GRAINPRO® TRANSAFELINER™

INSTRUCTION MANUAL

(Folding Method)

MA4078RAD1219-01

GRAINPRO
STORING THE FUTURE

"A GREEN, NOT ONLY FOR PROFIT COMPANY"

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1. PREPARATION

1.1. PREPARATION

1.1.1. Check the moisture content of the commodity using GrainPro Moisture Meter (MM5) (available for sale from GrainPro, Inc.) to ensure the MC is at a safe level for storage.

Recommended Moisture Content:
Coffee – 11.5-12%
Cocoa – 6-7%
Rice – 13-14%

1.1.2. Workers should not wear shoes with spikes that might cause damage to the TSL.

1.1.3. Ensure that container floor is free of any sharp objects that may damage the liner.

1.1.4. Place a mat or thick cardboard on the floor as additional protection for the TSL.

1.1.5. Carefully unfold the TSL and lay it facing upward.

1.1.6. Pull the top portion to unfold.

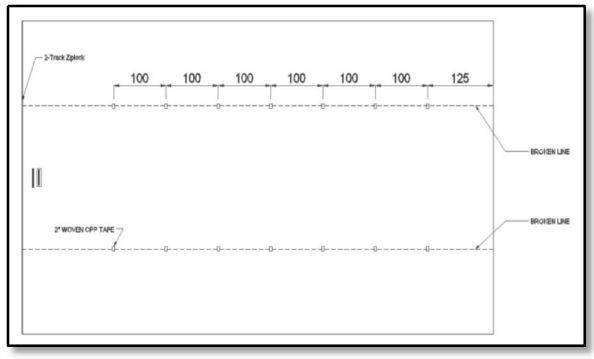
2. INSTALLATION USING FOLDING METHOD

A folding method refers a series of alternating folds to create multiple panels/sections of a similar size. The parallel pleats formed by the alternating folds resemble the expandable mid-section of an accordion musical instrument.

2.1. ATTACHMENT OF ROPE BRACES (TAPE)

2.1.1. On the laid TSL find the broken line markings from the back end of the TSL measure 125cm along the broken line and attach the supplied Woven OPP Tapes.

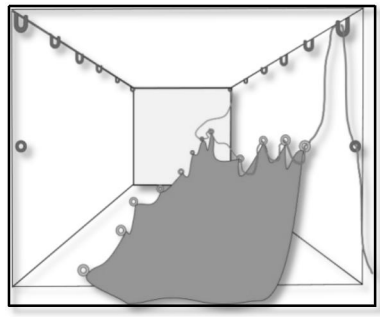
2.1.2. Stick another set of Woven OPP Tape along the broken line with a 100cm distance in between them. In total there will be 14 pieces of rope braces (Woven OPP Tape) for TSL-20 and 26 pieces for TSL-40. See picture on the right for rope brace location guide.



2.2. INSTALLATION PROCESS

2.2.1. Secure one end of the nylon rope (flexible nylon cord) into the hook located on the side wall and into the first hook on the ceiling of one side of the container van.

2.2.2. Insert the nylon rope through all the woven OPP tapes attached on one side the TSL then into the hook found on the back end of the container.



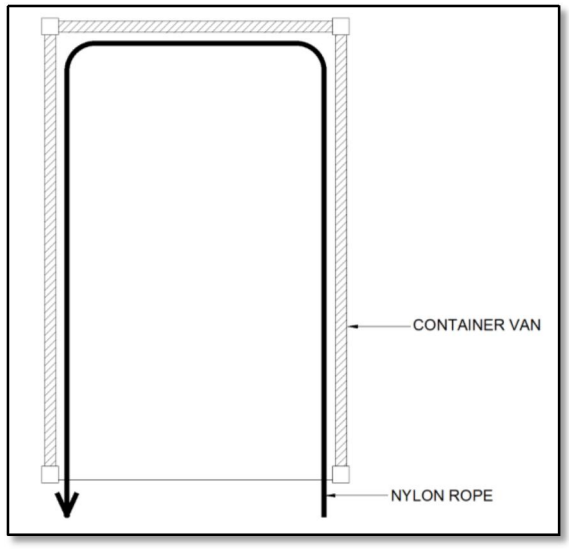
2.2.3. FOR TSL - 20

2.2.3.1. Hanging of liner should be done by completing one side (left or right) of the container first, starting from the door towards the back and then going around the perimeter of the container.

2.2.3.2. Follow procedure in 2.2.2. and when one side is finised insert the the loose end of the nylon rope to the hook on the other side (back end hook) and follow procedure 2.2.2. This time from the back towards the front.

2.2.3.3. Pull the loose end of the nylon rope to create tension and make sure that there are no sagging sections on the hanged TSL.

2.2.3.4. Secure the loose end of the nylon rope on the hook found on the mid section of the container door.



2.2.4. FOR TSL - 40

2.2.4.1. Hanging the liner should be done by completing one side (left or right) of the container first, starting from the door towards the back of the container. Two nylon ropes are required to be used for the TSL - 40, one for each side of the container.

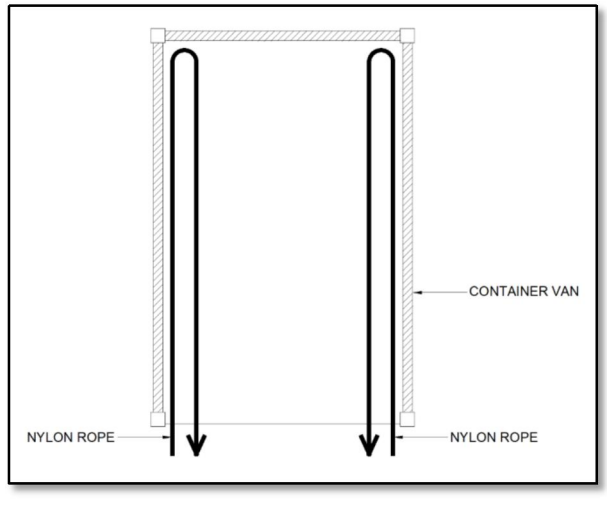
2.2.4.2. Follow procedure in 2.2.2. until the nylon rope is inserted through the rope braces and hooks (front and back end only) on one side of the container.

2.2.4.3. When one side of the container is complete, pull the lose end of the nylon rope towards the door of the container and insert it through the first hook found near the door.

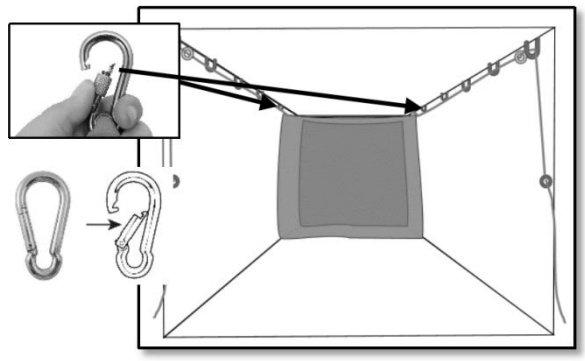
2.2.4.4. Pull the loose end of the nylon rope to create tension and make sure that there are no sagging sections on the hanged TSL.

2.2.4.5. Then secure the loose end of the nylon rope on the hook found on the mid- section of the container door.

2.2.4.6. Complete procedures 2.2.4.1 to 2.2.4.5 onto the other side of the container.



2.2.5. Carefully slide the liner towards the back of the container. Leave enough space for initial loading.



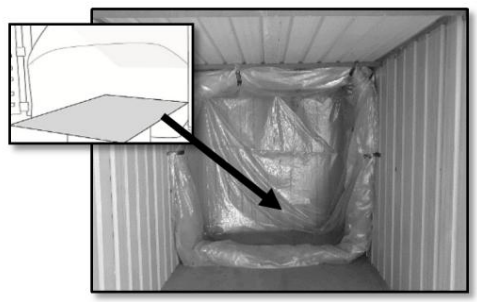
2.2.6. Add 2 pieces of carabiners (not included in the package) for added support. Insert the carabiners into the nylon rope and fasten into the container hooks nearest the folded section of the liner. The carabiners are used for folding method to avoid sagging of the liner during installation.

2.2.7. Fold the excess TSL material neatly and secure it around the peremeter of the container walls with tape.

2.2.8. Place cardboards on the TSL floor and along the walls for added protection;

2.2.8.1. **For Forklift loading** - place rubber mats on the TSL floor for added protection.

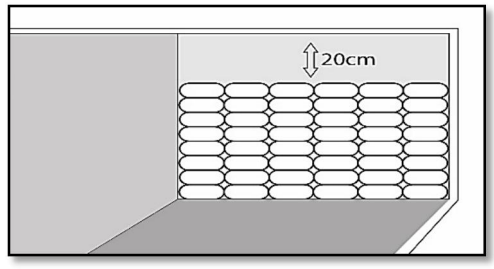
2.2.8.2. **For Manual Loading** - workers should not wear shoes with spikes that might cause damage to the liner.



2.2.9. After loading the first section of the TSL, remove the carabiners and tapes then unfold the liner. Pull it a few meters towards the front so the next section of the TSL could be loaded. Then follow procedures 2.2.6. to 2.2.8.

2.2.10. Complete procedure 2.2.9. until the TSL is fully loaded.

2.2.11. Make sure to leave at least 20cm distance between the roof of the container and top of the stacks to prevent condensation.



3. SEALING

3.1. USE OF DESICCANTS/DRY BAGS (REQUIRED)

Desiccants are commonly used to protect goods against moisture damage. Hygroscopic commodities, such as cocoa, coffee, and various nuts and grains are particularly susceptible to mold and rot when exposed to condensation and humidity.

3.1.1. Requirement:

a. One-thousand two-hundred (1200) grams or 6 bags of GrainPro Dry Bags per 20-footer.
b. Two-thousand four-hundred (2400) grams or 12 bags of GrainPro Dry Bags per 40-footer.

Note: 1 GrainPro Dry Bag contains 200 grams of calcium chloride and can absorb grams of moisture.

3.1.2. Place the GrainPro Dry Bags in perforated bags or sacks to prevent direct contact with commodity.

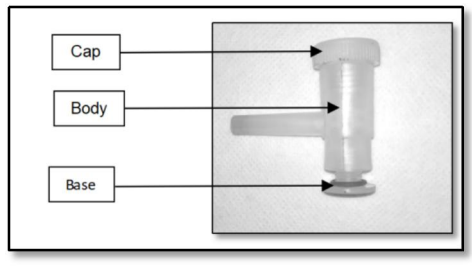
3.1.3. Cardboards may be placed on top of the stack. Cardboards provide increased water absorption. Then put the desiccants on top of the cardboards.

3.2. PLASTIC VALVE INSTALLATION FOR PRESSURE DECAY TEST (PDT), OR CO_2 OR O_2 READING

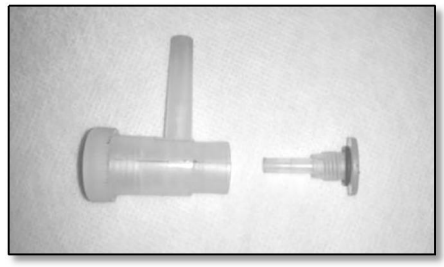
Install plastic valve before sealing or zipping the liner. Conduct PDT after sealing. CO_2 or O_2 reading (optional) is taken upon arrival of the container to verify the integrity of the TSL's hermeticity. After use, close the plastic valve.

3.2.1. Plastic valve components:

A. Cap – To open and close the valve
B. Body – Where tube or hose is inserted for PDT and CO_2 or O_2 reading
C. Base – Use for piercing the liner

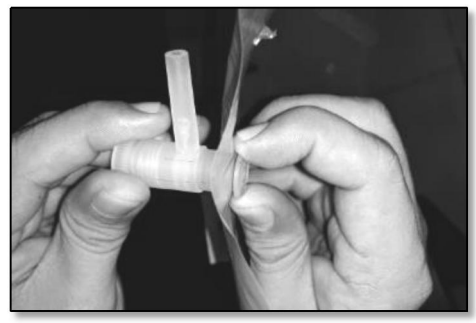


3.2.2. Dismantle the plastic valve by unscrewing the base.



3.2.3. Pierce the TSL using the plastic valve. Piercing should be done from the inner side of the TSL (approximately 20 cm from the zipper).

3.2.4. Screw the plastic valve body. The cap of the plastic valve should be positioned outside the loaded TSL. Firmly tightened the body into the base to prevent leakage.

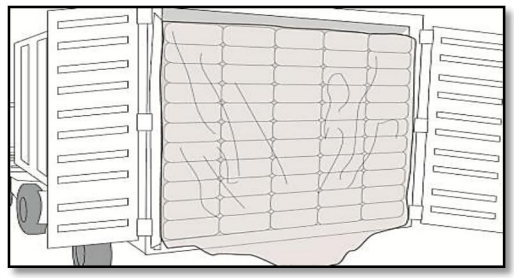


3.3. SEALING OF 2-TRACK PE ZIPPER

3.3.1. Remove the tapes and unfold the excess liner from the door perimeter and let it loose.

3.3.2. Untie the nylon rope from the rod on the side wall of container van.

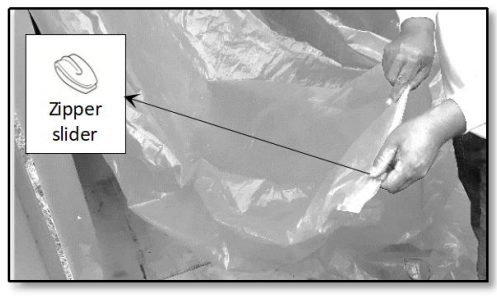
3.3.3. Pull the rope all the way out of the container to provide space between roof and liner for air circulation.



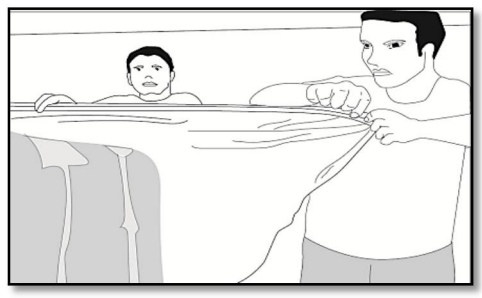
3.3.4. Hold the 2-track zippers together. Aligned for proper sealing.

3.3.5. Manually zip a few centimeters enough to initially engage the slider.

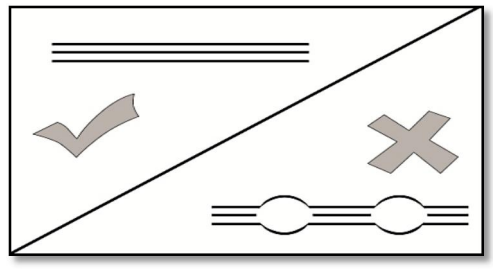
3.3.6. Position the slider on the manually zipped portion of the zip lock.



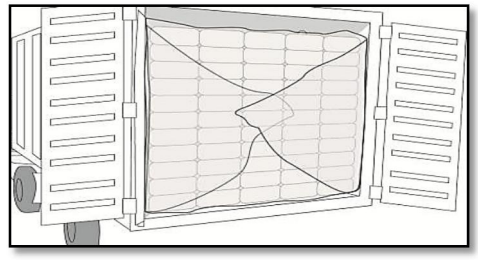
3.3.7. For ease of zipping two persons are required. One person does the zipping and the other person holds the other end steadily, making sure both sections of the zipper are in a straight line to avoid the zipper length being misaligned. Moving the slider while the zipper or slider is curved forces one of the zipper sections to elongate.



3.3.8. If uneven zipper ends are observed, both ends of the zipper should be slightly stretched and do the zipping from end to end.

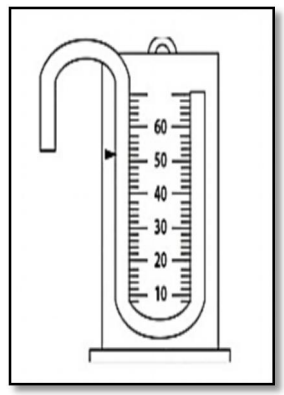


3.3.9. Fold extra liner and tape it against the stack. Ensure that no liner is stuck in-between doors.

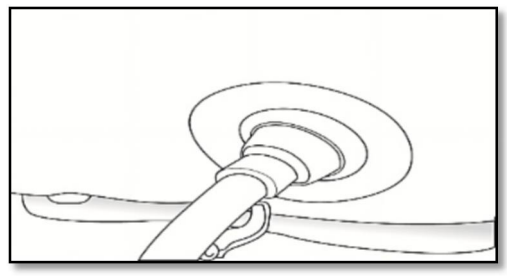


3.4. PRESSURE (VACUUM) DECAY TEST

3.4.1. After zipping, perform a pressure (vacuum) decay test (PDT) to ensure gas-tightness. With this test a manometer, vacuum pump and stopwatch shall be needed. A digital manometer of a commercially available or improvised U-tube manometer can be used to monitor the pressure.

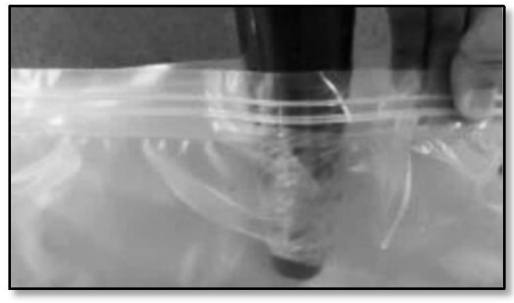


3.4.2. Connect the manometer hose to the flexible plastic valve previously installed in the TSL.



3.4.3. Twist the plastic valve cap to open.

3.4.4. Using a vacuum pump with at least 2.3 cubic meters of suction capacity per minute. Create at least -250 Pascals (Pa) or -25 millimeters' water (mm H_2O) vacuum inside the TSL by partially opening a portion of the zipper and insert the vacuum pump suction port.



3.4.5. For TSL to be considered sufficiently airtight, the initial vacuum should not be decreased by more than one-half (½) of the final vacuum (created by the vacuum pump) within five (5) minutes.

3.4.6. If the PDT test failed, check for holes/tears and poorly sealed zippers then repeat the PDT procedures.

3.4.7. After conducting PDT, twist the plastic valve to close.

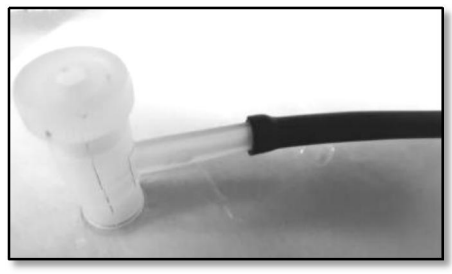
3.5. INSTALLING THE FLEXIBLE ADAPTER HOSE FOR CO_2 OR O_2 READING

To ensure gas-tightness, instead of PDT as an alternative the container with TSL can checked using the CO_2 analyzer or O_2 analyzer.

3.5.1. The flexible adapter hose is included in the GrainPro Carbon Dioxide Analyzer or the user can find equivalent flexible hose from local hardware using the specifications as shown:

Inside Diameter	4 mm (0.16 in.)
Length	>5 cm (2 in.)

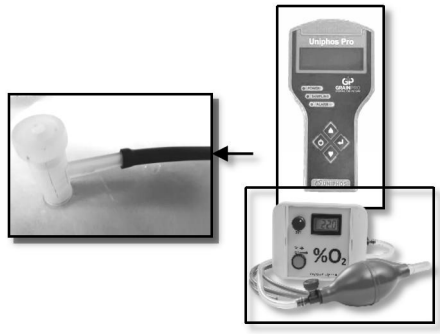
3.5.2. When taking the carbon dioxide or oxygen reading, install the flexible adapter hose into the plastic valve.



3.5.3. Twist the plastic valve cap to open.

3.5.4. Connect the O_2 or CO_2 analyzer to the flexible adapter hose and the reading.

Acceptable Values:
For O_2 analyzer, 3% or below after 15 to 30 days.
For CO_2 analyzer, 10 to 15% after 15 to 30 days.



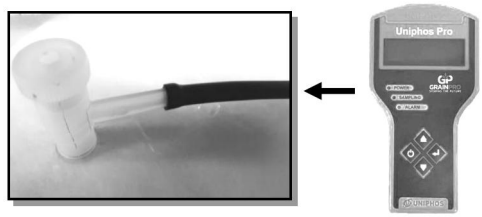
3.5.5. Twist the plastic valve cap to close after taking the readings.

3.6. USING CARBON DIOXIDE ANALYZER FOR MONITORING (WITHOUT CO_2 FLUSHING) - OPTIONAL

The GrainPro CO_2 analyzer uses a non-dispersive infrared radiation (NDIR) sensor for the detection of carbon dioxide. When a sensor encounters a target gas, voltage signal is generated in proportion to the gas concentration. This voltage signal is amplified, digitized and displayed on the instrument's OLED display.

3.6.1. When taking the carbon dioxide or oxygen reading, install the flexible adapter hose into the plastic valve.

3.6.2. Using the analyzer, carbon dioxide level can be checked through the plastic valve with flexible adapter hose before unloading. Increased carbon dioxide level indicates absence of any source of leaks from punctures, holes or damages. CO_2 level of ambient air is 0.04%.



3.6.3. Monitoring of carbon dioxide level is recommended to ensure control of insect infestation. Details of using CO_2 analyzer are discussed in the analyzer's instruction manual.

4. CARBON DIOXIDE PURGING

4.1. CARBON DIOXIDE (CO_2) SAFETY

4.1.1. Carbon dioxide does not support life. It can act as a simple asphyxiant by diluting the concentration of oxygen in air below the levels necessary to support life. As it is heavier than air it will tend to concentrate at lower levels.

4.1.2. Avoid breathing gas. Do not get in eyes, on skin, or on clothing. Wear leather safety gloves and safety shoes when handling cylinders.

4.1.3. Protect cylinders from physical damage. Do not drag, roll, slide or drop. While moving cylinder, always keep the removable valve cover in place. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders.

4.1.4. Never insert an object (e.g., wrench, screwdriver, and pry bar) into cap openings; doing so may damage the valve and cause a leak. Use an adjustable strap wrench to remove over-tight or rusted caps. Slowly open the valve. If the valve is hard to open, discontinue use and contact your supplier.

4.1.5. Close the cylinder valve after each use; keep closed even when empty.

4.1.6. Never apply flame or localized heat directly to any part of the cylinder. High temperatures may damage the cylinder and could cause the pressure relief device to fail.

4.2. CALCULATION OF CARBON DIOXIDE REQUIREMENT

4.2.1. Carbon dioxide requirement formula:

a. Total Volume – Volume Occupied by the Commodity.
b. For every 2.0 kg CO_2, 1 cubic meter of air is replaced.
c. Formula: (1 minus bulk density) x Volume (in m^3) x 2

Recommendations:

- If commodity temperature is at 15 deg Celsius or below, there is no need for TSL.
- If commodity temperature is 15-20 deg Celsius, use TSL without carbon dioxide flushing but fumigation should be conducted upon arrival.
- If commodity temperature is above 20 deg Celsius, use TSL with carbon dioxide flushing.

CARBON DIOXIDE REQUIREMENT BASED ON COMMODITY

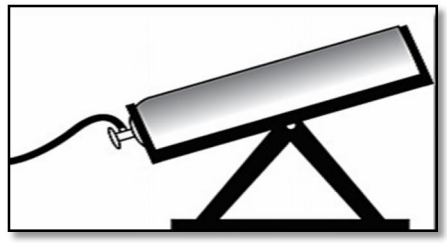
COMMODITY	BULK DENSITY	AMOUNT OF CARBON DIOXIDE (CO_2) FOR PURGING, kg		
		TSL 20	TSL 40	TSL 40 High Cube
	MT/m^3	33	66	76
Barley	0.62	25.1	50.2	57.9
Cashew nuts	0.50	33.0	66.0	76.2
Chia seeds	0.68	21.1	42.2	48.8
Chickpeas	0.74	17.2	34.3	39.6
Cocoa beans	0.56	29.0	58.1	67.1
Coffee beans	0.59	27.1	54.1	62.5
Cotton seed	0.40	39.6	79.2	91.4
Cowpea	0.75	16.5	33.0	38.1
Maize	0.72	18.5	37.0	42.7
Millet	0.63	24.4	48.8	56.4
Mung bean	0.75	16.5	33.0	38.1
Oats	0.43	37.6	75.2	86.9
Paddy	0.60	26.4	52.8	61.0

Paddy, rice bran	0.55	29.7	59.4	68.6
Peanuts, shelled	0.64	23.8	47.5	54.9
Rice, milled	0.80	13.2	26.4	30.5
Rye	0.72	18.5	37.0	42.7
Sesame	0.59	27.1	54.1	62.5
Sorghum	0.72	18.5	37.0	42.7
Soybean	0.75	16.5	33.0	38.1
Sunflower	0.41	38.9	77.9	89.9
Wheat	0.77	15.2	30.4	35.1

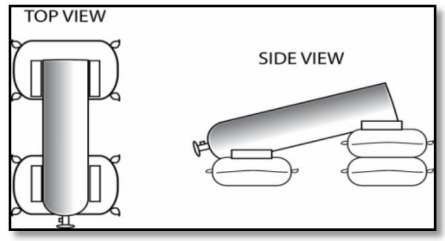
4.3. PROCEDURE FOR PURGING WITH CARBON DIOXIDE (CO_2)

4.3.1. Make sure that enough CO_2 is available on site. The weight of the CO_2 in the cylinder is supplied by the industrial companies (i.e. 22kg standard capacities which may be used to calculate the number of cylinders required). CO_2 cylinders are available with or without siphon (dip tube). For rapid flushing, the cylinder without siphon should be inverted.

4.3.2. For rapid flushing, the cylinder should be inverted using mechanical inverter. However, the cylinders with siphon should be in upright position during flushing.



4.3.3. If a mechanical inverter is not available, a makeshift inverter can be made using sandbags or other improvised technique. The cylinder should be inverted with its top resting on one sandbag and the bottom end resting on pile of two or three sandbags high.



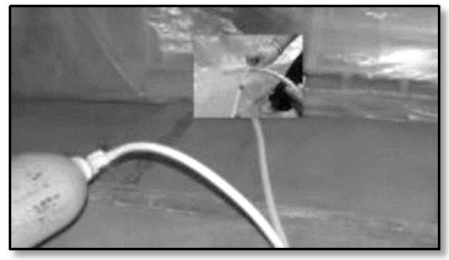
4.3.4. A standard high-pressure hose (available only as separate item) should be connected to the cylinder. This hose should be guaranteed to withstand a pressure of 88 atmospheres (1,300 psi, or 92 kg/cm^2). Ensure that all connections are made properly, and gaskets are in place where they are required. The high-pressure hose should have a length of about 2-meter and have matching coupler at cylinder.

4.3.5. Open a section of the zipper and insert the pressure kit. This serves as outlet to discharge O_2 when flushing.

4.3.6. Open the cylinder valve. Adjust opening of the valve until sound of liquid passing through the hose is heard. The liquid CO_2 flushes into the TSL and evaporates inside, it pushes the air upward, acting as a piston, until the air is totally replaced. The opening through the zipper serve as an outlet for the displaced air.

4.3.7. Ice formation along the pressurized hose and the pipe connector during CO_2 flushing:

4.3.7.1. During this procedure, some ice may form around the gas inlet and high-pressure hose.



4.3.7.2. Flushing (emptying of the cylinder) depends on the amount of CO_2 to be applied. Emptying one 22kg cylinder should only take about 20 to 30 minutes. If the pressure hose or the inlet valve gets blocked with ice, this is an indication that the CO_2 is being released too quickly. If this happens the cylinder should be closed until the ice melts, and then the cylinder valve should be re-opened and adjusted to reduce the flow.

4.3.7.3. An additional indication that the gas is being released too quickly is when the liner begins to balloon out because pressure begins to build-up inside. If this happens, the gas flow should be decreased at the cylinder valve until the rate of air being expelled through the outlet port is about the same as the rate of CO_2 entering the liner.

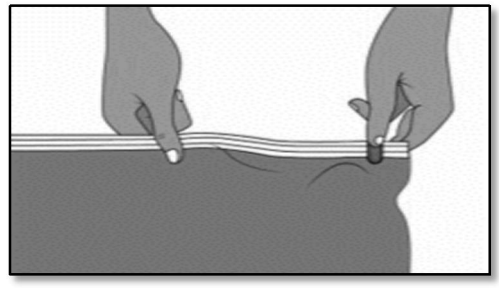
4.3.7.4. If necessary, for small scale applications and the cylinder is not inverted, weighing scales may be used to control the weight of the gas delivered. In this case the gas is released slowly through a pressure gauge which can be adjusted to control the flowrate.

4.3.8. Since CO_2 is heavier than air, the air in the TSL displaces upwards and is lifted out of the container through the outlet port. Complete displacement is not possible as there is always some mixing at the interface between the air and the CO_2. However, if the final CO_2 concentration reaches 80% then the O_2 concentration in the remaining air amounts to 4%. This mixing of the CO_2 with the remaining air, and absorption of CO_2 by the commodity, takes 12-24 hours depending on temperature. This is the time to determine the initial concentration of CO_2.

4.3.9. After the required weight of CO_2 has been flushed, immediately:

4.3.9.1. Close the CO_2 cylinder valve.

4.3.9.2. Close the zipper thoroughly using the slider.



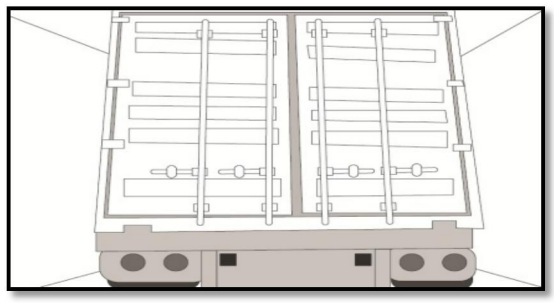
4.3.10. For controlling stored-product insects, maintaining CO_2 above 50% for 10 days, or CO_2 above 35% for 15 days is sufficient to provide complete control, after which the liner may be opened. In addition, temperature accelerates treatment. Effective insect control may be achieved in as little as three days at 25° and less at higher temperatures.

4.3.11. Although CO_2 is not toxic, it is an asphyxiant. It is advisable to unzip the TSL and wait until most of the CO_2 has dispersed.

4.4. CLOSING AND OPENING OF THE SHIPPING CONTAINER

4.4.1. Close the shipping container carefully and be sure not to pinch/squeeze the excess liner material between the container doors.

4.4.2. Care should be taken when opening the shipping container considering shifting of load while on transit. It is advised to open one side of the door first to check the loads.



5. MAINTENANCE AND CARE

5.1. REPAIRING PUNCTURES AND OTHER DAMAGES

5.1.2. Use an ordinary 2” wide plastic adhesive tape:
Clean the surface of the damaged area with damp cloth and allow the surface to totally dry before applying the plastic tape.

5.1.3. Protective maintenance:
5.1.3.1. Check the plastic tape occasionally and replace or re-patch if necessary.

6. MAINTENANCE AND CARE

6.1. RECYCLING

GrainPro TSL is made of polyethylene with barrier layer.

6.1.1. The products can be delivered to the nearest recycling facilities in the area.

6.1.2. Plastic #4 – LDPE (Low Density Polyethylene) can be recycled into compost bins, paneling, trash can liners and cans, floor tiles, and shipping envelopes.