Guidelines for Handling J-Lead & QFP Devices

January 1998, ver.3 Application Note 71

Introduction

Surface-mount J-lead and quad flat pack (QFP) devices are now common on boards because of their density, size, and cost benefits. A few precautions, however, are necessary to protect these devices from mechanical damage during transportation and storage. Following the guidelines in this application note will preserve the quality of Altera devices in J-lead and QFP packages and ensure easier soldering. This application note discusses the following topics:

- Transferring devices between tubes
- Transferring QFP devices without carriers between trays
- Dry-packing J-lead and QFP devices
- Shipping J-lead and QFP devices in boxes

Handling J-Lead & QFP Devices

To protect device leads and ensure proper operation, J-lead and QFP devices must be handled carefully when they are stored, shipped, and transferred. J-lead devices should be stored and shipped in tubes sealed with stoppers. When necessary, add foam inside the tubes for cushioning.

QFP devices in carriers should be shipped only inside tubes sealed with stoppers and if necessary, with foam. Carriers are static-dissipative, molded plastic shells that hold QFP devices in a secure frame to prevent mechanical damage to device leads. These QFP devices can be programmed and erased inside carriers, and they can tolerate the 125º C baking required for dry packing. When handling QFP devices in carriers, do not touch the QFP device; only use finger cots to touch the carrier.

If you need to insert a QFP device into a carrier, contact Altera Customer Marketing at (408) 544-7104. Go to the *QFP Carrier & Development Socket Data Sheet* for more information on QFP carriers.

QFP devices without carriers, or QFP devices that have been extracted from carriers, should be stored and shipped only in trays sealed with straps. When extracting QFP devices from a carrier, use only Altera QFP extraction tools, and inspect the orientation and lead integrity of the devices. You should extract devices directly into trays.

For more information on handling QFP devices without carriers, go to "Trays for QFP Devices Without Carriers" on page 822 and "Straps for QFP Devices Without Carriers" on page 823.

Tubes for J-Lead Devices & QFP Devices in Carriers

Altera-approved tubes protect J-lead and QFP devices in carriers from electrostatic discharge (ESD) as well as protect them during transportation and storage. Use clear tubes to allow easy inspection of the contents' top-side markings. The tube material should be antistatic (with "antistatic" printed on it), and they should be stiff enough to prevent the tubes from warping, cracking, or developing burrs during normal handling. Follow these guidelines when transporting or storing devices in tubes:

- Keep tubes horizontal.
- Keep devices in "dead bug" orientation. See Figure 1.
- Ensure that devices do not overlap inside the tube.

☞ When programming UV-erasable EPROM devices, use only conductive tubes.

Figure 1. Dead Bug vs. Live Bug Orientation

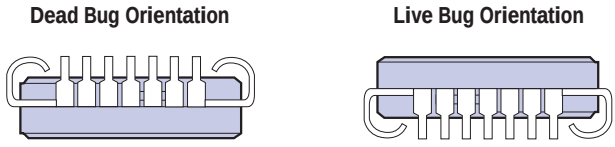
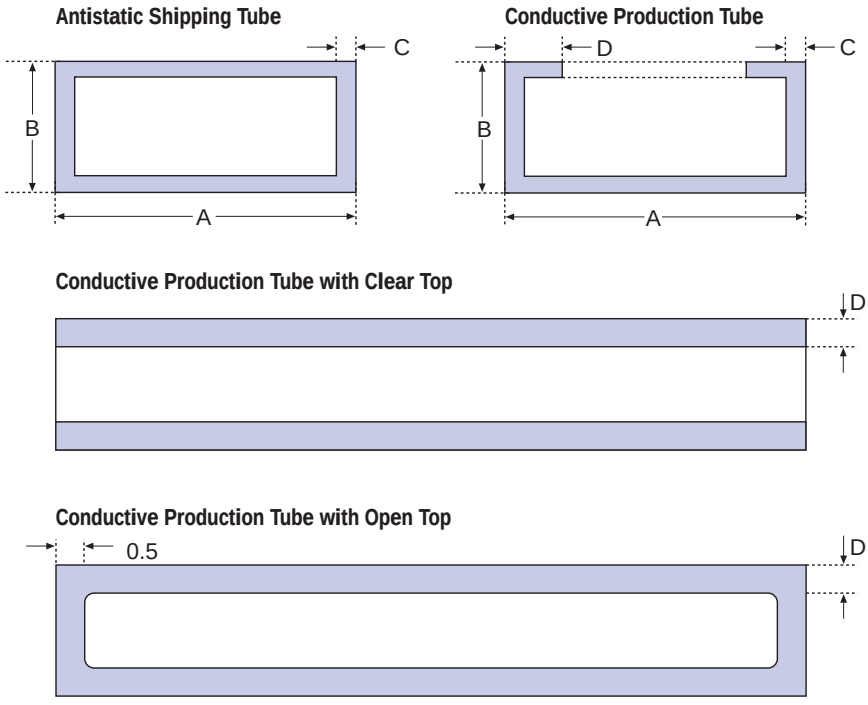


Figure 2 shows the tube dimensions required for each J-lead device. The tubes must match the dimensions of the device.

Figure 2. Tube Dimensions for J-Lead Devices

Dimensions are shown in inches.



Pin Count	A	B	C	D	Shipping Length	Production Length
20	0.480	0.260	0.025	0.140	20.00	20.25
28	0.580	0.260	0.025	0.140	20.00	20.25
44	0.780	0.260	0.025	0.140	20.25	20.25
68	1.100	0.280	0.035	0.150	20.00	20.25
84	1.300	0.280	0.035	0.150	20.25	20.25

Table 1 lists the part numbers for Altera-approved tubes for J-lead devices.

Table 1. Tube Part Numbers for J-Lead Devices *Note (1)*

Pin Count	Altera Reference Part Number		Tube Capacity (Devices)
	Antistatic Tube	Conductive Tube	
20	E20-03708-00	P20-03784-01	49
28	E20-02078-00	P20-03780-01	39
44	E20-02079-00	P20-03694-01	26
68	E20-02080-00	P20-03693-01	18
84	E20-03710-00	P20-03781-03	15

Note:
(1) To order tubes, contact your local sales representative.

Table 2 lists the part numbers for Altera-approved tubes for QFP devices in carriers.

Table 2. Altera-Approved Tubes for QFP Devices in Carriers *Note (1)*

Pin Count	Package Dimensions (mm)	Tube Capacity (QFP Devices in Carriers)	Altera Reference Part Number
100	14 × 20	23	E20-04726-00
160	28 × 28	14	E20-04743-00
208	28 × 28	14	E20-04743-00
240	32 × 32	12	E20-0408-00-00
304	40 × 40	10	E20-0408-01-00

Note:
(1) To order tubes, contact your local sales representative.

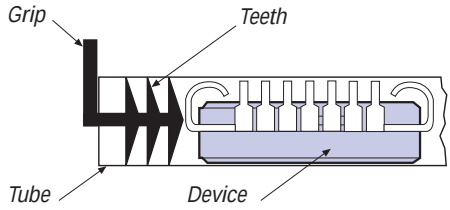
Go to "Transferring Devices between Tubes" on page 824 for information on how to transfer devices between tubes.

Stoppers for J-Lead & QFP Devices in Carriers

Stoppers seal tubes and protect J-lead and QFP devices in carriers against mechanical damage and ESD. Altera uses black stoppers that match the tube dimensions. Follow these guidelines when inserting stoppers:

- Seat stoppers firmly into both ends of the tube before transporting or storing devices.
- Push stopper teeth fully inside the tube, with the grip extending outside for easy removal. Do not insert the stopper completely inside the tube. See Figure 3.
- To prevent devices from moving inside an incompletely filled tube, insert foam between the parts and stopper.

Figure 3. Stopper Properly Inserted into a Tube



To reduce the risk of damaged leads, some special stoppers are designed to fit into a tube in only one way. Inserting these special stoppers correctly, with the grip in the same direction as the leads, is especially important. See Figure 4.

Figure 4. Proper Orientation of Special Stoppers

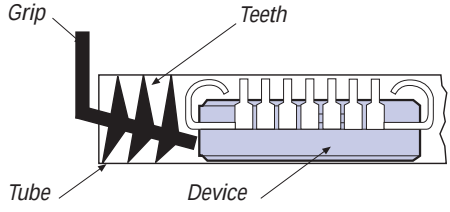


Table 3 lists the part numbers for Altera-approved black stoppers for J-lead devices.

Table 3. Black Stopper Part Numbers for J-Lead Devices *Note (1)*

Pin Count	Manufacturer Part Number
20	K-VT0236-25
28	K-VT0236-12
44	K-VT0236-14
68	K-VT0236-16
84	K-VT0037B-03

Note:
(1) To order stoppers, contact your local sales representative.

To prevent damage to leads during shipping, tubes of 208-, 240-, and 304-lead RQFPs in carriers should have modified stoppers. These stoppers have a notch cut out of them but are used just like other stoppers. See Figure 5.

Figure 5. Notched Stoppers for Tubes of RQFPs in Carriers

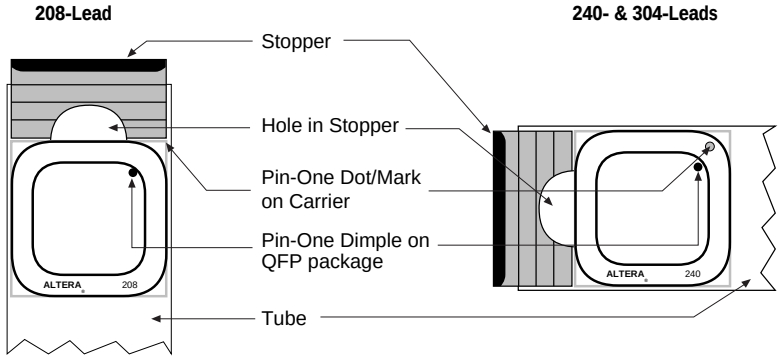


Table 4 lists the part numbers for Altera-approved black stoppers for QFP devices in carriers.

Table 4. Black Stopper Part Numbers for QFP Devices in Carriers *Note (1)*

Pin Count	Altera Part Number
100	E20-04739-00
160	E20-04764-00
208	E20-04764-00
240	E20-04765-00
304	E20-04766-00

Notes:
(1) To order stoppers, contact your local sales representative.

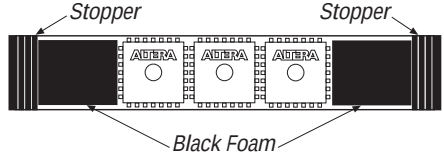
Foam for J-Lead Devices & QFP Devices in Carriers

Foam provides extra cushioning and restricts movement inside the tube to prevent device pins from bending. To support the devices evenly, the foam should be nearly as wide as the tubes. Foam should not be used in any full tube containing special stoppers that are shown in Figure 4 on page 819. When used, foam should be placed at each end of the tube between the stoppers and devices (see Figure 6).

Foam should be antistatic, non-corrosive, and free of contaminants. Place foam in tubes containing:

- A gap inside the tube measuring 1/4-inch or greater (for both J-Lead devices and QFP devices in carriers)
- Plastic J-lead chip carrier (PLCC) devices with 44 or more pins (full tubes containing PLCC devices with 28 or fewer pins) generally do not need foam)
- Ceramic J-lead chip carrier (JLCC) devices

Figure 6. Stoppers, Foam & Devices in a Tube

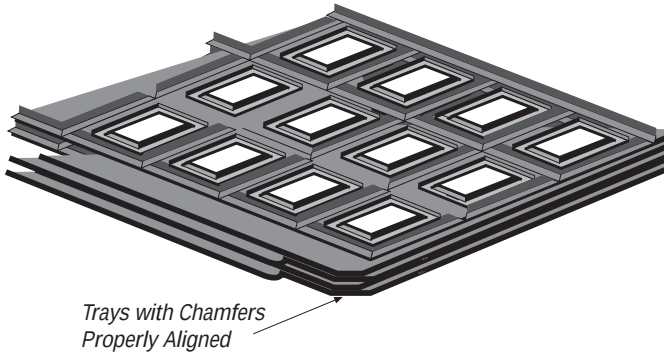


Trays for QFP Devices Without Carriers

To hold QFP devices without carriers, use only Altera-approved trays—full-sized Peak Plastic Corporation trays and 1/3-sized ITW Camtex trays. Other JEDEC-approved trays are not as protective of Altera's QFP devices because they are manufactured to different nominal specifications. When stacking trays for transportation or storage, follow these guidelines:

- Seal stacks of trays with straps.
- Make sure all trays are of the same revision. The revision is indicated by the letter following "Rev."
- Align all pin-one chamfers on the trays together. See Figure 7.
- Align trays and ensure that they are seated properly before strapping them.
- Stack power quad flat pack (RQFP) trays no higher than 5 trays (4 trays containing devices and 1 cover tray).
- Stack plastic quad flat pack (PQFP) trays no higher than 7 trays (6 trays containing devices and 1 cover tray).

Figure 7. Properly Aligned Peak Trays



All of the full-size Peak Plastic Corporation trays used by Altera can withstand temperatures of at least 150° C. These heat-resistant trays are not only more rigid, but they also can endure baking at 125° C, which is the recommended temperature for dehydrating moisture-sensitive devices. Table 5 lists the part numbers for Altera-approved, low-profile trays.

Table 5. Altera-Approved Trays for QFP Devices *Note (1)*

Package	Package Dimensions (mm)	Tray Capacity (Devices)	Peak Part Number *Note (2)*	Altera Reference Part Number
32-pin TQFP	7 × 7	250	ND-0707-1.0-1025-*n*	E20-03548-00
44-pin TQFP	10 × 10	160	ND-1010-1.0-0820-*n*	E20-03549-00
44-pin QFP, *Note (3)*	10 × 10	96	ND-1010-2.0-0616-*k*	E20-03550-00
100-pin TQFP	14 × 14	90	ND-1414-1.0-0615-*n*	E20-03551-00
100-pin QFP	14 × 20	66	ND-1420-2.7-0611-*n*	E20-03544-01
132-pin QFP	JEDEC	36	NX-PQFP-132-0409-*n*	E20-03355-00
144-pin TQFP	20 × 20	60	ND-2020-1.4-0512-*n*	E20-03557-00
160-pin QFP	28 × 28	24	ND-2828-3.5-0308-*n*	E20-04746-00
208-pin QFP	28 × 28	24	ND-2828-3.5-0308-*n*	E20-04746-00
240-pin QFP	32 × 32	24	ND-3232-3.4-0308-*n*	E20-04267-00
304-pin QFP	40 × 40	12	ND-4040-3.8-0206-*n*	E20-03552-00

Notes:

(1) To order 100 trays or less, contact EcoTech at (408) 988-2050. To order more than 100 trays, contact Peak Plastic Corporation (USA) at (408) 934-2480.

(2) For trays that can withstand 180° C, $n = 8$. For trays that can withstand 150° C, $n = 6$.

(3) The current tray (Peak part number ND-1010-2.0-0616-*k*) for this package is compatible with the old tray (Peak part number ND-1010-2.0-0616-*n*). Although Altera will eventually retire the old tray, both trays can safely be used together.

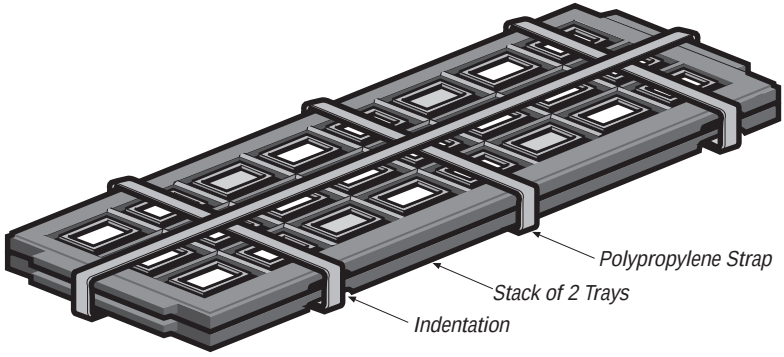
Straps for QFP Devices Without Carriers

Straps secure trays and prevent devices from jostling during transportation and storage. To hold trays together during transportation, Altera recommends using at least 1/2-inch-wide polypropylene straps that can withstand temperatures up to 130° C in case you need to bake the QFP devices before mounting. When storing devices, Altera recommends using either Velcro or polypropylene straps. Velcro straps that are 20 inches in length are sufficiently long to bind stacks of 2 to 7 trays for storage. Follow these guidelines when you strap trays together for shipping:

- Use only heat-sealed polypropylene straps. (Although Velcro straps can hold trays together during storage, they lack the strength required to hold trays together during transportation.)
- Set the tension on the strapping machine high enough to prevent straps from sliding off a stack of trays.
- Secure three heat-sealed polypropylene straps across the width of the stack, placing two of the straps in the indentations on the long sides of the trays. See Figure 8.
- Secure one polypropylene strap across the length of the tray.
- Remove straps with a knife to prevent jostling devices in the trays.

Do not use rubber bands, masking tape, string, or other similar material in place of Velcro or polypropylene straps.

Figure 8. Properly Secured Polypropylene Straps on a Stack of Trays

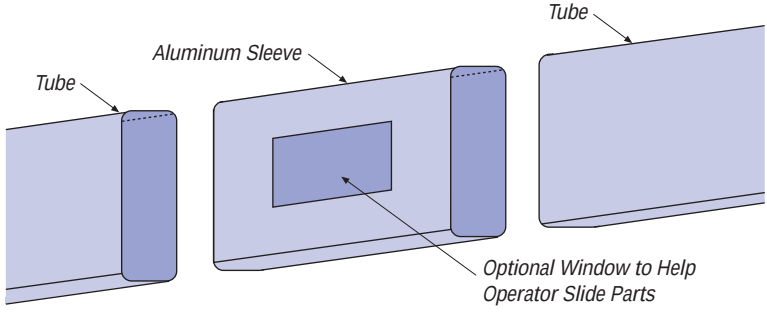


Transferring Devices between Tubes

To prevent leads from bending on tube edges, follow these steps when transferring J-lead devices and QFP devices in carriers from one tube to another:

1. Use a metal or plastic sleeve to line up tube ends (see Figure 9). If you do not have a sleeve, carefully line up the tube ends.
2. Tilt the tubes so that the devices slide from one tube to the other. Do not shake or vibrate the tubes.

Figure 9. Sleeve for Tube-to-Tube Transfer

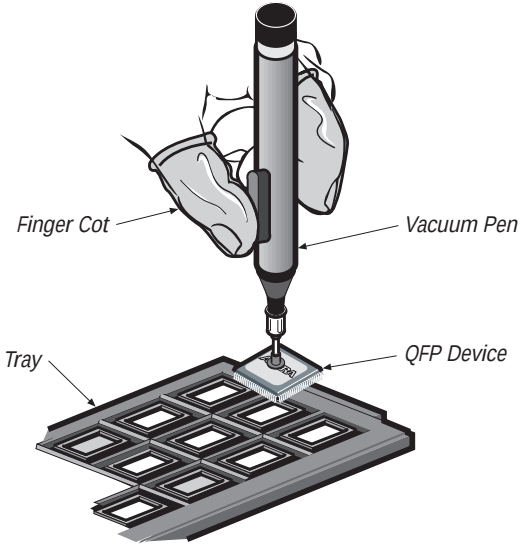


Transferring QFP Devices without Carriers between Trays

Altera recommends using automated pick-and-place machines in an ESD-protected environment to transfer QFP devices between trays. If you need to transfer QFP devices manually, follow these guidelines:

- Work in an ESD-protected environment.
- Use ground straps and finger cots.
- Only use vacuum pens to manually transfer QFP devices. Vacuum pens should be able to maintain their vacuum for at least four seconds. See Figure 10.
- Transfer devices right-side-up over a table; then release the vacuum only after the device is properly oriented and seated in the tray.
- QFP device leads should never contact the tray.

Figure 10. Transferring a QFP Device Using a Vacuum Pen



Dry Packing J-Lead & QFP Devices

Dry packing is a method of packing moisture-sensitive devices for shipment. Risk to moisture-sensitive devices can occur when the high soldering temperatures of the reflow process suddenly heat any moisture absorbed by a plastic package. Although many of Altera's J-lead and QFP devices are not sensitive to moisture, Altera has adopted dry packing as a standard practice for moisture-sensitive devices. This method eliminates all risk of moisture to the devices. In addition, Altera can dry-pack other devices upon request. The devices are first baked to remove any existing moisture and then packed and vacuum-sealed in moisture-barrier bags. Table 6 lists the contents of a typical dry pack.

Table 6. Dry Pack Contents

Item	Specification
Moisture-barrier bag	MIL-B-81705C, Type 1 or equivalent
Desiccant	MIL-D-3464, Type II or equivalent
Humidity-indicator card	Compliant with MIL-I-8835A
Labels	ID label and caution label

To maintain a moisture-free environment, follow these guidelines after receiving dry-packed devices from Altera:

- Open bags as close to the seal as possible to leave enough of the bag for resealing.
- Reseal bags after opening to minimize exposure to moisture.
- Inspect all dry packs for potential leaks in the seals or bags.
  - If a leak exists and the humidity-indicator card shows an unacceptable humidity level (i.e., the 30% dot has started to turn pink), rebake the devices.
  - If a leak exists but the humidity-indicator card shows an acceptable humidity level (i.e., the 30% dot is blue with no pink), reseal the devices in an undamaged bag.
- After opening dry packs, check that the humidity-indicator card shows acceptable humidity. If the card shows an unacceptable humidity level, rebake the devices.
- Rebake any devices stored for over one year.
- Store dry packs in conditions < 40º C and < 90% relative humidity.

In addition, Altera lists the floor life on every dry pack label. The floor life is the length of time a device can be exposed to a factory environment (< 30º C and < 60% relative humidity) after the device has been removed from the bag and before it is mounted. Rebake devices prior to mounting if the interval between opening a dry pack and mounting the devices onto a board exceeds the floor life of the devices.

Distributors have an additional allotment of time beyond the labeled floor life. Six hours are available for products with a 24-hour floor life, and 24 hours are available for products with a 120-hour floor life. These time allotments allow for programming and repacking as needed.

Altera recommends the following guidelines when dry-packing devices:

- When transferring parts to new dry pack bags, operators should remember to copy the floor life and expiration date accurately to the new dry-pack labels.
- Bake QFP devices in strapped heat-resistant trays at 125° C for at least 12 hours.
- Bake J-lead devices in heat-resistant tubes at 125° C for at least 12 hours. If you lack heat-resistant tubes, bake J-lead devices on a cookie sheet in dead-bug orientation.
- Use heat-sealed bags that are resistant to punctures and abrasion.
- Seal bags with a bag-sealing machine that can evacuate the air inside a bag. Relax the vacuum enough to prevent the bag from contracting so tightly over the tube or tray ends that it risks puncture.
- Replace the desiccant and humidity indicator card if the dry pack is open for longer than one hour.
- Use at least one unit of desiccant per dry pack.

Dry Pack Sizes

Table 7 shows the available dry pack sizes. Altera uses heavy-duty, 6" × 24", 6" × 30", and 10" × 30" bags for dry-packing tubes. Altera's bags for trays are 10" × 20".

Table 7. Dry Pack Sizes (Part 1 of 2)

Package & Lead Count *Note (1)*	Quantity per Container *Note (2)*	Type of Container	Maximum Containers per Bag	Maximum Devices per Bag
L84	15	Tube	10	150
Q100	66	Tray	6	396
Q100	23	Carriers and Tubes	10	230
Q132	36	Tray	6	216
Q160	24	Tray	6	144
Q160	14	Carriers and Trays	10	140
Q208	24	Tray	6	144
Q208	14	Carriers and Trays	10	140
R208	24	Tray	4	96
R208	14	Carriers and Trays	10	140
R240	24	Tray	4	96
R240	12	Carriers and Trays	10	120
R304	12	Tray	4	48

Table 7. Dry Pack Sizes (Part 2 of 2)

Package & Lead Count *Note (1)*	Quantity per Container *Note (2)*	Type of Container	Maximum Containers per Bag	Maximum Devices per Bag
R304	10	Carriers and Trays	10	100
T32	250	Tray	6	1500
T44	160	Tray	6	960
T100	90	Tray	6	540
T144	60	Tray	6	396

Notes:

(1) Package abbreviations: G = pin-grid array (PGA); L = plastic J-lead chip carrier (PLCC); R = power quad flat pack (RQFP); T = thin quad flat pack (TQFP).

(2) For trays, each listed quantity per container includes only trays filled with devices. An additional empty tray is required as a cover.

Shipping J-Lead & QFP Devices in Boxes

When shipping trays or tubes of devices, use only boxes that have passed the ASTM D776 test for shipping containers. To protect against ESD, Altera recommends that you use boxes with an internal, conductive finish. Filler material is added to boxes to cushion the contents and prevent trays or tubes from shifting position during shipping. Boxes should contain enough filler material to prevent stoppers from falling out of tubes when jostled. Filler material should meet the following standards:

- Filler materials should be antistatic and non-corrosive.
- Filler materials should not crumble, flake, powder, outgas, or shed.
- Filler materials should not scratch or puncture the trays, tubes, or dry-pack bags.

To order foam filler, contact Pacific Southwest Container at (800) 772-0444. To order bubble wrap, contact EcoTech at (408) 988-2050.