

Home total parenteral nutrition (TPN): Cycled TPN

Since your illness or its treatment has decreased your ability to eat or to eat enough, you need total parenteral nutrition (TPN). TPN is a method of helping you meet your nutritional needs. Nutrients are fed directly into your bloodstream, bypassing your gastrointestinal system. The TPN solution reaches your bloodstream through a specially designed tube called a central venous access device (also called a catheter, central line or line) that has been placed in one of your large veins. Since the solution enters your body through a vein, this therapy is also called an intravenous feeding.

A proper diet is important for health and growth. Maintaining or improving your nutritional status is a vital part of your total treatment plan. Food taken by mouth is broken down or digested in the stomach. It then enters the small intestine, where it is further broken down and absorbed into the bloodstream. Once in the bloodstream, the nutrients travel to all the cells of the body, where they are used for energy and to build body tissues.

The TPN solution you receive contains all the nutrients your body needs. These solutions usually contain protein, carbohydrate, electrolytes, vitamins, minerals, trace elements and water depending on your specific needs. You may also receive intravenous fat. Your doctor—who has carefully assessed your needs—orders the amount of each nutrient. You may receive your TPN continuously (24 hours per day) or cycled over a set number of hours a day. Your infusion time depends on your doctor's orders and your tolerance to the infusion. In summary, TPN is one way of providing your body with the nutrients it needs when part or all of your gastrointestinal system is not working.

Your doctor has arranged for you to receive TPN. Your doctor is confident that you and your caregiver will be able to learn to safely administer TPN so you may stay at home with family and friends in more comfortable surroundings.

Your doctor and hospital nurses may have already begun to teach you about TPN. If you have a home health nurse, they will continue this teaching. You will learn how to care for your intravenous catheter, to prepare your solution and to use your infusion pump as well as how to

monitor your body's response to the therapy. You may need to go to a local clinic or infusion center for catheter care and labs. The following guidelines will help you learn the skills you need.

IU Health Home Infusion Pharmacy will plan for your medications, supplies and equipment to be delivered to your home. A home health nurse and infusion pharmacist will keep your doctor informed about your progress. Remember, the goal is for you and your family to become as independent as possible in the use of home total parenteral nutrition.

General rules

- Good handwashing, wearing gloves and working on a clean surface prior to starting are necessary to prevent infection.
- Always scrub vials, TPN port and needleless connectors with a **new** alcohol pad for 15 seconds **each** time you use.
- If an open end of tubing, syringe or needle touches anything other than the sterile opening of the TPN bag or the pre-scrubbed needleless connector or vial, it must be thrown out and replaced with a new one.
- If disconnecting during infusion, place the red cap (small end) on end of the TPN tubing to prevent contamination.
- If the pump alarms during the procedure with **NO KEYPAD ACTIVITY**:
 - Press the **RUN/START** button, **YES** button to **REPEAT RX** message.
 - Allow the pump to scroll through the program again until it stops on the **PRESS RUN TO START** screen again.
 - This is your action screen that allows you to prime or start the TPN.

Troubleshooting

Refer to 'How to correct "Air in Line" alarm on the Curlin pump' and 'Troubleshooting Curlin pump alarms' on page 8. Call **317.962.4600** or **800.258.9530** for mechanical pump problems, or your nursing agency for all other questions.



Key words related to home parenteral nutrition

Carbohydrate: A nutrient that is a source of energy (calories) for the body. Dextrose is the carbohydrate in your TPN solution.

Electrolytes: Substances, such as potassium and sodium, that are essential to maintaining a balance between the cells in the body. IV solutions contain electrolytes to replace those you lose through normal body functions.

Fat emulsion: A nutrient (also called lipids) that is a source of energy (calories) and fatty acids. Fat emulsions are given with your TPN solution but may not be required daily.

Insulin: A hormone needed for your body to use sugar (carbohydrates) properly. Even though your body makes insulin, extra insulin may be added to your nutrient bag.

Minerals: Inorganic substances, such as magnesium and calcium, that are essential to the body.

Total parenteral nutrition: The delivery of nutrient solution directly into the bloodstream, bypassing the gastrointestinal system. Parenteral nutrition is also referred to as intravenous hyperalimentation (IVH), total parenteral nutrition (TPN), home parenteral nutrition (HPN) or hyperal.

Protein: Body tissue that is made from amino acids. Proteins are the body's building blocks and are needed to heal wounds and to fight infections.

Trace minerals: Minerals such as copper and zinc required by the body in small amounts.

Vitamins: Nutrients that are essential to the body in small quantities (e.g., vitamin A, B, C, D, E, K, etc.).

Troubleshooting TPN solution-related problems

TPN therapy may cause some problems. Fortunately, most problems are easily detectable. Your doctor will monitor your therapy and will change your prescription in your solution as needed. However, you need to know the early warning signs of TPN-related problems, how to prevent them and, if they occur, when to call your doctor.

Problem: Thirst, increased urination, increased pulse, headache

Cause: High blood sugar (hyperglycemia). Solution may have infused too fast. Insulin requirements may have increased. An early sign of infection.

Action: Check the infusion rate. Take your temperature. Call your nurse or doctor. The solution and/or rate of infusion may need adjustment.

Prevention: Infuse your TPN as ordered.

Problem: Nervousness, headache, nausea, cold sweats, hunger pains, shaky feeling, blurred vision

Cause: Low blood sugar (hypoglycemia). Insulin requirements may have decreased. Rapidly slowing or stopping the infusion without tapering.

Action: If able, drink a sugar-containing liquid (orange juice, soda or milk) as tolerated.

Prevention: Do not stop your TPN early as the pump is set to ramp down the infusion rate slowly at the end of each TPN cycle unless it is continuous.

Problem: Numbness or tingling in your extremities, double vision, twitching or tremors, abdominal or leg cramps, flushed skin

Cause: Possible electrolyte imbalance

Action: Write down your symptoms. Call your nurse or doctor.

Prevention: Routine follow-up with your doctor. Regular lab draws per your doctor's orders.

Problem: Positive blood glucose (fingerstick) of 200 or as ordered by MD

Cause: Glucose intolerance. Changing insulin requirements.

Action: Repeat test.

Prevention: If result is still out of range, contact your doctor or nurse.



Infusing intermittent (cycled) TPN with the Curlin pump

Supplies needed:

- TPN bag (at room temperature)
- Curlin filter tubing (blue filter)
- Additives
- Syringes for possible additives
 - ___ 3 mL syringes
 - ___ 5 mL syringes
 - ___ 10 mL syringes
 - ___ 1 mL syringes
- Insulin syringe
- ___ filter needle
- ___ mL prefilled heparin flush (___ units/mL)
- ___ mL prefilled saline flush
- Alcohol pads



Pump set-up:

Prepare your workspace by finding a firm surface that can be cleaned with a disinfectant wipe like Clorox or warm soap and water with a clean cloth that is squeezed out. Wash your hands after cleaning.

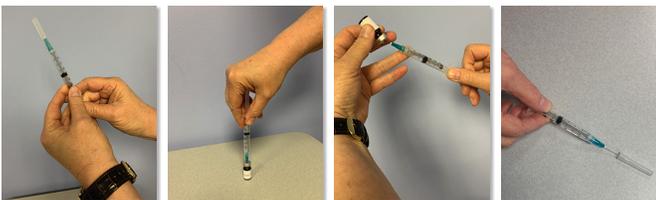


Gather your supplies and wash your hands.

Flip the lids off all the additive vials and scrub the tops for 15 seconds with a new alcohol pad for each vial. Allow to dry. Write the date opened on any multi-dose vials as they expire in 28 days once opened.



Use syringe size as directed for each additive. Inject air into additives as directed. Draw up amounts as directed, tap out the air bubbles, recap and set aside.



Add the following medications to your TPN bag as ordered.

Always check the TPN label for changes in your additives and amounts.

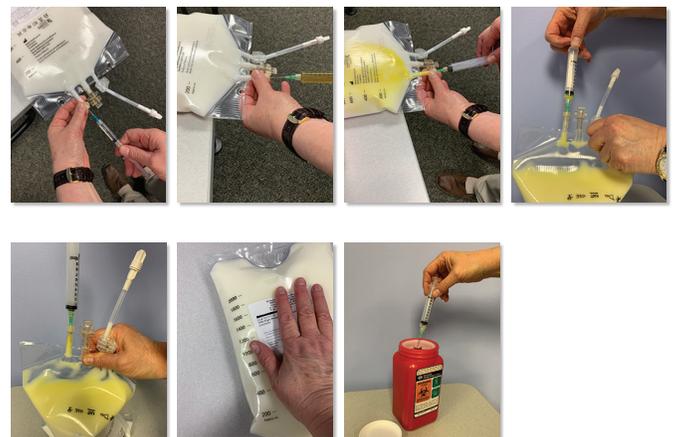
Use a ___ mL syringe for _____, a ___ mL syringe for _____, a ___ mL syringe for _____, a ___ mL syringe for _____.

Scrub the injection port on the TPN bag with a new alcohol pad for 15 seconds. Allow to dry. (This port may have foil covering the port. It needs to be removed before cleaning it.)



Inject the ordered additives, scrubbing the injection port for 15 seconds and allowing to dry before each new additive. Mix the bag gently by rocking back and forth after each additive. Add the smaller amounts first to ensure they mix well in the solution. Leave the last (largest) syringe in the injection port, turn the bag upside down to get any air pocket centered under the port and pull back on the plunger to pull air from the bag. Remove the syringe.

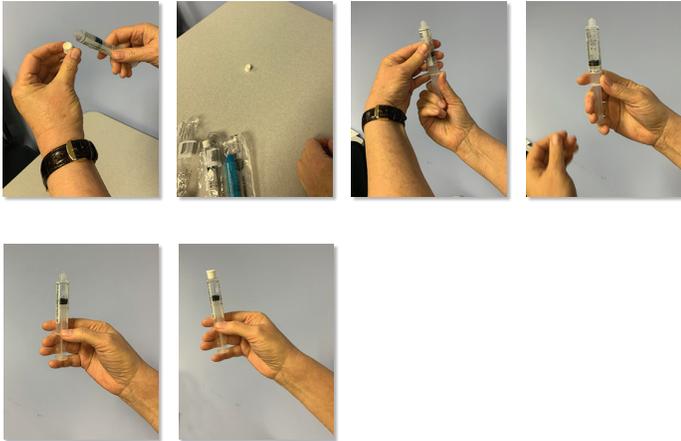
Dispose of needles in the "Sharps" container. (You do not need to recap needles before discarding.)



Set-up

Prepare prefilled flushes by holding the syringe straight up and down with the cap at the top.

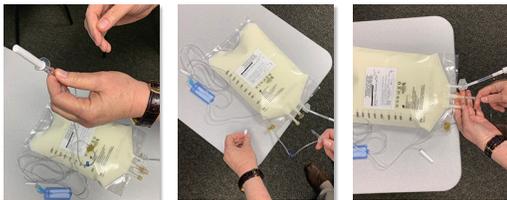
Pull down on the plunger until you feel the seal break or note the plunger moving slightly. Remove the cap. (Do not touch the inside of the cap or the tip of the syringe. If touched, get a new one.) Push up on the plunger to push the air out, then replace the cap.



Open the Curlin tubing package, twist and remove the round tab from the amber plastic piece (flow stop) of the tubing. (This clamps the line and prevents any free flow through the tubing.)



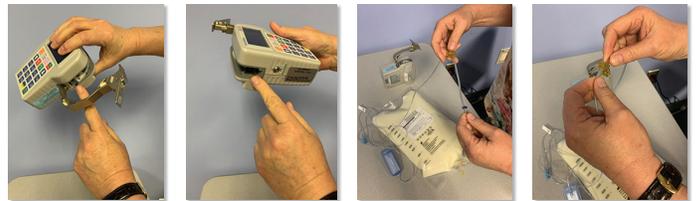
Insert the tubing into the bag by removing the cover of the tubing port and the cover of the "spiked" end of the tubing. Push and twist the spike into the bag to get it to the first marking on the spike. (Do not touch either the opening of the bag or the spike. If touched, you must start with a new set-up.)



To open the door of the pump, lift the latch on the top of the door and pull the door up and all the way to the right.



Insert the tubing into the pump by placing the square blue tubing guide into the right side of the pump in the direction of the blue arrow on the pump. **Caution:** The tubing should be placed in front of the latch hinge to prevent it from getting pinched when the latch is closed.



Lay the tubing over the center of the gray pumping section and insert the amber piece (flow-stop) into the rectangular box on the left side (see the yellow arrow on the left side of the pump).



Gently press the tubing into the black air detector slot.



If the slide clamp is closed, open it before closing the latch.

Close the latch of the pump by firmly pushing it down, then snap the handle down.



Turn the pump on by pressing the blue ON/OFF key.

The pump performs a self-test, beeping three times. The remaining battery life will show in a bar graph during the self-test.



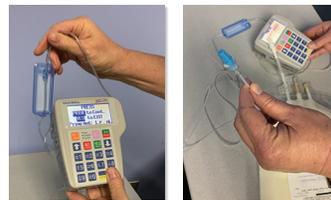
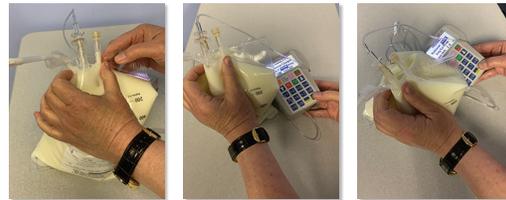
Next, a screen with PROGRAM, LIBRARY, is displayed. The cursor (grey bar) will be highlighting **PROGRAM**. Select **PROGRAM** by pressing the **YES/ENTER** key.

The pump will prompt **REPEAT RX OR NEW PROGRAM**. Press **YES/ENTER** if **REPEAT RX** is highlighted. **Caution:** If **RESUME** is highlighted then the full amount of TPN was not administered from the previous bag. The pump will only finish administering what's left according to the pump program, then run at KVO. To reset the pump, you must arrow down to **REPEAT RX** and press **YES/ENTER** two times to repeat the full prescription.

Your preprogrammed prescription values will scroll by in the next few display screens. The display screens will scroll automatically. (To halt the automatic review, press any key except **ON/OFF**, then review each line by pressing the **YES/ENTER** key to move the cursor past each line). The **PRESS RUN TO START** menu will appear on the screen at the end of the review.

When the **PRESS RUN TO START** screen shows, press and release the **PRIME** key. **Caution: Never prime when tubing is connected to the patient's IV.**

Position the bag upside down to get air centered under the tubing spike. Press and hold the **PRIME** key until all the air is out of the bag and tubing. The rectangular blue filter in the tubing must be hanging straight down to fill properly when priming. Priming is complete when the fluid gets to the end of the tubing and no air is visible in the bag or tubing (you may have to release and press prime again to finish).



When all the air is removed from the IV bag and tubing, release the PRIME key and press the YES/ENTER key to exit priming and get back to the PRESS RUN TO START screen.



Scrub your needleless connector with a new alcohol pad for 15 seconds. Let dry.

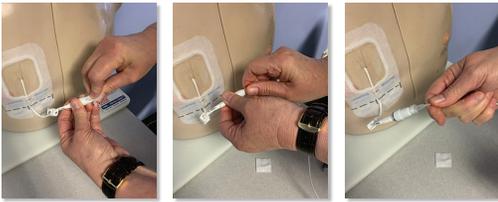


Remove the cap of saline flush. Push in and twist the syringe onto your needleless connector. Open the clamp on your catheter.

Flush with the ____ mL saline flush and remove the syringe.



Scrub your needleless connector again for 15 seconds with a new alcohol pad. Let dry. Connect the TPN tubing by removing the protective cover from the end of the TPN tubing and “push and twist” onto your needleless connector. Be sure all the clamps on your line and TPN line are open.



The pump will be on the PRESS RUN TO START menu.

Press the **RUN/PAUSE** key to start the TPN. The green light will flash to indicate the pump is running. Before your infusion is complete, prepare prefilled flushes:

_____ mL saline flush

_____ mL heparin (___ units/mL) flush



When your infusion is complete, the pump beeps three times and displays INFUSION COMPLETE.

The red light next to “alarm” will start flashing along with the green “running” light. Your bag is overfilled so at the end of your infusion period, the pump will automatically slow down and continue at a KVO (keep vein open) rate to give you time to get things ready to disconnect. Press the **RUN/PAUSE** key, then **ON/OFF** to turn off the pump.



Disconnect the TPN tubing by twisting the tubing from your needleless connector (do not loosen or unscrew the needleless connector from your IV line).

Scrub your needleless connector with a new alcohol prep pad for 15 seconds. Let dry.

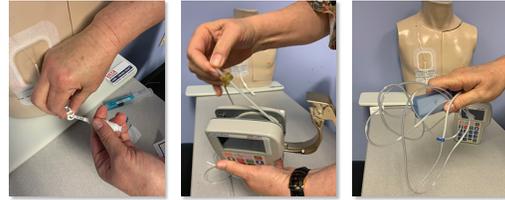


Flush first with the _____ mL saline flush. Scrub the needleless connector again for 15 seconds, let dry then flush with _____ mL heparin flush.

Remove the flush syringe.

Close the clamp on your catheter.

Lift the latch on the top of the door and pull the door up and all the way to the right. Remove the tubing and discard the bag and tubing in the regular trash.



Hint: remember “SASH” flushing

S _____ mL Saline flush

A _____ Administer TPN as ordered

S _____ mL prefilled Saline flush

H _____ mL prefilled Heparin flush

If you have any questions, call IU Health Home Care

Bloomington: 812.353.3104

Indianapolis: 317.962.4600 or 800.258.9530

Lafayette: 765.838.5750

Muncie: 765.747.3009

To reach IU Health Home Infusion Pharmacy:

T 317.962.4745



Indiana University Health

(continued on next page)

Curlin pump power sources

Curlin pumps can be powered by:

- Two size C alkaline batteries, installed in the compartment on the back of the pump.
- An AC adapter

Low battery alert

A beep will sound and a **LOW C-BATTERIES** alert will display when the power in the C batteries is low. When this alert occurs, replace the batteries.

Changing the batteries

To replace the size C batteries, turn the pump OFF or connect the AC adapter.

Hold the pump so that the back of the pump is facing you. If there is a slide to open/lock, slide to open. Pull the old batteries out from the top. Replace the batteries with both positive (+) poles at the top of the battery compartment. Place the bottom of the battery onto the spring and push the top down to avoid distorting the springs. Replace the cover. Press the **ON/OFF** button on the pump.

Wait for the self-check to finish. The word **PROGRAM** will be highlighted.

Press the **YES/ENTER** button. The word **RESUME** should be highlighted. Press **YES/ENTER**.

Press the **RUN/PAUSE** button to start the pump. The pump will continue the infusion wherever it left off. The green light next to the word **RUNNING** will be flashing.



Attaching the external power source

To attach the AC adapter, line up the two thin wires inside the adapter with the two small holes of the power port on the bottom of the pump and insert. Do not twist while plugging or unplugging as this may bend the wires and ruin the plug. Pull straight out and reposition then push straight in (it should go in easily when lined up correctly). If there is a blue plastic tab on the adaptor that is preventing you from plugging it into the power port, it is OK to break it off.

How to change clothes during an infusion

- Pause the pump by pressing the **RUN/PAUSE** key.
- Open package containing red end cap but leave it resting in open package to keep small end sterile.
- Disconnect the medication tubing from the patient's needleless connector (hold the tubing so the end does not touch anything, to keep it sterile).
- Immediately pick up the red end cap by the big end and screw the small end onto the end of the medication tubing. **Caution: Do not** touch the end of the medication tubing or the small end of the red cap. If the red end cap is contaminated get another one. If the medication tubing is touched the tubing must be changed. Call your home health nurse if you haven't been taught how to do that.
- Once the red end cap is in place you may set the medication tubing aside.
- Change clothes.
- Scrub your needleless connector with an alcohol pad for 15 seconds. Let dry.
- Remove the red end cap and reconnect the medication tubing to your needleless connector.
- Restart the pump by pressing the **RUN/PAUSE** key. Screen will display **RESUME** or **REPEAT RX**. **RESUME** will be highlighted, so press **YES/ENTER**, then the **RUN/PAUSE** key again.



How to correct “Air in Line” alarm on the Curlin pump

- The pump stops when alarming for air in line. Press **SILENCE** key to silence alarm. This will also “freeze” the alarm message until it is fixed.
- Open package containing red end cap but leave cap resting in open package to keep small end sterile.
- Disconnect the tubing from the patient’s line and hold the tubing so the end does not touch anything, to keep it sterile.
- Press the **RUN/PAUSE** key, then the **YES/ENTER** key to **RESUME** (this should be highlighted). The screen will return to the **RUN** to **START MENU**.
- Press **PRIME/BOLUS** key then release it.
- Press and hold **PRIME** key to prime air to end of tubing or into filter (if applicable). Release the **PRIME** key when done priming air out. Press **YES/ENTER** key at prompt to exit out of **PRIMING**.
- Place the protective red cap on end of the medication tubing. Pick up the red cap by the large end and screw the small end of the red cap onto the end of the medication tubing.
Caution: Do not touch the end of the medication tubing or the small end of the red cap. If the end cap is contaminated get another one. If the medication tubing is touched the tubing must be changed. Call your home health nurse if you haven’t been taught how to do that.
- Scrub your needleless connector with an alcohol pad for 15 seconds. Let dry.
- Untwist the red cap from the tubing and attach the tubing onto the needleless connector.
- Press **RUN/PAUSE** to restart the pump.

Troubleshooting Curlin pump alarms

Push **RUN/PAUSE**, **YES** to resume, fix the problem, then push **RUN** to restart.

Pump display conditions: How to correct

- **INFUSION COMPLETE:** Programmed amount has infused, and pump is in KVO (keep vein open) running slowly. Press **RUN/PAUSE**, add another IV bag/tubing if ordered and select **REPEAT RX** to start pump over for a new bag. If done, turn the pump off by pressing the **RUN/PAUSE** key, then the **ON/OFF** key.
- **ALARM AIR-IN-LINE:** The pump senses air in the tubing set. Remove air from the tubing set per your nurse’s instructions for priming. (How to correct ‘Air in line’ alarm” on page 8)
- **ALARM DOWN OCCLUSION:** The pump senses a blockage between the pump and your IV site. Check the tubing from the pump to your IV site. Unkink or unclamp the tubing. When the blockage is fixed, the pump will automatically restart the infusion.
- **ALARM UP OCCLUSION:** The pump senses a blockage between the IV bag and the pump. Press the **RUN/PAUSE** key, and check the tubing from the IV bag to the pump. Unkink the tubing, and check the bag for blockage. When the problem is fixed, select **RESUME** then press **RUN/PAUSE** to restart the pump.
- **ALARM HIGH UP PRESSURE:** The pump senses pressure on the IV bag. Press the **RUN/PAUSE** key, and make sure the IV bag is not empty or under pressure. Try unloading and reloading the tubing. Restart infusion.
- **ALARM (tubing) SET NOT INSTALLED:** The tubing has not been loaded or has been loaded incorrectly. Unload the tubing and reload. Be sure the tubing is centered in the gray area across the top and in front of the latch on the right side before closing.
- **ALARM UNATTENDED PUMP or NO KEYPAD ACTIVITY:** The pump has been paused for more than two minutes. Press **RUN/PAUSE** key, **YES/ENTER** to **RESUME** and **RUN/START** to restart pump where it left off or **REPEAT RX** if trying to start a new bag.
- **ALARM REPLACE (tubing) SET:** The pump senses a problem with the tubing. Try unloading and reloading the tubing. If still alarming, change the tubing or call your nurse.
- **ALARM DOOR OPEN or (tubing) SET NOT PROPERLY INSTALLED:** The pump door is open or the tubing is not loaded correctly. Unload the tubing and reload. Be sure the tubing is centered in the gray area across the top and in front of the latch on the right side before closing.



Pump display conditions: How to correct, continued

- **ALARM EMPTY BATTERY:** The batteries are low. Replace both of the C size alkaline batteries. See “Changing the batteries” on page 7.
- **ERROR CODE:** The pump needs reset or replaced. If an error code occurs, turn the pump off then back on. If it repeats, write down the Code # and call IU Health Home Infusion Pharmacy at **317.962.4745** or **800.258.9530** and ask for the pharmacy.

By signing this form, I confirm that I have received the information in this education guide and have been advised on infusion administration and complications.

Date: _____ RN/Agency: _____

Patient/Caregiver: _____

Education received: _____

Quick guide to TNP steps

Bag preparation before completion of current TPN bag:

- 1 Set the TPN bag out of the refrigerator for at least one hour prior to starting the procedure.
- 2 Scrub the top of all additive vials for 15 seconds each with a fresh alcohol pad and allow to dry. Draw up additives listed on the TPN label.
- 3 Inject additives into the scrubbed, dry rubber TPN port and gently roll the bag until the fluid mixed well. **Do not shake the bag.**
- 4 Open the Curlin tubing with the rectangular filter and twist off the round yellow tab from the spring clamp of tubing.
- 5 Remove the cover on the middle tubing port and the cover from the spike end of the Curlin tubing.
- 6 Twist and push the spike into the bag without touching the spike or open end of the bag.
- 7 When the current TPN bag infusion is complete, press pause and turn off the pump.
- 8 Press **YES** to **PROGRAM**, then **YES** to **REPEAT RX**.
- 9 The pump scrolls through the program and stops on the action screen.
- 10 Press **PRIME** to remove air from the bag and tubing. When done, clamp the TPN tubing with the white slide clamp.

Administration:

- 1 Prepare the saline flush. Scrub the patient's needleless connector. Unclamp the patient's catheter, attach the flush and flush.
- 2 Remove the flush syringe, scrub the needleless connector again with a new alcohol pad and attach the TPN tubing. Unclamp the TPN tubing.
- 3 Press the **RUN/START** button on the pump. Place the bag and pump in the backpack.

Disconnect:

- 1 When **INFUSION COMPLETE** is shown, press **RUN/PAUSE** then **ON/OFF**.
- 2 Disconnect the TPN tubing. Flush the line as directed by your nurse. Clamp the patient's catheter.

