APPLICATION GUIDE

Turboset™ Ultra Eco

Self-Crosslinking Waterborne Polyurethane Composite

PRODUCT DESCRIPTION

Turboset™ Ultra Eco is an NMP/NEP free, self-crosslinking waterborne polyurethane composite that is able to be formulated to <140g/L VOC US (< 50 g/L EU). **Turboset™ Ultra Eco** is designed to perform on sports, recreation and high traffic wood floors without the use of cross-linkers. One component (1K) waterborne finishes made from **Turboset™ Ultra Eco** can be formulated to have properties such as black heel mark, scuff and abrasion resistance comparable to 2K waterborne urethane finishes

Turboset™ Ultra Eco is based on a state of the art, self-crosslinking mechanism that cures as the wet film dries. **Turboset™ Ultra Eco's** ability to perform in demanding floor applications without adding cross-linkers simplifies and lowers the risks of application associated with 2K systems, while also reducing waste. If additional performance is desired, **Turboset™ Ultra Eco** can be further cross-linked with an external cross-linker, such as aziridine or isocyanate, to further improve properties such as hardness and chemical resistance.

FEATURES/BENEFITS

- NMP and NEP-Free
- Can be formulated to <140/50 grams/liter US/EU VOC*
- Excellent Taber abrasion and black heel mark resistance
- Excellent solvent rub resistance
- Adhesion to multiple substrates including solvent based stains
- Complies with European regulatory requirements
- Meets current US and EU VOC regulations
- Excellent wear properties
- Excellent chemical resistance
- Multiple use capability

*Using EPA method 24 / ISO 11890-2

PHYSICAL CHARACTERISTICS*

Appearance (wet)	Translucent to Slightly Cloudy Dispersion
Total Solids by Weight, %	36.0 ± 1.0
Total Solids by Volume, %	35.0 ± 1.0
Density, lbs/gal (g/ml)	8.69 (1.04)
Brookfield Viscosity, cps	< 500
pH	8.0 - 9.0
Volatile organic content, wt%	0.62 (triethylamine)
MFFT	<4.4°C
Freeze-Thaw Stability	Protect from freezing

* Property values represent typical results only and are not to be considered specifications

Lubrizol

www.lubrizolcoatings.com

TYPICAL APPLICATIONS

- Sports and commercial wood floors
- Other wood applications requiring tough, chemical resistant finishes

SHELF LIFE/STORAGE

Typical shelf life for this material unopened in a cool dry location is up to 2 years.

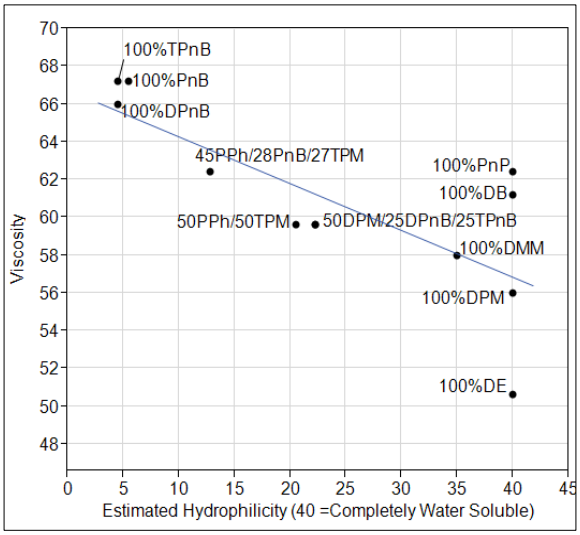
REGULATORY STATUS

Please see the product's current material safety data sheet, MSDS, for regulatory information. You can request an MSDS at www.lubrizolcoatings.com.

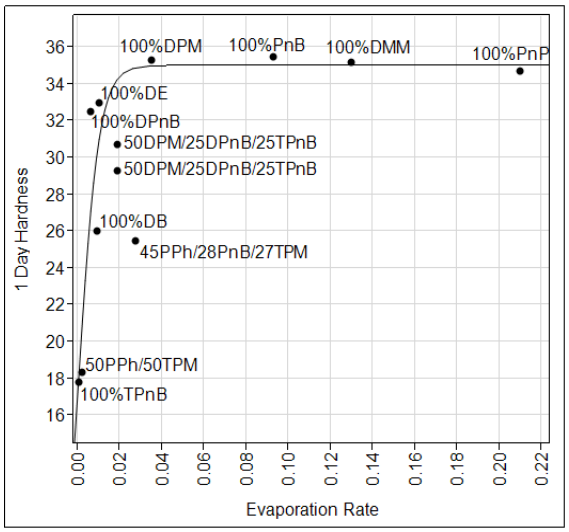
FORMULATION GUIDELINES

COALESCENT SOLVENTS

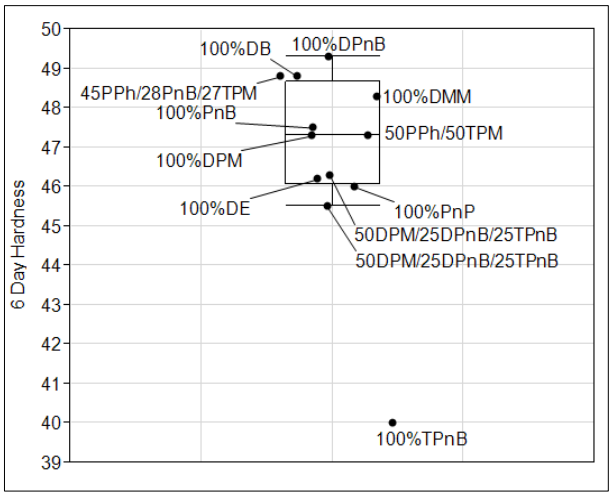
As supplied **Turboset™ Ultra Eco** is not a film former. For optimum film formation, the addition of glycol ether co-solvents are necessary. Optimum film property development can be achieved at less than 140 grams per liter VOC US EPA Method 24 (<50g/L EU ISO 18890-2) by using any of the following recommended cosolvents or combinations there-of.



The hydrophobicity of the cosolvents will have an impact on your finish viscosity.



The evaporation rate of the solvent will impact early hardness development of the finish.
***CAUTION:** Increases in evaporation rate can cause mud-cracking in thicker film applications*



While the evaporation rate of the cosolvent significantly influences early (24 hr.) film hardness development it has little influence on long term hardness except for TPnB

***** PM is not recommend for use as a cosolvent for **Turboset™ Ultra Eco**

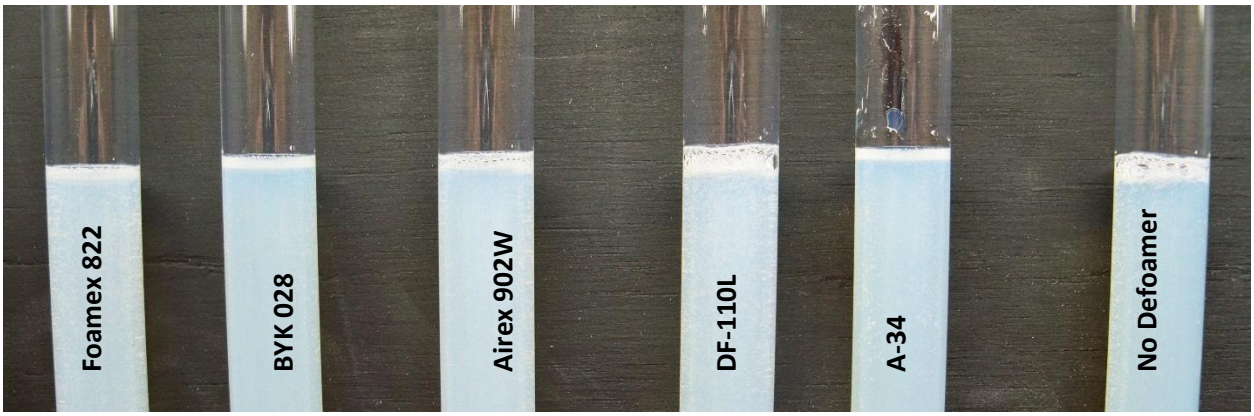
Volatile Organic Compound Amount

We have found that the amount of VOC added to **Turboset™ Ultra Eco** may change early development properties such as hardness and early chemical resistance as demonstrated in the table below

VOC in g/L		König Hardness				Black Heel Marking	COF via James Machine	Chemical Resistance tested after 7 days cure- 1 Hr. Recovery					
US	EU	1 Day Cure	3 Day Cure	7 Day Cure	14 Day Cure			Water Resistance - 4 Hr. Exp.	Spic N Span - 4 Hr. Exp.	1.4% Ammonia - 1 Hr. Exp.	50% Ethanol/Water - 1 Hr. Exp.	70% Isopropanol - 1 Hr. Exp.	Maximum Total Score = 100
46.7	**13.8**	**33**	**41**	**44**	**48**	**8**	**0.51**	**20**	**20**	**15**	**16**	**16**	**87**
136.9	**45.0**	**29**	**35**	**41**	**44**	**7**	**0.53**	**20**	**20**	**16**	**17**	**17**	**90**
248.9	**95.4**	**20**	**26**	**34**	**44**	**7**	**0.52**	**20**	**20**	**17**	**17**	**17**	**91**

DEFOAMERS

Defoamers are used with **Turboset™ Ultra Eco** to control the amount of foam created during application. The following defoamers have been found to work well for use with **Turboset™ Ultra Eco.**



	TEGO® Foamex 822	BYK® 028	TEGO® Airex 902W	Surfynol® DF-110L	FoamStar® A-34	Drewplus™ L-475	FoamStar® A-10	Surfynol® DF-75
In-Can Appearance	Good	Good	Good	Good	Good	Poor	Poor	Poor
Draw Down Appearance	Good	Good	Hazy	Good	Severe Craters	n/a	n/a	n/a
1 Minute Shake Visual Foam	Minimal	Minimal	Minimal	Moderate	Minimal	n/a	n/a	n/a

FLOW AND LEVELING AGENTS

Wood floor finish applications need excellent flow and leveling characteristics (along with foam control). While providing excellent flow and leveling these additives should not lower the coefficient of friction (COF) of the finish to levels that cause slip issues. The recommended flow and leveling agents for **Turboset™ Ultra Eco** meet those requirements at low usage levels.

Aerosol® OT-75	CYTEC
Surfynol® 104DPM	Air Products
Surfynol® 440	Air Products
BYK® 347	BYK
Dow Corning® Q2-5211	Dow Corning
Solsperse® 40000	**Lubrizol**

Silicone Slip Additives – use with care as they will impact slip properties

BYK® 333	BYK
TEGO® Glide 410	EVONIK

Note: Some interactions have been found between solvents and surfactants. If using DMM as a coalescing solvent it is recommended to use Surfynol® 440 to decrease haze. If using Envirogem® AD01 it is recommended not to use DPnB as a coalescing aid because it can cause leveling issues.

UV PROTECTION PACKAGES

HALS and UV absorbers such as Tinuvin® 1130 and 292 can be added to the formulations containing **Turboset™ Ultra Eco** for sunlight protection. It is recommended to add to water/cosolvent premix solution prior to adding to the polymer. It may be preferable to add to just the cosolvent and additives without any water in the premix and then add to resin.

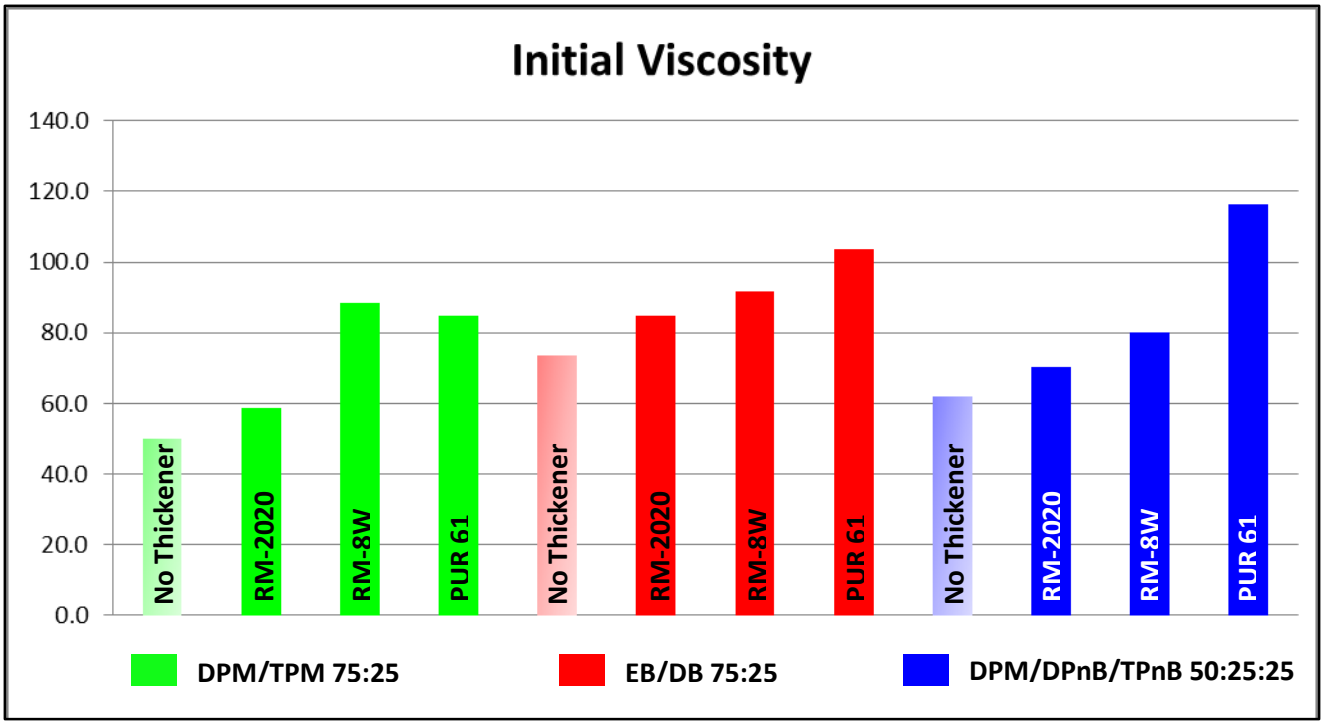
MATTING AGENTS AND SURFACE MODIFIERS

Surface modifiers can be used to control the gloss of formulations using **Turboset™ Ultra Eco.** Wax emulsions can also be used to improve the scratch resistance of **Turboset™ Ultra Eco** without significantly effecting the gloss. The following surface modifiers have been evaluated for use in finishes using **Turboset™ Ultra Eco;**

Lanco™ Liquimatt 2000	**Lubrizol**
Lanco™ Glidd 6040	**Lubrizol**
Lanco™ Glidd 6445	**Lubrizol**
Aquaslip™ 671	**Lubrizol**
ACEMATT® TS 100	EVONIK

THICKENERS AND VISCOSITY

HEUR type thickeners may be added to **Turboset™ Ultra Eco** formulations to adjust the rheology of the finish to achieve desired application properties. Solvent type can have an effect on thickener response. See below for a combination of solvents and thickeners used in a formulation with **Turboset™ Ultra Eco.** 0.12% of each thickener was added to the total formula weight.



* Units are in cps as tested on a Brookfield RVDV Spindle #2 at 100rpm.

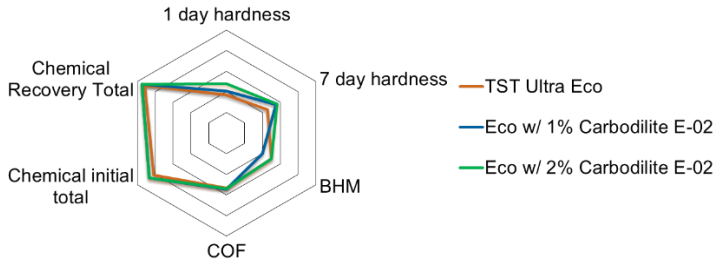
Thickeners Used:	
Acrysol™ RM- 8W	Dow Chemical
Acrysol™ RM- 2020NPR	Dow Chemical
DSX® 1550	Cognis
TAFIGEL® PUR 61	MÜNZING

EXTERNAL CROSSLINKERS

External crosslinkers can be added to **Turboset™ Ultra Eco** formulations to improve the performance of the finish to achieve desired application properties. For isocyanate crosslinkers it is recommended to start at a 20% active on weight solids of the polymer addition rate. We also recommend blending the iscosyanate with a cosolvent for easier incorporation into the paint. We have found that DMM is a good solvent for this use. For aziridine crosslinkers it is recommended to start at 2% active on total formulation weight. We always recommended to try a ladder of any crosslinker to optimize the performance properties desired. Crosslinkers below have all been found to work well with **Turboset™ Ultra Eco**.

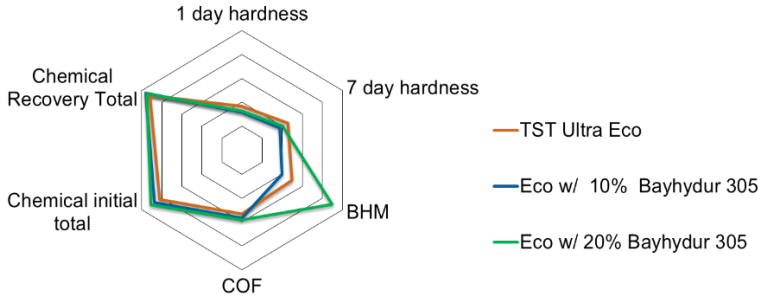
Bayhydur® 305	BAYER
PZ-33	PolyAziridine
Carbodilite™ E-02	Nisshinbo

Carbodiimide



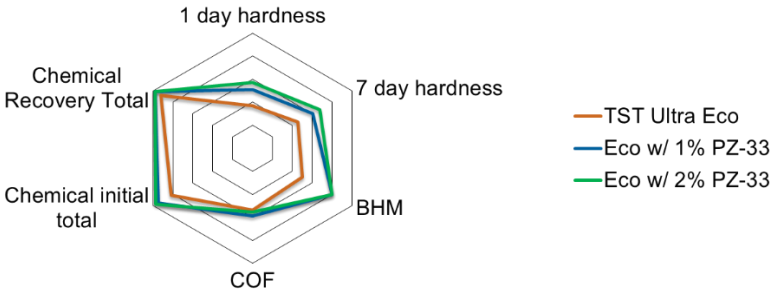
Carbodiimides can be used to increase film hardness and chemical resistance. it is recommended to start at 2% active on total formulation weight

Isocyanate



Isocyanates can be used to increase BHM resistance and chemical resistance. It is recommended to start at a 20% active on weight solids of the polymer addition rate.

Aziridine



Aziridines can be used to increase Hardness, BHM resistance and chemical resistance. It is recommended to start at 2% active on total formulation weight

STARTING POINT FORMULATIONS

High Gloss Wood Coating
Model Formula TSTULECO-01

Material	Lbs	Gal	Wt %	Use
Blend in order with agitation				
Turboset™ Ultra Eco	732.00	84.23	85.02	Resin
Water	58.00	6.96	6.74	
Add the following separately. Mix for 10 - 20 minutes.				
Water	1.00	0.12	0.12	
TEGO® Foamex 822	1.00	0.12	0.12	Defoamer
Premix the following items before adding to batch. Add while mixing.				
Water	34.00	4.08	3.95	
DPM (dipropylene glycol methyl ether)	17.00	2.15	1.97	Co-Solvent
DPnB (dipropylene glycol n-butyl ether)	8.50	1.12	0.99	Co-Solvent
TPnB (tripropylene glycol n-butyl ether)	8.50	1.09	0.99	Co-Solvent
BYK® 347	1.00	0.12	0.12	Wetting Agent
Add the following separately. Mix for 10 - 20 minutes.				
Acrysol™ RM-2020	0.00	0.00	0.00	Thickener
Total	861.00	100.00	100.00	

Physicals

Density, lbs/gal	8.6
Weight Solids, %	30.7%
Volume Solids, %	27.9%
US VOC, g/L (EPA Method 24)	139.7
EU VOC, g/L (ISO 11890-2)	46.2
China VOC, g/L (GB 24410-2009)	112.9

Ultra Low VOC Clear Gloss Wood Coating
Model Formula TSTULECO-02

Material	Lbs	Gal	Wt %	Use
Blend in order with agitation				
Turboset™ Ultra Eco	732.00	84.23	84.82	Resin
Water	108.70	13.05	12.60	
Premix the following items before adding to above. Add while mixing.				
TEGO® Foamex 822	1.00	0.12	0.12	Defoamer
Water	1.00	0.12	0.12	
Premix the following items before adding to above. Add while mixing.				
Water	7.50	0.90	0.87	
TPnB (tripropylene glycol n-butyl ether)	7.50	0.97	0.87	Co-Solvent
Solsperse™ 40000	4.30	0.49	0.50	Flow and Leveling
BYK® 347	1.00	0.12	0.12	Wetting Agent
Add the following separately. Mix for 10 - 20 minutes.				
Acrysol™ RM-2020	0	0	0	Thickener
Total	863.00	100.00	100.00	

Physicals

Density, lbs/gal	8.6
Weight Solids, %	31.1%
Volume Solids, %	30.0%
US VOC, g/L (EPA Method 24)	48.6
EU VOC, g/L (ISO 11890-2)	14.6

Semi-Matte Wood Coating
Model Formula TSTULECO-03

Material	Lbs	Gal	Wt %	Use
Blend in order with agitation				
Turboset™ Ultra Eco	700.00	80.55	81.13	Resin
Water	64.16	7.70	7.44	
Add the following separately. Mix for 10 - 20 minutes.				
Water	1.00	0.12	0.12	
TEGO® Foamex 822	1.00	0.12	0.12	Defoamer
Premix the following items before adding to batch. Add while mixing.				
Water	33.50	4.02	3.88	
DPM (dipropylene glycol methyl ether)	16.50	2.09	1.91	Co-Solvent
DPnB (dipropylene glycol n-butyl ether)	8.50	1.12	0.99	Co-Solvent
TPnB (tripropylene glycol n-butyl ether)	8.50	1.09	0.99	Co-Solvent
BYK® 347	1.00	0.12	0.12	Wetting Agent
Add the following separately. Mix for 10 - 20 minutes.				
Solsperse® 27000	9.00	0.95	1.04	Hyperdispersant
Lanco™ Glidd 6445	13.00	1.61	1.51	Matting Agent
Acematt® TS100	5.00	0.30	0.58	Matting Agent
TAFIGEL® PUR 61	1.70	0.20	0.20	Thickener
Total	862.86	100.00	100.00	

Physicals

Density, lbs/gal	8.63
Weight Solids, %	31.6
Volume Solids, %	28.7
VOC, g/L (EPA Method 24)	134.5
VOC, g/L (ISO 11890-2)	35.6
VOC, g/L (China GB 24410-2009)	107.8