

NCSX Work Approval Form (WAF)

WBS Number: 62

WBS Title: Cryogenic Systems

Job Number: 6201

Job Title: Cryogenic Systems

Job Manager: Geoff Gettlefinger

Description:

This WBS element consists of the three subsystems: (1) the LN2-LHe Supply System (WBS 621) which will be used to receive, store, and deliver cryogenics to the LN2 Coil Cooling System (WBS 622) and to the GN2 Cryostat Cooling System (WBS 623); (2) the LN2 Coil Cooling (WBS 622) which provides a closed loop LN2 system for the cooling of the modular coils (WBS 14), and conventional coils (WBS 13); and (3) the GN2 Cryostat Cooling System (WBS 623) which will be used to circulate nitrogen gas of a controlled temperature through the NCSX cryostat and, consequently, around the exposed surfaces of the structures within the cryostat during cooldown from room temperature and also during operation.

Schedule:

Job 6201:

Approvals:

Job Manager

Date

Responsible Line Manager

Date

Project Manager

Date

Engineering Department Head

Date

NCSX June 2007 ETC
TABLE I - Design Labor

WBS Number: 62
WBS Title: Cryogenic Systems
Job Number: 6201
Job Title: Cryogenic Systems
Job Manager: Geoff Gettlefinger

	Labor Hours					Assumptions	Basis of Estimate
	EMEM	EAEI	EEEM	EADB	Design		
WBS 62 Engineering Design and Oversight							
<u>WBS-621 LN2-LHe Supply &</u>							
<u>WBS-622 LN2 Coil Cooling Supply System</u>							
Document Requirements 621/622	16					Engineering judgement on NSTX and experience on Jobs 1409 & 1414	
CDR 621/622	8					Engineering judgement on NSTX and experience on Jobs 1409 & 1414	
Resolve CDR Chits 621/622	16					Engineering judgement on NSTX and experience on Jobs 1409 & 1414	
Prelim Dwgs 621/622				50		Engineering judgement on NSTX and experience on Jobs 1409 & 1414	
Flow Calcs 621/622	16					Engineering judgement on NSTX and experience on Jobs 1409 & 1414	
PDR 621/622	8					Engineering judgement on NSTX and experience on Jobs 1409 & 1414	
Resolve PDR Chits 621/622	16					Engineering judgement on NSTX and experience on Jobs 1409 & 1414	
Finalize Dwgs/Calcs 621/622				50		Engineering judgement on NSTX and experience on Jobs 1409 & 1414	
FDR 621/622	8					Engineering judgement on NSTX and experience on Jobs 1409 & 1414	
Resolve FDR Chits 621/622	16					Engineering judgement on NSTX and experience on Jobs 1409 & 1414	
WBS-623 GN2 Cryostat Cooling System							
Document Requirements 623	16					Engineering judgement on NSTX and experience on Job 1701 , previous	
CDR 623	8					Engineering judgement on NSTX and experience on Job 1701 , previous	
Resolve CDR Chits 623	16					Engineering judgement on NSTX and experience on Job 1701 , previous	
Prelim Models 623	80			80	40	Engineering judgement on NSTX and experience on Job 1701 , previous	
Fan Mechanical Design	160					Estimate based on opinions from Engineering Dept managers	
Fan Magnetics Design			160			Estimate based on opinions from Engineering Dept managers	
Stell Core Thermal Analysis 623		160				Estimate based on opinions from Engineering Dept managers	
PDR 623	8					Engineering judgement on NSTX and experience on Job 1701 , previous	
Resolve PDR Chits 623	16					Engineering judgement on NSTX and experience on Job 1701 , previous	
Finalize Dwgs/Calcs 623	16			70	40	Engineering judgement on NSTX and experience on Job 1701 , previous	
FDR 623	8					Engineering judgement on NSTX and experience on Job 1701 , previous	
Resolve FDR Chits 623	16					Engineering judgement on NSTX and experience on Job 1701 , previous	
Title III Support 62X	240					Engineering judgement on NSTX and experience on Jobs 1409 & 1414	
Totals	688	160	160	250	80		

NCSX June 2007 ETC
TABLE I - Materials and Subcontracts

WBS Number: 62
WBS Title: Cryogenic Systems
Job Number: 6201
Job Title: Cryogenic Systems
Job Manager: Geoff Gettlefinger

Description:

[See Table III](#)

NCSX June 2007 ETC
TABLE IV - Uncertainty of Estimate and Residual Risk Assessment

WBS Number: 62
WBS Title: Cryogenic Systems
Job Number: 6201
Job Title: Cryogenic Systems
Job Manager: Geoff Gettlefinger

Uncertainty of the Estimate

	<u>Uncertainty Range</u>			<u>Comments/Other Considerations</u>
	<u>High</u>	<u>Medium</u>	<u>Low</u> (%)	
Design Maturity			X	Only at a conceptual design phase - design still evolving as requirements are better defined.
Design Complexity		X		-20%/+40% More complex work requirements may have the potential to increase costs of this job

Note: High/Medium/Low uncertainty assessment from Job Manager. Uncertainty range based on ACEI recommended practice 18R-97 as amended for NCSX.

Residual Impacts

<u>Job</u>	<u>Risk Description</u>	<u>Likelihood of Occurring</u>	<u>Mitigation Plan</u>	<u>Basis of estimate</u>	<u>Cost Impact</u>		<u>Schedule Impact</u>	
					<u>Low</u>	<u>High</u>	<u>Low</u>	<u>High</u>
NONE								

Notes:

- [1] Low cost and schedule impacts are considered the minimum (0-percentile) impacts should the event occur.
High cost and schedule impacts are considered the maximum (100-percentile) impacts should the event occur
- [2] Cost impacts should be entered as man-hours (by demographic) and M&S direct cost under basis of estimate.
Cost impacts should NOT include standing army costs which are separately calculated from the schedule impact
Project control is responsible for quantifying the low and high cost impacts based on the labor hours and M&S identified
- [3] The schedule impacts should be entered as the min and max impacts on the critical path.
If there is no critical path impact then the schedule entries should be zero.
- [4] Likelihood of occurrence should be entered consistent with our risk classification methodology, i.e.
VL= Very Likely (P>80%), L=Likely (80%>P>40%), U=Unlikely (40%>P>10%), VU=Very Unlikely (P<10%), NC=Non-credible (P<1%)

WBS Number: 62
WBS Title: Cryogenic Systems
Job Number: 6201
Job Title: Cryogenic Systems
Job Manager: Geoff Gettlefinger

Copper Tubing

Part Number: 895529 \$412.00 Each

Type: General Purpose Copper Tubing (Alloy 122)

Material: Single Line

Shape: 1"

Outside Dia. Tolerance: ±.001"

Inside Dia.: .997"

Wall Thickness: .065"

Maximum Pressure: 600 psi @ 70°F

Operating Temperature Range: -425° to +400° F

Metal Bendability: Bendable By Hand

Temper: Soft (Annealed)

Yensile Strength: Low

Metal Construction: Seamless

Cleaning and Coating: Not Cleaned and Coated

Metal Flareability: Flareable

Sterilize With: Steam (Autoclave)

Shipped As: Coil

Specifications met: American Society for Testing and Materials (ASTM) ASTM B75

Compatible Fittings: Compression and Wirt Copper

Length: 10'

ZoneGuard Fixed Point Gas Detection Systems

ZoneGuard System Configuration Matrix

Part Number	ZoneGuard Sensor	Add To Part #	Integrally mounted sensor	Price
54-16-00	O ₂ Oxygen			\$ 1,318.00
54-16-01	LEL Combustible			\$ 1,539.00
54-16-02	CO Carbon monoxide			\$ 1,629.00
54-16-03	H ₂ Hydrogen sulfide			\$ 1,629.00
54-16-04	SO ₂ Sulfur dioxide			\$ 1,758.00
54-16-05	Cl ₂ Chlorine			\$ 1,859.00
54-16-10	CH ₄ Methane			\$ 1,859.00
54-16-11	PH ₃ Phosphine			\$ 1,859.00
54-16-20	NO ₂ Nitrogen dioxide			\$ 1,859.00

Oxygen Sensor

Part #	Description	Price
54-17-A0101	Single integrally mounted external strobe for ZoneGuard (red)	\$ 194.00
54-17-A0102	Single integrally mounted external strobe for ZoneGuard (amber)	\$ 194.00
54-17-A0103	Dual integrally mounted external strobes for ZoneGuard (red and amber)	\$ 359.00
54-17-A0201	Remote programmable volume adjustable audible alarm	\$ 135.00
54-17-A0202	Remote high intensity audible alarm	\$ 249.00
54-17-A0301	Top-hat guard for sensors installed in explosion proof remote housings	\$ 61.00
54-17-A0302	Spash guard for sensors installed in standard housings	\$ 61.00
54-17-A0401	Wire, 22 gauge, 6 conductor, twisted pair, annealed with drain, used to connect Oxygen remote detectors with ZoneGuard controller, 50 feet	\$ 61.00
54-17-A0402	Wire, 22 gauge, 4 conductor, twisted pair, annealed with drain, used to connect toxic remote detectors with ZoneGuard controller, 50 feet	\$ 61.00

ZoneGuard Accessories

Part No.	Description	Price
54-17-A0101	Single integrally mounted external strobe for ZoneGuard (red)	\$ 194.00
54-17-A0102	Single integrally mounted external strobe for ZoneGuard (amber)	\$ 194.00
54-17-A0103	Dual integrally mounted external strobes for ZoneGuard (red and amber)	\$ 359.00
54-17-A0201	Remote programmable volume adjustable audible alarm	\$ 135.00
54-17-A0202	Remote high intensity audible alarm	\$ 249.00
54-17-A0301	Top-hat guard for sensors installed in explosion proof remote housings	\$ 61.00
54-17-A0302	Spash guard for sensors installed in standard housings	\$ 61.00
54-17-A0401	Wire, 22 gauge, 6 conductor, twisted pair, annealed with drain, used to connect Oxygen remote detectors with ZoneGuard controller, 50 feet	\$ 61.00
54-17-A0402	Wire, 22 gauge, 4 conductor, twisted pair, annealed with drain, used to connect toxic remote detectors with ZoneGuard controller, 50 feet	\$ 61.00

Brass Cryogenic Relief Valves

Ideal for extreme low-temperature, liquefied gases such as oxygen, nitrogen, and carbon dioxide. Spring is Type 302 stainless steel. Disc is Viton for set pressures below 150 psi; PTFE for set pressures 150 psi and above. Cleaned, degreased, and packaged for oxygen service. Pressure is not adjustable. Temperature range is -320° to +165° F.

Connections: NPT male bottom inlet and 3/4" x 20 UNEF female top outlet. Optional pipe adapters are available to connect to top outlet. Adapter for the 1/4" and 3/8" inlet size provides a 3/8" NPT female outlet. Adapter for 1/2" inlet size provides a 1/2" NPT female outlet. [Go Online](#)

Please specify set pressure: 21, 35, 50, 75, 100, 125, 150, 200, 225 (230 for 3/8" valve), 250, 300, 350, 400, or 450 psi.

Pipe Size	In.	Relief Valves Each	Pipe Adapters Each
1/4"	2 5/8"	4931971 \$31.00	4931904 \$7.30
3/8"	2 5/8"	4931972 \$35.40	4931904 \$7.30
1/2"	2 11/16"	4931973 \$43.07	4931906 \$7.90

Rigid Polyurethane Foam Insulation for Pipe, Tube, and Fittings

- Temperature Range: -297° to +300° F
- Heat Flow Rate (K-Factor): 0.19 Btu/hr. x in./sq. ft. @ 75° F
- Density: 2.05 lbs./cu. ft.
- Color: Pipe and Tube, Blue with white facing; Fittings, blue

Whether your piping is hot, cold, or somewhere in between, this foam insulation can handle wide temperature ranges. It's made of closed-cell foam with a slit for easy installation. For indoor use; can be used outdoors with additional jacketing. Cut with a knife or saw.

1" thick foam insulation meets ASTM E84 25/50 for flame and smoke and 2" thick foam insulation meets ASTM E84 25/450 for flame and smoke. Insulation for pipe and tube has a kraft paper and aluminum foil jacket that allows moisture to evaporate and results mild and moldew. Jacket has a self-sealing adhesive strip. Insulation for 90° elbows and tees fits over threaded connections.

Rigid Polystyrene Foam Insulation

Lightweight and moisture-resistant, this closed-cell foam insulation is often used for packaging applications and is also ideal for cold room storage applications due to its low-temperature resistance. Cut with a utility knife or saw.

Insulation ID	Lip	FOR PIPE AND TUBE		FOR 90° ELBOWS		FOR TEES	
		1" Thick	2" Thick	1" Thick	2" Thick	1" Thick	2" Thick
70P	3 R.	5431K14 \$9.10	5431K34 \$17.71	9007T11 \$5.03	9007T31 \$10.29	9007T51 \$5.03	9007T71 \$10.29
1"	3 R.	5431K15 8.57	5431K35 16.79	9007T12 5.41	9007T32 10.84	9007T52 5.41	9007T72 10.84
1 3/8"	3 R.	5431K16 9.36	5431K36 19.22	9007T13 5.94	9007T33 11.96	9007T53 5.94	9007T73 11.96
1 1/2"	3 R.	5431K17 10.50	5431K37 20.80	9007T14 6.70	9007T34 12.86	9007T54 6.70	9007T74 12.86
2"	3 R.	5431K18 11.21	5431K38 21.89	9007T15 7.20	9007T35 13.95	9007T55 7.20	9007T75 13.95
2 3/8"	3 R.	5431K21 12.84	5431K41 24.14	9007T16 8.53	9007T36 15.31	9007T56 8.53	9007T76 15.31
2 1/2"	3 R.	5431K23 15.40	5431K43 28.32	9007T17 11.88	9007T37 19.79	9007T57 11.88	9007T77 19.79
3 1/2"	3 R.	5431K25 18.07	5431K45 30.71	9007T18 11.68	9007T38 19.70	9007T58 11.68	9007T78 19.79
4"	3 R.	5431K26 6.40	5431K46 31.84	9007T19 13.41	9007T39 13.41	9007T59 13.41	9007T79 22.90
4 1/2"	3 R.	5431K28 16.20	5431K48 33.89	9007T21 14.50	9007T41 24.38	9007T61 14.50	9007T81 24.38

Motor Starters with Overload Relay

Built to IEC (International Electrotechnical Commission) standards, these motor starters are smaller than heavy duty motor starters, making them a good choice for use in tight spaces. They activate via an electrical signal (input voltage) and can be operated remotely. An adjustable overload relay allows you to set the exact overload ampereage you need. The overload relay has Class 10 overload relay trip time (trips in less than 10 seconds) with manual reset, as well as one normally open (NO) and one normally closed (NC) electrically isolated auxiliary contact. Additional auxiliary contacts (NO, NC, or other service) are sold separately below.

Open-frame starters can come in a number of configurations:

- Open Frame
- Open Frame Reversing
- Enclosed

Starter for Vaporizer

Open-frame starters can come in a number of configurations: Open Frame, Open Frame Reversing, Enclosed.

Note: Make sure the full-load amp rating of your motor falls within the starter's adjustable overload amp range. (Rated voltage is related to the control motor voltage may be different.)

Please specify input voltage: 24 VAC, 34 VDC, 120 VAC, 200/240 VAC, or 480 VAC (24 VDC motor dimensions may vary).

Adjustable Overload Amp Range	MAXIMUM MOTOR HORSEPOWER RATING, hp			Open-Frame Starters		Enclosed Starters	
	115 VAC	230 VAC	230 VAC	HL	Wt. Lbs.	Each	
1 1/2-3	1/2	1/2	1/2	1/2	3.2"	7803K56 \$34.04	7803K76 \$76.34
1 1/2-7	1/2	1/2	1/2	1/2	3.2"	7803K57 \$34.04	7803K77 \$76.34
2-4	1/2	1/2	1/2	1/2	3.2"	7803K58 \$34.04	7803K78 \$76.34
3-5-10	1/2	1/2-1/2	3/4-1	3	3.2"	7803K59 \$34.04	7803K79 \$76.34
3-5-15	1/2	1/2-1/2	3/4-1-1 1/2	3	3.2"	7803K60 \$34.04	7803K80 \$76.34
5-15-25	3/4-1	3/4-1	1-1 1/2	3	3.2"	7803K61 \$34.04	7803K81 \$76.34
15-25-40	3/4-1	3/4-1	1-1 1/2	5	3.2"	7803K62 \$34.04	7803K82 \$76.34
17.5-24-30	1 1/2	1 1/2	1 1/2	15	4.8"	7803K63 \$60.44	7803K83 \$134.04
22.5-30-36	2	2	2	25	4.8"	7803K64 \$60.44	7803K84 \$134.04
30-40-50	3	3	3	35	6.0"	7803K65 \$60.44	7803K85 \$134.04
37.5-50-60	3	3-1/2	3-1/2	15	3.0"	7803K66 \$60.44	7803K86 \$134.04
45-60-80	5	5	5	25	3.0"	7803K67 \$60.44	7803K87 \$134.04
52.5-60-80	5	5	5	25	3.0"	7803K68 \$60.44	7803K88 \$134.04
60-80-100	5	5	5	25	3.0"	7803K69 \$60.44	7803K89 \$134.04

NCSX June 2007 ETC
TABLE V - Basis of Estimate

WBS Number: 62
WBS Title: Cryogenic Systems
Job Number: 6201
Job Title: Cryogenic Systems
Job Manager: Geoff Gettlefinger

Aluminum
This product matches all of your selections.

Part Number: 8868529 \$345.13 Each

Easy-to-Form Electrical Grade Aluminum (Alloy 1350)
Unfinished (MS)
Sheets, Bars, Strips, and Cubes

Material: Unfinished (MS)
Finish: Plain
Thickness: 0.004"
Length: 8.214"
Width: 48"
Standard
Without Material Certification

Temperature to Maintain Strength:
Specifications Met:
ASTM Specifications

Aluminum for Evaporators

omega.com Your One-Stop Source for Process Measurement and Control (888) 70-OMEGA (USA/Canada) | (202) 358-1880 (International)

HOME QUICK ORDER PRODUCTS FREE LITERATURE MY OMEGA OMEGA INFO

search by: Part Number All Omega Search

1/32 DIN Autotune Temperature/Process Dual Setpoint Controllers
CN132 Series

\$169.00 CN132

Temperature Controller

- 1/32 DIN Cutout
- User Selectable Input
- Autotune PID
- Configurable Dual Output
- Second Setpoint and Output
- NEMA-4X Front Panel
- Full Cost Strategy
- Auto-Manual Operation
- Optional 12 Vac/dc or 24 Vac/dc Models
- UL Recognized (US)

View related products - Temperature and Process Controllers and Power Switching Devices

GRAINGER Repair Parts Services Resources Company Info Contact Us Find A Branch Worldwide

Home Order Form Compare Items Register Your Account Help

Search Keyword(s) Go

LOG IN

User ID:

Password: Go

Remember my login

Item Details **Duct Heater**

HWACR • Heating Equipment • Finned and Strip Heaters

Heater, Fined Duct
Fined Duct Heater, Power Rating 16000 Watts, Voltage Rating 480 Volts, Minimum Air Flow 600 CFM, Minimum Duct Depth 12 Inches, Element Width 24 Inches, 3 Phase

Grainier Item # 3HT97
Price (ea.) **\$1,551.00**
Brand VULCAN
Mfr. Model # VFT1212-16C
Ship Qty. 1
Sell City (Will-Call) 1
Ship Weight (lbs.) 30.65
Usually Ships™ 1-3 Days
Catalog Page No. 3160



Catalog page 414

Globe Valves
For information about globe valves see page 413. For information about pipe size, see page 2-3.

Pipe OD to Pipe Size Conversions

Pipe OD	1/2"	3/4"	1"	1 1/4"	1 1/2"	1 3/4"	2"
Pipe Size	1/2"	3/4"	1"	1 1/4"	1 1/2"	1 3/4"	2"

Low-Temp Long-Stem Bronze Globe Valves

- Maximum Pressure: C, W, P (cold water pressure): 1/2", 1", and 2" sizes: 600 psi @ 300° F, 1 1/2" size: 400 psi @ 100° F (Steam: Not rated)
- Temperature Range: -320° to +100° F
- Rising stem

Extended stem keeps the packing from freezing even at cryogenic temperatures and the CTRF disc provides a tighter-than-normal seal. Casted and packed for nitrogen service. Body and screw-in bonnet are bronze. Stem is 300 series stainless steel, packing is PTFE, and is reinforced in machinable form. Socket bearing and seal are glass-filled PTFE. Meet MSS-SP-80 Class 300.

Pipe Size	End-to-End Lg.	Height	Part #	Each
1/2"	2 3/4"	9 3/4"	68419C12	\$103.31
3/4"	3 3/4"	10 1/2"	68419C15	241.54
1"	4 3/4"	14 3/4"	68419C18	399.92
1 1/2"	5 3/4"	15 1/4"	68419C30	508.08

Lever Arm Brass Globe Valves

- For compressed air and fluids only
- Maximum Pressure: See table
- Temperature Range: 50° to 200° F
- Rising stem

Often called whistle valves, these general service valves open quickly and are self-lubricating. Body and stem are brass. Gaskets and packing are Buna-N; spring is Type 302 stainless steel. Offered with two lever styles. Gaskets and stem are for hand operation and have an iron handle. Pull levers have a brass handle with a hole for cord or chain operation.

Pipe Size	End-to-End Lg.	Height	150 psi @ 50° F	400 psi @ 50° F
1/2"	2 5/8"	17 1/4"	402591	\$20.77
3/4"	2 5/8"	17 1/4"	402592	\$24.70
1"	2 5/8"	17 1/4"	402593	\$27.52
1 1/2"	2 5/8"	17 1/4"	402594	\$32.04

Isolation Valves

ACME CRYOGENICS 800-422-2770 ext. 601 • www.acmecryo.com
Fax 610-791-2402 • spetra@acmecryo.com

Quotation

To: Geoffrey Gettlefinger From: Brian Robinson
Company: PPPL (Princeton Plasma Physics Laboratory) Fax:
Phone: 609-242-2776 Date: May 30, 2007
Re: Request for Quotation
Quotation# EP6897 Pages: 2

Thank you for your interest in Acme Cryogenics. We appreciate following quotation:

Vac Jacketed Valves

Line Item 1
CVI G12A Vent Valve, Standard Non-Jacketed
Part Number: 70-2542-00415
Quantity: 1 unit \$2,820.61 each
Delivery: Available to ship 2 weeks ARO

Line Item 2
CVI Model V-1060-100-S-J-5 1" Cryogenic Manual Globe Valve, Vacuum Jacketed, Schedule 5 Pipe Stub End Connections
Part Number: 81-2542-02634
Quantity: 1 unit \$2,838.18 each
Delivery: Available to ship 2 to 3 weeks ARO

Line Item 3
CVI Model V-1070-100-S-J-5 1" Cryogenic Remote Cylinder Operated (C/O) Globe Valve, Vacuum Jacketed, Schedule 5 Pipe Stub End Connections, with CVI Model C-125 A-Size Pneumatic Cylinder Actuator, 12.5 Square Inch, Fail Closed (Air to Open)
Part Number: 82-2542-02914
Quantity: 1 unit \$4,191.73 each
Delivery: Available to ship 2 to 3 weeks ARO

NCSX June 2007 ETC
TABLE V - Basis of Estimate

WBS Number: 62
WBS Title: Cryogenic Systems
Job Number: 6201
Job Title: Cryogenic Systems
Job Manager: Geoff Gettlefingier

STANDARD BELLOW COMPANY
152 EAST GARDNER STREET
WINDSOR LOCKS, CT 06097
Telephone: (860) 232-3201
Fax: (860) 232-3201
http://www.stbco.com

Number: 0-21742
Date: March 6, 2007
Windsor Locks, CT
P.O. B. Please see below
Delivery: Net 30 Days

Quantity: 1
Description: Bellows Assembly P/N 200-125-4-BB
Unit Price: \$ 400.00 Each

Quantity: 60
Description: Bellows Assembly P/N 200-125-4-BB
Unit Price: \$ 165.00 Each

Quantity: 1
Description: Bellows Assembly P/N 200-125-5-BB
Unit Price: \$ 458.00 Each

Quantity: 60
Description: Bellows Assembly P/N 200-125-5-BB
Unit Price: \$ 204.00 Each

Quantity: 1
Description: Bellows Assembly P/N 325-225-4-BB
Unit Price: \$ 541.00 Each

Quantity: 60
Description: Bellows Assembly P/N 325-225-4-BB
Unit Price: \$ 259.00 Each

Quantity: 1
Description: Bellows Assembly P/N 325-225-5-BB
Unit Price: \$ 599.00 Each

Quantity: 60
Description: Bellows Assembly P/N 325-225-5-BB
Unit Price: \$ 328.00 Each

Quantity: 1
Description: Qty. 1-4.5 Weeks ARO
Unit Price: \$ 0.00

Quantity: 1
Description: Qty. 60-67 Weeks ARO
Unit Price: \$ 0.00

Thank you for your inquiry
David D. Eckert
David D. Eckert
Sales Engineer

SEC Accepts Visa & MasterCard

Swagelok

R.S. CRUM & COMPANY
1181 GLOBE AVENUE
MOUNTAINSIDE, NJ 07092-2999
Phone: NJ (808) 232-4444
Fax: (808) 232-6291
Phone: NY (212) 662-2266

QUOTE
97364575

Cust Order No: 45523
Bid Number: 45523
Ship To: 45523
** SEE IN **
PRINCETON FORRESTAL CAMPUS

C/O PRINCETON UNIV/ACCOUNTING
P.O. BOX 451 PLASMA PHYS. LAB
PRINCETON NJ 08543

RECEIVING #3
PLASMA PHYSICS LAB
PRINCETON NJ 08543

We Accept:

Quote Date	FOB Description	Expiration Date	Terms	Quote Number
01/18/07	Shipping Point	03/19/07	****NET 30 DAYS*****	97364575

Item	Description	Quantity	Unit Price	Disc	Amount
1	B-8BG-CU + 6-7 WEEK DELIVERY	60	183.84	0	11,030.40

Cryo/Pneumatic Valve Element

Print | How can we improve?

Plastic > PTFE Material > Outside Dia. > Inside Dia. > Compare Items

Tubing

This product matches all of your selections.

Part Number: 52315K184
1-04 Ft. \$1.37 per Ft.
25 or more \$1.08 per Ft.

Type: Extreme-Temperature PTFE Choose-A-Color Tubing
Material: PTFE (Polytetrafluoroethylene)
Shape: Single Line
Outside Dia.: 1/4" (.25")
Inside Dia.: 3/16" (.1875")
Wall Thickness: 1/32" (.0312")
Reinforcement: Unreinforced
Color: Orange Red
Maximum Pressure: 150 psi @ 70°F
Operating Temperature Range: -450°F to +500°F
Performance Characteristics: Vacuum Rated
Vacuum Rating: 29" Hg at 72°F
Bend Radius: 1"
Diameter: 9/64-450 (Hard)
Tensile Strength: 2,500-4,000 psi
Sterilize With: Gamma
Specifications Met: CFR21 177.1550
FDA Specification: Compression
Compatible Fittings: 5, 10, 25
Chemical Compatibility Link: 52315K184

Distribution Tubing

Thermax Inc.
888 Barnwood St. Dartmouth, MA 01948 USA
Telephone: (508) 248-2800
Fax: (508) 248-2800
Email: sales@thermax.com
Web: www.thermax.com

QUOTATION

May 30, 2007

Princeton University
Princeton Plasma Physics Laboratory
P.O. Box 451
Princeton, NJ 08543

Attention: Geoffrey A. Gettlefingier
Reference: Thermax T007-21088

Application:
Fluid: Nitrogen
Flow Rate: 5000 SCFH, max
Outlet Temp: -200 to 50°F
MW: 350-500
Pressure Drop: 20 psi
Site Electric: 480V/3PH/3W
Special Considerations: Cryogenic block, DCR control, NEMA 4 box

Based on the above conditions, Thermax is pleased to provide you with the following quotation:

Item	Qty (1)	Description
1	1	Thermaxcal Electric Vaporizer, Model HSA-C Stainless steel tube cast in aluminum block Regionally fabricated steel cartridge heater Control cabinet w/SCS controls including high temp block limit Vaporizer Connections: 1/2" NPT inlet, 1/2" NPT outlet 20 W/Power 160W Approx dimensions: 24 in x 14 in x 35 in Price each: \$16,420.00

Please allow 12 weeks to ship.

Vaporizer