INA PLASTICS S.A.
innovation at its best

QUALITY DEFINITION "DOUBLE TRAY SYSTEM"

NOVEMBER 2020

Quality Definition of the “Double Tray System” (DTS)

Description of the DTS

The DTS is a plastic double tray system made of Polystyrene (PS) raw material through the process of thermoforming. It consists of one flexible top tray for sowing or transplanting and one flexible bottom tray for support. Both trays of the system have drain holes. When the two trays are combined into the double tray system, the result is one unified and rigid object which is characterized by the fact that the bottom (supporting) tray has the reversed shape of the top tray.

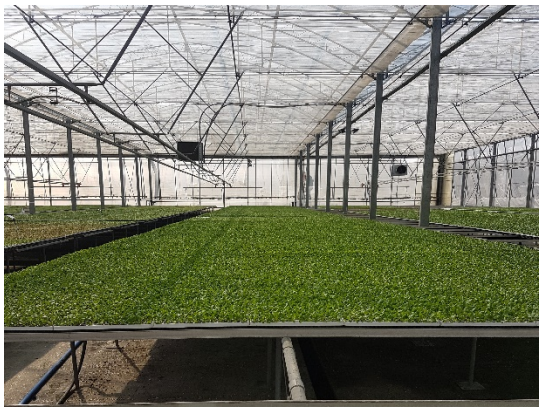
The design of the DTS is protected by international patent (**Patent No: WO 2014147250A1**) for the production or use of the trays.

Advantages and Characteristics

The combination of the two trays makes an inflexible system. The outer shape of the system is compatible with all sowing or transplanting automatic lines. Surrounding rim keeps excess substrate away from the system during the filling stage and also provides a smooth surface for printing crop information that is essential for production management. Double tray system is impenetrable from roots, so no anchoring on cell walls occurs and plant extraction is easy with no root damage. Plant extraction can be done through the drain holes with an extractor or by hand. Both parts of the plastic double tray system can be placed one inside the other respectively, thus keeping very low transport and storage volume (and cost). The product is made out of recycled PS (polystyrene) and is recyclable after use.

Advantages of the DTS: easy plant extraction with no injuries, low transport and storage cost, eco-friendly. The system is also rigid, very durable and does not require any changes on the existing production systems.

Another important and unprecedented characteristic of the DTS, is its floating capability. Thanks to its design, air is trapped in the grooves of the bottom tray making the tray system float carrying the weight of the soil and plants on it.

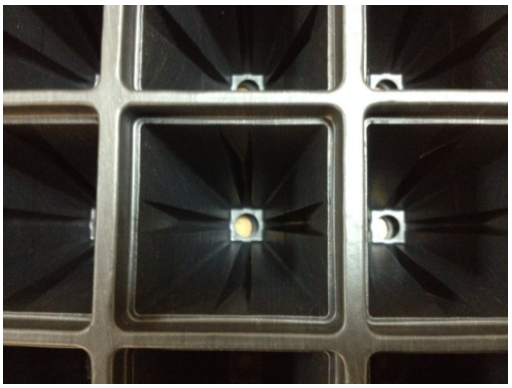


The Double Tray System, whether floating or not, gives, proven in the field, 12% minimum premature growth, better and healthier plants provided that appropriate and good agricultural practices are being applied.

Design and dimensions

The design of the top tray is similar to the expanded polystyrene or injection trays and is compatible with all sowing or transplanting automatic lines and greenhouse handling systems.

The cell design gives another advantage to the DTS trays. It has a groove on each side of the cell which forces the root system of the plant to be straight and prevents roots from curling.



Typical Cell Design

Available Top Tray DTS sizes with standard dimensions for the trays, cavity configuration, cell volume and typical packaging quantities are shown on the following tables:

USA SIZE

PRODUCT USA SIZE	TRAY DIMENSION (cm)	No of CELLS	CELL DIMENSION (mm)	CELL VOLUME (ml)	Plants/ sq. m.	PIECES PER PALLET*
DTS-045	67X33	45	63.2X58.8X61.2	180	203	1665
DTS-050	67X33	50	60X60X75	113	226	1665
DTS-072	67X33	72	45.5X45.5X72	72	325	1665
DTS-128	67X33	128	38x38x65	36	578	1665
DTS-128WR	67X33	128	38x38x68	42	578	1665
DTS-171	67X33	171	32x32x61,5	30	773	1665
DTS-210	67X33	210	27x28x56	22	949	1665
DTS-300	67X33	300	24x24x50,5	15	1356	1665
DTS-338	67X33	338	20x20x50	10,9	1535	1665
DTS-406	67X33	406	20x20x47	10	1836	1665

The surrounding rim of the top tray is (14 to 15 mm) high.

EURO SIZE

PRODUCT EURO SIZE	TRAY DIMENSION (cm)	No of CELLS	CELL DIMENSION (mm)	CELL VOLUME (ml)	Plants/ sq. m.	PIECES PER PALLET*
DTS-054	60x40	54	53x53x59	112	225	1650
DTS-077	60x40	77	48x48x67	64	320	1650
DTS-096	60x40	96	41x41x63	62,6	399	1760
DTS-150	60x40	150	32x32x60	32	624	2400
DTS-228	60x40	228	24x24x55	18	948	1760
DTS-240	60x40	240	26x26x39	plug 22x27	998	1008
DTS-330	60x40	330	21x21x50	12	1373	1870

ITALIAN SIZE

PRODUCT ITALIAN SIZE	TRAY DIMENSION (cm)	No of CELLS	CELL DIMENSION (mm)	CELL VOLUME (ml)	Plants/ sq. m.	PIECES PER PALLET*
DTS-040	52x32	40	52x54x65	99	250	2140
DTS-045	55x33	45	50x50x75	91	250	2000

* Pallet size 100x120x230 cm.

Every tray configuration comes with its equivalent base tray.

Detailed Dimensions and Thicknesses of Top and Base Trays, analytically:

U.S. SIZE

Type of tray	Sheet Thickness microns	Length in mm	Width in mm	Thickness			Weight gr	Tolerance ES Norms
				Min' upper part mm	Min Cell walls mm	Min bottom mm		
Top tray 45 cells	700	670	330	0.68	0.035	0.030	175	5%
Base Tray 45 cells	750	670	330	0.62	0.037	0.032	180	5%
Top tray 50 cells	700	670	330	0.68	0.035	0.030	175	5%
Base Tray 50 cells	750	670	330	0.62	0.037	0.032	180	5%
Top tray 72 cells	700	670	330	0.68	0.035	0.030	175	5%
Base Tray 72 cells	750	670	330	0.62	0.037	0.032	180	5%
Top tray 128 cells	670	673	335	0.058	0.032	0.028	170	5%
Base Tray 128 cells	750	675	335	0.064	0.035	0.031	180	5%
Top tray 171 cells	700	670	330	0.060	0.033	0.029	170	5%
Base Tray 171 cells	800	670	330	0.067	0.037	0.032	200	5%
Top tray 210 cells	730	669	330	0.062	0.034	0.030	175	5%
Base Tray 210 cells	800	671	332	0.067	0.037	0.032	200	5%
Top tray 300 cells	750	669	331	0.064	0.035	0.031	180	5%
Base Tray 300 cells	800	670	332	0.067	0.037	0.032	200	5%
Top tray 338 cells	750	669	331	0.064	0.035	0.031	180	5%
Base Tray 338 cells	800	670	332	0.067	0.037	0.032	200	5%
Top tray 406 cells	750	670	331	0.062	0.034	0.031	180	5%
Base Tray 406 cells	800	670	331	0.067	0.038	0.032	200	5%

EURO SIZE

Type of tray	Sheet Thickness microns	Length in mm	Width in mm	Thickness			Weight gr	Tolerance ES Norms
				Min' upper part mm	Min Cell walls mm	Min bottom mm		
Top tray 54 cells	700	600	400	0.68	0.035	0.030	190	5%
Base Tray 54 cells	750	600	400	0.62	0.037	0.032	195	5%
Top tray 77 cells	700	600	400	0.68	0.035	0.030	190	5%
Base Tray 77 cells	750	600	400	0.62	0.037	0.032	195	5%
Top tray 96 cells	700	600	400	0.68	0.035	0.030	190	5%
Base Tray 96 cells	750	600	400	0.62	0.037	0.032	195	5%
Top tray 150 cells	670	600	400	0.058	0.032	0.028	184	5%
Base Tray 150 cells	750	600	400	0.064	0.035	0.031	195	5%
Top tray 228 cells	730	600	400	0.062	0.034	0.030	190	5%
Base Tray 228 cells	800	600	400	0.067	0.037	0.032	217	5%
Top tray 240 cells	750	600	400	0.064	0.035	0.031	195	5%
Base Tray 240 cells	800	600	400	0.067	0.037	0.032	217	5%
Top tray 330 cells	750	600	400	0.064	0.035	0.031	195	5%
Base Tray 330 cells	800	600	400	0.067	0.037	0.032	217	5%

ITALIAN SIZE

Type of tray	Sheet Thickness microns	Length in mm	Width in mm	Thickness			Weight gr	Tolerance ES Norms
				Min' upper part mm	Min Cell walls mm	Min bottom mm		
Top tray 40 cells	700	520	320	0.68	0.035	0.030	115	5%
Base Tray 40 cells	750	540	320	0.62	0.037	0.032	120	5%
Top tray 45 cells	700	550	330	0.68	0.035	0.030	140	5%
Base Tray 45 cells	750	550	330	0.62	0.037	0.032	145	5%

Raw material

Both trays of the DTS, top and bottom, are made from High Impact Polystyrene sheet.

Production Process & Quality Milestones

1. **Sheet production**

Thickness verification with tolerance +/- 1%

Pendulum Impact test per 500 kg roll to verify IZOD > 7

2. **Thermoforming Process**

PS sheet is being heated up to 180 degrees Celsius uniformly.
Next steps are forming, drain holes opening and peripheral cutting.
Final step is the automatic stacking of the trays by the machine on batches of **10** pieces.
Every batch is visually checked for deficiencies and it is placed on the transportation pallet.

The **mechanical strength** of the DTS is tested and verified using the first batch of trays produced from each new roll fed in the machine.

The **test** is carried out by placing the DTS on rails (30mm either side) and putting a flexible blanket weight of 20 kg evenly on the surface, simulating the real application conditions.

Packaging for transportation

The trays are placed on pallets (1,00 m x 1,20 min four columns at the height of 2,3 meters).

Every pallet carries only top or bottom trays.

The exact number of trays per pallet for every tray is noted on the table with the available DTS trays.

Pallets are wrapped up with white color stretch film for the stabilization of the trays on the pallet for transportation. Each pallet is covered with a cardboard top hat and PP straps are folding the pallet from top to bottom (including the pallet) from both sides.

Every pallet is marked with the type of tray, the quantity and the production date.

Upon request, the trays can be packed in carton boxes on pallets. In this case each box contains approximately 70 pcs and each pallet holds 21 boxes.

Quality Standards and Tolerances

1. **Dimensions**
   Dimensions are shown in the drawings of the molds in Appendix 1. They can vary due to shrinkage to up to 1%.
2. **Raw material**
   The sheet is produced from HIPS (High Impact Polystyrene) with impact strength > 7. Thickness varies between 0,70 mm thick to 0,8 mm.
   The material is a mixture of recycled PS + additives. Process is done in such a way that specifications of the final products are ensured.
   In the case of the floating application the raw material is a special grade HIPS with high melt flow index to secure 100% porous free material.
3. **Thickness of the material on the DTS**
   During the thermoforming process as products are being formed from sheet into their final shape, an amount of thickness is lost. Thus the thickness of the material at the bottom of the cells will be significantly less from the original thickness of the sheet.
   The thickness of polystyrene sheet for the top trays is between 700 to 750 microns and for the bottom trays between 750 to 800 microns.
   The thickness of the side and the bottom of the cells and the side skirt of the top tray (all the “formed” in depth parts of the tray) can be medium 300 microns ± 5%, with a minimum of 120 microns in particular deep corners depending on the design of the mold.
4. **Weight of the tray**
   The actual weight of the tray is not of high importance when it comes to its application; more important is the actual minimum thickness of material on every part of the tray as mentioned before (Material Thickness).
   The medium weight of the trays, top or bottom, can be between 170 to 200 gr according to application.
5. **Drain Holes**
   Drain holes in the trays are offering drainage to the plants. The diameter of the drain holes of the trays, top and bottom, can be found between 6mm and 16mm. It is possible that drain hole of the top tray differs from that of the bottom tray. The alignment of the drain holes of the top and the bottom tray is not always absolute but it will always leave a minimum “operational” diameter of 90%. Visual check of the drain holes alignment is performed on every batch of 10 pieces of base tray production.
6. **Surface finish**
   The surface of the trays is glossy; free from perceptible projections, lumps, or indentations and adequately smooth passing the test of “cotton glove”.

Instructions for handling

Our trays are robust enough for the application they were designed and engineered for.

Removing the trays from the pallet must be done in batches. Each stack must be held from two opposite sides and lifted up simultaneously preferably holding the trays from underneath.

The trays, top or bottom, on their own are flexible and must not be placed on uneven surfaces and put any weight on them because they can suffer damages.

When the two trays, top and bottom, are combined together become robust and strong enough to overcome all the usual loads and stress found in the green house or the field.