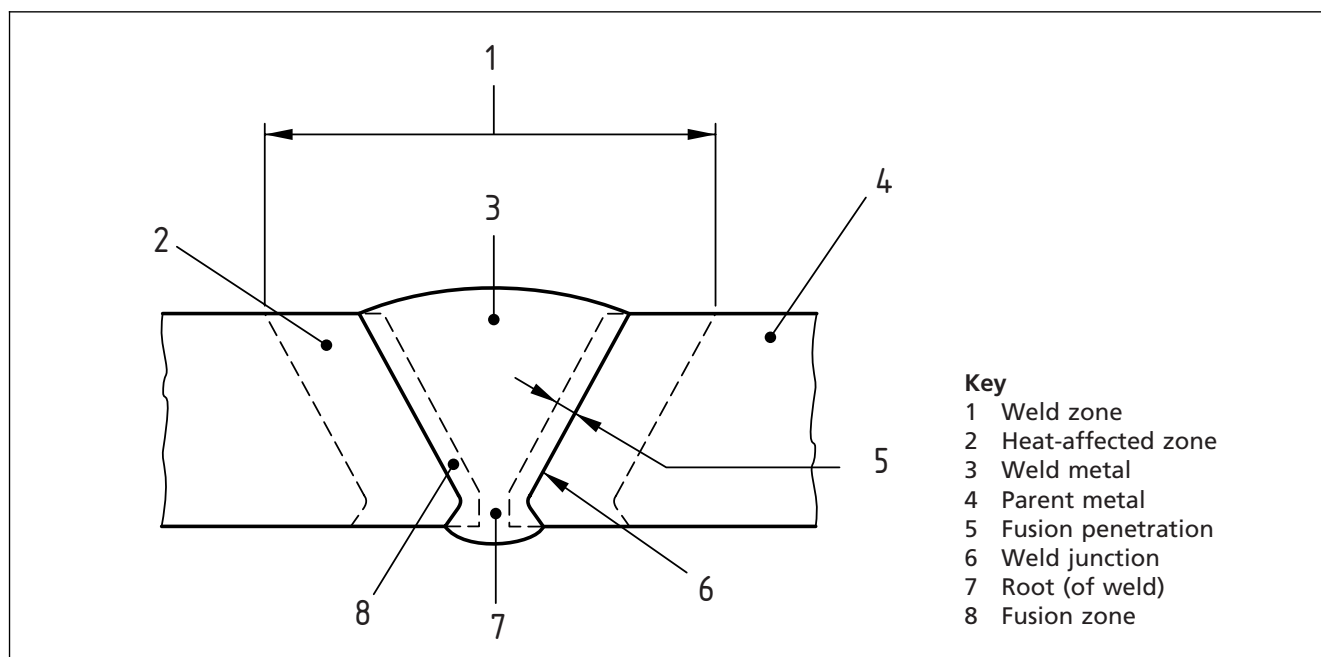
This standard is intended for designers, those drafting welding specifications, welding production, manufacturers and inspection personnel.

Preferred and equivalent terms are given in bold type. Non-preferred terms are given in medium type. Deprecated terms are indicated as such.

Section 1. Terms common to more than one section

No.	Term	Definition
10 001	welding	joining process in which two or more parts are united producing a continuity in the nature of the workpiece material(s) by means of heat or pressure or both, and with or without the use of filler material
10 002	weld	union of pieces of material resulting from welding
10 003	welder	operator who performs or controls the welding process
10 004	welding operator	person who controls fully mechanized or automatic fusion welding processes
10 005	welding plant welder: <i>deprecated</i>	apparatus for providing and controlling energy, and movement if necessary, for making a weld
10 006	welding process	particular method of welding involving the application of certain metallurgical, electrical, physical or mechanical principles
10 007	manual welding	welding where the electrode holder, welding hand gun, torch or blowpipe is manipulated by hand
10 008	partly mechanized welding	manual welding where the wire feed is mechanized
10 010	mechanized welding	welding in which the welding parameters are maintained within a suitable tolerance by mechanical or electronic means and which may be manually varied during the welding process to create the required welding conditions
10 011	automatic welding	welding in which all operations are preset and performed automatically during the process
10 012	strength weld	weld designed to withstand stress
10 013	parent metal base metal: <i>deprecated</i>	metal to be joined or surfaced by welding, braze welding or brazing (See Figure 4.)
10 014	filler metal	welding consumable added during welding to form the weld
10 015	filler wire welding wire	filler material in the form of a wire which may or may not be a part of the welding circuit
10 016	filler rod welding rod: <i>deprecated</i>	filler material in the form of a rod which may or may not be a part of the welding circuit
10 017	flux	material used during welding, brazing or braze welding to clean the surfaces of the joint chemically, to prevent atmospheric oxidation and to reduce impurities <i>NOTE In arc welding, many other substances, which perform special functions, are added.</i>
10 018	deposited metal	filler metal that has been added during welding
10 020	weld metal	all metal melted during the making of a weld and retained in the weld (See Figure 4.)
10 021	run pass	metal melted or deposited during one passage of an electrode, or torch or blowpipe

Figure 4 Root, fusion penetration, weld junction and zones of typical welds



No.	Term	Definition
10 022	deposition rate	mass of filler metal consumed per unit of productive welding time
10 023	weld zone	zone containing the weld metal and the heat-affected zone (See Figure 4.)
10 024	heat-affected zone HAZ	portion of non-melted parent metal whose microstructure has been affected (See Figure 4.)
10 025	fusion zone	part of the parent metal that is melted into the weld metal, as determined on the cross-section of a weld (See Figure 4.)
10 026	fusion line	interface between the weld metal and the non-melted parent metal as determined on the cross-section of a fusion weld
10 027	welding technique	manner in which an operator manipulates an electrode, a blowpipe or a similar appliance
10 028	welding procedure	specific course of action followed in welding, including a list of materials and, where necessary, tools to be used (See Annex A to Annex G.)
10 030	(welding) sequence	order and direction in which joints, welds or runs are made
10 031	weld run sequence	order in which the runs of a weld or deposited layer are produced
10 032	stud welding	joining of a metal stud or similar part to a workpiece <i>NOTE Welding may be accomplished by arc, resistance, friction or other suitable process, with or without external gas shielding. The weld is made over the whole end area of the stud or attachment.</i>
10 033	hard facing hard surfacing	application of a hard, wear-resistant material to the surface of a component by welding, braze welding or spraying
10 034	spatter	globules of metal expelled during welding or cutting

No.	Term	Definition
10 035	duty cycle	1) <i>In the sense of “welding operator” duty cycle</i>, ratio of time spent welding to the total time which includes other activities, e.g. changing electrodes, slag removal 2) <i>In the sense of “machine” duty cycle</i>, measure of the capability of the welding equipment
10 036	transferred arc	arc established between the electrode of the plasma arc torch and the workpiece
10 037	non-transferred arc	arc established between the electrode and the constricting nozzle of the plasma arc torch or thermal spraying gun <i>NOTE The workpiece does not form part of the electrical circuit.</i>
10 038	electrode pick-up	contamination of a non-consumable electrode by metal or scale from the surface of the workpiece
10 040	pick-up	1) <i>In fusion welding</i>, transfer of alloying elements from the parent metal to the weld metal as a result of dilution 2) <i>In resistance welding</i>, particles of the surface of the workpiece that adhere to the surface of the electrodes, or vice versa
10 041	arc eye	irritation of the eye caused by exposure to radiation from an electric arc
10 042	electrode holder	device to hold an electrode and to convey current to it <i>NOTE 1 In resistance welding, this is device holding a spot welding electrode.</i> <i>NOTE 2 In arc welding, this is a tool for clamping, guiding and connecting a covered electrode to the welding circuit while insulating the operator from the welding</i>
10 043	welding glass filter glass	special filter that provides protection against glare when welding and in addition reduces the UV radiation and IR radiation that is dangerous to the human eye
10 044	heat filter	colourless, transparent, heat-absorbing glass plate placed between the plain glass and the welding glass to protect the eyes <i>NOTE It is usually used in high current metal inert-gas welding.</i>
10 045	blowpipe torch: <i>deprecated</i>	device for mixing and burning gases to produce a flame for welding, brazing, braze welding, cutting, heating and similar operations (See also terms 32 142 to 32 144.)
10 046	flashback	retrogression of the flame beyond the blowpipe body into the hose, with possible subsequent explosion
10 047	pressure regulator gas regulator	device for attachment to a gas cylinder or pipeline for reducing and regulating the gas pressure to the working pressure required
10 048	residual welding stress	stress remaining in a metal part or structure as a result of welding
10 050	pulse	unidirectional flow of current of either polarity of brief duration
10 051	pulse time	duration of a pulse

No.	Term	Definition
10 052	welding primer weldable primer: <i>deprecated</i>	paint that is applied to a shot-blasted metal surface for protective purposes, which does not have to be removed prior to welding and does not prevent the making of a satisfactory weld
10 053	welding consumables	all materials, such as filler materials, gas, flux or paste, used up during welding and enabling or facilitating the formation of a weld
10 054	welding equipment	basic apparatus used in welding such as power source, as well as wire feeder and powder feeder, etc.
10 055	welding accessories	all items of welding equipment associated with welding, other than welding plant and welding consumables
10 056	layer	stratum of weld metal consisting of one or more runs, side by side
10 057	building-up	overlay welding to obtain or restore required dimensions
10 058	surfacing	producing a layer of metal, by welding, on a workpiece to obtain desired properties or dimensions
10 060	joint preparation weld preparation	preparation for making a connection where the individual components, suitably prepared and assembled, are joined by welding or brazing
10 061	joint	junction of workpieces or the edges of workpieces that are to be joined or have been joined
10 063	air gap gap	1) <i>In fusion welding</i> , minimum distance at any cross-section between edges, ends or surfaces to be joined 2) <i>In magnetically-impelled arc butt welding</i> , space between component surfaces across which the arc is maintained during the heating (arcing) period
10 064	heat input	heat introduced into the joint during welding, referred to a characteristic dimension, such as a bead or weld length, weld cross-section, weld spot diameter
10 066	acceptance criteria	specified quality criteria for defining conformance of a weld
10 067	acceptance level	specific set of acceptance criteria where more than one set can be selected
10 068	examiner	person who has been appointed to verify compliance with the applicable standard <i>NOTE In certain cases, an external independent examiner can be required.</i>
10 069	examining body	organization that has been appointed to verify compliance with the applicable standard <i>NOTE In certain cases, an external independent examining body can be required.</i>
10 070	welding procedure specification WPS	document that has been qualified and provides the required variables of the welding procedure to ensure repeatability during production welding
10 071	welding procedure qualification record WPQR	record comprising all necessary data needed for qualification of a preliminary welding procedure specification
10 073	welding variable	variable which influences the characteristics of the welded joint

No.	Term	Definition
10 074	essential variable	welding condition that requires qualification
10 075	additional variable non-essential variable	welding condition addressed in the welding procedure specification but not requiring qualification
10 076	standard material	material produced and delivered in accordance with a standard or specification
10 080	re-start	point on the run where the welding is or was re-started
10 081	post-weld heat treatment	application of heat to an assembly after welding, brazing, soldering, thermal spraying or cutting
10 082	plasma gas	ionized gas that generally forms the major portion of an arc column and provides a conducting path for the current
10 083	preheat	heating of an appropriate area of a workpiece before welding, normally to achieve the preheating temperature
10 084	cooling rate	rate of decrease of temperature with time over a specified temperature range or time
10 085	heating rate	rate of increase of temperature with time over a specified temperature range or time
10 088	dissimilar material joint	welded joint in which the parent materials have significant differences in mechanical properties and/or chemical composition
10 089	as welded	pertaining to the condition of weld metal, welded joints, and weldments after welding, but prior to any subsequent thermal, mechanical, or chemical treatments <i>NOTE For alloys that may undergo natural ageing (e.g. some aluminium alloys) the as-welded condition lasts only for a limited period of time.</i>
10 090	auxiliary material	welding consumable used during welding, generally not forming part of the finished weld
10 091	quality level	description of the qualities of a weld on the basis of type, size and amount of selected imperfections
10 092	fitness-for-purpose	ability of a product, process or service to serve a defined purpose under specific conditions
10 093	side edge of workpiece	edge of workpiece, transverse to weld surface (see Figure 5, item 2) <i>NOTE Illustration from BS EN ISO 17659.</i>

Figure 5 Preparation for square butt weld

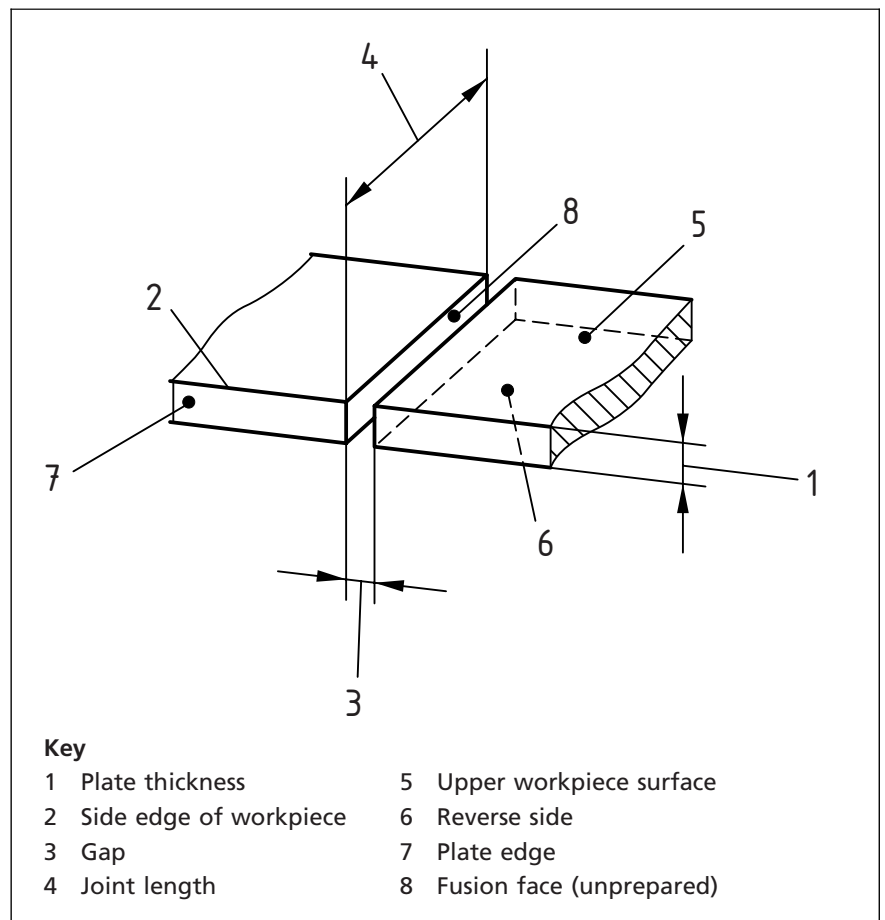
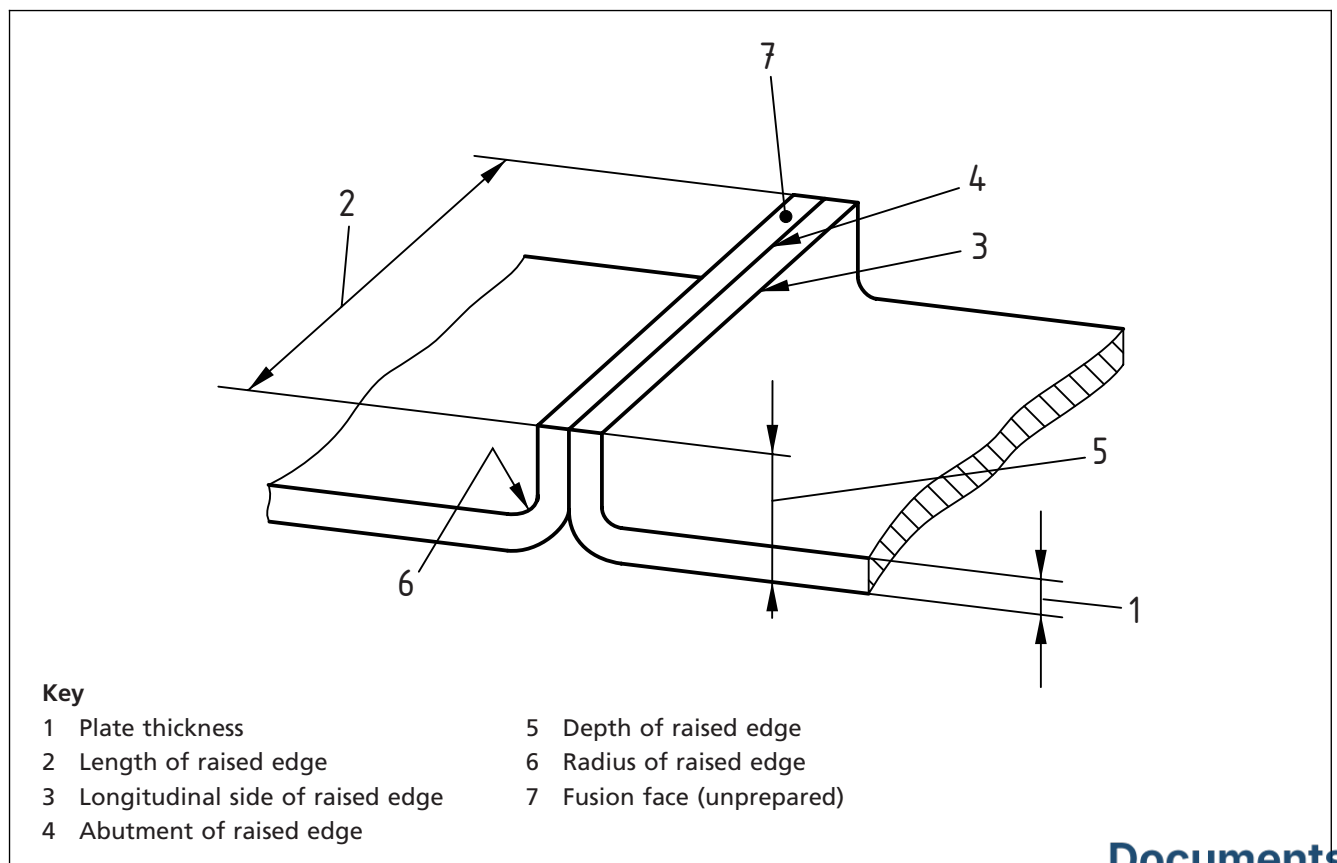


Figure 6 Preparation for butt weld between plates with raised edges



No.	Term	Definition
10 094	abutment of raised edge	contact surface of a raised-edge joint (see Figure 6, item 4) <i>NOTE Illustration from BS EN ISO 17659.</i>
10 095	homogeneous joint	welded joint in which the weld metal and parent material have no significant differences in mechanical properties and/or chemical composition <i>NOTE A welded joint made of similar parent materials without filler metal is considered homogeneous.</i>
10 097	plate edge	edge of a plate, normal to the joint axis (see Figure 5, item 7) <i>NOTE Illustration from BS EN ISO 17659.</i>
10 098	manufacturing organization	workshop or site or both which is/are under the same technical and quality management
10 099	welding co-ordinator	qualified person who has responsibilities in the manufacturing operation for carrying out one or more co-ordination tasks for welding or welding related matters, e.g. planning, controlling, supervising, monitoring, and whose competence and knowledge has been demonstrated by training, education and/or relevant manufacturing experience
10 100	high pressure blowpipe	blowpipe in which the pressure of both the fuel gas and the oxygen/compressed air, measured immediately before the point of mixing, is higher than the pressure of the mixture, measured between point of mixing and welding nozzle
10 101	low pressure blowpipe	blowpipe in which the fuel gas pressure, measured immediately before the mixing chamber, is lower than the pressure of the gas mixture, measured between the mixing chamber and welding nozzle
10 102	edge distance	distance between the centre of a weld and the nearest edge of the workpiece
10 103	range of qualification	extent of qualification for an essential welding variable
10 104	batch sample	one or more units of product selected at random from the batch and considered to be representative of the batch
10 105	plate thickness	See Figures 5, 6, 7, 8, 9, and 10. <i>NOTE Illustrations from BS EN ISO 17659.</i>
10 106	nominal thickness	specified thickness, excluding any permitted tolerances
10 108	welding procedure test	making and testing of a representative welded joint, in order to prove the feasibility of a welding procedure <i>NOTE 1 This term is not usually applied to any tests that may have been made during the development of a welding procedure.</i> <i>NOTE 2 Sometimes an additional joint of a different type is welded in order to obtain relevant test data.</i>
10 109	function test	test of a welding unit set-up in accordance with a welding procedure specification (WPS)
10 110	production test	welding test carried out in the production environment on the welding unit, on actual products or on simplified test pieces, during an interruption of normal production
10 111	pre-production welding test	welding test having the same function as a welding procedure test, but based on a non-standard test piece representative of the production conditions

No.	Term	Definition
10 112	production sample testing	testing of actual welded products sampled from a continuous production
10 113	manufacturer's previous welding experience	practice authenticated by test data demonstrating that established production welding procedures have been capable of consistently producing welds of acceptable quality over a period of time
10 114	upper workpiece surface	normally the side of the joint accessible for the commencement of welding (see Figure 5, item 5, and Figure 7, item 5).
		<i>NOTE Illustrations from BS EN ISO 17659.</i>
10 115	reverse side	side of the joint opposite to the upper workpiece surface (see Figure 5, item 6, and Figure 7, item 6).
		<i>NOTE Illustrations from BS EN ISO 17659.</i>

Figure 7 Preparation for single bevel butt weld with backing

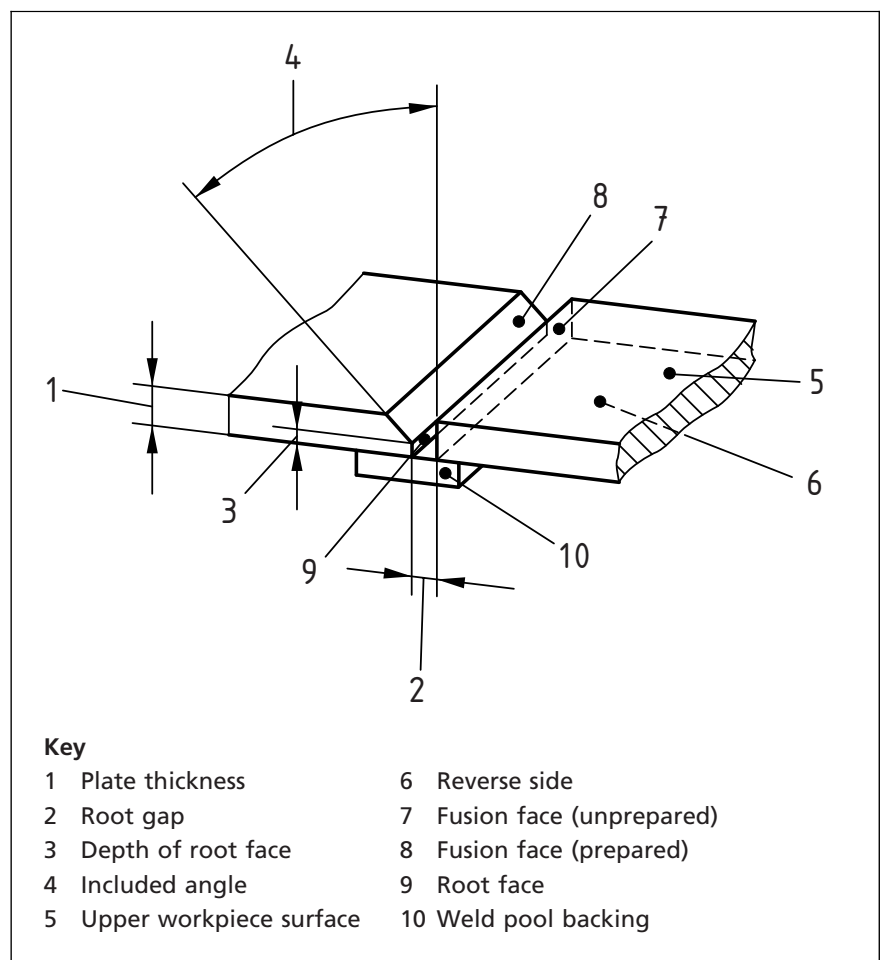
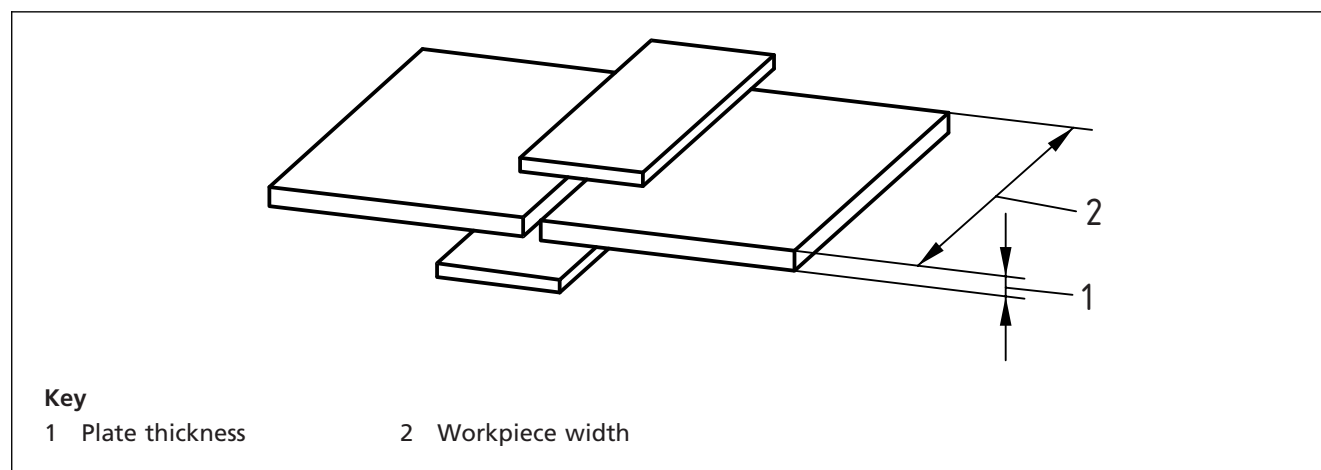


Figure 8 Configuration for double-covered lap joint



No.	Term	Definition
10 116	slope	<i>in welding geometry</i> , angle between the root line and the positive x-axis of the horizontal reference plane in straight welds
10 117	ferrite number	arbitrary number indicating magnetic attraction relative to a series of reference samples and therefore proportional to the ferro-magnetic phase content
10 118	work instruction	simplified specification of the welding procedure, suitable for direct application in the workshop
10 119	weld interface	contact area after the welding force is applied
10 120	workpiece width	width of the workpiece, parallel to the weld surface (see Figure 8, item 2) <i>NOTE Illustration from BS EN ISO 17659.</i>
10 121	lap width	dimension of overlap, transverse to the joint line (see Figure 9, item 4) <i>NOTE Illustration from BS EN ISO 17659.</i>
10 122	weld length	overall length of continuous deposited weld metal in a joint <i>NOTE Illustration from BS EN ISO 17659.</i>

Figure 9 Configuration for single lapped joint

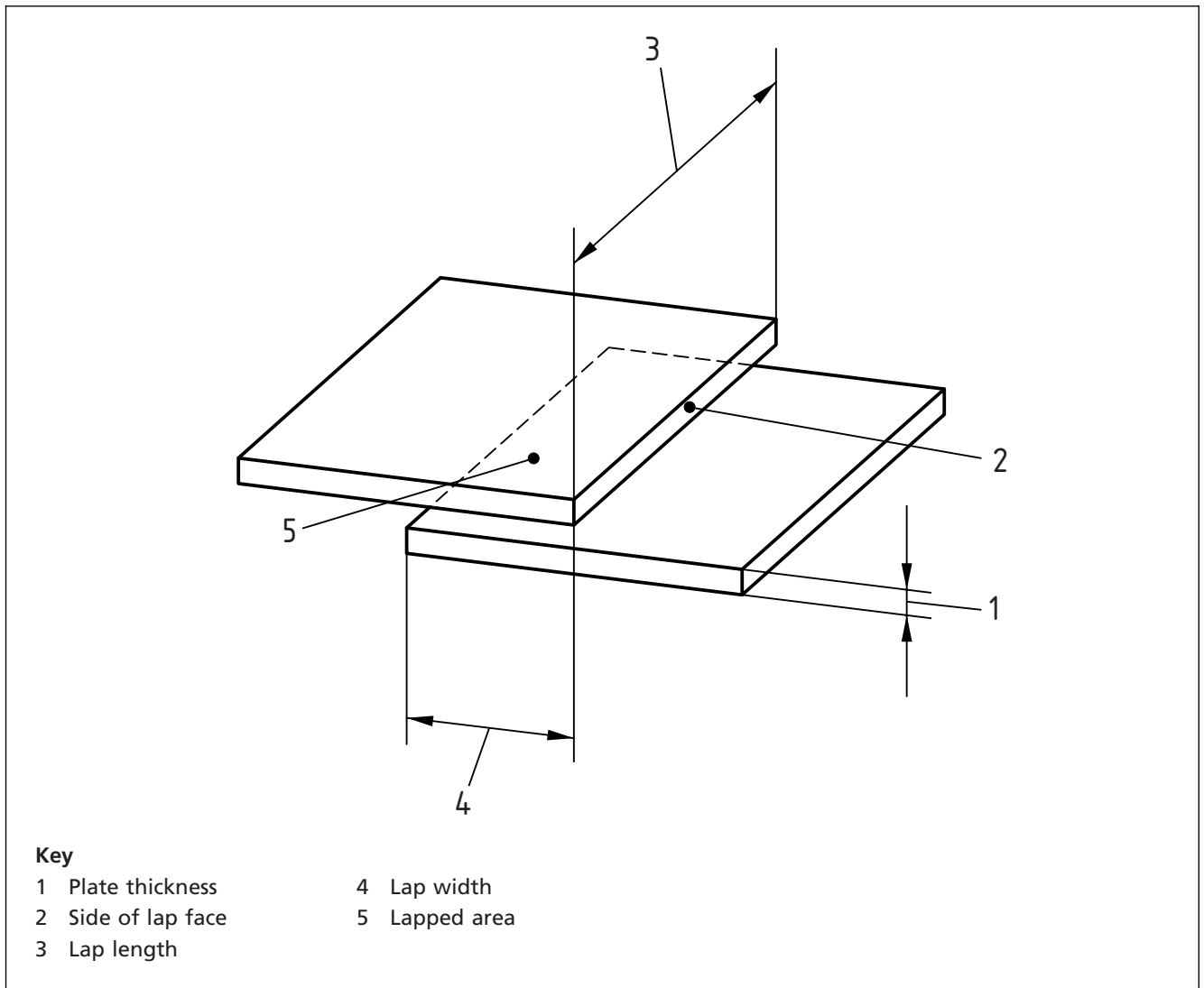
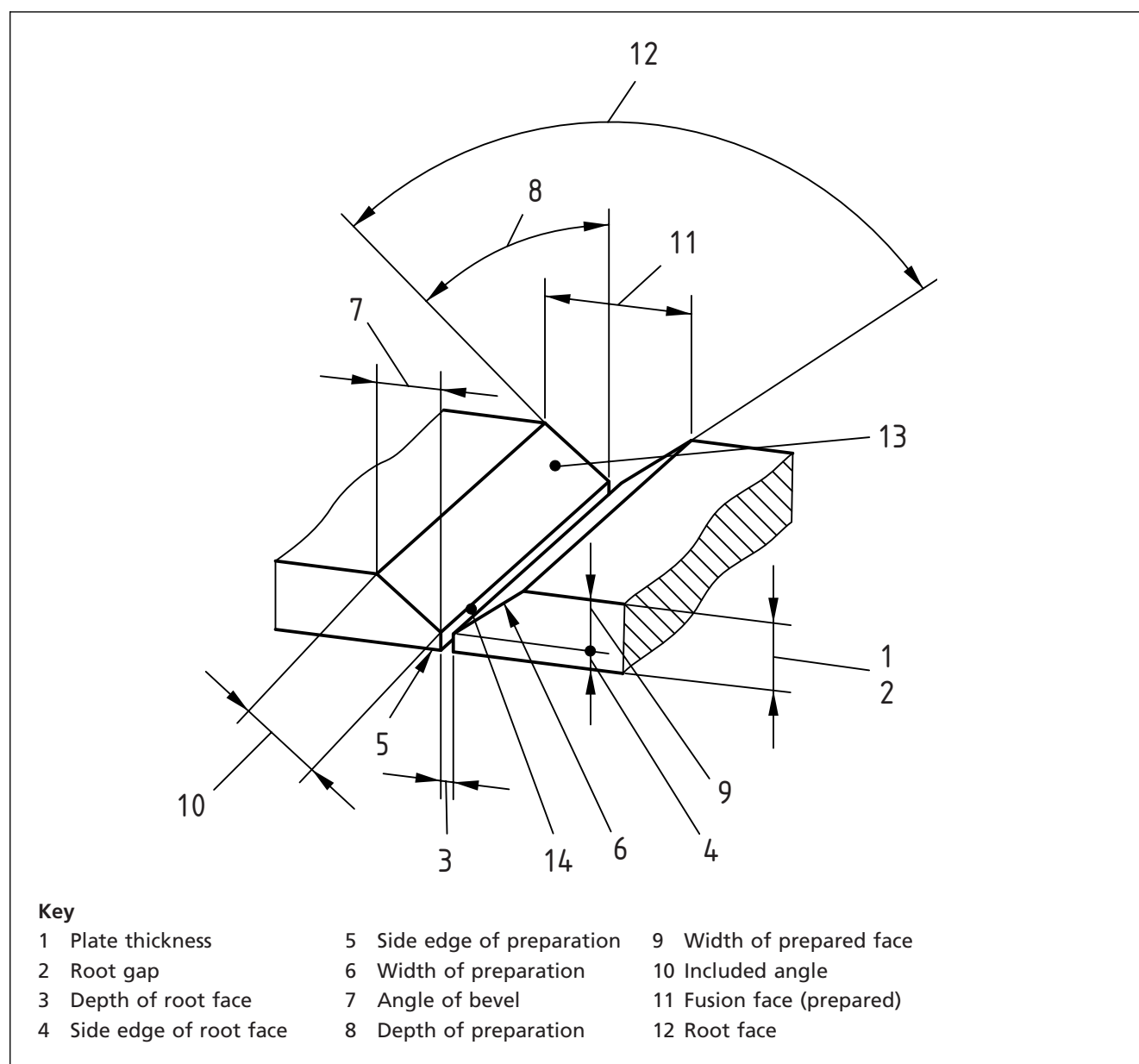


Figure 10 Preparation for single V-butt weld



No.	Term	Definition
10 123	lap length	length of lap, parallel to the joint line (see Figure 9, item 3) <i>NOTE Illustration from BS EN ISO 17659.</i>
10 124	joint length	dimension of joint in the direction of the weld axis (see Figure 5, item 4, Figure 63, item 3, and Figure 65, item 2) <i>NOTE Illustrations from BS EN ISO 17659.</i>
10 125	batch	collection of one or more units of products, made in a single production run
10 126	parent material	material to be joined, or surfaced, by welding, braze welding or brazing
10 127	contracting parties	parties who have entered into a supply contract

No.	Term	Definition
10 128	welding co-ordination personnel	personnel who have responsibilities in the manufacturing operation for welding and welding related activities whose competence and knowledge have been demonstrated by, e.g. training, education and/or relevant manufacturing experience
10 129	corrosion resistant surfacing	adherent material for protection of a surface against corrosion
10 130	heat resistant surfacing	adherent material for protection of a surface against heat
10 131	overlap	<i>in a lap joint</i> , minimum distance between the edges of overlap plates <i>in beam welding</i> , portion of the weld pass remelted prior to the slope down <i>in seam welding</i> , area in the preceding weld remelted by the succeeding weld
10 132	rotation	<i>in welding geometry</i> , angle between the centreline of a weld and the positive y-axis or a line parallel to the y-axis, measured in the counter-clockwise direction in the plane of the transverse cross-section of the weld
10 133	production welding	welding carried out during manufacture before final delivery to the end user
10 134	robotic welding	automatic welding using a robot that can be preprogrammed to different welding paths and fabrication geometries
10 135	fully mechanized welding	welding where all the main operations (excluding the handling of the workpiece) are mechanized <i>NOTE</i> Manual adjustment of welding variables during welding is possible.
10 136	lapped area	area of overlapped material in a lapped joint (see Figure 9, item 5) <i>NOTE</i> Illustration from BS EN ISO 17659.
10 137	preheat maintenance temperature	minimum temperature in the weld zone which shall be maintained if welding is interrupted
10 138	preheating temperature	temperature immediately prior to the commencement of welding resulting from the heating of the parent metal in the region of the weld
10 140	finishing welding	welding carried out in order to remove casting defects and core openings to ensure the agreed quality of castings
10 142	joint welding	production welding used to join components together
10 143	qualified person	person whose competence and knowledge have been obtained by education, training and/or relevant experience <i>NOTE</i> In order to demonstrate the level of competence and knowledge a qualification test may be required.
10 144	heterogeneous joint	welded joint in which the weld metal and parent material have significant differences in mechanical properties and/or chemical composition
10 145	productive welding time	time during which the welding operation takes place
10 146	welding conditions	conditions under which welds are made; these include environmental factors (e.g. weather), stress and ergonomic factors (e.g. noise, heat, cramped working conditions) and workpiece-related factors (e.g. parent metal, groove shape, working position)

No.	Term	Definition
10 147	welding parameters	information needed for the performance of welding with a specified welding procedure <i>NOTE Welding parameters are, e.g. welding consumables, parent material, joint preparation, welding current, welding voltage, travel speed, preheating, working and interpass temperature and run sequence.</i>
10 148	welding sequence schedule	schedule specifying the order and direction in which welds are to be made on a workpiece
10 149	welding time	time required for making a weld (excluding preparatory or finishing operations) <i>NOTE It consists of productive welding time and the servicing time.</i>
10 150	joint efficiency	ratio of strength of a joint to the strength of the parent metal, expressed as a percentage
10 151	faying surface interface: <i>deprecated</i>	1) surface of one component that is intended to be in contact with a surface of another component to form a joint 2) <i>in friction welding</i> , contact area developed between the workpieces after completion of the welding operation
10 152	stud	fastener to be attached by stud welding
10 153	protrusion	<i>in stud welding</i> , distance between the tip of the stud and the face of the support device in their initial position
10 154	lift	<i>in stud welding</i> , distance between the stud tip and the workpiece surface with the stud-lifting mechanism in position and activated
10 155	semi-automatic welding partly mechanized welding	welding in which some of the welding parameters, such as arc length, are automatically controlled, but manual guidance is necessary
10 156	shop weld	weld made within the premises of the manufacturer of the welded assembly
10 157	site weld	weld made at the location where the assembly is to be installed
10 158	covered filler rod coated filler rod: <i>deprecated</i>	filler rod having a covering of flux
10 159	fusion boundary weld junction fusion line	boundary between the fusion zone and the heat-affected zone (See Figure 4.)
10 160	approved welding procedure	documented welding procedure that has been approved by such means as an inspecting authority either by means of a welding procedure test or authentic documented experience gained with the welding of joints similar to that to which the welding procedure applies, or other approved methods
10 161	three-phase welding power source three-phase welding machine	welding power source in which power is taken from all three phases of a three-phase supply to provide a single welding current or three single-phase welding currents
10 162	idling time	time during which energy is available for welding but is not being used

No.	Term	Definition
10 163	recovery time	time required, after a change of conditions has occurred in a welding circuit, for either the current or the voltage, or both, to recover to a specific percentage of their value before the change
10 164	cycle	arbitrary unit of time, of duration equal to that of one cycle of the alternating current supply <i>NOTE Normally in the UK this is 1/50 s</i>
10 165	nozzle-constricted arc	arc that is constricted or shaped by the nozzle walls
10 166	vortex-constricted arc	arc that is constricted by a vortex produced by swirling liquid or gas
10 167	transferred arc	constricted arc that is struck between an electrode mounted within a torch and the workpiece
10 168	non-transferred arc	constricted arc that is struck between an electrode within a torch and a second electrode which forms a nozzle through which the plasma flows
10 169	partially transferred arc	constricted arc formed when the workpiece is connected to one terminal of the power supply and the other terminal is connected to an electrode within the torch; the torch nozzle also forms part of the electrical circuit and is at an intermediate potential
10 170	sleeve joint	joint where the ends of two pipes or round bars fit into a short length of pipe, the inside diameter of which approximates to the outside diameter of the two other members
10 171	fixed shield	independently mounted device to provide protection from injury during welding or cutting
10 172	plain glass cover glass	clear glass or other transparent material used to protect the surface of welding glass from spatter
10 173	welding spectacles	spectacles fitted with welding glass, normally issued to persons whose duties require them to work in the vicinity of welding or cutting operations
10 174	welding goggles	protective device enclosing a space in front of the eyes to shield them from injury during welding or cutting, fitted with welding glass and plain glass
10 175	chipping goggles	protective device enclosing a space in front of the eyes to shield them from injury during chipping, grinding or cutting, fitted with plain glass
10 176	face mask	1) protective device worn in front of the face to shield it from injury during welding or cutting, fitted with welding glass and plain glass 2) protective device supplied with fresh air and worn over the nose and mouth
10 177	helmet head screen head shield	protective device supported on the head and arranged to shield the face and throat from injury during welding, fitted with a window consisting of welding glass and plain glass, and if necessary a heat filter
10 178	welding gloves	gloves to protect the hands, or gauntlets to protect the hands and forearms, from heat and metal splashes due to welding or cutting

No.	Term	Definition
10 179	open injector-mixer bunsen-type mixer	injector-mixer where the additional gas is drawn in from the atmosphere
10 180	closed injector- mixer	injector-mixer that is closed to the atmosphere, the entrained gas being drawn up through a tube connected to the unit
10 181	cone	more luminous part of a flame, which is adjacent to the nozzle orifice
10 182	feather	carbon-rich zone, visible in a flame, extending around and beyond the cone when there is an excess of carbonaceous gas
10 183	gas envelope	gas surrounding the inner cone of an oxy-fuel gas flame
10 184	threaded hose connection	threaded part (inlet or outlet) of a welding or cutting appliance to which a fitted hose is coupled <i>NOTE Threaded hose connections, hose coupling nuts and hose couplers have right-hand threads for non-combustible gases and left-hand threads for combustible gases. Hose coupling nuts and hose couplers having left-hand threads are notched.</i>
10 185	hose coupling nut union nut: <i>deprecated</i>	nut used for securing the hose coupling nipple to a threaded hose connection or to a hose coupler (See note to term 10 184.)
10 186	hose coupling nipple	metal component, one end of which is inserted into a hose, the other end has a seating and a shoulder around which can be rotated the hose coupling nut (See note to term 10 184.)
10 187	fitted hose	length of hose at each end of which is a hose coupling nipple and a hose coupling nut
10 188	hose coupler	component, consisting of a hexagonal centre portion with threaded ends, for connecting two lengths of fitted hose (See note to term 10 184.)
10 189	flame snap-out	unintentional extinction of the flame outside the nozzle orifice
10 190	gas economizer	auxiliary device designed for temporarily cutting off the supply of gas to the welding equipment, except the supply to a pilot jet where fitted
10 191	two-stage regulator	gas regulator in which the gas pressure is reduced to the working pressure in two stages
10 192	manifold regulator multi-stage regulator	gas regulator in which the gas pressure is reduced to the working pressure in more than one stage
10 193	flame arrestor flashback arrester	safety device fitted in a fuel gas system to prevent any flashback reaching the fuel gas pipeline or supply
10 194	hydraulic back pressure valve	water-charged non-return safety valve fitted in an acetylene gas system to prevent flashback or back pressure from the blowpipe reaching the acetylene generator
10 195	flame normalizing	normalizing carried out by direct flame heating
10 196	interpulse time	period of time between successive pulses during the making of a single weld
10 197	welding cycle welding cycle time	period required to complete a welding cycle
10 198	weld timer	device that controls only the weld time

No.	Term	Definition
10 199	welding rectifier welding convertor rectifier converter	device that converts single or multiphase power from the frequency of the power supply to unidirectional current
10 200	stored-energy welding	method of welding in which the welding energy is stored in an inductor, a capacitor, an electric accumulator or a flywheel during a period of time relatively long compared to the welding time
10 201	burnt weld	weld in which the weld metal has been grossly overheated causing excessive oxidizing thereby reducing the strength of the joint
10 202	weldability	ease with which a material or materials can be welded to give an acceptable joint
10 203	plasma arc	transferred arc in which a constriction (mechanical or magnetic) is used to produce a thin pencil-like configuration of plasma and electrons to give a high heat concentration over a small area
10 204	plasma jet	jet or plasma formed by a non-transferred arc and expelled through an orifice at high velocity by gas pressure
10 205	plasma weld surfacing	surfacing or cladding in which the heat is provided by a plasma arc that may be transferred or partially transferred to the workpiece <i>NOTE The cladding material may be applied as powder or as filler wire that is fused to the parent metal.</i>
10 206	nozzle tip: <i>deprecated</i>	generally detachable part of a blowpipe from which gas or gases emerge
10 207	blowpipe head	part of a blowpipe to which a nozzle is fitted
10 208	blowpipe shank	part of a blowpipe that is normally held or gripped, to which are fixed the valves and threaded hose connections
10 209	combined blowpipe combined outfit: <i>deprecated</i> combined set: <i>deprecated</i>	blowpipe that, when fitted with the appropriate attachments, can be used for welding, cutting, heating or flame cleaning
10 210	head mixing blowpipe	blowpipe with a mixer or injector-mixer in the head
10 211	harsh flame	flame in which the velocity of the gases is higher than normal
10 212	soft flame	flame in which the velocity of the gases is lower than normal
10 213	dissolved acetylene	acetylene made stable under pressure by being dissolved in a liquid, e.g. acetone
10 214	groove weld	weld in a preparation made to receive weld metal
10 215	roll welding	welding with pressure in which a force is progressively applied by mechanically operated rolls after heating by different means
10 216	robot	programmable, multi-function manipulator
10 217	manipulation	operation of grasping and moving an object
10 218	adaptive control system feedback control system	control method in which control parameters are continuously and automatically adjusted in response to measured process variables to achieve the specified performance

No.	Term	Definition
10 219	joint recognition	form of adaptive control that recognizes variations in the geometry detects changes in the joint geometry and instructs the welding machine to take the appropriate corrective action
10 220	weld recognition weld feature recognition	form of adaptive control that recognizes variations in the geometry (including penetration depth) of the weld or weld pool being made and instructs the welding machine to take the appropriate corrective action
10 221	joint tracking seam tracking	form of adaptive control that monitors changes in the location of the joint to be welded and instructs the welding machine to take the appropriate corrective action
10 222	forehand welding	welding technique in which the welding torch or gun is pointed in the direction of welding
10 223	backhand welding	welding technique in which the welding torch or gun is pointed towards the completed weld, i.e. opposite to the direction of welding

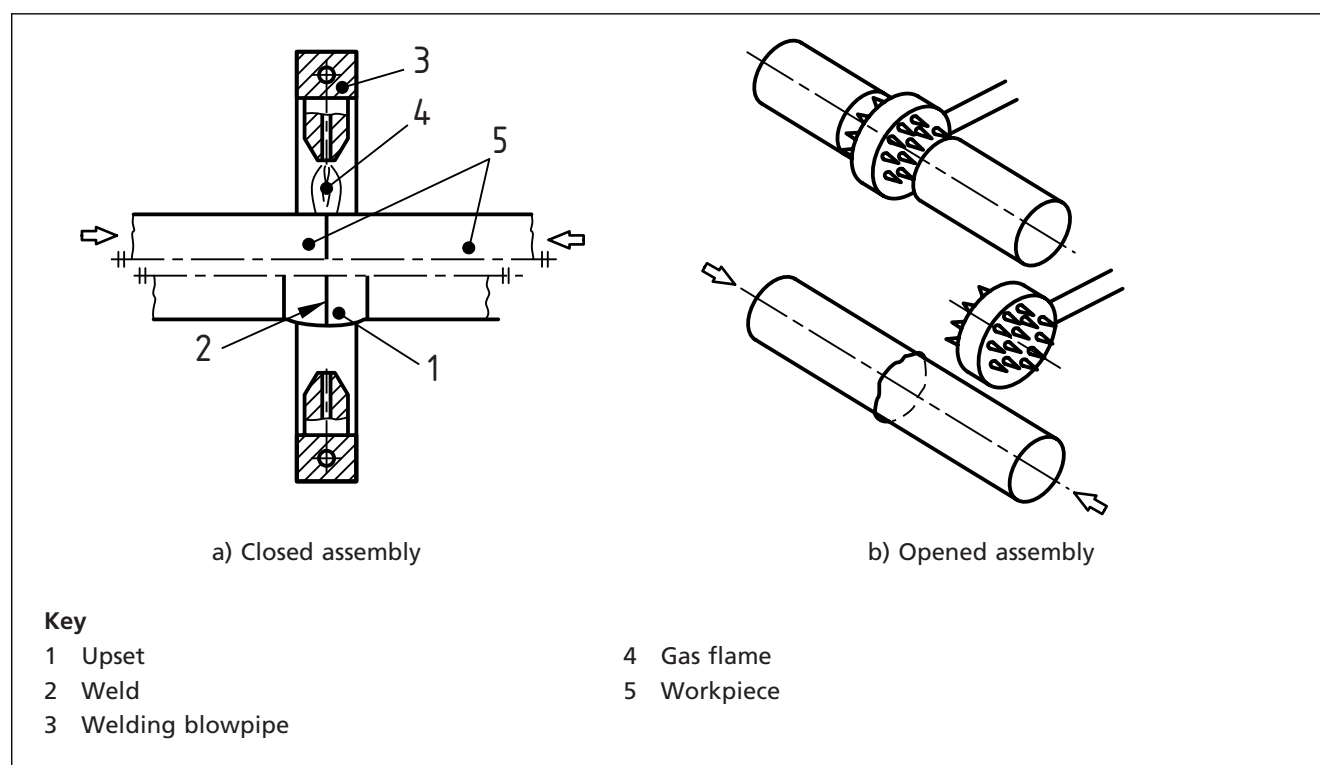
Section 2. Terms relating to welding with pressure

Subsection 21. Terms relating to more than one subsection

No.	Term	Definition
21 001	welding with pressure	welding in which sufficient outer force is applied to cause more or less plastic deformation of both the faying surfaces, generally without the addition of filler metal <i>NOTE Usually, but not necessarily, the faying surfaces are heated in order to permit or to facilitate unifying.</i>
21 002	interface	contact area when the welding force is applied
21 003	HF induction welding	welding in which an alternating electric current of at least 10 kHz is induced in the work to produce heat which in association with a forging action produces a joint
21 004	upset metal upset	parent metal proud of the normal surfaces of the work as a result of forging or pressing
21 005	upset allowance	length allowed for the total shortening of both components due to upsetting
21 006	upset speed	rate of movement of the moving workpiece during upsetting
21 007	welding cycle	succession of operations effected by the machine for the making of a weld and the return to the initial position
21 008	upset force ¹⁾	force producing or tending to produce upset metal
21 010	upset pressure	pressure (force per unit area) resulting from the upset force
21 011	total allowance	<i>In pressure, resistance butt, flash or friction welding, the length allowed, in preparation for welding, for the total shortening of both components due to all the operations that are actually used in the making of a weld</i>
21 012	upset length	total actual shortening of both components due to the forging action in the making of a weld
21 013	forging force forge force	1) force applied normal to the faying surfaces to complete the weld 2) <i>In friction welding, force applied normal to the faying surfaces at the time when relative movement between the components is ceasing or has ceased</i>
21 015	forging time forge time	duration of application of the forging force
21 016	dwelt	<i>in resistance welding, maintain the electrode force after the cessation of current</i>
21 017	dwelt time	<i>in fusion welding, time during which the energy source pauses at any point in each oscillation</i>
21 020	oxy-fuel gas pressure welding	welding with pressure in which the workpieces are heated at the faying surfaces by an oxy-fuel gas flame and the weld is made by applying a force without addition of filler metal; the assembly may be of the open or closed type <i>NOTE This process is illustrated in Figure 11.</i>

¹⁾ Force is sometimes incorrectly referred to as pressure. See terms 21 013 to 21 020.

Figure 11 Oxy-fuel gas pressure welding



No.	Term	Definition
21 021	ultrasonic welding	welding process in which mechanical vibrations of low amplitude superimposed on a static force, and usually at frequencies above the audible limit, make a weld between two surfaces to be joined at a temperature well below the melting point of the parent metal <i>NOTE Additional heat may or may not be applied.</i>
21 022	diffusion welding	welding with pressure whereby the workpieces are kept in contact under specified continual pressure and are heated either on their faying surfaces, or in their entirety at a defined temperature over a controlled time (accompanied by a figure) <i>NOTE This results in local plastic deformation and thereby intimate contact of the surfaces and diffusion of the atoms through the interface. This produces complete continuity of the material. The operation may take place in a vacuum, under a gas shield or in a fluid, preferably without the addition of a filler metal.</i>
21 023	explosive cladding	cladding by explosive welding (see 26 001)
21 024	magnetically-impelled arc butt welding	welding process in which the faying surfaces of the workpieces are heated by a short duration arc between them and then brought together by the application of a force, the arc being impelled along the joint line by magnetic fields <i>NOTE The arc current can be either constant or increased in steps.</i>
21 025	upsetting	1) operation of locally increasing the cross-sectional area of a workpiece by the application of a longitudinal force 2) final operation of butt or flash welding comprising the application of a force to the ends of the workpieces after heating to welding temperature

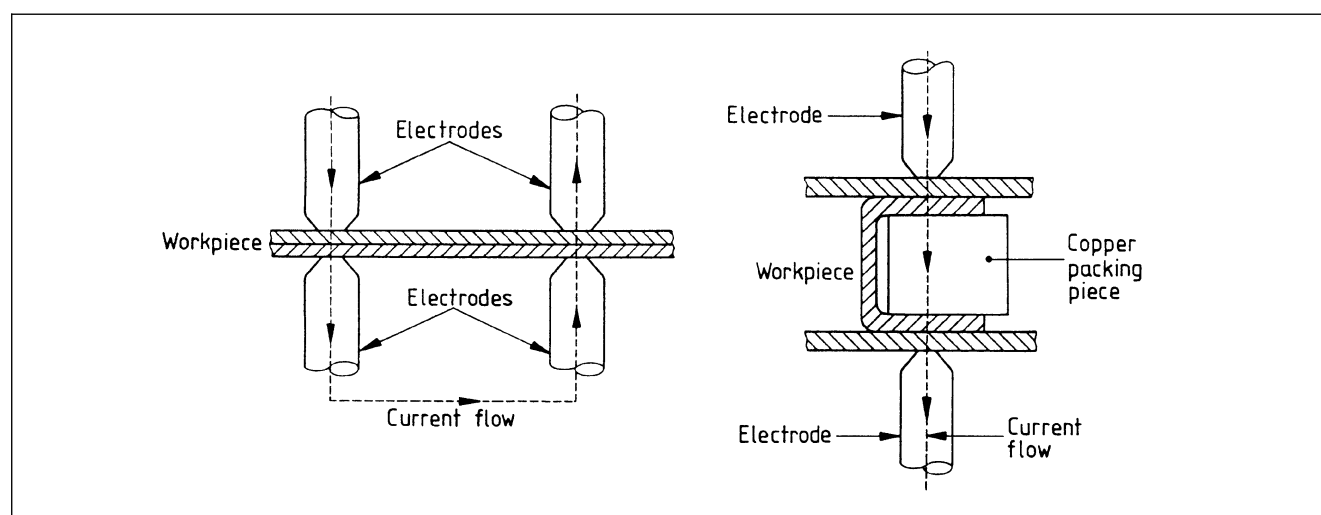
No.	Term	Definition
21 026	pressure contact area	initial surface contact area of the components through which force is transmitted
21 027	forward force²⁾	force applied to the movable head of a welding machine in the direction necessary to make a weld
21 028	initial force²⁾	first steady or peak force applied normal to the interface, during the welding cycle
21 029	welding force²⁾ welding load: <i>deprecated</i>	force, at the abutting surfaces of a workpiece, used to make a weld
21 030	post-weld upset force²⁾	force required to reduce the workpiece to its correct length after welding
21 031	post-heating force²⁾	force applied by the electrodes to the work during the time post-heating current is flowing
21 032	forward pressure	pressure (force per unit area) resulting from the forward force
21 033	initial pressure	pressure (force per unit area) resulting from the initial force
21 034	welding pressure	pressure (force per unit area) resulting from the welding force
21 035	post-weld upset pressure	pressure (force per unit area) resulting from the post-weld upset force
21 036	post-heating pressure	pressure (force per unit area) resulting from the post-heating force
21 037	overhang	distance a component projects from the die or clamp in the direction of the mating component for resistance butt, flash, friction, pressure or magnetically impelled arc butt welding
21 038	digital timer	apparatus for controlling intervals of time by means of counting, to a preset number, pulses which have a constant rate of repetition
21 039	analogue timer	apparatus for controlling intervals of time that relies upon any time dependent physical change
21 040	sequence timer	apparatus comprising a group of timers for controlling various functions in a welding cycle in a predetermined sequence
21 041	total loss	<i>In pressure, resistance butt, flash, friction or magnetically impelled arc butt welding</i> , total amount of shortening of both components due to all the operations that are actually used in the making of a weld
21 042	forge welding fire welding	welding with pressure in which the workpieces are heated in air in a forge and the weld is made by applying blows or some other impulsive force sufficient to cause permanent deformation at the interfaces

²⁾ Force is sometimes incorrectly referred to as pressure. See terms 21 032 to 21 036.

Subsection 22. Terms relating only to resistance welding

No.	Term	Definition
22 001	resistance welding	welding with pressure in which the heat necessary for welding is produced by resistance to an electrical current flowing through the welding zone
22 002	resistance butt welding slow butt welding: <i>deprecated</i> upset butt welding: <i>deprecated</i>	resistance welding in which the components are butted together under pressure, and current is allowed to flow until the temperature is reached at which upset metal is produced and the weld is completed
22 003	flash welding flash butt welding: <i>deprecated</i>	resistance welding during which heating is obtained when the workpieces are progressively and repeatedly advanced towards each other, causing the current to flow through localized points, thus creating flashing and expulsion of molten metal
22 004	spot welding	resistance welding in which a weld is produced at a spot in the work-piece between electrodes, the weld being of approximately the same area as the electrode tips, or as the smaller of tips of differing size; force is applied to the spot, usually through the electrodes, continuously throughout the process
22 005	stitch welding	spot welding in which successive welds overlap
22 006	multiple spot welding	spot welding in which, by the use of more than two electrodes, two or more welds are made simultaneously or in an automatically controlled sequence
22 007	series spot welding	spot welding in which two or more welds are made simultaneously in electrical series (See Figure 12.)

Figure 12 Examples of series spot welding



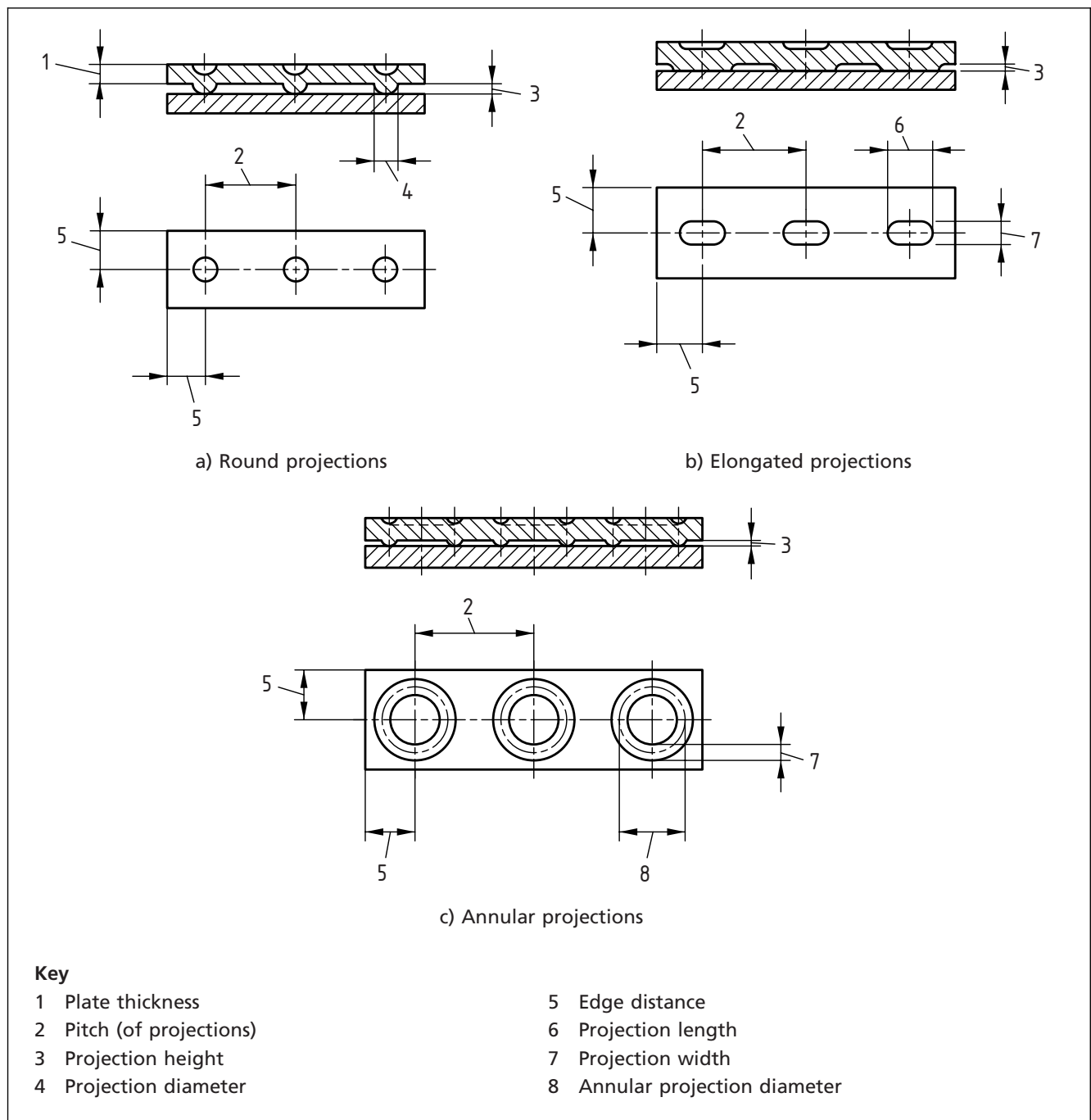
No.	Term	Definition
22 008	seam welding	resistance welding in which force is applied continuously and current continuously or intermittently to produce a linear weld, the workpiece being between two electrode wheels or between an electrode wheel and an electrode bar; the wheels apply the force and current and rotate continuously during the making of the linear weld
22 010	projection welding	resistance welding in which the force and current are localized by the use of a projection or projections raised on or formed from one or more of the faying surfaces, the projections collapsing during welding
22 011	resistance stud welding	stud welding using projection welding (See terms 10 032 and 22 010)
22 012	percussion welding	welding with pressure employing the heat from an arc produced by a rapid discharge of electrical energy; pressure is applied percussively during or immediately following the electrical discharge
22 013	HF resistance welding	resistance welding in which an alternating electric current of at least 10 kHz is fed through contacts to the work to provide the heat for welding; the high frequency current concentrates along adjacent surfaces to produce highly localized heat prior to the application of welding force
22 014	cross-wire weld	resistance weld at the point of contact between crossed wires or rods made with pressure applied continuously
22 015	resistance welding electrode electrode	replaceable portion of a resistance welding machine that transmits current and applies force to the pieces to be welded
22 016	electrode shank	portion of an electrode for spot or stitch welding intended to be held by, and to make electrical contact with, an electrode holder
22 017	electrode wheel	seam welding electrode in the form of a rotating disc
22 018	flashing allowance	length allowed for the total shortening of both components due to flashing, in preparation for flash welding
22 020	electrode pressure	pressure (force per unit of electrode contact area) resulting from the electrode force
22 021	flashing time³⁾	<i>In flash welding</i> , period of time between the start of continuous flashing and the time when the upset force is applied
22 022	upset time³⁾	duration of upset travel
22 023	upset current time³⁾	time during which upset current flows
22 024	cool time³⁾ off-time	<i>In pulsation and seam welding</i> , period of time between two successive heat times in the same welding cycle
22 025	weld time³⁾	<i>In resistance welding</i> , duration of continuous flow of welding current
22 026	hold time³⁾ dwell time	period of time between the cessation of current in a welding cycle and the cessation of electrode force
22 027	welding current	current (excluding preheating current) used to bring the workpiece to, and maintain it at, welding temperature

³⁾ Attention is drawn to Figures 14 to 25 for diagrammatic representation of these terms.

No.	Term	Definition
22 028	flashing current	current flowing during flashing time
22 030	flashing travel	distance travelled by the moving head during flashing
22 031	flashing speed	rate of travel of the moving head during flashing
22 032	throat depth throat	<i>in resistance welding</i> , usable distance from the centre of the platens or the axes of the electrodes or, in the case of oblique electrodes, the point of intersection of the electrode axes in the working position or the contact line of electrode wheels and that part of the equipment body located closest to it
22 033	throat gap	1) <i>in spot and seam welding equipment</i> , usable distance between the arms or the outer current-conducting parts of the welding circuit 2) <i>in projection welding equipment</i> , clamping distance between the platens
22 034	indirect spot welding	spot welding in which only one electrode tip is used per weld; a backing electrode or the workpiece itself completes the electrical circuit and resists the force of the electrode tip
22 035	forge delay time	period of time between the start of weld time and the instant of application of maximum welding force
22 036	backing electrode	plate or strip of current-carrying material used in place of an electrode on one side of the work to reduce the marking for multi spot, seam or projection welds
22 037	upset current	current flowing during upsetting
22 038	flashing loss	<i>In flash welding</i> , total actual shortening of both components during the flashing time
22 040	flashing	<i>in flash welding</i> , phenomenon occurring as the components are progressively advanced towards each other, when the current, confined to localized points of contact, causes repeated expulsion of molten metal
22 041	double-conductor connection cable	cable comprising two conductors providing an electrical link between the secondary terminals of a resistance welding transformer and the welding set, and designed to have as low an electrical resistance as possible
22 042	single-conductor connection cable	cable comprising one conductor providing an electrical link between the secondary terminals of a resistance welding transformer and the welding set
22 043	staggered resistance welds	generally spot welds in two or more rows, in a staggered pattern (see Figure 14)
22 044	projection diameter	maximum diameter of individual projection [See Figure 13a), item 4]

NOTE Illustration from BS EN ISO 17659.

Figure 13 Forms of projection welds



No.	Term	Definition
22 045	annular projection diameter	mean diameter of an annular projection [See Figure 13c), item 8] <i>NOTE Illustration from BS EN ISO 17659.</i>
22 046	nugget diameter	<i>in resistance spot and projection welding</i> , mean of the minimum and maximum diameters of the fused zone measured at the interface omitting the corona bond area
22 047	row pitch	perpendicular distance between rows of spot welds, aligned parallel to the joint axis (see Figure 14, item 4) <i>NOTE Illustration from BS EN ISO 17659.</i>

Figure 14 Typical example of weld made using pressure – Double row of staggered, spaced spot welds

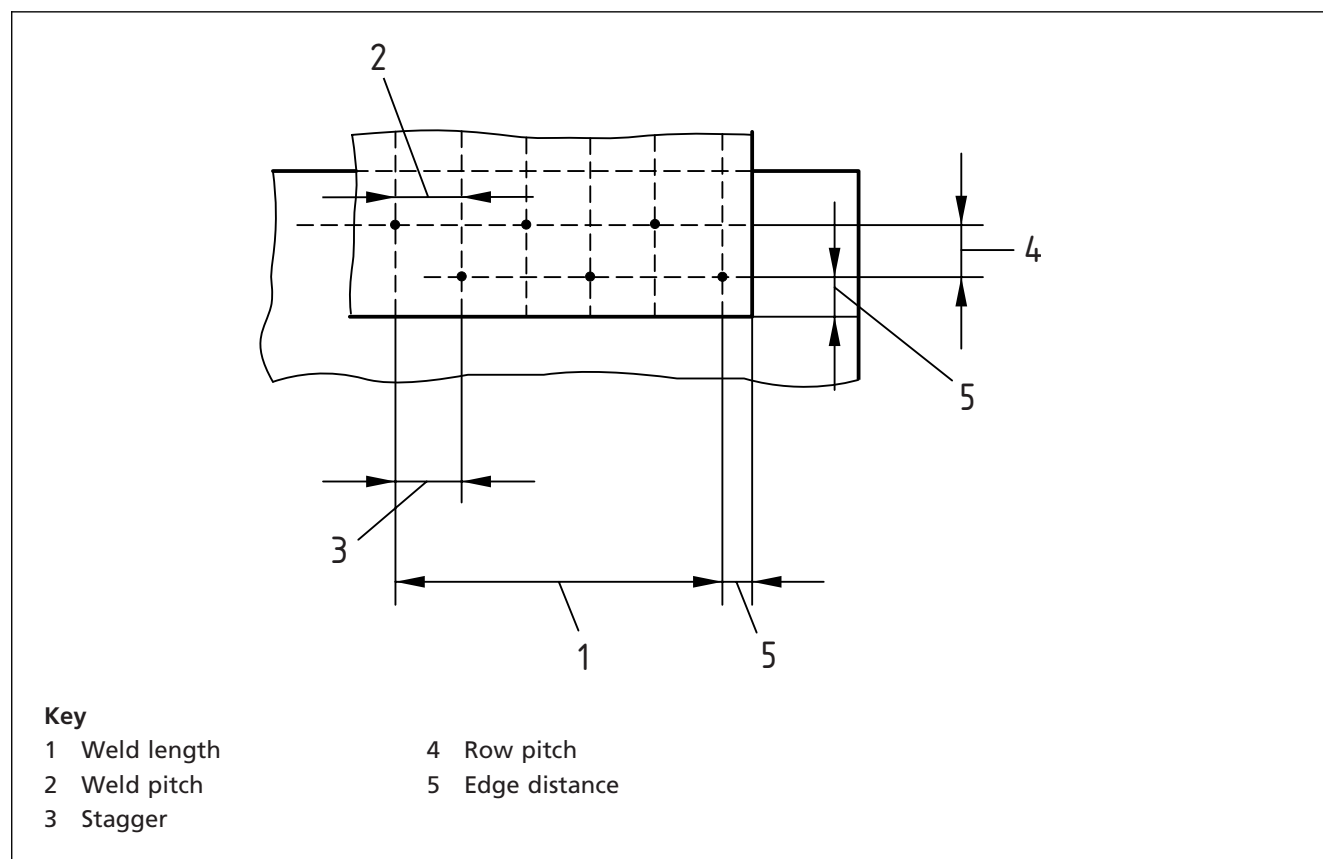
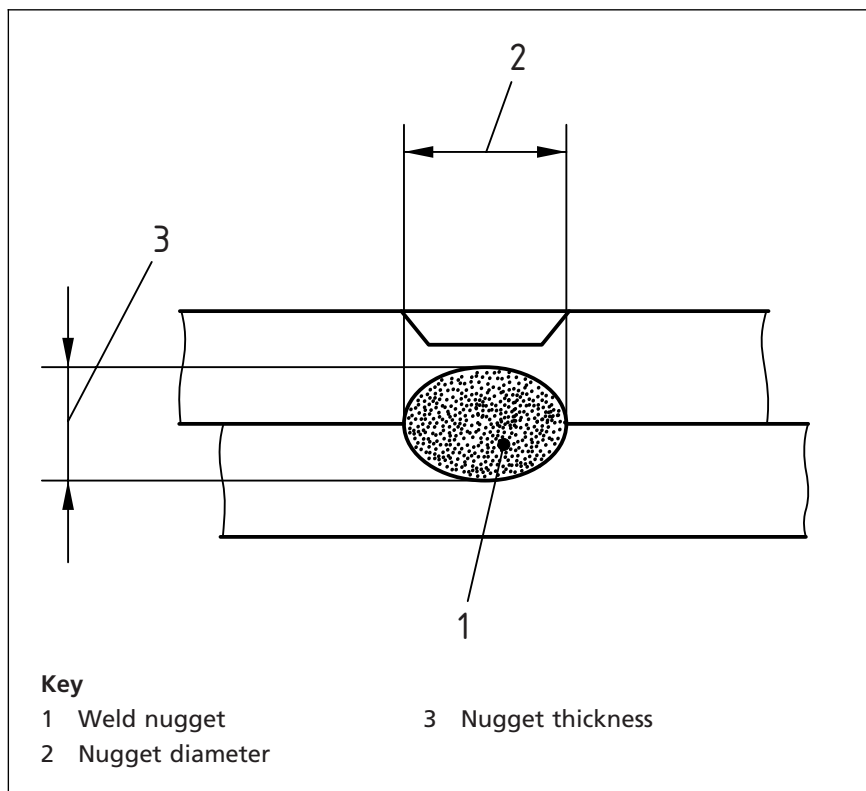
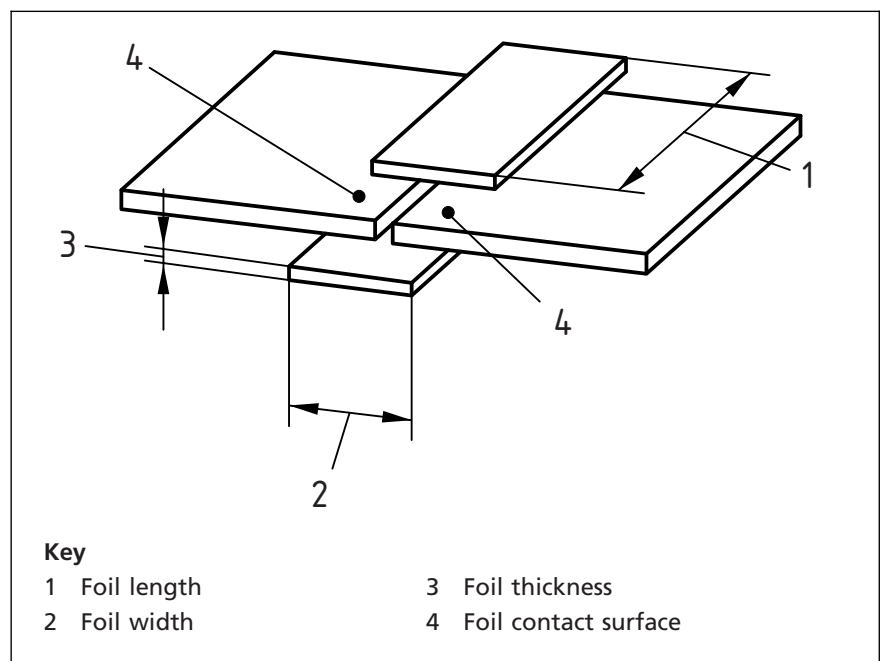


Figure 15 Typical example of weld made using pressure – Projection weld



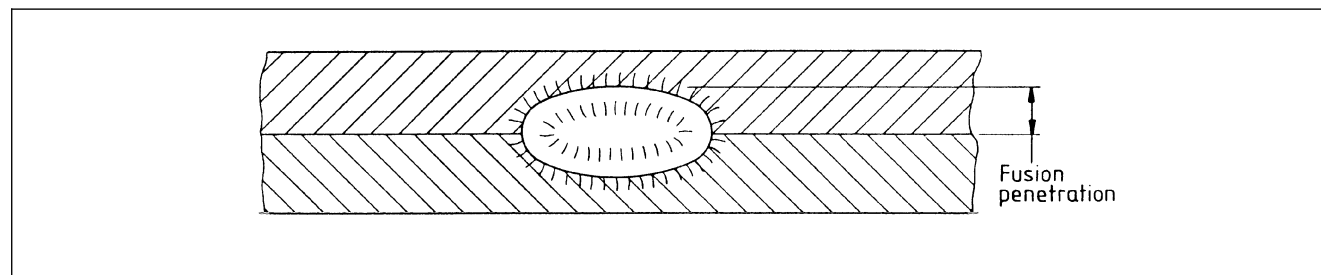
No.	Term	Definition
22 048	pitch of projections	distance between adjacent projection centres in a direction parallel to the joint line [see Figure 13a), item 2, Figure 13b), item 2, and Figure 13c), item 2]. <i>NOTE Illustration from BS EN ISO 17659.</i>
22 049	weld pitch	<i>In a double row of spot welds, distance between adjacent weld centres in a direction parallel to the joint line (same as "stagger"; see Figure 14, item 2)</i> <i>NOTE Illustration from BS EN ISO 17659.</i>
22 050	foil thickness	thickness of foil in a foil butt seam weld (see Figure 16, item 3) <i>NOTE Illustration from BS EN ISO 17659.</i>

Figure 16 Foil butt-seam weld



22 051	nugget thickness	maximum height of nugget in the thickness direction (see Figure 15, item 3) <i>NOTE Illustration from BS EN ISO 17659.</i>
22 052	projection height	height of projection prior to welding [see Figure 13a), item 3, Figure 13b), item 3, and Figure 13c), item 3] <i>NOTE Illustration from BS EN ISO 17659.</i>
22 053	indentation	depression on the exterior surface or surfaces of a spot or seam weld
22 054	projection width	<i>In elongated projections, width of projection, transverse to the joint direction [see Figure 13b), item 7]</i> <i>In annular projections, difference between the inner and outer radius of an annular projection [see Figure 13c), item 7]</i> <i>NOTE Illustration from BS EN ISO 17659.</i>
22 055	foil width	width of foil, measured transverse to the joint axis (see Figure 16, item 2) <i>NOTE Illustration from BS EN ISO 17659.</i>

No.	Term	Definition
22 056	projection length	length of an elongated projection [see Figure 13b), item 6] <i>NOTE Illustration from BS EN ISO 17659.</i>
22 057	foil length	length of foil, parallel to the joint axis (see Figure 16, item 1) <i>NOTE Illustration from BS EN ISO 17659.</i>
22 058	weld nugget	zone in a spot, seam or projection weld where the metal has been melted (see Figure 17)

Figure 17 **Weld nugget**

No.	Term	Definition
22 059	indentation depth	depth of permanent indentation of joint surface produced by electrode after welding (see Figure 18, item 5) <i>NOTE Illustration from BS EN ISO 17659.</i>
22 060	nugget overlap	width of re-melting of nugget by adjacent nugget (see Figure 19, item 3) <i>NOTE Illustration from BS EN ISO 17659.</i>

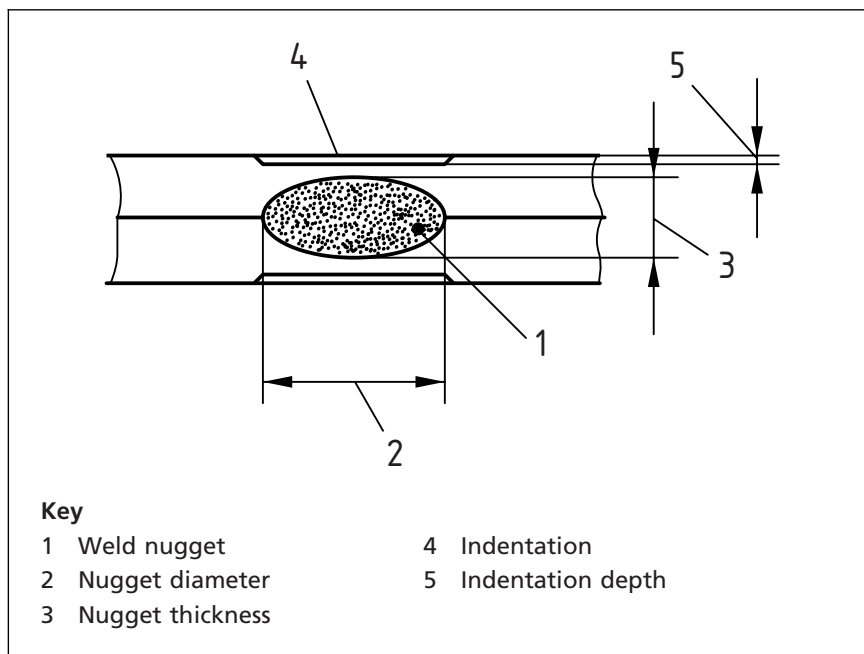
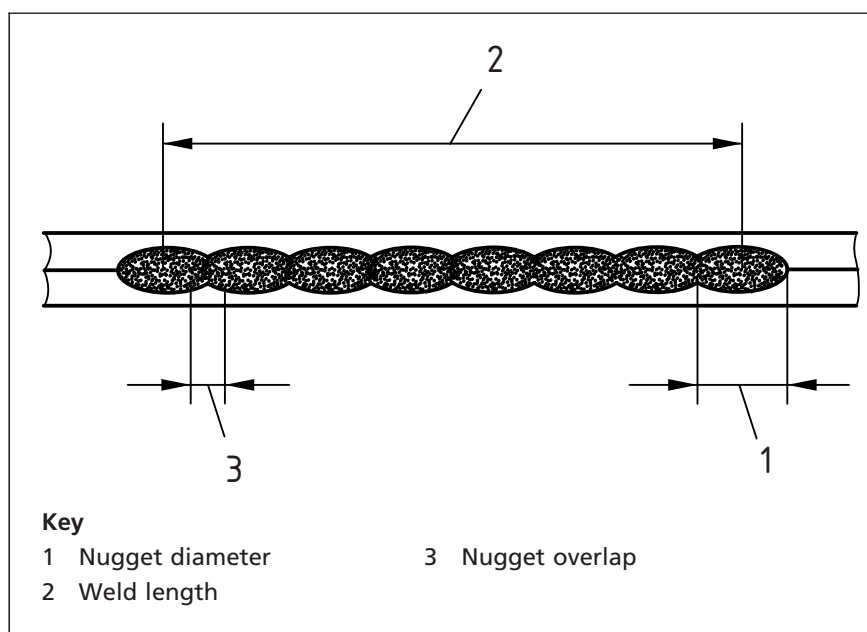
Figure 18 **Typical example of weld made using pressure – Resistance spot welds**

Figure 19 Typical example of weld made using pressure – Seam weld



No.	Term	Definition
22 061	resistance weld setter	<i>in resistance welding</i> , person who sets up mechanized or automatic welding
22 062	foil contact surface	contact surface between foil and workpiece (see Figure 16, item 4)
		<i>NOTE Illustration from BS EN ISO 17659.</i>
22 063	mash seam weld	seam or stitch weld, between two components of similar thickness, where the amount of overlap determines the width of weld, so made that the ultimate thickness of the workpiece at the weld approximates to that of one component (see Figure 20)
22 064	nail head welding	variant of heated nozzle welding in which the end of one or two wires which has been fed through the nozzle and heated by a flame or electric discharge, forms a small globule, which under the effect of the applied force is flattened into the shape of a nail head (see Figure 21)

Figure 20 Mash weld

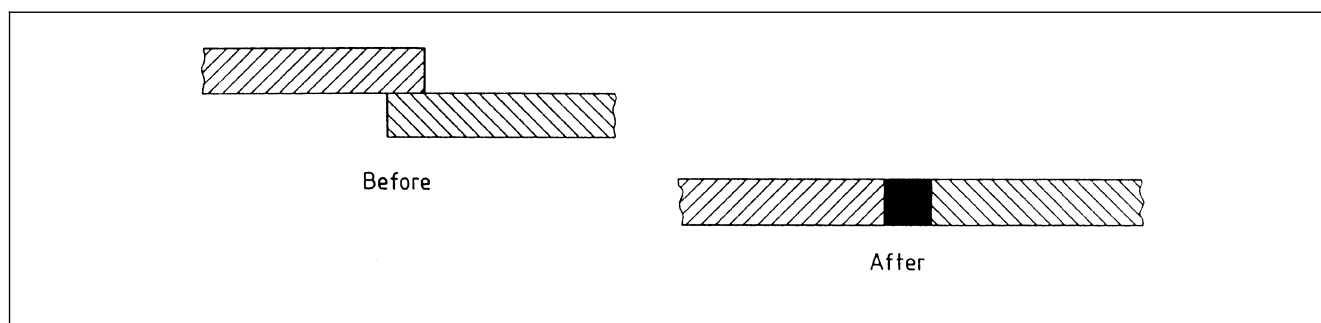
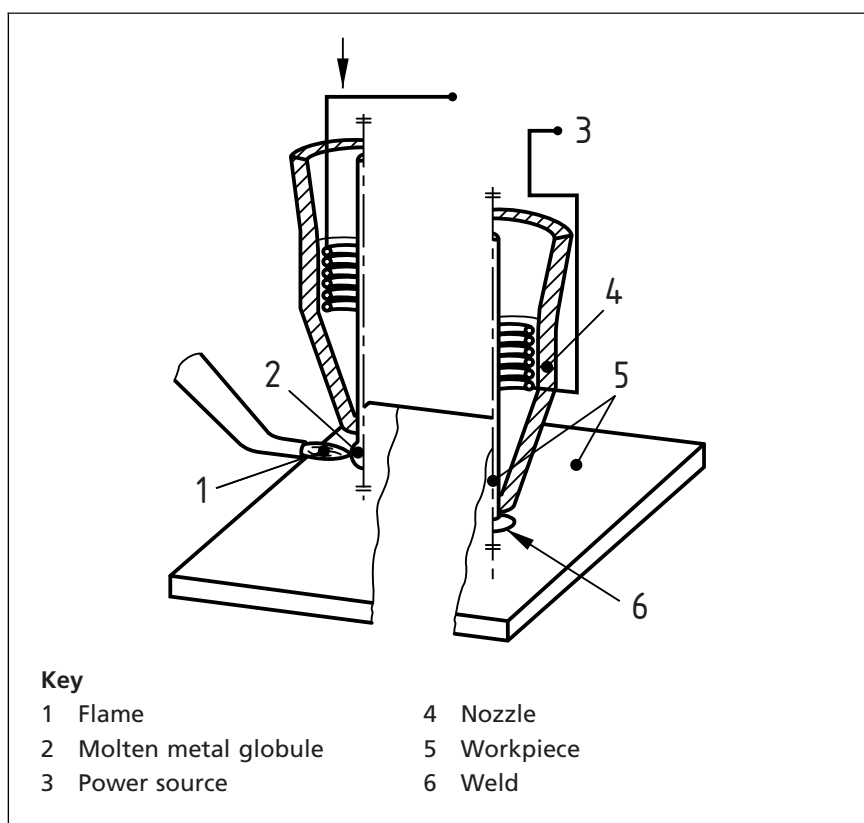


Figure 21 Nail head welding



No.	Term	Definition
22 065	straight flash welding	flash welding technique in which flashing starts as soon as the workpieces are brought into contact and is maintained until upsetting takes place
22 066	flash welding with preheating	flash welding technique in which preheating current is applied to the workpieces to facilitate the onset of flashing
22 067	roller spot welding	spot welding in which force is applied continuously and current intermittently to produce a line of separate spot welds, the workpieces being between two electrode wheels or between an electrode wheel and an electrode bar; the wheels apply the force and current and rotate continuously while the line of welds is being made
22 068	step-by-step roller spot welding	spot welding in which force is applied continuously and current intermittently to produce a line of separate spot welds, the workpieces being between two electrode wheels or between an electrode wheel and an electrode bar; the wheels apply the force and current and are stationary during the normal flow of current and rotate when reduced or no current is flowing
22 069	step-by-step seam welding	resistance welding in which force is applied continuously and current intermittently to produce a linear weld, the workpiece being between two electrode wheels or between an electrode wheel and an electrode bar; the wheels apply the force and current and are stationary during the normal flow of current and rotate when reduced or no current is flowing

No.	Term	Definition
22 070	step-by-step welding	seam or roller spot welding in which the electrode wheel is stationary during the passage of weld current and rotates when reduced or no current is flowing
22 071	butt-seam welding	resistance welding applied progressively to a butt joint; electrodes press on the work on each side of the joint to pass current through it while welding force is generally applied by other means
22 072	foil butt-seam welding tape butt-seam welding	seam welding of two close square butted components with metal tape or wire placed or fed centrally to bridge one or both sides of the joint (see Figure 16)
22 073	pulsation welding woodpecker welding: <i>deprecated</i>	spot or projection welding in which the welding current is interrupted one or more times without release of pressure or change of location of the electrodes
22 074	half-cycle welding	spot, projection or percussion welding in which the welding operation is completed in a whole or part of any one half cycle of the a.c. supply
22 075	electrode tip	surface of an electrode for spot or stitch welding intended to make contact with the workpiece
22 076	vertical electrode	electrode for spot or stitch welding in which the electrode tip is normal to the axis of the electrode shank
22 077	angle electrode inclined electrode	electrode for spot or stitch welding in which the electrode tip is not normal to the axis of the electrode shank
22 078	offset electrode	electrode for spot or stitch welding in which the electrode tip is not concentric with the axis of the electrode shank
22 079	vertical centre electrode straight electrode	vertical electrode where the electrode tip is concentric with the axis of the electrode shank (See Figure 22.)
22 080	vertical offset electrode	vertical electrode where the electrode tip is not concentric with the axis of the electrode shank (See Figure 23.)

Figure 22 Vertical centre electrode

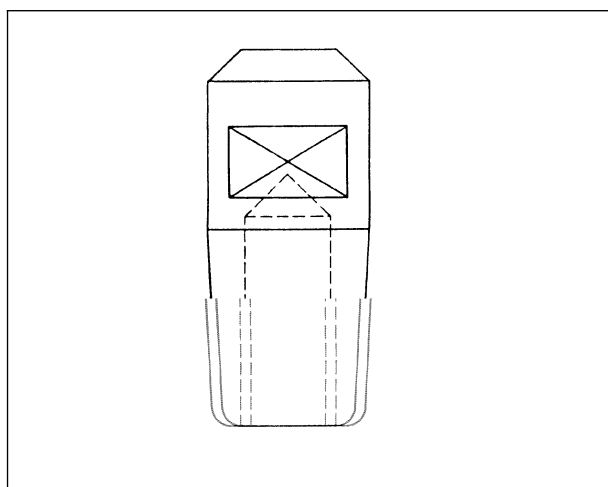
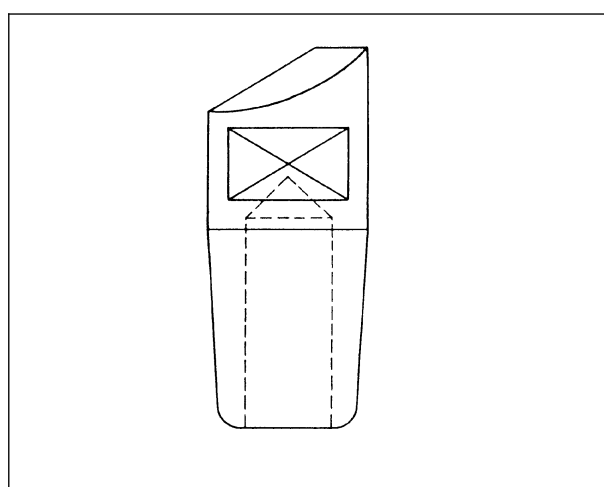


Figure 23 Vertical offset electrode



No.	Term	Definition
22 081	angle offset electrode	angle electrode in which the electrode tip is not concentric with the axis of the electrode shank (see Figure 24)
22 082	cranked offset electrode cranked electrode	offset electrode in which the centreline of the electrode is not straight (see Figure 25)

Figure 24 Angle offset electrode

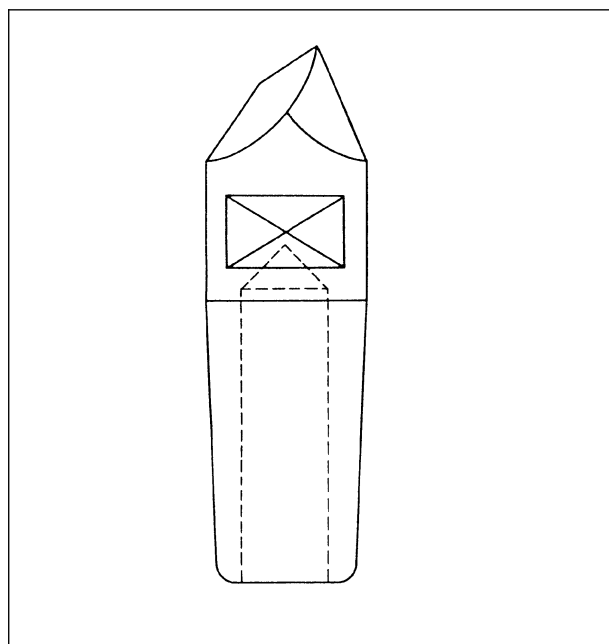
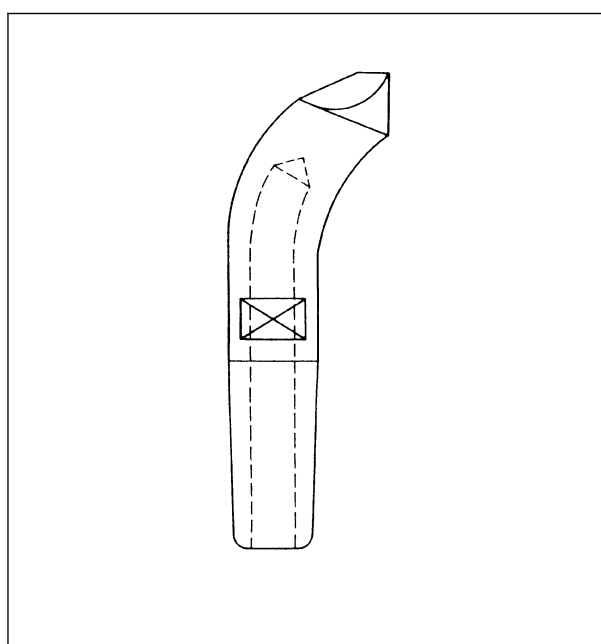


Figure 25 Cranked offset electrode



No.	Term	Definition
22 083	pad electrode flat electrode	electrode having an area of contact with the work that is much larger than the weld required
22 084	tread	peripheral surface of an electrode wheel
22 085	electrode pick-up	contamination of the resistance welding electrode by metal or scale from the surface of the workpiece
22 086	surface pick-up	contamination of the surface of a resistance weld by particles of the electrode
22 087	welding die die	device for locating the components of a workpiece in a resistance welding machine and for transmitting force and welding current to them
22 088	insert	small piece of metal, usually hard wearing and of comparatively high resistivity, used as an electrode tip, or attached to a welding die and projecting sufficiently beyond it to make contact with the workpiece
22 089	platen	part of a resistance welding machine on which welding dies or bolsters can be mounted and which conveys force and welding current to them
22 090	bolster	electrode holder for mounting on a platen
22 091	arm	member projecting from a resistance welding machine, which carries current, or supports a conductor carrying current, to an electrode holder and which is required to transmit or support the welding force
22 092	fin	extrusion of metal extending outward beyond the upset metal in the form of a fin
22 093	splash	thin streaks of metal left adhering between the components or on their surfaces as the result of molten metal being expelled from a joint or from under the electrodes during spot, seam, or projection welding

No.	Term	Definition
22 094	weld contact area interface: <i>deprecated</i>	area through which welding current passes from one component to another during resistance welding
22 095	electrode contact area clamp contact area die contact area	area through which current passes from an electrode or a clamp to the workpiece
22 096	backward force ⁴⁾ back pressure: <i>deprecated</i>	force tending to separate the electrodes
22 097	electrode force ⁴⁾	force transmitted by the electrodes to the workpiece
22 098	backward pressure back pressure: <i>deprecated</i>	pressure (force per unit area) resulting from the backward force
22 099	hand-operated welding machine	welding machine in which the mechanical force is applied by hand
22 100	foot-operated welding machine pedal-operated welding machine	welding machine in which the mechanical force is applied by means of a pedal
22 101	power-operated welding machine	welding machine in which mechanical force is applied by an inanimate source of power
22 102	motor-operated welding machine	welding machine in which the travel of the electrode is provided and the mechanical force is applied by means of a motor-driven mechanism
22 103	portable spot-welding machine	spot-welding machine: a) that can be carried about complete, or b) in which the electrodes, the moving arms and the force application device have flexible connections to a fixed transformer and control equipment, thus providing a limited amount of portability
22 104	plier spot-welding machine pincer spot-welding machine	portable spot-welding machine in which force is applied to electrodes by means of a lever system similar to that of pliers
22 105	capacitor spot-welding machine ⁵⁾ condenser-discharge spot-welding machine	spot-welding machine in which welding current is caused to flow through the secondary winding of a transformer and the welding electrodes by the discharging of a capacitor through the primary winding of the transformer
22 106	inductor spot-welding machine ⁵⁾ induction spot-welding machine	spot-welding machine in which the welding current is caused to flow through the secondary winding of the transformer and the welding electrodes by the interruption of the flow of a direct current through the primary winding of the transformer
22 107	battery spot-welding machine ⁵⁾	spot-welding machine in which a battery is used to provide the welding current
22 108	weld slug	piece of metal pulled from one sheet when a spot or projection weld is prised apart <i>NOTE The diameter of the slug may be used for weld quality assessment.</i>

⁴⁾ Force is sometimes incorrectly referred to as pressure. See terms 22 020 and 22 098.

⁵⁾ These machines are sometimes referred to as "stored-energy machines".

No.	Term	Definition
22 109	preheat time	duration of preheating current <i>NOTE In flash welding it is the time between the first passage of current and the start of continuous flashing.</i>
22 110	squeeze time⁶⁾	period of time between the normal application of force by the electrodes to the work and the first passage of current
22 111	heat time⁶⁾ on-time	duration of each successive current impulse, in pulsation and seam welding
22 112	step time⁶⁾	<i>In roller spot welding and in step-by-step roller spot welding,</i> period of time between successive weld times
22 113	chill time⁶⁾ quench time	period of time between the end of welding current and the start of post-heating current
22 114	post-heat time⁶⁾	duration of flow of post-heating current
22 115	current-off time⁶⁾	period of time between the cessation of current in one welding cycle and the beginning of current in the next
22 116	pressure-off time⁶⁾	<i>In spot, seam and projection welding,</i> period of time between two successive welding cycles when no electrode force is being applied to the workpiece
22 117	preheating current	current used to raise the temperature of a workpiece from ambient temperature to a predetermined value below welding temperature just before the application of welding or flashing current

⁶⁾ Attention is drawn to Figures 26 to 37 for diagrammatic representations of these terms.

Figure 26 Time and pressure diagram for simple spot, stitch, or projection welding

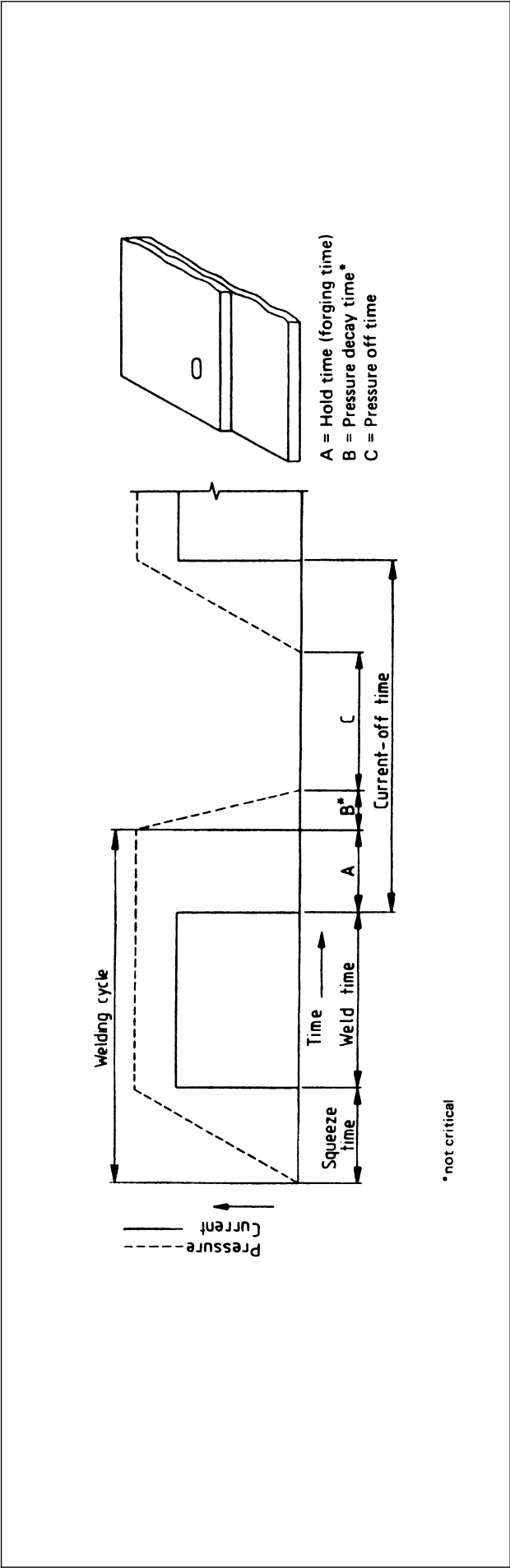


Figure 27 Time and pressure diagram for pulsation spot or projection welding

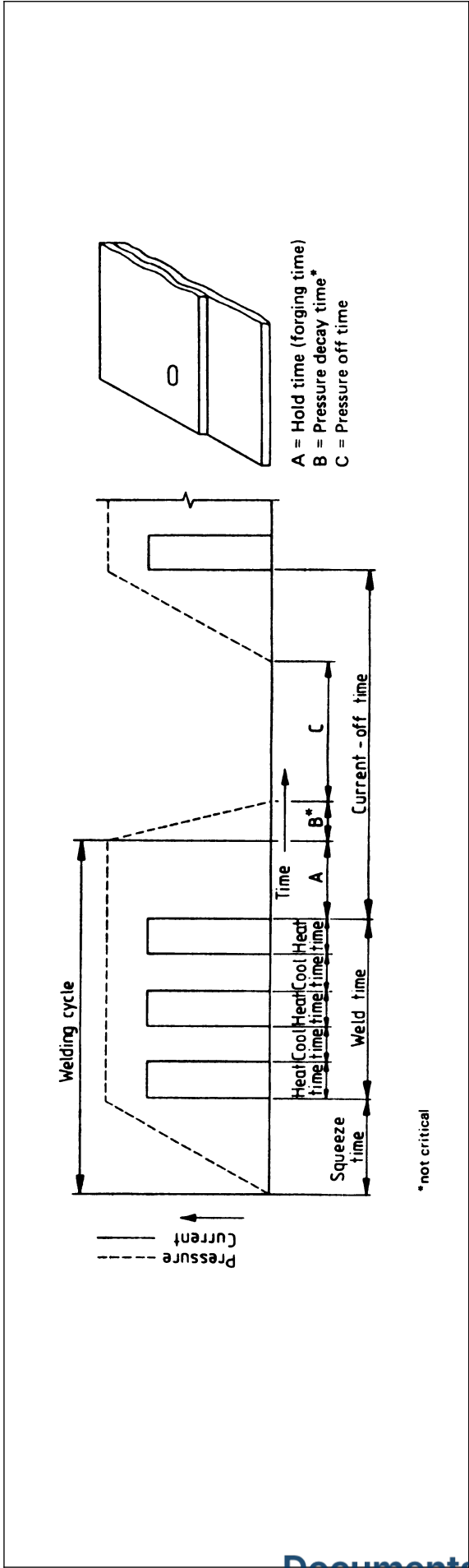


Figure 28 Time and pressure diagram for spot or projection welding, programme control

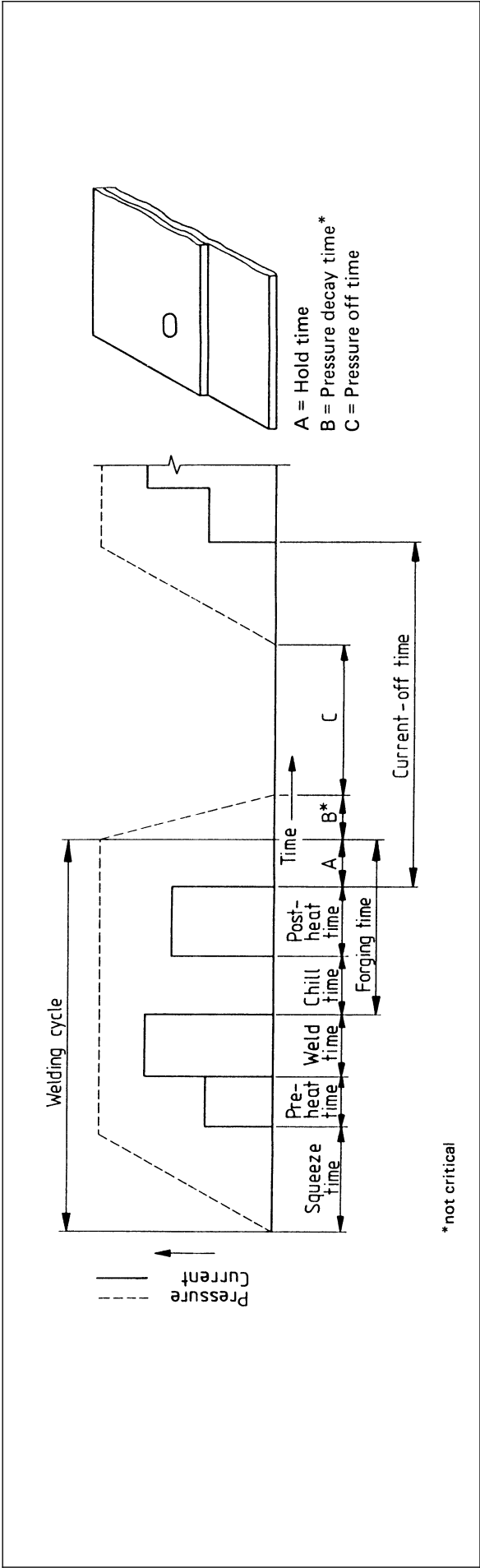


Figure 29 Time and pressure diagram for pulsation spot or projection welding, programme control

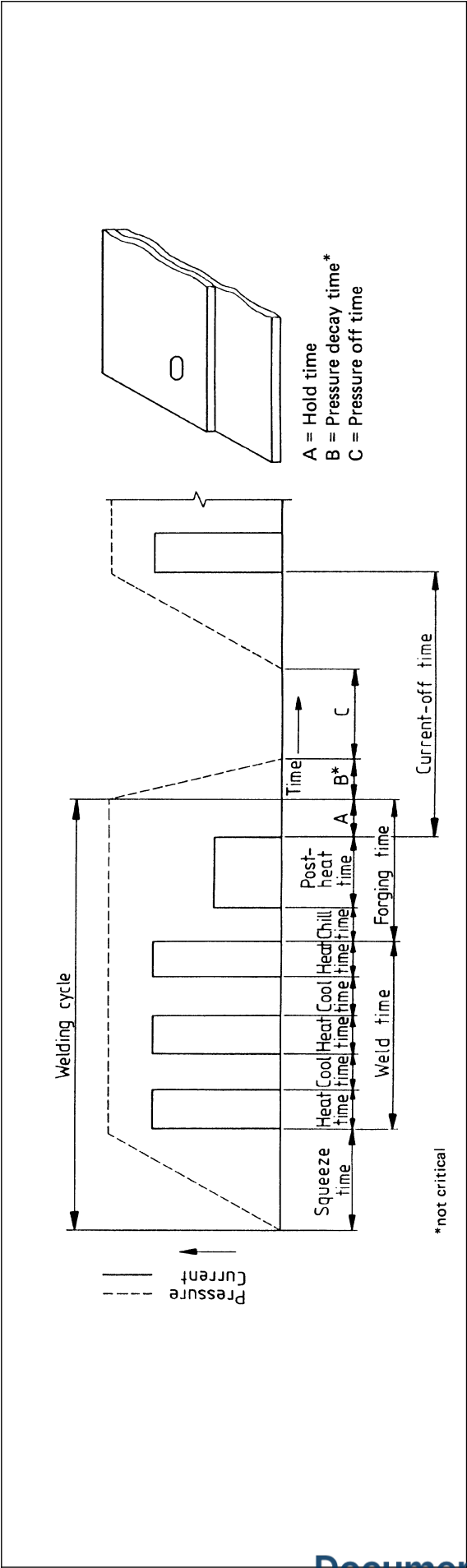


Figure 30 Time and pressure diagram for spot welding, programme control with dual-pressure cycle

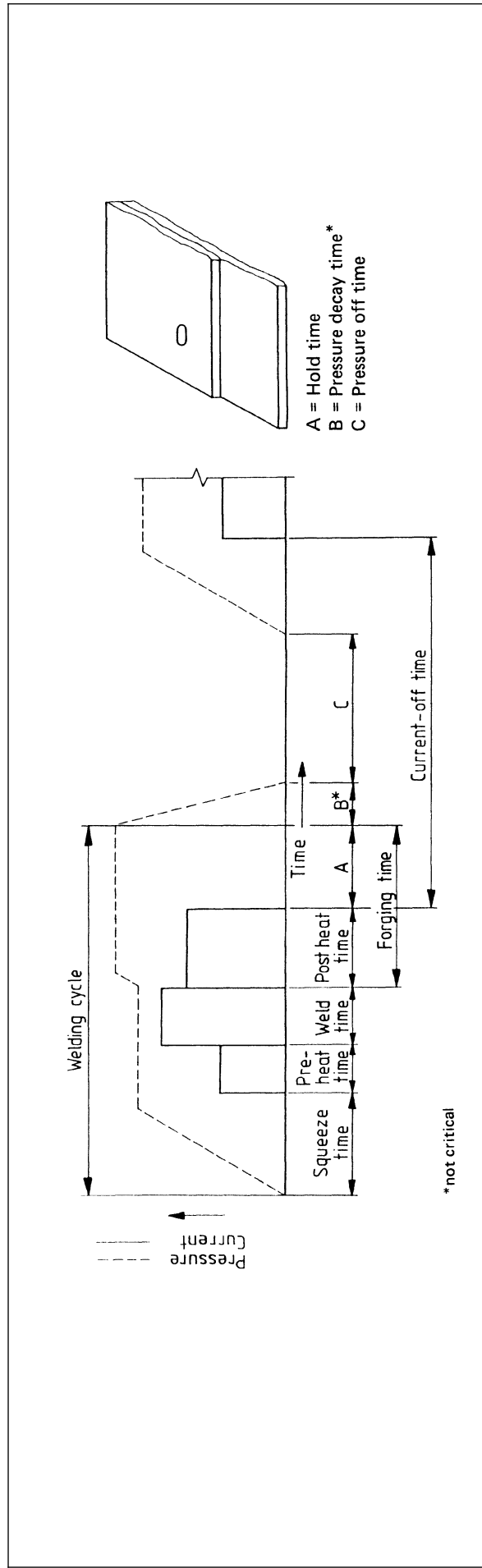


Figure 31 Time and pressure diagram for seam welding

