



Crystal Chem

Dog Insulin ELISA Kit Instruction

For the quantitative determination of insulin
in dog serum, plasma, and cell culture media

**Catalog #90156
96 Assays**

For research use only. Not for use in diagnostic procedures.

Crystal Chem, Inc.
1536 Brook Drive, Suite A
Downers Grove, IL 60515, USA
Tel: (630) 889-9003 Fax: (630) 889-9021
E-mail: sales@crystalchem.com
URL: <http://www.crystalchem.com>

TABLE OF CONTENTS

<i>A. Intended Use</i>	1
<i>B. Introduction</i>	1
<i>C. Principles of the Assay</i>	2
<i>D. Kit Storage</i>	2
<i>E. Assay Materials</i>	
E.1. Materials supplied.....	3
E.2. Materials required but not provided... ..	3
<i>F. Reagent Precautions</i>	4
<i>G. Maximizing Kit Performance</i>	4
<i>H. Preparation of Dog Plasma and Serum</i>	5
<i>I. Low Range Assay (0.1 – 6.4 ng/mL)</i>	
I.1. Preparation of reagents.....	5
I.2. Preparation of working dog insulin standards.....	7
I.3. Assay procedure	8
I.4. Determining the insulin concentration.....	9
<i>J. Wide Range Assay (0.1 – 12.8 ng/mL)</i>	
J.1. Preparation of reagents	10
J.2. Preparation of working dog insulin standards.....	10
J.3. Assay procedure	11
J.4. Determining the insulin concentration	12
<i>K. High Range Assay (1 – 64 ng/mL)</i>	
K.1. Preparation of reagents.....	13
K.2. Preparation of working dog insulin standards	13
K.3. Assay procedure	14
K.4. Determining the insulin concentration.....	15
<i>L. Appendix</i>	
L.1. Performance characteristics (low range assay).....	16
L.2. Summary of reagent preparation	16
L.3. Summary of Dog Insulin ELISA kit	17
<i>Warranty</i>	18

Catalog #90156

A. Intended Use

The Dog Insulin ELISA kit is for the quantitative determination of insulin in dog serum, plasma, and cell culture media. Please read the complete kit insert before performing this assay. The kit is for *RESEARCH USE ONLY*. It is not intended for use in clinical or diagnostic procedures or for internal or external use in humans or animals.

B. Introduction

Insulin is the primary hormone produced in the β cells of the islets of Langerhans, and is known not only to regulate glucose metabolism, ie. the uptake of blood glucose to the liver and peripheral tissues, but also play other important physiological roles.

Recent increases in the incidence of diabetes and obesity have stimulated intensive research on insulin levels and production. As a result, the accurate measurement of insulin in experimental animals is becoming increasingly important.

The kit is a simple, precise, and sensitive ELISA sandwich assay for dog insulin. The following assays can be run using the Dog Insulin ELISA kit:

TABLE 1 - Sensitivity of range of assay

Assay	Sensitivity Range (based on 5 μL sample)
Low range assay (Section I)	0.1 – 6.4 ng/mL
Wide range assay (Section J)	0.1 – 12.8 ng/mL
High range assay (Section K)	1 – 64 ng/mL

C. Principles of the Assay

1. First reaction

Dog insulin in the sample is bound to the guinea pig anti-insulin antibody coated on the microplate well.

2. Washing

Unbound material is removed by washing.

3. Second reaction

Horseradish peroxidase (POD)-conjugated anti-insulin antibody is then bound to the guinea pig anti-insulin antibody/dog insulin complex immobilized to the microplate well.

4. Washing

Excess POD-conjugate is removed by washing.

5. Enzyme reaction

The bound POD-conjugate in the microplate well is detected by the addition of the 3, 3', 5, 5'-tetramethylbenzidine (TMB) substrate solution.

6. Measurement of absorbance

7. Evaluation of results

The insulin concentration is determined via interpolation using the standard curve generated by plotting absorbance versus the corresponding concentration of dog insulin standard.

D. Kit Storage

1. Upon receipt of the Dog Insulin ELISA kit, store it at 2-8°C and avoid light exposure (do not freeze the kit or hold it at temperatures above 25°C).
2. The kit should not be used after the expiration date.

Catalog #90156

E. Assay Materials

E.1. Materials supplied

TABLE 2 - Contents of the kit

Mark	Description	Amount
A	Antibody-coated Microplate (One pack contains 6 x 8 well modules, i.e., 48 wells / pack)	2 packs
B	Dog Insulin Standard, Lyophilized	2.56 ng/vial (for 100 μ L)
C	Anti-Insulin Enzyme Conjugate Stock Solution	1 bottle (8 mL)
D	Enzyme Conjugate Diluent	1 bottle (4 mL)
E	Enzyme Substrate (TMB) Solution	1 bottle (13 mL)
F	Enzyme Reaction Stop Solution (1 N Sulfuric Acid)	1 bottle (13 mL)
G	Sample Diluent	1 bottle (30 mL)
H	Wash Buffer Stock Solution (20X Concentrate)	1 bottle (50 mL)
	Frame for affixing the microplate well module	1 piece
	Plastic microplate cover	1 piece

E.2. Materials required but not provided

Micropipettes and disposable tips

Volumetric flasks

Distilled or deionized water

Polypropylene microtubes

Test tube racks

Vortex mixer

Aspirator for washing procedure

Microplate reader (capable of measuring A_{450} and A_{630} values)

F. Reagent Precautions

1. Avoid direct contact with the Enzyme Substrate Solution (marked “E”) and the Enzyme Reaction Stop Solution (marked “F”). In case of contact, immediately flush eyes or skin with plenty of water and get medical advice.
2. Do not allow the Enzyme Substrate Solution (marked “E”) to contact any metal.
3. Only appropriately-trained personnel should use the kit. Laboratory personnel should wear suitable protective clothing. All chemicals should be considered potentially hazardous.

G. Maximizing Kit Performance

1. Given the small sample volumes required (5 μ L), pipetting should be done as carefully as possible. A high quality 10 μ L or better precision pipette should be used for such volumes. Drops of liquid adhering to the outside of the pipette tips should be removed by wiping to ensure the highest degree of accuracy.
2. In order to prevent the microplate wells from drying out, samples and reagents should be dispensed quickly into the wells. In no case should 10 minutes be exceeded per plate per assay step.
3. The wash procedure should be done thoroughly in order to minimize background readings.
4. Each standard and sample should be assayed in duplicate.
5. The same sequence of pipetting and other operations should be maintained in all procedures.
6. Do not mix reagents that have different lot numbers.

H. Preparation of Dog Plasma and Serum

Plasma: Collect blood into a tube containing an anticoagulant such as heparin (final concentration: 1 unit/mL), EDTA (final concentration: 0.1%), or sodium citrate (final concentration: 0.76%), and centrifuge at 4°C for 20 min at 2000 x g.

Serum: Collect blood, allow to clot, and centrifuge at 4°C for 20 min at 2,000 x g.

Note: *Be sure to avoid hemolysis during preparation. Do not use turbid serum or plasma samples. Turbid serum or plasma should be centrifuged to produce a clear solution. Samples which need to be diluted must be diluted using the Sample Diluent (marked "G").*

I. Low Range Assay (0.1 – 6.4 ng/mL)

I.1. Preparation of reagents

Prior to use, all reagents should be brought to room temperature (18-25°C), and should be stored at 2-8°C immediately after use. Before use, mix the reagents thoroughly by gentle agitation or swirling.

1. Antibody-coated microplate

Remove the "Antibody-coated Microplate" (marked "A") from the sealed foil pouch after the pouch has been equilibrated to room temperature.

Note: *The microplate pouch should be opened only once the kit is ready to be used. Any remaining unused wells should be stored properly back in the foil pouch as to avoid moisture.*

2. Dog insulin stock solution

Reconstitute the "Dog Insulin Standard, Lyophilized" (marked "B") by careful addition of 100 µL of distilled or deionized water to the vial. Invert the vial gently until the contents are completely dissolved. This stock solution contains 25.6 ng/mL of dog insulin. The reconstituted dog insulin stock solution is stable for one week at 2-8°C and one month at -20°C. For longer storage, stock solution should be stored at -80°C.

Catalog #90156

3. Anti-insulin enzyme conjugate

For six strips, prepare the needed volume of anti-insulin enzyme conjugate solution by mixing 3.6 mL of “Anti-Insulin Enzyme Conjugate Stock Solution” (marked “C”) with 1.8 mL of “Enzyme Conjugate Diluent” (marked “D”), and mix completely to ensure a homogeneous and clear solution. Prepare only enough as needed. Avoid foaming during mixing.

Note: *The anti-insulin enzyme conjugate should be prepared just before the second reaction and must be used immediately.*

4. Enzyme substrate solution

The “Enzyme Substrate Solution” (marked “E”) is provided as a ready-to-use preparation. Once the bottle is opened, the enzyme substrate solution should be handled with care and stored properly as to avoid contamination and maximize stability.

Note: *Avoid exposure of the enzyme substrate solution to light.*

5. Enzyme reaction stop solution (1 N sulfuric acid)

The “Enzyme Reaction Stop Solution” (marked “F”) is provided as a ready-to-use preparation.

6. Sample diluent

The “Sample Diluent” (marked “G”) is provided as a ready-to-use preparation. Once the bottle is opened, the sample diluent should be handled with care and stored properly as to avoid contamination and maximize stability.

7. Wash buffer

The “Wash Buffer Stock Solution” (marked “H”) should be brought to 1 L with distilled or deionized water in a volumetric flask. Mix the solution well before use. Prepare only enough as needed.

Catalog #90156

I.2. Preparation of working dog insulin standards

1. Pipette 150 μL of sample diluent (marked "G") and 50 μL of dog insulin stock solution (25.6 ng/mL) into a polypropylene microtube labeled 6.4 ng/mL, and mix thoroughly.
2. Dispense 50 μL of sample diluent into six polypropylene microtubes labeled 0.1, 0.2, 0.4, 0.8, 1.6, and 3.2 ng/mL, respectively.
3. Dispense 50 μL of the 6.4 ng/mL standard into the 3.2 ng/mL microtube, and mix thoroughly.
4. Dispense 50 μL of the 3.2 ng/mL standard into the 1.6 ng/mL microtube, and mix thoroughly.
5. Repeat this dilution scheme using the remaining microtubes.
6. Dispense 50 μL of sample diluent into one polypropylene microtube labeled 0 ng/mL.

Note: The working insulin standards should be prepared shortly before use and discarded after use. Prepare working insulin standards using polypropylene microtubes because polypropylene exhibits minimal adsorption of insulin.

TABLE 3 - Preparation of working dog insulin standards (low range assay)

	Dog Insulin concentration (ng/mL)							
	6.4	3.2	1.6	0.8	0.4	0.2	0.1	0
DISS*(μL)	50							
SD**(μL)	150	50	50	50	50	50	50	50
		50	50	50	50	50	50	
								
Total (μL)	200	100	100	100	100	100	100	50

DISS* : Dog Insulin Stock Solution (25.6 ng/mL)

SD** : Sample Diluent

Catalog #90156

I.3. Assay Procedure

First reaction:

1. Remove the antibody-coated microplate modules (marked "A") from the sealed foil pouch after the pouch has been equilibrated to room temperature. Affix the microplates to the supporting frame.
2. In each well, dispense 95 μL of sample diluent (marked "G").
3. Pipette 5 μL samples (or 0, 0.1, 0.2, 0.4, 0.8, 1.6, 3.2, and 6.4 ng/mL working dog insulin standards) into the wells.

Note: *Each standard and sample should be assayed in duplicate. It is also recommended that a 10 μL or better precision pipette be used when dispensing small volumes (5 μL).*

4. Cover the microplate with the plastic microplate cover and incubate for 2 hours at 4°C.

Second reaction:

5. Aspirate well contents and wash five times using 300 μL of wash buffer per well. After each wash, remove any remaining solution by inverting and tapping the plate firmly on a clean paper towel.
6. Dispense 100 μL per well of anti-insulin enzyme conjugate.
7. Cover the microplate with the plastic microplate cover and incubate for 30 minutes at room temperature.

Third reaction:

8. Aspirate well contents and wash seven times using 300 μL of wash buffer per well. After each wash, remove any remaining solution by inverting and tapping the plate firmly on a clean paper towel.
9. Immediately dispense 100 μL per well of enzyme substrate solution and react for 40 minutes at room temperature. During the enzyme reaction, avoid exposing the microplate to light.

Note: *Do not cover the microplate with aluminum foil.*

10. Stop the enzyme reaction by adding 100 μL per well of enzyme reaction stop solution (marked "F").
11. Measure absorbance within 30 minutes using a plate reader. (Measure A_{450} values and subtract A_{630} values).

Catalog #90156

I.4. Determining the insulin concentration

1. Determine the mean absorbance for each set of duplicate standards or samples.

Note: If individual absorbance values differ from the mean by greater than 20%, performing the assay again is recommended. The mean absorbance of the 0 ng/mL standard should be less than 0.1.

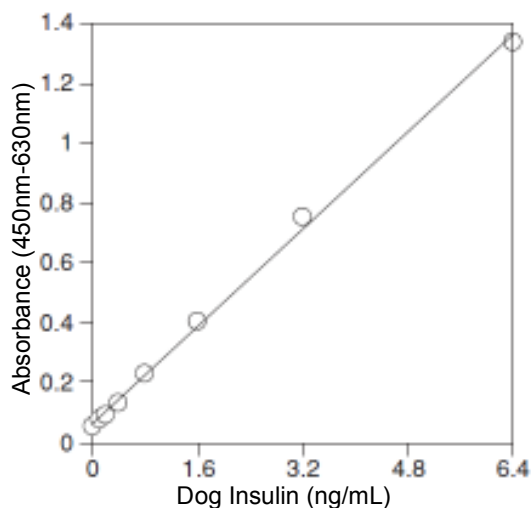
2. Using linear graph paper, construct the insulin standard curve by plotting the mean absorbance value for each standard on the Y axis versus the corresponding standard dog insulin concentration on the X axis. Figure 1 is an example of a typical standard curve generated by the low range assay.

Note: A standard curve should be plotted every time the assay is performed.

3. Dog insulin concentrations in the samples are interpolated using the standard curve and mean absorbance values for each sample.

Note: Samples with a high insulin concentration (6.4 ng/mL or higher) should be diluted with the sample diluent and rerun.

Figure 1 - A typical low range standard curve (linear fit)



Catalog #90156

J. Wide Range Assay (0.1 – 12.8 ng/mL)

J.1. Preparation of reagents

1. Prepare all the reagents for use according to Section I.1 under Low Range Assay.

J.2. Preparation of working dog insulin standards

1. Pipette 50 μL of sample diluent (marked "G") and 50 μL of dog insulin stock solution (25.6 ng/mL) into a polypropylene microtube labeled 12.8 ng/mL, and mix thoroughly.
2. Dispense 50 μL of sample diluent into seven polypropylene microtubes labeled 0.1, 0.2, 0.4, 0.8, 1.6, 3.2 and 6.4 ng/mL, respectively.
3. Dispense 50 μL of the 12.8 ng/mL standard into the 6.4 ng/mL microtube, and mix thoroughly.
4. Dispense 50 μL of the 6.4 ng/mL standard into the 3.2 ng/mL microtube, and mix thoroughly.
5. Repeat this dilution scheme using the remaining microtubes.
6. Dispense 50 μL of sample diluent into one polypropylene microtube labeled 0 ng/mL.

Note: The working insulin standards should be prepared shortly before use and discarded after use. Prepare working insulin standards using polypropylene microtubes because polypropylene exhibits minimal adsorption of insulin.

TABLE 4 - Preparation of working dog insulin standards (wide range assay)

	Dog Insulin concentration (ng/mL)								
	12.8	6.4	3.2	1.6	0.8	0.4	0.2	0.1	0
DISS*(μL)	50								
SD**(μL)	50	50	50	50	50	50	50	50	50
		50	50	50	50	50	50	50	
									
Total (μL)	100	100	100	100	100	100	100	100	50

DISS* : Dog Insulin Stock Solution (25.6 ng/mL)
SD** : Sample Diluent

Catalog #90156

J.3. Assay Procedure

First reaction:

1. Remove the antibody-coated microplate modules (marked "A") from the sealed foil pouch after the pouch has been equilibrated to room temperature. Affix the microplates to the supporting frame.
2. In each well, dispense 95 μL of sample diluent (marked "G").
3. Pipette 5 μL samples (or 0, 0.1, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, and 12.8 ng/mL working dog insulin standards) into the wells.

Note: *Each standard and sample should be assayed in duplicate. It is also recommended that a 10 μL or better precision pipette be used when dispensing small volumes (5 μL).*

4. Cover the microplate with the plastic microplate cover and incubate for 2 hours at 4°C.

Second reaction:

5. Aspirate well contents and wash five times using 300 μL of wash buffer per well. After each wash, remove any remaining solution by inverting and tapping the plate firmly on a clean paper towel.
6. Dispense 100 μL per well of anti-insulin enzyme conjugate.
7. Cover the microplate with the plastic microplate cover and incubate for 30 minutes at room temperature.

Third reaction:

8. Aspirate well contents and wash seven times using 300 μL of wash buffer per well. After each wash, remove any remaining solution by inverting and tapping the plate firmly on a clean paper towel.
9. Immediately dispense 100 μL per well of enzyme substrate solution and react for 40 minutes at room temperature. During the enzyme reaction, avoid exposing the microplate to light.

Note: *Do not cover the microplate with aluminum foil.*

10. Stop the enzyme reaction by adding 100 μL per well of enzyme reaction stop solution (marked "F").
11. Measure absorbance within 30 minutes using a plate reader. (Measure A_{450} values and subtract A_{630} values).

J.4. Determining the insulin concentration

1. Determine the mean absorbance for each set of duplicate standards or samples.

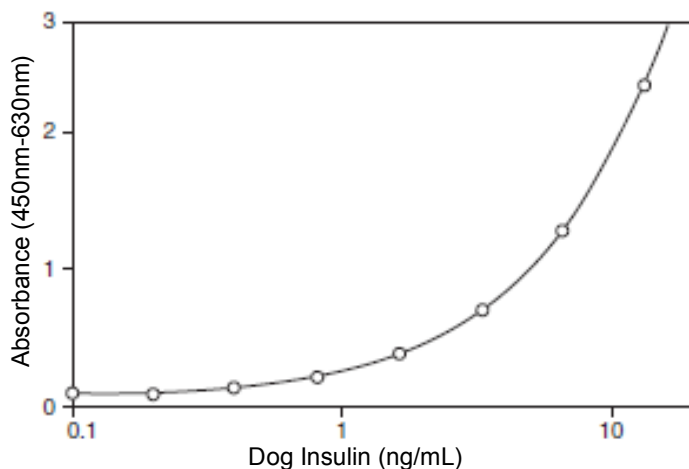
Note: *If individual absorbance values differ from the mean by greater than 20%, performing the assay again is recommended. The mean absorbance of the 0 ng/mL standard should be less than 0.1.*

2. Using semi-log graph paper, construct the insulin standard curve by plotting the mean absorbance value for each standard on the Y axis versus the corresponding standard dog insulin concentration on the X axis. Figure 2 is an example of a typical standard curve generated by the wide range assay.

Note: *A standard curve should be plotted every time the assay is performed.*

3. Dog insulin concentrations in the samples are interpolated using the standard curve and mean absorbance values for each sample.

Figure 2 - A typical wide range standard curve (4- parameter fit)



K. High Range Assay (1 – 64 ng/mL)

Note: *Bold underlined items denote the procedural differences between the low range and high range assay.*

K.1. Preparation of reagents

1. Prepare all the reagents for use according to Section I.1 under Low Range Assay except for the dog insulin stock solution and anti-insulin enzyme conjugate, which should be prepared as detailed below:

Dog insulin stock solution - Reconstitute the “Dog Insulin Standard, Lyophilized” (marked “B”) by careful addition of **40 μ L** of distilled or deionized water to the vial. Invert the vial gently until the contents are completely dissolved. This stock solution contains 64 ng/mL of dog insulin. The reconstituted dog insulin stock solution is stable for one week at 2-8°C and one month at -20°C. For longer storage, stock solution should be stored at -80°C.

Anti-insulin enzyme conjugate - For six strips (48 wells), prepare the needed volume of anti-insulin enzyme conjugate solution by mixing **2.0 mL** of “Anti-Insulin Enzyme Conjugate Stock Solution” (marked “C”), **1.0 mL** of “Enzyme Conjugate Diluent” (marked “D”), and **6.0 mL of “Sample Diluent” (marked “G”)**. Mix completely to ensure a homogeneous and clear solution. Prepare only enough as needed. Avoid foaming during mixing.

Note: *The anti-insulin enzyme conjugate should be prepared just before the second reaction and must be used immediately.*

K.2. Preparation of working dog insulin standards

1. Pipette 40 μ L of dog insulin stock solution (64 ng/mL) into a polypropylene microtube labeled 64 ng/mL.
2. Dispense 20 μ L of sample diluent into six polypropylene microtubes labeled 1, 2, 4, 8, 16, and 32 ng/mL, respectively.
3. Dispense 20 μ L of the 64 ng/mL standard into the 32 ng/mL microtube, and mix thoroughly.
4. Dispense 20 μ L of the 32 ng/mL standard into the 16 ng/mL microtube, and mix thoroughly.
5. Repeat this dilution scheme using the remaining microtubes.
6. Dispense 20 μ L of sample diluent into one polypropylene microtube labeled 0 ng/mL.

Note: *The working insulin standards should be prepared shortly before use and discarded after use. Prepare working insulin standards using polypropylene microtubes because polypropylene exhibits minimal adsorption of insulin.*

Catalog #90156

**TABLE 5 - Preparation of working dog insulin standards
(high range assay)**

	Dog Insulin concentration (ng/mL)							
	64	32	16	8	4	2	1	0
DISS*(μ L)	40							
SD**(μ L)	0	20	20	20	20	20	20	20
		20	20	20	20	20	20	
								
Total (μ L)	40	40	40	40	40	40	40	20

DISS* : Dog Insulin Stock Solution (64 ng/mL)

SD** : Sample Diluent

K.3. Assay Procedure

First reaction:

1. Remove the antibody-coated microplate modules (marked "A") from the sealed foil pouch after the pouch has been equilibrated to room temperature. Affix the microplates to the supporting frame.
2. In each well, dispense 95 μ L of sample diluent (marked "G").
3. Pipette 5 μ L samples (or 0, 1, 2, 4, 8, 16, 32, and 64 ng/mL working dog insulin standards) into the wells.

Note: *Each standard and sample should be assayed in duplicate. It is also recommended that a 10 μ L or better precision pipette be used when dispensing small volumes (5 μ L).*

4. Cover the microplate with the plastic microplate cover and incubate for 2 hours at 4°C.

Second reaction:

5. Aspirate well contents and wash five times using 300 μ L of wash buffer per well. After each wash, remove any remaining solution by inverting and tapping the plate firmly on a clean paper towel.
6. Dispense 100 μ L per well of anti-insulin enzyme conjugate.
7. Cover the microplate with the plastic microplate cover and incubate for 30 minutes at room temperature.

Third reaction:

8. Aspirate well contents and wash seven times using 300 μ L of wash buffer per well. After each wash, remove any remaining solution by inverting and tapping the plate firmly on a clean paper towel.
9. Immediately dispense 100 μ L per well of enzyme substrate solution and react for **10 minutes** at room temperature. During the enzyme reaction, avoid exposing the microplate to light.

Note: *Do not cover the microplate with aluminum foil.*

Catalog #90156

10. Stop the enzyme reaction by adding 100 μ L per well of enzyme reaction stop solution (marked "F").
11. Measure absorbance within 30 minutes using a plate reader. (Measure A_{450} values and subtract A_{630} values).

K.4. Determining the insulin concentration

1. Determine the mean absorbance for each set of duplicate standards or samples.

Note: If individual absorbance values differ from the mean by greater than 20%, performing the assay again is recommended. The mean absorbance of the 0 ng/mL standard should be less than 0.1.

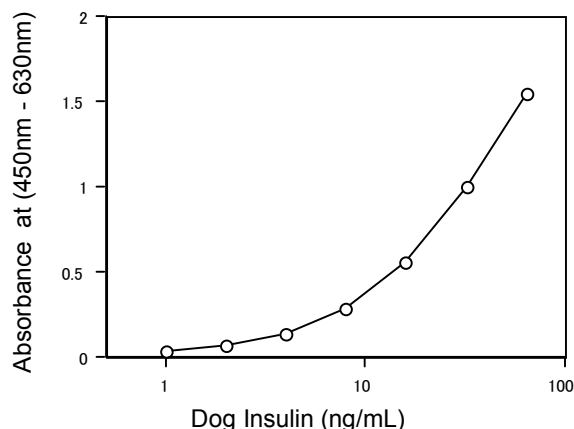
2. Using semi-log graph paper, construct the insulin standard curve by plotting the mean absorbance value for each standard on the Y axis versus the corresponding standard dog insulin concentration on the X axis. Figure 3 is an example of a typical standard curve generated by the high range assay.

Note: A standard curve should be plotted every time the assay is performed.

3. Dog insulin concentrations in the samples are interpolated using the standard curve and mean absorbance values for each sample.

Note: Samples with a high insulin concentration (64 ng/mL or higher) should be diluted with the sample diluent and rerun.

Figure 3 - A typical high range standard curve (4-parameter fit)



Catalog #90156

L. Appendix

L.1. Performance characteristics (low range assay)

1. Precision: The intra-assay precision C.V. $\leq$ 10%
The inter-assay precision C.V. $\leq$ 10%
2. Sensitivity: The analytical sensitivity of the low/wide range assay using a 5 μ L sample is 0.05 ng/mL.

L.2. Summary of reagent preparation

TABLE 6 - Summary of reagent preparation

Reagent	Preparation Procedure	
	Low/Wide Range	High Range
A: Antibody-coated Microplate	Ready to use	
B: Dog Insulin Standard, Lyophilized	Dilute with 100 μ L of water*	Dilute with 40 μ L of water*
C: Anti-Insulin Enzyme Conjugate Stock Solution	For 6 modules** Reagent C - 3.6mL	For 6 modules** Reagent C - 2mL
D: Enzyme Conjugate Diluent	Reagent D - 1.8mL	Reagent D - 1mL Reagent G - 6mL
E: Enzyme Substrate (TMB) Solution	Ready to use	
F: Enzyme Reaction Stop Solution (1 N Sulfuric Acid)	Ready to use	
G: Sample Diluent	Ready to use	
H: Washing Buffer Stock Solution (20X Concentrate)	Bring contents of the bottle to 1 L with water*	

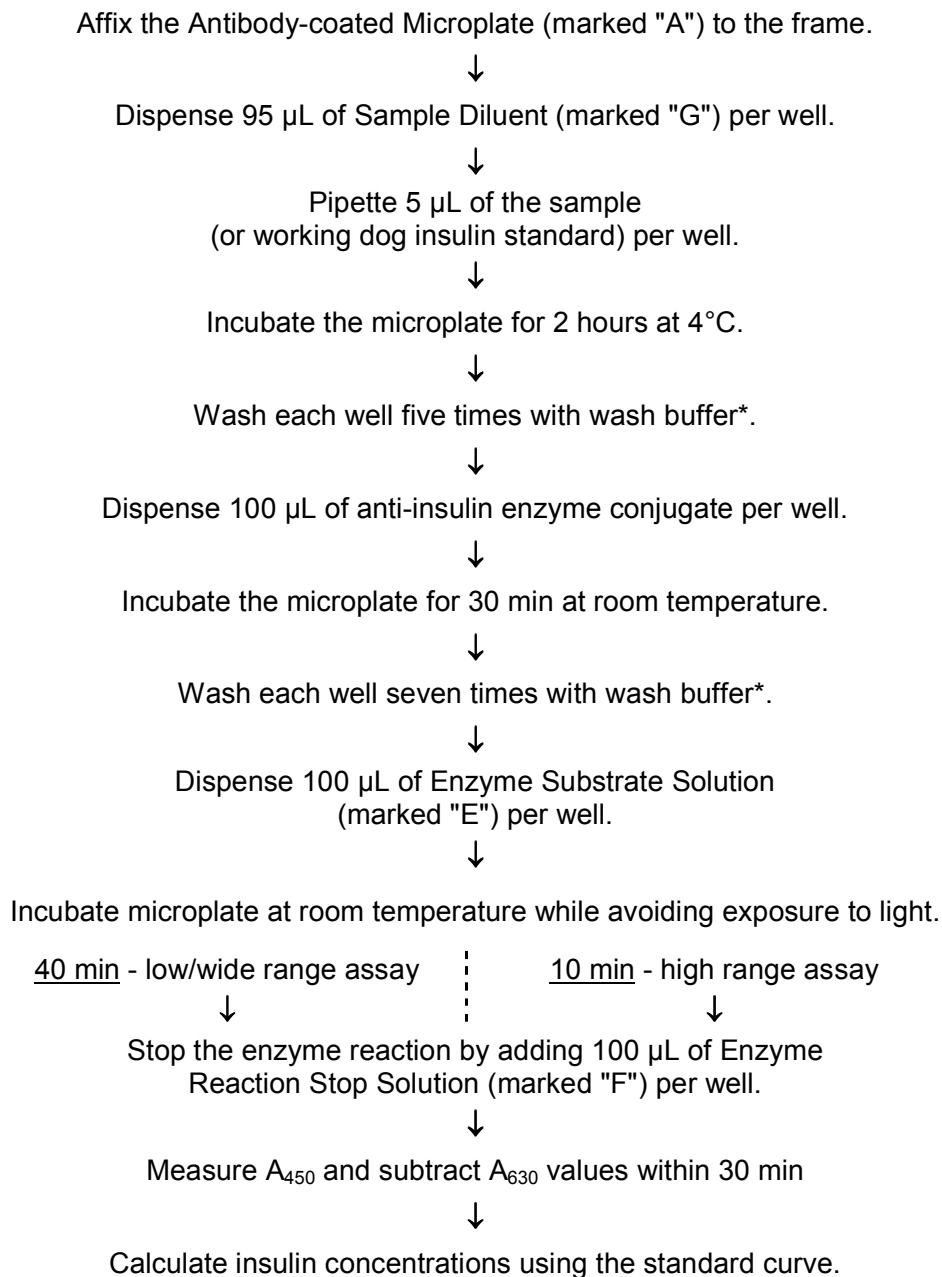
Note: All reagents should be brought to room temperature (18-25°C) prior to use.

* Distilled or deionized water.

** Prepare just before the second reaction.

Catalog #90156

L.3. Summary of Dog Insulin ELISA kit assay



* Each well should be washed with 300 µL of wash buffer. Aspirate the wells completely so all excess solution is removed.

Catalog #90156

Warranty

Crystal Chem Inc. makes no warranty of any kind, either expressed or implied, except that the materials from which its products are made are of standard quality. Buyer assumes all risk and liability resulting from the use of this product.

THERE IS NO WARRANTY OF MERCHANTABILITY OF THE PRODUCTS, OR THAT SUCH PRODUCTS ARE FIT FOR ANY PARTICULAR PURPOSE. CRYSTAL CHEM INC'S LIABILITY SHALL NOT EXCEED THE RETURN OF THE PURCHASE PRICE, AND UNDER NO CIRCUMSTANCES SHALL CRYSTAL CHEM INC. BE LIABLE FOR SPECIAL OR CONSEQUENTIAL DAMAGES, OR EXPENSES ARISING DIRECTLY OR INDIRECTLY FROM THE USE OF THIS PRODUCT.