

**The professional's
pocket guide
to infusion site
management**

*Revised and
expanded edition*

ACCU-CHEK[®]

Live life. The way you want.

The professional's pocket guide to infusion site management

This guide is designed as a reference for healthcare professionals and the insulin pump wearers they counsel. There may be several equally valid methods regarding infusion site management for arriving at the same therapeutic outcome. In this guide, we have described the most commonly used techniques. Experience will validate the most appropriate method for your own personal situation. Please consult your healthcare professional before making any changes to your current practices and regimen.

Disclaimer

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This book is not meant to be a substitution for professional medical care. Always consult the healthcare team for treatment plans and recommendations.

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“A lot of people starting out on the pump don’t realize that problems with infusion catheters are the number one cause of unexplained high blood glucose. Using the right type of catheter and skin tape can greatly reduce this risk.”

From *Smart Pumping*, edited by Dr. Howard Wolpert, American Diabetes Association, 2003.

“Successful pumping is dependent upon successful infusion sets. Set change frequency of every 48 hours reduces the risk of needle/cannula micro-occlusions that result in decreased insulin delivery to the patient, but do not create sufficient back-pressure to trigger occlusion alarms. Automatic insertion aides can, in some patients, create an ‘apple core effect,’ resulting in a tissue plug at the distal needle/cannula and early onset occlusion.”

Margaret M. Ulchaker, MSN, RN, CDE, CNP, NP-C, BC-ADM

“Trouble-shooting labile/elevated blood glucose levels in the pump patient should always invoke consideration of inconsistent insulin delivery due to infusion site problems. After optimizing dietary factors, appropriate compensation for variable exercise, in addition to tweaking the multiple basal rates and meal/snack boluses, the insulin pump healthcare team may be at a loss to explain persistent glucose lability. While a pump mechanical problem is possible to explain inconsistent insulin delivery, the majority of the problems are related to infusion site issues. Careful attention to all the elements outlined in the monograph will be of major assistance to the insulin pump healthcare team in tracing the source of infusion site related glucose lability.”

John P. Sheehan, MD, FACE, FACN

Introduction

Infusion sets are designed to carry insulin from the pump to the body. Infusion sets are available in many different designs and combinations of cannula and tubing lengths to accommodate a wide variety of body types, lifestyles and activity levels. In addition, new infusion set designs and enhancements are available on a regular basis.

Despite the importance of the infusion set to insulin pump therapy, many healthcare professionals and their patients do not devote enough time to fully understanding the infusion set itself, or the wide range of issues related to infusion set usage and infusion site management.

We provide you with this guide to help educate you on infusion sets and their usage, and to give you tips on infusion site management and troubleshooting to help make using an insulin pump a safe, successful and therapeutic regimen for the treatment of diabetes.





Infusion Set Selection

Features and Benefits

Infusion sets offer a number of design features, each of which have specific benefits. By understanding the main infusion set features, patients and healthcare practitioners can more easily choose the infusion set that matches the patient's body type, lifestyle and activity level.

▪ **Universal versus proprietary sets**

- Most infusion sets on the market are universal; they use a luer-lock connection that can be used on pumps with a standard luer-lock fitting.
- Medtronic MiniMed's Paradigm® pump uses a proprietary infusion set—the connection is not a universal luer-lock fitting. Therefore, only sets made for use with this pump can be utilized.

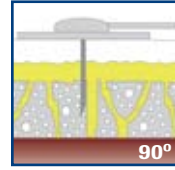
▪ **Steel versus soft cannula**

- Steel cannula infusion sets can be used by people who have an allergy to the materials that comprise the soft cannula, who have had problems in the past with soft cannula sets becoming kinked or dislodged, or who have high muscle mass and low body fat. This type of infusion set should be changed every 24-48 hours.
- Soft cannula infusion sets are more popular than steel cannula infusion sets, are generally considered more comfortable, are good for those prone to allergic reactions to nickel, and may cause less trauma to the tissue. The soft cannula set is inserted with a steel introducer needle that is removed after insertion is complete. Soft cannula infusion sets should be changed every 48-72 hours.
- Many practitioners have new pump users initially wear steel cannula infusion sets until they become used to inserting the sets and wearing the pump. The advantage is that the risk of the catheter kinking or bending is greatly minimized while the practitioner is attempting to regulate insulin doses with the new pump.

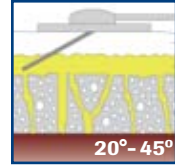


▪ 90° versus angled insertion

- 90° infusion sets are inserted straight into the skin at a 90° angle and have a shorter introducer needle; therefore, this type of set is good for quick insertion and for people who have needle phobia.



- Angled infusion sets are inserted at an angle of 20°-45° to the skin and have a longer introducer needle; therefore, this type of set is good for slow insertion and to provide a greater variety of infusion depths to accommodate differences in amounts of subcutaneous tissue as well as fatty tissue.



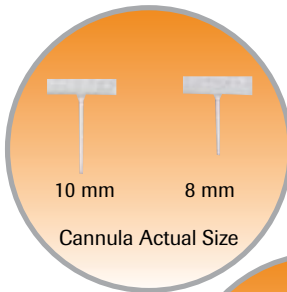
- Regardless of the type of infusion set or whether the person inserts it quickly or slowly, the set should be inserted in one smooth motion.

▪ Cannula lengths

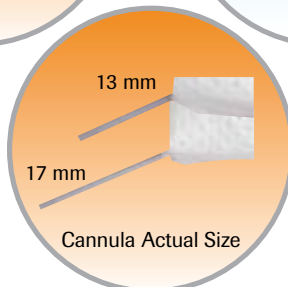
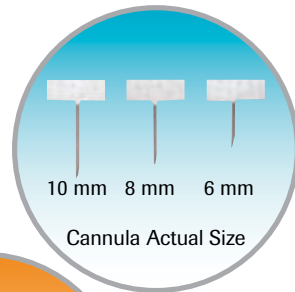
- 90° and angled infusion sets come in 2-3 different lengths to accommodate various amounts of subcutaneous tissue.

Representative infusion set cannula lengths

**ACCU-CHEK Ultraflex
Infusion Set**



**ACCU-CHEK Rapid-D
Infusion Set**



**ACCU-CHEK Tender
Infusion Set**

Age	Body mass index (BMI) weight in kilograms + (height in meters) ²	Recommended cannula length
Children <12 years old Very slim adults	Any	6 mm 8 mm / 10 mm
Adolescents 12-18 years old	Normal (BMI < 25) Overweight (BMI > 25)	6 mm 8 mm / 10 mm
Adults	Normal (BMI < 25) Overweight (BMI > 25)	6 mm 8 mm / 10 mm

Source: Disetronic Medical Systems Inc.

The table describes recommended cannula lengths based on various body mass index (BMI) levels. Please note that these recommendations are not absolute; careful monitoring by the healthcare provider is required to ensure proper cannula length for each individual based on BMI, activity level, lifestyle and physiology.

▪ Insertion depth

- Angled infusion sets are designed to be inserted at a 20°-45° angle. By varying the insertion angle, this type of set offers the most control over insertion depth. When using angled sets, both the angle and depth of insertion can be adjusted and may be slightly different with each insertion. Therefore, careful monitoring by the healthcare provider is used to determine the correct depth for each individual when using angled infusion sets.



- Using 90° sets allows for consistency in insertion depth.

- **Tubing lengths**

- Most infusion sets are produced with a variety of tubing lengths to fit different body sizes and to accommodate wearing the pump in a variety of places. (It is important to ensure that there is enough tubing to easily perform everyday activities such as placement of the pump when using the restroom.) Please note that infusion set tubing may not be interchangeable among brands or types of infusion sets. Use the tubing specifically designed for your infusion set to avoid problems.

- **A note on infusion set priming**

- Proper priming techniques are crucial for consistent insulin delivery. Air bubbles in the tubing can lead to missed insulin delivery, resulting in unpredictable blood glucose levels. **While disconnected**, be sure to prime the tubing completely, checking for air bubbles. Occasionally, bends in the infusion set tubing can look like an air bubble. In this case, if additional priming does not cause the suspected “bubble” to move, it is probably a bend in the tubing. Learn to recognize air bubbles and continue priming until all air bubbles are removed.

- **Recommended length of use**

- Steel cannula—change every 24-48 hours.
- Soft cannula—change every 48-72 hours.

The above usage guidelines help to ensure that the infusion set will perform well. Again, a certain amount of trial and error is necessary, as some patients may require an infusion set change on a more frequent basis. Consequences of wearing an infusion set longer than recommended include infection, redness or pus at the infusion site; pain; hardening of infusion site and decreased and/or unpredictable insulin absorption. Changing the infusion set at the recommended intervals, as well as practicing good site rotation, are keys to long-term infusion success.

- **Packaging options**

- Some sets are packaged with the infusion set plus tubing and with extra needles packaged without the tubing; this packaging is designed to allow changing of the steel cannula every 24-48 hours or soft cannula every 48-72 hours as directed while using the tubing for up to 6 days. See the infusion set manufacturer’s instructions for use to determine correct usage.

- **Filling volume**

- Infusion sets are packaged with a variety of tubing lengths and therefore require different filling volumes. The longer the tubing, the more insulin it takes to fill it.
- Some infusion set tubings are co-extruded, which means that there is a tube within a tube, creating a smaller inner diameter. Advantages include less insulin filling volume and decreased likelihood of kinking the tubing.

- **Insertion technique**

- Some people prefer a quick insertion (jabber) while others prefer a slow, controlled insertion (tapper).
- Regardless of the insertion technique, the set should be inserted in one smooth motion. Consistency is the key when inserting an infusion set!

- One-handed versus two-handed insertion

- Infusion sets that can be inserted with only one hand are useful for:

- People with dexterity problems or who can use only one hand
- Alternate site placement

- Generally, steel cannula sets inserted at 90° can be inserted with one hand, because it may not be necessary to pinch up the skin upon insertion.



- **Insertion devices**

- Most infusion sets are designed for easy insertion without the aid of an insertion device. However, for some people, an insertion device may lower the resistance to insertion and may provide less painful and more consistent cannula placement. An insertion device can be helpful for:

- Children or people with needle phobia
- People with dexterity issues or unsteady hands
- Insertion in difficult-to-reach places, such as the hips or upper buttocks



- As helpful as insertion devices are for some people, it must also be recognized that insertion devices:
 - Decrease control over the depth of insertion
 - Apply the same insertion force, regardless of skin thickness
 - If disposable, are more expensive and add to waste
- **Infusion set materials and allergy**
 - Steel cannulas are made of pure surgical stainless steel. Stainless steel used in infusion sets can contain as much as 8-12% nickel. People who experience an allergic reaction to nickel or stainless steel should use caution when trying this type of infusion set. Signs of an allergic reaction include redness, itchiness or mild pain.
 - Soft cannula sets utilize a stainless steel introducer needle to allow the soft cannula to be placed in the subcutaneous tissue. In this case, the stainless steel needle is removed upon insertion of the soft cannula and remains under the skin for only a few seconds.
 - Soft cannula sets have a Teflon® cannula, are latex free, and do not contain PVC (polyvinyl chloride).
 - Some people may be allergic to the adhesive in the dressing or the glue used to manufacture the infusion sets; trial and error with different products is recommended to determine individual sensitivity.
 - Because every person can react differently to infusion set materials, it's a good idea to have the patient sample various infusion set types.

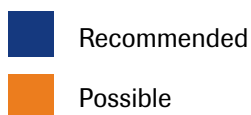
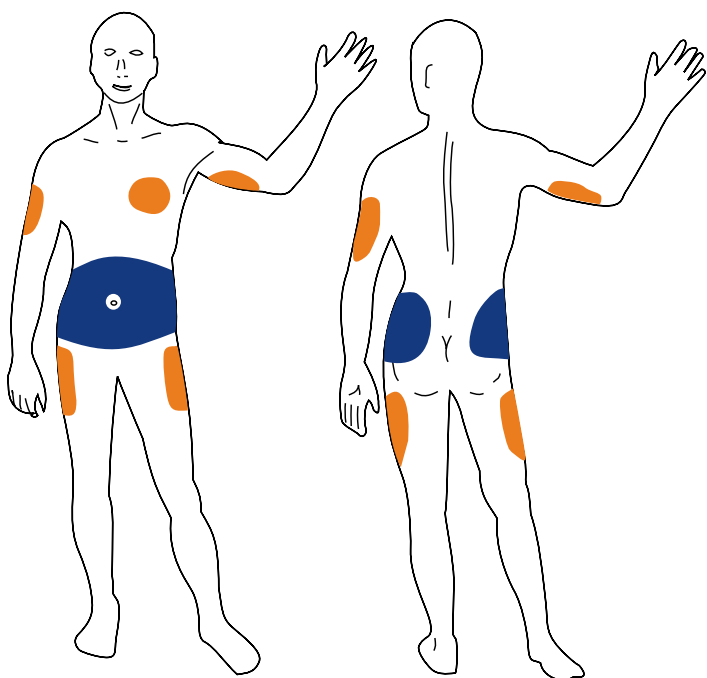
Infusion Site Selection

Recommended Areas & Absorption Differences

Because of the differences in absorption rates of different parts of the body, basal rate adjustments may be needed based on blood glucose monitoring results.

- **Abdomen**
 - Best absorption area.
- **Hips and upper buttocks**
 - Slower absorption than abdominal area, but an excellent location for people who are very active or who have low body fat.
- **Outer thighs**
 - Slower absorption than abdomen, but absorption may accelerate with activity.
 - Use of the inner thigh area may increase the risk of irritation and infection (i.e., cellulitis).
- **Back of the arms**
 - Slower absorption than abdomen, but absorption may accelerate with activity.
 - This area is also more difficult to use if two hands are required for insertion.
- **Breast tissue**
 - In some cases, breast tissue can be successfully used as an infusion site. Please check with your healthcare provider before using this area.





Areas to Avoid

- 2 inches around belly button
- High sensitivity areas
- Under a waistband
- Areas exposed to rubbing or bumping
- Over a bone
- Blood vessels
- Scar tissue/surgical scars
- Fatty tissue overgrowth
- Bruised areas
- Liposuction
- Body piercing
- Tattoos

Site Preparation

General Practices to Teach Patients

▪ Aseptic technique

- Start with clean hands. Proper hand washing technique involves using an antibacterial soap and warm water for 2 minutes, then drying hands completely with a clean towel.
- To cleanse the insertion area, start in the center of the area and wipe with a cloth moistened with antibacterial soap and warm water, sterile prep pad or alcohol swab in an outward and circular motion, cleaning an area about the size of a tennis ball.
- Allow the area to air dry for at least 60 seconds; do not blow on the site to help it dry faster.



▪ Body hair

- Trim the hair around the insertion area or use an electric razor; using other means of hair removal may lead to irritation and/or infection.

Special Challenges for Some Pump Users

▪ Excessive perspiration or humidity

- See **Related Products** section for extra-strength adhesives.
- When using products, make sure the skin is clean and dry between all applications and before insertion.
- Sandwich technique—cleanse the skin using an adhesive wipe, allow to dry, apply a sterile dressing, insert the set into the dressing, and cover the set with another sterile dressing to “sandwich” the infusion set. It may be desirable to cut a hole in the center of the top sterile dressing to allow for easy disconnection.



- **Athletes, children and very active people**
 - Follow same procedure as for excessive perspiration or humidity.
 - Place the site in an area that will not be agitated by the activity.

- **People prone to infection**
 - People on immunosuppressive agents or anti-rejection medications should perform a triple preparation procedure or as recommended by their physician or healthcare worker:
 - Wash the area with an antibacterial soap and let dry.
 - Cleanse the area with an antibacterial solution and let dry.
 - Apply an antiseptic and adhesive wipe to the area and let dry.
 - Pump users should never use an infusion set beyond the recommended period.

- **Needle phobia**
 - Numb the site
 - See **Related Products** section for topical anesthetics.
 - Some products can take up to 30 minutes to properly numb the site; it is important that the pump user is capable of inserting the set without numbing the skin for an emergency set change. Cold (e.g., ice) can be used if no anesthetic is available.

Infusion Set Insertion

Inserting Infusion Sets

- NEVER USE A PREVIOUSLY OPENED PACKAGE; A NEW STERILE INFUSION SET SHOULD ALWAYS BE USED.
- Inserting the set while in a standing position ensures more comfortable site placement.
- To achieve a clean, direct insertion the skin must be “tight.” Depending on the user’s skin type and insertion site, this can be achieved by pinching or stretching the skin taut.
 - If the skin “dimples” on insertion, the person should stretch rather than pinch the skin.
 - The set should be inserted in one smooth motion.
- Insertion devices are designed to stretch and hold the skin, eliminating the need for manual manipulation of the skin.
- **Bolus for airspace**
 - A bolus is required after insertion of a soft cannula infusion set in order to fill the airspace created once the introducer needle is removed.
 - The amount of the bolus is determined by the length of the cannula and the pump’s ability to deliver that amount of insulin (see infusion set package insert for the recommended amount).
- Blood glucose level should be checked 1 to 3 hours after insertion of a new set to ensure proper infusion; therefore, changing the set at bedtime is not recommended. This is especially important when using soft cannula sets, as they have the potential to kink or bend upon insertion.





Infusion Set Removal

Removing the Dressing

- While in the shower, use warm water to loosen the dressing.
 - Arranging site changes around a morning shower will aid in easier removal of the old set and will help to prepare the skin for insertion of a new set. Also, it may be easier to remember to do a post-site-change blood glucose test after getting ready for the day (approximately 1 hour after insertion).
- Remove the dressing by loosening all four corners and peeling it towards the center.
- As an alternative, apply baby oil or a solvent (see **Related Products** section) to the edge of the dressing to loosen it and dab the skin underneath as the dressing is being removed.
- Once the dressing is loose, the skin should be kept taut while carefully removing the dressing. Firm pressure should be applied if bleeding or oozing occurs, and the site should be watched carefully for proper healing for the next 2-3 days.
- The cannula should always be inspected after removal to check for kinking or blood.
- Infusion sets and dressings should be disposed of safely according to local biohazard material regulations.
- AN INFUSION SET SHOULD NEVER BE REMOVED AND REINSERTED INTO ANOTHER SITE—ALWAYS USE A NEW INFUSION SET AND SELECT A NEW LOCATION.



Post-removal Skin Care

- Some practitioners may recommend application of Bactroban Cream® or other antibiotic ointment.
- Pump users with dry skin may benefit from using a moisturizer after removal of the set (proper hydration will also aid in maintaining healthy, hydrated skin).

- Some pump users develop infusion site scarring that does not resolve despite proper skin care. This type of skin problem is very difficult to treat, but should not interfere with insulin delivery.
- Proper skin care of areas of lipohypertrophy involves avoiding use of the area until the hypertrophy resolves.

Infusion Sets and Pregnancy

Site Management During Pregnancy

Site management during pregnancy (sometimes referred to as gestational diabetes) is highly individualized. The selection and management of infusion sets and insertion techniques should be discussed with the members of the healthcare team most experienced with the various infusion sets and the changing needs of a woman during pregnancy. The important thing is to keep the blood glucose readings in a normal range, as defined by the healthcare team. Frequent blood glucose checks are required, as well as a backup insulin delivery plan, an “emergency kit” of supplies, and, of course, good infusion site management techniques.

- **In general, the following parameters apply**

- First trimester

As long as the mother-to-be is comfortable with her current infusion set and already has good infusion site management techniques, no changes in infusion set type or infusion site management techniques are usually needed. Some women prefer not to insert in the central area of the abdomen during the first trimester, but as long as insertion and infusion site placement is comfortable and insulin is being absorbed predictably (as evidenced by blood glucose readings) site placement options are similar to those of a non-pregnant woman.

Since blood glucose levels are often erratic and unpredictable during the first trimester due to hormonal changes, it is especially important to review signs and treatment of DKA (diabetic ketoacidosis) and hypoglycemic reactions. At a minimum, pre- and post-prandial (before and after food consumption) blood glucose measurements, as well as a bedtime and often a 2-3 a.m. blood glucose check, will be needed, as recommended by the healthcare team. Remember to carry additional infusion sets, a backup insulin injection device as well as fast-acting glucose and, if recommended by your healthcare team, a glucagon kit.

- Second Trimester

As women may start to gain adipose (fatty) tissue in the hip/flank areas with pregnancy, insertion sets and sites need to be revisited. Anyone using short cannula infusion sets may need to consider with their healthcare team the use of longer cannula lengths. In addition, the insertion sites may need to migrate to the side of the abdomen/flank/hip areas. It is still safe to insert centrally, but many pregnant women prefer to keep their infusion sites in a less obvious location. With excessive weight gain or if carrying multiples, there is an additional challenge of reaching insertion sites and manipulating the insertion set. In these cases, an infusion set with a short “pig tail” of additional tubing—like the ACCU-CHEK Rapid-D infusion set—may make reaching the infusion set disconnection mechanism much easier.

The hormonal changes of second trimester are more predictable and there is generally less risk of hypoglycemia. The more likely scenario may be high blood glucose readings. In addition, the insulin requirements may steadily and often dramatically increase. Again, frequent blood glucose checks and consultation with the healthcare team are essential. Infusion site management continues to be very important, especially if the healthcare team recommends increased insulin infusion volume. Very often the healthcare team will begin to advise more frequent infusion set changes beginning in the second trimester until the baby is delivered.



- Third Trimester

As the pregnancy progresses, women often develop stretch marks and tight, shiny skin abdominally. The general rule is to avoid these areas as infusion sites. The infusion site areas often preferred are the “love handle” areas of the hips on each side. The general rule is that if you can “pinch an inch” it probably is a good site. Many women find a deeper insertion angle is needed to attain good insulin absorption. In this case, using a longer cannula—or if using an angled insertion set, utilizing a deeper insertion angle while staying in the subcutaneous tissue—allows this flexibility. Again, based on the advice of the healthcare team, the infusion set may need to be changed more frequently than the manufacturer’s recommendations due to the often increased doses of insulin required. During this time, blood glucose readings need to be taken frequently, and basal/bolus doses will probably change. In the few days prior to the onset of labor, insulin requirements will probably drop—a clue to “pack the bags”!

- Post Partum

Generally speaking, women might be expected to go back to their pre-pregnancy infusion sets and site rotation patterns after giving birth. In reality, women often have been exposed to new infusion set products and site management techniques through pregnancy and like them! They learn to approach infusion set management in new ways and integrate this information into life after pregnancy.

Related Products

For Skin Preparation:

Antiseptics

- Antibacterial soap
- Hibiclens®
- Betadine®
- Povidone iodine wipes
- BZK wipes (benzalkonium chloride)

Adhesive Solutions

- Tincture of benzoin
- Antiperspirant
- Skin Bond® (latex based)
- Mastisol® (latex-free)
- Skin-Tac-H® (latex-free)

For Securing the Site:

Tapes

- Hypafix™
- Mefix®
- Transpore™
- Micropore™
- Paper tape

Barrier Wipes

- IV Prep® wipes
- Skin-Prep®
- Bioclusive™
- Bard® Protective Wipes

Topical Anesthetics

- Ice
- Cold spoon
- Numby stuff®
- LMX4™ cream
- EMLA cream (prescription only)

Sterile Dressings

- OpSite® IV 3000
- PolySkin™ II
- Tegaderm™
- Tegaderm™ HP
- DuoDerm®

For Skin Care After Removal:

Anti-allergy

- Benadryl® spray
- Hydrocortisone cream

Anti-itch

- Aveeno®
- Benadryl® spray
- Caladryl®
- Cortizone

Solvents and Adhesive Removers

- Baby oil
- Uni-Solve®
- Detachol®
- Remove™

Topical Antibacterial Ointments

- Bacitracin
- Neosporin®
- Polysporin®
- Bactroban Cream®
(prescription only)

Products listed are registered trademarks of their respective owners.

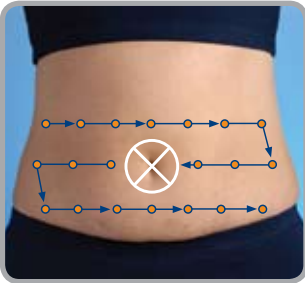
Site Rotation

Site Rotation Patterns

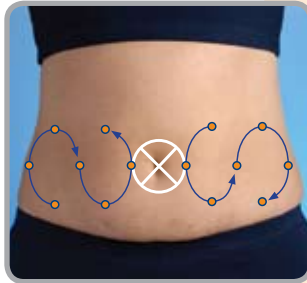
Site rotation is an essential component of successful infusion therapy. Proper site rotation helps minimize the chances of infection, scarring and other site problems, and helps to ensure good insulin absorption. Simply put, site rotation is a systematic method of moving the infusion set to various locations to ensure that the just-used site has a chance to fully heal before another infusion set is inserted into that area. Any site rotation method that works well for the individual can be used. Some suggestions are listed below for those who have not yet established a site rotation pattern.

- New sites should be at least:
2 inches (5 cm) away from a previous site, as well as
2 inches (5 cm) away from the belly button.

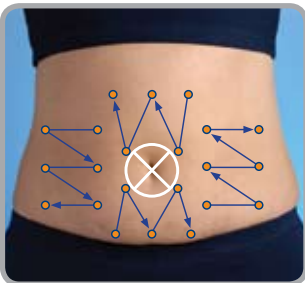
▪ Horizontal Pattern



▪ Curve Pattern



▪ Zig Zag Pattern



▪ Crisscross Pattern



Site Rotation Frequency

- Writing the date of insertion on the infusion set adhesive dressing with a permanent marker may be helpful as a reminder to change the infusion set on the appropriate day.
- Steel cannulas must be changed every 24-48 hours.
- Soft cannulas must be changed every 48-72 hours.
- **Exceptions**
 - During pregnancy, entire infusion sets should be changed every 24-48 hours, or as directed by the healthcare team.
 - The set should be changed *immediately* if you have two high unexplained blood glucose readings within 2 hours (after attempts at a meal or blood glucose correction bolus, whether or not ketones are present), or if pain, irritation or bleeding occurs. (If a correction bolus has failed to bring down an unexplained elevated blood glucose reading, the patient should contact their physician or follow their physician's recommendations in addition to changing the infusion set.)

Consequences of Poor Site Rotation

- Unpredictable insulin absorption.
- "Pump bumps" found at the point of insertion.
- Scar tissue.
- Increased risk of infection.
- Lipohypertrophy.
 - Lipohypertrophy is an enlargement in the area where the infusion set is placed (see figures below).
 - Lipohypertrophy can result in poor absorption and increased insulin use.



Lipohypertrophy Front View



Lipohypertrophy Side View

Special Considerations

- Pump users may prefer different types of infusion sets for different sites—for example, using an angled infusion set for the abdominal area and a 90° set for the hip area.
- “Pump bumps” are areas under the skin that feel like small frozen peas. Generally they occur when a set has been left in too long. Pump bumps are the body’s natural reaction to a foreign object and will disappear over time. It is best to avoid this area until the bump is no longer noticed by touch. A good general rule to avoid pump bumps is to follow the infusion set package insert guidelines and recommended length of use. If you cannot remember the last time you changed your site, it’s a good time to change it.
- If you suspect you have an infected site, contact your healthcare provider immediately!
- Site rotation during pregnancy: It is a general rule that infusion sites may be placed into subcutaneous tissue anywhere you can “pinch an inch” in the recommended insertion areas. This is also true during pregnancy. Although utilizing the abdomen will not harm the baby, most women prefer the hip and outer thigh areas for site placement once the abdomen begins to grow. Proper infusion site rotation at least every 24-48 hours or more frequently based on the recommendation of the healthcare team should be stressed due to the importance of maintaining tight blood sugar control during gestation.
- If you have been inserting in areas of lipohypertrophy and you move your site to a new area, your insulin requirements may need to be reduced, so frequent blood sugar checks are recommended.

Preventing Infection

Important Points for Pump Users to Know

- Infections generally begin under the skin at the tip of the cannula, not on the surface.
- **Signs and symptoms of infection:**
 - Elevated blood sugar
 - Redness
 - Heat
 - Lump under the skin
 - Pus
 - Pain
 - Fever
- Serious infections may require surgical incision and drainage.
- Systemic antibiotics may be required for treatment; pump users should not delay in contacting their healthcare provider.

Steps to Take for Infection Prevention

- Always wash your hands.
- Keep all parts of the infusion set clean.
- Follow proper infusion site preparation techniques according to the infusion set instructions for use and the recommendation of your healthcare provider.
- Avoid touching or breathing on the infusion set cannula and the insertion area when prepping the site; allow the prepped site to air dry for at least 60 seconds prior to inserting the infusion set.
- Never keep site longer than recommended.
- Never reuse products unless approved on labeling.
- Never use products if the seal has been broken or if the expiration date has passed; these conditions lead to a break in the sterility of the product.
- Always assure a proper seal between the dressing and the skin.

- Use a safety loop (tape a loop of tubing to the skin near the insertion site). If the tubing is accidentally pulled, the safety loop will prevent the set from being dislodged.



- Change site at the first sign of pain, swelling, discomfort or redness.
- Inspect the site frequently for problems.
- **“When in doubt, change it out!”**

Disconnecting and Reconnecting

Disconnecting

- **Reasons to disconnect from the pump (The Four S's)**

- Sports
- Swimming/showering
- Sexual activity
- Scanning (CAT scan, MRI, etc.)



- **Preventing gravity infusion**

- The pump user should *never* disconnect the tubing at the pump while the infusion set and tubing are still connected to the body.

- **Pump on or off**

- Generally it is better to leave the pump “on” or in “run” when disconnecting briefly in order to prevent occlusions and to avoid having to remember to restart the pump; only a very small amount of insulin is lost during the disconnect time.

- **Needle covers and protectors**

- Covers and protectors provided with the infusion set packaging should be utilized.
- Covers and protectors should be kept clean by storing them in a clean container (e.g., contact lens case, empty test strip vial, or a film canister).

Reconnecting

- **Prevent backflow of insulin**

- While still disconnected from the pump, the pump user should prime 1-2 units of insulin and visually confirm flow of insulin or confirm by dripping insulin on back of hand.

- **Ensure secure connection**

- Some infusion sets have an audible “click” to ensure a secure connection. In addition, a quick visual check accompanied by a gentle tug on the tubing at both the pump connection and infusion set connection can also help ensure a secure connection.

Time Off Pump/Missed Basal

- Usually no adjustment is necessary for being off of the pump for less than an hour.
- Adjustments may have to be made for longer periods.
- There may be times when replacing missed insulin is unnecessary due to the activity level while the pump is off (i.e., physical activity).
- The pump user should always check blood glucose before disconnecting and every hour while disconnected to help determine the appropriate action.
- Before going into a Jacuzzi®, sauna or tanning bed, the pump user should disconnect from the pump. Be aware that the increased temperature exposure from these activities may cause hypoglycemia from increased insulin absorption or hyperglycemia from denatured or “bad” insulin.

Special Situations

Situation	Solutions & Suggestions for the Pump User
Rash/itching	<ul style="list-style-type: none"> ▪ Could be due to loss of protective skin oils with use of alcohol or soap; cleanse the skin and create a barrier using antiseptic and adhesive wipes.
Pump bumps—white or red dots at the point of insertion	<ul style="list-style-type: none"> ▪ Cover the area with a topical antibacterial ointment; observe and monitor the area for infection. To prevent in the future, make sure not to wear the set longer than recommended, and follow a consistent site rotation plan.
Lumps under the skin	<ul style="list-style-type: none"> ▪ Do not wear the infusion set longer than recommended and follow a consistent site rotation plan. ▪ Change the site placement, the type of infusion set or the type of insulin.
Burning during a bolus	<ul style="list-style-type: none"> ▪ If the bolus is large, use an extended bolus or deliver the bolus in 2 equal parts before and after the meal. ▪ Try a different type of infusion set or a shorter length cannula.
Dressing does not stick well	<ul style="list-style-type: none"> ▪ Make sure site is clean and dry prior to insertion. ▪ Apply an extra-strength adhesive. ▪ Use the sandwich technique: cleanse the skin using an adhesive wipe; allow to dry; apply a sterile dressing; insert the set into the dressing; cover the set with another sterile dressing to “sandwich” the infusion set
Dressing sticks too well	<ul style="list-style-type: none"> ▪ Carefully remove dressing after loosening with a skin-friendly adhesive remover or baby oil to prevent skin irritation. ▪ Run warm water over dressing in the shower to help loosen the adhesive.
Bleeding or bruising at the site	<ul style="list-style-type: none"> ▪ Bruising at the site: replace the set and tubing in a new area; do not rub the area; do not utilize the area for future site placement until the bruising has completely disappeared. ▪ Blood in cannula or tubing: replace the set using a new area and tubing if necessary. ▪ Bleeding from insertion site upon removal: apply firm pressure to the area with a sterile cloth; do not rub the area.
High blood sugar response after site change	<ul style="list-style-type: none"> ▪ Place new infusion set in different area; attach the tubing to new site; prime for the airspace; leave the old infusion set in the skin for 1-2 hours after the new site has been placed to allow for complete absorption of remaining insulin.
Insulin leaks out of site once set is removed	<ul style="list-style-type: none"> ▪ Due to lipohypertrophy or the set not being placed deep enough; change the infusion site placement and/or try a longer cannula or deeper placement.

General Tips

Pump users with impaired vision or dexterity problems may require extra training to ensure proper site placement and maintenance. Athletes and pet owners should also take extra precautions when wearing infusion sets.

Tips for Pump Users with Impaired Vision and/or Dexterity Problems

- **Priming**
 - Following the infusion set instructions for priming, the pump user should hold the end of the tubing or the set over the back of the hand to confirm that the tubing is completely primed once a drop of insulin can be felt and smelled on the back of the hand.
- **Insertion**
 - Using an adhesive wipe will help the pump user identify the selected, cleansed area of insertion by feeling for the “tacky” skin that remains after an adhesive wipe is used.
- **Reconnecting**
 - Most infusion sets have an audible click to verify that the set has been properly reconnected. In addition, a quick visual check accompanied by a gentle tug on the tubing at both the pump connection and infusion set connection can help ensure a secure connection.

Tips for Pump Users Who Are Athletes

- When choosing a site location, be sure to avoid placing the infusion set in areas that may have a higher risk of being bumped or otherwise dislodged. Also, consider using a safety loop as described on page 30. Check the infusion site often during athletic activity. Use of additional adhesive solutions or sterile dressings may be advised for more rigorous athletic activity. Since athletic activity can decrease blood glucose levels, be sure to check blood glucose frequently, and adjust basal insulin delivery accordingly.

Tips for Pump Users with Pets

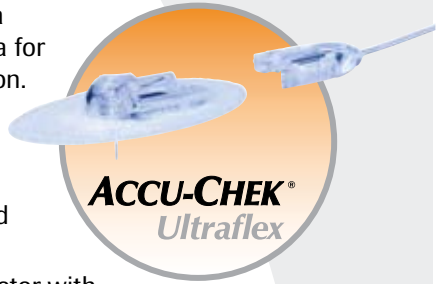
- Pay close attention to the infusion set tubing, and consider using a safety loop as shown on page 30. Cats and dogs can be intrigued by the infusion set tubing and can easily tug on the tubing, potentially dislodging the infusion set. Also, be cautious of kinks, bends or bites in the infusion set tubing. These can lead to reduced and/or unpredictable insulin flow.

Tips for Specific Infusion Sets

Making the right choice when it comes to infusion sets involves the advice of the healthcare team and an assessment of body type, lifestyle and activity levels. The family of ACCU-CHEK infusion sets features a wide range of designs, cannula and tubing lengths, and insertion options to fit the pump user's needs.

▪ **ACCU-CHEK Ultraflex infusion set**

- 90° insertion angle with a specially-tapered cannula for easy, comfortable insertion.
- Two cannula lengths and three tubing lengths for maximum comfort, convenience and wearability.
- Unique, reversible connector with an audible safety “click” for easy reconnection.
- Integrated introducer needle cover designed to fit tightly for easy disposal.
- Easy-grip blue holder cap to aid insertion.
- Easy-to-locate tabs for removal of paper backing.
- Ridges at the connection point for easy identification of disconnection area.



▪ **ACCU-CHEK LinkAssist automatic insertion device**

- For use with the ACCU-CHEK Ultraflex infusion set.
- Automatic insertion for consistent cannula placement.
- Easier insertion in hard-to-reach infusion sites.
- Open base allows insertion site viewing.
- Automatic safety lock helps prevent unintentional activation.
- One-finger activation for quick and easy insertion.



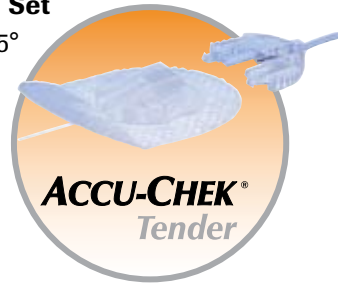
▪ **ACCU-CHEK Rapid-D infusion set**

- 90° insertion angle and non-kinking stainless steel cannula for “no mistake insertion.”
- Three cannula lengths and three tubing lengths for maximum comfort, convenience and wearability.
- Primes as a unit, requiring fewer preparation steps.
- Easy-to-remove paper backing with tabs that can be grasped with fingers or a device.
- Easy-grip handle to assist in insertion.
- Easy twisting connection and audible connection confirmation.
- “Pig tail” for easier connection/disconnection in hard-to-reach insertion sites.



▪ **ACCU-CHEK Tender Infusion Set**

- Angled insertion with a 20°-45° range accommodates a variety of body types and lifestyles.
- Two cannula lengths and three tubing lengths for maximum comfort, convenience and wearability.
- Easy-to-handle base unit.
- Ridges at the connection point for easy identification of disconnection area.
- Rounded top and flat bottom allow only one option for proper reconnection.
- May be especially appropriate for lean individuals.
- Requires finer technique and may not be the most appropriate choice for individuals with impaired vision or dexterity problems.



For more information about ACCU-CHEK infusion sets, visit disetronic-usa.com.

Troubleshooting

Infusion Set-Related Hyperglycemia

Related to the Pump

- Have you received an occlusion alarm on your pump?
See “Troubleshooting Occlusions and Obstructions” on page 40 for proper procedure.
 - Solution: Contact technical support for the pump company if unable to determine cause of problem.

Related to the Tubing

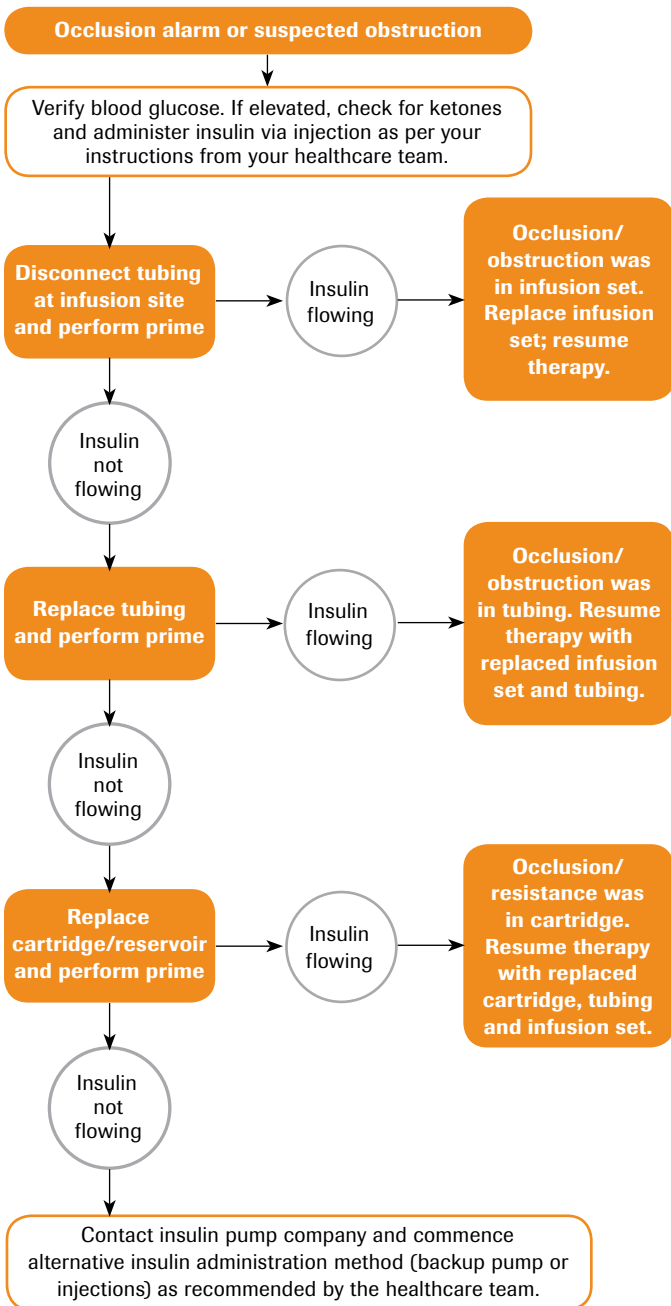
- Is there blood in the tubing?
- Is the tubing “clicked in” to the infusion set?
- Is there air in the tubing?
 - Solution: Disconnect the tubing from the set and prime out the air **immediately** (infusing air instead of insulin does not harm the tissue, but it can lead to hyperglycemia due to interference with insulin infusion).
 - Prevention: Fill the cartridge with room temperature insulin; draw the insulin from the vial using a slow and steady technique and be sure to check the tubing and system for air bubbles.
- Are there leaks in the tubing or at the luer-lock connection? Do you smell insulin?
- Has the tubing been used longer than recommended?
- Has the tubing been reused, but not according to the manufacturer’s instructions?
 - Solution: Change tubing; be sure connections are tight and re-prime, making sure you are disconnected from your site and ensuring that there are no air bubbles left in the tubing.

Related to the Site

- Is there blood in the cannula?
- Is the cannula dislodged from the skin or kinked?
- Is the dressing wet or leaking?
- Is there rash, redness, drainage or pain at the site?
- Has the site been used longer than recommended?
 - Solution: Change infusion set; inspect cannula for kinking upon removal.

Troubleshooting Occlusions and Obstructions

Use this handy flow chart to help identify and troubleshoot suspected occlusions and obstructions.



Glossary

Basal delivery: A continuous 24-hour delivery of insulin that matches background insulin needs.

Basal rate: The rate at which a continuous, low level of insulin is delivered.

Blood glucose: The main sugar found in the blood and the body's main source of energy. Also called blood sugar.

Blood glucose level: The amount of glucose in a given amount of blood. It is noted in milligrams per deciliter (mg/dL) or millimoles per liter (mmol/L).

Blood glucose meter: A small, portable machine used by people with diabetes to check their blood glucose levels. After pricking the skin with a lancet, one places a drop of blood on a test strip in the machine. The meter (or monitor) soon displays the blood glucose level as a number on the meter's digital display.

Blood glucose monitoring: Checking blood glucose levels on a regular basis in order to manage diabetes. A blood glucose meter (or blood glucose test strips that change color when touched by a blood sample) is needed for frequent blood glucose monitoring.

Blood sugar: See *blood glucose*.

Bolus: A dose of insulin delivered quickly to match carbohydrate intake or to bring a high blood glucose back to normal.

Cannula: The Teflon® or stainless steel tube through which insulin is delivered into the skin.

Certified Diabetes Educator (CDE): A healthcare professional with expertise in diabetes education who has met eligibility requirements and successfully completed a certification exam. See *diabetes educator*.

Co-extruded: A smaller tube within a tube.

Complications: Harmful effects of diabetes such as damage to the eyes, heart, blood vessels, nervous system, teeth and gums, feet and skin, or kidneys. Studies show that keeping blood glucose, blood pressure, and low-density lipoprotein cholesterol levels close to normal can help prevent or delay these problems.

Diabetes educator: A healthcare professional who teaches people with diabetes how to manage their condition. Some diabetes educators are Certified Diabetes Educators. Diabetes educators are found in hospitals, physician offices, managed care organizations, home healthcare and other settings.

Diabetic ketoacidosis (DKA): An emergency condition in which extremely high blood glucose levels, along with a severe lack of insulin, result in the breakdown of body fat for energy and an accumulation of ketones in the blood and urine. Signs of DKA are nausea and vomiting, stomach pain, fruity breath odor and rapid breathing. Untreated DKA can lead to coma and death.

DKA: See *diabetic ketoacidosis*.

Extended bolus: A bolus of insulin given over an extended period of time.

Gestational diabetes mellitus (GDM): A type of diabetes mellitus that develops only during pregnancy and usually disappears upon delivery, but increases the risk that the mother will develop diabetes later. GDM is managed with meal planning, activity and, in some cases, insulin.

Glucagon: A hormone produced by the alpha cells in the pancreas that raises blood glucose. An injectable form of glucagon, available by prescription, may be used to treat severe hypoglycemia.

Glucose: One of the simplest forms of sugar.

Glucose tablets: Chewable tablets made of pure glucose used for treating hypoglycemia.

Hyperglycemia: A condition in which the blood contains an abnormally high level of glucose, characteristic of diabetes mellitus.

Hypoglycemia: Too low a level of glucose (sugar) in the blood. This occurs when a person with diabetes has injected too much insulin, eaten too little food, or has exercised without extra food. A person with hypoglycemia may feel nervous, shaky, weak or sweaty, and have a headache, blurred vision and hunger. Hypoglycemia is treated by consuming a carbohydrate-rich food such as a glucose tablet or juice. It may also be treated with an injection of glucagon if the person is unconscious or unable to swallow. Also called an insulin reaction.

Infusion set: A device that carries insulin from the insulin pump to the body.

Infusion site rotation: Changing the sites on the body where insulin is infused or injected.

Injection: Inserting liquid medication or nutrients into the body with a syringe. A person with diabetes may use short needles or pinch the skin and inject at an angle to avoid an intramuscular injection of insulin.

Insertion device: A spring-loaded device into which an infusion set headset fits, and which injects the cannula into the skin with the press of a button.

Insulin: A hormone secreted by the beta cells of the Islets of Langerhans in the pancreas. Needed by many cells to use glucose for energy.

Insulin adjustment: A change in the amount of insulin a person with diabetes takes based on factors such as food intake, activity and blood glucose levels.

Insulin pump: A small, computerized, programmable device about the size of a pager that can be programmed to send a steady stream of insulin into the bloodstream as basal insulin, as well as larger amounts prior to meals as boluses. It replaces insulin injections.

Introducer needle: A needle that extends through the soft cannula and punctures the skin, thus “introducing” the cannula into the tissue. The needle is removed after the set has been inserted, leaving the cannula in place.

Jabber: Someone who prefers a quick insertion of their infusion site.

Ketoacidosis: A very serious condition in which the body does not have enough insulin. An excess release of free fatty acids causes high levels of ketones to accumulate in the blood and urine. Also see *diabetic ketoacidosis*.

Ketone: A chemical produced when there is a shortage of insulin in the blood and the body breaks down body fat for energy. High levels of ketones can lead to diabetic ketoacidosis and coma. Sometimes referred to as ketone bodies.

Ketosis: A ketone buildup in the body that may lead to diabetic ketoacidosis. Signs of ketosis are nausea, vomiting and stomach pain.

Lipohypertrophy: An overgrowth of fatty tissue caused by not changing infusion sites.

Low blood sugar: See *hypoglycemia*.

Luer-lock connector: The fitting on the end of the infusion set tubing and on the insulin pump cartridge that allows them to be connected, or locked, together securely.

Needle phobia: Fear of needles and inability to give oneself an injection.

Occlusion: Blockage.

Postprandial blood glucose: The blood glucose level taken 1 to 2 hours after eating.

Preprandial blood glucose: The blood glucose level taken before eating.

Proprietary infusion set: An infusion set made to fit a specific pump; doesn't fit on any other pumps or devices.

Pump: See *insulin pump*.

Sandwich technique: Placement of a dressing under and over an infusion set.

Self-management: In diabetes, the ongoing process of managing diabetes. Includes meal planning, planned physical activity, blood glucose monitoring, taking diabetes medicines, handling episodes of illness and of low and high blood glucose, managing diabetes when traveling, and more.

Sharps container: A container for disposal of used needles and syringes or other sharp objects; often made of hard plastic so that needles cannot poke through.

Staph carrier: Someone prone to infection with staphylococcus bacteria.

Subcutaneous infusion: Putting a fluid (e.g., insulin) into the tissue just under the skin with an infusion set.

Syringe: A device used to inject medications (e.g., insulin) or other liquids into body tissues. The syringe for insulin has a hollow plastic tube with a plunger inside and a needle on the end.

Tapper: Someone who prefers a slow, controlled insertion of their infusion site.

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