

Testing "Home Care" Pumps

These instructions were prepared for anyone who needs to test "Kangaroo" feeding pumps, (Sherwood Medical Inc.); "Provider" pumps (Abbott Labs Inc., and Pancretec Inc.); and "CADD" pumps (Pharmacia Deltec Inc.)

The Kangaroo 224 and 324, the Provider ONE, the CADD-TPN, the CADD-1 and the CADD-PLUS are characteristic of many pumps carried by home care providers.

Follow these steps when testing home care pumps:

1. THROW AWAY USED SETS

If the pump you will be testing has a used set in it, take the set out of the pump and **throw it away!!!** Home care pumps are commonly used to infuse thick, sticky solutions. Even when diluted with water, these solutions can gum up Infutest's fluid system and make the Infutest unusable.

You should have one clean "test set" for each type of pump you will be checking with Infutest. If you use only distilled water, and drain and remove the set from the pump when you have finished testing, the "test set" should last a long time.

for more information about pump IV sets, Sse the Application Note, *PUMP IV SETS AND SYRINGES*.

2. USE DISTILLED WATER

The best liquid to use with Infutest is distilled water. **Clean** tap water having **low mineral content** is also acceptable for use with Infutest. To prevent bubbles from forming, the water should be at room temperature. **Saline (0.9% Injection USP), D5W, D25W and D50W are fluids that should be avoided at all costs.**

See the Application Note, *TEST FLUID RECOMMENDATIONS*, for more information.

3. PRIME THE INFUTEST CAREFULLY

Don't quickly discharge a lot of water into the Infutest when priming. Pushing too hard on the priming syringe

will generate turbulence in the water, which in turn will create a lot of little air bubbles inside the Infutest's fluid system. When testing home care pumps in particular, these little bubbles could result in erroneous measurements.

Prime a dry Infutest by carefully discharging about 30 ml from the priming syringe over 10 seconds. Repeat this step once or twice when initially priming a dry Infutest.

Before starting each test, gently flush the channel with about 5 ml of water. This is essential when testing all home care pumps.

More detail on this topic is provided in the Application Note, *BRUSH BETWEEN MEALS, FLUSH BETWEEN TESTS*.

4. PROGRAM THE PUMP APPROPRIATELY

Set the delivery rate on Kangaroo pumps between 100 and 250 ml/hr. Turn "OFF" the dose limit, or input a large volume (e.g. 100 ml).

Similar rates should be used when testing Provider and CADD-TPN pumps. On the Provider, set "AMOUNT" between 100 and 300, and set "TIME" to 01:00. Leave "TAPER UP" and "TAPER DOWN" times set to zero (just press "ENTER" when these times are displayed).

Use similar settings for the "INFUSION ML" and "INFUSION PERIOD (HR:MIN)" on the CADD-TPN pump. Do not input "TAPER ↑" or "TAPER ↓" times on the CADD-TPN.

If you are testing the CADD-PLUS pump, select Continuous Mode and input the maximum setting of 75.0 ML/H for Delivery Rate.

5. USE THE SINGLE RATE TEST

For home care pumps, select the "Single Rate Test" on Infutest's START screen. The Single Rate Test incorporates special software to accurately measure

the unique delivery pattern produced by Kangaroo, Provider, CADD-TPN and similar pumps.

Never select "Dual-Rate" or "PCA Pump" on the Infutest when testing home care pumps. These tests are meant for acute care pumps.

6. AUTOSEQUENCE FOR "DOSE" TESTS

If you need to measure the **exact** volume delivered by a home care pump in a test, then you should program and use an Infutest AutoSequence. The Infutest *Operating Manual* provides instructions on how to program AutoSequences using the Infutest's EDIT SEQ screen.

After selecting an AutoSequence on the EDIT SEQ screen, set "ENABLED" to "Yes", and then enter the pump manufacturer and model number. You must set the "RATE TEST" of the AutoSequence to "Single" for home care pumps. The most important parameter to program is the "INF TIMER". This will depend on the **dose** or the **VTBI** that will be infused from the home care pump during the test. Calculate the INF TIMER as follows:

$$\text{INF TIMER} = \frac{\text{Dose or VTBI (ml)}}{\text{Rate (ml/h)}} \times 3600$$

and then enter this number using the AutoSequence EDIT SEQ screen.

For example, you could program Infutest AutoSequence #1 to test the accuracy of a Kangaroo 324 in delivering a 20 ml DOSE. In your test, the Kangaroo's delivery rate is 200 ml/h. The INF TIMER must be set to:

$$\text{INF TIMER} = \frac{20 \text{ ml}}{200 \text{ ml/h}} \times 3600 = 360 \text{ seconds}$$

After programming, AutoSequence #1 would appear as follows:

AutoSequence 1			
ENABLED: Yes <-	RATE TEST: Single		
MFR: Shrwood	INF TIMER: 360 sec		
MOD: Kangaru	OCCL TEST: Off		
REMARK	AUTO-OUTPUT: Off		
Set pmp rate	OUTPUT PORT: None		
EXIT	AUTOSEQ+	MODIFY	SELECCT

7. USE INFUTEST'S "SYNCHRO-START"

When starting a test on a home care pump, you should always flush the Infutest channel and then press the "GO" key on the Infutest **first**, as directed by the START screen. After you start the Infutest, **then** you can start the home care pump. This is the case whether you are using the Single Rate Test, **or** an AutoSequence.

Kangaroo, Provider and CADD pumps all wait a few seconds after you press the "START" button before actually beginning to infuse. If you don't follow the above startup sequence, you will override Infutest's Synchro-Start feature. In this case, the Infutest will not be synchronized to the pump's delivery cycle, and so you will tend to get results which seem **low** compared to the pump's rate setting.

8. RUN THE TEST UNTIL 20 ML IS INFUSED

When testing Kangaroo, Provider and CADD-TPN pumps with the Single Rate Test, you should wait until "Vol.:" displayed on the Infutest is **at least 20 ml** before you press the STOP key. For these pumps, you must infuse a sizable volume to obtain an accurate measure of the average delivery rate, or "Avg Flow" as shown on the Infutest. With the pump set to 200 ml/hr, it will take 6 minutes to deliver the required 20 ml.

When testing CADD-1 and CADD-PLUS pumps, you only need to collect about 8 ml because these pumps deliver fluid in much smaller boluses. Run the Single Rate Test for 10 minutes or so to obtain an accurate measure of the average delivery rate.

As described previously, the best way to measure the exact amount of fluid delivered in a test is to use an AutoSequence. The AutoSequence INF TIMER should be programmed such that a volume or "dose" of **at least 20 ml** will be measured by the time the AutoSequence stops the test.

ABOUT HOME CARE PUMPS

Home care pumps are significantly different from the pumps used in the ICU of a hospital. Home care pumps are not intended to deliver critical medications, and so accuracy of fluid delivery in the *short-term* is not important. For home care applications, a volumetric accuracy of $\pm 5\%$ is adequate as determined over relatively long intervals ranging from ten minutes to one hour.

To reduce physical dimensions, battery size, and power consumption, most home care pumps operate by alternately turning on and off a motor which drives the fluid delivery mechanism. Since the motor runs at one speed, the duration of the motor's "on-cycle" and the interval between on-cycles determines the flow rate.

For Kangaroo and Provider pumps, the bolus delivered in the "on-cycle" can range from 0.2 to 2 ml (0.5 ml for CADD-TPN; 0.05 ml for CADD-1 and CADD-PLUS). A few seconds to several minutes may elapse between "on-cycles". This type of delivery characteristic is typical of pumps used in enteral feeding applications, where viscous nutrient solutions may be infused through a nasogastric tube. Clinically, the cyclic delivery characteristic produced by enteral feeding pumps may help prevent aspiration of the formula in some patients.

When testing enteral feeding and other home care pumps, short-term indications, such as those provided by the Infutest, can be expected to fluctuate significantly about the pump's set rate depending on *synchronization* of Infutest's measurement cycle to the pump's alternating delivery cycle. Because of the highly intermittent nature of the delivery, a substantial volume (e.g. 20 ml) must be collected to obtain an accurate and meaningful measure of the flow rate.

Starting a measurement at an appropriate instant in the delivery cycle is also important, unless the total volume collected is very much larger than the bolus delivered in the "on-cycle". To minimize the volume which must be collected in a test, it is necessary to synchronize the measuring instrument to the pump's delivery cycle. This is true whether the measuring instrument is a burette, an electronic scale, or the Infutest. The "Synchro-Start" feature of the Infutest has been specifically developed to achieve the necessary synchronization to the fluid delivery produced by enteral feeding and other home care devices, and thus greatly simplify the testing of such devices.