ORTEC®

SLP Series Silicon Lithium-Drifted Planar Low-Energy X Ray Detector Product Configuration Guide

For x-ray spectroscopy with a nuclear accelerator, radioactive source, or x-ray tube.

- Premium performance spectroscopy from 1 keV to 30 keV
- Superior resolution performance at low and high count rates
- Multi-detector arrays available for use at fusion facilities
- Thin Be window
- High peak-to-background ratio
- PopTop flexibility

ORTEC SLP Series Lithium-Drifted Silicon X-Ray Detectors provide the spectroscopist with a highly sensitive, premium performance research tool for detecting x rays from a nuclear accelerator, radioactive source, or x-ray tube. The energy range of detection (Fig. 1) is from 30 keV down to 1 keV, depending on the thickness of the beryllium window.

The x-ray detector consists of a lithium-drifted silicon crystal and a cryogenically-cooled-FET, a high-gain, low-noise hybridized preamplifier in a PopTop capsule with a thin Be entrance window. The ORTEC Si(Li) detector crystal is manufactured under an exclusive process. Special techniques for lithium drifting result in a negligible detector element dead layer whose characteristics will not change even if the detector is stored at room temperature.

The SLP Series Si(Li) detector provides exceptional resolution performance. A pulsed optical feedback preamplifier having and energy rate in excess of 4000 MeV/s* is supplied with the SLP Series detectors.

An ultra-thin Be window (either 0.3 mil and 0.5 mil) is an option.

SLP detectors have an exclusive high-rate indicator and high-voltage shutdown protection feature. If the LN_2 supply is exhausted and the detector begins to warm while high voltage is applied, the high voltage will automatically shut off, thus protecting the FET from damage.

As a single element or in multiple detector arrays (Figs. 2 and 3), the SLP Series has become an important tool in soft x-ray spectroscopy in fusion research. Please contact the factory or your local sales representative for specific information on these applications.

An SLP PopTop detector consists of:

(a) A Si(Li) detector element (Fig. 4) mounted, in most systems, inside the vacuum enclosure of its PopTop capsule.

(b) A charge-sensitive preamplifier and a HV filter, with accompanying cable pack. The first stage of the preamplifier is also mounted inside the vacuum enclosure to ensure proper cooling for optimum noise and reliability. The second stage of the preamplifier and HV filter are part of the PopTop assembly but reside outside the vacuum enclosure to which they are connected by vacuum feedthroughs.

(c) A dipstick cryostat with a 30-liter LN_2 dewar or a combination cryostat-dewar assembly.

*The POF does not "lock up" or saturate at high count rates, unlike resistor-feedback designs. At ultra-high count rates with the POF, throughput is limited by reset pulse rates. 4000 MeV/s is an estimate of maximum "useable" energy rate.

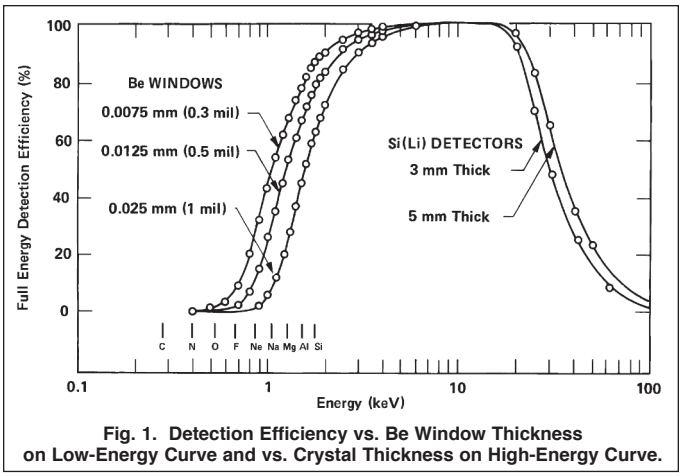


Fig. 1. Detection Efficiency vs. Be Window Thickness on Low-Energy Curve and vs. Crystal Thickness on High-Energy Curve.

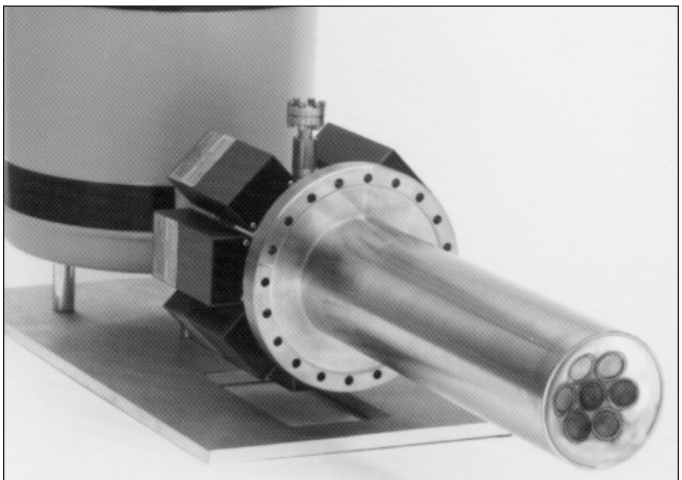


Fig. 2. Array, Comprising Seven Tightly-Packed 6-mm-diam Si(Li) Detectors, Used at Synchrotron Light Source.

Fig. 3. Examples of Multiple Detector Arrays for Soft X-Ray Spectroscopy. Note the three Be windows in each endcap. Three Si(Li) detectors share a common cryostat in each of the systems shown.

The Following Specifications are Provided for Each Model SLP Detector

- Active crystal diameter and depth.
- Energy resolution at 5.9 keV photons from ^{55}Fe at optimum shaping time unless the window material prohibits this energy.

Configuration Guidelines

PopTop or Streamline (non-PopTop) Configuration

The essence of a PopTop detector system is that the detector element, preamplifier, and high voltage filter are housed in a detector "capsule" which is then attached to an appropriate cryostat (Figure 4.)

In so called Streamline systems, the detector capsule is NOT demountable. Detector capsule and cryostat share the same vacuum. In configuration terms, this requires a cryostat or cryostat/dewar selection with the cryostat having a matching diameter to the capsule endcap. A cryostat must always be ordered with a Streamline capsule, because they are integral.

The actual PopTop capsule has its own vacuum. It can be mounted on any of the available cryostats, cryostat/dewar combinations, or the X-COOLER III mechanical cooling system.

Steps to Configure Your ORTEC Detector

1) Configure the Detector Model

- Capsule type (PopTop or Streamline)
- Crystal dimensions and specifications
- Endcap and window
- Mount
- Preamplifier
- High Voltage Filter
- Cable Package

2) Configure the Cryostat/Dewar Model

- Vertical Dipstick style (separate Dewar)
- Horizontal Dipstick style (separate Dewar)
- Portable with all-position or multi-position cryostat/dewar models
- Downlooking designed to be oriented with the detector pointing down
- Sidelooking designed to be oriented with the detector horizontal at the bottom of the dewar
- "J" configuration designed with the detector attached near the bottom of the dewar and a right angle bend in the cryostat orienting the detector to look up.

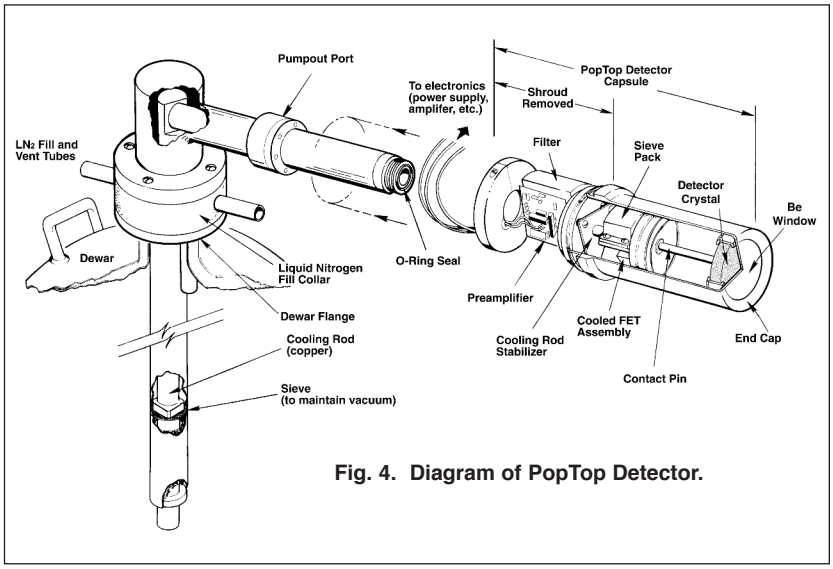


Fig. 4. Diagram of PopTop Detector.

A cryostat and dewar or other cooling device are required for operation.

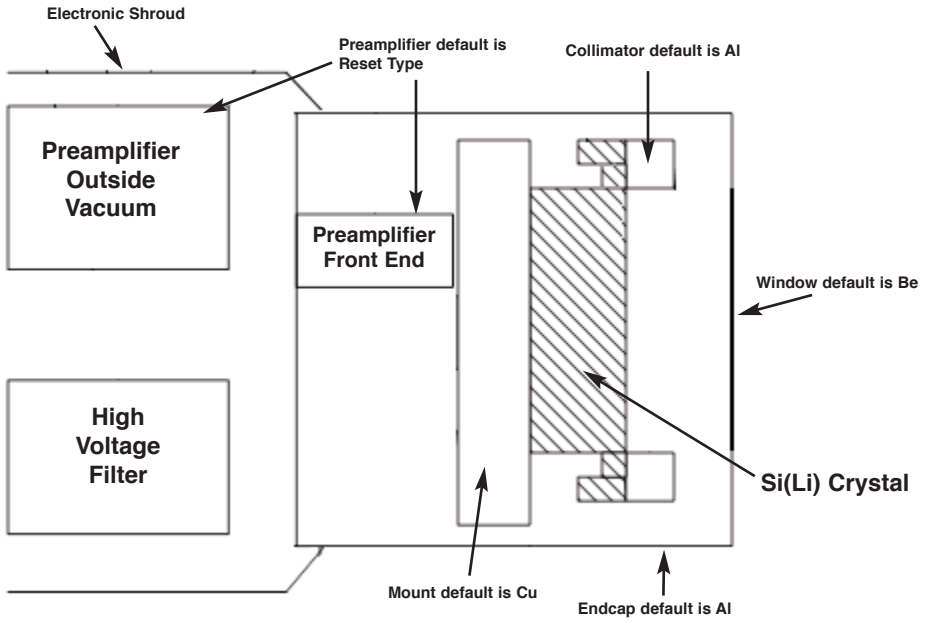
If a PopTop detector has been selected, you can choose a PopTop style cryostat, cryostat/dewar combination or the X-COOLER III mechanical cooler.

If a Streamline detector has been selected, you must choose a cryostat or cryostat/dewar model for the detector to be mounted on and vacuum sealed. The cryostat or cryostat/dewar combination diameter must match the endcap diameter of the selected detector.

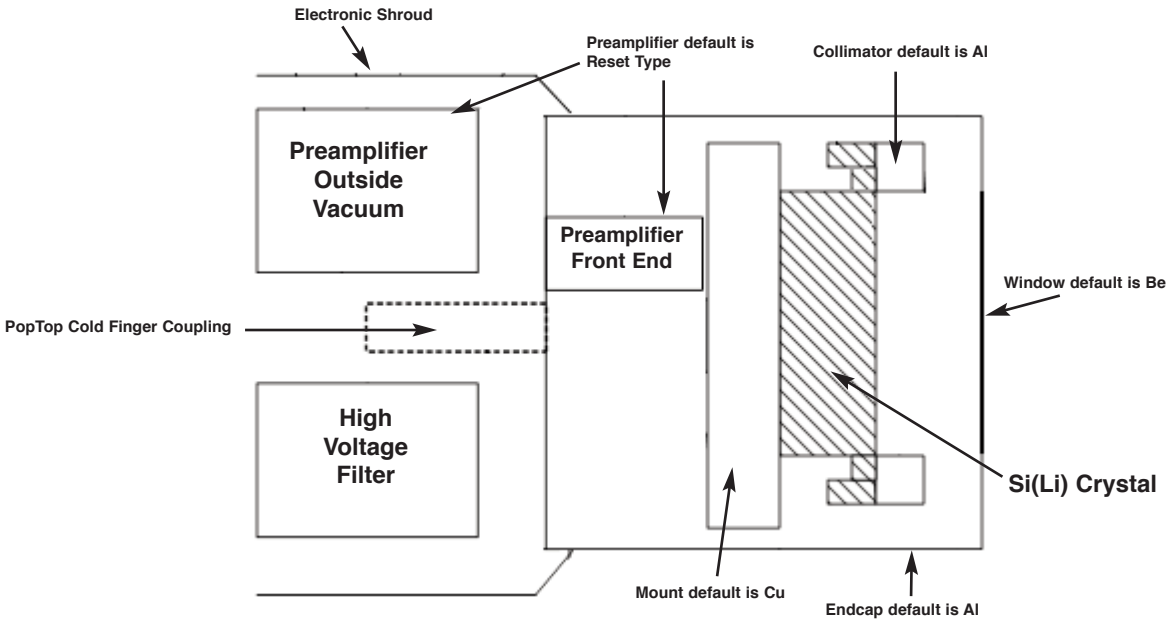
Defining the Detector Model

Base Model (example)	PopTop or Streamline
SLP-06165	P (PopTop) (Streamline)

Streamline Detector Capsule

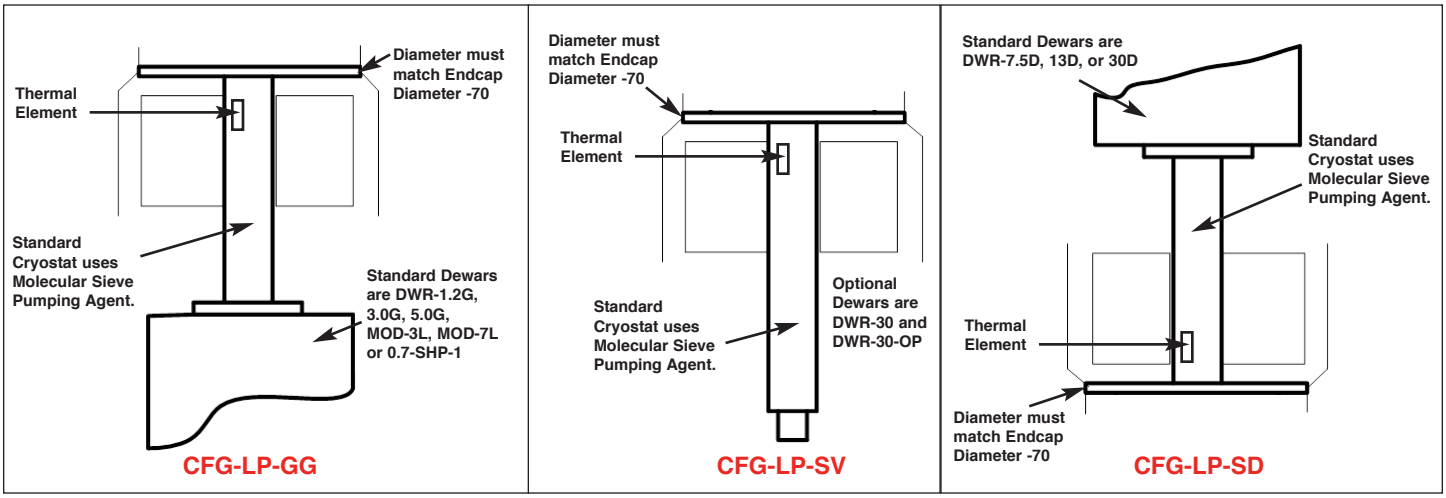


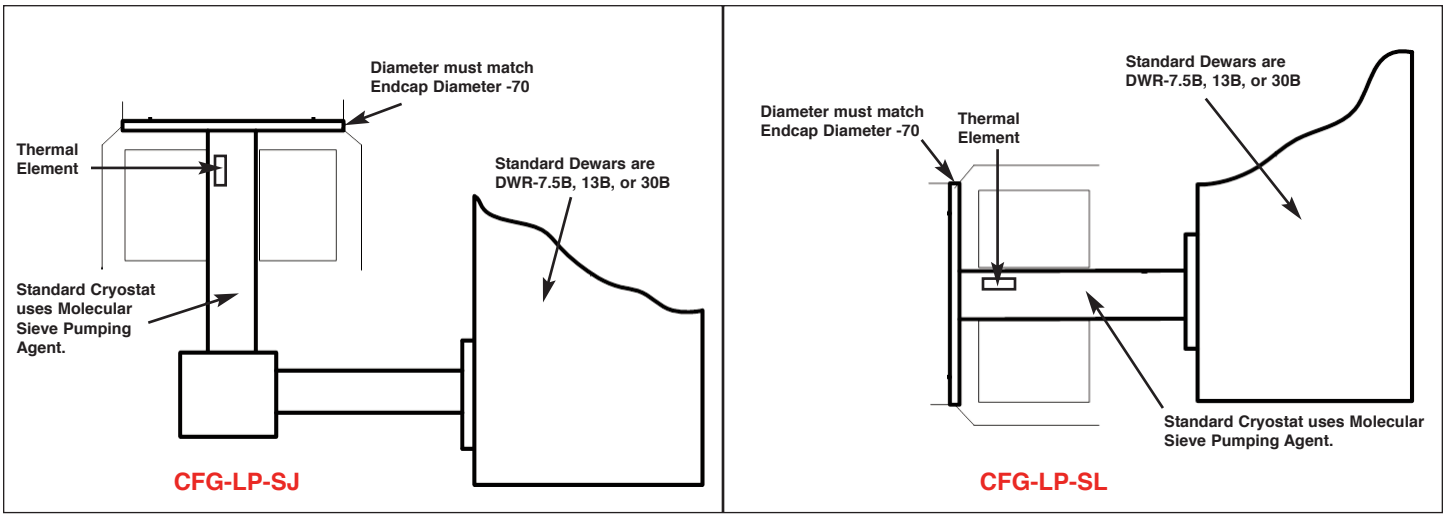
PopTop Detector Capsule

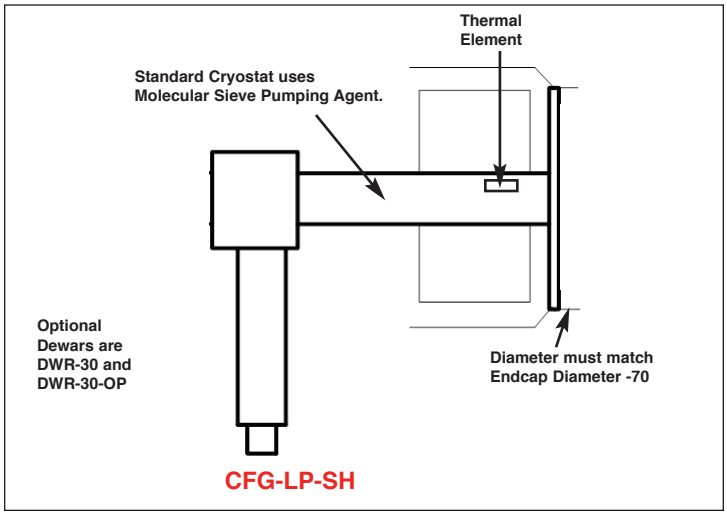


Streamline Cryostat and Cryostat/Dewar Assemblies

Streamline systems (detector capsule and cryostat) share the same vacuum, requiring a cryostat or cryostat/dewar selection with the cryostat having a matching diameter to the capsule endcap.







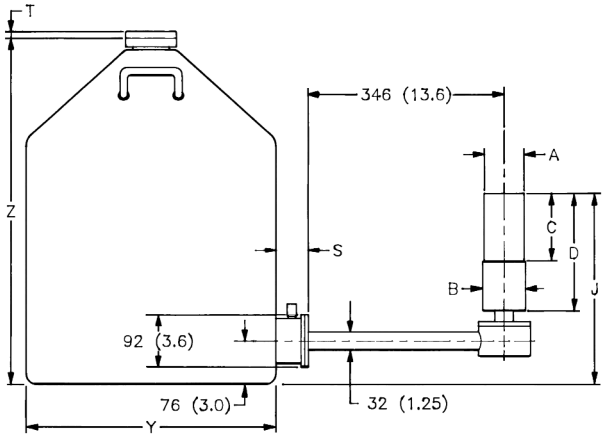
PopTop and Streamline Dimensional Data

Streamline systems (detector capsule and cryostat) share the same vacuum, requiring a cryostat or cryostat/dewar selection with the cryostat having a matching diameter to the capsule endcap. A cryostat must be ordered with a Streamline capsule.

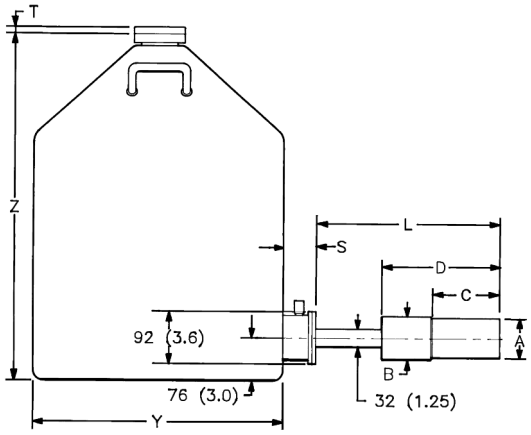
The PopTop capsule contains a vacuum unto itself. It can be mounted on any of the available cryostats, cryostat/dewar combinations, or the X-COOLER III mechanical cooling system.

The cryostat and dewar drawings that follow are to be used in conjunction with the accompanying tables of dimensions.

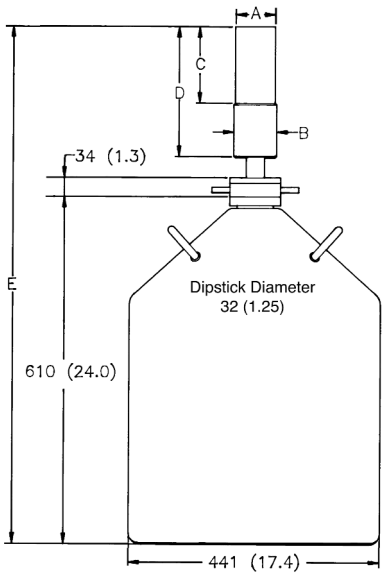
Note: Cryostat/Dewar drawings are NOT to scale, see tables that follow for complete dimensions.



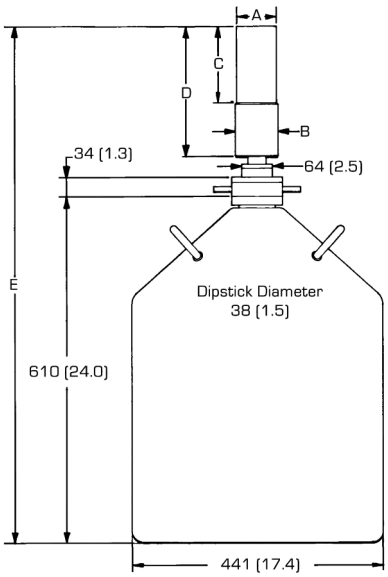
CFG-LP-SJ, DWR-30B (or -13B or -7.5B)



CFG-PS4-30 (or -13 or -7.5)
or
CFG-LP-SL, DWR-30B (or -13B or -7.5B)

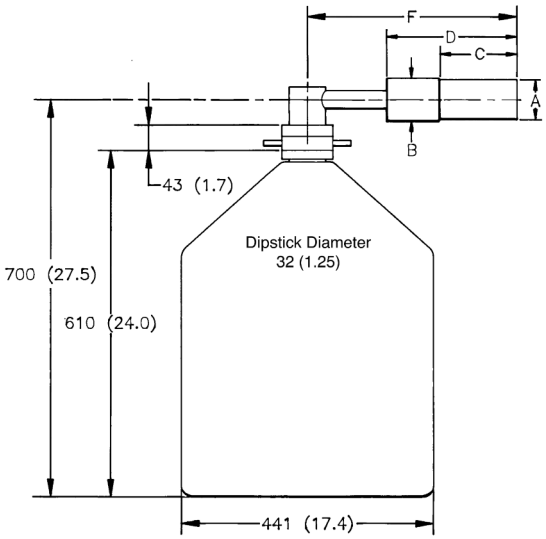


CFG-LP-SV, DWR-30

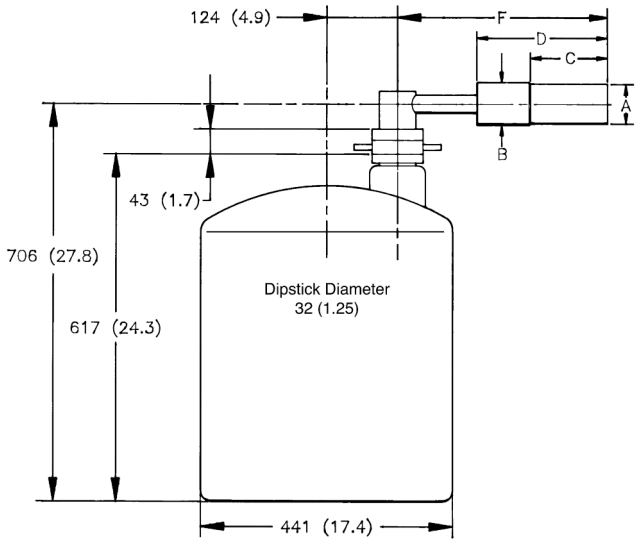


CFG-PV4, DWR-30

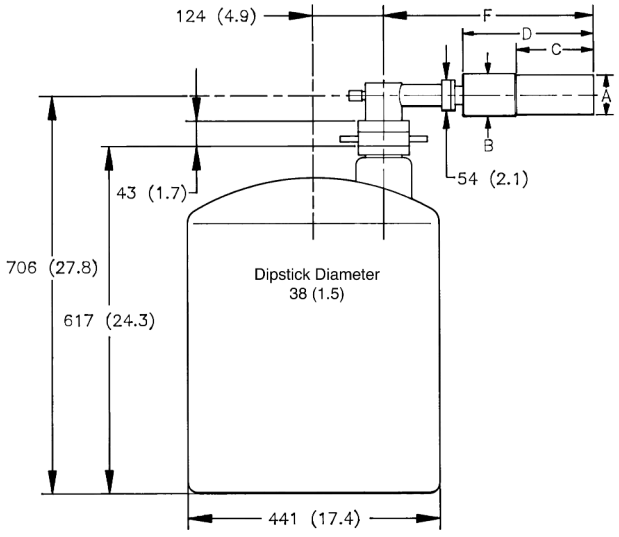
Note: Cryostat/Dewar drawings are NOT to scale, see tables that follow for complete dimensions.



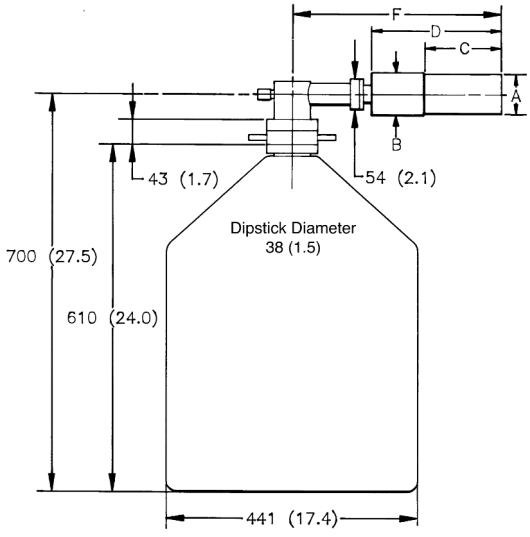
CFG-LP-SH, DWR-30



CFG-LP-SH, DWR-30-OP

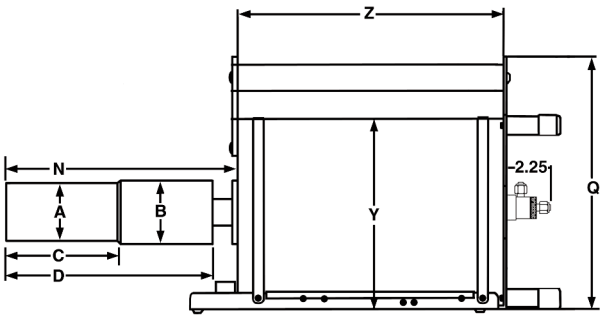


CFG-PH4, DWR-30-OP

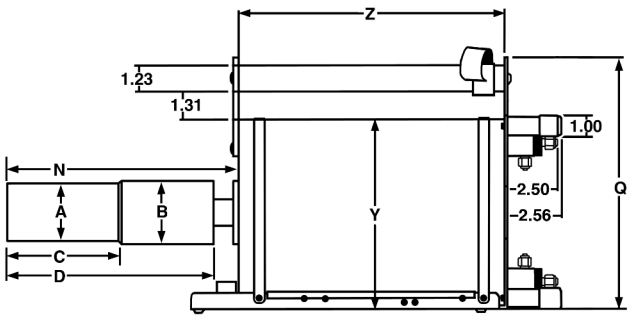


CFG-PH4, DWR-30

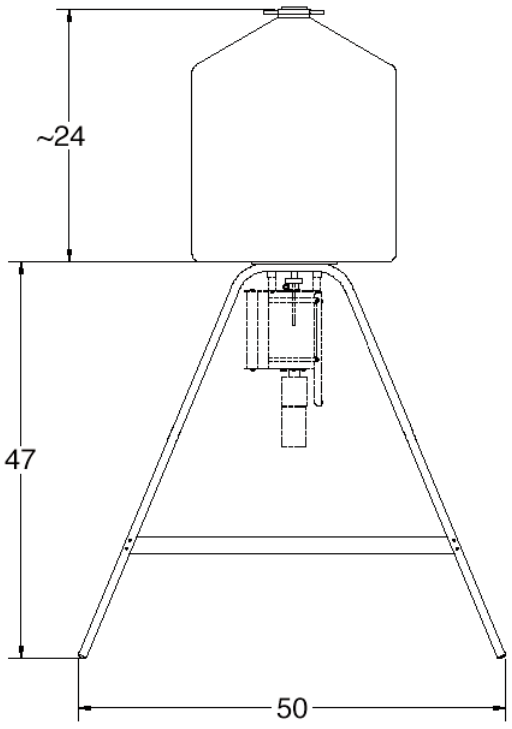
Note: Cryostat/Dewar drawings are NOT to scale, see tables that follow for complete dimensions.



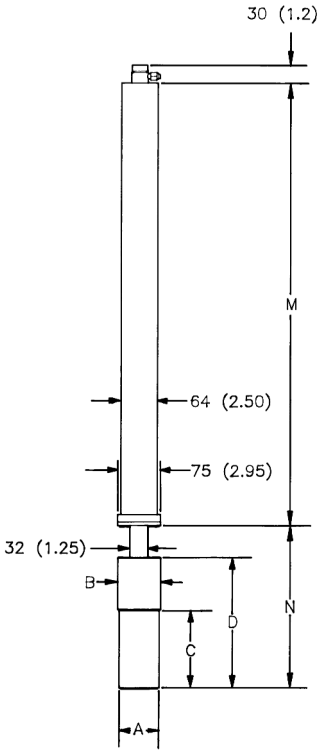
CFG-PG4-1.2 (or -3 or -5)
or
CFG-LP-GG, DWR-1.2G (or -3.0G, -5.0G)



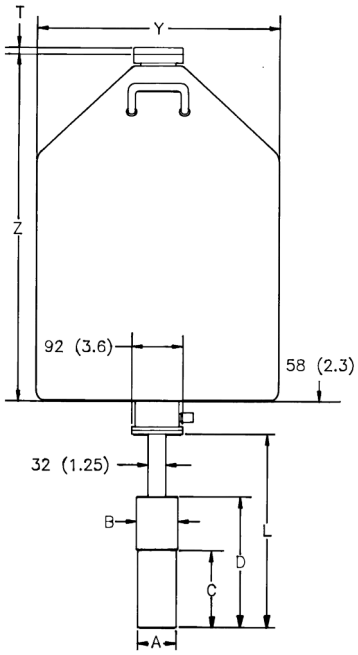
CFG-PMOD4-3 (or -7)
or
CFG-LP-GG, DWR-MOD3L (or -MOD7L)



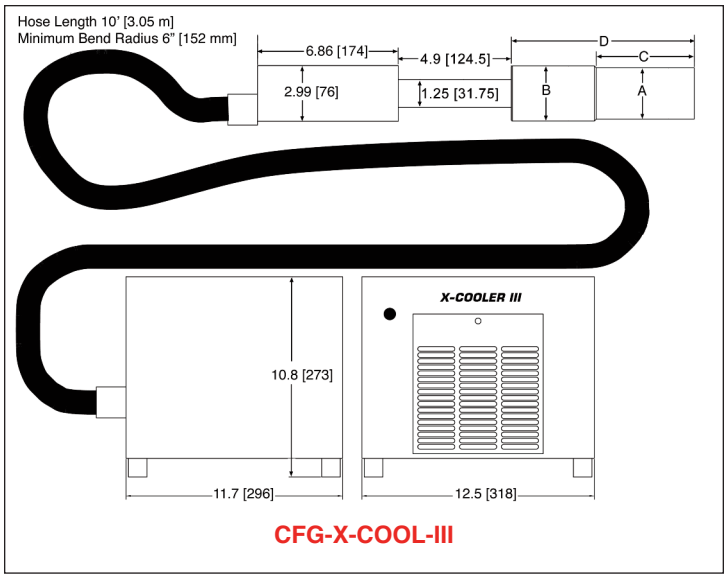
DWR-S/F



CFG-PSHP4
or
CFG-LP-GG, DWR-0.7-SHP-1



CFG-PD4-30 (or -13 or -7.5)
or
CFG-LP-SD, DWR-30D (or -13D or -7.5D)



CFG-X-COOL-III

SLP Detector Dimensions

- Dimensions are for reference only and subject to change.
- If dimensional constraints are critical, contact the factory.

Dim.	Unit	Tol.	PopTop	Streamline
A	mm (in)	0.3 (0.01)	70 (2.75)	70 (2.75)
B	mm (in)	0.3 (0.01)	75 (2.95)	75 (2.95)
C	mm (in)	5 (0.2)	135 (5.3)	71 (2.8)
D	mm (in)	8 (0.3)	250 (9.8)	182 (7.2)
E	mm (in)	8 (0.3)	947 (37.3)	854 (33.6)
F	mm (in)	18 (0.7)	396 (15.6)	305 (12.0)
J	mm (in)	10 (0.4)	X X	318 (12.5)
L	mm (in)	18 (0.7)	338 (13.3)	274 (10.8)
M	mm (in)	10 (0.4)	790 (31.1)	X X
N	mm (in)	8 (0.3)	278 (10.9)	215 (8.5)

Gamma Gage and Side-Looking Dewar Dimensions

- Dimensions are for reference only and subject to change.
- If dimensional constraints are critical, contact the factory.

			Cryostat/Dewar or Dewar Type							
			CFG-PG4 and DWR-x.xG			CFG-PMOD4 and DWR-MOD-xL		CFG-PS4, CFG-PD4, DWR-xxB and DWR-xxD		
			VOLUME			VOLUME		VOLUME		
Dim.	UNIT	TOL. ±	1.2L	3L	5L	3L	7L	7.5L	13L	30L
Q	mm (in)	13 (0.5)	229 (9.0)	302 (11.9)	302 (11.9)	229 (9.0)	302 (11.9)	X X	X X	X X
S	mm (in)	7.6 (0.3)	X X	X X	X X	X X	X X	77 (3.0)	77 (3.0)	60 (2.3)
T	mm (in)	5 (0.2)	X X	X X	X X	X X	X X	10 (0.4)	10 (0.4)	13 (0.5)
Y	mm (in)	5 (0.2)	157 (6.2)	229 (9.0)	229 (9.0)	157 (6.2)	229 (9.0)	224 (8.8)	307 (12.1)	442 (17.4)
Z	mm (in)	5 (0.2)	229 (9.0)	267 (10.5)	419 (16.5)	292 (11.5)	320 (12.6)	452 (17.8)	429 (16.9)	610 (24.0)

Example Model Numbers

Streamline Configuration

SLP-16220	16-mm diameter, 5-mm deep SLP planar detector with 70-mm diameter endcap.
CFG-LP-GG-70	Portable Gamma Gage cryostat with matching 70-mm diameter flange.
DWR-1.2G	1.2 liter all-position dewar for Gamma Gage cryostat.
SLP-06165	6-mm diameter, 5-mm deep SLP detector with 70-mm diameter endcap.
CFG-LP-SD-70	Downlooking cryostat with matching 70-mm diameter flange.
DWR-7.5D	7.5 Liter downlooking dewar for downlooking cryostat.

PopTop Configuration

SLP-16220P	16-mm diameter, 5-mm deep SLP detector with 70-mm diameter endcap.
CFG-PG-3	Portable Gamma Gage cryostat with 3 liter all-position dewar.
SLP-06165P	6-mm diameter, 5-mm deep SLP detector with 70-mm diameter endcap.
CFG-PD4-7.5	Downlooking cryostat with 7.5 liter dewar.

Ordering Information

- For Streamline, remove the “P” from the model number.
- If dimensional considerations are critical, contact factory.
- OPT-0.3 = 8 μm (0.0003-in) thick Be (ultra-thin) unsupported window.
- OPT-0.5 = 13 μm (0.005-in) thick Be window.
- Cryostat and dewar or other cooling device are not included with detector.
- Cryostat and dewar or other cooling device are required for operation.
- A cryostat must be ordered with a Streamline detector.

Model No.	Active Diameter (mm)	Thickness (mm)	Area (mm^2)	Energy Resolution FWHM (eV) @ 5.9 keV	Endcap Diameter (mm)	Be Window Thickness (μm)
SLP-04160P	≥4	5	≥12.5	≤160	70	25
SLP-04160P-OPT-0.3	≥4	5	≥12.5	≤160	70	7.6
SLP-04160P-OPT-0.5	≥4	5	≥12.5	≤160	70	13
SLP-06165P	6	5	28	165	70	25
SLP-06165P-OPT-0.5	6	5	28	165	70	13
SLP-10180P	10	5	80	180	70	25
SLP-16220P	16	5	200	220	70	50

SLP PopTop Cryostats and Dewars

• Dewar included except where marked *.

Model No.	Description
CFG-PD4-7.5	Down-looking Cryostat with 7.5-liter Dewar
CFG-PD4-13	Down-looking Cryostat with 13-liter Dewar
CFG-PD4-30	Down-looking Cryostat with 30-liter Dewar
CFG-PG4-1.2	Gamma Gage Cryostat with 1.2-liter Dewar
CFG-PG4-3	Gamma Gage Cryostat with 3-liter Dewar
CFG-PG4-5	Gamma Gage Cryostat with 5-liter Dewar
CFG-PH4	Horizontal Cryostat (Dipstick type). Includes LNTC1.5WH. Dewar not included.* Choose DWR-30 or DWR-30-OP.
CFG-PMOD4-3	Gamma Gage Cryostat with 3-liter Multi-Orientation Dewar
CFG-PMOD4-7	Gamma Gage Cryostat with 7-liter Multi-Orientation Dewar
CFG-PS4-7.5	Side-Looking Cryostat with 7.5-liter Dewar
CFG-PS4-13	Side-Looking Cryostat with 13-liter Dewar
CFG-PS4-30	Side-Looking Cryostat with 30-liter Dewar
CFG-PSHP4	Down-Looking Shallow-Hole Probe with 0.7-liter Dewar
CFG-PV4	Vertical Cryostat (Dipstick type). Includes LNTC1.5WH. Dewar not included.* Choose DWR-30 or DWR-30-OP.
DWR-30	30-liter Dewar
DWR-30-OP	30-liter Offset-Port Dewar
DWR-S/F	Storage Fill Dewar for CFG-PG4-X
CFG-X-COOL-III-115	X-COOLER III with PopTop connector using 110-120 V ac, 60 Hz Input Power
CFG-X-COOL-III-230	X-COOLER III with PopTop connector using 220-240 V ac, 50 Hz Input Power

SLP Streamline Cryostats

• Select dewar from SLP Streamline Dewars. Dewar included except where marked*.

Model No.	Description
CFG-LP-GG-70	Gamma Gage Cryostat Dewar
CFG-LP-SD-70	Down-Looking Cryostat with Dewar
CFG-LP-SH-70	Horizontal Cryostat (Dipstick type). Includes LNTC1.25WH. Dewar not included.*
CFG-LP-SJ-70	J-type Cryostat with Dewar
CFG-LP-SL-70	Side-Looking Cryostat with Dewar
CFG-LP-SV-70	Vertical Cryostat with (Dipstick type). Includes LNTC1.25WH. Dewar not included.*

SLP Streamline Dewars

For Cryostat	Choose	Description	
CFG-LP-GG	DWR-1.2G	1.2-liter All-Orientation Dewar	Included with Cryostat
	DWR-3.0G	3.0-liter All-Orientation Dewar	Included with Cryostat
	DWR-5.0G	5.0-liter All-Orientation Dewar	Included with Cryostat
	DWR-MOD-3L	3-liter Multi-Orientation Dewar	Included with Cryostat
	DWR-MOD-7L	7-liter Multi-Orientation Dewar	Included with Cryostat
	DWR-0.7-SHP-1	0.7-liter Shallow-Hole Probe Dewar	Included with Cryostat
	DWR-S/F	Storage/Fill Dewar for DWR-XG	
CFG-LP-SJ, SL	DWR-7.5B	7.5-liter Side-Looking Dewar	Included with Cryostat
	DWR-13B	13-liter Side-Looking Dewar	Included with Cryostat
	DWR-30B	30-liter Side-Looking Dewar	Included with Cryostat
CFG-LP-SD	DWR-7.5D	7.5-liter Down-Looking Dewar	Included with Cryostat
	DWR-13D	13-liter Down-Looking Dewar	Included with Cryostat
	DWR-30D	30-liter Down-Looking Dewar	Included with Cryostat
CFG-LP-SV, SH	DWR-30-OP	30-liter Offset-Port Dewar	
	DWR-30	30-liter Dewar	

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Specifications subject to change
040413

ORTEC®

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