Drum Utilisation Guide

Factors affecting container performance

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Closures

Palletisation & Stacking

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Introduction

This utilisation Guide is intended to provide answers to frequently asked questions about Francis Ward drums. What factors affect drum performance? will my chemical product be compatible?, what does the UN marking mean?

Should you require information not contained within this Guide please contact the sales team at Francis Ward who will be pleased to assist.

Factors Affecting Container Performance

There is a range of factors which can enhance or reduce the performance of polyethylene drums and these should always be considered when specifying containers for the carriage of hazardous chemicals.

Outdoor Weathering

Most plastics are highly resistant to weathering agents such as oxidation, extremes of temperature, humidity, wind, precipitation, chemical impurities in the atmosphere, fall-out, biological agents and light. They will however undergo some chemical transformation and consequent degradation when exposed to sunlight or fluorescent light for long periods. The result is discolouration, loss of clarity, loss of gloss, and tensile, impact strength reductions. Visibly polyethylenes will exhibit crazing, cracking and become increasingly brittle. In order to prevent this UV photo catalytic degradation the polyethylene's used in the manufacture of Francis Ward containers are UV stabilised by adding a high strength HALS type UV stabiliser to the base polymer. Even greater protection can be provided by the incorporation of a small percentage of carbon black which effectively blocks out UV light.

Chemical Attack

Oxidisers are the only group of materials capable of chemically degrading polyethylenes. The polyethylene types chosen for Francis Ward drums are resistant to many oxidisers but will be attacked to varying degrees by some acids and service life figures take this into account.

Chemical + Physical Attack

This is encountered in two forms as environmental stress cracking (commonly referred to as ESC) and plasticization due to absorption.

Stress Cracking

Stress cracking occurs when stress crack agents such as strong detergents are brought into contact with stressed areas of a container. If cracks are present for example as scratches or gouges the stress crack agents can cause propagation of the fracture resulting in wall failure.

The polyethylenes used in the composition of all Francis Ward drums have very high ESCR (environmental stress crack resistance) values. UN Packaging Group I containers use polymers which match or exceed the maximum test results achievable. In addition the rotomoulding process used to produce Francis Ward drums is a largely stress free process. The combination results in drums with very high ESCR properties.

Plasticisation

Polyethylene will absorb certain chemicals and this will result in swelling, weight gain, softening and some loss of stiffness. These plasticising agents do not chemically degrade the polymer and in some cases they are sufficiently volatile that their removal from contact with the polymer results in drying out and a return to the original polymer properties. The chemicals concerned are chiefly solvents and other hydrocarbon derivatives. For a variety of reasons some of these materials are not considered compatible with Francis Ward drums and this is indicated in the Chemical Compatibility and Service Life listing.

Filling

When filling Francis Ward drums ensure that filling nozzles do not damage the neck of the container the inside of the container or its closure.

Closures should be correctly attached and tightened to the correct torque setting (shown in the container product information sheet). Where vented closures are to be used, ensure they are in good condition, all components are present and undamaged, and that once attached, containers are only stored upright.

Temperature of Contents

Chemicals are more reactive at elevated temperatures. With some acids, raising their temperature 10° to 20° C above room temperature will cause accelerated attack of the polyethylene container wall - thermal oxidative degradation. For this reason the practice of diluting acids within Francis Ward drums is not recommended. The exothermic reaction which occurs can lead to premature embrittlement and potential impact failures.

Physical Abuse

Drums that are physically mishandled, dropped or dragged on their sides are less likely to realise long service life. Scratches and gouges created by such handling can contribute to premature drum failures.

If handling equipment is to be employed ensure that it is suitable for use with the drum design.

When palletising drums it is important to ensure that the pallets employed are in sound condition, of correct size, preferably close boarded, and free of splinters, broken boards, nails or other protrusions that could puncture the drums.

Cleaning

It is recommended that containers are rinsed before initial filling in order to remove any possible contaminants from production finishing operations. This is particularly important prior to packing high purity solutions.

Rinsing out containers with clean water before each repeat filling helps remove residues and also prevents cross contamination.

When cleaning drums avoid using steam lances which can blister and melt through drum walls.

Solvents should not be used for cleaning since they may be absorbed into the wall of the drum causing softening and swelling as well as potential cross contamination with drum contents.

Water up to 60°C in temperature can be used without detrimentally affecting the drums.

Storage

When storing empty containers avoid placing them near hot pipes, boilers, steam outlets etc. Utilising clean storage areas will also assist in preventing subsequent product contamination.

Container Dedication

The adoption of a dedicated container policy greatly improves service life expectancy. The use of individual containers for the carriage of more than one chemical substance is not recommended. Such practice can lead to container failures as synergistic reactions between the residues of one product and new contents can occur. Laundering (rinsing out of containers) is not always effective in removing residues especially in the case of chemicals which permeate the polyethylene drum wall.

Light Sensitive Chemicals

Chemicals which are subject to photo catalytic reactions such as Sodium Hypochlorite are best packed within black containers. This will prevent reactions occurring that could accelerate chemical degradation of the container.

As mentioned previously black containers will also provide longer service life since they are resistant to UV attack from sunlight.

Mixed Chemical Solutions

These should always be assessed carefully. The synergistic reactions possible in such formulations are often aggressive and can cause premature drum failure. If in doubt contact the Francis Ward sales team for advice.

Chemical Compatibility & Service Life

The following table shows a range of chemicals for which a maximum service life in years has been listed for the Francis Ward drum range.

Service life expectations have largely been determined by reviewing historical records. Additional information obtained from the manufacturers of the raw materials used to produce the containers has also been used.

Since Francis Ward has no control over the conditions of service that are encountered by individual containers no assurances in any form are provided. The figures quoted are best estimates based upon average service life conditions. As previously stated extremes of sunlight exposure, handling abuse or multi-purpose use (non-dedication of contents) can significantly affect service life expectations.

The list of chemicals shown is of course not exhaustive. Wherever solutions are to be packed for which no data exists we strongly recommend that the end user determines acceptable compatibility by conducting laboratory tests.

Mixed chemical solutions should always be assessed carefully. The synergistic reactions possible in such formulations are often aggressive and can cause premature drum failure. If in doubt contact the Francis Ward sales team for advice.

Key

Compatible No known effect on drum polymer.
Variable Compatibility Chemical attack on drum polymer will occur.
Not Compatible Extreme chemical attack to drum polymer will occur.

Chemical	Concentration %	Maximum Service Life (Yrs.)		Notes
		Warlord	Warboy	
A				
Acetaldehyde	100	2	2	
Acetic Acid (glacial)		5	5	
Acetic Anhydride				
Ammonia Aqueous		5	7	Vented closure required
Aluminium Chloride	100	5	7	
Aluminium Fluoride	100	5	7	
Aluminium Sulphate	100	5	7	
Ammonium Carbonate		5	7	
Ammonium Chloride		5	7	
Ammonium Fluoride		5	7	
Ammonium Hydroxide	28	5	7	Vented closure required
Ammonium Nitrate		5	7	
Ammonium Persulphate		5	7	
Ammonium Sulphate		5	7	
Amyl Acetate	100			
Amyl Alcohol	100	5	5	
Amyl Chloride	100			
Aniline	100	2	2	
Aqua Regia				
Arsenic Acid	All	5	5	
Aromatic Hydrocarbons				
Ascorbic Acid	10	5	5	
B				
Barium Carbonate	Saturated	5	7	
Barium Chloride	Saturated	5	7	
Barium Hydroxide		5	7	
Barium Sulphate	Saturated	5	7	
Barium Sulphide	Saturated	5	7	
Benzene				
Benzoic Acid	All	5	5	
Bismuth Carbonate	Saturated	5	5	
Bleach Lye	10	5	5	
Borax	Saturated	5	5	
Boric Acid	All	5	5	
Boron Trifluoride		5	5	
Bromine (liquid)				
Butanediol	100	5	5	
n-Butyl Acetate	100	3	3	
n-Butyl Alcohol	100	5	5	
Butyric Acid	Concentrated			

Chemical	Concentration %	Maximum Service Life (Yrs.) Warlord	Warboy	Notes
C				
Calcium Bisulphide		5	7	
Calcium Carbonate	Saturated	5	7	
Calcium Chlorate	Saturated	5	7	
Calcium Chloride	Saturated	5	7	
Calcium Hydroxide	Concentrated	5	7	
Calcium Hypochlorite		5	7	
Calcium Nitrate	50	5	7	
Calcium Oxide	Saturated	5	7	
Calcium Sulphate		5	7	
Camphor Oil		2	2	
Carbon Disulphide				
Carbon Tetrachloride		2	2	
Carbonic Acid		5	5	
Castor Oil	Concentrated	5	7	
Chlorine Liquid				
Chlorine Water	2	5	5	
Chlorobenzene				
Chloroform		2	2	
Chlorosulphonic Acid				
Citric Acid	Saturated	5	5	
Copper Chloride	Saturated	5	5	
Copper Cyanide	Saturated	5	7	
Copper Fluoride	2	5	7	
Copper Nitrate	Saturated	5	7	
Copper Sulphate	Saturated	5	7	
D				
Developers, photographic		5	5	
Dibutylphthalate		2	2	
Dichlorobenzene				
Diethyl Ketone		2	2	
Diethyl Glycol		5	5	
Diesel Oil		5	5	
Diglycolic Acid		5	5	
Dimethylamine				
Disodium Phosphate		5	5	
E				
Emulsions, photographic		5	5	
Ethyl Acetate	100	2	2	
Ethyl Alcohol	100	5	5	

Chemical	Concentration %	Maximum Service Life (Yrs.) Warlord	Warboy	Notes
Ethyl Alcohol	35	5	5	
Ethyl Benzene				
Ethyl Chloride				
Ethyl Ether				
Ethylene Chloride				
Ethylene Glycol		5	7	
F				
Ferric Chloride	Saturated	5	7	
Ferric Nitrate	Saturated	5	7	
Ferrous Chloride	Saturated	5	7	
Ferric Chloride	Saturated	5	7	
Ferric Nitrate	Saturated	5	7	
Ferrous Chloride	Saturated	5	7	
Ferrous Sulphate		5	7	
Fluoboric Acid		5	5	
Fluosilicic Acid	Concentrated	5	5	
Formic Acid	All	5	7	
Fructose	Saturated	5	5	
Fruit Pulp		5	7	
Furfural	100	2	2	
Furfuryl Alcohol		2	2	
G				
Gallic acid	All	5	5	
Glucose		5	5	
Glycerine		5	5	
Glycol		5	5	
Glycolic Acid	30	5	5	
H				
n-Heptane		2	2	
Hexachlorobenzene		5	5	
Hexanol, Tertiary		5	5	
Hydrobromic Acid	50	5	5	
Hydrochloric Acid	All	5	7	
Hydrocyanic Acid	Saturated	5	5	
Hydrofluoric Acid	<60	5	5	UN limit
Hydrofluoric Acid	>60, <85	2	2	UN limit
Hydrogen Sulphide		5	7	
Hydroquinone		5	5	
Hypochlorous Acid	Concentrated	5	5	

Chemical	Concentration %	Maximum Service Life (Yrs.)		Notes
		Warlord	Warboy	
I				
Inks		5	5	
Iodine (in K Solution)		2	2	
L				
Lead Acetate		5	7	
Lead Nitrate		5	7	
M				
Magnesium Carbonate	Saturated	5	7	
Magnesium Chloride	Saturated	5	7	
Magnesium Hydroxide	Saturated	5	7	
Magnesium Nitrate	Saturated	5	7	
Magnesium Sulphate	Saturated	5	7	
Methyl Alcohol	100	5	5	
Methylene Chloride		2	2	
Mineral Oils		2	2	
N				
Naphtha		2	2	
Napthalene		2	2	
Nickel Chloride	Concentrated	5	7	
Nickel Nitrate	Saturated	5	7	
Nickel Sulphate	Concentrated	5	7	
Nicotine	Dilute	5	5	
Nitric Acid	≤55	5	5	Opaque drum required
Nitric Acid	≥56, ≤69	2	2	UN limit, Opaque drum reqd.
Nitric Acid	≥70			
Nitrobenzene				
O				
n-Octane		5	5	
Oxalic Acid	Saturated	5	5	
P				
Perchloroethylene				
Petrol				
Photographic Solutions		5	5	
Phosphoric Acid	<50	5	7	
Phosphoric Acid	≥50	5	5	
Plating Solution - Brass		5	5	
Plating Solution – Copper		5	5	
Plating Solution – Gold		5	5	
Plating Solution – Lead		5	5	
Plating Solution – Nickel		5	5	

Chemical	Concentration %	Maximum Service Life (Yrs.) Warlord	Warboy	Notes
Plating Solution – Silver		5	5	
Plating Solution – Cadmium		5	5	
Plating Solution – Tin		5	5	
Plating Solution – Zinc		5	5	
Potassium Bicarbonate		5	7	
Potassium Bromide	Saturated	5	5	
Potassium Carbonate		5	7	
Potassium Chlorate	Saturated	5	7	
Potassium Chloride	Saturated	5	7	
Potassium Chromate	40	5	7	
Potassium Cyanide	Saturated	5	7	
Potassium Dichromate	40	5	7	
Potassium Ferro Cyanide	Saturated	5	7	
Potassium Fluoride		5	7	
Potassium Hydroxide	Concentrated	5	7	
Potassium Nitrate	Saturated	5	7	
Potassium Perchlorate	10	5	7	
Potassium Permanganate	20	5	7	
Potassium Persulphate	Saturated	5	7	
Potassium Sulphate	Concentrated	5	7	
Potassium Sulphide	Concentrated	5	7	
Potassium Sulphite	Concentrated	5	7	
Propargyl Alcohol		5	5	
n-Propyl Alcohol		5	5	
Propylene Glycol		5	5	
Pyridine		5	5	
R				
Resorcinol	Saturated	5	5	
S				
Salicylic Acid	Saturated	5	5	
Selenic Acid		5	5	
Silver Nitrate Solution		5	7	
Soap Solution	Any	5	5	
Sodium Acetate	Saturated	5	7	
Sodium Benzoate	35	5	7	
Sodium Bicarbonate	Saturated	5	7	
Sodium Bisulphate	Saturated	5	7	
Sodium Bisulphite	Saturated	5	7	
Sodium Borate		5	7	
Sodium Bromide	Dilute	5	7	

Chemical	Concentration %	Maximum Service Life (Yrs.) Warlord	Warboy	Notes
Sodium Carbonate	Concentrated	5	7	
Sodium Chlorate	Saturated	5	7	
Sodium Chloride	Saturated	5	7	
Sodium Cyanide		5	7	
Sodium Dichromate	Saturated	5	7	
Sodium Ferro Cyanide		5	7	
Sodium Fluoride	Saturated	5	7	
Sodium Hydroxide	Concentrated	5	7	
Sodium Hypochlorite	8	5	7	Vented closure required
Sodium Hypochlorite	15	5	7	Vented closure required
Sodium Nitrate		5	7	
Sodium Sulphate		5	7	
Sodium Sulphide	Saturated	5	5	
Sodium Sulphite	Saturated	5	5	
Stannic Chloride	Saturated	5	5	
Stannous Chloride	Saturated	5	5	
Starch Solution	Saturated	5	5	
Stearic Acid	100	5	5	
Sulphuric Acid	0-98	5	7	
Sulphuric Acid	Fuming			
Sulphurous Acid		5	5	
T				
Tallow		5	7	
Tannic acid	Saturated	5	7	
Tetrahydrofuran	Saturated			
Titanium Tetrachloride	Saturated			
Toluene				
Trichloroethylene				
Triethylene Glycol		5	5	
Trisodium Phosphate	Saturated	5	7	
Turpentine				
U				
Urea	0-30	5	7	
W				
Wetting Agents		5	5	
X				
Xylene				
Z				
Zinc Bromide	Saturated	5	7	
Zinc Carbonate	Saturated	5	7	
Zinc Chloride	Saturated	5	7	

UN Certification

Regulations and Testing

The packing and carriage of hazardous chemicals is controlled within the EC via modal regulations. Those most applicable to Francis Ward containers are the ADR and RID regulations which cover road and rail transportation respectively.

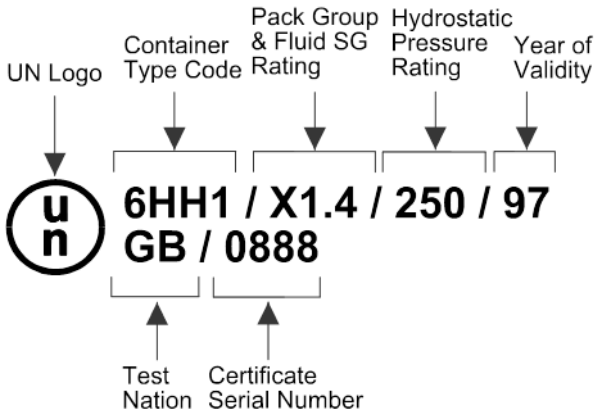
In order for a container to be used with hazardous chemicals it must be tested and certified in accordance with the ADR and RID regulations. The performance tests applied are those defined by the United Nations and include a drop test, hydraulic pressure test, leakproofness test and stack test.

Container Marking

All chemical products have a hazard rating and an associated Packaging Group as follows:

Extreme Hazard	Group I	Pack Group X
Moderate Hazard	Group II	Pack Group Y
Low Hazard	Group III	Pack Group Z

Containers will, once tested, have to display a marking which indicates their UN test rating and packaging group. An example marking with an explanation of its components is shown below.



All UN certified Francis Ward containers bear such a marking which is indelibly printed into the moulding.

Container Life Limits

The general life limits for plastic containers are shown in the UN Orange Book.

There is a five year life limit for 3H1 single-walled containers - Warlord.

The Warboy is a 6HH1 Composite pack for which the 5 year life limit does not apply.

A number of specific chemicals are limited to a 2 year life in plastic containers; these are indicated in the chemical compatibility listing in this guide.

Closures

Selection

It is important that the correct closure is selected for the intended container contents. The majority of products are compatible with standard closures. Where product degassing and subsequent pressurisation of the container may occur a vented closure should be specified.

Colour coding

Francis Ward closures can be supplied colour coded to match containers. This is a recommended means to ensure that closures remain product dedicated.

Torque

When sealing containers ensure that the correct torque setting is applied to the closure. A special tool to enable this without damaging the closures can be supplied.

Torque settings are defined on the relevant container specification sheet.

Storage

Once containers are filled and the closures secured they should always be stored in an upright position.

Replacement

It is important to ensure when using closures that they are intact, all components are present, and that they are not damaged or degraded to such an extent that their performance will be compromised.

Francis Ward closures should not be used in service for more than 2 years. Every closure is embossed with the month and year of issue to enable the assessment of closure age.

Palletisation & Stacking

The following table indicates pallet efficiency and stack capability for the Francis Ward container range.

Container Type	**Number/Layer** Euro Pallet 1000x1000	**Number/Layer** ISO Pallet 1200x1000	**Layers/ Pallet**	**Pallets/ Stack**
30L Warboy	9	9	2	2
45L Warboy	5	6	2	2
20L Warlord	9	12	3	2
30L Warlord	9	12	2	2
28L Warlord CF	9	12	2	2

It is important to ensure that pallets are close boarded, free of protruding splinters or nails and that container types are not mixed within a layer.

Whilst every attempt has been made to ensure that the information provided in this product information guide is accurate and reliable Francis Ward cannot accept responsibility for the interpretation of the information provided. It is the responsibility of the user to determine the chemical compatibility of the container with its intended contents.

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