

# Transportable hermetic storage and vacuum equipment for disinfestation of durable commodities



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# Aims of the developed technologies and consumer demands

- **Environmentally friendly**
- **Efficient**
- **Affordable price**
- **Simple to handle**
- **Free from toxic chemicals**

# Core concept of the technology

The presented technologies are based on flexible PVC liners that **enclose and seal** the treated commodity providing an atmospherically **controllable treatment chamber**.

The **manipulation** of the **modified atmosphere** treatment is determined by the specific requirements of the **commodities** and the **manufacturing processes**.

# The range of environmentally friendly technologies that can be implemented as alternatives to methyl bromide

## ✿ Modified atmospheres:

➤ Low pressures

➤ Enriched CO<sub>2</sub> atmosphere

➤ Enriched N<sub>2</sub> atmosphere

➤ Hermetic storage (bio-generated atmospheres)

## ✿ Heat

## ✿ Environmentally friendly fumigants

## ✿ Integration of treatments

# Two technologies already adopted by the industry

## ② **Low pressure technology (Vacuum)**

- ✓ Quarantine treatments for commodities that are packaged in bags.
- ✓ Insect control treatments upon demand.
- ✓ Quality assurance during storage.

## ② **Hermetic technology (bio-generated atmospheres)**

- ✓ Quarantine treatments for commodities with high respiration rates such as: geophytes, onions, potatoes.
- ✓ Insect control treatments of stored commodities such as grain.

# Low pressure (Vacuum) technology

❖ In order to simplify this technology for the end-user in Israel the following treatment protocol was chosen:

➤ **Commodity conditions:**

- ✓ Commodity **temperature at about 30°C**
- ✓ Commodity **relative humidity at about 55%**

➤ **Treatment conditions**

- ✓ **Pressure** of the treatment at about **50 mm Hg**
- ✓ Exposure **time depending on the insect species**

# A complete vacuum set-up





# V-HF (vacuum hermetic fumigation) treatment chamber



**Front opening**

**Zipper**

**Pump**

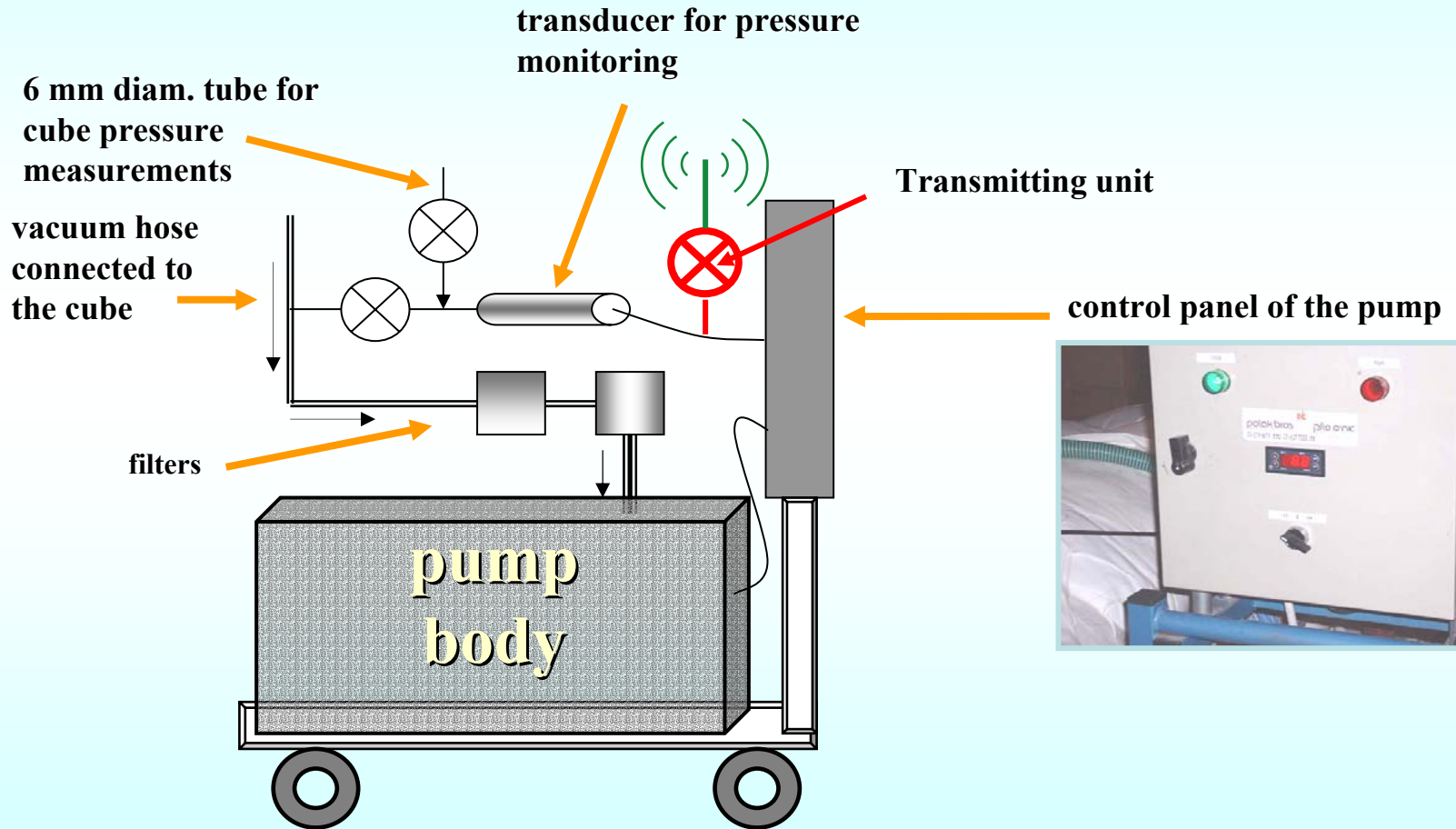
**Loading on pallets**

**Actual pressure measured directly in the chamber**





# The pump and the control panel of the vacuum system



# The effect of 50 mm Hg on egg mortality at 55% r. h. and 30°C

Test insects	LT <sub>99</sub> values (hours to obtain 99% mortality)
<i>Trogoderma granarium</i>	46 h
<i>Lasioderma serricorne</i>	<b>91 h</b>
<i>Oryzaephilus surinamensis</i>	32 h
<i>Tribolium castaneum</i>	<b>22 h</b>
<i>Ephestia cautella</i>	45 h
<i>Plodia interpunctella</i>	49 h

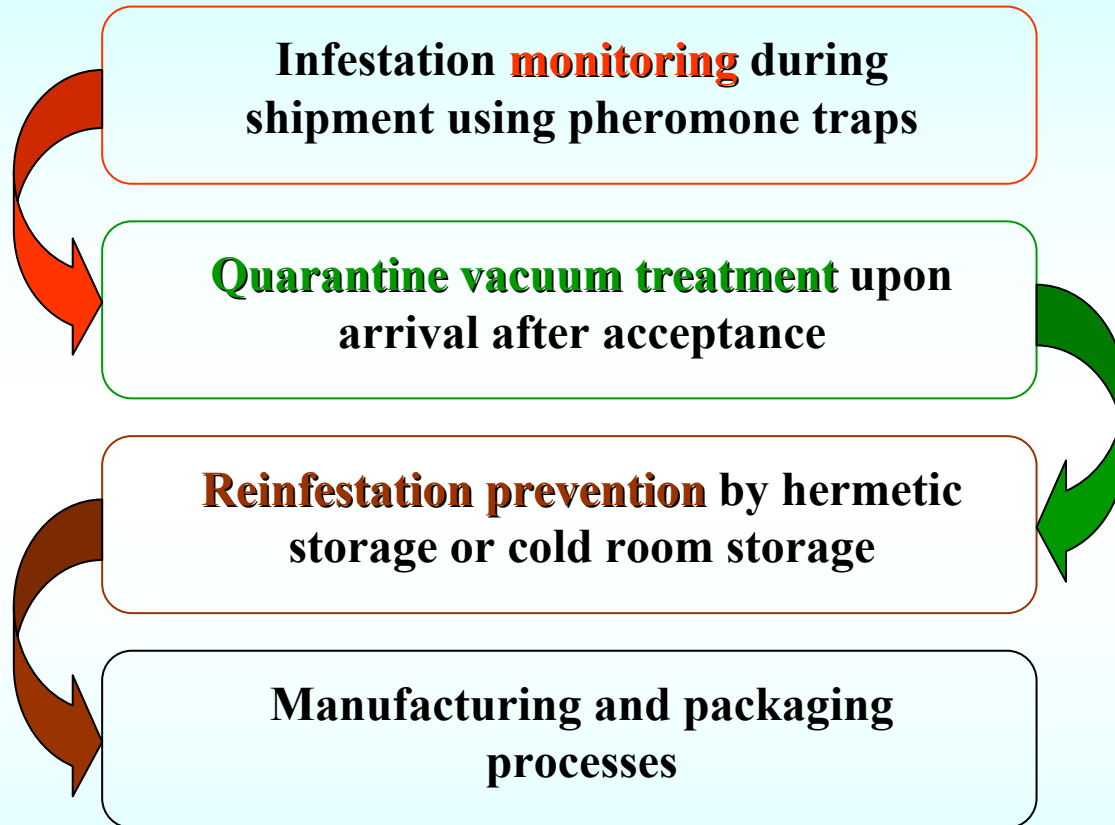
# Semi-commercial field tests that produced 100% mortality of insects

Treated Commodity	Infestation found in the treated commodity	Test insects used in the trials
Oat	<i>T. castaneum</i> , <i>O. surinamensis</i>	<i>E. cautella</i>
Corn chips	<i>E. cautella</i>	<i>T. castaneum</i> , <i>E. cautella</i> , <i>O. surinamensis</i> ,
Cocoa beans		<i>E. cautella</i> , <i>O. surinamensis</i> ,, <i>T. castaneum</i> , <i>P. interpunctella</i>
Wheat	<i>S. oryzae</i> , <i>O. surinamensis</i> <i>T. castaneum</i>	<i>O. surinamensis</i>
Wheat flour	<i>R. dominica</i> <i>O. surinamensis</i> <i>T. castaneum</i>	<i>T. castaneum</i> , <i>O. surinamensis</i> , <i>E. cautella</i>
Semolina		<i>T. castaneum</i> , <i>O. surinamensis</i> , <i>E. cautella</i>

# Semi-commercial field tests that produced 100% mortality of insects (continued)

Treated Commodity	Infestation found in the treated commodity	Test insects used in the trials
Almonds		<i>O. surinamensis</i> , <i>L. serricorne</i> , <i>E. cautella</i>
Garden peas		<i>C. chinensis</i> , <i>S. oryzae</i> , <i>T. castaneum</i>
Chick peas	<i>S. oryzae</i> , <i>C. chinensis</i> , <i>T. castaneum</i> , <i>R. dominica</i>	<i>C. chinensis</i> , <i>S. oryzae</i> , <i>T. castaneum</i>
Sun flower sees		<i>T. castaneum</i> , <i>L. serricorne</i> , <i>E. cautella</i>
Semolina		<i>T. castaneum</i> , <i>O. surinamensis</i> , <i>E. cautella</i>
Rice	<i>T. castaneum</i> , <i>S. oryzae</i> , <i>O. surinamensis</i>	<i>O. surinamensis</i> <i>E. cautella</i> , <i>S. oryzae</i>

# Quality assurance of soybeans imported from Canada adopted by Israeli manufacturer



**Cost analysis:** **Installation** costs (20 tons cube + pump + ancillary) = € 6580  
**Optional handling & operational** costs (per 20 tons treatment) = € 18  
Treatment cost based on **10 year** amortization = € 1.2

# Hermetic technology (bio-generated atmospheres)

© This technology was developed to enable bulb growers to replace methyl bromide quarantine fumigation with a non chemical treatment:

➤ **Commodity conditions:**

✓ Commodity **temperature is 30°C**

➤ **Treatment conditions**

✓ Reduction of oxygen concentration to below 1%

✓ Exposure **time of 72 hours (specifically against the large narcissus fly)**

# A fan circulating hot air within the chamber to obtain 30°C





# bio-generated atmospheres

## Reducing O<sub>2</sub> concentration by bulbs respiration



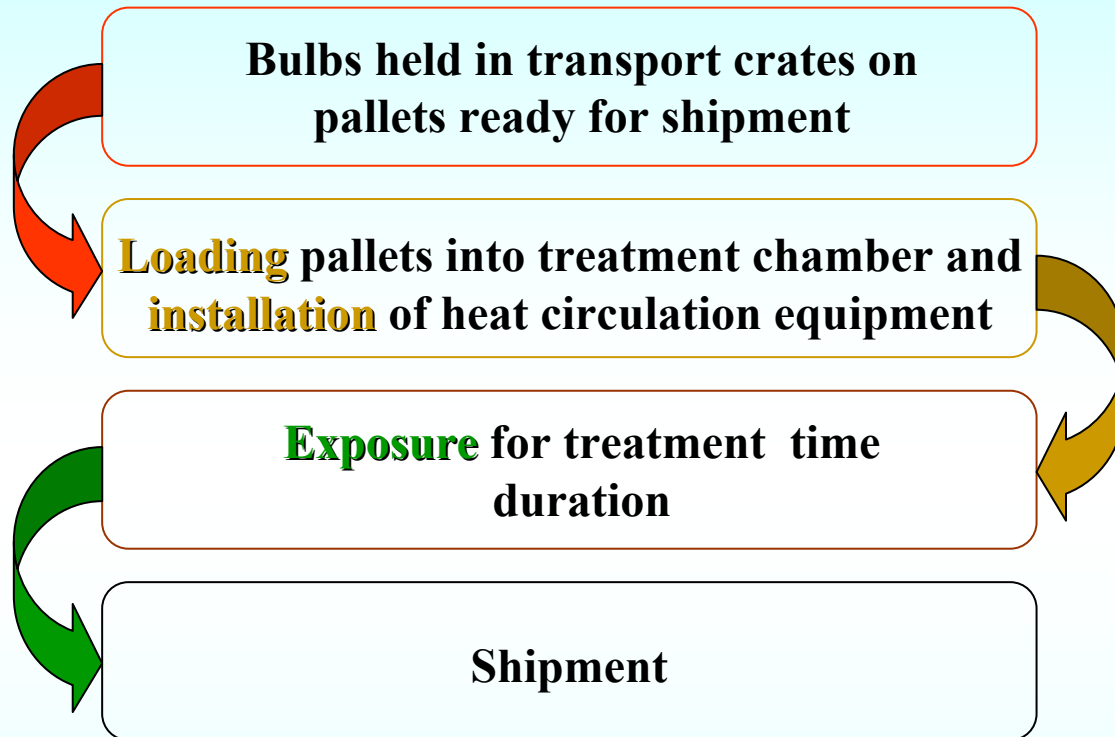
Adhering the liner to the crates by removing excess air with vacuum cleaner



When oxygen level drops to below 1% hermetic seal is held for additional 3 days



# Quarantine treatment of narcissus bulbs as alternative to methyl bromide for Israeli growers



**Cost analysis:** **MB -** Total annual costs for MB fumigation were: **€ 6240**  
(1070 tons at € 5.8/ton)  
**Hermetic -** Price of each cocoon is about **€ 2200 (6 units € 13200)**  
**Handling & operation is carried out by growers**

**Growers recuperate expenses in about two seasons of use with no future expense**

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# Information on the application of these technologies can be found at:

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or

Eitan Amichai, Nationwide Exterminators Ltd.,  
Israel

[www.pest.co.il](http://www.pest.co.il)

# Units used to express atmospheric pressure and their equivalent partial pressure of oxygen expressed in mm Hg and in percentage

mm Hg (torr)	atmosphere	kg/cm <sup>2</sup>	inches Hg	kPa	mbar	mm Hg Oxygen	% Oxygen
<b>760</b>	1.00	1.03	29.92	101,325	1,013	159	<b>20.9</b>
<b>600</b>	0.79	0.82	23.62	79,993	800	125	<b>16.5</b>
<b>500</b>	0.66	0.68	19.68	66,661	667	105	<b>13.8</b>
<b>400</b>	0.53	0.54	15.75	53,329	533	84	<b>11.0</b>
<b>300</b>	0.39	0.41	11.81	39,997	400	63	<b>8.3</b>
<b>200</b>	0.26	0.27	7.87	26,664	267	42	<b>5.5</b>
<b>100</b>	0.13	0.14	3.94	13,332	133	21	<b>2.8</b>
<b>50</b>	<b>0.07</b>	<b>0.07</b>	<b>1.97</b>	<b>6,666</b>	<b>67</b>	<b>11</b>	<b>1.4</b>
<b>0</b>	0.00	0.00	0.0	0	0	0	<b>0.0</b>