PUMP FAILURE GUIDELINE
Planning Ahead

All technology, including pumps, can fail occasionally, even within their warranty period. It is important to be able to independently initiate injection treatment if required. The aim of this guide is to assist you in this process.

Remember: More than 2 hours without insulin delivery can lead to Diabetic Ketoacidosis (DKA).

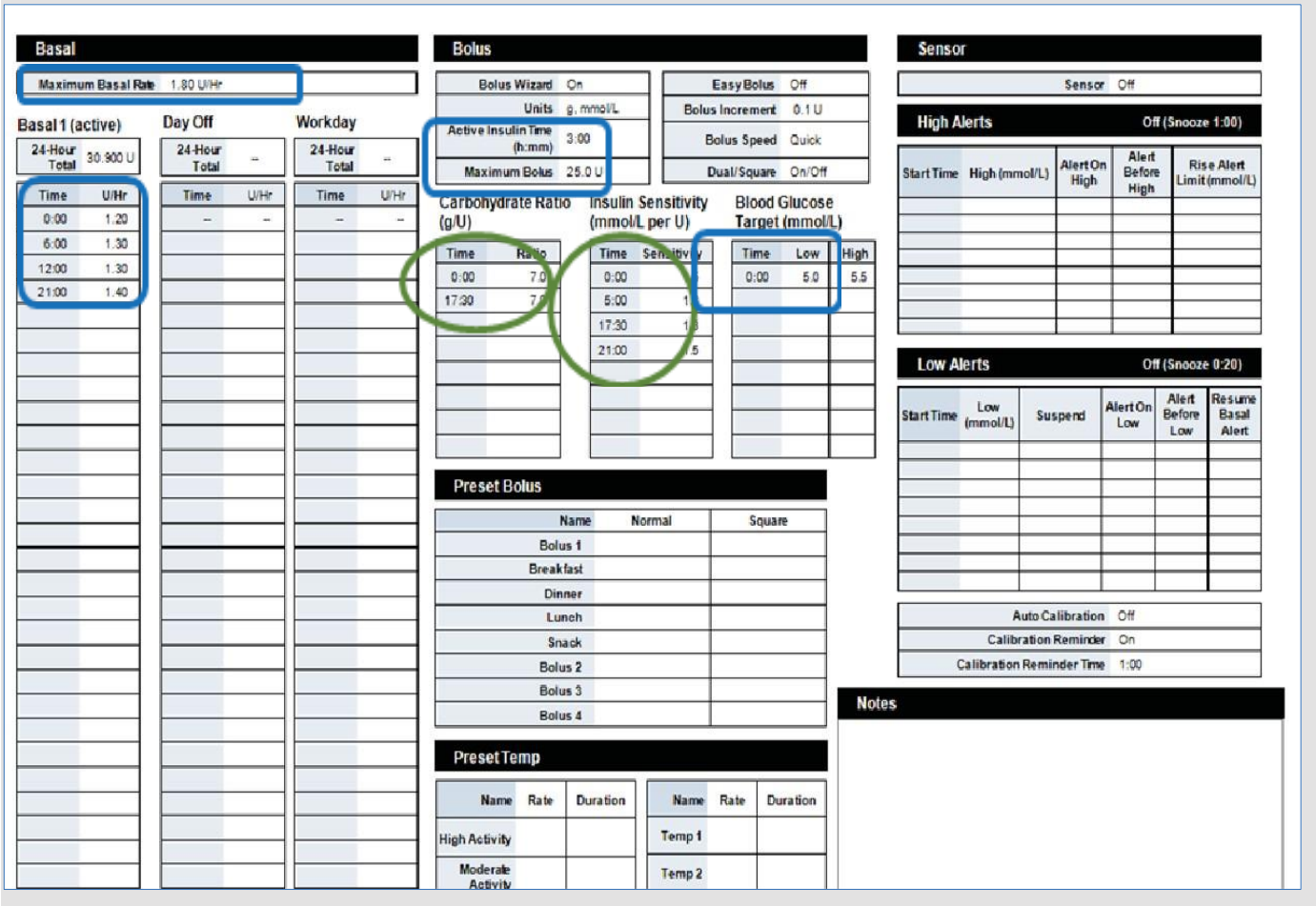
Be prepared: - All families on pump therapy should ensure they have:

- Novorapid or Humalog pens with penfill cartridges or disposable pens
- Pen needles
- An up-to-date prescription (in date) for long-acting insulin (Lantus)
- A plan of how to calculate doses if you need to change back to injections

To be able to calculate doses you will need to refer to the pump's programmed settings. The best way to ensure you have your child's latest data is to **upload the pump regularly.** One page gives you all the settings you will need.

Note: Specific device details are provided for the pumps currently funded; the clinical advice stands for all pump users

Medtronic Carelink Professional settings page (below):



As kaitiaki (carers/guardians) of diabetes related services, it is a collective responsibility to establish an environment that facilitates a pathway for people with diabetes to navigate te ao mate huka - the world of diabetes[1].

[1] Te Kaiwhakahaere Māori te Roopu mate huka Debbie Rawiri - Te Whatu Ora Waitaha Canterbury

Tandem Settings (https://my.glooko.com/users/sign_in)- Go to Create PDF report, click Devices, click Create PDF

Pump Volume: Quick Bolus — High
Pump Volume: Reminders — Medium

Basal

Active basal program

Bolus

Max Bolus — 12 U
Quick Bolus Enabled — OFF

Hybrid closed loop

Closed Loop Enabled — ON
Total Daily Insulin — 45 U
Weight

Basal

Active	
00:00 (5 hr)	0.6 Units/hr
05:00 (5 hr)	1 Units/hr
10:00 (7 hr)	0.85 Units/hr
17:00 (7 hr)	1.4 Units/hr
Total	23.75 Units
Lazy day	
00:00 (5 hr)	0.78 Units/hr
05:00 (5 hr)	0.91 Units/hr
10:00 (7 hr)	0.845 Units/hr
17:00 (7 hr)	1.3 Units/hr
Total	23.465 Units

Insulin:Carb ratios

Active	
00:00 (5 hr)	6 g/Unit
05:00 (5 hr)	5.5 g/Unit
10:00 (7 hr)	8 g/Unit
17:00 (7 hr)	4.5 g/Unit
00:00 (5 hr)	6 g/Unit
05:00 (5 hr)	5.5 g/Unit
10:00 (7 hr)	12 g/Unit
17:00 (7 hr)	4.5 g/Unit

Sensitivity (ISF, correction)

Active	
00:00 (5 hr)	2 mmol/L
05:00 (5 hr)	0.5 mmol/L
10:00 (7 hr)	0.5 mmol/L
17:00 (7 hr)	0.5 mmol/L
Lazy day	
00:00 (5 hr)	2 mmol/L
05:00 (5 hr)	2 mmol/L
10:00 (7 hr)	2 mmol/L
17:00 (7 hr)	2 mmol/L

BG target range

Active	
00:00 (5 hr)	6 mmol/L (+0/-0)
05:00 (5 hr)	6 mmol/L (+0/-0)
10:00 (7 hr)	6 mmol/L (+0/-0)
17:00 (7 hr)	6 mmol/L (+0/-0)
00:00 (5 hr)	5.5 mmol/L (+0/-0)
05:00 (5 hr)	5.5 mmol/L (+0/-0)
10:00 (7 hr)	5.5 mmol/L (+0/-0)
17:00 (7 hr)	5.5 mmol/L (+0/-0)

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Settings will be required to be able to calculate injection doses, and to enter into a replacement pump if needed.

It is worth spending the time on the phone to the pump company's helpline to enable uploading of the pump.

The **green shapes highlight the ICR and ISF you can use for injection doses if the pump fails.*

*The **blue shapes** highlight additional settings required for when you need to reprogram a replacement pump.*

You will need to know:

1. Current Insulin to Carbohydrate Ratio **(ICR)** – there may be multiple ICR's at different times of the day
2. Current Insulin Sensitivity Factor **(ISF)** - there may be multiple ISF's at different times of the day
3. 24-hour basal Total Dose

Calculating Your Insulin Dose:

- Your Lantus dose should be equal to your 24-hour basal total (round to the nearest whole number) and is to be given at the same time every day.
- If your pump screen is still working, you may be able to use it to calculate how much insulin to give as a rapid-acting insulin bolus by entering in the current Blood Glucose Level (BGL) and carbohydrate amount if eating and giving the calculated dose via injection.
- If your pump screen is not working, food bolus and correction doses can be manually calculated as below:

Insulin to Carbohydrate Ratio

Ratio →	3	4	5	6	7	8	9	10	11	12	15	18	20	25	30
Carbs ↓															
5	1	1	1	1	0.5	0.5	0.5	0.5	-	-	-	-	-	-	-
10	3	2	2	1.5	1	1	1	1	0.5	0.5	0.5	0.5	0.5	-	-
15	5	3	3	2	2	1.5	1.5	1.5	1	1	1	1	0.5	0.5	0.5
20	6	5	4	3	2.5	2.5	2	2	1.5	1.5	1	1	1	0.5	0.5
25	8	6	5	4	3	3	2.5	2.5	2	2	1.5	1	1	1	0.5
30	10	7	6	5	4	3.5	3	3	2.5	2.5	2	1.5	1.5	1	1
35	11	8	7	6	5	4	3.5	3.5	3	3	2	2	1.5	1	1
40	13	10	8	6.5	5.5	5	4	4	3.5	3	2.5	2	2	1.5	1
45	15	11	9	7	6	5.5	5	4.5	4	3.5	3	2.5	2	1.5	1.5
50	16	12	10	8	7	6	5.5	5	4.5	4	3	2.5	2.5	2	1.5
55	18	14	11	9	7.5	6.5	6	5.5	5	4.5	3.5	3	2.5	2	1.5
60	20	15	12	10	8.5	7.5	6.5	6	5	5	4	3	3	2	2
65	21	16	13	11	9	8	7	6.5	5.5	5	4	3.5	3	2.5	2
70	23	17	14	11.5	10	8.5	7.5	7	6	5.5	4.5	3.5	3.5	2.5	2
75	25	18	15	12	10.5	9	8	7.5	6.5	6	5	4	3.5	3	2.5
80	26	20	16	13	11	10	8.5	8	7	6.5	5	4	4	3	2.5

Insulin to Carbohydrate Ratio

Meal	Breakfast	Morning Tea	Lunch	Afternoon Tea	Dinner
ICR	1: _____	1: _____	1: _____	1: _____	1: _____

Insulin Sensitivity Factor (BGL drop from 1 unit of insulin)

ISF	1	1.5	2.0	2.5	3	4	5	6	7	8	10	12	15	20
7	1	0.5	0.5	-	-	-	-	-	-	-	-	-	-	-
8	2	1	1	0.5	0.5	0.5	-	-	-	-	-	-	-	-
9	3	2	1.5	1	1	0.5	0.5	0.5	-	-	-	-	-	-
10	4	2.5	2	1.5	1	1	0.5	0.5	0.5	0.5	-	-	-	-
11	5	3	2.5	2	1.5	1	1	0.5	0.5	0.5	0.5	-	-	-
12	6	4	3	2	2	1.5	1	1	0.5	0.5	0.5	0.5	-	-
13	7	4.5	3.5	2.5	2	1.5	1	1	1	0.5	0.5	0.5	0.5	-
14	8	5	4	3	2.5	2	1	1	1	0.5	0.5	0.5	0.5	-
15	9	6	4.5	3.5	3	2	1.5	1	1	1	0.5	0.5	0.5	-
16	10	6.5	5	4	3	2.5	1.5	1.5	1	1	0.5	0.5	0.5	0.5
17	11	7	5.5	4	3.5	2.5	2	1.5	1	1	1	0.5	0.5	0.5
18	12	8	6	4.5	4	3	2	1.5	1.5	1	1	1	0.5	0.5
19	13	8.5	6.5	5	4	3	2	2	1.5	1.5	1	1	0.5	0.5
20	14	9	7	5.5	4.5	3.5	2.5	2	2	1.5	1	1	0.5	0.5
21	15	10	7.5	6	5	3.5	3	2.5	2	1.5	1.5	1	1	0.5
22	16	10.5	8	6	5	4	3	2.5	2	2	1.5	1	1	0.5
23	17	11	8.5	6.5	5.5	4	3	2.5	2	2	1.5	1	1	0.5
24	18	12	9	7	6	4.5	3.5	3	2.5	2	1.5	1.5	1	0.5
25	19	12.5	9.5	7.5	6	4.5	3.5	3	2.5	2	1.5	1.5	1	0.5
26	20	13	10	8	6.5	5	4	3	2.5	2.5	2	1.5	1	1
27	21	14	10.5	8	7	5	4	3.5	3	2.5	2	1.5	1	1
28	22	14.5	11	8.5	7	5.5	4	3.5	3	2.5	2	1.5	1	1
29	23	15	11.5	9	7.5	5.5	4.5	3.5	3	2.5	2	1.5	1.5	1
30+	24	16	12	9.5	8	6	4.5	4	3	3	2	2	1.5	1

***Remember there must be a 2-hour gap between rapid-acting insulin injections to avoid insulin stacking**

***If ketones are >1.0 give 1.5 x correction**

What If You Haven't Done a Recent Pump Upload?

- It is strongly recommended you use **Appendix A** to record rates at least once per month, and when changes are made to rates.
- Use the pump history and record the Total Daily Dose (TDD) for the past 5 days.
- Add the 5 days together and divide by 5 to get an average TDD.

What If You Don't Have Any Long-Acting Insulin (Lantus)?

- Check glucose levels every 3 hours and give correction based on ISF.
- Give food bolus whenever eating using Insulin to Carbohydrate ratio.
- Request a prescription for Lantus from your team.

Calculating Insulin to Carbohydrate Ratio and Insulin Sensitivity Factor

Insulin to Carbohydrate Ratio

Under 5 Years Old - To get a general idea of what the ICR should be, use the **300 RULE:**

- Divide **300** by the average amount of insulin given over the last 5 days (average TDD).
- This gives you the carbohydrate part of the ratio.

For example:
If the average daily dose of insulin over the last 5 days is 15 units:
The calculation is 300 divided by 15 units, (300 / 15 = 20) so the ICR is 1:20.

5 Years or Older - To get a general idea of what the ICR should be, use the **400 RULE:**

- Divide **400** by the average amount of insulin given over the last 5 days.
- This gives you the carbohydrate part of the ratio.

For example:
If the average daily dose of insulin over the last 5 days is 50 units:
The calculation is 400 divided by 50 units, (400 / 50 = 8) so the ICR is 1: 8.

Insulin Sensitivity Factor (ISF)

To get a general idea of what the ISF should be, use the **100 RULE:**

- Divide **100** by the average daily amount of insulin given over the last 5 days

For example:
If the average daily dose of insulin over the last 5 days is 20 units:
The calculation is 100 divided by 20 units (100/20 = 5) so 1 unit lowers the blood glucose level by 5 mmol/L.

The total basal dose on the pump will give you a good guide of how much Lantus you child will require. If you are not sure what the total basal dose is, give 40% of the average TDD.

PUMP FAILURE CHECKLIST & PLAN

Checklist:

- Novorapid or Humalog penfill cartridges
- Pen needles
- Long-acting insulin or an in-date prescription (e.g. Lantus)

Action if your pump fails:

- Check BGL
- Check ketones if BGL > 15 mmol/l
- Give insulin if needed
- Give **long-acting** insulin via injection – either total basal daily dose, or if not sure what this is, give 40% of total daily dose (TDD x 0.4)
- Give **rapid-acting** insulin via injection before meals
- Call the pump company helpline or your local representative

Medtronic: 0800 633 487 (24-hour technical helpline)

Tandem: 0508 634 103 (24-hour technical support)

Note: in general, a pump failure can be managed by the family at home and should not require a call to the emergency service.

If no long-acting insulin is immediately available, rapid-acting insulin will be required every 3 hours via injection using your insulin sensitivity factor and whenever eating using your insulin to carbohydrate ratio.

Going back onto insulin pump therapy

After receiving a replacement pump, it is important to plan going back onto pump therapy. The Lantus dose should be halved the night before to going back onto the pump.

If you are unsure about any of the information given in this guide, please call your diabetes team for assistance

INSULIN PUMP RATES

APPENDIX A

Standard Basal Rate (s)	
Time	Hourly Rate
24 hour total basal:	

Total Daily Dose (last 5 days)		
Day	Date	Time

Insulin Sensitivity	
Time	ISF

Target Blood Glucose Level	
Time	Target Range

Insulin Carbohydrate Ratio	
Time	ICR