

**Baseline Report (not under Configuration Control)**

**Appendix\_21\_Glossary\_2F94QX**

Glossary of vacuum terms relevant to ITER

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## **ITER Vacuum Handbook Appendix 21**

### **Glossary of vacuum terms relevant to ITER**

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*Note that common standard vacuum terms related to gas flow, vacuum pumps or pressure measurement are not included as they may be found in any standard textbook on the subject.*

Back-filling	Raising the pressure of a vacuum space by admission of a defined gas.
Baking or bakeout	Heating of a vacuum component to remove adsorbed gas (usually water) from the surface.
Bellows ( <i>incorrectly</i> bellow)	A section of a vacuum envelope which permits movement of one part of the vacuum envelope with respect to another part.
Blow hole	A surface hole in a material which has solidified from a liquid and which may join onto a void within the material, especially in a weld melt zone or in a braze fill.
Bonding	In this context, the joining of two materials or vacuum items to form a permanent, leak tight joint.
Brazing	A technique for joining two items by filling the interspace between them with another material, usually an alloy, which melts at a temperature lower than that of the items and which wets the surface of each of the items, filling gaps between workpieces by capillary action.
Clean	A vacuum item is clean when it is in a state such that it emits no undesirable species into the vacuum space or does not adversely affect any desired process in the vacuum.
Clean work plan	A documented set of procedures by means of which a vacuum item shall be transformed into a clean state and by means of which it shall be maintained in that state during all subsequent operations or procedures.
Cleaning	The process of transforming a vacuum item from a contaminated state to a clean state.
Coating	Covering the surface of a material with a conformal layer of another material.
Cold welding	A process by which two clean metal surfaces held in physical contact become permanently bonded without the action of heat.
Component	See Vacuum component
Contaminant	A substance on the surface or in the bulk of a vacuum item which can interfere with any process intended to be carried out on that item or which can desorb to give an undesirable species in the residual gas of the vacuum.
Cross contamination	Where a contaminant present on the surface or in the bulk of one vacuum item is transferred onto or into another vacuum item.

Cryopumping	Removal of a gas from the vacuum space by condensing it onto a cold surface
Cryosorption	Removal of a gas from the vacuum space by adsorbing it onto a cold porous material e.g. charcoal or zeolite.
Cutting fluid	A fluid used for cooling and/or lubricating a cutting device, e.g. a milling head.
CVD (Chemical vapour deposition)	Deposition of a coating onto a substrate by chemical reaction in or from the gas phase, usually at an elevated temperature.
DA	Domestic Agency
Degassing	Removal of gas dissolved in a material, usually by heating the material to a high temperature in a vacuum.
Desorption	The release of a substance from a surface into the vacuum space. ( <i>Note: the related verb form is desorb</i> )
Diffusion	In this context, the transmission of gas atoms or molecules from one side of a vacuum barrier to the other by direct migration through the solid or glassy phase or along the grain boundaries of the material.
Diffusion bonding	A technique for joining two items by filling the interspace between them with a material or materials which can diffuse into the surface layers of the host material of each item under the action of heat and/or pressure thereby forming a bond between them.
Dry lubricant	In this context, a solid state material which when deposited between two surfaces in vacuum reduces the coefficient of friction significantly or prevents cold welding.  Examples would be MoS <sub>2</sub> , WS <sub>2</sub> or WSe <sub>2</sub> .
Edge welded bellows	Bellows which are formed from a number of thin annuli by welding around the circumference of alternately the inner and outer diameters of the annuli. Such bellows can provide great flexibility longitudinally and significant flexibility in the transverse direction.
Electrical break	A device which permits two parts of the envelope of a vacuum system to operate at different electrical potentials whilst maintaining gas flow continuity between the two parts of the vacuum envelope.
Explosion bonding	A technique for joining two items, usually in the form of sheet metal, by generating a high pressure at the interface by means of an explosion. There will not normally be any filler material between the items.
Feedthrough	A device by means of which electrical potential or current can cross the boundary of a vacuum space or by means of which a pipe carrying a fluid can cross the boundary of a vacuum space.

Formed bellows	Bellows formed from a thin sheet or cylinder of metal in which convolutions are manufactured by rolling or by hydrostatic pressing against a former. Such bellows allow limited flexibility in any direction.
Friction bonding	A technique for joining two dissimilar materials by using friction heating to liquefy the interface.
Full penetration welding	Welding where the heat is applied to one side of a prepared joint such that the melt zone extends through the whole thickness of the material.
Gasket	A mechanical seal that fills the space between two objects.
Getter	A material which acts as a vacuum pump by trapping residual gas atoms by chemically bonding them to the atoms of the getter material or by dissolving them.
Helium bombing	A technique by which a nominally hermetically sealed component is subjected to an overpressure of helium so that, on subsequent exposure of the component to a vacuum, helium desorption into that vacuum indicates that a leak or porosity may be present which allowed helium to enter the component.
Helium leak detection	Using the transmission of helium gas through a leak path from the higher pressure side of a vacuum barrier to the lower pressure side and detecting the passage of the helium by means of a suitable mass sensitive device e.g. a mass spectrometer.
High vacuum (HV)	Pressures between $10^{-3}$ Pa and $10^{-7}$ Pa.
Hipping	Material forming by applying a high pressure to a powder at a high temperature but below its melting point so that the particles stick together to form a relatively dense and non-porous solid.
Inclusion	A particle embedded in a material that is chemically or structurally different from the host material.
ITER Vacuum Responsible Officer (RO)	A person nominated by ITER as the arbitrator on matters pertaining to vacuum.
Leak rate	The volumetric flow of gas through a vacuum barrier.
Leak tight	Not exhibiting a leak rate great than the minimum detectable leak.
Liquid dye penetrant	A liquid of low viscosity which is used to penetrate small voids or porosity in a material and which evaporates to leave a coloured dye in the voids thus revealing their presence.
Medium vacuum	Pressures between 0.1 Pa and $10^{-3}$ Pa.
Minimum detectable leak	Smallest value of leak rate which can be detected by the apparatus being used, usually at a signal to noise ratio of 2.
Outgassing	Gas desorbed from a vacuum surface due to the temperature of the surface. Such gas will normally derive from the surface or immediate sub-surface layers of the material.

Permeation	Diffusion or porosity.
Porosity	Transmission of a gas through a solid due to linked small voids in the solid.
Purge gas	A gas flowing through a vacuum system, usually in turbulent flow mode, so as to remove a contaminant such as water.
PVD (Physical Vapour Deposition)	Deposition of a coating onto a substrate from the gas phase, by a means such as evaporation, sublimation or sputtering.
Residual gas	Those atomic or molecular species contributing to the pressure inside a vacuum envelope.
Residual gas scan	A mass spectrometric analysis of the residual gas in a vacuum space.
Rough vacuum	Pressures between atmosphere and 0.1 Pa.
Scale	Poorly adhered oxide clumps on a metal, particularly steel, caused when the metal cools from high temperature to room temperature in atmosphere e.g. after hot rolling of sheet steel or welding.
Sealing surface or seal face	A surface of a vacuum item which is used to form a leak tight joint by means of a vacuum seal being pressed against it.
Seamless pipe	Pipe (or tube) formed without longitudinal weld
Sintering	Material formed by heating a powder to a high temperature, but below its melting point, so that the particles stick together.
Sputtering	A process by which sufficient energy is transferred to the atoms of a target material so that they escape into the vacuum space. The energy transfer may be effected by an electron beam or by ions generated in the gas phase by a gas discharge for example.
<i>Supplier</i>	Any legal entity providing items or services in accordance with a contractual document. An all-inclusive term used in place of any of the following third parties DA's, vendor, seller, contractor, subcontractor, fabricator, consultant, and their sub-tier levels).
Trapped volume	In this context either (i) a void within a material with a small passage opening to the vacuum space (the passage will have a transverse dimension smaller than that of the void.) (ii) a space between two surfaces in contact which is not well vented to the vacuum space.
Ultrahigh vacuum (UHV)	Pressures $< 10^{-7}$ Pa.
Undetectable leaks	Leaks with a value below the sensitivity (minimal detectable leak rate) of the equipment being used to try to find them.
Vacuum arc	A vacuum discharge which carries sufficient current to melt the surface of the material into which it comes into contact.

Vacuum baking	Baking a vacuum item which is totally immersed in a vacuum.
Vacuum barrier	A boundary between a vacuum space and another space.
Vacuum component or item	Any item with one or more surfaces exposed to vacuum. The term includes individual components (like a fixing screw for example), a sub assembly (like a pumping port) or a complete assembly (like the whole vacuum vessel).
Vacuum discharge	A mechanism whereby the residual gas inside a vacuum system becomes ionised and hence electrically conducting.
Vacuum flange	A demountable vacuum joint, normally used in pairs.
Vacuum seal	In this context, a gasket trapped between two vacuum flanges to create a leak tight joint.
Vacuum space	A bounded system held at sub-atmospheric pressure.
Vacuum Specialist	A person nominated by the ITER Vacuum Responsible Officer as an expert in a particular field of vacuum science or technology.
Vacuum system	Any assemblage of vacuum items forming a discrete, independent vacuum space, comprising at the minimum a vacuum envelope, pumping and pressure measurement.
Vacuum valve	A mechanical device which can be used to isolate or link two individual vacuum spaces, depending on its state.
Venting	Opening a vacuum space to another space.
Welding	A technique for joining two items by melting the interface region, with or without the use of a filler material.

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