

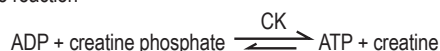
SPIFE® Touch CK Vis Isoenzyme Procedure

Cat. No. 3332, 3333

The SPIFE Touch CK Vis Isoenzyme procedure is intended for the qualitative and quantitative analysis of the creatine phosphokinase isoenzymes in serum by agarose electrophoresis using the SPIFE Touch system.

SUMMARY

Creatine phosphokinase (CK) (EC 2.7.3.2) is an energy transfer enzyme which catalyzes the reversible reaction



CK exists primarily in skeletal muscle, cardiac muscle and the brain, with small amounts in several other tissues.¹ A number of diverse clinical episodes such as surgical procedures, intramuscular injections and myocardial infarct induce increased CK activity in the serum.^{2,3} The source of elevated CK activity may be narrowed by isoenzyme assessment. There are two molecular CK subunits, designated M and B, the combinations of which produce three isoenzymes: CK-MM (isolated primarily from skeletal muscle), CK-MB (myocardium) and CK-BB (primarily from the brain).³

CK isoenzyme analysis is one of the important procedures used in the detection of myocardial damage.⁴ After an acute myocardial infarction (MI), CK-MB appears in the serum in approximately 4 to 6 hours, reaches peak activity at 18-24 hours, and may disappear completely within 72 hours. Within the first 48 hours after MI, CK-MB is present in 100% of the patients with MI as well as in some cases of severe coronary insufficiency.^{1,3,7}

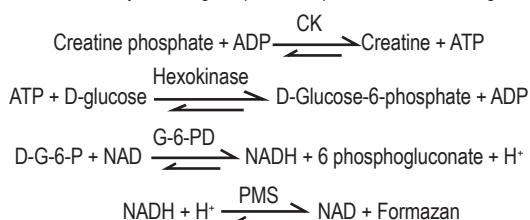
Definitive laboratory testing in the diagnosis of MI is accomplished by performing studies of CK isoenzymes in conjunction with lactate dehydrogenase (LD) isoenzymes.^{3,5-8} The specificity and sensitivity achieved with these two tests has eliminated the necessity for additional enzyme studies in accurately diagnosing MI.⁶ The most important consideration in the interpretation of CK and LD isoenzyme patterns is the detection of the characteristic change of pattern of multiple examinations (the relatively fast appearance and disappearance of CK-MB and the flip of LD1 and LD2).^{1,3,35} Persistent elevation in CK-MB is not indicative of myocardial infarct. CK-MB may be helpful in diagnosing a small infarct in which total CK never exceeds the upper limit of normal.⁹

CK produced by myocardium is only 25-40% CK-MB, the remainder being CK-MM.^{1,4} Therefore, an elevation in CK due to myocardial infarction produces not only a rise in CK-MB but in CK-MM as well.³ The isoenzymes of CK have been assessed by various methods.¹⁰⁻¹⁹ Electrophoresis offers the distinct advantage of complete separation of the isoenzymes without risk of carryover.³

PRINCIPLE

The isoenzymes of CK are separated according to their electrophoretic mobility on agarose gel. After separation the gels are incubated with the SPIFE CK Vis Isoenzyme Reagent.

The SPIFE CK Vis Isoenzyme Reagent (substrate) utilizes the following reactions:



REAGENTS

1. SPIFE CK Vis Isoenzyme Gel

Ingredients: Each gel contains agarose in a AMP/MOPSO buffer. Sodium azide has been added as a preservative.

WARNING: FOR IN-VITRO DIAGNOSTIC USE. Refer to Sodium Azide Warning.

Preparation for Use: The gels are ready for use as packaged.

Storage and Stability: The gels should be stored at room temperature (15 to 30°C), in the protective packaging, and are stable until the expiration date indicated on the package. **DO NOT REFRIGERATE OR FREEZE THE GELS.**

Signs of Deterioration: Any of the following conditions may indicate deterioration of the gel: (1) crystalline appearance indicating the agarose has been frozen, (2) cracking and peeling indicating drying of the agarose, (3) bacterial growth indicating contamination, (4) thinning of gel blocks.

2. CK Vis Isoenzyme Reagent

Ingredients:

Adenosine 5'-diphosphate (ADP) 12 mM
Creatine phosphate 90 mM

Adenosine 5'-monophosphate (AMP) 15 mM
Magnesium Acetate 60 mM
Diadenosine pentaphosphate 0.1 mM
Nicotinamide adenine dinucleotide (NAD) 10 mM
D-glucose 60 mM
Glucose-6-phosphate dehydrogenase
(L_mesenteroides) 7,500 IU/L
Hexokinase (Yeast) 9,000 IU/L
PMS 0.15 mM
Bovine Serum Albumin (BSA) 4.5 g/L

WARNING: FOR IN-VITRO DIAGNOSTIC USE ONLY. DO NOT INGEST.

Preparation for Use: Reconstitute each of two vials of CK Vis Isoenzyme Reagent with 1.5 mL of CK Isoenzyme Diluent.

Storage and Stability: The dry reagent should be stored at 2 to 8°C and is stable until the expiration date on the vial. Reconstituted reagent is stable for 1 hour at 15 to 30°C.

Signs of Deterioration: If the unreconstituted reagent is not a uniformly white or slightly off white dry powder, it should not be used.

3. CK Vis Isoenzyme Diluent

Ingredients: The diluent contains MES, sucrose, Triton X and sodium azide added as a preservative.

WARNING: FOR IN-VITRO DIAGNOSTIC USE. DO NOT INGEST. Refer to Sodium Azide Warning.

Preparation for Use: The diluent is ready for use as packaged.

Storage and Stability: The diluent should be stored at 2 to 8°C and is stable until the expiration date indicated on the vial.

Signs of Deterioration: Discard the diluent if it shows signs of bacterial growth.

4. CK Vis Chromogen

Ingredients: 0.023 g Tetranitro Blue Tetrazolium (TNBT) per mL Dimethylformamide
WARNING: FOR IN-VITRO DIAGNOSTIC USE. DO NOT INGEST-IRRITANT.

Preparation for Use: Add 150 µL of Chromogen to each vial of dissolved Reagent, invert several times and use immediately.

Storage and Stability: The Chromogen should be stored at 2 to 8°C and is stable until the expiration date indicated on the vial.

Signs of Deterioration: The product should be discarded if it shows noticeable signs of turbidity.

5. CK Vis Activator

Ingredients: The Activator contains 114 mM BME (Beta Mercapto Ethanol) in Tris base.

WARNING: FOR IN-VITRO DIAGNOSTIC USE. DO NOT INGEST.

Preparation for Use: The product is ready for use as packaged.

Storage and Stability: The Activator should be stored at 2 to 8°C and is stable until the expiration date indicated on the vial.

Signs of Deterioration: The product should be discarded if it shows noticeable signs of turbidity.

6. Citric Acid Destain

Ingredients: After dissolution, the destain contains 0.3% (w/v) citric acid.

WARNING: FOR IN-VITRO DIAGNOSTIC USE. DO NOT INGEST - IRRITANT.

Preparation for Use: Pour 11 L of deionized water into the Destain vat. Add the entire package of Destain. Mix well until completely dissolved.

Storage and Stability: Store the Destain at 15 to 30°C. It is stable until the expiration date on the package.

Sodium Azide Warning

To prevent the formation of toxic vapors, sodium azide should not be mixed with acidic solutions. When discarding reagents containing sodium azide, always flush sink with copious quantities of water. This will prevent the formation of metallic azides which, when highly concentrated in metal plumbing, are potentially explosive.

In addition to purging pipes with water, plumbing should occasionally be decontaminated with 10% NaOH.

INSTRUMENTS

A SPIFE Touch Analyzer must be used to electrophorese, apply reagent, incubate, wash and dry the gel. The gels may be scanned on a separate densitometer such as the QuickScan Touch/2000 (Cat. N. 1690/1660). Refer to the appropriate Operator's Manual for detailed operating instructions.

SPECIMEN COLLECTION AND HANDLING

Specimen: Serum is the specimen of choice.

Collection of Specimen: Proper timing of specimen collections is critical to accurate interpretation of CK isoenzyme analysis. A blood specimen should be obtained immediately upon admission of the patient to the hospital and at 8 to 12 hour intervals thereafter for a minimum of 36 hours.

Interfering Substances:

1. Mature red blood cells contain no CK; however, some of the side reactions may occur in the coupled enzyme assay resulting in lower estimated CK activity. Non-hemolyzed samples are, therefore, preferred.²⁰
2. CK is inactivated by heat.²⁰
3. Repeated freezing and thawing destroys activity (see Serum Storage).
4. For the effects of various drugs on CK activity, refer to Young, et al.²¹

Serum Storage:

1. The blood specimen should be refrigerated (2 to 8°C) immediately after collection. Serum should be separated from the red blood cells as soon as possible.
2. Serum specimens may be stored at 2 to 8°C for up to 48 hours.²²
3. Specimens may be stored frozen (-20°C) for up to two weeks.²² Frozen specimens should be thawed at room temperatures and should never be placed in a 30°C to 37°C water bath for thawing. Repeated freezing and thawing destroys CK activity and should be avoided.

PROCEDURE

Materials Provided: The following materials are provided in the SPIFE CK Vis Isoenzyme Kit. Individual items are not available.

Sample Test Size

	Cat. No.
40 Sample	3332
20 Sample	3333
SPIFE CK Vis Isoenzyme Gels (10)	
CK Vis Isoenzyme Reagent (20 x 1.5 mL)	
CK Vis Isoenzyme Diluent (2 x 15 mL)	
CK Vis Chromogen (2 x 1.5 mL)	
CK Vis Activator (2 x 0.2 mL)	
REP Blotter C (10)	
Citric Acid Destain (1 pkg)	
Blade Applicator Kit - 20 Sample	

Materials provided by Helena but not contained in the kit:

Item	Cat. No.
SPIFE Touch	1168
Quick Scan Touch	1690
Quick Scan 2000	1660
Disposable Sample Cups (Deep Well)	3360
SPIFE 20, 40, 60 Dispo Cup Tray	3370
CK/LD Control	5134
REP Prep	3100
Gel Block Remover	1115
SPIFE Reagent Spreaders	3706
Applicator Blade Weights	3387

STEP-BY-STEP METHOD

NOTE: If the staining chamber was last used to stain a gel, the SPIFE Touch software has an automatic wash cycle prompted by the initiation of the SPIFE Touch CK test. To verify the status of the stainer chamber, use the arrows under the **STAINER UNIT** to select the appropriate test, place the empty Gel Holder into the stainer chamber and press **START**. If washing of the staining chamber is necessary, the prompt "Vat must be washed. Remove gel and install gel holder." will appear. Press **RETRY** to begin the stainer wash. The cleaning process will complete automatically in about 7 minutes. To avoid delays after incubation, this wash cycle should be initiated at least 7 minutes prior to the end of the run.

I. Sample Preparation

1. Add 1 µL Activator to 100 µL patient sample or control. Mix and allow to sit at room temperature for 10 minutes.
2. If testing 21-40 samples, remove two disposable Applicator Blades from the packaging. If testing fewer samples, remove one Applicator Blade from the packaging.
3. Place the two Applicator Blades into the vertical slots in the Applicator Assembly identified as 8 and 14. If using one Applicator Blade, place it into either of the two slots noted above.

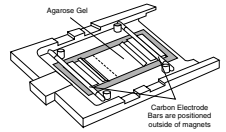
Note: The Applicator Blade will only fit into the slots one way; do not try to force the blade into the slots.

4. Place an Applicator Blade Weight on top of each Applicator Blade. When placing the weight on the blades, position the weight with the thick side to the right.
5. Slide the appropriate number of Disposable Cup Strips into the middle or bottom rows of the Cup Tray. If testing less than 21 samples, place the cups into the row that corresponds with applicator placement.

6. Pipette 75 - 80 µL of pretreated patient serum or control into each cup. Cover the tray until ready to use.

II. Gel Preparation

1. Remove the gel from the protective packaging and discard overlay.
2. Place a REP Blotter C, with the longer end parallel with the gel blocks. Gently blot the entire surface of the gel using slight fingertip pressure on the blotter and remove the blotter.
3. Dispense approximately 2 mL of REP Prep onto the left side of the electrophoresis chamber.
4. Place the left edge of the gel over the REP Prep aligning the round hole on the left pin of the chamber. Gently lay the gel down on the REP Prep, starting from the left side and ending on the right side, fitting the obround hole over the right pin. Use lint-free tissue to wipe around the edges of the plastic gel backing, especially next to electrode posts, to remove excess REP Prep. Make sure no bubbles remain under the gel.
5. Clean and wipe the electrodes and the Reagent Spreaders with lint-free tissue.
6. Place a carbon electrode on the outer ledge of each gel block on the outside of the magnetic posts. Improper contact between the electrode and the gel block may cause skewed patterns. Close the chamber lid.



III. Preparation of Isoenzyme Reagent

1. Reconstitute each of two vials of the CK Vis Isoenzyme Reagent with 1.5 mL of CK Vis Isoenzyme Diluent. Mix well by inversion. Do not add the Chromogen until ready to use as it can cause excess background on the gel.

IV. Electrophoresis/Visualization

Using the instructions provided in the Operator's Manual, set up the parameters as follows for the SPIFE Touch.

	Separator Unit
Load 1	Prompt: None Time: 0:02 Temperature: 21°C Speed: 6
Load 2	Prompt: None Time: 0:02 Temperature: 21°C Speed: 6
Load 3	Prompt: None Time: 0:02 Temperature: 21°C Speed: 6
Load 4	Prompt: None Time: 0:30 Temperature: 21°C Speed: 6
Apply 1	Prompt: None Time: 1:00 Temperature: 21°C Speed: 6 Location: 1
Load 5	Prompt: None Time: 0:30 Temperature: 21°C Speed: 6
Apply 2	Prompt: None Time: 1:00 Temperature: 21°C Speed: 6 Location: 1
Electrophoresis	Prompt: None Time: 4:30 Temperature: 13°C Voltage: 750 V mA: 65 mA
Apply Reagent	Prompt: Remove Gel Blocks Temperature: 37°C Cycles: 8
Incubate	Prompt: None Time: 20:00 Temperature: 45°C
End	

	Stainer Unit
Destain 1	Prompt: None Time: 2:30 Recirculation: On Valve: 2 Fill, Drain
Destain 2	Prompt: None Time: 2:30 Recirculation: On Valve: 2 Fill, Drain
Wash 1	Prompt: None Time: 2:30 Recirculation: On Valve: 7 Fill, Drain
Wash 2	Prompt: None Time: 2:30 Recirculation: On Valve: 7 Fill, Drain
Dry	Prompt: None Time: 25:00 Temperature: 63°C

End

- Open the chamber lid and place the Cup Tray with samples on the SPIFE Touch. Align the holes in the tray with the pins on the instrument.
- Place a reconstituted vial of reagent (without chromogen) into each outer hole of the reagent bar, ensuring that the vial is pushed down as far as it can go. Close the chamber lid.
- Use the arrows under **SEPARATOR UNIT** to select the appropriate test. Press **START** and choose an operation to proceed. The SPIFE Touch will apply the samples, electrophorese and beep when finished.
- Open the chamber lid, remove the electrodes and dispose of blades as biohazardous waste.
- With the gel still in the chamber, use a Gel Block Remover or straight edge to completely remove and discard the two gel blocks.
- Use a lint-free tissue to wipe around the edges of the gel including the gel block area.
- Place a Reagent Spreader (glass rod) across each end of the gel inside the magnetic posts.
- Remove the reagent vials and add 150 µL of Chromogen to each vial of prepared Reagent. Invert several times to mix, and replace immediately into each outer hole of the reagent bar, ensuring that the vial is pushed down as far as it can go. Close the chamber lid.

V. Incubation

- Press the **CONTINUE** button to apply reagent and start the incubation timer.
- At the end of the incubation, the instrument will beep. Remove the gel from the chamber.
- Attach the gel to the holder by placing the round hole in the gel mylar over the left pin on the holder and the obround hole over the right pin on the holder.
- Place the Gel Holder with the attached gel facing backwards into the stainer chamber.
- Use the arrows under **STAINER UNIT** to select the appropriate test. Press **START** and choose an operation to proceed. The instrument will destain, wash and dry the gel.
- When the gel has completed the process, the instrument will beep. Remove the Gel Holder from the stainer and scan the bands.

VI. Evaluation of the CK Isoenzyme Bands

- Qualitative evaluation: The SPIFE CK Vis Isoenzyme Gel may be visually inspected for the presence of the bands.
- Quantitative evaluation: Scan the SPIFE CK Vis Isoenzyme Gel in the Quick Scan Touch/2000 using the Acid Violet filter. A slit size of 5 is recommended.

Stability of End Product

The CK gels should be scanned for quantitative results within two hours after drying.

Calibration

A calibration curve is not necessary because relative intensity of the bands is the only parameter determined.

Quality Control

The CK/LD Isoenzyme Control (Cat. No. 5134) can be used to verify all phases of the procedure and should be used on each gel run. The control should be used as a marker for proper location of the isoenzyme bands and may also be quantitated to verify the accuracy of quantitations. Refer to the package insert provided with the control for assay values. Additional controls may be required for federal, state or local regulations.

REFERENCE VALUES

Reference range studies including 50 normal men and women were performed by Helena Laboratories. The following results were obtained:

	Range
% MM	96.7-100
% MB	0- 3.3
% BB	0

These values should only serve as guidelines. Each laboratory should establish its own expected value range with this procedure.

RESULTS

CK-BB is the fastest moving, most anodic band. CK-MM is the slowest moving, most cathodic band, and CK-MB migrates intermediate to CK-MM and CK-BB.^{1,2,3}

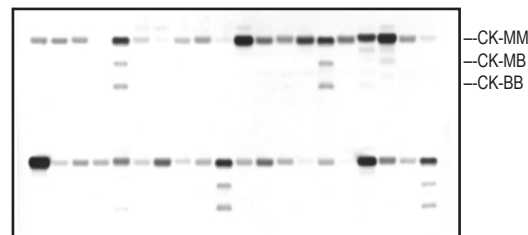


Figure 1: A representation of a SPIFE CK Vis Isoenzyme Gel showing the relative position of the CK Isoenzyme bands.

Calculation of the Unknown

The QuickScan Touch/2000 densitometer will automatically calculate and print the relative percent and the absolute value for each band. Refer to the Operator's Manual provided with the instrument.

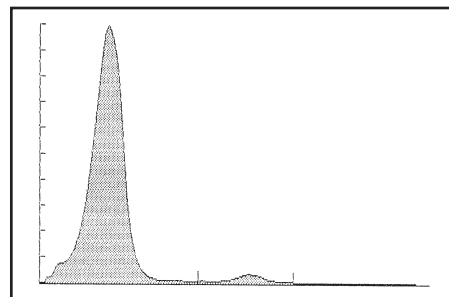


Figure 2: SPIFE CK Vis electrophoresis scan.

LIMITATIONS

The CK Vis Isoenzyme Reagent is linear to 700 U/L total CK as determined with a UV kinetic method at 37°C. Results for sensitivity studies show that the CK Reagent is sensitive to 2.5 U/L.

NOTE: The CK method is not designed to identify tumor markers.

Interfering Factors: Refer to SPECIMEN COLLECTION AND HANDLING.

Further Testing Required: Lactate dehydrogenase (LD) isoenzyme studies performed in conjunction with the CK isoenzymes provide a much more definitive test in the diagnosis of myocardial infarct.^{2,3}

INTERPRETATION OF RESULTS

CK-MM

- Often the only isoenzyme of CK found in normal serum.¹
- Elevated in: (a) Skeletal muscle injury (b) Myocardial injury (c) Brain injury.^{1,3}

CK-MB

- May be present in serum from normal subjects in the amount of 0-5%.^{23,36} Note that small amounts of CK-MB activity have been interpreted as an alert to possible myocardial infarct and should be followed by serial CK and LD isoenzyme studies.
- Positive indication of myocardial infarct when the following criteria are met:
 - Proper clinical setting.²
 - CK-MB activity > 5% of total CK activity and a minimum of 10 IU/L.^{1,14,24}
 - CK-MB shows characteristic change in pattern (relatively rapid appearance and disappearance).^{1,3,35}
- Positive identification of second myocardial infarct: After the first MI the CK-MB increases after starting to decline. The total CK may or may not show an increase after starting to decline.
- Values following open heart surgery³

CK and LD isoenzymes are less specific following open heart surgery than in most diagnostic situations. The CK-MB will be elevated due to myocardial damage resulting from the operative procedure as well as trauma to the heart from manipulation and cannulation. The LD is flipped secondary to hemolysis from extra corporeal circulation. Infarct patients have higher levels of CK-MB activity, but the wide range of isoenzyme activity seen in non-MI patients overlaps that noted in patients with MI. This makes complete discrimination impossible. Despite this difficulty, accuracy

in diagnosing MI can be increased by doing serial determinations of CK-MB in the post-operative period and analyzing its activity trend. Perioperative infarct patients will usually have a progressive rise in CK-MB levels, while non-MI patients exhibit a more precipitous post-operative decrease in that fraction.^{2,25}

5. Elevation in diseases other than myocardial infarct:^{1,3}
- | | |
|-------------------------------|-----------------|
| Severe coronary insufficiency | Dermatomyositis |
| Duchenne's muscular dystrophy | Myoglobinuria |
| Rocky Mountain Spotted Fever | Polymyositis |
| Rhabdomyolysis | Reye's Syndrome |

CK-BB

- Often seen in the serum of patients with prostatic carcinoma and occasionally in the serum of patients with other carcinomas and malignant tumors.¹
- Rarely seen in the serum of patients with brain injury due to damage to the blood-brain barrier.^{1,26}
- Occasionally seen in the serum of patients with severe shock syndrome (probably due to lung or small bowel involvement).
- Occasionally seen in the serum of patients with chronic renal failure, gastric cancer, women in labor, Reye's syndrome, oat cell carcinoma and malignant hyperpyrexia.¹

ATYPICAL CK BANDS

A number of atypical bands of CK have been reported. Atypical bands migrating between CK-MB and CK-MM have been attributed to CK-BB complexed to IgG^{27,28} and CK-MM complexed to lipoprotein,²⁹ as well as others without positive identification.³⁰⁻³² Mitochondrial CK migrates cathodically to CK-MM³³, and a band designated "macro" CK, isolated from a cancer patient, also migrated cathodic to CK-MM.³⁴

PERFORMANCE CHARACTERISTICS

PRECISION

Within Run studies were run using one patient sample and one control run in replicate on one gel. N = 20

Control	Fraction	Mean	SD	CV%
	% MM	63.6	0.5	0.8
	% MB	13.3	0.4	3.2
	% BB	23.2	0.4	1.8

Between Run studies were done using one patient sample and one control run in replicate on nine gels. N = 180

Control	Fraction	Mean	SD	CV%
	% MM	64.0	1.8	2.8
	% MB	13.4	0.7	5.6
	% BB	22.6	1.2	5.4

CORRELATION STUDIES

34 patient specimens were tested on the SPIFE CK Vis method and SPIFE Touch CK Vis method.

N	= 34	Y = 1.0021X - 0.1646
Slope	= 1.0021	X = SPIFE CK on SPIFE 3000
Intercept	= -0.1646	Y = SPIFE CK on SPIFE Touch
r	= 0.9998	

LINEARITY

The system has been validated to be linear to 700 U/L total CK.

SENSITIVITY

Results from validation studies show that the system is sensitive to 2.5 U/L.

BIBLIOGRAPHY

- Brish, L.K., *CK & LD Isoenzyme A Self-Instructional Text*, Am Soc of Clin Path Press, Chicago 30-47, 1984.
- Wolf, P.L., Griffiths, J.C., and Koett, J.W., *Interpretation of Electrophoretic Patterns of Proteins and Isoenzymes*, Mason Pub, New York, 60, 1981.
- Tietz, N.W., Ed *Textbook of Clinical Chemistry*, W.B. Saunders Co., Philadelphia, 678-700, 1986.
- Galen, R.S., *Human Path*, 6(2):141-155, 1975.
- Marmor, A. and Alpan, G., *Clin Chem*, 24(12):2206, 1978.
- Galen, R.S., *JAMA*, 232(2):145-147, 1975.
- Wagner, G.S. and Roe, C.R., et al., *Circulation*, 47:263-269, 1973.
- Frolich, J. et al., *Clin Biochem*, 11(6):232-234, 1978.
- D'Souza, J.P. et al., *Clin Biochem*, 11(5):204-209, 1978.
- Mercer, D.W., *Clin Chem*, 20(1):36-40, 1974.
- Rao, R.S. et al., *Clin Chem*, 21(11):1612-1618, 1975.
- Jockers-Wretou, E. and Pfeleiderer, G., *Clin Chim Acta*, 58:223-232, 1975.
- Roberts, R. et al., *Science*, 194:855-857, 1976.
- Wong, R. and Swallen, T.O., *AJCP*, 64:209-216, 1975.
- Van DerVeen, K.J. and Willebrands, A.F., *Clin Chim Acta*, 13:312-316, 1966.
- Burger, A. et al., *Biochemische Zeitschrift*, 339:305-314, 1964.

- Deul, D.H. and Van Breeman, J.F.L., *Clin Chim Acta*, 10:276-283, 1964.
- Rosalki, S.B., *Nature*, 207:414, 1965.
- Trainer, T.D. and Gruenig, D., *Clin Chim Acta*, 21:151-154, 1968.
- Henry, R.J. and Cannon, D.C., Eds., *Clinical Chemistry Principles and Techniques*, 2nd Ed. Harper and Row, New York, 901-903, 1974.
- Young, D.S. et al., *Effects of Drugs on Clinical Laboratory Tests* 3rd ed., AACCPress, Washington, D.C. 1990.
- Hyong Won Cho and Meltzer, H.Y., *AJCP*, 71(1):75-82, 1979.
- Marmor, A. et al., *Lancet*, Oct. 14, 813-814, 1978.
- Galen, R.S. Personal Communication, June 1980.
- Galen, R.S., *Diag Med*, Feb. 74-87, 1978.
- Bayer, P.M. et al., *Clin Chem*, 22(8):1405-1407, 1976.
- Stein, W. and Bohner, *Clin Chem*, 25(8):1513, 1979.
- Urguhart, N. and Rabkin, S.W., *Clin Chem*, 28(6):1400, 1982.
- Velletri, K. et al., *Clin Chem*, 21(12):1837-1838, 1975.
- Sax, S.M. et al., *Clin Chem*, 22(1):87-91, 1976.
- Ljungdahl, L. and Gerhardt, W., *Clin Chem*, 24(5):832-834, 1978.
- Lott, J.A., *Clin Chem*, 24(6):1047, 1978.
- James, G.P. and Harrison, R.L., *Clin Chem*, 25(6):943-947, 1979.
- Yuu, Hojo, et al., *Clin Chem*, 24(11):2054-2057, 1978.
- Yasminah, W.G., Pyle, R.B., Cohn, J.N., et al., *Circulation* 55, (No. 5):733-737, 1977.

SPIFE CK Vis Isoenzyme System

SPIFE CK Vis Isoenzyme Kit

Cat. No. 3332, 3333

- SPIFE CK Vis Isoenzyme Gels (10)
- CK Vis Isoenzyme Reagent (20 x 1.5 mL)
- CK Vis Isoenzyme Diluent (2 x 15 mL)
- CK Vis Chromogen (2 x 1.5 mL)
- CK Vis Activator (2 x 0.2 mL)
- REP Blotter C (10)
- Blade Applicator Kit - 20 Sample
- Citric Acid Destain (1 pkg)

Other Supplies and Equipment

The following items, needed for performance of the SPIFE Touch CK Vis Isoenzyme Procedure, must be ordered individually.

Item	Cat. No.
SPIFE Touch	1168
Quick Scan Touch	1690
Quick Scan 2000	1660
Disposable Sample Cups (Deep Well)	3360
SPIFE 20, 40, 60 Dispo Cup Tray	3370
CK/LD Control	5134
REP Prep	3100
Gel Block Remover	1115
SPIFE Reagent Spreaders	3706
Applicator Blade Weights	3387

For Sales, Technical and Order Information and Service Assistance, call 800-231-5663 toll free.

Helena Laboratories warrants its products to meet our published specifications and to be free from defects in materials and workmanship. Helena's liability under this contract or otherwise shall be limited to replacement or refund of any amount not to exceed the purchase price attributable to the goods as to which such claim is made. These alternatives shall be buyer's exclusive remedies.

In no case will Helena Laboratories be liable for consequential damages even if Helena has been advised as to the possibility of such damages.

The foregoing warranties are in lieu of all warranties expressed or implied including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.

