



# HP Indigo Division Technical Note

## Subject: Protect-all (PET) and Derprosa (BOPP) compatible Pack Ready Film feasibility test report

### 1. **Background:**

Compatible Pack Ready Films are commercially available thermal films that can be used as laminates over print for flexible packaging using the Karlville Pack Ready laminator.

### 2. **Objective:**

The purpose of this trial is to test the functionality of two compatible films against two type of digital prints – surface printed MET-PET/PE and reverse printed BOPP

### 3. **Procedure:**

3.1 Each roll underwent a feasibility matrix testing different lamination conditions in order to find the optimal working window per composition. The roll was examined for:

- Curling
- Wrinkles
- Lamination performance between the laminate and the ink

The lamination was performed under the following conditions:

Unwinder 1	Unwinder 2	Temperature [C]	Speed [m/min]	Wrapping angel [deg.]
EVA/BOPP (Derprosa)	Ink/MET-PET/PE	100	40	90
EVA/BOPP (Derprosa)	Ink/MET-PET/PE	120	40	60
EVA/BOPP (Derprosa)	Ink/MET-PET/PE	140	40	30
EVA/BOPP (Derprosa)	Ink/BOPP	100	40	90
EVA/BOPP (Derprosa)	Ink/BOPP	120	40	60
EVA/BOPP (Derprosa)	Ink/BOPP	140	40	30
EVA/PET (Protect-all)	Ink/MET-PET/PE	100	40	90
EVA/PET (Protect-all)	Ink/MET-PET/PE	120	40	60
EVA/PET (Protect-all)	Ink/MET-PET/PE	140	40	30
EVA/PET (Protect-all)	Ink/BOPP	100	40	90
EVA/PET (Protect-all)	Ink/BOPP	120	40	60
EVA/PET (Protect-all)	Ink/BOPP	140	40	30

- The lamination bond strength (LBS) was tested using the standard T-peel testing procedure, according to ASTM D1876.



3.2 The best laminate was form each compositions was sealed under the following conditions and examined for

- Color change
- Seal area appearance

Sealant layer	Upper jaw type	Lower jaw type	Upper jaw temp [C]	Lower jaw temp [C]	Force [N]	Dwell time [sec]
PE	Flat 1" + Teflon	1" Silicon + Teflon	170-240	RT	450	0.5,1, 2
	Grooved 1"	Grooved 1"	170-240	RT	450	0.5,1, 2
BOPP	Flat 1" + Teflon	1" Silicon + Teflon	120-180	RT	450	0.5,1, 2
	Grooved 1"	Grooved 1"	120-180	RT	450	0.5,1, 2

**4. Results:**

4.1 LBS results taken 48 hours after the lamination process

Unwinder 1	Unwinder 2	Temperature [C]	Wrapping angle [deg.]	Overall appearance	LBS at t=48hrs [N/in]			LBS at t=10 days [N/in]		
					Patch #22	Patch #16	Patch #11	Patch #22	Patch #16	Patch #11
EVA/BOPP (Derprosa)	Ink/MET-PET/PE	100	90		8.4	8.9	8.7	5.5	6.3	9
EVA/BOPP (Derprosa)	Ink/MET-PET/PE	120	60		10.8	10.5	15	10.0	10.5	12.3
EVA/BOPP (Derprosa)	Ink/MET-PET/PE	140	30		11.0	9.0	14.2	10.3	5.3	9.8
EVA/BOPP (Derprosa)	Ink/BOPP	100	90		3.9	3.8	8.7	NA	4.6	NA
EVA/BOPP (Derprosa)	Ink/BOPP	120	60		9.0	4.1	18.5	7.6	9.2	18.0
EVA/BOPP (Derprosa)	Ink/BOPP	140	30		12.2	7.8	5.3	9.5	5.2	20
EVA/PET (Protect-all)	Ink/MET-PET/PE	100	90		8.8	10.0	16.6	9.7	11.6	16.3
EVA/PET (Protect-all)	Ink/MET-PET/PE	120	60		9.5	9.7	16.4	8.2	8.4	13.0
EVA/PET (Protect-all)	Ink/MET-PET/PE	140	30		11.3	9.7	15.6	13.4	11.7	19.9
EVA/PET (Protect-all)	Ink/BOPP	100	90		10.3	12.5	17.0	8.6	7.7	20
EVA/PET (Protect-all)	Ink/BOPP	120	60		13.5	15.3	20	13.0	15.8	30
EVA/PET (Protect-all)	Ink/BOPP	140	30		15.1	15.8	CBO	16.1	13.5	30



#### 4.2 Seal test results

Top ply	Second ply	Dwell time [s]	170°C	180°C	190°C	200°C	210°C
PET (Protect-all)	MET-PET/PE	0.5	0	1.5	47	58	58
		1	50	70	>100	>100	>100
BOPP (Derprosa)	MET-PET/PE	0.5	2.1	4.5	24.5	89	>100
		1	63	80	>100	>100	>100

Top ply	Second ply	Dwell time [s]	120°C	130°C	140°C	150°C	160°C
PET (Protect-all)	BOPP	0.5	0	0	0	0	3
		1	0	0	0.3	4.9	6
BOPP (Derprosa)	BOPP	0.5	0	0	0	4.7	6
		1	0	0	3.4	5.7	5.8

#### 4.3 Sealed area appearance

Top ply	Second ply	Jaws type	Sealing temperature [C]	Dwell time [s]	Sealed area visual appearance result
PET (Protect-all)	MET-PET/PE	Flat	170-240	1	Good appearance up to 220°C
		Grooved			Ink creeping at all temperatures
BOPP (Derprosa)	MET-PET/PE	Flat			Good appearance up to 180°C
		Grooved			Ink creeping at all temperatures

Top ply	Second ply	Jaws type	Sealing temperature [C]	Dwell time [s]	Sealed area visual appearance result
PET (Protect-all)	BOPP	Flat	120-180	1	NA
		Grooved			
BOPP (Derprosa)	BOPP	Flat			Good appearance up to 140°C
		Grooved			Ink creeping at all temperatures

### 5. Conclusions:

- LBS results show good lamination performance between the thermal film and the digital print
- High nip temperature (140°C) compromises the appearance of the laminate
- Low nip temperature (100°C) revealed a decrease in the LBS values after 10 days
- 120°C was found to be the optimal temperature yielding good appearance and stable LBS
- Seal tests revealed creeping of the ink when using a grooved jaw for all compositions at all temperatures and dwell times
- Sealing appearance with flat jaws for BOPP Derprosa is good only for low temperatures. At those temperatures the sealing bond strength is still low (both for Met-PET/PE and BOPP printed substrates)



**6. Summary:**

Both Derprosa (BOPP) and Protect-all (PET) compatible films yield high LBS values with good visual appearance within the identified working parameters. The seal strength and appearance raise some concerns, however, the seal strength is dictated solely by the underlying (printed) substrate, in this case the MET-PET/PE and BOPP. The appearance and creeping of the ink are strongly related to the conditions at which the seal was performed – in our case using a manual sealer and a specific type of grooved jaw. Based on past experience, the compositions at hand can withstand harsher sealing conditions, with goo results, including zipper crash and grooved jaw sealing with proper setup on various pouch machines.

We find both Derprosa (BOPP) and Protect-all (PET) compatible films to **pass** the feasibility trial and can be recommended for use with Pack Ready Lamination.