ExxonMobil

Jayflex™ plasticizers for advantaged performance

Energy lives here™

Why Jayflex DINP and DIDP plasticizers? Jayflex DINP and DIDP are di-esters with a chemical structure providing an optimum balance between polar and non-polar groups. Key characteristics of the plasticizer are very slow diffusion and outstanding permanence derived from two high molecular weight branched alcohol chains.

Key advantages

- Track record of safe use
- High molecular weight
- Good pre-gelation and fusion characteristics
- Good low temperature properties
- Favorable cost performance
- Excellent compatibility with PVC
- Globally available
- Suited to variety of processing techniques

Safe and registered under REACH

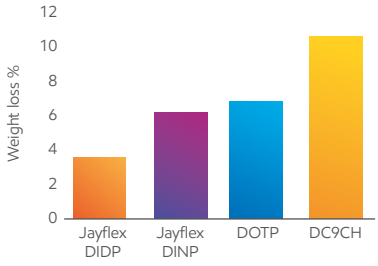
Not only are Jayflex DINP and DIDP registered under REACH, but following extensive evaluations between 2009 and 2013 the EU concluded DINP and DIDP are safe for use in all current applications with no further risks identified*.

Volatile losses

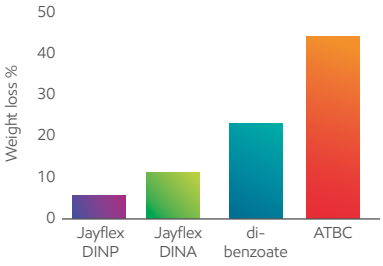
The rate of volatile loss of a plasticizer from PVC is controlled by diffusion to and evaporation from the surface. Rates of plasticizer losses can be anticipated from the neat plasticizer weight loss. Jayflex DINP and DIDP offer a high level of permanency compared to terephthalates or cyclohexanoates. Alternative plasticizers such as adipates, di-benzoates or citrates are substantially more volatile than Jayflex DINP and DIDP.

*DINP and DIDP are restricted in the EU based on precautionary grounds in toys and childcare articles which can be placed in the mouth.

Neat plasticizer weight loss %
(24h at 155°C - FV *)



Neat plasticizer weight loss %
(24h at 155°C - FV *)



* ExxonMobil test method
DC9CH: 1,2-cyclohexane di-carboxylic acid di-isononyl ester
DOTP: di-2-(ethylhexyl) terephthalate
ATBC: acetyl tributyl citrate
Di-benzoate: mixture of di-propylene, di-ethylene and tri-ethylene glycol di-benzoate

Improved flexible PVC processing

A low solution temperature indicates that dry blends can form at a relatively low temperature, will occur faster at a set temperature or that plastisols will gel and fuse at a lower temperature. It also indicates that the plasticizer is tolerant of the use of secondary plasticizers.
Jayflex DINP and DIDP plasticizers help to better achieve the key stages of flexible PVC processing, such as dryblending, full fusion and development of optimum mechanical properties.

Optimum solution temperature (T)

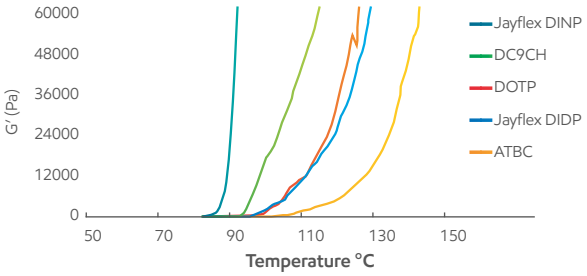
	Jayflex DINP	Jayflex DIDP	DOTP	ATBC	DC9CH
Solution T °C *	127	132	139	138	144

ExxonMobil test method - PTM 7 - Source file: data on neat properties

Good plastisol pre-gelation and fusion

When processing plastisols, the gelling energy is worked only by heat transfer. The higher the plasticizer solution temperature, the higher the processing temperature or the longer the time needed to achieve plastisol gelation. The rate of plastisol viscosity increases with the temperature is an indication of the solvency power of the plasticizer and its ease of processing. Jayflex DINP is faster gelling than most alternative plasticizers.

Gelation curve - storage modulus as a function of temperature

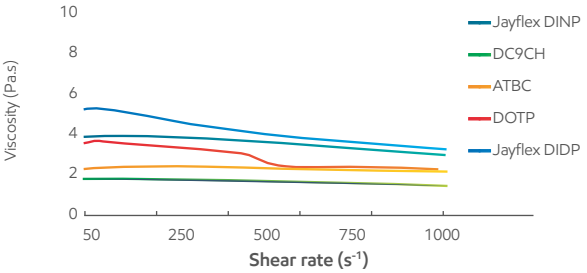


ExxonMobil test method - Formulation - Solvin 382NG 100 phr, Plasticizer 60 phr, Stab 1 phr.

Easy plastisol processing

Plastisol rheology gives an indication of the ease of processing when evaluated at the shear rate of the process. Plastisol viscosity increases with plasticizer neat viscosity and plasticizer solvency power. Poor gelling plasticizers impart lower plastisol viscosities but require higher processing temperature. Jayflex DINP offers an ideal compromise and good viscosity stability over time.

Plastisol viscosity as a function of shear rate (s-1) after a day



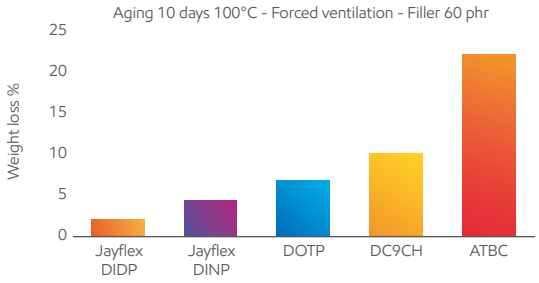
ExxonMobil test method - Formulation - Solvin 382NG 100 phr, Plasticizer 60 phr, Stab 1 phr.

High permanency and low volatile losses

Resistance to volatile loss from the end product under service conditions constitutes a key factor for plasticizer selection. For most flexible applications, in-service plasticizer evaporation is the essential parameter that drives finished product durability. Jayflex DINP and DIDP plasticizers exhibit the lowest level of volatile losses and therefore the highest level of permanency.

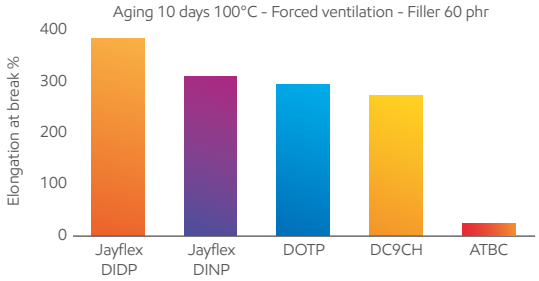
Maximum weight loss or change of mechanical properties (stress at break, elongation at break) before and after aging determines the suitability of compounds for wire and cable. Jayflex DINP and DIDP plasticizers help compounds reach the highest levels of retained properties after aging.

Compound weight losses



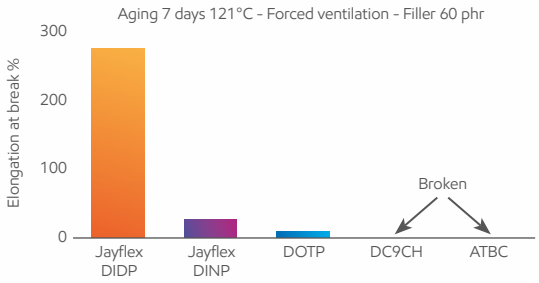
ExxonMobil test method - Formulation - Solvin 271PC 100 phr, Plasticizer (DINP 53 phr, others at efficiency), $CaCO_3$ EXH1 60 phr, Baeropan MC8656K-A-ST 5 phr

Compound aging in 10 days at 100°C

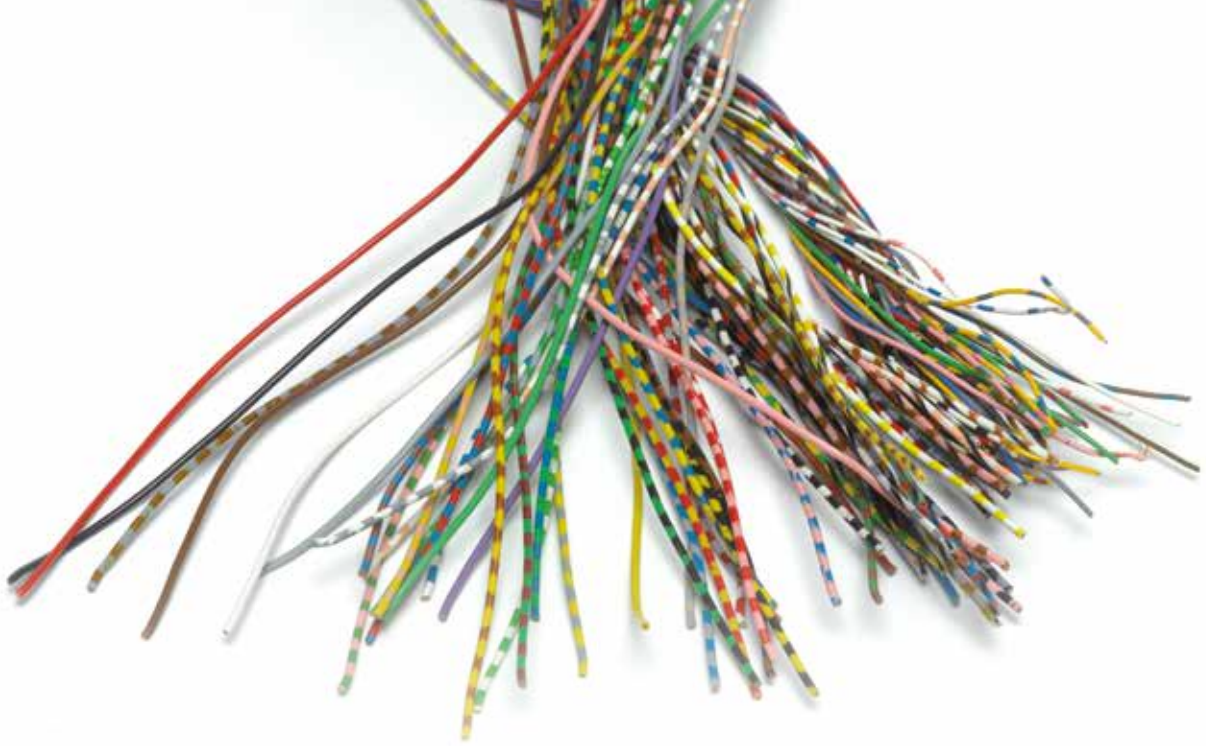


ExxonMobil test method - Formulation - Solvin 271PC 100 phr, Plasticizer (DINP 53 phr, others at efficiency), $CaCO_3$ EXH1 60 phr, Baeropan MC8656K-A-ST 5 phr

Compound aging in 7 days at 121°C



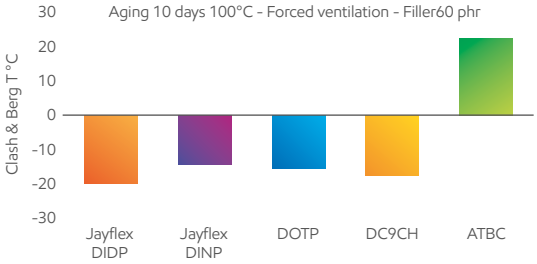
ExxonMobil test method - Formulation - Solvin 271PC 100 phr, Plasticizer (DINP 53 phr, others at efficiency), $CaCO_3$ EXH1 60 phr, Baeropan MC8656K-A-ST 5 phr



Good low-temperature performance

At equivalent hardness, Jayflex DIDP plasticizer provides improved low-temperature properties, retained over time, as shown in the accelerated aging study.

Cold flexibility



ExxonMobil test method - Formulation - Solvin 271PC 100 phr Plasticizer (DINP 53 phr, others at efficiency), $CaCO_3$ EXH1 60 phr, Baeropan MC8656K-A-ST 5 phr

Low fogging for automotive applications

Evaporation of plasticizers from car interior components can contribute to fogging. Typical automotive requirements call for neat plasticizer fogging condensates (16 h/100°C) - DIN 75201 B) below 1 mg. Only Jayflex DIDP plasticizer meets this requirement.

Low fogging for automotive applications

	Jayflex DIDP	Jayflex DINP	DOTP	ATBC	DC9CH
Fogging value (mg) *	0.7	1.3	2.8	21	3.6

ExxonMobil test method - neat plasticizer fogging

Flexibility at the lowest cost

Jayflex DINP and DIDP plasticizers combine low density and efficiency for maximum volume cost advantage.

Acceptable plasticizer efficiency level

	Jayflex DIDP	Jayflex DINP	DOTP	ATBC	DC9CH
Substitution factor *	1.10	1.06	1.03	1.01	1.09

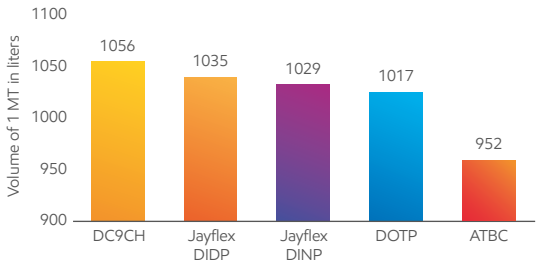
* Calculated using ExxonMobil test method and literature.
How to apply efficiency factors: concentration of Plasticizer 2 = concentration of Plasticizer 1 * substitution factor Plasticizer 2 / substitution factor Plasticizer 1

More volume with less weight

Each ton of a low-density plasticizer like Jayflex DINP or DIDP translates into high volume of finished product or a lower cost per unit volume.

$$\frac{\text{price}}{\text{volume}} = \frac{\text{price}}{\text{weight}} \times \text{density}$$

Volume of 1MT based on plasticizer density



Excellent compatibility with PVC

Compatibility of a plasticizer can be defined as the level of incorporation in PVC above which it will exude or sweat from the surface of a fully processed compound. The loop test (ASTM D3291-74) observes plasticizer compatibility with PVC during compression and while under tensile stress. Jayflex DINP and DIDP exhibit better compatibility over terephthalates and cyclohexanoates.

PVC compatibility

Plasticizers	Loop test (ASTM modified) 7 days	ICT Loop test 7 days
Jayflex DINP (53 phr)	0	0
Jayflex DIDP (55 phr)	0	0
DOTP (54 phr)	3	1
ATBC (50 phr)	0	0
DC9CH (55 phr)	0.5	0

Visual assessment: 0 = no exudation, 0.5 = little spots, 1 = slight exudate, 1.5 = slight exudate and small spots, 2 = moderate exudation and small spots, 2.5 = drops but area not saturated, 3 heavy exudation and total area saturated by a continuous film or big droplets.
ExxonMobil test method
Formulation - Solvin 271GC 100 phr, Plasticizer as shown, CACO3 80 phr, stabilizer BAZn 2.5 phr

Good extraction resistance

Jayflex DINP and DIDP plasticizers exhibit similar resistance to extraction versus alternatives but due to lower volatility will show lower losses over time, and longer product life.

Migration in food stimulant in mg/kg food - 10 days at 40°C

	Jayflex DIDP	Jayflex DINP	DOTP	ATBC	DOA	DC9CH
Distilled water	< 0.2	< 0.2	< 0.2	4	< 0.2	< 0.2
3% Acetic acid	< 0.2	< 0.2	< 0.2	3	< 0.2	< 0.2
10% Ethanol	< 0.2	< 0.2	< 0.2	6	0.7	< 0.2
95% Ethanol	5875	-	-	-	12625	7875

ExxonMobil test method

Globally available

The prime requirement for any raw material is sustainable production volumes. Jayflex DINP and DIDP plasticizers are produced in large quantities and available throughout the Asia Pacific region, Europe and the Americas.

Sustainable development

ExxonMobil Chemical supports the development of thorough Life Cycle Assessment and Life Cycle Inventory processes to drive product improvement for sustainable development. ExxonMobil Chemical is committed to support and contribute to efforts aimed at evaluating materials over "cradle-to-grave" life cycles.

REACH registration numbers

Jayflex DINP plasticizer is registered under 01-2119432682-41-0000
Jayflex DIDP plasticizer is registered under 01-2119422347-43-0000

True general-purpose plasticizers

Jayflex DINP and DIDP show superior performance in the key requirements for a general purpose plasticizer. Jayflex plasticizers exhibit low volatile losses and high gelation, are cost competitive, are available globally and have a longstanding record of safety in use and wide toxicological review.

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Contact us for more information:
exxonmobilchemical.com/en/products/plasticizers

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