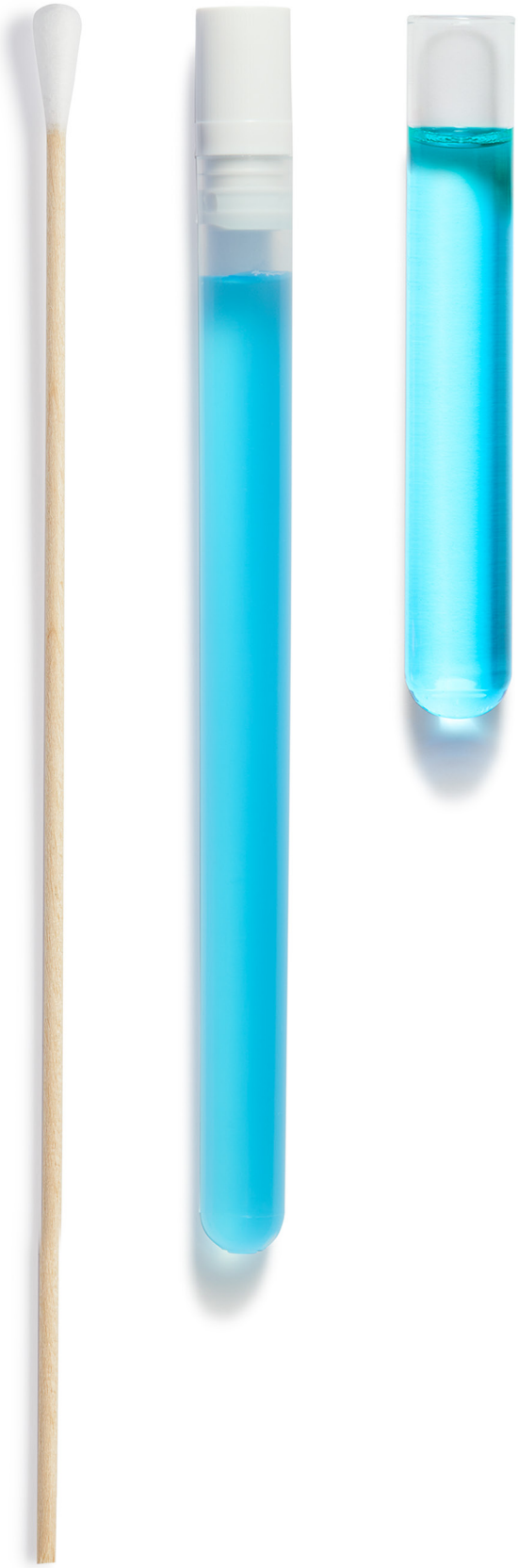


12. TECHNICAL INFORMATION AND INDEXES

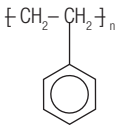
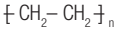
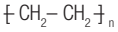
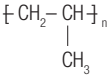
CHEMICAL RESISTANCES

	PELD		PEHD		PP		PS		TPX		ABS		PMMA		PC		PVC		PTFE	
°C	20	50	20	50	20	50	20	50	20	50	20	50	20	50	20	50	20	50	20	50
1.4 - dioxane	▲	■	▲	▲	■	■	●	●	■	■			●	●	■	■	●	●	▲	▲
Acetaldehyde	▲	●	▲	■	▲	●	●	●	▲	●	●	●	●	●	■	●	■	●	▲	▲
Acetic acid	▲	▲	▲	▲	▲	▲	■	■	▲	▲	●	●	●	●	▲	■	▲	■	▲	▲
Acetone	■	●	▲	▲	▲	▲	●	●	▲	▲	■	■	●	●	●	●	●	●	▲	▲
Acrylonitrile	▲	▲	▲	▲	■	●	●	●	●	●			●	●	●	●	●	●	▲	▲
Adipic acid	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▲	▲	▲	▲	▲	■	▲	▲
Aluminium chloride	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▲	▲	●	●	▲	■	▲	▲
Aluminium hydroxide	▲	▲	▲	▲	▲	▲	■	■	▲	■			■	■	■	●	▲	▲	▲	▲
Allyl alcohol	▲	▲	▲	▲	▲	▲	▲	■	▲	■			●	●	▲	■	■	●	▲	▲
Amino acids	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲					▲	▲	▲	▲	▲	▲
Ammoniac	▲	▲	▲	▲	▲	▲	■	●	▲	▲			▲	▲	●	●	■	■	▲	▲
Ammonic hydroxide (30 %)	▲	▲	▲	▲	▲	▲	■	●	▲	▲	▲	■	▲	▲	●	●	▲	■	▲	▲
Ammonium chloride	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	■	■	■	■	▲	■	▲	▲
Amyl acetate	■	●	▲	■	■	●	●	●	▲	■			▲	▲	●	●	●	●	▲	▲
Amyl alcohol	▲	▲	▲	▲	▲	▲	■	■	▲	▲					▲	▲	■	■	▲	▲
Amyl chloride	●	●	●	●	●	●	●	●	●	●			●	●	●	●	●	●	▲	▲
Aniline	▲	■	▲	▲	▲	▲	●	●	▲	■	●	●	●	●	■	●	●	●	▲	▲
Aqua regia	●	●	●	●	■	●	■	●	■	■	●	●	●	●	●	●	■	■	▲	▲
Benzaldehyde	▲	▲	▲	▲	▲	▲	●	●	▲	▲	●	●	●	●	■	●	●	●	▲	▲
Benzene	■	●	▲	▲	▲	■	●	●	▲	■	●	●	●	●	●	●	●	●	▲	▲
Benzine	■	●	▲	▲	■	■	●	●	▲	■			▲	▲	■	●	▲	▲	▲	▲
Benzoid acid	●	●	●	●	●	●	●	●	●	●			●	●	■	■	■	■	▲	▲
Boric acid (10 %)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Bromine	●	●	●	●	●	●	●	●	●	●			●	●	●	●	●	●	▲	▲
Bromoform	●	●	●	●	●	●	●	●	●	●			●	●	●	●	●	●	▲	▲
Butyl acetate	■	■	▲	▲	■	■	●	●	▲	■	●	●	●	●	●	●	●	●	▲	▲
Butyl alcohol	▲	▲	▲	▲	▲	▲	■	●	▲	■	●	●	■	●	■	■	■	■	▲	▲
Calcium chloride	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▲	▲	▲	▲	■	●	▲	▲
Calcium hydroxide	▲	▲	▲	▲	▲	▲	▲	■	▲	▲			▲	▲	●	●	▲	▲	▲	▲
Calcium hypoclorit	▲	▲	▲	▲	▲	▲	▲	▲	▲	■			■	■	■	●	■	●	▲	▲
Carbon sulphate	●	●	●	●	●	●	●	●	●	●			●	●	●	●	●	●	▲	▲
Carbon tetrachloride	●	●	■	●	●	●	●	●	●	●			■	●	●	●	●	●	▲	▲
Citric acid	▲	▲	▲	▲	▲	▲	▲	■	▲	▲	▲	▲			▲	■	■	■	▲	▲
Cupric sulphate	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▲	▲	▲	▲	▲	■	▲	▲
Chlorine (10 %)	■	●	■	●	■	●	●	●	■	●			■	●	■	■	■	●	▲	▲
Chlorine water	●	●	●	●	●	●	●	●	■	●	▲	▲	●	●	●	●	●	●	▲	▲
Chloroform	●	●	▲	■	●	●	●	●	■	●	●	●	●	●	●	●	●	●	▲	▲
Chlorydic acid (35 %)	▲	▲	▲	▲	▲	▲	■	■	▲	▲			■	●	●	●	■	●	▲	▲
Chromic acid (10 %)	▲	▲	▲	▲	▲	▲	■	■	▲	▲			■	●	▲	■	▲	■	▲	▲
Chromic acid (50 %)	▲	■	▲	■	■	■	●	●	■	■			●	●	■	●	▲	●	▲	▲
Chromic sulphate blend	▲	●	▲	●	●	●	■	■	■	●			●	●	●	●	▲	■	▲	▲
Decahydronaphtalene	■	■	■	■	●	●	●	●	■	●			●	●	●	●	▲	■	▲	▲
Dichlorobenzene	■	●	■	●	■	●	●	●	●	●	●	●	●	●	●	●	●	●	▲	▲
Diethylene glycol	▲	▲	▲	▲	▲	▲	■	●	▲	▲			●	●	■	■	●	●	▲	▲
Dimethyl formamide	▲	▲	▲	▲	▲	▲	●	●	▲	▲			●	●	●	●	■	●	▲	▲
Dimethyl sulphoxide	▲	▲	▲	▲	▲	▲	●	●	▲	▲			●	●	●	●	●	●	▲	▲
Ether	●	●	■	●	■	●	●	●	●	●	●	●	●	●	●	●	●	●	▲	▲
Ethyl acetate	▲	▲	▲	▲	▲	▲	●	●	▲	■	●	●			●	●	●	●	▲	▲
Ethyl alcohol (100%)	▲	▲	▲	▲	▲	▲	●	●	▲	■	■	■	●	●	▲	■	▲	■	▲	▲
Ethylene chloride	●	●	●	●	■	●	●	●	●	●	●	●	●	●	●	●	●	●	▲	▲
Ethylene oxide	■	■	■	■	■	●	●	●	■	●			●	●	■	●	■	●	▲	▲
Fluorine	●	●	●	●	●	●	●	●	■	●			●	●	■	■	▲	▲	▲	▲
Formaldehyde (40 %)	▲	▲	▲	▲	▲	▲	●	●	▲	▲	■	●	●	●	▲	■	■	●	▲	▲
Formic acid (98-100 %)	▲	▲	▲	▲	▲	▲	▲	■	▲	▲	■	■	●	●	▲	■	●	●	▲	▲
Fuel oil	■	●	▲	■	▲	▲	●	●	■	■			■	●	▲	■	●	●	▲	▲

	PELD		PEHD		PP		PS		TPX		ABS		PMMA		PC		PVC		PTFE	
°C	20	50	20	50	20	50	20	50	20	50	20	50	20	50	20	50	20	50	20	50
Hexane	●	●	▲	■	▲	■	■	●	■	●	●	●	▲	▲	●	●	■	●	▲	▲
Hydrofluoric acid (40 %)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			●	●	●	●	■	●	▲	▲
Hydrofluoric acid (70 %)	▲	●	▲	■	▲	■	●	●	▲	■			●	●	●	●	●	●	▲	▲
Hydrogen peroxide (35%)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	●	●	●	●	▲	▲	▲	■	▲	▲
Iodine	●	●	●	●	▲	▲	■	●	▲	■			●	●	■	●	●	●	▲	▲
Isobutyl alcohol	▲	▲	▲	▲	▲	▲	■	■	▲	▲			■	●	▲	▲	▲	■	▲	▲
Isopropyl alcohol	▲	▲	▲	▲	▲	▲	■	■	▲	▲			■	●	▲	▲	▲	■	▲	▲
Isopropyl benzene	■	●	▲	■	■	●	●	●	●	●			●	●	●	●	●	●	▲	▲
Lactic acid	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	■	●	▲	▲	■	■	▲	▲
Mercurous chloride	▲	▲	▲	▲	▲	▲	▲	■	▲	▲			▲	▲	▲	▲	●	●	▲	▲
Mercury	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▲	▲	▲	▲	▲	▲	▲	▲
Methyl acetate	■	●	■	■	▲	■	●	●	▲	▲	●	●			●	●	●	●	▲	▲
Methyl alcohol	▲	■	▲	▲	▲	▲	■	●	▲	▲	■	●	●	●	▲	■	▲	■	▲	▲
Methyl propyl ketone	▲	■	▲	▲	▲	■	●	●	■	■			●	●	●	●	●	●	▲	▲
Methylene chloride	●	●	■	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	▲	▲
Mineral oil	▲	■	▲	▲	▲	▲	▲	▲	▲	▲			▲	▲	▲	▲	▲	▲	▲	▲
Monochloroacetic acid	▲	▲	▲	▲	▲	▲	●	●	▲	▲			■	●	■	●	▲	▲	▲	▲
Nitric acid (10 %)	▲	▲	▲	▲	▲	▲	●	●	▲	▲	▲	▲	▲	■	▲	■	▲	■	▲	▲
Nitric acid (50 %)	■	■	■	●	■	●	●	●	■	●			■	■	▲	■	■	●	▲	▲
Nitric acid (70 %)	●	●	●	●	●	●	●	●	■	●	●	●	■	●	●	●	●	●	▲	▲
Nitrobenxene	●	●	■	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	▲	▲
Oxalic acid	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	■	▲	▲	▲	▲	▲	▲	▲	▲
Ozone	▲	▲	▲	▲	▲	▲	■	■	▲	▲			▲	▲	▲	▲	▲	■	▲	▲
Perchloric acid	▲	●	▲	●	▲	●	●	●	■	●	●	●	●	●	●	●	■	●	▲	▲
Perchloroethylene	●	●	●	●	●	●	●	●	●	●			■	●	●	●	●	●	▲	▲
Phenol (100 %)	▲	■	▲	▲	▲	▲	●	●	■	■			●	●	●	●	●	●	▲	▲
Phosphoric acid (85 %)	▲	▲	▲	▲	▲	▲	▲	■	▲	▲	▲	▲	●	●	▲	▲	▲	■	▲	▲
Phtalat dibutylic	■	●	■	●	▲	■	●	●	▲	■			●	●	●	●	●	●	▲	▲
Potassium chloride	▲	▲	▲	▲	▲	▲	■	■	▲	▲			▲	▲	▲	▲	▲	■	▲	▲
Potassium hydroxide	▲	▲	▲	▲	▲	▲	■	■	▲	▲	▲	▲	▲	▲	●	●	■	■	▲	▲
Potassium permanganate	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	■	■	▲	▲	▲	▲	▲	▲	▲	▲
Propylene glycol	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▲	■	●	●	▲	▲
Propylene oxide	▲	▲	▲	▲	▲	▲	●	●	▲	▲					●	●	●	●	▲	▲
Pyridine	▲	■	▲	■	■	■	●	●	▲	■	●	●	●	●	●	●	■	●	▲	▲
Salicylic acid	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲							■	●	▲	▲
Salicylic aldehyde	▲	▲	▲	▲	▲	▲	●	●	▲	▲					■	■	●	●	▲	▲
Silver acetate	▲	▲	▲	▲	▲	▲	■	■	▲	▲			■	■	▲	▲	■	■	▲	▲
Silver nitrate	▲	▲	▲	▲	▲	▲	■	■	▲	▲			▲	▲	▲	▲	■	■	▲	▲
Sodium acetate	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			●	●	▲	▲	■	■	▲	▲
Sodium dichromate	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▲	▲			▲	▲	▲	▲
Sodium hydroxide	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			●	●	▲	▲	▲	▲
Sulfuric acid (60 %)	▲	▲	▲	▲	▲	▲	●	●	▲	▲			●	●	■	■	■	●	▲	▲
Sulfuric acid (98 %)	■	●	■	●	●	●	●	●	▲	▲	●	●	●	●	●	●	●	●	▲	▲
Tartaric acid	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			■	■	▲	▲	▲	▲	▲	▲
Tetrahydrofuran	●	●	■	●	●	●	●	●	■	●	●	●	●	●	●	●	●	●	▲	▲
Toluene	■	●	■	■	■	●	●	●	■	●	●	●	●	●	●	●	●	●	▲	▲
Trichloroethane	●	●	■	●	●	●	●	●	●	●			●	●	●	●	●	●	▲	▲
Trichloroethylene	●	●	■	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	▲	▲
Triethylene glycol	▲	▲	▲	▲	▲	▲	▲	■	▲	▲			■	■	▲	■	■	●	▲	▲
Tripropylene glycol	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			■	■	▲	■	■	●	▲	▲
Turpentine	■	●	■	●	●	●	●	●	■	■	●	●	▲	▲	●	●	▲	▲	▲	▲
Urea	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▲	▲	●	●	■	●	▲	▲
Vinylidene chloride	●	●	■	●	●	●	●	●	●	●			●	●	●	●	●	●	▲	▲
Xylol	■	●	■	●	●	●	●	●	■	●	●	●	●	●	●	●	●	●	▲	▲
Zinc chloride (10 %)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			●	●	▲	▲	▲	■	▲	▲
Zinc sulphate (10 %)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	●	●	■	■	▲	▲	▲	■	▲	▲

▲ = Excellent / very good chemical resistance ■ = Good / limited chemical resistance ● = Poor chemical resistance

CHEMICAL RESISTANCES

	POLYSTYRENE	POLYETHYLENE HIGH DENSITY	POLYETHYLENE LOW DENSITY	POLYPROPYLENE
GENERAL PROPERTIES	**PS Crystal (GPPS)**	**PEHD**	**PELD**	**PP Homopolymer**
Structure	Amorphous structure 	Structure with few ramifications, greater compaction 	Very branched chain structure, greater flexibility 	Partially crystalline 
Optical properties	TRANSPARENT	TRANSLUCENT	TRANSLUCENT	TRANSLUCENT
Mechanical resistance	Rigid and hard but fragile Low impact resistance	Rigid Very good impact resistance	Less stiffness and toughness than PEHD Good impact resistance	Rigid
Density	1.04 - 1.05 g/cm^3	0.924 - 0.980 g/cm^3	0.918 - 0.927 g/cm^3	0.898 - 0.950 g/cm^3
Max. temperature	70º C	80º C	75º C	121º C
Min. temperature	-10º C	-50º C	-50º C	0º C*
Autoclavable	NO	NO	NO	YES
Gas sterilization	DOSES LIMITED	YES	YES	YES
Gamma irradiation Sterilization	YES	YES	YES	DOSES LIMITED
Beta irradiation Sterilization	YES	YES	YES	DOSES LIMITED
Water absorption	0.098 - 0.11 %	0.010 - 0.011 %	0.010 - 0.011 %	0.010 - 0.10 %
Properties	- Insulator, low electrical conductivity - Sparkly	- Excellent thermal and chemical resistance - Easily charges static electricity	- Good thermal and chemical resistance - Easily charges static electricity	- Resists better high temperatures - Great resistance to stress cracking - Lightweight

*There are special blends of PP like those from our cryovials, which are able to withstand up to –196 ºC.

	POLYSTYRENE	HIGH DENSITY POLYETHYLENE	LOW DENSITY POLYETHYLENE	POLYPROPYLENE
GENERAL CHEMICAL RESISTANCE	PS	PEHD	PELD	PP STANDAR
Oils	LIMITED	LIMITED	LOW	GOOD
Acids	LIMITED*	GOOD	GOOD*	GOOD*
Alcohol	GOOD	GOOD*	GOOD	GOOD
Bases	GOOD	GOOD	GOOD	GOOD
Ketones	NULL	LIMITED	LIMITED	LIMITED
Esters	LOW	LIMITED	LIMITED	LIMITED
Fats	GOOD	GOOD	GOOD	GOOD
Hydrocarbons -aromatics	NULL	LIMITED	LOW	LOW
Hydrocarbons Chloride	See**	LIMITED	LIMITED	See**
Hydrocarbons Halogenated	NULL	LOW	NULL	LOW
Metals (Cu, Mn, Co)	See**	See**	See**	LIMITED
Oxidants	NULL	LOW	LOW	LOW

* LOW for certain acids and depending on the concentration.
** The chemical resistance of plastics is detailed in the specific table of resistance according to the different chemical compounds.

STERILISATION METHODS

TYPES OF STERILIZATION

METHOD	Dry heat	Autoclave,Super Heated Steam under pressure	Ethylene Oxide ("EO Gas")
PROCEDURE	Direct action of dry heat. For example: 171 for 60', 160 for 120' or 140 for 180'.	Action of 3 elements: temperature, water steam and pressure 121 ºC (20') (+1atm)	Exposure of the material to the gas for a time that can reach up to 8h, at a temperature between 40ºC and 50ºC and with a relative humidity between 50% and 60%.
RECOMMENDED FOR	Glassware, metals and liquids.	Glassware, fabrics, liquids etc. All materials resistant to heat above 121ºC and moisture.	All materials with some exceptions. It is often used when materials to be sterilized are sensitive to steam or radiation.
PRECAUTIONS	High temperatures may damage fragile metals.	It is not recommended for some types of plastic. In the case of closed containers, the caps must not be adjusted (steam must be allowed to enter and exit easily).	Requires a subsequent ventilation to ensure sterilised products are free of residual gases that may be toxic.
LIMITATIONS	The own material's limitations. High heat soaking may unacceptably affect material properties.	Generally for low volume products.	Ethylene oxide is toxic and explosive.

STERILE A STERILIZATION TYPE: in this case the parts are not sterilized at the end of its manufacture process since is the process by itself which is able to obtain a sterile product. This is because the entire process from injection of different plastic components to the assembly is protected by a sterile atmosphere, thanks to the cowling of the entire installation and the placement of laminar flows that create an overpressure sterile air inside the facilities.

CENTRIFUGATION

Conversion G y R.P.M.

The **relative centrifugal force (RCF)** can be determined using the formula:

$FCR = 1.118 \times 10\text{-}6 \times r \times n^2$

r= radius of the rotor (mm); distance between the axis of the rotor and the farest wall of the tube.
n= rotating speed (revolutions per minute).
The result is expressed in terms of acceleration (g); 1 g is equal to 9.807 m/s^2.
It is recommended that the centrifuge caps fit in size and shape to the tubes to be centrifuged.

CONVERSION (ºF - ºC - ºK)

ºF (Farenheit) = (ºC x 1.8) + 32	ºC (Celsius) = (ºF – 32) x 0.556	ºK (Kelvin) = ºC + 273.15

TYPES OF STERILIZATION

METHOD	By ionizing radiation (gamma rays)	By ionizing radiation (beta rays)
PROCEDURE	Photons emitted by the radioisotope Co-60.	High energy electrons generated in a particle accelerator.
RECOMMENDED FOR	Widely used in industries to sterilise single use material. Sterilisation doses are calculated from bioburden counts.	Widely used in industries to sterilise single use material. Sterilisation doses are calculated from bioburden counts.
PRECAUTIONS	Limitations in some applications, as some material properties may be unacceptably altered by this method.	Limitations in some applications, as some material properties may be unacceptably altered by this method.
LIMITATIONS	The effects are cumulative, so the material that has been sterilized by this method cannot be re-sterilized by many other conventional methods (eg ethylene oxide), after its initial use.	The electron beam has limited penetration power, so the density of the product to be sterilized must be taken into account. The effects are cumulative, so the material that has been sterilized by this method cannot be re-sterilized by many other conventional methods (eg ethylene oxide), after its initial use.

The sterilization indicator labels are small round stickers that change their colour when the material is properly sterilized:
Radiation: from yellow to red.
Ethylene oxide: from violet to green.

CONVERSION CHART XG - R.P.M.

r \ xg	1,000 xg	1,500 xg	2,000 xg	2,500 xg	3,000 xg	3,500 xg	4,000 xg	4,500 xg	5,000 xg	10,000 xg	15,000 xg
50 mm	rpm 4,227	5,177	5,978	6,683	7,321	7,908	8,454	8,967	9,452	13,367	16,371
75 mm	3,451	rpm 4,227	4,881	5,457	5,978	6,457	6,903	7,321	7,717	10,914	13,367
100 mm	2,989	3,661	rpm 4,227	4,726	5,177	5,592	5,978	6,340	6,683	9,452	11,576
125 mm	2,673	3,274	3,781	rpm 4,227	4,630	5,001	5,347	5,671	5,978	8,454	10,354
150 mm	2,440	2,989	3,451	3,859	rpm 4,227	4,566	4,881	5,177	5,457	7,717	9,452
175 mm	2,259	2,767	3,195	3,572	3,913	rpm 4,227	4,519	4,793	5,052	7,145	8,751
200 mm	2,113	2,588	2,989	3,342	3,661	3,954	rpm 4,227	4,483	4,725	6,683	8,185
225 mm	1,993	2,440	2,818	3,151	3,451	3,728	3,985	rpm 4,227	4,456	6,301	7,717
250 mm	1,890	2,315	2,673	2,989	3,274	3,537	3,781	4,010	rpm 4,227	5,978	7,321