

WTI-Classification

3A Enterprises, management, economics, politics, legislation

- 3AA Management planning, management strategies
- 3AAK Management information system, knowledge management
Reference to: Database management systems 3DFB
Reference to: Communication networks/switching technology 3GN
- 3AAP Project management
- 3AB Project engineering and planning of plants, equipment construction
 e.g.: Plant location planning (from starting of new plants to plant shutdown)
Reference to: Biotechnological apparatuses, plants and reactors 3PZO
Reference to: Chemical apparatuses and plants 3PLL
Reference to: Power plants, nuclear reactors 3EE
- 3ABC Plant safety
 e.g.: Power station, safety, chemical plant safety, incident defense planning
Reference to: Power plants, nuclear reactors 3EE
- 3ABZ Security for business
Reference to: Control technology, monitoring 3IT
- 3AD Costs, finance, investment
- 3ADA Balance (corporate), reporting
- 3ADB Enterprise valuation, controlling
- 3AE Marketing, product research, sales promotion, distribution
- 3AEN New product development
- 3AI Production planning and control, operational research
- 3AIB Computer integrated manufacturing (CIM), virtual production
 e.g. Think tanks, digital factories
Reference to: Simulation methods, simulation models 3BAS
Reference to: Assembling lines and assembly systems 3LZ
Reference to: Rapid Prototyping, Rapid Tooling 3LD
- 3AIX Logistics, material management/control
Reference to: Hoisting and transportation technology, storage 3ML
- 3AK Maintenance, servicing
Reference to: Vehicle safety/testing/maintenance 3NRX
Reference to: Software engineering/maintenance, application software 3DG
- 3AL Quality assurance/management, certification
 Note: Quality inspection, quality assurance, lifetime or products reliability do allocate to the corresponding products,
 e.g. reliability of soldered connections at electronics 3FU
Reference to: Control technology, monitoring 3IT
Reference to: Wiring, connecting, plug-in units, housings 3FU
- 3AM Occupational safety, accident prevention
 e.g.: Protective gears, accident statistics, accident prevention rules, occupational safety, damage prevention, ear protection
Reference to: Noise sources/injury/abatement 3UMR
Reference to: Mathematical methods 3BA
Reference to: Legislation, product liability, data protection 3AR
Reference to: Clothing (apparel), functional wear, protective clothing 3TML
- 3AMB Ergonomics, occupational health
 e.g.: Health protection, industrial diseases
- 3AR Legislation, product liability, data protection
Reference to: Occupational safety, accident prevention 3AM
- 3ARA Industrial law
Reference to: Personnel management, wage plans, training, career 3AS
- 3ARD Data privacy protection
Reference to: Computer hardware, computer operation 3DD
- 3AS Personnel management, wage plans, training, career
Reference to: Industrial law 3ARA
- 3AT Technical development, technology transfer
- 3ATB Technology assessment
- 3ATH Technical history, archaeology
- 3AU Design methodology, merchandising technology, technical standards and rules

- 3AX Economic research and policy
- 3AXB Environmental policy, ecology, ecosystems
 e.g.: Environmental audit
Reference to: Biosciences , life sciences 3BZ
Reference to: Environmental engineering, environmental pollution 3U
- 3AXF Research and development

3B Natural sciences (fundamentals, basic methods, models)

Note: Since almost all technical special branches do serve on natural science and technological fundamentals, methods or models, these „fundamentals“ are only allowed to use if they are indeed in the main focus and give a broad-based discussion with the paper’s content. Inadequate are important facts or factors only.

- 3BA Mathematical methods
 e.g.: Analysis, group theory, function theory, mathematical logics, numerical methods, optimizing calculation, statistics, topology, probability calculation
Reference to: Occupational safety, accident prevention 3AM
- 3BAS Simulation methods, simulation models
 e.g.: MATLAB, FEM, CFD, statistical simulation (economics)
Reference to: Computer software (technical-scientific) 3DL
Reference to: Computer integrated manufacturing (CIM), virtual production 3AIB
- 3BB Mechanics of solids, liquids and gases
 e.g.: science of elasticity, science of material strength, hydrodynamics, continuum mechanics, science of vibrations, fracture mechanics, dynamics/kinematics of solids/liquids/gases
Reference to: Mechanical properties of materials 3KXM
Reference to: Tribology 3MD
- 3BBB Acoustics of solids, liquids and gases
 e.g.: Aeroacoustics, room acoustics, noise properties, infrasound, ultrasound
Reference to: Acoustic properties of materials 3KXA
- 3BBS Fluid dynamics
 e.g.: Aerodynamics, flow fields, single-/multiphase systems, rheology, non-newtonian fluids
Reference to: Fluidics (hydraulics, pneumatics) 3ME
- 3BF Optical engineering
 e.g.: Holography, optical components, infrared/ultraviolet radiation
Reference to: Optoelectronic devices, integrated optics 3FX
- 3BFB Laser science, quantum optics
- 3BFX Nonlinear optics
 e.g.: Kerr cells, optical transistors, stimulated Raman scattering, Brillouin scattering, superfluorescence
- 3BG Electricity and magnetism, electrical engineering (theory)
 e.g.: Dielectricity, electrodynamics, electrostatics, photo/magnetolectric/magneto-optical/superconductivity effects, electric/magnetic fields
Reference to: Electrical/magnetic properties of materials 3KXE
Reference to: Electric/magnetic/electromagnetic fields effects on living beings 3UMZ
Reference to: Semiconductor properties of materials 3KXH
- 3BN Thermodynamics, statistical physics, heat flow
 e.g.: Heat transfer, chaotic systems
Reference to: Phase diagrams of materials 3KWR
Reference to: Physical chemistry 3BXP
- 3BR Solid state physics, semiconductor theory
 e.g.: Electronic structure, thin-film physics, ordered states, spin glass, polymer physics, tunnel effects
Reference to: Semiconductor properties of materials 3KXH
- 3BU Atomic and molecular physics
 e.g.: Atomic/molecular excitation/interaction/spectrum
Reference to: Materials properties 3KX
- 3BUB Physics of plasmas and electric discharges
 e.g.: Electrical processes in gases, gas discharges, plasma production/diagnostics/interactions, magnetohydrodynamics
- 3BUX Nuclear physics, physics of elementary particles
 e.g.: Atomic energy/matter/fission, radioactivity, electromagnetic transition, particle sources

- 3BW Geosciences, geophysics
 e.g.: Geology, prospecting science, mineralogy, meteorology, ocean science, geological/rocks/soil mechanics, hydrology and geological technology
Reference to: Geotextiles 3TMP
Reference to: Raw materials (natural/secondary) 3KB
Reference to: Mining, tunneling, petroleum/natural gas production, deep well drilling 3MZ
- 3BX Fundamentals of chemistry
Reference to: Chemical engineering, chemical reaction engineering 3PL
- 3BXA Inorganic chemistry (fundamentals)
Reference to: Inorganic nonmetallic materials 3KG
- 3BXC Organic chemistry (fundamentals)
Reference to: Organic materials, polymers 3KK
- 3BXE Colloid chemistry , radiochemistry
Reference to: Particle chemistry, disperse systems, emulsions, colloids, suspensions 3PLK
- 3BXP Physical chemistry
 e.g.: Electrochemistry, photochemistry
Reference to: Thermodynamics, statistical physics, heat flow 3BN
- 3BZ Biosciences , life sciences
 e.g.: Anatomy, biocybernetics, biology, microbiology, radiobiology
Reference to: Biomedical engineering 3R
Reference to: Bioprocess engineering, biotechnology 3PZ
Reference to: Wood science and engineering 3SK
Reference to: Environmental pollution and engineering 3UX
Reference to: Environmental policy, ecology, ecosystems 3AXB
Reference to: Environmental pollutants and toxicology 3UM
- 3BZA Biophysics (fundamentals)
 e.g.: Biophysical technique, biomechanics, biomechanical models
Reference to: Electric/magnetic/electromagnetic fields effects on living beings 3UMZ
- 3BZB Pharmacology, pharmaceutical fundamentals, toxicology
Reference to: Biomedical engineering 3R, Environmental pollutants and toxicology 3UM
Reference to: Biomedical/biochemical properties of materials 3KXZ
Reference to: Production of pharmaceutical products 3PP
- 3BZG Fundamentals of genetic engineering and molecular biology
 e.g.: Proteomics, DNA/RNA functions
Reference to: Biocomputing, neurocomputing 3DBC
- 3BZH Biochemistry (fundamentals)
Reference to: Biomedical/biochemical properties of materials 3KXZ

3D Data processing and data systems technology

- 3DB Information theory (fundamentals), informatics
 e.g.: Algorithm/automata/computer theories, combinatory circuit theories, cybernetics, parallel computing, transputers, computer architecture (theory)
- 3DBC Artificial intelligence, neural networks, expert systems, fuzzy logic
 e.g.: AI influence, learning systems, biocomputing, neurocomputing
Reference to: Fundamentals of genetic engineering and molecular biology 3BZG
Reference to: Biochips, DNA chips (gene chips) 3PZX
- 3DD Computer hardware, computer operation
 e.g.: Computing centres, multicomputers, hardware security (reliability), data backup, data security
Reference to: Data privacy protection 3ARD
- 3DDB Mainframe computers, super computers
 e.g.: High-speed/ high-performance/optical/massively parallel computers
- 3DDG Peripheral computer equipment, mass storage, data carriers
 e.g.: Monitors (computer displays), chip cards, CD-ROMs, discs (computer), cassettes (magnetic tape), keyboards, electronical identification systems, printers, mouse controllers (computers), scanners (input system), interfaces (hardware), bus systems
Reference to: Printing machines/processes, reproduction techniques 3MIK
- 3DDR Workstations, minicomputers, microcomputers
 e.g.: PCs (personal computers), laptops, notebooks, pentops, add-on cards, graphic cards, PC plug-in cards

- 3DDX Central processing units (CPUs)
Reference to: Microprocessors 3FTR
- 3DF Systems architecture/software, programming languages
 e.g.: Utility software, program translators, editors (data processing), software library, compilers, file management systems, job control, emulations
- 3DFB Database management systems
 e.g.: Database software, database management systems, online databases, online information systems
Reference to: Communication media/services 3GL
Reference to: Management information system, knowledge management 3AAK
- 3DG Software engineering/maintenance, application software
 e.g.: Projecting of software development, software engineering, software project management, human-computer interfaces, menu-driven navigation, program generators, programming theories/methods, automatic programming, CASE (computer-aided software engineering)
 Note: This classification only is allowed to use if „software“ is indeed in the main focus and gives a broad-based discussion with the paper’s content. Inadequate are facts or factors only.
Reference to: Maintenance, servicing 3AK
- 3DK Office software, electronic publishing
 e.g.: Software for text processing and document mangement, desktop publishing, software for project management and language translation, business software
 Note: Branches software additional must be classified to the belonging branch, e.g. energy management 3E
Reference to: Printing machines/processes, reproduction techniques 3MIK
Reference to: Graphic data processing, virtual reality 3DR
- 3DL Computer software (technical-scientific)
Reference to: Simulation methods, simulation models 3BAS
- 3DLB CAD/CAE/CAM/CIM systems
Reference to: Rapid Prototyping, Rapid Tooling 3LD
- 3DR Graphic data processing, virtual reality
 e.g.: Graphics software, presentation graphics
Reference to: Office software, electronic publishing 3DK
Reference to: Printing machines/processes, reproduction techniques 3MIK
Reference to: Multimedia 3GG
Reference to: Rapid Prototyping, Rapid Tooling 3LD
- 3DU Process data processing
 e.g.: Process software
Reference to: Control technology, monitoring 3IT
- 3DX Computer networks, distributed data processing
 e.g.: Data teleprocessing, data transmission, communication software, PC mainframe communication, network software, network concentrators, network interconnectors (bridges, routers, hubs)
Reference to: Communication networks/switching technology 3GN
Reference to: Network theory (concentrated circuits) 3FAB
- 3DXA Internet-based systems
 e.g.: Internetworking, internet remote maintenance, internet diagnostics, LANs (local-area networks), WANs (widearea networks), internet security
Reference to: Communication networks/switching technology 3GN
Reference to: Communication protocols/procedures 3GRP
- 3E Power engineering and energy management
- 3EB Energy industry, energy management
 e.g.: Primary energy reserves/sources (natural gas, crude oil, biomass), energy demand/saving/balance
Reference to: Biotechnologically manufactured products 3PZS
- 3EBB Electricity supply industry
 e.g.: Current demand/tariffs/importation/exportation
- 3ED Fuel
- 3EE Power plants, nuclear reactors
 e.g.: Power plant components, power plant cooling systems, cogeneration, tidal power plants
Reference to: Project engineering and planning of plants, equipment construction 3AB
Reference to: Plant safety 3ABC
Reference to: Turbogenerators 3EU
- 3EEB Power plant control engineering
- 3EI Thermal engineering, refrigeration and cold storage

- 3EIB Heat pumps
- 3EIC Heat transfer engineering, heat exchangers
 e.g.: Recuperators, thermal solar-energy use, heat recovery
Reference to: Fluidics (hydraulics, pneumatics) 3ME
Reference to: Electric energy storage devices, direct energy conversion 3ELB
- 3EIF Heating plants, industrial burners and furnaces
 e.g.: Steam generators, long-distance heating
Reference to: Electric heat 3EK
- 3EIH Heating, ventilation, air conditioning, clean room technology
Reference to: Vehicle components 3NRN
- 3EIK Refrigeration and cold storage
 e.g.: Refrigerant, antifreezes, air liquefaction
Reference to: Electric household appliances 3EX
Reference to: Cooling vehicles 3NDG
- 3EK Electric heat
 e.g.: electron-beam/spark/high-frequency/induction/capacitive/laser-ray/electric-arc/microwave/plasma-jet/
 ultrasound/ resistive heating
 Note: This classification only is allowed to use if electric heat generation, electric heat influence or electric
 heat control indeed are in the main focus and give a broad-based discussion with the paper's content.
 Otherwise the paper must be classified to the belonging ovens or production process.
Reference to: Coating processes (thin/thick films) 3LX
Reference to: Chemical/electrochemical machining 3LKG
Reference to: Heating plants, industrial burners and furnaces 3EIF
Reference to: Microwave engineering/devices 3GX
Reference to: Welding, soldering 3LNB
- 3EL Direct energy conversion, energy storage
- 3ELB Electric energy storage devices, direct energy conversion
 e.g.: Solar cells, photovoltaics, isotope batteries, thermoelectric generators, galvanic elements, MHD
 generators magnetohydrodynamic convertors, fuel cells
Reference to: Heat transfer engineering, heat exchangers 3EIC
- 3ELX Thermal, chemical and mechanical energy storage devices
- 3EM Electric power transmission and systems
 e.g.: Medium/high/extra-high voltage-transmission, power-system networking, reactive-power
 compensation, electric-power lines/cables
Reference to: Network theory (concentrated circuits) 3FAB
- 3EN Power switching devices
 e.g.: Circuit breakers, on-load/disconnecting switches, busbars, circuit-breaking arcs, arc quenching,
 Medium/high/extra-high voltage switchboard plants/devices
- 3EP Low-voltage installations, lighting engineering
 e.g.: Electric light sources, lightings, luminaries
Reference to: Electric and electronic equipment of vehicles 3NRT
- 3ER Electrical protective measures and devices
 e.g.: Lightning protection, fault current limiting
- 3ES Power electronics, current convertors
 e.g.: Static-current/electrical rectifiers, rectifier inverters, current convertors, uninterruptible power supply,
 stationary standby power-systems, power units, battery chargers, electronics current-supply
- 3ET Power transformers, reactive power compensation
 e.g.: Transductors
- 3EU Electrical machines and drives
 e.g.: Electrical motors/generators, turbogenerators, induction linear motors, direct-current/
 alternating-current/three-phase machines, synchronous/asynchronous machines, special electrical
 machines, stepping motors, rotary current-convertors
Reference to: Power plants, nuclear reactors 3EE
Reference to: Hand tools 3MN
Reference to: Drives for electrical road vehicles 3NRF
- 3EW Nonstationary and emergency power supplies
 e.g.: Mobile standby power-systems, Diesel-electric generators
- 3EX Electric household appliances
 e.g.: Electrical refrigerators/freezers, vacuum cleaners, domestic cookers, washing machines, clothes dryers
Reference to: Refrigeration and cold storage 3EIK

3EZ Electro-physical laboratory equipment
 e.g.: Particle accelerators, irradiation devices, large-magnets systems, extra-high voltage/current experimental plants, surge-current experimental plants
 Reference to: *Laboratory techniques* 3IU

3F Electronics and microelectronics

Reference to: *Electric and electronic equipment of vehicles* 3NRT
 Reference to: *Semiconductor properties of materials* 3KXH

3FA Basic circuits (analogue, digital)

3FAB Network theory (concentrated circuits)

e.g.: Quadrupole/filter theories, network analysis/synthesis, equivalent-circuit diagrams

Note: Network in this classification must be used within the meaning of concentrated circuits.

Not meant are computer/communication/electrical networks.

Reference to: *Computer networks, distributed data processing* 3DX

Reference to: *Electric power transmission and systems* 3EM

Reference to: *Communication networks/switching technology* 3GN

3FAG Signal/frequency filters, equalisers

e.g.: Digital/debugging/sampling/RLC-active/RC-active/CCD filters, NICs (negative-impedance converters), gyrators

Reference to: *Microwave engineering/devices* 3GX

3FAR Amplifiers, signal converters/generators, oscillators

e.g.: Operational amplifiers, signal inverters, A/D converters, D/A converters, frequency converters, frequency/function generators, pulse discriminators, pulse formers, PLL systems (phase-locked loops)

Reference to: *Communication devices and techniques* 3GR

Reference to: *Microwave engineering/devices* 3GX

3FAX Digital basic circuits

e.g.: Digital adders/multipliers, flip-flops, logic gates, serializers, deserializers

3FE Processing of semiconductor materials

e.g.: Doping (semiconductor), diffusional doping, epitaxy (semiconductor technology), ion implantation

Reference to: *Semiconductor properties of materials* 3KXH

Reference to: *Manufacturing technology* 3L

Reference to: *Nucleation, crystal growth, vitrification, epitaxy* 3KWB

3FF Components and circuits fabrication

e.g.: E-beam/X-ray lithography, photolithography, MOS technology (CMOS, COSMOS, BICMOS, HCMOS, NMOS), unipolar/bipolar technology

Note: This classification includes testing, reliability, lifetime, quality assurance and production monitoring.

Reference to: *Chemical/electrochemical machining* 3LKG

Reference to: *Semiconductor/microelectronics components* 3FT

Reference to: *Micro-electro-mechanical components* 3QBE

Reference to: *Welding, soldering* 3LNB

3FK Passive/electromechanical components

e.g.: Resistors, varistors, capacitive components, capacitors, inductive components, electric coils, magnetic cores, permanent magnets, magnetic-field/piezoelectric components, microswitches, electric relays, key switches, switching devices, actuation magnets, device-guarding components, electric/magnetic shielding-components

Reference to: *Micro-electro-mechanical components* 3QBE

Reference to: *Sensor technology, actuator, sensors and actuators* 3IL

3FKB Electronic tubes/valves

e.g.: Television/cathode-ray/colour-picture/travelling-wave tubes

Reference to: *Audio, video, photography, cinematography, radio, tv* 3GG

3FKG Displays

e.g.: LCDs (liquid-crystal displays), LEDs (light-emitting diodes), PDPs (plasma display panels)

3FKR Superconducting devices and magnets

3FR Circuit development/design

e.g.: Developing of application-specific integrated circuits (ASICs), computer-assisted circuits/systems design

- 3FT Semiconductor/microelectronics components
Reference to: Components and circuits fabrication 3FF
Reference to: Micro-electro-mechanical components 3QBE
Reference to: Microwave engineering/devices 3GX
Reference to: Biochips, DNA chips (gene chips) 3PZX
- 3FTB Discrete semiconductor components
 e.g.: Semiconductor diodes, transistors, thyristors
Reference to: Optoelectronic devices, integrated optics 3FX
Reference to: Microwave engineering/devices 3GX
Reference to: Semiconductor properties of materials 3KXH
- 3FTG Integrated analogue/digital/hybrid/thin/thick film circuits
 e.g.: Integrated voltage regulators, intelligent power ICs (smart-power ICs), LSI (large scale integration), gate arrays, pre-programming of digital integrated circuits, ASICs (application-specific integrated circuits), PLDs (programmable logic devices)
Reference to: Microwave engineering/devices 3GX
Reference to: Optoelectronic devices, integrated optics 3FX
- 3FTR Microprocessors
 e.g.: CISC-/RISC-/numeric processors, coproc., DSPs (digital signal proc.), micro controllers, controller components
 Reference to: Central processing units (CPUs) 3DDX
- 3FTX Memory devices
 e.g.: Semiconductor memories (RAMs, DRAMs, SRAMs, PROMs, EPROMs, EEPROMs), magnetic bubble memories, memory cards
- 3FU Wiring, connecting, plug-in units, housings
 e.g.: Circuit boards, electrical components, contacting (joining), semiconductor packages, plug-and-socket connection, SMD/SMT (surface mounting technology), soldered/welded/solderless wiring-technique, circuitcomponents insertion
Reference to: Welding, soldering 3LNB
Reference to: Quality assurance/management, certification 3AL
- 3FX Optoelectronic devices, integrated optics
 e.g.: Laser/luminescence diodes, photodiodes, photovoltaic devices, photothyristors, phototransistors, photoresistors, optical-fibre couplers, optocouplers, optoelectronic couplers
Reference to: Integrated analogue/digital/hybrid/thin/thick film circuits 3FTG
Reference to: Discrete semiconductor components 3FTB
Reference to: Microsystems technology 3QB
Reference to: Optical engineering 3BF

3G Communications and telecommunication engineering

- 3GA Fundamentals of telecommunications engineering
 e.g.: Communication traffic theory, queueing theory (waiting line theory), information theory, systems theory of communication engineering, cryptology, transmission security, transmission disturbance
- 3GE Electromagnetic interference of circuits
 e.g.: EMC (electromagnetic compatibility EMI (electromagnetic interference), EMP (electromagnetic pulse), electrosmog (EMC)
Reference to: Electric/magnetic/electromagnetic fields effects on living beings 3UMZ
- 3GF Signal recognition/processing
 e.g.: Character recognition, pattern recognition (signal recognition), signal noise (signal recognition)
Reference to: Medical measurement, bioelectrical signal processing 3RBB
- 3GFB Pattern recognition/processing, image processing
- 3GFX Speech analysis/synthesis/processing
- 3GG Audio, video, photography, cinematography, radio, tv
 e.g.: Multimedia, phonotechnology, sound/image recording, sound/image rendition, Hi-Fi technique, stereophonics, microphones, loudspeakers, digital/video cameras, consumer electronics
Reference to: Electronic tubes/valves 3FKB
Reference to: Printing machines/processes, reproduction techniques 3MIK
Reference to: Graphic data processing, virtual reality 3DR

- 3GL** Communication media/services
e.g.: Telefax, telephones, office communication systems, mailbox systems, video conferencing
Reference to: Database management systems 3DFB
- 3GN** Communication networks/switching technology
e.g.: ISDN (integrated services digital networks), local telephone networks, private branch switching technique, switching networks
Reference to: Internet-based systems, LANs, WANs 3DXA
Reference to: Management information system, knowledge management 3AAK
Reference to: Network theory (concentrated circuits) 3FAB
Reference to: Computer networks, distributed data processing 3DX
- 3GR** Communication devices and techniques
e.g.: Modulation, encoding, digitalization of signals, multiplexing, transmission band conversion, clock regenerators, modems, intermediate repeaters, digital/synchronous/ asynchronous transmission
Reference to: Microwave engineering/devices 3GX
Reference to: Amplifiers, signal converters/generators, oscillators 3FAR
- 3GRP** Communication protocols/procedures
e.g.: EDI (electronic data interchange), HDLC (high-level data link control), communication protocols, OSI (open systems interconnection), authentication
Reference to: Internet-based systems 3DXA
- 3GS** Communication cables/lines
e.g.: telecommunication cables, coaxial cables
Reference to: Microwave engineering/devices 3GX
- 3GSB** Optical waveguides, fibreglass cables
- 3GU** Optical communications, fibreglass networks
e.g.: optical transmission systems, infrared transmission
- 3GW** Radio communication/transmission
e.g.: free space propagation, radio antennas/transmitters/receivers, directional/mobile radio, satellite communication
- 3GX** Microwave engineering/devices
e.g.: Millimetre/submillimetre wave technique, microwave amplifiers/guides
Reference to: Discrete semiconductor components 3FTB
Reference to: Amplifiers, signal converters/generators, oscillators 3FAR
Reference to: Semiconductor/microelectronics components 3FT
Reference to: Integrated analogue/digital/hybrid/thin/thick film circuits 3FTG
Reference to: Electric heat 3EK
Reference to: Electrical, magnetic measuring methods 3IDE
Reference to: Communication cables/lines 3GS
Reference to: Communication devices and techniques 3GR
Reference to: Signal/frequency filters, equalisers 3FAG
- 3GZ** Radar, position/direction finding, navigation
e.g.: Echo sounding, sonar, missiles controllers, radio beacons, ILS (instrument-landing systems), aerial surveillance, satellite navigation
Reference to: Acoustic measuring methods 3IDA

3I Measurement, testing and control

Reference to: Environmental engineering, environmental pollution 3U

- 3IB** Measuring units/systems
e.g.: Legal calibration, general calibration
- 3ID** Measuring/testing methods/devices
Note: All sub classifications of 3ID* include measurement/test devices/equipments/methods.
Note: Analytical measuring technique must be classified to the belonging process,
e.g.: Clinical laboratories diagnosis 3RBX, Physico-chemical measuring methods 3IDC, Particle spectroscopy/microscopy 3IDX
- 3IDA** Acoustic measuring methods
e.g.: Ultrasound microscopy, ultrasonic inspection
Reference to: Radar, position/direction finding, navigation 3GZ

- 3IDB Biological-biochemical measuring methods
 e.g.: Biosensoric measurement
 Reference to: *Biochips, DNA chips (gene chips)* 3PZX
 Reference to: *Biosensors* 3IL
- 3IDC Physico-chemical measuring methods
 e.g.: AAS (atomic absorption spectrometry), chromatography, electrophoretic measurement, particle spectrometry, voltammetry
- 3IDE Electrical, magnetic measuring methods
 e.g.: Resistance thermometers, magnetometers, high-voltage/extra-high voltage/communication/microwave measurement technique
 Reference to: *Microwave engineering/devices* 3GX
- 3IDM Mechanical measuring methods
 e.g.: Barometers, mechanical force sensors, weighers
- 3IDO Optical measuring methods
 e.g.: Ellipsometry, interferometry, Raman-/infrared measuring, photometry, optical Doppler effecting, optical microscopy, thermography
- 3IDT Thermal measuring methods
 e.g.: Calorimetry, DTA (differential thermal analysis), TG (thermogravimetry)
- 3IDX Particle spectroscopy/microscopy
 e.g.: AES (Auger electron spectrometry), atomic force microscopy, EXAFS-process (Extended X-ray Absorption Fine Structure), gamma-ray/ X-ray/neutron diffraction process, Mossbauer spectroscopy, RHEED process (Reflection High-Energy Electron Diffraction), SIMS (secondary-ion mass spectrometry)
- 3IF Measuring variables
- 3IFA Measuring/testing of acoustical variables
 e.g.: Sound-intensity/sound-velocity measurement
- 3IFC Measuring/testing of chemical variables, chemical analysis
 e.g.: pH value measurement, CSB value measurement, detection/verification of organic/inorganic substances
 Reference to: *Clinical laboratories diagnosis* 3RBX
- 3IFE Measuring/testing of electric/magnetic variables
 e.g.: Magnetic susceptibility measurement, inductance/capacitance/impedance measurement, I-V characteristics measurement
- 3IFF Measuring/testing of frequency and time
 e.g.: Event number measurement, frequency counters, clock systems
- 3IFM Measuring/testing of mechanical/geometrical variables/mass/density
 e.g.: Pressure/range/torque/acceleration/stress measurement, mechanical vibration measurement, surface roughness measurement
- 3IFO Measuring/testing of optical variables
 e.g.: Measuring of optical absorbency/refractivity, colour measurement
- 3IFS Measuring/testing of fluid flow variables
 e.g.: Viscosimetry, flow velocity measurement, flow-rate measurement
- 3IFT Measuring/testing of thermal variables/humidity
 e.g.: Thermometry, thermal transmittance testing, dew-point measuring
- 3IFX Nuclear radiation measurement, particle detection
 e.g.: Radioactivity measurement
- 3IG Materials testing/inspection
 Note: Additional the belonging test method must be classified.
 Reference to: *Manufacturing technology* 3L
 Reference to: *Materials and material properties* 3K
- 3IGB Destructive materials testing
 e.g.: Compression/bending/hardness/fatigue testing, impact strength test
- 3IGK Corrosion testing
 Reference to: *Chemical properties of materials, corrosion/erosion behaviour* 3KXU
- 3IGT Fibre, yarn and textile testing
 e.g.: Testing of textile fabrics and textile products, wear trials, textile field trials
 Reference to: *Sensory material properties* 3KXP
 Reference to: *Textiles, garment, textile machinery* 3T

- 3IGX Non-destructive testing/inspection of materials/components
e.g.: X-ray determination (materials testing), ultrasonic testing (materials testing), acoustic emission testing, magnetic particle testing, eddy current testing, crack detection, computer tomography (materials testing)
- 3IK Measured data processing and display
e.g.: Measurement registration, measured-value transducing, measured-data transmission, multigauging system, measuring amplifiers, recording instruments, oscilloscopes
- 3IL Sensor technology, actuator, sensors and actuators
e.g.: Sensing elements, wire strain gauges, magnetic field probes, image sensors, biosensors, piezoelectric sensors, piezoelectric actuators, microactuators
Reference to: Biochips, DNA chips (gene chips) 3PZX
Reference to: Biological-biochemical measuring methods 3IDB
Reference to: Passive/electromechanical components 3FK
- 3IN Control theory, cybernetics
e.g.: Adaptive systems, decision theory, systems theory (control engineering)
- 3IR Control and control systems
Reference to: Chemical process-development, -modelling, -performance and -optimization 3PLD
Reference to: Biotechnological process development 3PZP
- 3IRB Electric/electronic control systems
e.g.: Electric and electronic actuators (correcting elements)
- 3IRG Hydraulic/pneumatic control systems
- 3IRR Programmed/programmable controllers
e.g.: SPC (stored-program control), numerical control (NC, CNC, DNC)
- 3IT Control technology, monitoring
e.g.: Process controlling, remote monitoring, building automation systems, control station, signaling technique, warning devices, warning systems
Reference to: Fire safety and fire fighting technology 3MX
Reference to: Process data processing 3DU
Reference to: Quality assurance/management, certification 3AL
Reference to: Traffic control systems/signalling installations 3NAB
Reference to: Security for business 3ABZ
- 3IU Laboratory techniques
e.g.: laboratory equipment, laboratory instruments
Reference to: Electro-physical laboratory equipment 3EZ
Reference to: Clinical laboratories diagnosis 3RBX

3K Materials and material properties

- Reference to: Manufacturing technology 3L*
Reference to: Raw material processing 3PA
Reference to: Materials testing/inspection 3IG

- 3KB Raw materials (natural/secondary)
e.g.: Crude ores, clay mineral, scraps (waste), scrap glass, cinder (ash)
Reference to: Geosciences, geophysics 3BW
Reference to: Garbage, waste treatment/avoidance/management 3UMB
Reference to: Mining, tunneling, petroleum/natural gas production, deep well drilling 3MZ
- 3KE Metallic materials
- 3KEB Steels, cast steel
e.g.: Simple steel, microalloyed steel, low alloy steel, high alloy steel
- 3KEE Pure iron, iron alloys
- 3KEG Cast iron
- 3KEM Nonferrous metals/alloys/casting materials
e.g.: Intermetallic compounds, light/heavy/noble metals
- 3KER Superalloys
- 3KET Metallic glasses, amorphous metals/pure metals and alloys
- 3KEX Cemented carbides, cermets
- 3KG Inorganic nonmetallic materials
Reference to: Inorganic chemistry (fundamentals) 3BXA

- 3KGB Minerals, natural/synthetic crystals, rocks
e.g.: Rubies (corundum), garnets (gem), sapphires, quartz materials, diamonds (precious stone), graphite, natural stones & sand
- 3KGG Ceramic/refractory materials, glass ceramics
e.g.: oxide ceramics, non oxide ceramics, silica ceramics, clay ceramics
Reference to: Organic-inorganic composites 3KMD
- 3KGR Glass
e.g.: Special glass, oxide glass, oxygen free glass
- 3KGU Binders, construction materials
e.g.: Cement, lime, plaster (gypsum), concrete, asphalt, bitumen
- 3KH Fibres, microfibrres, nanofibrres
Reference to: Fibre extraction, fibre production, yarn technology 3TC
Reference to: Nanotechnology 3QN
Reference to: Fibre-reinforced composites 3KMB
- 3KHB Natural fibrres
e.g.: Animal fibrres, vegetable fibrres, asbestos fibrres, rock fibrres
- 3KHX Chemical/glass/carbon/metal fibrres
- 3KK Organic materials, polymers
e.g.: Leather, elastomers, rubbers
Reference to: Fibre extraction, fibre production, yarn technology 3TC
Reference to: Organic chemistry (fundamentals) 3BXC
- 3KKB Plastics
Reference to: Smart textiles, industrial textiles 3TMP
- 3KKC Cellulose
Reference to: Wood 3SL
Reference to: Paper 3SV
- 3KM Composites
- 3KMA Particle-reinforced composites
Reference to: Particle chemistry 3PLK
- 3KMB Fibre-reinforced composites
Reference to: Fibrres, microfibrres, nanofibrres 3KH
Reference to: Fibre extraction, fibre production, yarn technology 3TC
Reference to: Smart textiles, industrial textiles 3TMP
- 3KMC Laminated materials, laminates, gradient materials
- 3KMD Organic-inorganic composites
e.g.: Organic modified ceramics (ORMOCER)
Reference to: Ceramic/refractory materials, glass ceramics 3KGG
- 3KMF Metal-matrix composites (MMCs)
- 3KMK Ceramics/glass-matrix composites (CMCs)
- 3KMN Polymer-matrix composites (PMCs)
- 3KMZ Additives
- 3KP Powders, granular solids
Reference to: Production of basic chemicals and chemical intermediate products 3PLE
Reference to: Mechanical properties of materials 3KXM
Reference to: Powder metallurgy 3LEK
Reference to: Materials exploitation/extracting/master forming technology 3LE
- 3KS Foam materials
e.g.: Foamed plastics, ceramic foams, metal foams
- 3KU Coatings, thin films
Reference to: Wood coatings 3SM
- 3KUF Film sheets
- 3KW Materials science
- 3KWB Nucleation, crystal growth, vitrification, epitaxy
Reference to: Processing of semiconductor materials 3FE
- 3KWG Crystal structure, material structure/textures
e.g.: Lattice defects, structure of amorphous substances, structure of melts, quasicrystals, irradiation effects on crystals
Reference to: Nanotechnology, nanotubes 3QN

- 3KWR Phase diagrams of materials
 e.g.: Heterogeneous equilibrium, recrystallization, eutectics, peritectics, microstructural changes
 Reference to: *Thermodynamics, statistical physics, heat flow* 3BN
- 3KX Materials properties
 Reference to: *Atomic and molecular physics* 3BU
- 3KXA Acoustic properties of materials
 e.g.: Ultrasonic attenuation, sound conductivity, optoacoustic material properties
 Reference to: *Acoustics of solids, liquids and gases* 3BBB
- 3KXE Electrical/magnetic properties of materials
 e.g.: Dielectric permeability, photoconductivity, piezoelectricity, thermoelectric voltage; magnetization, remanence, diamagnetism, paramagnetism, ferromagnetism, magneto-optic rotation; magnetoresistance, Hall constant, magnetic inductivity; transition temperature, critical field intensity
 Reference to: *Electricity and magnetism, electrical engineering (theory)* 3BG
 Reference to: *Material behaviour under radiation exposure* 3KXS
- 3KXH Semiconductor properties of materials
 e.g.: Bandgap/dark/intrinsic/extrinsic conductivity, Schottky barrier
 Reference to: *Electronics and microelectronics* 3F
 Reference to: *Electricity and magnetism, electrical engineering (theory)* 3BG
 Reference to: *Solid state physics, semiconductor theory* 3BR
 Reference to: *Discrete semiconductor components* 3FTB
 Reference to: *Processing of semiconductor materials* 3FE
- 3KXM Mechanical properties of materials
 e.g.: Bending/compression/tensile/shearing strength, elasticity, fracture toughness, plasticity, creep (materials), ductility, hardness, stress strain diagrams
 Reference to: *Mechanics of solids, liquids and gases* 3BB
 Reference to: *Powders, granular solids* 3KP
- 3KXO Optical properties of materials
 e.g.: Optical absorption, transparency, optical reflectivity/refractivity
 Reference to: *Material behaviour under radiation exposure* 3KXS
- 3KXP Sensory material properties
 e.g.: Comfort properties, breathability
 Reference to: *Fibre, yarn and textile testing* 3IGT
 Reference to: *Finishing, pretreatment, bleaching, resin finishing, coating of textiles* 3TK
- 3KXS Material behaviour under radiation exposure
 e.g.: Radiation resistance
 Reference to: *Electric/magnetic/electromagnetic fields effects on living beings* 3UMZ
 Reference to: *Electrical/magnetic properties of materials* 3KXE
 Reference to: *Optical properties of materials* 3KXO
 Reference to: *Radioactive radiation sources/damage/protection* 3UMX
 Reference to: *Thermal/thermomechanical properties of materials* 3KXT
- 3KXT Thermal/thermomechanical properties of materials
 e.g.: Refractivity, thermal shock resistance, thermal expansion, thermal conductivity, thermal shock behaviour
 Reference to: *Material behaviour under radiation exposure* 3KXS
- 3KXU Chemical properties of materials, corrosion/erosion behaviour
 e.g.: Acid/lye resistance, slag action resistance, bacterial corrosion, stress corrosion cracking, fatigue crack corrosion, cathodic corrosion protection, cavitation, hydrogen embrittlement
 Reference to: *Fermentation, cell culture* 3PZA
 Reference to: *Corrosion testing* 3IGK
- 3KXW Surface properties
 e.g.: Roughness, wettability, surface tension, hydrophobicity
- 3KXZ Biomedical/biochemical properties of materials
 e.g.: Biocompatibility
 Reference to: *Biochemistry (fundamentals)* 3BZH
 Reference to: *Biomedical engineering* 3R
 Reference to: *Bioprocess engineering, biotechnology* 3PZ
 Reference to: *Pharmacology, pharmaceutical fundamentals, toxicology* 3BZB

3L Manufacturing technology

Note: The manufacturing technology includes the belonging processes, plants, machines and tools.

Reference to: *Processing of semiconductor materials* 3FE

Reference to: *Raw material processing* 3PA

Reference to: *Materials and material properties* 3K

Reference to: *Materials testing/inspection* 3IG

3LD Rapid Prototyping, Rapid Tooling

e.g.: Selective laser sintering, fused deposition modeling

Reference to: *CAD/CAE/CAM/CIM systems* 3DLB

Reference to: *Graphic data processing, virtual reality* 3DR

Reference to: *Computer integrated manufacturing (CIM), virtual production* 3AIB

3LE Materials exploitation/extracting/master forming technology

Reference to: *Powders, granular solids* 3KP

3LEB Iron and steel making

e.g.: Direct/melting reduction process, pig iron production (blast furnace), continuous casting (steel), secondary metallurgy

3LEE Nonferrous metal production

e.g.: Electrolytic aluminium production, copper converters, continuous casting (nonferrous metal)

3LEG Foundry

e.g.: Foundry melt technique, sand mould technique, moulding materials, pressure/chill castings, rheocasting, foundry patternmaking, cast aftertreatment

3LEK Powder metallurgy

e.g.: Sintered/hard metals production

Reference to: *Powders, granular solids* 3KP

3LEM Production/processing of non-metallic inorganic materials

e.g.: Ceramics/glass/cement production, design of ceramics/glass; ceramics/glass products

3LER Production/processing of minerals

e.g.: Diamond/ruby synthesis, YAG/YIG production, crystal growing

3LET Production/processing of plastics/rubbers

e.g.: Plastics foaming, polymerization, polycondensation, vulcanization, calendaring process, blow moulding, design of plastics, tires production

3LEX Production/processing of composite materials

e.g.: Laminates winding process, impregnation technique, in-situ deposition

Reference to: *Wood manufacturing technology, composite materials with wood* 3SN

3LF Mechanical working

e.g.: Magnetic forming

3LFB Press forming

e.g.: Compressive/explosive forming, cold massive forming, forging process, extruding, tube extrusion

3LFG Rolling

e.g.: Metal sheet rolling, profile contour rolling, wire rolling

3LFR Deformation by tension/tension-compression stresses

e.g.: Forming under tensile and compressive condition, deep/wire drawing, elongation (forming), hydroforming

3LFX Deformation by bending and shear stresses

e.g.: Forming by bending, forming under shearing condition, stamping, cylindrical bending, torsional straining

3LK Material removal processes

3LKB Machining (chip-type), cutting

e.g.: Turning, milling, drilling, water jet cutting, whetting, polishing, lapping, broaching, honing

Reference to: *Woodworking machinery* 3SP

3LKG Chemical/electrochemical machining

e.g.: Etching process, spark erosion machining, LIGA process, electropolishing

Reference to: *Components and circuits fabrication* 3FF

Reference to: *Electric heat* 3EK

3LKR Surface cleaning (mechanical and chemical)

e.g.: High-pressure cleaning, sandblasting, descaling, unrusting, deburring, acid cleaning

Note: Cleaning of materials (e.g. zone melting) must be classified with the belonging materials.

Reference to: *Thermal separation (molding)* 3LNX

- 3LN Joining, thermal cutting
- 3LNB Welding, soldering
e.g.: Metal fusion/pressure welding, gas-shielded arc welding, hard/soft soldering, filler materials, brazing
solders, welding gases, plastics welding, diffusion welding, friction stir welding
Reference to: Electric heat 3EK
Reference to: Components and circuits fabrication 3FF
Reference to: Wiring, connecting, plug-in units, housings 3FU
- 3LNG Adhesive bonding
e.g.: Adhesive materials, adhesive bonding of metals/plastics
- 3LNR Positive and negative joining
e.g.: Forming joining, screwing, riveting, folding and creasing, bordering (crimping), clasping, tucking,
stranding, clinch joining, pressure bonding
- 3LNX Thermal separation (molding)
e.g.: Plasma jet cutting, laser cutting, laser engraving, oxygen cutting, flame planing
Reference to: Surface cleaning (mechanical and chemical) 3LKR
Reference to: Separation of solid, liquid and gaseous matters, disperse systems 3PH
- 3LR Processes for changing properties of materials
Reference to: Drying of solid, liquid and gaseous matters 3PF
- 3LRB Heat treatment for changing properties of materials
e.g.: Quench hardening, annealing, laser hardening, quenching and tempering, artificial aging (metallurgy)
- 3LRG Thermochemical processes to change surface properties
e.g.: Carbonization, nitriding, carbonitriding, boriding, aluminizing, surface alloying, plasma pretreatment
- 3LRR Mechanical surface treatment
e.g.: Shot peening, surface rolling, strengthening/polish/precision rolling
- 3LX Coating processes (thin/thick films)
Reference to: Electric heat 3EK
- 3LXB Metal deposition
e.g.: Roll cladding, ion plating, electroplating, chemical metallization, hot dip galvanizing, electrolytic
oxidation, aluminium oxidizing, galvanizing, selective electroplating, electrophoresis coating,
electroless plating
Reference to: Metal spraying 3LXX
- 3LXG Nonmetal deposition
e.g.: Chromating, enamelling, glazing (coating process), plastics coating, varnishing, phosphating
Reference to: Wood coatings 3SM
Reference to: Varnishes (chemical products) 3PLE
Reference to: Production of basic chemicals and chemical intermediate products 3PLE
- 3LXR Atomizing, sputtering, vapour deposition
e.g.: PVD (physical vapour deposition), radiofrequency/magnetron/direct-current/ultrasound/reactive
sputtering, CVD (chemical vapour deposition), MOCVD (metalorganic CVD), LPCVD (low-pressure CVD)
- 3LXX Thermal spraying
e.g.: Metal/ceramic/plastics/plasma/powder/electric-arc/flame spraying, spray coating
Reference to: Metal deposition 3LXB
- 3LZ Assembling lines and assembly systems
Reference to: Computer integrated manufacturing (CIM), virtual production 3AIB

3M Mechanical engineering

- 3MB Machine components
- 3MBB Detachable joints
e.g.: Screws, threads, lock rings, dowel pins, feather keys
- 3MBE Springs, absorbers, machine foundations/casings
e.g.: Liquid/air/metal springs, vibration/shock absorbers
- 3MBK Power transmission units, brakes
e.g.: Shaft hub joints, mechanical joints/couplings/chains/shafts, ropes, friction linings, gearwheels
- 3MBL Tubes, pipe joints, tubings
Reference to: Water and gas supply, sanitary engineering 3MR
- 3MBM Seals and gaskets
e.g.: Contact seals, non-contact seals

- 3MBR Valves and fittings
e.g.: Gate valves, regulating valves, ball valves
- 3MBX Bearings
e.g.: Friction bearings, antifriction bearings, magnetic bearings, slideways, antifriction guideways
- 3MD Tribology
e.g.: Friction, wastage, lubrication, lubricants, cutting fluids, antiadhesive agents
Reference to: Mechanics of solids, liquids and gases 3BB
- 3ME Fluidics (hydraulics, pneumatics)
e.g.: Hydraulic/compressed-air motors, hydraulic/pneumatic valves, hydraulic cylinders, compressed-air hoses
Reference to: Fluid dynamics 3BBS
Reference to: Heat transfer engineering, heat exchangers 3EIC
- 3MF Gears and linkages
e.g.: Friction gears
- 3MFB Gear drives, flexible drive mechanisms
e.g.: Planetary gears, belt drives, CVT gearboxes
- 3MFL Link mechanisms, crank mechanisms
e.g.: Cam mechanisms, maltese cross transmissions, cam type drives, eccentric/linear gears
- 3MFR Hydraulic and electric transmission
- 3MG Turbomachinery and piston engines
- 3MGB Steam turbines
- 3MGD Hydraulic turbines, marine propellers
- 3MGF Gas turbines, jet engines, rocket engines
- 3MGG Wind turbines, windmills
- 3MGK Pumps
e.g.: Rotary/turbo/rotary-piston/diaphragm/hose/vacuum/displacement pumps
Reference to: Vacuum technology 3MU
- 3MGL Compressors, fans
e.g.: Blower/turbo/screw/piston compressors
- 3MGN Piston-driven engines
e.g.: Otto-/Diesel-/ rotary-piston/gas/marine engines, Stirling motors
Reference to: Special drives for vehicles 3NRB
- 3MGR Turbomachinery: carburation/combustion
e.g.: Carburetors, turbochargers, burnables injection, fuel tanks, valves for combustion engines, sparking plugs, fuel consumption, exhaust catalysts
- 3MGT Cooling systems for turbomachinery/piston-driven engines
- 3MI Processing and processing machines
Reference to: Woodworking machinery 3SP
Reference to: Paper making machines 3SY
- 3MIB Civil engineering, construction (building) machinery
e.g.: Building/underground/bridge construction/engineering, damming (engineering), dredgers, earthmoving equipment, building components, industrial floors
Reference to: Mining, tunneling, petroleum/natural gas production, deep well drilling 3MZ
- 3MIK Printing machines/processes, reproduction techniques
e.g.: Offset printing machines, printing processing machines, printing inks, serigraphy machines, microfilms, mikrofiches, letterpress/flexographic/planographic/continuous-form printing, serigraphy, duplicating devices, newspaper technique, gravure process
Reference to: Peripheral computer equipment, mass storage, data carriers 3DDG
Reference to: Office software, electronic publishing 3DK
Reference to: Multimedia 3GG
Reference to: Graphic data processing 3DR
- 3MIM Packaging machines/technology/materials
- 3MIR Food and beverages processing machines
Reference to: Biotechnologically manufactured products 3PZS
Reference to: Food technology 3PN
Reference to: Chemical apparatuses and plants 3PLL
Reference to: Biotechnological apparatuses, plants and reactors 3PZO
- 3MIT Agricultural and forestry machinery
Reference to: Commercial vehicles 3NDG

- 3ML Hoisting and transportation technology, storage
 e.g.: Cranes, trackbound/wire-rope/flow/continuous conveyors, mine hoists, elevators, industrial trucks, loading facilities, commissioning stackers
Reference to: Mining: mining, tunneling, shaft construction 3MZB
Reference to: Logistics, material management/control 3AIX
- 3MLB Tanks, silos
 e.g.: Bulk materials bunkers, pressureless vessels
Reference to: Oil/gas underground storages 3NT
- 3MM Robots, industrial handling
- 3MN Hand tools
 e.g.: Electric/pneumatic hand tools
Reference to: Electrical machines and drives 3EU
- 3MR Water and gas supply, sanitary engineering
Reference to: Tubes, pipe joints, tubings 3MBL
Reference to: Pipelines 3NT
- 3MU Vacuum technology
Reference to: Vacuum pumps 3MGK
- 3MX Fire safety and fire fighting technology
 e.g.: Fire engines, fire-suppression agents, fire-alarm systems, fire fighting
Reference to: Commercial vehicles 3NDG
Reference to: Control technology, monitoring 3IT
- 3MZ Mining, tunneling, petroleum/natural gas production, deep well drilling
Reference to: Civil engineering, construction (building) machinery 3MIB
Reference to: Biological degradation and bioremediation 3PZI
Reference to: Geosciences, geophysics 3BW
Reference to: Raw material processing 3PA
Reference to: Raw materials (natural/secondary) 3KB
- 3MZB Mining: mining, tunneling, shaft construction
 e.g.: Surface mining, underground mining, trepanning, roadheading method, extraction (mining), mine ventilation, mine surveying
Reference to: Explosives, blasting agents 3MZC
Reference to: Mine railways 3NF
Reference to: Mine hoists 3ML
- 3MZC Explosives, blasting agents
 e.g.: Explosion/blasting technique
Reference to: Mining: mining, tunneling, shaft construction 3MZB
- 3MZE Oil & Gas: Drilling, production, process equipment
 e.g.: Oil/natural-gas well-drilling plants, oil/natural-gas mining
Reference to: Marine engineering, Ocean and coastal structures 3NX
Reference to: Oil/gas underground storages 3NT

3N Traffic, transportation, vehicles

- 3NA Traffic systems
 e.g.: Metropolitan/urban/highway/rail/maritime/air traffic, fleet management
- 3NAB Traffic control systems/signalling installations
 e.g.: Tolage
Reference to: Control technology, monitoring 3IT
- 3ND Road vehicles
- 3NDB Passenger cars, two-wheeled vehicles
 e.g.: Station wagons, estate cars, racers
- 3NDG Commercial vehicles
 e.g.: Motorbuses, caravans, truck tractors, snow removers, commercial/cooling/road-cleaning vehicles, tank/garbage trucks
Reference to: Garbage, waste treatment/avoidance/management 3UMB
Reference to: fire-fighting vehicles 3MX
Reference to: Refrigeration and cold storage 3EIK
Reference to: Agricultural and forestry machinery 3MIT

- 3NF Rail vehicles, suspended railways and ropeways
 e.g.: Locomotives, railway passenger vehicles, railway wagons, smeltery transportations, rail laying, maglev vehicles, mine railways
Reference to: Mining: mining, tunneling, shaft construction 3MZB
- 3NK Ships, watercraft, shipbuilding
 e.g.: Shipbuilding market/company technology, types of ships, ship theory/propulsion/equipments
- 3NN Aircraft, space vehicles/stations
- 3NR Automotive engineering
- 3NRB Special drives for vehicles
 e.g.: Methanol/hydrogen drives, hybrid propulsions
Reference to: Otto-/Diesel-/piston-driven engines 3MGN
- 3NRF Drives for electrical road vehicles
Reference to: Electrical machines and drives 3EU
- 3NRK Chassis, mechanics/dynamics of vehicle movement, vehicle body
 e.g.: Bogies, wheel suspensions, vehicle steering
- 3NRN Vehicle components
 e.g.: Automotive air-conditioning systems, vehicle seats, safety belts, trailer couplings
Reference to: Heating, ventilation, air conditioning, clean room technology 3EIH
- 3NRT Electric and electronic equipment of vehicles
Reference to: Electronics and microelectronics 3F
Reference to: Low-voltage installations, lighting engineering 3EP
- 3NRX Vehicle safety/testing/maintenance
 e.g.: Accident mechanics, side-crash security, collision dynamics, vehicles testbeds, carwashes
Reference to: Maintenance, servicing 3AK
- 3NT Pipelines
 e.g.: Gas/petroleum pipelines, gas pressure reservoir, petroleum reservoir, underground/storage tanks
Reference to: Oil & Gas: Drilling, production, process equipment 3MZE
Reference to: Tanks, silos 3MLB
Reference to: Water and gas supply, sanitary engineering 3MR
- 3NX Marine engineering, Ocean and coastal structures
 e.g.: Offshore structures, fishing/diving/deep-sea/ocean technique/engineering, deep-sea mining
Reference to: Oil & Gas: Drilling, production, process equipment 3MZE
- 3NZ Military engineering

3P Process engineering, bioprocess engineering, downstream processing, reaction engineering

Note: includes the relevant processes, plants, products and chemicals

- 3PA Raw material processing
Reference to: Mining, tunneling, petroleum/natural gas production, deep well drilling 3MZ
Reference to: Manufacturing technology 3L
Reference to: Materials and material properties 3K
- 3PAB Processing of anorganic, mineral raw materials
 e.g.: Ore-, clay-, stone processing, coal processing
Reference to: Biological degradation and bioremediation 3PZI
- 3PAD Processing of organic raw materials
 e.g.: Cellulose processing, biomass processing
Reference to: Fibre extraction, fibre production, yarn technology 3TC
Reference to: Biotechnologically manufactured products 3PZS
- 3PB Size reduction
 e.g.: Crushing, grinding, shredding, mashing, and squeezing
- 3PD Material combination, mixing
 e.g.: Granulating, agglomerating, pelletizing, briquetting, kneading, homogenizing, emulsifying
- 3PF Drying of solid, liquid and gaseous matters
 e.g.: Freeze-, contact-, radiation-, spray drying, calcination, roasting
Reference to: Processes for changing properties of materials 3LR

- 3PH Separation of solid, liquid and gaseous matters, disperse systems
e.g.: Sieving, classifying, dewatering, membrane separation processes, electrostatic filter, biofilter, ion exchanger, desalination, extraction systems, condensation processes
Reference to: Thermal separation (molding) 3LNX
- 3PHB Sorption technology
e.g.: Absorption technology, adsorption technology
- 3PHC Membrane and diffusion separation processes
e.g.: Dialysis, electrodialysis, electrophoresis, osmosis, reverse osmosis, electroosmosis, thermodiffusion, pressure diffusion
- 3PHD Distillation, rectification technology
- 3PJ Sterilization and disinfection processes
- 3PL Chemical engineering, chemical reaction engineering
Reference to: Fundamentals of chemistry 3BX
- 3PLA Chemical equilibrium, kinetics, catalysis, chemical solutions
- 3PLC Chemical reactions, chemical reaction engineering
Reference to: Biotechnological reaction technology and processing 3PZM
Reference to: Chemical apparatuses, plants and reactors 3PLL
- 3PLD Chemical process-development, -modelling, -performance and -optimization
Reference to: Biotechnological process development 3PZP
Reference to: Control and control systems 3IR
- 3PLE Production of basic chemicals and chemical intermediate products
e.g.: Production of chemical semi-products
Reference to: Biotechnologically manufactured products 3PZS
Reference to: Nonmetal deposition 3LXG
Reference to: Powders, granular solids 3KP
- 3PLF Production of inorganic chemical final products
e.g.: Production of potash salt
Reference to: Biotechnologically manufactured products 3PZS
- 3PLG Production of organic chemical final products
e.g.: Production of methanol
Reference to: Biotechnologically manufactured products 3PZS
Reference to: Wood coatings 3SM
- 3PLK Particle chemistry, disperse systems, emulsions, colloids, suspensions
Reference to: Colloid chemistry 3BXE
Reference to: Nanotechnology, nanotubes 3QN
Reference to: Particle-reinforced composites 3KMA
- 3PLL Chemical apparatuses, plants and reactors
e.g.: Reaction apparatuses
Reference to: Biotechnological apparatuses, plants and reactors 3PZO
Reference to: Chemical reactions, chemical reaction engineering 3PLC
Reference to: Food and beverages processing machines 3MIR
Reference to: Project engineering and planning of plants, equipment construction 3AB
- 3PLM Chemical micro process engineering
Reference to: Micro technology 3Q
- 3PN Food technology
Reference to: Biotechnologically manufactured products 3PZS
Reference to: Food and beverages processing machines 3MIR
Reference to: food exposure 3UXR
- 3PP Production of pharmaceutical products
Reference to: Pharmaceutical fundamentals, toxicology 3BZB
- 3PZ Bioprocess engineering, biotechnology
Reference to: Biomedical/biochemical properties of materials 3KXZ
Reference to: Life sciences 3BZ
- 3PZA Fermentation, cell culture
e.g.: Algae, bacteria, yeasts, fungi
Reference to: bacterial corrosion 3KXU
- 3PZC Biotransformation and enzymatic processes
- 3PZE Molecular biotechnology
e.g.: Strain development
- 3PZG Tissue Engineering
e.g.: Cultivation of cells, tissues and organs

- 3PZI Biological degradation and bioremediation
 e.g.: Biological leaching procedures, wastewater treatment, biofilters
 Reference to: *Processing of inorganic, mineral raw materials* 3PAB
 Reference to: *Mining, tunneling, petroleum/natural gas production, deep well drilling* 3MZ
 Reference to: *Water pollution, wastewater* 3UXX
- 3PZK Agrobiotechnology
 e.g.: Transgenic plants
- 3PZM Biotechnological reaction technology and processing
 e.g.: Biotechnological material-, impulse-, and energy-transfer in bioreactors, biotechnological reaction engineering and process behavior in biotechnology, biocatalysts
 Reference to: *Chemical reactions, chemical reaction engineering* 3PLC
- 3PZO Biotechnological apparatuses, plants and reactors
 Reference to: *Chemical apparatuses and plants* 3PLL
 Reference to: *Project engineering and planning of plants, equipment construction* 3AB
 Reference to: *Food and beverages processing machines* 3MIR
- 3PZP Biotechnological process-development, -modelling, -performance and -optimization
 Reference to: *Chemical process-development, -modelling, -performance and -optimization* 3PLD
 Reference to: *Control and control systems* 3IR
- 3PZS Biotechnologically manufactured products
 e.g.: Microbial biomass, biogas
 Reference to: *Energy industry* 3EB
 Reference to: *Food technology* 3PN
 Reference to: *Food and beverages processing machines* 3MIR
 Reference to: *Production of basic chemicals and chemical intermediate products* 3PLE
 Reference to: *Production of inorganic chemical final products* 3PLF
 Reference to: *Production of organic chemical final products* 3PLG
 Reference to: *Processing of organic raw materials* 3PAD
- 3PZU Downstream processing in biotechnology
 e.g.: Biological disintegration, cell disintegration, product separation/remediation in biotechnology
- 3PZX Biochips, DNA chips (gene chips)
 Reference to: *Biocomputing, neurocomputing* 3DBC
 Reference to: *Biological-biochemical measuring methods* 3IDB
 Reference to: *Semiconductor/microelectronics components* 3FT
 Reference to: *Sensor technology, actinic* 3IL

3Q Microtechnology, nanotechnology

Reference to: *Chemical micro process engineering* 3PLM

- 3QB Microsystems technology
 Reference to: *Optoelectronic devices, integrated optics* 3FX
- 3QBD Micromechanical components
- 3QBE Micro-electro-mechanical components
 e.g.: MEMS (microelectromechanical systems), microreactors
 Reference to: *Components and circuits fabrication* 3FF
 Reference to: *Semiconductor/microelectronics components* 3FT
 Reference to: *Passive/electromechanical components* 3FK
- 3QN Nanotechnology, nanotubes
 Reference to: *Fibres, microfibres, nanofibres* 3KH
 Reference to: *Crystal structure, material structure/textures* 3KWG
 Reference to: *Particle chemistry, disperse systems, emulsions, colloids, suspensions* 3PLG

3R Biomedical engineering

Reference to: *Biomedical/biochemical properties of materials* 3KXZ
 Reference to: *Biosciences, life sciences* 3BZ
 Reference to: *Pharmacology, pharmaceutical fundamentals, toxicology* 3BZB

- 3RB Medical diagnosis and diagnostic systems
 e.g.: Electrodiagnostics

- 3RBB Medical measurement, bioelectrical signal processing
e.g.: Biomagnetic measurement, measuring of physiological parameters, audiometry, organ-function measuring
Reference to: Signal recognition/processing 3GF
- 3R BX Clinical laboratories diagnosis
e.g.: Blood analysis, cytometry, enzyme diagnostics, immunoassays
Reference to: Laboratory techniques 3IU
Reference to: Measuring/testing of chemical variables, chemical analysis 3IFC
- 3RF Diagnostic medical imaging
e.g.: Thermography (medical diagnosis), diaphanoscopy
- 3RFB Computer-aided tomography, magnetic resonance imaging
e.g.: MR angiography, Cine MRI (medical diagnosis), emission CT (medical diagnosis), electrical impedance tomography (medical diagnosis), X-ray CT (medical diagnosis), microwave tomography (medical diagnosis)
- 3RFF Medical endoscopic diagnosis
e.g.: Laparoscopy, video endoscopy (medical diagnosis)
- 3R FK Nuclear medicine diagnosis
e.g.: Scintigraphy (medical diagnosis), radionuclide ventriculography
- 3R FN Medical X-ray diagnostics
e.g.: Digital radiography (medical diagnosis), film screen combination
- 3R FT Medical ultrasonic diagnostics
e.g.: Echocardiography, endoscopic ultrasonography
- 3RI Optometry, physiological optics, vision aids
e.g.: Spectacles, contact lenses, eye refractometry
- 3RK Medical treatment
e.g.: Chemotherapy, gene therapy, infusions
- 3R KB Surgery
e.g.: High-frequency surgery, minimally invasive surgery, endoscopic therapy, microwave/catheter/laser ablation, laser angioplasty, medical operation technique, lithotripsy
- 3R KG Electro therapy, light therapy, climate therapy
e.g.: Therapeutical electrical stimulation, cardiac pacemakers, high-frequency/low-temperature therapy, magnetic field therapy, medical ultrasound therapy, microwave/thermal therapy, PDT (photodynamic therapy)
- 3R KR Radiation therapy
e.g.: Gamma-ray therapy, X-ray therapy, nuclear-medical therapy
- 3R KX Acute medical care
e.g.: Anaesthesia, ventilation (respiration), reanimation
- 3RN Rehabilitation engineering, prostheses, artificial organs
e.g.: Blood pumps system, dialyzers, artificial heart, artificial pancreas, oxygenators
- 3RNB Passive endoprostheses
e.g.: Artificial eye lenses, heart valve prosthesis, orthopaedic implants, dental prosthesis
- 3RNX Technical aids for rehabilitation
e.g.: Myoelectric controlled prosthesis, exoprosthesis, blind person aids, hearing aids, communication aids for handicappeds, orthosis, wheelchairs
- 3RT Hospital management/information systems, doctor's practice management
e.g.: Hospital engineering, medical picture-archiving systems, medical communication systems, telemedicine, patient data-management systems

3S Wood and paper

- 3SK Wood science and engineering
e.g.: Wood anatomy/chemistry/physics/preservation
Reference to: Biosciences , life sciences 3BZ
- 3SL Wood
e.g.: Raw/laminated wood, sawn timbers, wood fibre boards, wood composites, cork
Reference to: Cellulose 3KKC

- 3SM Wood coatings
e.g.: Varnishes/foils for wood, wood preservatives
Reference to: *Production of organic chemical final products* 3PLG
Reference to: *Nonmetal deposition* 3LXG
Reference to: *Coatings, thin films* 3KU
- 3SN Wood manufacturing technology, composite materials with wood
e.g.: Wood fibre-board manufacturing, formed wood-parts manufacturing, wood composites manufacturing
Reference to: *Production/processing of composite materials* 3LEX
- 3SP Woodworking machinery
e.g.: Mechanical/noncutting wood processing, sawing/milling/drilling/cutting machines (woodworking), laminated wood composing machines, wood presses, woodworking centres, wood production lines
Reference to: *Machining (chip-type), cutting* 3LKB
Reference to: *Processing and processing machines* 3MI
- 3SQ Wood finished products
e.g.: Wood furnitures, wood components, wood packing agents, wood toys, wood sports devices
- 3SV Paper
Reference to: *Cellulose* 3KKC
- 3SY Paper making machines, paper technology, paper pulp processing
Reference to: *Processing and processing machines* 3MI

3T Textiles, garment, textile machinery

Note: *Textile machines must be classified to the belonging sub classifications (in technological connection).*
Reference to: *Fibre, yarn and textile testing* 3IGT

- 3TC Fibre extraction, fibre production, yarn technology
Reference to: *Processing of organic raw materials* 3PAD
Reference to: *Fibre-reinforced composites* 3KMB
Reference to: *Fibres, microfibres, nanofibres* 3KH, *Organic materials, polymers* 3KK
- 3TCE Spinning, winding, twisting, texturing of yarn
e.g.: Spinning (textile process), spooling (winding), doubling (shedding), twisting/texturing (yarn), yarns (textile good), spinning preparation
- 3TG Warping, beaming, sizing, braiding, tufting, lace manufacturing
e.g.: Sectional warping, warping (weaving), beaming (textile process), warp preparation, warp slashing, knotting (textiles), tufting (upholster), bobbins
- 3TGB Weaving
e.g.: Woven fabrics
- 3TGG Knitting
e.g.: Meshing (knitting), knitted goods, hosieries
- 3TGR Nonwoven manufacturing
e.g.: Spunbondeds, needle-punched nonwoven fabrics, melt blowing (textiles)
- 3TK Finishing, pretreatment, bleaching, resin finishing, coating of textiles
e.g.: Textiles pretreatment/bleaching/coating/drying, singeing, desizing
Reference to: *Sensory material properties* 3KXP
- 3TKB Dyeing and printing of textiles
e.g.: Pigment printing, vat dyeing, prints (substrate), colour kitchen
- 3TM Textiles, textile goods
- 3TMB Making-up, embroidering of textiles
e.g.: Sewing, cloth cutting, zippers, garment design
- 3TML Clothing (apparel), functional wear, protective clothing
e.g.: Outerwears, tailored size, underwear, career apparel, smart clothes
Reference to: *Occupational safety, accident prevention* 3AM
- 3TMP Smart textiles, industrial textiles
e.g.: Geotextiles, medical/mobile/industrial textiles, building fabrics
Reference to: *Fibre-reinforced composites* 3KMB
Reference to: *Geosciences, geophysics* 3BW
Reference to: *Plastics* 3KKB
- 3TMW Home and household textiles, carpets
e.g.: Curtains (limpid), furnishing fabrics, bedclothes, textile wall papers

3TT Textile care, care labelling
e.g.: Ironing, rental linen, dry cleaning solvents, spot removal (textiles)

3U Environmental engineering, environmental pollution

Reference to: Environmental policy, ecology, ecosystems 3AXB

Reference to: Measurement, testing and control 3I

3UM Environmental pollutants and toxicology

Reference to: Biosciences, life sciences 3BZ

Reference to: Pharmacology, pharmaceutical fundamentals, toxicology 3BZB

3UMB Garbage, waste treatment/avoidance/management

e.g.: Garbage depository, landfill covering, waste incinerator plants, waste recycling, used oil removal, garbage composting, recycling technique

Reference to: refuse collection vehicles 3NDG

Reference to: Raw materials (natural/secondary) 3KB

3UMG Environmental chemicals, chemical pollutants/avoidance

3UMR Noise sources/injury/abatement

e.g.: Machinery/traffic noises, sound insulation

Reference to: Occupational safety, accident prevention 3AM

3UMX Radioactive radiation sources/damage/protection

e.g.: Radioactive wastes, radioactive-waste disposal, reprocessing of reactor fuels

Reference to: Material behaviour under radiation exposure 3KXS

3UMZ Electric/magnetic/electromagnetic fields effects on living beings

e.g.: Electro-smog

Reference to: Biophysics (fundamentals) 3BZA

Reference to: Electricity and magnetism, electrical engineering (theory) 3BG

Reference to: 3GE Electromagnetic interference of circuits 3GE

Reference to: Material behaviour under radiation exposure 3KXS

3UX Environmental pollution and engineering

Reference to: Biosciences, life sciences 3BZ

3UXB Soil contamination/protection/cleanliness

e.g.: Soil decontamination, contaminated soils

3UXG Air pollution

e.g.: Pollutant emission, industrial gas purification, motor-vehicle exhaust detoxication, flue gas desulfurization, climatic change

3UXR Earth biosphere pollution

e.g.: Noxious nuisance of forestry/agriculture/fishery/foods

Reference to: Food technology 3PN

3UXX Water pollution, wastewater

e.g.: Wastewater treatment/prevention, drain channel systems, potable water treatment/cleanliness, water protection, sea water pollution

Reference to: Biological degradation and bioremediation 3PZI