

This heading comprises four parts:

Part A Removing metal (and non-metals *when not provided for elsewhere*) by electro-erosion

Part B Miscellaneous working of metals *not provided for elsewhere*

Part C Removal of material by laser

Part D Removing metal by fusion (*other than* as provided for in Parts A and C of this heading and *including* removing non-metals by sputter etching *when not provided for in other headings*)

Relationship with the Universal Indexing Schedules (heading U1S)

In addition to recording the nature of broader processes or apparatus with or in which inventions classified here may be used, U1S is used, subject to its indexing rules, to index materials operated on and useful products obtained, except for mere references to “metals” or “metal articles” or to tubes or sheets, which are regarded as commonplace applications

Operative date for Key entries

The operative dates of the terms in this heading are:

1. for terms annotated by a marginal code, that of the Edition corresponding to the code
2. for other terms in this Edition, earlier than that of Edition A

Exclusion references

The exclusion references listed in this heading are not exhaustive. Reference should be made to the appropriate general heading/s for processes, materials, elements or devices which may be more widely applicable than can appropriately be classified in this heading

PART A: Electro-erosion

Explanation of subject matter and relationship with other headings

Classified here are apparatus and processes for removing metal by:

- (a) electric discharge machining *ie* by means of an intermittent spark or arc discharge between an electrode and a workpiece
- (b) electrochemical machining *ie* by passing a current between an electrode and a workpiece in the presence of an electrolyte

Also classified here are apparatus and processes for removing non-metallic materials by electro-erosion *when not provided for in other headings*

Excluded are:

- . electrolytic removal which is not localised or does not involve a substantial change in shape *eg* etching, roughening, graining, polishing, stripping—C7B, Electrolysis (deburring falling within this definition is also to be found in heading C7B; other deburring by electro-erosion is to be found in this heading B3V)
- . processes for surface hardening by electro-erosion—C7N, Heat treatment of metals

Other exclusions are to be found in the body of the Classifying Schedule

Part A—contClassifying Schedule

. *See also* Indexing Schedule for Part A

- h VEA association of electro-erosion with other technique *eg* grinding  
 . electrode constructions incorporating abrasives &c—*See* term VEEC *below*  
 . association of metal electro-erosion with other metal working or treating operation where there is significant interest in the association—B3A, Multi-operation metal article manufacture
- h VEB association of electric discharge and electrochemical machining  
 . electrode constructions for electric discharge and electrochemical machining—*See* term VEEC *below*  
 control and command; measuring; indicating—  
 . disclosures which are predominantly electronic—*See* G3N, Automatic electric control systems; G3R, Electric retroactive control; H2K, Electric protective systems  
 . disclosures of interest to machine tools in general—*See* B3B, Machine tool details  
 . sensing, measuring and testing techniques of interest *per se*—*See* G1- headings as appropriate  
 . programmed or condition responsive control of—  
 . . gap size  
 . . relative movement of tool and work *eg* to machine a particular contour (*including* vibration of tool and or work; *excluding* movement specifically to adjust gap size)
- h VECP . . electrode power supply *eg* to suppress short circuits; to control pulse timing  
 h VECF . . fluid supply or composition  
 h VECM . . machine on/off *eg* disabling machine in response to fault detection  
 . . . switching off current supply to electrode—*See* term VECP *above*
- h VECD . . indicator; display; alarm  
 h VECQ . . other single factor  
 h VECW . . more than one of the above; unspecified  
 h VECX . control and command, measuring, indicating subjects *not provided for above*
- h VED overall organisation of electro-erosion apparatus and processes *not provided for elsewhere*  
 unit subjects—  
 . control; measurement, indication of the subjects set out below—*See* terms VEC- *above*
- h VEP . concerning power supply  
 . . to suppress short circuits &c—*See* term VECP *above*  
 . . pulse circuits of general interest—*See* H3- headings as appropriate  
 . concerning electrode—  
 . . mounting, supporting, guiding, feeding, pre-positioning—  
 . . . wire electrode  
 . . . other or unspecified
- h VEEW . . construction (*including* electrode assemblies); composition  
 h VEEB . . other  
 h VEEC . concerning working/cooling fluid *including* dealing with waste products—  
 h VEEX . . composition  
 h VEFC . . other *eg* storing, supplying, regenerating, dealing with waste products  
 h VEFX . concerning workpiece *eg* feeding, conveying, supporting  
 h VEW . . as part of electro-erosion process *eg* vibrating workpiece during electro-erosion—*See* elsewhere as appropriate *eg* terms VECT; VED *above*
- h VEX . other unit subjects
- h VEQ applications of electro-erosion (*eg* making particular articles)

Indexing Schedule for Part A

. terms from this Schedule are assigned with any classifying term from Part A

- h V4A1F applications of electro-erosion—  
 V4A1H . eroding metallic layer on backing member  
 V4A1K . making metal powder  
 h V103 . surface hardening  
 . eroding non-metal workpiece
- h V101 nature of electro-erosion technique—  
 h V102 . electric discharge  
 . electrochemical
- h V4A1E3 other features—  
 h V4A1W . vibrating or reciprocating electrode or workpiece  
 h V4A1M . travelling wire electrode  
 . use of magnetism

PART B: Miscellaneous working of metals not provided for elsewhere

*This Part of the heading comprises only the following subject matter:*

- . altering physical or molecular structure of metal by mechanical treatment
- . crushing or flattening waste metal buckets, cans, and like articles
- . end-capping rods and tubes
- . jointing metal to metal and other materials (*eg* ceramics), and jointing ceramics to ceramics, *by methods not provided for in other headings*
- . making articles from old rails and scrap (*including* reworking worn articles, *not provided for in other headings*)
- . producing flow of metal by rotary smooth discs or other rubbing-tools
- . thermo-aluminic and like chemical reaction processes
- . unjointing adhesive joints by mechanical force
- . working metal at specific temperatures
- . miscellaneous metal working procedures not provided for in other headings

Excluded are:

- . metal working and treating operations and combinations thereof provided for by other B3- headings or by C7- headings
- . machine tool details—B3B, Machine tool details
- . machine-element constructions of general interest—F2- headings as appropriate

*To facilitate searches for combinations of features, throughout this part of the heading each feature is indexed for which a coded term is available, irrespective of novelty*

- altering physical or molecular structure of metal by mechanical treatment—
  - . applied to special work—
    - V2D1 . . magnetic sheets and wire
    - V2D2 . . reinforcement members
    - V2D3 . . springs
  - V2A . explosive treatment
  - V2B . vibration treatment
  - V2C . other mechanical treatment
- V9 crushing or flattening waste buckets, cans, and like articles
- V6 end-capping rods and tubes
  - . capping cans. *See* B3J, Seaming &c metal sheets
  - . capping nails. *See* B3H, Power hammers &c
  - . force fits, assembling, apparatus and processes for. *See* B3U, Riveting &c
- V10 jointing metal to metal and other materials (*eg* ceramics), and jointing ceramics to ceramics, *by methods not provided for in other headings*
  - . adhesive compositions. *See* C3A, Cellulose derivatives &c; C3B, Epoxy resins; C3P, Addition polymers &c; C3V, Miscellaneous polymer compositions, articles and uses; C4X, Miscellaneous compositions and materials
  - . by interposed vitreous materials subjected to heat. *See* C1M, Glass and vitreous enamels
  - . by sintering powdered metal. *See* C7D, Process metallurgy &c
  - . compound united sheets of metal with other materials. *See* B5N, Laminated products
  - . processes and apparatus for uniting metal and ceramic materials by casting the metal. *See* B3F, Casting metals
  - . soldering, brazing or welding where a metal is involved *eg* metal-to-ceramic, or ceramic-to-ceramic with interposed metal—*See* B3R, Welding, soldering and brazing
- V7 making articles from old rails and scrap, *including* reworking worn articles, *not provided for in other headings*
  - . by piling. *See* B3H, Power hammers &c
- V1 producing flow of metal, by rotary smooth discs or other rubbing tools
  - . severing by high speed rotary smooth discs. *See* B5L, Sawing, woodworking &c
- V5 thermo-aluminic and like chemical-reaction processes
  - . casting apparatus and processes. *See* B3F, Casting metals
  - . clamps for use in welding. *See* B3R, Welding, soldering and brazing
  - . thermo-aluminic and like mixtures. *See* C5G, Fuels; C7D, Process metallurgy &c
- V11 unjointing adhesive joints by mechanical force
- V3 working metal at specific temperatures
  - . miscellaneous metal working procedures *not provided for in other headings*—
    - VX4 . blowing after the manner of glass-blowing
    - VX7 . by cavitation in liquid
    - VX3 . metal flakes, making by unclassified operations
    - VX6 . repairing damaged panels by successively applying resin and layers of glass fibres
    - VX5 . surfaces, treating non-mechanically to prevent the spreading of minute cracks
    - VX1 . working articles formed from single crystals without finally changing the crystalline state

PART C: Removal of Material by LaserExplanation of Subject Matter and Relationships with other headings

This Part deals with subject-matter where the centre of interest lies in cutting or machining a workpiece using a laser beam. Such operations include the formation of a hole or a linear cut, or only cutting part-way through a workpiece *eg*, scoring, or removing surface irregularities, and may be done by burning, melting, or causing the material to crack as the result of a thermal shock

Where the disclosure essentially relates to a specialised laser operation for which specific provision is made in another heading it is classified in that heading, *eg* production of printing plates—*See* B6C, Printing &c; medical use—*See* A5R, Medical, dental and veterinary equipment; cigarette perforation—*See* A2C, Cigarettes, tobacco &c. Disclosures in which the use of a laser is merely incidental or the laser beam is listed as one of several possible tools, or is only used in one of several operations and is not the centre of interest, are classified in the heading appropriate to the purpose specified. Disclosures in which the centre of interest lies merely in the use of a laser for a given purpose (*eg* substituting it for a known tool) are also dealt with by the heading appropriate for the purpose specified. Headings which may need to be considered in these connections include those referred to above, and also B3A, Multi-operation metal article manufacture; B4B, Cutting &c; B5A, Moulding plastic substances &c; B5E, Working stone &c; B5L, Sawing, woodworking &c; C1M, Glass and vitreous enamels; and Part D of this heading, B3V

Disclosures where neither the nature of the workpiece nor of the tool is central to the disclosure, such as positioning of tools relative to workpieces, holding and securing workpieces, catching debris, cooling, &c are subject matter for B3B, Machine tool details

Disclosures where the interest is in a control system are classified in G3N, Automatic electric control systems

In general, if the disclosure essentially concerns the use of a laser for a cutting or machining operation and appears to be of wider applicability than any one heading (even if there is only disclosure of one application) it is classified in this Part, subject to the exclusions below

Optical control of laser beams where the interaction of the beam with the workpiece is not of interest is primary subject matter for G2F, Controlling light or G2J, Optical apparatus &c

Containing or dispersing the beam to render it harmless outside the immediate machining site is subject matter for G2J, Optical apparatus &c

Production of the laser beam *per se* is subject matter for H1C, Stimulated-emission devices

Use of the Classifying Schedule These notes are intended for guidance and should not be taken to detract from the generality of the terms as set out in the Classifying Schedule

Terms VLA and VLB: Associations of laser machining or cutting operations

These terms cover disclosures where the laser operates simultaneously with another operation, and also those where a two-stage process is involved *eg* using a laser to make a mask which is then used in a further laser or other operation or the application of thermal shock by laser, to pre-stress a workpiece in order to crack it mechanically

Term VLC: General arrangement of apparatus

This term is applied when no one aspect is identifiable as being of prime importance

Terms VLD and VLE: Controlling characteristics of the beam

These terms are applied for disclosures concerned with controlling the effect of the beam on the workpiece. Among the properties of the beam which may be controlled are focus (*eg* on an irregularly shaped object), pulse duration, intensity, wavelength and beam diameter

Term VLF: Synchronisation or other coordination of relative travel of beam and workpiece

Term VLG: Introducing gas stream, suction, or special atmosphere to workpiece—*See* Indexing Terms V241 to V246 for the purposes for which the gas streams &c are used. Atmosphere chambers are also classified here

Term VLH: Enhancement of effect of beam. The principal subject classified here is the use of absorbent coatings to enhance the heating of non-absorbent (*ie* transparent or reflecting) materials

Part C—cont

Term VLJ: Removal of, or protection of workpiece from, debris. This term includes coatings peeled off after the laser operation, in a manner similar to masking tape

Term VLK: Patterns, masks and templates. This includes all the techniques indexed by terms V251 to V25X. If the pattern is the workpiece itself (*eg* following its edge in order to make a parallel cut) it is classified by term VLD

Term VLX: Other subjects

In certain of the unit subjects provided for in the Classifying Schedule there is affinity with other headings where lasers are used for other purposes, *eg* B3R, Welding, soldering and brazing; C7N, Heat-treatment of metals, B5K, Joining, binding, folding edges; B6C, Printing &c (*eg* for production of lithographic printing plates) B6F, Selective printing &c; keyboards and B6J, Engraving, etching and embossing

Prior to Edition J, the subject-matter of this Part was classified according to the materials or applications specified in the disclosure, much being previously classified under term V4A2C in Part D of this Heading

Classifying Schedule

. *See also* Indexing Schedule for Part C

association of laser machining or cutting operation—

j VLA . with one or more other laser machining or cutting operations only

j VLB . with one or more simultaneous non-laser operation(s)

j VLC general arrangement of apparatus, *including* associations of subjects *below*

controlling characteristics of the beam—

. optical apparatus including beam steering and scanning arrangements—*See* G2J, Optical apparatus &c, G2F, Controlling light

. laser construction—*See* H1C, Stimulated-emission devices

j VLD . using feedback from sensors monitoring the workpiece, *eg* sensing temperature, position

. . sensors *per se*—*See* headings appropriate to the sensing technique *eg* G1D, Heat and temperature measurements; temperature-responsive actuators

. . synchronising movement—*See* term VLF *below*

j VLE . other

j VLF synchronisation or other co-ordination of relative travel of beam and workpiece

j VLG introducing gas stream, suction, or special atmosphere to workpiece being machined (*eg* for inhibiting or promoting a reaction, cooling, debris removal &c)

. cooling of optical system—*See* G2J, Optical apparatus &c

j VLH enhancement of effect of beam *eg*, absorbent coating

. reactive gas—*See* term VLG *above*

j VLJ removal of, or protection of workpiece from, debris

. by suction, by blowing—*See* term VLG *above*

j VLK patterns, masks, templates

. absorbent coatings—*See* term VLH *above*

. using feedback from the workpiece itself—*See* term VLD *above*

. controlling the laser using signals derived by scanning an original on a point to point basis (*eg* raster scan)—*See* H4F, Pictorial communication

j VLX other subjects

Part C—contIndexing Schedule for Part C

		workpiece shape—
j	V201	. block
j	V202	. sheet material—
j	V203	. . stack
j	V204	. . single sheet
j	V205	. . continuous web
j	V20X	. other specified shape
		workpiece material—
j	V211	. metal
j	V212	. wood
j	V213	. glass
		. stone—
j	V214	. . gems
j	V215	. . other
j	V216	. ceramic
j	V217	. semiconductors
j	V218	. human or animal tissue
j	V219	. plastics
j	V220	. paper
j	V221	. woven fabric
j	V21X	other specified material
		operations performed by laser—
		<i>Note: specialised laser techniques relating to certain operations for which indexing terms are provided below are classified in the Headings indicated in brackets</i>
j	V231	. cutting holes
j	V232	. cutting blocks, slices
j	V233	. trimming, shaving
j	V234	. cracking
j	V235	. scoring
j	V236	. engraving (B6J)
j	V237	. surgery &c (A5R)
j	V238	. welding, soldering (B3R)
j	V23X	. other
j	V241	promoting chemical reaction
j	V242	inhibiting chemical reaction
j	V243	cooling
j	V244	debris removal
		. not applied with Classifying Term VLJ
j	V245	protection of personnel
j	V246	material support, handling
		use of patterns, masks, templates—
j	V251	. sensed by profile copying
j	V252	. sensed by optical scanning <i>other than</i> by the cutting laser
j	V253	. masks in contact with workpiece
j	V254	. transparencies and holograms
j	V255	. stored as digital information
j	V25X	. other

Part D: Removing metal by fusion &c

*This Part of the heading comprises only the following subject matter:*

- . removing metal by fusion (*other than* by electro-erosion), *including* removing non-metals by sputter etching *when not provided for in other headings*

Note:

Disclosures where the use of a laser is an essential part of a cutting or machining operation are subject-matter for Part C of this heading (subject to the restrictions outlined in the introduction to that Part). However, disclosures wherein the use of a laser for removing material from a metal object is not essential (*eg* it is mentioned merely as one of several possible tools which may be used) are classified here, the use of the laser being indicated by indexing term V4A2C. Prior to Edition J this term was also applied to subject-matter now in Part C of this heading

Excluded is:

- . construction of means for converting electrical energy into heat—H5H, Electric heating; microwave heating &c

*To facilitate searches for combinations of features, throughout this part of the heading each feature is indexed for which a coded term is available, irrespective of novelty*

removing metal by fusion, *including* removing non-metals by sputter etching *when not provided for in other headings*—

- . by electro-erosion—*See* Part A
- . by laser—*See the Note in the introduction to this Part*
- . procedures—
  - . . dividing by high speed friction saws. *See* B5L, Sawing, woodworking &c
  - . . dividing by tensioning a part heated to plastic state. *See* B3E, Bending and breaking metals
  - . . high speed friction saws. *See* B5L, Sawing, woodworking &c
- V4B1 . . continuous arc cutting
  - . . . arc electrodes for. *See* H5H, Electric heating; microwave heating &c
  - . . . bombardment with charged particles, or utilizing beams of charged particles or radiation—
  - . . . electron and ion beams generation and handling. *See* H1D, Electric discharge tubes &c
- V4A2A . . . electron beam
- V4A2B . . . ion beam (*including* sputter etching)
- V4A2C . . . laser beam
  - . . . . *See the Note in the introduction to this Part*
- V4A2X . . . other
- V4C . . flame desurfacing
- V4B2 . . fuel gas and oxygen cutting
  - . . . blowpipes, blowpipe and other burners, and burner fittings (*including* provision of supplementary gas jets for use in subaqueous working). *See* F4T, Burners &c
- V4B3 . . induction heating
- V4BX . . other procedures
- . miscellaneous features of metal removing procedures—
  - . . profile copying and like devices for guiding work or tool
  - . . . electric line and template following systems. *See* G3N, Automatic electric control systems
- V4D . . use of adjuvant powder