ICFO

Finançat per la Unió Europea

Generalitat de Catalunya

SPECIFICATION SHEET

Supply, installation and commissioning of a *Die Bonder Equipment* for the ICFO, financed by FEDER Catalunya 2021-2027

FILE NUMBER: ICFO 2026-042

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CLAUSE 1. Object of the contract

The purpose of this contract is the supply, installation and commissioning of a "**Die Bonder Equipment**" for the ICFO, financed by FEDER Catalunya 2021-2027.

The types of items supplied are linked to the CPV (Common Public Procurement Vocabulary) **38000000-5** Laboratory, optical and precision equipment (except glasses).

CLAUSE 2. Needs to satisfy

PhotonChip is a platform project that will help bring photonic technologies, in particular integrated photonics and photonic chips, from scientific feasibility to prototype stage to be applied in, for instance, communications as 6G transceivers, sensors, quantum computing and technology platforms.

Once operational, PhotonChip will cover the whole photonic chip value chain (design, packaging, testing) and train new experts thanks to dedicated programs.

As part of the Institute of Photonic Sciences (ICFO), PhotonChip will use advanced technologies as quantum technologies for cybersecurity, virtual and augmented reality, artificial intelligence, and machine learning.

In the development of the project, ICFO needs to acquire a **Die Bonder Equipment** for Integrated Circuits packaging. The purpose of this equipment is to provide the ICFO packaging line of the possibility to perform die attachment, soldering and flip-chip bonding processes, enabling the assembly of components onto different substrates or packages.

The Die Bonder Equipment shall be a flexible and modular platform capable of achieving a placement accuracy of ±3 µm. It shall support multiple face-up/ face-down alignment and bonding processes, as well as different assembly technologies with controlled and programmable temperature cycles and bonding force.

CLAUSE 3. Technical requirements

Technical proposal structure - minimum mandatory equipment characteristics

The die bonder shall be a flexible assembly system integrating an optical alignment unit, a substrate holding base and a die pick and place system, enabling the accurate assembly of dies and other components onto various substrates.

The die bonder equipment shall provide, at minimum, the following **functionalities**:

1. System configuration.
   a. Flexible and a modular table top machine.
   b. It shall be designed to support precision assembly processes while maintaining manual operation and process control.

2. Assembly processes. It shall support Die Bonding and Flip Chip bonding processes (face to face and face down alignment), including:
   a. Thermo-compression bonding.
   b. Soldering.
   c. Adhesive based attachment, including adhesives dispensing.

   d. UV light and thermal curing.
   e. Bonding processes with temperatures up to 400ºC.
   f. Bonding processes under controlled gas atmosphere, including N^2 and formic acid.

3. Precision. It shall provide an assembly precision equal or better than ±3 µm, in both die bonding and flip chip bonding processes.

4. Components, die and substrates specifications. The equipment shall be capable to handle a wide range of device dimensions, including but not limited to dies, ceramic substrates, packages, PCBs…
   a. Components dimensions ranging from, at least, 50 x 50 μm^2 to 100 x 100 mm^2.
   b. It shall support single units and batch configurations.

5. Force control. Automatic bond force control, programmable in the range of 0.2 to 500 N, minimum.

To ensure the implementation of the above-mentioned functionalities, the system shall include, at minimum, the following **components**:

1. Substrate holding base, including at minimum:
   a. Multi-axis base providing movement along three linear and one rotational axis.
   b. Vacuum based chuck capable of holding gel packs and tray packs of 2" and 4".
   c. Heating chuck, with the following minimum requirements: *(all functionalities can be implemented in a single chuck, or in various exchangeable chucks)*
      i. Programable temperature profiles.
         - Slow heating ramps compatible with substrate pre-heating processes.
         - Fast heating ramps (up to 20 ºC/s) compatible with substrate soldering processes.
         - Heating temperatures of at least 400 ºC.
         - Fast cooling capacity.
         - Heating area of 100 x 100 mm^2
      ii. Precise force control capability up to at least 500N.
      iii. Component fixation by vacuum.

2. Bond head for die picking, alignment, placement and bonding operations, including associated fixtures, with the following minimum capabilities:
   a. Handling dies up to 30 x 30mm^2.
   b. Integrated die heating, supporting fast heating and controlled cooling, for thermal-based processes.
   c. Integrated UV light source for UV curing processes.
   d. Adjustable die parallelism for alignment and contact control.
   e. Vacuum based die fixation.

3. Optical alignment system for high-precision component and substrate alignment, including:
   a. Video system for live process monitoring.
   b. The optical system shall be capable of handling and aligning big components without compromising precision.

4. Pressure -time dispenser integrated into the system and compatible with 3 cm^3 syringes.

5. Formic acid delivery system and all required fixtures and interfaces to support inert and/or reducing atmosphere soldering processes.

6. Calibration fixtures required for equipment calibration and process accuracy verification.

7. Set of tools required for system start-up, including at minimum a hateable die pick-up tool and a self-aligning die pick-up tool for parallelism compensation.

Software requirements

1. The system must include the software required to manage all required functionalities described above, including process control (e.g. heating and cooling ramps, bonding force, dispensing parameters), as well as monitoring and data logging.

2. Any PC required for system operation or software execution shall be supplied by the vendor as part of the system.

3. The software shall be installed on the system, and shall be supplied with a permanent (non-expiring) license.

Technical documentation or manuals to be delivered

A set of documentation shall be provided, covering the following topics:

- Comprehensive system user manual, including both hardware and software descriptions, routine servicing and troubleshooting.

CLAUSE 4. Power distributions and safety

The system shall include:

- Electrical Operation: 230V ±10%, 50 Hz (per UNE-EN 61010-1, Spanish adoption of IEC 61010-1)
- CE-certification.
- Safety interlocks.

CLAUSE 5. System layout and services

The proposal shall include a set of “system layout and services documentation”, containing the following information:

- System layout, including overall footprint, weight, drawings and detailed description of the different system components.
- Installation and start-up requirements, including required utilities, service connections, and any applicable environmental specification.

CLAUSE 6. Transportation, installation, start-up.

- Contract includes the installation and start-up of the system, including system checking, functional tests and the supply of all those elements necessary for its correct operation

- The proposal will include transportation to ICFO's facilities including insurance and all export/import and customs duties.

- Any other customs or miscellaneous expenses, unexpected and not covered in the tender, which may arise until the equipment arrives at ICFO, must initially be borne by the Supplier and will be reimbursed by ICFO upon submission of supporting documentation proving the actual incurrence of such expenses.

- The machine will be placed in the designated location by ICFO. The contractor shall cover all costs, organization, and coordination related to the placement, including the provision of any required specialized equipment or vehicles, as well as any necessary component disassembly and reassembly for unloading and transportation inside the building, strictly following the route specified by ICFO.

  Note: Designated location has level, step-free access. Delivery using a truck equipped with a loading ramp or liftgate, together with appropriate wheeled handling equipment, is recommended to facilitate safe installation.

- The contractor will be responsible for the removal and proper disposal of the packaging when the machine is delivered and unpacked, or its storage during the warranty period in case the original packaging needs to be kept.

Process qualification

A Site Acceptance Test (SAT) shall be performed as part of the delivery and acceptance process of the equipment. It shall include, at minimum:

a) Verification of key machine parameters, including but not limited to placement accuracy, max temperature reached, force control, and other relevant specifications to demonstrate compliance with the specification.

b) Epoxy-based attachment of two silicon dummy dies, within the dimensional limits defined in the specification.

c) All test results, reports and data shall be included in the documentation delivered to ICFO.

Protocol in the event of SAT failure and remediation deadlines

Should the equipment fail any of the tests or verifications established in the SAT, the following protocol shall apply:

1. Formal notification of failure (Day 0): ICFO shall notify the contractor in writing and through a verifiable channel of the deficient results obtained, specifying in detail the parameters that did not meet the required values and attaching the corresponding measurement reports.

2. Corrective Action Plan (deadline: 5 working days from notification): the contractor shall submit to ICFO a written corrective Action Plan, identifying the root cause of the non-compliance, the proposed corrective measures, and an implementation schedule not exceeding 30 calendar days from the date of failure notification.

3. Re-execution of the SAT (deadline: maximum 30 calendar days from notification): once the corrective measures have been implemented, the contractor shall repeat the SAT in the presence of ICFO technical staff, within the aforementioned deadline. All costs associated with this repetition shall be borne entirely by the contractor.

CLAUSE 7. Warranty and Follow-on Support

- 1-year Full Warranty on all parts and components of the system irrespective of the manufacturer. The warranty will include the replacement of any faulty or damaged part(s) during normal use of the system, no matter the manufacturer of the component(s). It will cover any cost related with the disassembly, transportation, reparation and re-assembly of the damaged component(s), including all travelling and living costs of the required service engineer(s). An on-site repair, or a justified alternative to reduce the system down time to the minimum, will always be the first service option. A team of properly qualified and skilled service engineers will have to be available.

- System maintenance support available during, at least 10 years, including access to technical assistance. The supplier shall provide feedback from a qualified technical specialist within 5 working days.

- Spare parts will be available during, at least, 10 years after system supply.

- An estimation of the cost of a warranty extension or available support contract options after warranty period will be included in the proposal.

CLAUSE 8. Training

- System training for ICFO personnel shall be included: the number of training days shall be specified in the proposal (min. 1 day).

- The training shall ensure proper and safe operation of the system by designated equipment operators and engineers.

- The training program shall also provide an overview of basic maintenance procedures, covering routine preventive tasks and essential troubleshooting guidelines.

- Training will take place at the ICFO facilities, scheduled on a mutually agreed date.

CLAUSE 9. Delivery and Installation Time

The maximum execution period of the contract shall be **FOUR (4) MONTHS**, counted from the day following the date of its formalisation.

Within this period, the supplier must complete the manufacturing, transportation, delivery, installation, integration, commissioning of the system, and the execution of the Site Acceptance Tests (SAT). The delivery time shall therefore be understood as the full period required to complete all contractual obligations up to the successful acceptance of the equipment at ICFO facilities.

CLAUSE 10. Tender budget

- The tender budget (maximum bid price) for the supply is **250,000 €** (VAT excluded).

- Payment terms: Full payment will be made once the final receipt of supply, installation and commissioning is issued.

Castelldefels, on the date of its digital signature,

Prof. Dr. Valerio Pruneri
Group Leader Optoelectronics – ICFO