



Validation Report: KDX BOPP EVA



Subject: Pack Ready validation test report for KDX (film supplier) / KARLVILLE trial

Date November 17, 2019

(Supplier & Product) KDX BOPP HS 28um - SUBMITTED FOR EVALUATION

Requirements:

1. Roll Details:

In Table 1 list number of rolls, size of rolls and details of all thermal lamination films including product codes, corona treatment, additives (if applicable) etc...

2. SAMPLES to be sent to Israel:

- a. 70m (230ft.) of laminated material (see test protocol supplied by HP-Indigo R&D)
- b. Pouching: Karlville to send pouches of the laminated film - **N/A**

Procedure:

Roll Details and condition: Each of the produced rolls underwent an incoming inspection and tested for:

- ▶ Visual inspection: Record general condition and/or any defects (coating quality, visual defects) & Curling
- ▶ Constructions: Each construction shall be listed along with all pertinent details captured in Table 2

Production /summary: Run lamination test based on test protocol supplied by HP R&D. fill Table 3 for process parameters.

- ▶ LBS testing: Each construction will be subject to Lamination Bond Strength (LBS) measurements as indicated in the test protocol. LBS measurements will be performed as follows:
 - Immediately after the lamination (to be performed by Karlville)
 - 24 hours after the lamination (to be performed by Karlville)
 - 2-4 weeks after the lamination (to be performed in parallel by Karlville & HP-Indigo R&D @ Israel)



Table 1 – Roll details:

Product code	Material	Resin EMA or EVA	Thickness [µm]	Roll width [mm]	Corona treatment [Y/N]	Additives
09030922B062011D1/A	HS BOPP GLOSS	EVA	28	750	YES	N/A

Table 2 - Production summary & experimental details:

EXP. #	Printed substrate	Surface / reverse print	TAP substrate	TAP on top or 2'nd	Total Thickness [µm]
RS-009	BOPP 20um	REVERSE	KDX BOPP HS GLOSS	TOP	48

Table 3 - Process parameters:

EXP. #	Nip temperature [°C]	Lamination speed [m/min]	Corona on TAP [W]	Corona on print [W]	Wrapping angle [deg.]	Tension print [kg]	Tension tap [kg]	Tension RW [kg]	Tension infeed [kg]	Pressure [Bar] L/R	Pre- Heat [°C]
RS-009	130	40	2.0	2.0	100	8.0	2.0	10.0	8.0	2.0 / 2.0	40

1. Pre-lamination – film inspection remarks:

- ▶ Curling score (in cm TD and MD): Minor curling in TD and MD
- ▶ Thermal active layer coating quality: Good
- ▶ Visual defects: N/A
- ▶ Comments: N/A



2. Post lamination results:

Exp. #	Composition	AVG. LBS [N/in] (Failure mode*)						Visual appearance (Y/N)		
		Left side of hot drum OS			Right side of hot drum GS			Curling	Wrinkles	Pinching
		Patch 22	Patch 16	Patch 11	Patch 22	Patch 16	Patch 11			
RS-009	t=0	4.0	4.1	6.4	4.0	4.3	6.1	N/A	N/A	N/A
	t=24	7.2	7.3	6.5	6.0	7.5	5.2			

* The abbreviations of the failure modes stand for the following:

NT - Not transfer of ink from the printed substrate to laminated substrate

TT - Total transfer of ink from the printed substrate to laminated substrate

PT - Partial Transfer of ink from the printed substrate (write the percentage of ink remaining on the printed substrate)

PTT - Partial TAP transfer from the Pack Ready film

TTT - Total TAP Transfer from the Pack Ready film to the printed substrate

3. Sealing bond strength results:

Exp. #	Composition	Substrate	Dwell time [sec]	SBS [N/in]				
				120C	130C	140C	150C	160C
RS-009	RS-009 BOPP/INK/HS BOPP GLOSS	HS-BOPP	0.5					
			1					



4. Sealed are appearance:

			Dwell time [sec]	SBS [N/in]				
				120C	130C	140C	150C	160C
RS-009	BOPP/INK/HS BOPP GLOSS	HS-BOPP	0.5					
			1					

Colorcode reflects property rating: ■ Red = Bad ■ Yellow = Moderate ■ Green = Good

Summary:

The lamination of KDX HS BOPP to the reverse printed BOPP results are: Acceptable adhesion and pull strength results post lamination using the parameters listed in Table #3. The LBS has increased post 24 hours, see values @ T=24. In addition to overall clear and glossy appearance, the KDX BOPP has passed the lamination appearance criteria and has passed the lamination validation process.

A 70 M roll was sent to R&D Israel for further testing.