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Re: Linear Low density material Vs. Linear High density material.

The term "high" is often conceived as better; we are born and raised with this throughout our entire life. My score is "higher" than yours. What a high scoring game, that was great! It's no wonder that when someone sells you a product and it says "high" you make the assumption that it would be better than "low". This is not true with linear polyethylene rotational molding resins.

There are a variety of rotational molding resin suppliers, some of which are Exxon Mobile, Chevron Phillips, Nova Chemicals just to mention a few. Assmann currently uses Exxon Mobile as our primary vendor.

Exxon Mobile produces a line of linear polyethylene resins for use in the food, toy, and chemical industries. This line includes both low and high density resins, with densities ranging from .932 g/cc to .948 g/cc. Assmann Corporation chooses to mold our linear polyethylene tanks from Low Density (.938) material (LL8460). We make this choice due to its ***Environmental Stress Crack Resistance*** (ESCR) and its superior impact strength versus (.942) linear high density material.

(ESCR) ***Environmental Stress Crack Resistance*** is a true measurement of the polyethylene materials chemical resistance. Simply put, the resin is notched and then submersed in a known stress cracking agent to polyethylene (Igepal) then the hours are measured until the material fails. Below are results of Linear Low versus Linear High.

- (**550hrs** @ 100% Igepal and **48hrs** @ 10% Igepal for HDPE)

- (>**1000hrs** @ 100% Igepal and **145hrs** @ 10% Igepal for LL-8461)

Impact strength is another reason why we choose low density in lieu of high density. On thicker walled parts, linear low density out-performs high density. The numbers below show that high density actually has lower impact strength as wall thickness increases. If you consider that most tanks above 1,000 gallons have a wall thickness greater than ¼" it's easy to see which material is safer.

- (1/8" thick sample tested @-40 deg C. = 80 Ft Lbs HDPE)
- (1/8" thick sample tested @-40 deg C. = 70 Ft Lbs LDPE)

- (1/4" thick sample tested @-40 deg C. = 180 Ft Lbs HDPE)
- (1/4" thick sample tested @-40 deg C. = 190 Ft Lbs LDPE)

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Assmann Corporation, through years of molding and in-the-field experience, has determined that low density linear resin is better suited than high density linear resin for chemical storage applications. The chart below demonstrates a side by side comparison of the two materials referenced.

Linear High Density Material

Assmann Corporation Linear Low Density Material

	ASTM Method[2]	Units	Linear Polyethylene Grades							
Resin Grade			LL 8360 or LLP8360	LL-8555 or LLP8555	LL 8446*	LL 8455 or LLP8455	LL 8450 or LLP8450	LL 8460 or LLP8460	HD 8660 or HDP8660	HD 8760 or HDP8760
Characteristics			Low warpage Excellent ESCR Excellent impact Easy to process UV-8 Stabilized	Superior processability Excellent surface finish and color UV-8 or UV-4	Excellent processability Easy grinding Low warpage UV-8 Stabilized	Excellent processability Easy grinding Low warpage UV-4 Stabilized	Excellent processability High stiffness Excellent color UV-8 Stabilized	Excellent Balance of Stiffness, Toughness and Processability UV-8 Stabilized	Superior stiffness, toughness creep, and tear properties. UV-8 Stabilized	Outsta... stiffne... proces... UV-8 S...
Typical Applications			Externally supported IBC's Consumer articles	Display cabinets Toys / playground equipment	Toys Consumer articles General purpose articles Tanks	Toys Indoor articles	Playground equipment Water tanks	Tanks and IBC's Playground eqpt. Industrial Parts	Agricultural tanks IBC's Industrial Products	RV Ta... Consu... articles
Resin Properties[1]										
Density	D-4883	g/cc	0.932	0.936	0.936	0.936	0.937	0.938	0.942	0.948
Melt Index	D-1238	g /10 min	5.2	6.8	5.0	5.5	5.0	3.3	2.0	5.0
Peak Melting Point	D-3418	°C (°F)	125 (257)	126 (259)	125 (257)	125 (257)	127 (261)	127 (261)	129 (264)	131 (268)
Environmental Stress Crack Resistance (ESCR), F_{50}	D-1693, Cond. A 100% Igepal 10% Igepal	Hr Hr	>1000 650	275 55	36 24	36 24	>1000 185	>1000 145	550 48	9 9
Flexural Modulus	D-790 at 1% secant Procedure B	MPa (kpsi)	600 (87)	702 (102)	730 (106)	702 (102)	730 (106)	771 (112)	888 (129)	1060 (154)
Tensile Strength at Yield	D-638, Type IV specimen 2"/min @ 1/8" thick	MPa (psi)	15.1 (2200)	17.2 (2500)	17 (2450)	16.0 (2325)	17.6 (2550)	17.9 (2575)	20.3 (2950)	23.4 (3400)
Tensile Elongation @ Yield		%	20.6	17.5	17	17	16.7	17.7	16.2	15.3
Deflection Temperature	D-648 @ 66 psi @ 264 psi	°C (°F)	55 (131) 37 (98)	59 (138) 38 (100)	52 (126) 36 (97)	57 (135) 38 (101)	61 (142) 38 (100)	62 (144) 39 (102)	67 (153) 41 (106)	74 (166) 43 (110)
Impact Strength @ -40°C	ARM 1/8" (3.17 mm) thickness	J (ft-lbs)	88 (65)	81 (60)	68 (50)	72 (53)	77 (57)	95 (70)	108 (80)	79 (58)
	1/4" (6.35 mm) thickness	J (ft-lbs)	217 (160)	217 (160)	177 (130)	170 (116)	183 (135)	258 (190)	244 (180)	176 (130)

We hope that this explanation will clarify the questions between high density and low density materials. There are many things to consider when choosing a polyethylene tank. Material is simply one. There are process related stresses due to tapered wall thickness versus uniform wall thickness and water cooling versus air cooling.

Please view: www.assmann-usa.com/why_assmann.htm for a full explanation of why Assmann Corporation of America should be your first choice for Polyethylene Chemical Storage Tanks.

Sincerely,

Steve Rowlison
V.P. Sales and Marketing
Assmann Corporation of America