

## **Overview of Fusion Technologies**

Fusion research requires a range of technologies such as those indicated below in the provisional list for the ITER project. If your company provides any of these technologies / products then you are invited to register your details in the Fusion and ITER suppliers' data base.

### **Activity**

**100**

#### **CIVIL ENGINEERING AND BUILDINGS**

##### **110 BUILDING WORK**

- 111 Buildings and public works
- 112 Minor building work, flooring
- 113 Concrete shielding blocks
- 114 Cladding, roofing, waterproofing
- 115 Paint work
- 116 Huts and temporary buildings
- 117 Metal framing and minor metalwork
- 118 Timber joinery
- 119 Glazing, blinds

##### **120 ROADWORKS**

- 121 Roads and car parks
- 122 Road marking
- 123 Gardening
- 124 Fencing
- 125 Earthworks and piling
- 126 Soil sampling - Surveying
- 127 Road signs

##### **130 INSTALLATIONS AND SUPPLY OF PIPES**

- 132 Steel pipes
- 133 Stainless steel pipes
- 134 Sanitary pipes
- 135 Heating pipes
- 136 Lagging of pipes
- 137 Supply of steel pipes
- 138 Supply of stainless-steel pipes
- 139 Supply of non-ferrous pipes
- 13A Miscellaneous

##### **140 ELECTRICAL INSTALLATION WORK**

- 141 Cable-laying
- 142 Lighting - Power
- 143 Telephone, telex, telefax

##### **150 HEATING AND AIR-CONDITIONING EQUIPMENT (SUPPLY AND INSTALLATION)**

- 151 Boilers
- 152 Heat exchangers
- 153 Ventilation installations
- 154 Air-conditioning installations
- 155 Air-conditioning units
- 156 Ventilation and air-conditioning trunking
- 157 Air filters
- 158 Miscellaneous

160 HOISTING GEAR  
161 Manual  
162 Light- and medium-duty overhead travelling cranes  
163 Heavy-duty overhead travelling cranes  
164 Handling and fork-lift trucks  
165 Accessories  
166 Lifts, service lifts  
167 Derricks, pulleys  
168 Platforms, lifting tables

170 WATER SUPPLY AND TREATMENT  
171 Pumps  
172 Heat exchangers  
173 Cooling plants  
174 Demineralizers - Water softeners  
176 Valves, cocks, etc.  
177 Flexible tubing  
178 Accessories  
179 Flowmeters for installations and water treatment  
17A Water treatment

180 CIVIL ENGINEERING AND BUILDINGS  
181 Compressed air - Compressors  
182 Fire-fighting, prevention and detection  
183 Fuel oils  
184 Lubricating oils  
185 Building materials  
186 Fireproofing materials  
187 Building equipment - Scaffolding  
188 Heat and sound insulation for buildings  
189 False floors  
18A Storage equipment

**Activity**  
**200**

**ELECTRICAL ENGINEERING**

210 SWITCH GEAR AND SWITCHBOARDS  
211 Very-high-voltage switch gear (380-220-110-66 kV)  
212 HV switch gear (18-10-6-3 kV)  
213 LV switch gear (low voltage)  
215 HV switchboards  
216 LV switchboards  
217 Cubicles, boxes (electrical engineering)  
218 Electrical engineering accessories  
21R Maintenance and/or repair of switchgear

220 POWER TRANSFORMERS  
221 Very-high-voltage transformers  
222 HV transformers  
223 LV transformers  
224 Reactances  
225 HV pulse transformers  
226 Variable-ratio transformers  
227 Special transformers

## 230 POWER CABLES AND CONDUCTORS

- 231 HV cables
- 232 LV cables
- 233 Radiation-resistant cables
- 234 Coaxial cables
- 235 Water-cooled cables
- 236 Cable accessories
- 237 Wire
- 238 Non-insulated conductors
- 23A Bus bars

## 240 CONTROL AND COMMUNICATION CABLES

- 241 Multicore cables
- 242 Coaxial cables
- 243 Telephone cables
- 244 Radiation-resistant signal cables
- 245 Optical fibres
- 246 Instrument wires, measurement cables
- 247 Flat cables
- 248 Accessories

## 250 POWER SUPPLIES AND CONVERTERS

- 251 Diesel sets
- 252 No-break power supplies and converters
- 253 Pulsed power
- 254 Switch-mode power converters
- 255 HV power rectifiers
- 256 LV power rectifiers
- 257 DC power converters
- 258 Chargers
- 259 Reactive power compensators
- 25R Maintenance and/or repair of power supplies and converters

## 260 MAGNETS

- 261 Complete large (> 50 tons) magnets
- 262 Complete small- and medium-sized magnets
- 263 Yokes/Magnets
- 264 Coils/Magnets
- 265 Superconducting coils/Magnets
- 266 Permanent magnet systems
- 267 Accessories for magnets

## 270 MEASUREMENT AND REGULATION

- 271 Measuring instruments
- 272 Recorders
- 273 Measuring transformers
- 274 Processors for networks controls
- 275 Programmable processors
- 276 Miscellaneous
- 27R Maintenance and/or repair of measuring and regulating instruments

280 ELECTRICAL ENGINEERING  
281 Filters/Electrical engineering  
282 Power capacitors  
283 AC motors  
284 DC motors  
285 Accumulators  
286 Industrial fittings  
287 Lighting equipment  
288 Motor reduction gearing  
289 Cable trays  
28A Ceramics  
28B Insulation materials and gases  
28C Dielectric liquids  
28R Maintenance and/or repair of motors and miscellaneous components

290 ELECTRICAL ENGINEERING COMPONENTS  
291 Resistors (braking, starting)  
292 High-power resistors  
293 Fuses, protective devices  
294 Protection relays  
295 Encoders (see also 384)  
296 Connecting equipment  
297 Miscellaneous electrical engineering components

**Activity**  
**300**

**ELECTRONICS**

310 ACTIVE ELECTRONIC COMPONENTS  
311 Electronic tubes  
312 Discrete solid-state devices  
313 Integrated circuits  
314 Microprocessor chips  
316 Optical transmitters and receivers (see also 486)  
317 Hybrid circuits  
318 Quartz  
319 Crystals  
31A Gas-discharge devices

320 PASSIVE ELECTRONIC COMPONENTS  
321 Capacitors  
322 Resistors, potentiometers  
323 Inductances  
324 Connectors  
325 Switches, buttons, fuses  
326 Relays  
327 Indication and display devices  
328 Filters  
329 Delay circuits

330 ELECTRONIC MEASURING INSTRUMENTS

- 331 Panel meters
- 332 Frequency generators
- 335 Oscilloscopes
- 336 Data analysers
- 337 Multimeters
- 338 Spectrum analysers
- 339 Specialised measuring stations
- 33A Miscellaneous electronic measuring instruments
- 33R Maintenance and/or repair of measuring instruments

340 POWER SUPPLIES - TRANSFORMERS

- 341 LV power supplies - general
- 342 HV power supplies - general
- 343 NIM power supplies
- 344 CAMAC power supplies
- 345 Constant-current power supplies
- 346 EUROBUS power supplies
- 347 Transformers
- 348 Pulse transformers
- 349 Variable transformers
- 34A FASTBUS power supplies
- 34R Maintenance and/or repair of power supplies and transformers

350 FUNCTIONAL MODULES AND CRATES (see also 440 and 480)

- 351 Analogue - general
- 352 Digital - general
- 353 NIM modules and crates
- 354 CAMAC modules and crates
- 355 EUROBUS modules and crates
- 356 FASTBUS modules and crates
- 357 Telecommunications - analogue
- 358 Telecommunications - digital
- 359 Video
- 35A Radio communication
- 35B VME modules and crates
- 35R Maintenance and/or repair of modules and crates

360 RF AND MICROWAVE COMPONENTS AND EQUIPMENT

- 361 Components below 100 MHz
- 362 Components above 100 MHz
- 363 Ferrite cores
- 364 Low-level amplifiers
- 365 Power amplifiers
- 366 Wave guide components
- 367 Coaxial components
- 368 RF tubes and klystrons
- 369 Miscellaneous RF and microwave components and equipment

370 CIRCUIT BOARDS

- 371 Printed circuits
- 372 Multi-layer printed circuits
- 373 Manufacturing machines
- 374 Electrolytic treatment
- 375 Accessories
- 376 Printed circuit substrates
- 377 Printed circuit films
- 378 Multiwire circuits
- 379 Wire-wrap circuits

- 380 ELECTRONICS
- 381 Bays, racks / electronics
- 382 Casings, boxes, chassis
- 383 Fans
- 384 Servo-motors, tachos, synchros (see also 275)
- 385 Batteries
- 386 Heat exchangers
- 389 Electronics documents

- 390 ELECTRONIC ASSEMBLY AND WIRING WORK
- 391 Assembly and wiring without off-site testing
- 392 Assembly and wiring with off-site testing
- 393 Assembly and wiring with technical design study and testing
- 394 As 393, for specialised fields (e.g. Multiplex)
- 395 Off-site multiwire assembly and wiring
- 396 On-site multiwire assembly and wiring

**Activity**

**400**

**DATA PROCESSING**

- 410 COMPUTERS AND WORK-STATIONS
- 411 Mainframe computers
- 412 Minicomputers
- 413 Servers
- 414 Work-stations
- 415 Desktop Personal Computers
- 416 Single-board computers
- 417 Calculators
- 418 Office automation, text processing systems
- 419 Portable Personal Computer
- 41L Hire of data-processing equipment
- 41R Maintenance and/or repair of computers and workstations

- 420 STORAGE SYSTEMS
- 421 Memory boards
- 422 Cartridge discs drives
- 423 Fixed discs
- 424 Magnetic tape drives
- 426 Diskette drives
- 427 Cartridge tape drives
- 428 Optical discs drives
- 429 Automated storage systems
- 42A Miscellaneous data-processing storage systems

- 430 DATA-PROCESSING PERIPHERALS
- 432 Terminals (alpha-numeric)
- 433 Printers
- 434 Graphic displays
- 435 Plotters
- 436 Equipment for microfiches, micro-films
- 437 Miscellaneous data-processing peripherals
- 43R Maintenance and/or repair of peripherals
- 440 INTERFACES (see also 350)
- 441 CAMAC process interfaces
- 443 VME process interfaces
- 444 G64 process interfaces
- 445 High-energy-physics interfaces (CAMAC, VME, FASTBUS)

450 SOFTWARE  
451 Operating systems  
452 Programming language processors  
453 DBMS  
454 Software for office automation  
455 CAD/CAM and engineering software  
456 Network software, electronic mail  
457 Application packages  
458 Miscellaneous software  
45R Software maintenance

460 CONSUMABLES ITEMS FOR DATA-PROCESSING

461 Magnetic tapes and cassettes  
462 Cartridges (tape and disc)  
464 Printer paper  
467 Microfiches  
468 Data-processing cards (consumable)  
469 Diskettes  
46A Optical discs  
46B Other consumable items  
46C Miscellaneous: consumable items

470 STORAGE FURNITURE (DATA-PROCESSING) (see also 350)

471 Information storage vaults  
472 Storage (tapes, diskettes, cartridges)

480 DATA COMMUNICATION (see also 350)

481 Local-area networks (hardware)  
482 Wide-area networks (hardware)  
483 Network gateways, bridges  
484 Modems  
485 Multiplexers  
486 Fibre-optics interfaces (see also 316)  
48R Maintenance and/or repair of data transmission equipment

**Activity**

**500**

**MECHANICAL ENGINEERING  
(SUPPLIES AND MANUFACTURING TECHNIQUES)**

510 RAW MATERIALS (SUPPLIES)

511 Iron, steel (see also 137)  
512 Stainless steel (see also 138 and 679)  
513 Copper, copper alloys  
514 Aluminium, aluminium alloys  
515 Nickel, nickel alloys  
516 Special metals and alloys  
517 Metal powders  
518 Non-metal products  
519 Miscellaneous other raw materials  
51A Hardware (nuts, bolts, etc.)

520 MACHINE TOOLS, WORKSHOP AND QUALITY CONTROL EQUIPMENT

- 521 Sheet metal equipment
- 522 Machining equipment
- 523 Welding and joining equipment
- 524 Heat treatment equipment
- 525 Surface treatment equipment
- 526 Quality control equipment
- 527 Assembly equipment
- 528 Machine tool accessories
- 52R Maintenance and/or repair of manufacturing and control equipment

530 CASTING AND MOULDING (MANUFACTURING TECHNIQUES)

- 531 Grey iron
- 532 Steel
- 533 Stainless steel
- 534 Copper, copper alloys
- 535 Aluminium, aluminium alloys
- 536 Refractory metals and alloys
- 537 Gravity, pressure die casting
- 538 Lead
- 539 Plastic injection

540 FORGING (MANUFACTURING TECHNIQUES)

- 541 Iron, steel
- 542 Stainless steel
- 543 Copper, copper alloys
- 544 Aluminium, aluminium alloys
- 545 Refractory metals and alloys
- 546 Powder metallurgy

550 BOILER METAL WORK (MANUFACTURING TECHNIQUES)

- 551 Mild steel ( $\leq 5$  mm)
- 552 Mild steel ( $> 5$  mm)
- 553 Stainless steel ( $\leq 5$  mm)
- 554 Stainless steel ( $> 5$  mm)
- 555 Copper, copper alloys
- 556 Aluminium, aluminium alloys
- 557 Other non ferrous metals

560 SHEET METAL WORK (MANUFACTURING TECHNIQUES)

- 561 Stainless steel ( $\leq 1$  mm)
- 562 Stainless steel (1 - 3 mm)
- 563 Copper, copper alloys ( $\leq 1$  mm)
- 564 Copper, copper alloys (1 - 3 mm)
- 565 Aluminium, aluminium alloys ( $\leq 1$  mm)
- 566 Aluminium, aluminium alloys (1 - 3 mm)
- 567 Other non ferrous metals

570 GENERAL MACHINING WORK

- 571 Small sizes ( $\leq 5$  kg)
- 572 Medium sizes (5 - 100 kg)
- 573 Large sizes (100 kg - 5 tons)
- 574 Very large sizes ( $> 5$  tons)
- 575 Welding



580 PRECISION MACHINING WORK

581 Very small sizes ( $\leq 100$  g)

582 Small sizes (100 g - 5 kg)

583 Medium sizes (5 - 100 kg)

584 Large sizes (100 kg - 1 ton)

585 Very large sizes ( $> 1$  ton)

586 Welding

590 SPECIALISED TECHNIQUES

591 Combined technology assemblies

592 Beryllium machining

593 Working of special metals and alloys

594 High-technology welding

595 Fibreglass

596 Plastic materials

597 Ceramics moulding and machining

598 Laser machining

599 Spark-erosion machining

59A Heat treatment

59B Vacuum heat treatment

59C Component cleaning

59D Surface treatment

59E Composite materials

**Activity**

**600**

**VACUUM AND LOW-TEMPERATURE TECHNOLOGY**

610 VACUUM PUMPS

611 Mechanical

612 Diffusion

613 Getter

614 Cryopumps

615 Turbo-molecular

616 Ion

617 Sublimation

618 Accessories for vacuum pumps

61R Maintenance and/or repair of vacuum pumps

620 REFRIGERATION EQUIPMENT

621 Installations de séparation de l'air

622 Linde-cycle systems

623 Claude-cycle systems

624 Sterling-cycle systems

625 Various systems

626 Accessories for refrigeration equipment

630 GAS-HANDLING EQUIPMENT

631 High-pressure reservoirs

632 Medium-pressure reservoirs

633 Gas holders and balloons

634 Recovery pumps and blowers

635 Compressors

636 Driers and purifiers

637 Miscellaneous gas-handling equipment

63R Maintenance and/or repair of gas-handling equipment

640 STORAGE AND TRANSPORT OF CRYOGENS

- 641 Tanks insulated at atmosph. pressure
- 642 Vacuum-insulated tanks (dewars and cryostats)
- 643 Vacuum-insulated tanks with reflecting layers
- 644 Tanks insulated with cooled screens
- 645 Pipework insulated at atmospheric pressure
- 646 Vacuum-insulated transfer lines
- 647 Pumps
- 649 Miscellaneous

650 MEASUREMENT EQUIPMENT (VACUUM AND LOW-TEMPERATURE TECHNOLOGY)

- 651 Gauges
- 652 Residual-gas analysers
- 653 Leak detectors
- 654 Thermometers
- 655 Liquid-level gauges
- 656 Mass-flow meters
- 657 Mass spectrometers
- 658 Miscellaneous items for measurement
- 65R Maintenance and/or repair of vacuum measuring instruments

660 LOW-TEMPERATURE MATERIALS

- 661 Metals and alloys of low normal resistivity
- 662 Superconducting metals and alloys
- 663 Superconducting wires and cables
- 664 Dielectric materials
- 665 Thermal insulating materials
- 666 Thermal radiation reflectors
- 667 Cryogenes
- 668 Special metals and alloys
- 669 Special adhesives

670 VACUUM COMPONENTS AND CHAMBERS

- 671 Flanges, seals, clamps
- 672 Bellows
- 675 Valves
- 676 Bakeout equipment
- 677 Optical windows
- 678 Feedthroughs
- 679 Tubes
- 67A Large-size vacuum chambers ( $\geq 1$  m)
- 67B Small- and medium-size vacuum chambers ( $< 1$  m)

680 LOW-TEMPERATURE COMPONENTS

- 681 Valves
- 682 Joints
- 683 Seals
- 684 Connectors
- 685 Feedthroughs
- 686 Coaxial cables
- 687 Low-temperature insulated wires
- 688 Miscellaneous other low-temperature components

690 VACUUM AND LOW-TEMPERATURE TECHNOLOGY

- 691 Lubricants
- 692 Climatic test chambers
- 693 Ovens
- 694 Evaporators

**Activity  
700**

**SPECIAL TRITIUM SYSTEMS AND COMPONENTS**

Tbc

**Activity  
800**

**MISCELLANEOUS**

**810 OPTICAL AND X-RAY EQUIPMENT**

- 811 Lasers
- 812 Mirrors, lenses
- 813 Optical benches
- 814 X-ray sets
- 815 Endoscopes
- 816 Miscellaneous optical and X-ray equipment

**820 PHOTOGRAPHIC EQUIPMENT**

- 821 Photographic equipment
- 822 Audio-visual equipment
- 823 Microfilm readers
- 824 Microfilms and accessories
- 825 Photocopiers
- 826 Photographic work
- 827 Miscellaneous photographic equipment
- 82R Maintenance and/or repair of photographic equipment

**830 GASES**

- 831 Industrial gases
- 832 Inflammable Gases for experiments
- 833 Gas fittings
- 834 Non Flammable Gases for experiments

**840 CHEMICALS**

- 841 Chemicals
- 842 Adhesives and special resins
- 843 Special chemical vessels, tanks
- 844 Chemical decontamination equipment

**850 TOOLING**

- 851 Portable machine tools
- 852 Hand tools
- 853 Cutting tools for machine tools
- 854 Miscellaneous tooling
- 855 Tools for electronics purposes
- 85R Maintenance and/or repair of tooling

**860 FURNITURE**

- 861 Office furniture
- 862 Workshop furniture
- 863 Laboratory furniture
- 864 Data-processing furniture

870 VARIOUS SUPPLIES

- 871 Stationery
- 872 Small laboratory items
- 873 Infirmary
- 874 Working and safety clothing
- 875 Miscellaneous communal and restaurant equipment
- 876 Typewriters
- 877 Telephone, telex, telefax equipment
- 878 Documents and miscellaneous publications
- 879 Subscriptions
- 87A Patents
- 87R Maintenance and/or repair of miscellaneous equipment

880 OTHER COMMODITIES

- 88A Books, reports, standards (library)
- 88B Periodicals (library)
- 88C Bookbinding (library)
- 88D Inter-library loans
- 88E Library: participation costs, database
- 88F Library: printing costs

890 TRANSPORT-RELATED SUPPLIES

- 891 Utility vehicles and passenger cars
- 892 Electric vehicles
- 893 Fire engines, ambulances
- 894 Trailers, miscellaneous equipment
- 895 Garage equipment
- 896 Spare parts
- 897 Fuel
- 898 Packing and transport costs
- 899 Undefined
- 89A Vehicle maintenance
- 89B Transport Insurance

8A0 RADIATION PROTECTION

- 8A1 Radioactive sources
- 8A2 Laboratory radiation detectors (\*), and spectrometers
- 8A3 Radiation monitors
- 8A4 Dosimeters
- 8A5 Detectors of non-ionising radiation
- 8A6 Protective clothing
- 8A7 Warning equipment and signs
- 8A8 RA decontamination equipment
- 8A9 Miscellaneous
- 8AR Maintenance and/or repair of radiation protection instruments

8B0 CHARGES

- 8B1 Electricity charges
- 8B2 Gas charges
- 8B3 Fuel costs
- 8B4 Water charges
- 8B5 Telephone charges, etc.
- 8B6 Data communications charges

**Activity  
900**

**VARIOUS SERVICES**

- 910 INDUSTRIAL SUPPORT
- 921 Cable laying
- 922 Installation work
- 923 Wiring and assembly work
- 924 Design work
- 925 Installation supervision
- 936 Alignment metrology and topometry
- 941 Cleaning of buildings
- 942 Site cleaning
- 943 Maintenance of pipe installations
- 944 Maintenance of electrical installations
- 945 Maintenance of heating and air conditioning
- 946 Maintenance of hoisting gear
- 947 Handling work
- 948 Cleaning of pipes and tanks
- 949 Waste disposal
- 951 Computing
- 971 Civil engineering and buildings
- 972 Electrical engineering
- 975 Mechanical engineering
- 976 Electro-mechanical design
- 981 Storage
- 982 Site supervision
- 983 Secretarial work
- 984 Goods transport
- 985 Vehicle hire
- 986 Research work
- 987 Materials inspection
- 988 Printing
- 989 Miscellaneous plant hire
- 98A Various training sessions
- 98B Laundry work
- 990 Temporary labour
- 991 Workshop jobs
  
- 920 CONSULTANTS
- 9A1 Civil engineering and building consultants
- 9A2 Electrical engineering consultants
- 9A3 Electronics engineering consultants
- 9A4 Mechanical engineering consultants
- 9A5 Data-processing consultants

**Activity  
1000**

**Robotics, Automation and Telem Manipulation**

Tbc