

# Sources for Medical Imaging



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Isotope Products Laboratories is committed to providing our medical imaging partners with the highest quality products, ensuring product safety, prompt delivery, and the highest levels of customer support and technical service.

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# General Information

## Contact Information

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## Licensing Requirements

It is company policy to require written verification of the customer's Agreement State or NRC radioactive materials license for all items. No orders will be processed without a copy of the customer's license on file at IPL. This may be either a copy of the applicable portion of the license or a signed document on company letterhead stating that the customer's license authorizes possession of the desired items in the form and quantity described on the purchase order. Compliance with applicable local, state and federal regulations concerning procurement and possession of radioactive materials is the responsibility of the customer.

## Exempt Quantities

Small amounts of some byproduct material may be purchased without a specific license per Nuclear Regulatory Commission (NRC) regulations 10CFR30.18 and 10CFR30.71 Schedule B or the equivalent Agreement State regulations. Up to ten license exempt radioactive standards or sources may be shipped at one time. NRC regulations prohibit the further incorporation or use of license exempt sources in a manufactured device intended for further distribution. Contact the NRC or appropriate state agency for information on the use or possession of license exempt sources.

## Quality Assurance

Isotope Products Laboratories (IPL) maintains a comprehensive Quality Assurance program based on a number of industry recognized standards and regulations ensuring the production of consistently superior products.

IPL's quality System is registered to ISO 9001/EN46001 and follows the regulations set forth in NRC Regulatory Guide 4.1.5 and 10CFR Appendix B, the required directive for the Nuclear Power Utilities and their suppliers.

IPL manufactures a wide range of nuclear medicine devices that bear the CE Mark. This indicates their conformity to the provisions of Council Directive 93/42/EEC Annex II and enables them to be distributed freely within the European Community. All issues regarding any Isotope Products CE marked sources in Europe are handled and reported by IPL's European Representative. They can be contacted as follows:

### BEBIG Isotopen- und Medizintechnik GmbH

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D-13125 Berlin  
www.bebig.de  
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IPL's continued compliance to these quality related regulations is assured through a system of periodic audits performed by independent audit teams as well as by trained IPL personnel.

## Product Changes

New product and method development is a continuing process at IPL. Catalog specifications notwithstanding, we reserve the right to change production methods or fabrication techniques which do not diminish the performance of the product.

## Availability

Since IPL manufactures a large variety of products with many options, only a small inventory of certain finished products is maintained. Please contact the Sales Order Department for more information regarding the availability of a certain product or nuclide.

## Returns Policy

Due to the nature of our products, all sales are final and no items can be returned for credit unless the customer has demonstrated that the product does not meet specifications. Such a claim must be made within 30 days of receipt of order and the source returned to Isotope Products Laboratories, within 60 days after receipt of the shipment.

NOTE: Before any return is made, IPL MUST be notified so that a return authorization number can be assigned and proper shipping arrangements can be made. Shipments returned without a proper authorization number may be refused upon delivery.

Full credit will be given for sources that are found not to meet specifications as long as the source is returned to IPL within the 60 day period mentioned above. IPL will pay the return freight for the source, and the freight on the replacement.

Sources reported and returned after the 60 day period will not be given credit, nor will IPL pay for the return freight.

In the case that the customer ordered the incorrect part the following will apply:

The customer will have 30 days to request a replacement source. There will be a restocking fee charged for the original source. If the customer calls between 30 and 60 days, only 50% credit will be given for the original source.

After a 60 day period no credit will be given.

In the event that the sources are being returned from an overseas location, the shipment must be sent with DDP (Delivery Duty Paid) terms so that the customer is billed for all fees.

## Nuclear Medicine Source Disposal Policy

Isotope Products Laboratories will take back all nuclear medicine sources for disposal on a one-to-one basis. A source may be returned for disposal as long as the equivalent replacement source is purchased from IPL at the time of the disposal request.

The customer will be required to pay all shipping costs for the return of the sources. In the event that the sources are being returned from an overseas location, the shipment must be sent with DDP (Delivery Duty Paid) terms so that the customer is billed for all fees.

Please note that customers will be charged for any unauthorized return, including freight.

## Terms, Conditions and Warranty

Our payment terms are net 30 days from date of shipment, delays in mailing of invoice notwithstanding.

All payments are to be made in U.S. Dollars. A \$700 documentary collection handling charge will be assessed to all orders involving a documentary letter of credit or draft for collection. A \$50 handling fee will be charged for all orders involving prepayment via wire transfer of funds. All new accounts must submit banking information and three references for credit review. Please allow three days to verify your credit status.

See page 23 for complete terms and conditions.

## Methods of Calibration

Isotope Products Laboratories participates in the Radioactivity Measurements Assurance Program (MAP) conducted by the National Institute of Standards and Technology (NIST) in cooperation with the Nuclear Energy Institute (NEI).

In this program NIST provides blind samples which are assayed by IPL, with the results sent to NIST. NIST then reports back to IPL the difference between the NIST calibrated value and the IPL calibrated value. In addition, IPL routinely sends finished products to NIST for product verification and calibration. Over the years IPL has maintained a high degree of precision and accuracy with NIST. Traceability is established and maintained through this cross-calibration process.

A Certificate of Calibration is provided for each NIST traceable source purchased from IPL. The Certificate provides a statement of traceability, a complete description of the physical and nuclear characteristics of the source, a description of the method of calibration, and quantitative identification of detected impurities. Activities are given in the Curie and SI systems. All sources are manufactured to a precision of  $\pm 15\%$  with respect to the customer's requested activity. NIST traceable sources have an accuracy of  $\pm 5\%$  or better with respect to the certified measured value. Non-traceable (nominal) sources have an accuracy of  $\pm 15\%$  with respect to the measured value and are supplied with a Nominal Data Sheet which characterizes the source. IPL uses half-lives listed in IAEA TEC DOC-619 whenever possible. Please refer to your NIST Certificate of Calibration or Nominal Data Sheet for the appropriate nuclear data.

The total uncertainty associated with the traceable sources, which is an estimate of the possible variance between the certified activity and the true activity, includes weighing uncertainty, random uncertainty, and systematic uncertainty. The quadratic combination of these uncertainties is generally less than 5% at the 99% confidence level.

IPL maintains a variety of state-of-the-art detector systems to calibrate sources and to check for impurities. The calibration equipment is checked daily using NIST traceable standards and stability is further insured by maintaining the instrumentation in a carefully controlled environment. All assay equipment and techniques are verified through MAP on an on-going basis.

Sources are either calibrated directly against NIST standards or by using NIST traceable assay equipment and techniques.

## Definitions

### Coefficient of Variation (CV)

A ratio of the standard deviation vs. the average count, expressed as a percentage. This factor expresses the overall scattering of values from the average.

### Integral Non-Uniformity (INU)

Measurement of the difference between the maximum count and the minimum count, expressed as a percentage. This factor is a measurement of the gap between the coldest and hottest points.

### Differential Non-Uniformity (DNU)

Measurement of the largest extremes between two neighboring points on the flood source; all of the neighboring points are compared, and the highest value is reported. This factor describes how uniform the transition is from one unit cell to the next unit cell.

# Co-57 Flood Sources



The Isotope Products Laboratories' Co-57 Flood Source provides a uniform field of radiation for evaluation of Nuclear Medicine gamma camera performance, allowing detection and correction of any camera malfunction prior to diagnostic use. The useful life of the Co-57 flood source is approximately 2 years. The Co-57 flood sources are available in a variety of circular and rectangular dimensions, with activities to meet the standards established by the manufacturers of the gamma cameras.

## Construction

Isotope Products Laboratories' Co-57 flood sources consist of Co-57 as cobalt chloride uniformly dispersed in high impact casting resin which is cured and placed in an ABS encapsulation consisting of two formed halves that interlock upon assembly and are ultrasonically welded so that disassembly without destruction of the encapsulation is not possible.

## Quality

IPL's Manufacturing Process ensures that Nuclear Medicine customers will receive the highest quality flood source available to perform quality control on gamma cameras.

Flood sources are scanned using a gamma camera. The camera images each flood source for parameters including differential and integral non-uniformity in accordance with ANSI N42.2.25.

Visual checks are performed to detect any distortions of the active element and the outside capsule.

A Leak Test is performed on all sources prior to shipment.

## Uniformity

IPL's flood sources are manufactured according to the following specifications:

CV ≤ 1.0%  
INU ≤ 3.6%

**Announcing  
Perflexion,<sup>TM</sup>  
the world's  
only flexible  
flood source.**

Call for details.

FLOOD SOURCES ARE AVAILABLE WITH OPTIONAL CASE. IF A CASE IS NOT REQUESTED, THE FLOOD SOURCE WILL BE SUPPLIED WITH A LEAD LINED CARDBOARD CONTAINER

Model Number	Configuration	Active Dimensions	Overall Dimensions	Activity (mCi)	Activity (MBq)
NES 297	CIRCULAR	14" (35.6cm)	19.3"(49cm)	5	185
NES 298	CIRCULAR	14" (35.6cm)	19.3"(49cm)	10	370
NES 391	CIRCULAR	18.5" (47cm)	19.3"(49cm)	5	185
NES 392	CIRCULAR	18.5" (47cm)	19.3"(49cm)	10	370
NES 394	CIRCULAR	18.5" (47cm)	19.3"(49cm)	11-20	407-740
NES 8009	CIRCULAR	23.5" (59.7cm)	25.4"(64.5cm)	5	185
NES 8012	CIRCULAR	23.5" (59.7cm)	25.4"(64.5cm)	10	370
NES 8150	CIRCULAR	23.5" (59.7cm)	25.4"(64.5cm)	11-20	407-740
NES 8300	RECTANGULAR	23.9" x 16.4" (60.7cm x 41.7cm)	25.4" x 17.9" (64.5cm x 45.5cm)	5	185
NES 8400	RECTANGULAR	23.9" x 16.4" (60.7cm x 41.7cm)	25.4" x 17.9" (64.5cm x 45.5cm)	10	370
NES 8430	RECTANGULAR	23.9" x 16.4" (60.7cm x 41.7cm)	25.4" x 17.9" (64.5cm x 45.5cm)	15	555
NES 8450	RECTANGULAR	23.9" x 16.4" (60.7cm x 41.7cm)	25.4" x 17.9" (64.5cm x 45.5cm)	20	740
NES 8470	RECTANGULAR	18" x 14" (45.7cm x 35.6cm)	19.3" x 15.3" (49cm x 38.9cm)	5	185
NES 8480	RECTANGULAR	18" x 14" (45.7cm x 35.6cm)	19.3" x 15.3" (49cm x 38.9cm)	10	370
NES 8490	RECTANGULAR	18" x 14" (45.7cm x 35.6cm)	19.3" x 15.3" (49cm x 38.9cm)	11-20	407-740
NES 8496	RECTANGULAR	14.25" x 8.23" (36.2cm x 20.9cm)	16.2" x 9.7" (41.1cm x 24.6cm)	5-20	185-740

# Perflexion™

The world's most innovative flood source



## Smallest. Lightest. Most convenient.

Isotope Products Laboratories Perflexion flood source eliminates bulk and weight with its unique flexible design and tungsten composite WolfGuard™ shield. Together with superior source uniformity, low impurities, and excellent durability, Perflexion makes every other source seem, well . . . obsolete.

Only Perflexion gives you:

- Lightest weight—weighs less than 29 lbs including the tungsten shield and hard case
- Smallest form factor—source rolls to fit in a 6" x 6" x 22" tube for convenient storage
- Best shielding—5-10x better than lead cases

## Perflexion™ Frequently Asked Questions

### Q: What is unique about the Perflexion flood source?

**A:** Perflexion is the world's only flexible flood source. The unique, patent-pending design was developed in response to customer feedback—IPL asked what you wanted in a "perfect" flood source, and overwhelmingly, the response was that our customers hated the lead-lined cases. The only way to reduce the case weight without compromising shielding safety is to change the geometry. We developed the Perflexion flood source to lie flat for calibration use, but to roll into a compact cylinder for storage, to provide the most convenient, ergonomic flood source and case with optimum shielding protection.

### Q: Will the source crack, crease, flake, curl, or tear over time?

**A:** No. The Perflexion active element material was custom-formulated for IPL, to meet the demands of years of use and abuse. You can fold, bend, crush, and pull this material without deforming or damaging the source, and it will not crease, crack, flake, or tear over time. In addition, the polymer "memory" ensures that the source will return to flatness even after being stored in a rolled configuration. IPL has performed extensive fatigue testing on the polymer, and Perflexion shows excellent integrity and uniformity even after several working lives' worth of fatigue.

### Q: What about radiation dose from handling Perflexion?

**A:** Dose rate monitoring during beta testing indicates that a technician rolling and unrolling the Perflexion source once a day will receive approximately 30-35 mR per year extremity dose. Perflexion can be removed from its WolfGuard shield and positioned on the camera using the attached handles, and so the actual handling time may be equal or less than for a rigid source with a lead-lined hard case. In addition, the convenient "carryon-luggage" style wheels and telescoping handle of the hard case allow Perflexion to transport easily in its shield, so technicians will no longer need to risk excess exposure by carrying a bare source from the hot lab in order to avoid the hassle of a large, unwieldy lead-lined case.

### Q: What do I do if I need to lift the source off the collimator for imaging, for example by propping it on paper cups?

**A:** On request, IPL can provide a rigid polycarbonate plate with the dimensions of the Perflexion source, for use in applications where the source needs a rigid support.

Model Number	Configuration	Active Dimensions	Overall Dimensions	Activity (mCi)	Activity (MBq)
PF24R-057	RECTANGULAR	23.9" x 16.4" (60.7cm x 41.7cm)	25.25" x 17.75" (64.1cm x 45cm)	5-20	185-740
PF16R-057	RECTANGULAR	16" x 10.5" (40.6cm x 26.7cm)	17.4" x 11.9" (44.2cm x 30.2cm)	5-20	185-740
PF09R-057	RECTANGULAR	9" x 9" (22.9cm x 22.9cm)	10.5" x 10.5" (26.7cm x 26.7cm)	10	370



Perflexion™ and WolfGuard™ Shield in Transport Case



Tungsten Composite Shielding

# Application Guide

## Co-57 Flood Sources

Camera Manufacturer	SPECT or Planar	Source Type	Head Size	Recommended Nominal Activity	Perflexion™ Model	IPL Source Model
<b>Digirad</b>						
2020tc	SPECT	Rectangular	8" x 8"	10 mCi	PF09R-057-10M	FL09R-057-10M
Cardius 2	SPECT	Rectangular	8" x 8"	10 mCi	PF09R-057-10M	FL09R-057-10M
<b>Elsint</b>						
SP4	SPECT	Circular	15.75"	10 mCi Max	N/A	NES392
SP6	SPECT	Rectangular	21.25" x 15.75"	10 mCi Max	PF24R-057-10M	NES8400
Helix	SPECT	Rectangular	21.25" x 15.75"	10 mCi Max	PF24R-057-10M	NES8400
Cardial	SPECT	Rectangular	15.75" x 10"	10 mCi Max	PF16R-057-10M	NES8480
Varicam	SPECT	Rectangular	21.25" x 15.75"	10 mCi Max	PF24R-057-10M	NES8400
<b>General Electric Medical Systems</b>						
300 AM	Planar	Circular	10"	3 mCi	N/A	NES297
Maxi 2	Planar	Circular	15"	5 mCi	N/A	NES391
Maxi 37	Planar	Circular	15"	5 mCi	N/A	NES391
5000 Series	SPECT	Circular	24"	10 mCi	N/A	NES8012
Maxxus	SPECT	Rectangular	21" x 16"	10 mCi	PF24R-057-10M	NES8400
Starcam XRT	SPECT	Rectangular	21" x 16"	10 mCi	PF24R-057-10M	NES8400
Starcam XCT	SPECT	Circular	15.4"	10 mCi	N/A	NES392
Starcam ACT	SPECT	Circular	15.4"	10 mCi	N/A	NES392
Optima	SPECT	Rectangular	14" x 9"	7.5 mCi	PF16R-057-10M	NES8480
Millenium MPS	SPECT	Square	14" x 14"	10 mCi	N/A	NES8480
Millenium MPR, VG	SPECT	Rectangular	15.75" x 21.75"	10 mCi	PF24R-057-10M	NES8400
Millenium MG	SPECT	Rectangular	14" x 20"	10 mCi	PF24R-057-10M	NES8400
Neurocam	SPECT	Rectangular	7.9" x 6.7"	10 mCi	PF09R-057-10M	FL09R-057-10M
Myosight	SPECT	Rectangular	20" x 14"	10 mCi	PF24R-057-10M	NES8400
Infinia	SPECT	Rectangular	21.25" x 15.75"	10 mCi	PF24R-057-10M	NES8400
DSTi/Dsi	SPECT	Rectangular	12.99" x 14"	10 mCi	N/A	NES8480
<b>Hitachi</b>						
1024C	SPECT	Circular	13.5"	5 mCi	N/A	NES297
1024 RDT	SPECT	Rectangular	19.7" x 14.2"	10 mCi	PF24R-057-10M	NES8400
1024 R	SPECT	Rectangular	19.7" x 14.2"	10 mCi	PF24R-057-10M	NES8400
Neuro Spect	SPECT	Rectangular	8.7" x 6.7"	10 mCi	PF09R-057-10M	FL09R-057-10M
150-250DSP	SPECT	Rectangular	20" x 15"	10 mCi	PF24R-057-10M	NES8400
260 DSP	SPECT	Rectangular	22" x 16"	10 mCi	PF24R-057-10M	NES8400
<b>Mediso Medical Imaging Systems</b>						
CardioSpect SC	SPECT	Rectangular	20.8" x 15.3"	10 mCi	PF24R-057-10M	NES8400
CardioSpect SR	SPECT	Rectangular	20.8" x 15.3"	10 mCi	PF24R-057-10M	NES8400
CardioSpect D90	SPECT	Rectangular	14.5" x 9"	10 mCi	PF16R-057-10M	NES8480
CardioSpect VMAX	SPECT	Rectangular	20.8" x 15.3"	10 mCi	PF24R-057-10M	NES8400
NeuroSpect Quad	SPECT	Rectangular	9" x 8"	10 mCi	PF09R-057-10M	FL09R-057-10M
<b>Nuclear Chicago Searle</b>						
Phogamma	Planar	Circular	12"	5 mCi	N/A	NES297
LEM	Planar	Circular	9.75"	3 mCi	N/A	NES297
LFOV	Planar	Circular	15"	5 mCi	N/A	NES391
<b>Park Medical</b>						
Isocam I & II	SPECT	Rectangular	22.3" x 16.5"	10 mCi	PF24R-057-10M	NES8400
<b>Philips (formerly Marconi/Picker)</b>						
Dynamo	Planar	Circular	10"	3 mCi	N/A	NES297
411	Planar	Circular	11"	5 mCi	N/A	NES297
412	Planar	Circular	12"	5 mCi	N/A	NES297
415	Planar	Circular	15"	5 mCi	N/A	NES391
Prism 1000	SPECT	Rectangular	20" x 15"	10 mCi	PF24R-057-10M	NES8400
Prism 2000	SPECT	Rectangular	20" x 15"	10 mCi	PF24R-057-10M	NES8400
Prism 3000	SPECT	Rectangular	15.7" x 9.4"	10 mCi	PF16R-057-10M	NES8480
SX300	SPECT	Square	14" x 14"	10 mCi	N/A	NES8480
Axis /Irix	SPECT	Rectangular	21" x 15.5"	10 mCi	PF24R-057-10M	NES8400

Camera Manufacturer	SPECT or Planar	Source Type	Head Size	Recommended Nominal Activity	Perflexion™ Model	IPL Source Model
<b>Philips (formerly ADAC)</b>						
Cardio MD	SPECT	Rectangular	9.2" x 15.4"	10 mCi Max	PF16R-057-10M	NES8496
Cardio 60	SPECT	Rectangular	20" x 15"	10 mCi Max	PF24R-057-10M	NES8400
Skylight	SPECT	Rectangular	20" x 14"	10 mCi	PF24R-057-10M	NES8400
Merida	SPECT	Rectangular	20.47" x 14.57"	10 mCi	PF24R-057-10M	NES8400
ARC 3000	Planar	Circular	15"	10 mCi	N/A	NES392
Genesys	SPECT	Rectangular	20" x 15"	10 mCi Max	PF24R-057-10M	NES8400
Argus	SPECT	Rectangular	20" x 15"	10 mCi Max	PF24R-057-10M	NES8400
Solus, Cardial, or Vertex	SPECT	Rectangular	20" x 15"	10 mCi Max	PF24R-057-10M	NES8400
Forte	SPECT	Rectangular	20" x 15"	10 mCi Max	PF24R-057-10M	NES8400
Cirrus	SPECT	Circular	15"	10 mCi	N/A	NES392
<b>Raytheon</b>						
	Planar	Circular	16"	5 mCi	N/A	NES391
<b>Siemens Medical Systems</b>						
Multispect 2	SPECT	Rectangular	21.25" x 15"	10 mCi	PF24R-057-10M	NES8400
Multispect 3	SPECT	Rectangular	16" x 12"	10 mCi	N/A	NES8480
3700, 7500 Orbiter Series	SPECT	Circular	15.25"	10 mCi	N/A	NES392
Body Scan	SPECT	Rectangular	23.5" x 13.5"	10 mCi	PF24R-057-10M	NES8400
Diacam	SPECT	Rectangular	21.25" x 15"	10 mCi	PF24R-057-10M	NES8400
3700, 7500 Orbiter Series	SPECT	Rectangular	21.25" x 15"	10 mCi	PF24R-057-10M	NES8400
c.cam	SPECT	Rectangular	14" x 8.4"	10 mCi	PF16R-057-10M	NES8496
e.cam	SPECT	Rectangular	21.25" x 15"	10 mCi	PF24R-057-10M	NES8400
<b>SMV (Sopha Medical)</b>						
DST	SPECT	Rectangular	11.7" x 15.8"	10 mCi	N/A	NES8480
DSX	SPECT	Rectangular	21.3" x 15.75"	10 mCi	PF24R-057-10M	NES8400
DS7	SPECT	Circular	15.75"	10 mCi	N/A	NES392
Bodytrac	SPECT	Rectangular	21.3" x 15.75"	10 mCi	PF24R-057-10M	NES8400
DSTXL	SPECT	Rectangular	21.3" x 15.75"	10 mCi	PF24R-057-10M	NES8400
Vision FX Series	SPECT	Rectangular	20" x 15"	10 mCi	PF24R-057-10M	NES8400
<b>Technicare (G.E)</b>						
Mobile 420	Planar	Circular	10"	3 mCi	N/A	NES297
Mobile 420	Planar	Circular	12"	5 mCi	N/A	NES297
Mobile 420	Planar	Circular	15"	5 mCi	N/A	NES391
Omega 500	SPECT	Rectangular	20" x 14.5"	10 mCi	PF24R-057-10M	NES8400
Gemini 700	SPECT	Rectangular	20" x 14.5"	10 mCi	PF24R-057-10M	NES8400
Gemini 600	SPECT	Circular	15"	10 mCi	N/A	NES392
<b>Toshiba America</b>						
GCA7100A, 7200	SPECT	Rectangular	21.5" x 19"	10 mCi	PF24R-057-10M	NES8400
GCA9300	SPECT	Rectangular	16.1" x 8.3"	10 mCi	PF16R-057-10M	NES8480
GCA901, 901A	SPECT	Rectangular	20.1" x 14.5"	10 mCi	PF24R-057-10M	NES8400
GCA901WB	SPECT	Rectangular	20.1" x 14.6"	10 mCi	PF24R-057-10M	NES8400
GCA602, 602A	SPECT	Circular	13.75"	5 mCi	N/A	NES297
GCA601A	SPECT	Circular	13.75"	5 mCi	N/A	NES297
t.cam	SPECT	Rectangular	21.25" x 15"	10 mCi	PF24R-057-10M	NES8400
<b>Trionix Res. Lab.</b>						
Monad	SPECT	Rectangular	24" x 14.5"	10 mCi	PF24R-057-10M	NES8400
Biad 24/XLT24	SPECT	Rectangular	24" x 14.5"	10 mCi	PF24R-057-10M	NES8400
Biad 20/XLT20	SPECT	Rectangular	20" x 14.5"	10 mCi	PF24R-057-10M	NES8400
Triad XLT/88	SPECT	Rectangular	15.75" x 8.7"	10 mCi	PF16R-057-10M	NES8480
Triad XLT 20	SPECT	Rectangular	20" x 14.5"	10 mCi	PF24R-057-10M	NES8400
<b>Union Carbide</b>						
Union Carbide	Planar	Circular	16"	5 mCi	N/A	NES391

# Accessories

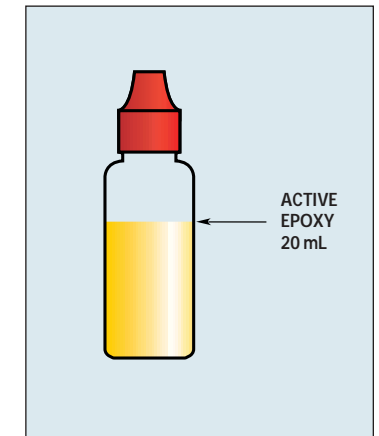


## Dose Calibrator Reference Standards (RV or E Vial)

Dose Calibrator Reference Sources provide a safe and convenient method of calibrating instruments for measuring the accuracy of imaging solutions most commonly utilized by medical technicians. The Dose Calibrator is manufactured by uniformly distributing the active element in 20mL of epoxy, comprising a density of approximately 1.0 g/cm<sup>3</sup>. Each standard is supplied in a 27mL polyethylene vial. Calibration is in terms of activity contained in an aqueous solution. NIST traceable within ±5% at the 99% confidence level.

Model Number	Nuclide	Activity (mCi)	Activity(MBq)
RV-057-5M	Co-57	5	185
RV-057-10M	Co-57	10	370
RV-137-200U	Cs-137	.200	7.4
RV-137-250U	Cs-137	.250	9.25
RV-133-250U	Ba-133	.250	9.25
RV-SET	Co-57, Cs-137, Ba-133	5, .200, .250	185, 7.4, 9.25
RV-SET-1	Co-57, Co-60, Cs-137, Ba-133	5, .050, .200, .250	185, 1.85, 7.4, 9.25
RV-SET-2	Co-57, Co-60, Cs-137	5, .050, .200	185, 1.85, 7.4
RV-060-50U	Co-60	0.050	1.85

Other nuclides, activities and geometries are available upon request.



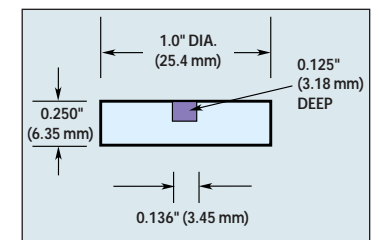
Dose Calibrator Vial

## Spot Markers (SM-057)

The IPL Spot Markers are used for patient orientation during the performance of a camera study. A 0.136" (3.45 mm) diameter active area is marked with purple epoxy and centered in a 1" x 0.250" (25.4 mm x 6.35 mm) clear acrylic disk. Contained activity is supplied as a nominal value ± 15%.

Model Number	Nuclide	Activity (μCi)	Activity(MBq)
SM-057-25U	Co-57	25	0.925
SM-057-50U	Co-57	50	1.85
SM-057-100U	Co-57	100	3.7
SM-057-200U	Co-57	200	7.4

Other activities and nuclides are available upon request.



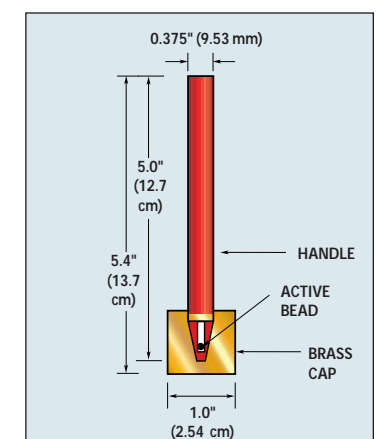
Spot Marker

## Pen Point Markers (PP-057)

The IPL Pen Point marker is used to mark a point of interest during a camera study. The Pen Point Marker contains Co-57 in a ceramic matrix at the end of a 5.0" (12.7 cm) anodized aluminum rod. The pen-shaped rod screws into a brass cap which shields the active point. The Pen Point Marker is used in tracing the outlines of anatomical features on a patient. The trace appears almost instantly on the camera display. Contained activity is supplied as a nominal value +/- 15%.

Model Number	Nuclide	Activity (μCi)	Activity(MBq)
PP-057-100U	Co-57	100	3.7
PP-057-200U	Co-57	200	7.4

Other activities are available upon request.

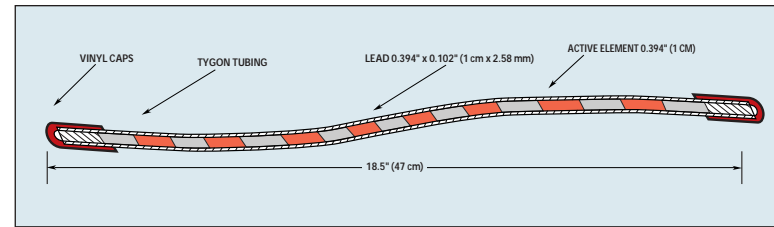


Pen Point Marker

# Accessories

## Flexible Rulers (FR-057)

Radioactive rulers and markers are used to define anatomical locations and/or organ size during a camera study. The Flexible Ruler is a plastic tube 0.19" (4.8 mm) in diameter containing 47 alternating 0.394" (10 mm) sections of Co-57 and inactive lead. The overall length of the ruler is 18.5" (47 cm) with an active length of 17.7" (45 cm). Contained activity is supplied as a nominal value  $\pm 15\%$ .



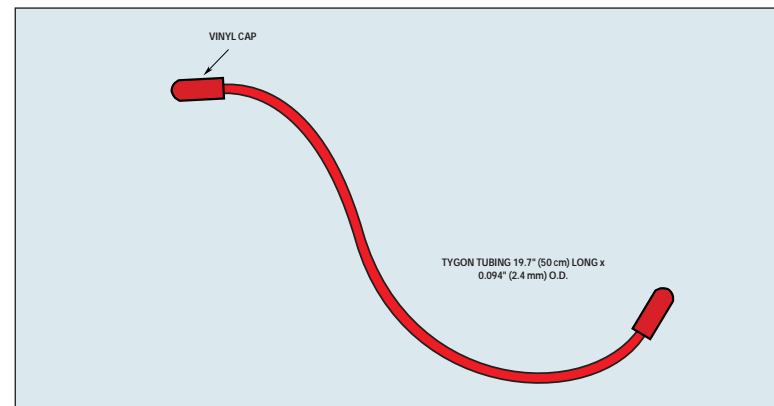
Flexible Ruler

Model Number	Nuclide	Activity ( $\mu\text{Ci}$ )	Activity (MBq)
FR-057-460U	Co-57	460	17.02

Other activities are available upon request.

## Flexible Markers (FM-057)

Co-57 uniformly dispersed in an epoxy matrix is injected into a 0.094" (2.4 mm) outer diameter flexible plastic tube having an inner diameter of 0.02" (0.508mm). The overall length and the active length of the ruler is 19.7" (50 cm). Contained activity is supplied as a nominal value  $\pm 15\%$ .



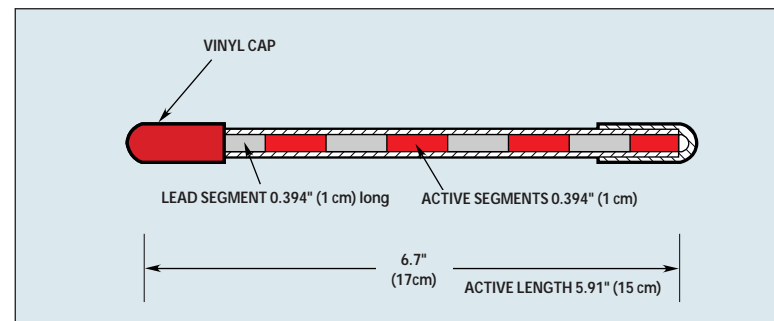
Flexible Marker

Model Number	Nuclide	Activity ( $\mu\text{Ci}$ )	Activity (MBq)
FM-057-150U	Co-57	150	5.55

Other activities are available upon request.

## Rigid Rulers (RR-057)

The Rigid Ruler is a plastic tube 0.197" (5 mm) in diameter containing 17 alternating 0.394" (10mm) sections of Co-57 and inactive lead. The overall length of the ruler is 6.7" (17 cm) with an active length of 5.91" (15 cm). Contained activity is supplied as a nominal value  $\pm 15\%$ .



Rigid Ruler

Model Number	Nuclide	Activity ( $\mu\text{Ci}$ )	Activity (MBq)
RR-057-160U	Co-57	160	5.92

Other activities are available upon request.

## Gamma Tube Standards

Each source consists of a polypropylene test tube containing 0.75 mL of active epoxy with the balance of the test tube filled with cold epoxy. Each set contains Ba-133, Cs-137, Co-57, Co-60, Cd-109, Mn-54, and Na-22.

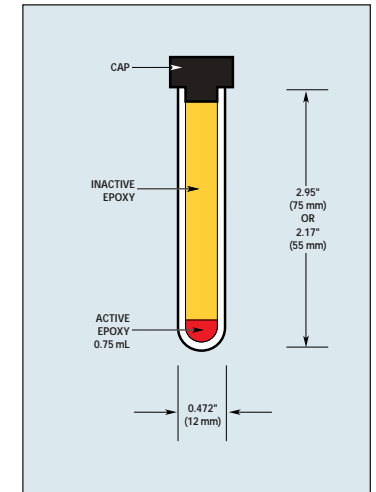
Test tube sizes available: 2.95" x 0.472" (75 mm x 12 mm), 2.17" x 0.472" (55 mm x 12 mm)

A variety of other nuclides and tube sizes are available upon request. Customer-supplied tubes can be utilized upon request. Tube sources are calibrated as NIST traceable with an accuracy of  $\pm 5\%$  at the 99% confidence level.

Model Number	Activity ( $\mu\text{Ci}$ )	Activity (kBq)
GF-290T-100N	0.1	3.7
GF-290T-1U	1.0	37

Other activities are available upon request.

Test tube standards may also be purchased individually.



Gamma Tube Standards

## Well Counter (Rod) Standards

Each source consists of a lucite rod measuring 5" x 0.5" (127 mm x 12.7 mm) or 2.95" x 0.5" (74.9 mm x 12.7 mm). The activity is located in a 0.187" x 0.187" (4.75 mm x 4.75 mm) well, positioned approximately 0.250" (6.35 mm) from the top of the rod. Set includes Ba-133, Cs-137, Co-57, Co-60, Cd-109, Mn-54, and Na-22.

Rod sources are calibrated and NIST traceable with an accuracy of  $\pm 5\%$  at the 99% confidence level.

Model Number	Nuclide	Length		Activity ( $\mu\text{Ci}$ )	Activity (kBq)
		Inches	mm		
GF-0012	Co-57	2.95	74.9	0.1	3.7
GF-0208	Co-57	2.95	74.9	1	37
GF-0014	Cs-137	2.95	74.9	0.1	3.7
GF-0209	Cs-137	2.95	74.9	1	37
GF-0206	Cs-137	5	127	0.1	3.7
GF-0210	Co-57	5	127	1	37
GF-0207	Co-57	5	127	0.1	3.7
GF-0211	Cs-137	5	127	1	37
GF-290R-100N	SET	5	127	0.1	3.7
GF-290R-1U	SET	5	127	1	37
GF-0235	Ba-133	2.95	74.9	0.1	3.7
GF-0239	Ba-133	5	127	0.1	3.7

Other nuclides, activities and geometries are available upon request.



Well Counter Standards

# Sources for Dedicated PET



Isotope Products Laboratories is the leader in source manufacturing for Positron Emission Tomography (PET) studies. IPL manufactures Ge-68 Transmission Sources and quality assurance sources for major dedicated PET camera makers such as GE Medical Systems, Siemens Medical Systems, Positron Corporation and others. In addition, IPL manufactures Cs-137 and Na-22 sources for dedicated PET cameras for Philips Medical Systems and Siemens/CTIMI Medical Systems.

Custom Sources: IPL can manufacture PET sources for custom needs. Please contact an IPL Medical Imaging Customer Service Representative for additional information.

## SIEMENS MEDICAL SYSTEMS ECAT EXACT/HR/ART/951R/951/31/931/08™ Phantom for Quality Assurance

Product Code	Nuclide	Activity
EG-0068	Ge-68	2.5-4.0 mCi (92.5 - 148 MBq) without groove
EG-0310	Ge-68	1.2-4.0 mCi (44.4 - 148 MBq) with groove
EG-0317	Ge-68	1.2-4.0 mCi (44.4 - 148 MBq) with groove

IPL DRAWING NUMBER	A1911
ENCAPSULATION	High density polyethylene right circular cylinder
DIMENSIONS	8.37" diameter x 8.87" high (21.3cm x 22.5cm)
ACTIVE VOLUME	6 Liters
SOURCE MATRIX	Epoxy
DENSITY	1.0 g/cm <sup>3</sup> ±7%
NUCLIDE PURITY	>99%
UNIFORMITY	±5% coefficient of variation measured with a resolution of 1 cm <sup>3</sup> source volume
CALIBRATION	Calibrated and NIST traceable with an absolute activity accuracy ±5% of measured value



Ge-68 Phantom

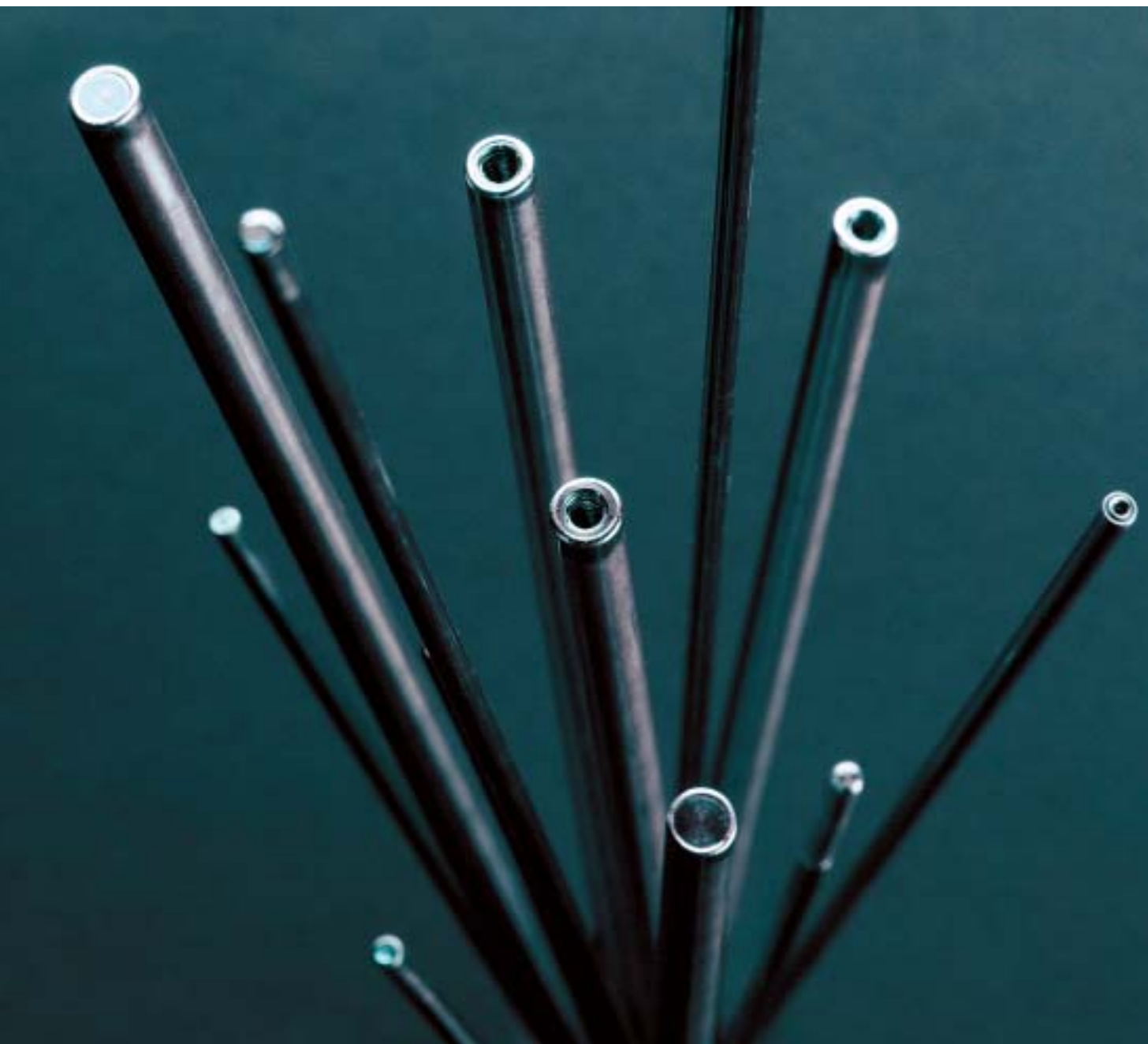
## ADAC MEDICAL C-PET™ Quality Assurance Point Source

Product Code	Nuclide	Activity
GF-0227	Na-22	100 uCi (3.7 MBq)

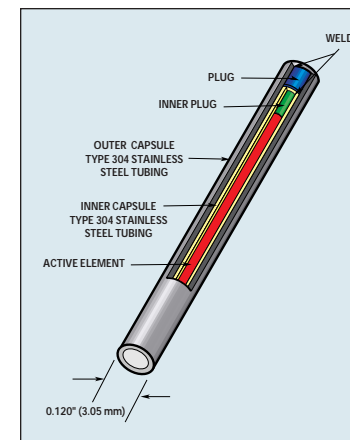
IPL DRAWING NUMBER	1001 (Type D)
OVERALL DIMENSION	1" diameter x 0.250" high (25.4mm x 6.35mm)
ACTIVE DIMENSION	.040" (1mm)
NUCLIDE PURITY	>99%



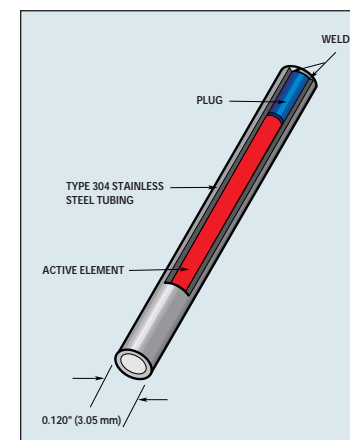
Point Source



The Ge-68 line source is utilized to calibrate Positron Emission Tomography scanner systems. It is used as a transmission standard or a source of annihilation photons to provide a tissue density correction to permit more accurate diagnostic scanning of patients. The source is mounted on a movable holder which revolves around the patient's head or body. The source emits photons which attenuate in the patient to varying degrees, depending on the particular location of the source with respect to the patient. The counter-opposed detectors on the PET system detect the radiation at any given point and the system software computes and stores this information. The instrumentation "corrects" the annihilation radiation intensity emitted from the administered radiopharmaceutical, automatically adjusting for the effect of the density and thickness of the tissue through which the photons travel at all the reference locations. This provides a "background corrected" scan of the patient to optimize resolution and define more precisely the distribution of the radiopharmaceutical.



**Doubly Encapsulated Point Source**



**Singly Encapsulated Point Source**

**GE MEDICAL SYSTEMS PET ADVANCE™  
Transmission and Quality Assurance Pin**

Product Code	Nuclide	Activity
HEGL-0019	Ge-68	10.8 mCi x2 (400 MBq) x2
HEGL-0020	Ge-68	1.62 mCi (60 MBq)



IPL DRAWING NUMBER	A3407
ENCAPSULATION	Triply encapsulated 304 stainless steel
OVERALL LENGTH	8.88" (225.6 mm)
ACTIVE LENGTH	6.108" (155 mm)
OVERALL DIAMETER	0.156" (3.96 mm) (handle is 0.75" 19.05 mm)
ACTIVE DIAMETER	0.060" (1.52 mm)
NUCLIDE PURITY	>99%
UNIFORMITY	≤5% integral non-uniformity measured in centimeter long segments

**GE MEDICAL SYSTEMS DISCOVERY ST™  
Normalization Pin**

Product Code	Nuclide	Activity
HEGL-0132	Ge-68	1.49 mCi (55 MBq)



IPL DRAWING NUMBER	A3429
ENCAPSULATION	Singly encapsulated 304 stainless steel
OVERALL LENGTH	11.54" (293.1 mm)
ACTIVE LENGTH	6.30" (160 mm)
OVERALL DIAMETER	0.156" (3.96 mm) (with handle 0.75" 19 mm)
ACTIVE DIAMETER	0.055" (1.40 mm)
NUCLIDE PURITY	>99%
UNIFORMITY	≤5% integral non-uniformity measured in centimeter long segments

**SIEMENS MEDICAL SYSTEMS ECAT EXACT/HR™  
Transmission Pin**

Product Code	Nuclide	Activity
HEGL-0080	Ge-68	2.5-4.0 mCi x3 (92.5-148 MBq) x3



IPL DRAWING NUMBER	A3418-2
ENCAPSULATION	Singly encapsulated 304 stainless steel
OVERALL LENGTH	7.56" (192 mm)
ACTIVE LENGTH	7.21" (183 mm)
OVERALL DIAMETER	0.125" (3.18 mm)
ACTIVE DIAMETER	0.093" (2.36 mm)
NUCLIDE PURITY	>99%
UNIFORMITY	≤5% integral non-uniformity measured in centimeter long segments

# Sources for SPECT



Isotope Products Laboratories manufactures a wide range of Attenuation Correction line sources for Single Photon Emission Computed Tomography (SPECT) studies.

A SPECT image is developed by measuring a collimated radiation beam emitted from a patient's body. The radiation beam is produced by injecting a known radiopharmaceutical into the patient. SPECT image quality can suffer from unquantified attenuation effects caused as the beam passes through tissue of varying density and thickness. A line source is utilized to produce a "control beam" that is measured concurrently with the "radiopharmaceutical beam." The two beams are integrated and patient specific attenuation is calculated. The resulting image is of higher quality than an image produced without attenuation correction.

The typical Attenuation Sources for SPECT studies are Gd-153, Co-57 and Ba-133. Isotope Products Laboratories also manufactures Molecular Coincidence Detection (MCD) sources for PET applications. Typically the MCD sources for PET studies are Gd-153, Cs-137 and Ba-133.

Sources for both applications are configured in both line and point geometries. The nuclides, activities and dimensions are manufactured in accordance to OEM Camera manufacturer specifications. Line sources are singly or doubly encapsulated with welded joints.

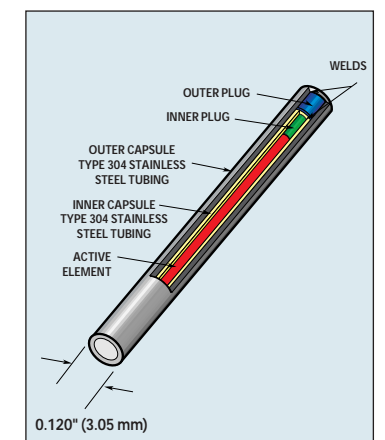
Custom Sources: As part of IPL's commitment to Nuclear Medicine, custom Line Sources for standard and non-standard gamma cameras can be manufactured. Please contact an IPL Medical Imaging Customer Service Representative for additional information.

## ADAC MEDICAL SYSTEMS VANTAGE™ Transmission Pin



Product Code	Nuclide	Activity
NES 8412	Gd-153	250 mCi x2 (9.25 GBq) x2

IPL DRAWING NUMBER	A3402
ENCAPSULATION	Doubly encapsulated in 304 stainless steel
OVERALL LENGTH	20.5" (520.7mm)
ACTIVE LENGTH	20.0" (508mm)
OVERALL DIAMETER	0.12" (3.05mm)
ACTIVE DIAMETER	0.060" (1.52mm)
NUCLIDE PURITY	<0.005% High Energy Impurities
UNIFORMITY	≤5% integral non-uniformity measured in centimeter long segments



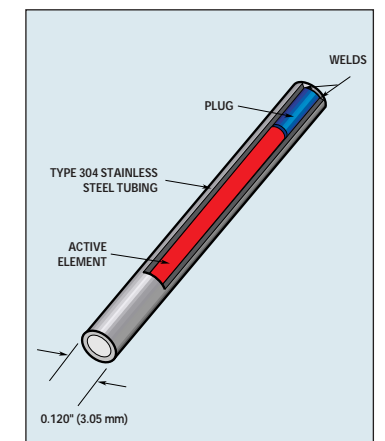
Doubly Encapsulated Line Source

## ADAC MEDICAL SYSTEMS MCD™ Quality Assurance Pin



Product Code	Nuclide	Activity
HEGL-0109	Ge-68	500 uCi (18.5 MBq)

IPL DRAWING NUMBER	A3402
ENCAPSULATION	Doubly encapsulated in 304 Stainless Steel
OVERALL LENGTH	5.7" (144.8mm)
ACTIVE LENGTH	5.2" (132.1mm)
ACTIVE DIAMETER	0.060" (1.52mm)
OVERALL DIAMETER	0.12" (3.05mm)
NUCLIDE PURITY	>99%
UNIFORMITY	≤5% integral non-uniformity measured in centimeter long segments



Singly Encapsulated Line Source

# Sources for SPECT

## SMV MEDICAL SYSTEMS DST™ Transmission Pin



Product Code	Nuclide	Activity
NES 8424	Gd-153	323 mCi x2 (12GBq) x2

IPL DRAWING NUMBER	A3421
ENCAPSULATION	Doubly encapsulated in 304 stainless steel
OVERALL LENGTH	9.06" (230 mm)
ACTIVE LENGTH	8.66" (220 mm)
OVERALL DIAMETER	0.120" (3.05 mm) (Ring OD 0.177", 4.5 mm)
ACTIVE DIAMETER	0.060" (1.52 mm)
NUCLIDE PURITY	<0.005% High energy Gamma impurities
UNIFORMITY	±5% integral non-uniformity measured in centimeter long segments

## SIEMENS MEDICAL SYSTEMS ECAM PROFILE ATTENUATION™ Transmission Pin



Product Code	Nuclide	Activity
NES 8426 (Set of 4)	Gd-153	20 mCi x4 (740MBq) x 4

IPL DRAWING NUMBER	A3410
ENCAPSULATION	Singly encapsulated in 304 stainless steel
OVERALL LENGTH	8.11" (206 mm)
ACTIVE LENGTH	7.86" (200 mm)
OVERALL DIAMETER	0.120" (3.05 mm)
ACTIVE DIAMETER	0.090" (2.29 mm)
NUCLIDE PURITY	<0.005% High Energy Impurities
UNIFORMITY	±10% integral non-uniformity measured in centimeter long segments

## GE MEDICAL SYSTEMS MILLENIUM/ACUSCAN™ Transmission Pin



Product Code	Nuclide	Activity
NES 8429	Gd-153	450 mCi (16.6GB) x 2

IPL DRAWING NUMBER	A3431
ENCAPSULATION	Singly encapsulated in 304 stainless steel
OVERALL LENGTH	20.5" (520.7 mm)
ACTIVE LENGTH	20.0" (508 mm)
OVERALL DIAMETER	0.120" (3.05 mm)
ACTIVE DIAMETER	0.060" (15.24 mm)
NUCLIDE PURITY	>99%
UNIFORMITY	±10% integral non-uniformity measured in centimeter long segments



# Multimodal Sources

Increase your coregistration accuracy with IPL.

## Multimodal Spot Markers and Fiducial Markers

Available in Co-57 for CT-SPECT and Ge-68 or Na-22 for CT-PET fusion imaging, these markers help increase the accuracy of your image registration. Activities up to 100µCi nominal available.

### Model MMS01 Specifications

Capsule: 1" x 0.25" (D x H) white Delrin  
Active dimensions: 1mm x 1mm cylinder  
Suggested usage: high-resolution PET point source or fiducial marker.

### Model MMS02 Specifications

Capsule: 1" x 0.25" (D x H) clear cast acrylic  
Active dimensions: 1.5mm x 1.5mm cylinder  
CT target: 1/4" OD bone-equivalent ring (surrounds active element)  
Suggested usage: multimodal fiducial marker for image coregistration.

### Model MMS03 Specifications

Capsule: 1" x 0.25" (D x H) clear cast acrylic with etched crosshairs for laser alignment  
Active dimensions: 1mm diameter sphere  
CT target: 2mm OD bone-equivalent ring (surrounds active element)  
Suggested usage: multimodal fiducial marker for image coregistration.



Multimodal Spot Markers

### Model MMS04 Specifications

Capsule: 3 x 3 x 8mm clear acrylic with Delrin plug  
Active dimensions: 1 x 0.5mm (D x H) cylinder  
CT target: active element is CT-visible  
Suggested usage: multimodal fiducial marker for image coregistration, recommended for small animal studies or other situations where a small source capsule is needed.



MMS04

### Model MMS06 Specifications

Capsule: 1" x 0.25" (D x H) clear cast acrylic  
Active dimensions: 0.25mm diameter sphere  
Suggested usage: high-resolution point source or spot marker for use with scanners with resolution better than 3mm.

# Packaging and Shipping Containers

Packaging and shipment of radioactive materials at Isotope Products Laboratories adhere to the regulations of the U.S. Department of Transportation regulations, 49CFR and the International Air Transportation Association (IATA).

Isotope Products Laboratories uses two types of packaging to ship radioactive materials: excepted packaging and type A packaging.

Type A packaging is used to carry normal form radioactive material as defined by the  $A_2$  values of 49 CFR 173.435 (1998) and IATA 10.4.2.3 (2001) and encapsulated radioactive material that has been issued an IAEA certificate of Competent Authority Special Form Radioactive Material Encapsulation Certificate by the U.S. Department of Transportation.

In the Standard Type A configuration, sources are sealed in an inner container and centered in a fiberboard box. Sources requiring heavy shielding are shipped in a lead shield centered in a fiberboard box.

Excepted Packaging (Limited Quantity) is used when the activity limits do not exceed those defined in 49 CFR 173.425 (1998) and IATA regulations table 10.5.A (2001) and the radiation level at any point on the package does not exceed 0.5 millirem per hour. All boxes shipped from Isotope Products as "excepted packages" meet the requirements of 49 CFR 173.421(1998) and IATA regulation 10.5.9.4(2001).

Radiation levels on the external surfaces of all packages and at a distance of one meter from all external surfaces (Transport Index), will not exceed the limits set in 49 CFR 173.441(1998) or IATA 10.5.16 (2001). All measurements are made with an Eberline RO2 or equivalent survey instrument.

Unless special arrangements are made with the customer in advance, radiation levels at the surface of any shielded inner containers will not exceed 200 millirem per hour as measured with an Eberline RO2 or equivalent survey instrument.

# ANSI/ISO Classifications

The development of these standards began in 1962 and they were published in 1968. The standards were written so that both the regulatory agencies and the users would have specifications which would characterize radioactive sources and establish performance standards.

The table is from ISO 2919; 1999, Classification of sealed source performance

Current copies of these standards are available from:

**American National Standards Institute**  
1430 Broadway  
New York, NY 10018  
(212) 642-4900

**Global Engineering**  
15 Inverness Way East  
Englewood CO 80112  
(800) 854-7179

**International Organization for Standardization**  
1, Rue De Varendel  
Case Postale 56  
CH-1211 Geneva 20  
Switzerland  
41-22-734-0150

The concept of both ANSI.N542 and ISO.2919 is that design standards are not mandated but a series of tests are specified for which prototypes of new designs are subjected. In this manner innovation is encouraged without sacrificing safety standards. Minimum performance must be met to demonstrate suitability for certain applications.

# ANSI/ISO Classifications

TEST	CLASS						X
	1	2	3	4	5	6	
<b>TEMPERATURE</b>	No Test	-40°C (20 min) +80°C (1 h)	-40°C (20 min) +180°C (1 h)	-40°C (20 min) +400°C (1 h) and thermal shock to 20°C	-40°C (20 min) +600°C (1 h) and thermal shock to 20°C	-40°C (20 min) +800°C (1 h) and thermal shock to 20°C	Special Test
<b>EXTERNAL PRESSURE</b>	No Test	25 kPa absolute to atmospheric	25 kPa absolute to 2 MPa absolute	25 kPa absolute to 7 MPa absolute	25 kPa absolute to 70 MPa absolute	25 kPa absolute to 170 MPa absolute	Special Test
<b>IMPACT</b>	No Test	50 g from 1 m or equivalent imparted energy	200 g from 1 m or equivalent imparted energy	2 kg from 1 m or equivalent imparted energy	5 kg from 1 m or equivalent imparted energy	20 kg from 1 m or equivalent imparted energy	Special Test
<b>VIBRATION</b>	No Test	3 times 10 min 25 to 500 Hz at 49 m/s <sup>2</sup> (5 gn) <sup>1</sup>	3 times 10 min 25 to 50 Hz at 49 m/s <sup>2</sup> (5 gn) <sup>1</sup> and 50 to 90 Hz at 0.635 mm amplitude peak to peak and 90 to 500 Hz at 98 m/s <sup>2</sup> (10 gn) <sup>1</sup>	3 times 30 min 25 to 80 Hz at 1.5 mm amplitude peak to peak and 80 to 2000 Hz at 196 m/s <sup>2</sup> (20 gn) <sup>1</sup>	Not Used	Not Used	Special Test
<b>PUNCTURE</b>	No Test	1 g from 1 m or equivalent imparted energy	10 g from 1 m or equivalent imparted energy	50 g from 1 m or equivalent imparted energy	300 g from 1 m or equivalent imparted energy	1 kg from 1 m or equivalent imparted energy	Special Test

<sup>1</sup>) Acceleration maximum amplitude

The tests are performed on two sources. Different specimens of the same source design are allowed for each test in the above table. To pass a test the sealed source must retain its activity after each test and pass the prescribed leak tests. Source performance is generally described as C12345, a letter and five digits. The letter will be either C or E. C indicates the activity does not exceed limits established by nuclide dependent upon its toxicity and the solubility of its physical form. E indicates the activity exceeds those limits. The five digits indicate, respectively, the highest test passed for temperature, pressure, impact, vibration, and puncture.

SEALED SOURCE USAGE	SEALED SOURCE TEST AND CLASS					
	TEMPERATURE	PRESSURE	IMPACT	VIBRATION	PUNCTURE	
<b>Radiography - Industrial</b>	Unprotected source	4	3	5	1	5
	Source in device	4	3	3	1	3
<b>Medical</b>	Radiography	3	2	3	1	2
	Gamma Teletherapy	5	3	5	2	4
<b>Gamma gauges</b> (medium and high energy)	Unprotected source	4	3	3	3	3
	Source in device	4	3	2	3	2
<b>Beta gauges and sources for low energy gamma gauges or X-ray fluorescence analysis</b> (excluding gas filled sources)		3	3	2	2	2
<b>Oil well logging</b>		5	6	5	2	2
<b>Portable moisture and density gauge</b> (including hand held or dolly transported)		4	3	3	3	3
<b>General neutron source application</b> (excluding reactor start-up)		4	3	3	2	3
<b>Calibration sources - Activity greater than 30 µCi</b>		2	2	2	1	2
<b>Gamma Irradiators<sup>1</sup></b>	Categories II, III, IV	4	3	4	2	4
	Category I	4	3	3	2	3
<b>Ion Generators<sup>2</sup></b>	Chromatography	3	2	2	1	1
	Static eliminators	2	2	2	2	2
	Smoke detectors	3	2	2	2	2

<sup>1</sup>For the purposes of this Standard, gamma irradiators have been divided into four distinct categories.

<sup>2</sup>Source-device combination may be tested.

Category I—Self-Contained-Dry Source Storage Category II—Panoramic-Dry Source Storage  
Category III—Self-Contained-Wet Source Storage Category IV—Panoramic-Wet Source Storage

# Terms and Conditions

**1. DEFINITIONS.** A. The word "goods" as used herein means products offered or acknowledged in this catalog, ordered by Buyer and furnished by Seller. B. The word "services" means testing and other services offered or acknowledged in this catalog, ordered by Buyer and provided by Seller.

**2. GENERAL.** The terms and conditions set forth herein shall exclusively govern the sale of goods by Seller to Buyer and the furnishing of services by Seller to Buyer. Acceptance of this offer or of the goods or services furnished under quotations or acknowledgements is expressly limited to the terms and conditions contained herein. Any terms and conditions stated by Buyer in any purchase order or other document accepting or ordering such goods or services containing statements, clauses, terms or conditions modifying, adding to, repugnant to, or inconsistent with the terms and conditions of Seller herein contained, may only be deemed accepted by Seller if so stated in writing by a duly authorized signatory of Seller. Buyer further expressly agrees that such terms accepted by Seller are accepted only upon the condition and with the express understanding that, notwithstanding any statements, clauses, terms or conditions contained on any forms of Buyer, the liabilities of Seller shall be determined solely by the terms and conditions stated herein. Acceptance by Buyer of any goods offered for sale or services performed by Seller is expressly limited to the terms and conditions contained herein, and acceptance of said terms shall be deemed to be acceptance of the Buyer's performance inconsistent with any term or condition herein shall constitute a waiver as to said term or condition only.

**3. PRICES.** All prices quoted are in U.S. dollars, F.O.B. Burbank, California and/or Valencia, California. Quoted prices do not include charges for shipping, handling, insurance and hazardous materials documentation. State, use, consumption, compensating and excise taxes and retailers occupations taxes payable or collectable by Seller in connection with its sales shall be in addition to invoice prices and are not listed on the invoice unless specifically noted. Buyer will reimburse Seller for same at the time of payment of the invoice, whether or not such taxes are separately stated on the invoice. If Buyer claims exemption from any of these taxes, Buyer shall promptly furnish satisfactory proof of such exemption and shall indemnify Seller for any loss or damage, including attorneys' fees, Seller may incur in the event any taxing authority finds that Seller should have collected tax.

**4. DELIVERY.** All delivery dates are estimated as accurately as possible; however, Seller shall not be liable for any loss, damage or delay caused or occasioned by acts of God, fire, strikes, insurrection, riot, accident, embargo, delay of carrier, act of civil or military authority, failure of a supplier to make timely delivery, the requirements of any statute, order or directive of any governmental authority, or, without limiting the generality of the foregoing, by any other cause which is unavoidable or beyond Seller's reasonable control. If delays from any such cause occur, the delivery time is correspondingly extended.

**5. TITLE AND RISK OF LOSS.** Title to and risk of loss of goods shall pass to the Buyer upon delivery to carrier even if transportation costs are prepaid by the Seller.

**6. PAYMENT TERMS.** Payment shall be due 30 days from date of invoice. If Buyer requests Seller to hold goods for delivery later than scheduled, the invoice shall bear the scheduled delivery date and payment shall be due 30 days from the scheduled delivery date. Buyer bears all risk of loss or damage while such goods are in Seller's possession and shall pay all reasonable charges for goods held for more than two months and shall reimburse Seller for all use or personal property taxes levied on held goods at any time while in Seller's possession. Seller shall have the right to modify, change or withdraw credit at any time and without notice. If in Seller's judgment the financial responsibility of Buyer becomes impaired or unsatisfactory or if Buyer defaults under any contract with Seller, Seller may demand and Buyer shall give advance cash payment or satisfactory security and Seller may withhold shipments until such payment or security is received. Buyer expressly waives any right of set-off and shall make no deductions from payments due hereunder or for any damages of any type claimed by Buyer against Seller.

**7. LIMITED WARRANTY.** Seller warrants its goods to be of the quality described in its current catalogs or specifications delivered by Seller to Buyer as of the date of shipment. Seller warrants that catalog goods modified in accordance with Buyer's specifications and non-catalog goods manufactured to Buyer's specifications will be free from defects in materials and workmanship and manufactured in conformity with specifications furnished to Seller by Buyer as of the date of shipment or specifications delivered by Seller to Buyer as of the date of shipment. Seller warrants its services to be of a workmanlike quality. SELLER MAKES NO OTHER WARRANTY. THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES, GUARANTIES, OBLIGATIONS OR LIABILITIES WHICH MAY BE EXPRESSED OR IMPLIED BY SELLER OR ITS REPRESENTATIVES, ALL STATUTORY AND IMPLIED WARRANTIES, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND OTHER THAN TITLE, ARE HEREBY EXPRESSLY NEGATED AND EXCLUDED. This warranty does not apply to goods which have been repaired or altered by other than authorized representatives of Seller, which have been subject to misuse, negligence or accident or which have been operated or maintained or inspected other than in the strictest accordance with the applicable manuals or instructions furnished by Seller. Equipment and accessories not of Seller's manufacture, if any, are warranted only to the extent they are warranted by the manufacturers thereof, and Seller hereby assigns its interest under any such warranty to Buyer. ANY COMPLAINTS OF BREACH OF WARRANTY MUST BE RECEIVED IN WRITING BY THE SELLER WITHIN 30 DAYS OF RECEIPT OF GOODS BY BUYER OR THE PERFORMANCE OF SERVICES HEREUNDER. The maximum liability for breach of warranty shall be the invoice price of the goods or services. Upon the Seller's request, Buyer shall return goods to Seller at Seller's expense.

**8. LIMITATION OF LIABILITY AND INDEMNIFICATION.** SELLER ASSUMES NO LIABILITY FOR SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND. Buyer by acceptance of the goods or services assumes all liability for, and shall indemnify and hold Seller harmless against, the consequence of use or misuse by Buyer, its employees or others. Further, Buyer agrees to defend any and all suits, claims and demands brought against Seller and agrees to and will indemnify Seller and save it harmless from and against any and all suits, claims and demands whatsoever for injuries to or death of any person, or damage to or loss of property alleged out of, in connection with or to be incidental to Seller's furnishing of goods or services contemplated herein, whether or not such injury, death, loss or damage shall be caused or contributed to by the joint or concurring negligence of Seller. Buyer further agrees to and will pay, liquidate, discharge and satisfy any and all judgements, awards or expenses which may be rendered against or incurred by Seller on account of injuries to or death of any person or loss or damage to any property whatsoever, caused by, arising out of, in connection with or incidental to Seller's furnishing of the goods or services contemplated herein, including but not limited to all costs of suit, attorneys' fees and expenses in connection therewith, whether or not such judgement, award or expense is rendered against or incurred by Seller, in whole or in part, because of the joint or concurring negligence of the Seller. As used in this paragraph, the word "Seller" shall include Seller, its officers, directors, employees and agents. Buyer's care, custody and control at any time of the goods contemplated herein shall give rise to a conclusive presumption between the parties that any negligence was joint or concurring. This paragraph, in its entirety, also applies to suits, claims and demands based on the rules of strict liability and product liability.

**9. CHANGES AND GOODS MADE TO BUYER'S SPECIFICATIONS.** Seller reserves the right where possible to make any change in material or in its design which is an improvement but bears no obligation to do so. If goods are made to specifications of Buyer, it is upon the express condition that Buyer shall assume all responsibility and shall indemnify and hold the Seller harmless if the goods infringe or contribute to the infringement of, or are alleged to infringe or contribute to the infringement of any letters, patent, copyright or trademark where such infringement arose out of the designs, drawings or specifications supplied by Buyer alone or in combination with elements supplied by Seller.

**10. SELLER INSPECTION AND TESTING.** The goods are inspected and, where practicable, submitted to Seller's standard tests at Seller's plant before delivery. Buyer agrees to pay Seller reasonable additional charges for any additional tests which Buyer requires Seller to perform.

**11. BUYER INSPECTION AND ACCEPTANCE.** Within 30 days after tender of delivery to or receipt by Buyer of any shipment, Buyer shall inform Seller in writing if the goods are found defective or short in any respect. Failure to so inform Seller or any use by Buyer of the goods shall constitute conclusive evidence that Seller satisfactorily performed and Buyer waives any right to reject such goods thereafter.

**12. COMPLIANCE WITH LAWS.** Buyer agrees that in the performance hereof it will comply with all applicable laws, statutes, rules, regulations or orders of the National government or political subdivision thereof and same shall be deemed incorporated by reference herein. A. In the United States: Federal and State regulations require a copy of a Buyer's NRC license, Agreement State License, or Licensing State License together with all amendments, to be on file with Seller before any shipment of radioactive materials can be made. Buyer and Seller each warrant that it is an equal opportunity employer and that if this order is placed as a contract or subcontract under United States Government prime contract, those clauses required by federal law to be included are herein incorporated by reference. B. In Canada: A copy of the Buyer's AECB license, together with all amendments must be on file with Seller prior to any shipment of radioactive materials.

**13. LIMITATION PERIOD.** Causes of action for breach of contract relative to any order for goods or services shall not be asserted after one year from the date that said cause of action occurs, provided that this limitation shall not apply to actions by Seller to recover purchase price of the goods.

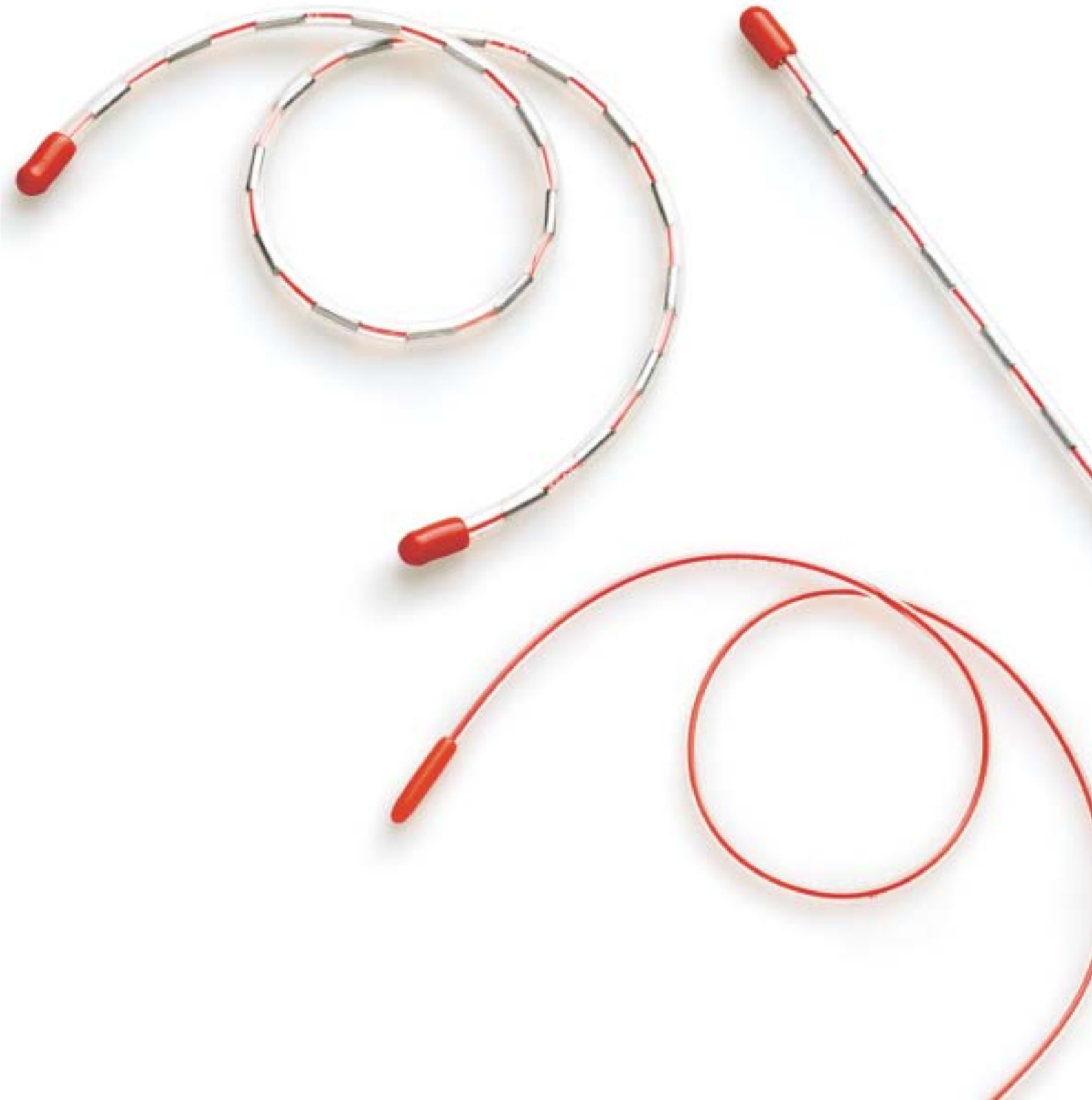
**14. CANCELLATION.** The contract arising out of Buyer's order cannot be canceled, transferred to others, or changed after receipt by Seller, except as may mutually be agreed in writing between the parties.

**15. APPLICABLE LAW.** Seller reserves any and all rights and remedies provided by law. The contract arising out of Buyer's order shall be interpreted and construed in accordance with the laws of the State of California.

**16. WAIVERS.** No waiver by Seller of any breach of any provision hereof shall constitute a waiver of any other breach of such provision. Seller's failure to object to provisions contained in any communications from Buyer shall not be deemed an acceptance of such provisions or as a waiver of the provisions hereof.

**17. NO OTHER REPRESENTATIONS.** There are no understandings, agreements, representations or warranties, either written or oral, relative to the goods or services that are not fully expressed in this document. No statement, recommendation or assistance made or offered through its representatives or by any sales literature in connection with the use of any goods, shall be or constitute a waiver by Seller or any of the provisions hereof. The provisions of this document supersede and cancel any previous understanding or agreement between the parties with respect to the subject matter hereof and this document expresses the final and complete understanding of the parties.

**18. ARBITRATION.** All disputes arising out of this contract shall be determined by binding arbitration in accordance with the rules of the American Arbitration Association. In such arbitration, the prevailing party shall be awarded attorneys' fees and costs (including costs of experts) and the provisions of California Code of Civil Procedure Section 1283.05 shall apply.



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**J. Gravengaard Corporation**

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