

## Electron Tubes for a High-Performance Fusion Reactor based on Innovative Technology

|                   |                 |                       |            |
|-------------------|-----------------|-----------------------|------------|
| Registration No.  | Number 00044    |                       |            |
| Registration Date | October 6, 2009 | Registration Category | Category 2 |

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| Name<br>(Model, etc.)     | High power gyrotron with energy recovery system                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |  |
| Location                  | Naka-shi, Ibaraki                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |  |
|                           | National Institutes for Quantum and Radiological Science and Technology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |
| Owner<br>(Custodian)      | National Institutes for Quantum and Radiological Science and Technology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |
| Manufacturer<br>(Company) | Japan Atomic Energy Research Institute (now National Institutes for Quantum and Radiological Science and Technology), Toshiba Corporation (now Canon Electron Tubes & Devices Co., Ltd.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |  |
| Year Manufactured         | 1994                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |  |
| Reason For<br>Selection   | Gyrotrons are high-powered vacuum electron tubes that emit millimeter-wave beams by getting energy from accelerated electrons. However, spent electrons generate an enormous amount of heat when they are trapped in a collector. This device employs a technique called collector potential depression (CPD) that slows down the speed of the electrons entering the collector so they generate far less heat. This substantially reduces the amount of energy that must be input to the system. This approach is called "energy recovery" by collector. The important point is that this disproves the conventional wisdom that a CPD could never work with a gyrotron. Indeed, this is the world's first successful implementation of an energy recovery type gyrotron. Thanks to this breakthrough, efforts can now focus on candidates for the main source of heat for the International Thermonuclear Experimental Reactor. |  |  |
| Registration<br>Standard  | 1-B (Show a uniquely Japanese scientific or technological development from an international perspective.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |

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|-----------------------------|-------------------------------------------------------------------------------------|--|--|
| Open/Closed<br>to Public    | Open to Public (Reservation Required)                                               |  |  |
| Photo                       |  |  |  |
| Other useful<br>information |                                                                                     |  |  |