



**Particle Physics Division
Mechanical Department Engineering Note**

Number: MD-ENG-296

Date: 20 December 2010

Project Internal Reference: 485-1.02.04.01

Project: Microboone

Title: Microboone Filter Skid Vessel Pricing

Author(s): Mike Zuckerbrot

Reviewer(s):

Key Words: Microboone, filter vessel, filter skid

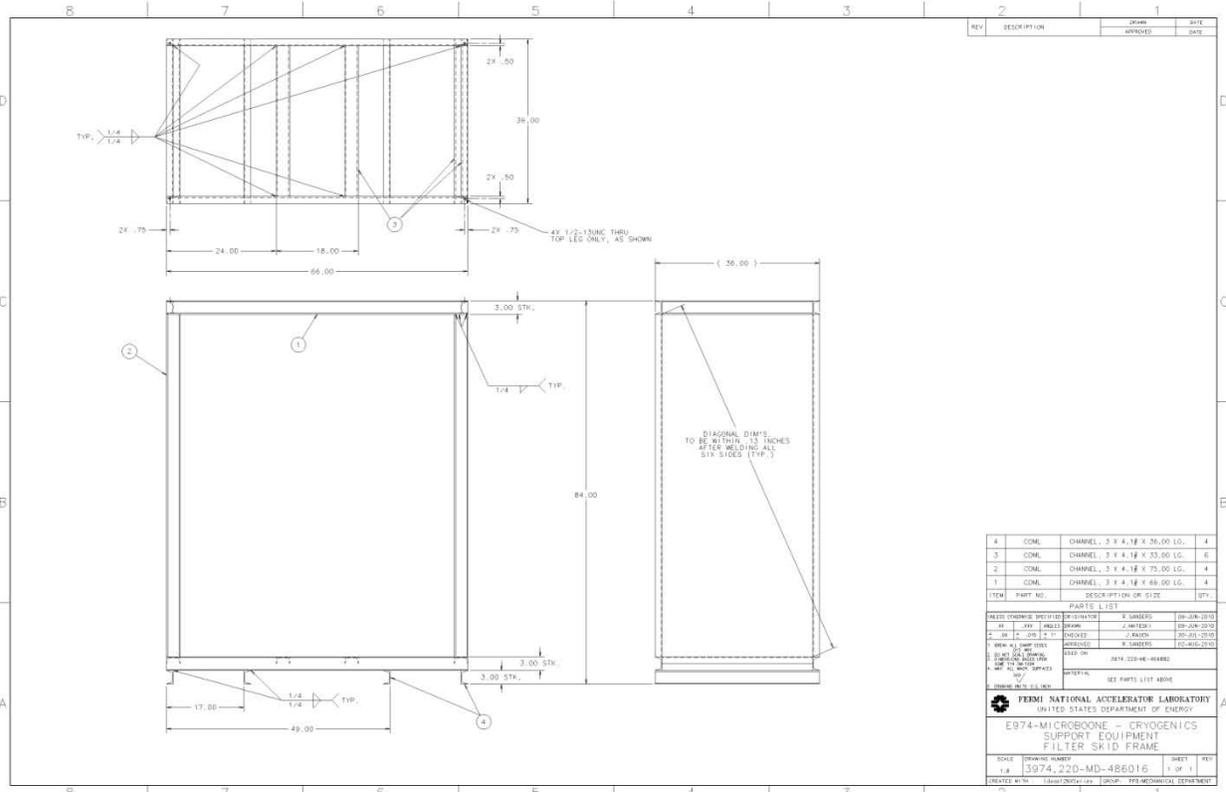
Applicable Codes:

Abstract Summary:

This note reviews part and labor costs for assembling the Microboone filter skid in house at Fermilab opposed to having it outsourced. The final in house assembly cost does not include contingency, which should be added to account for welding costs, delivery, etc.

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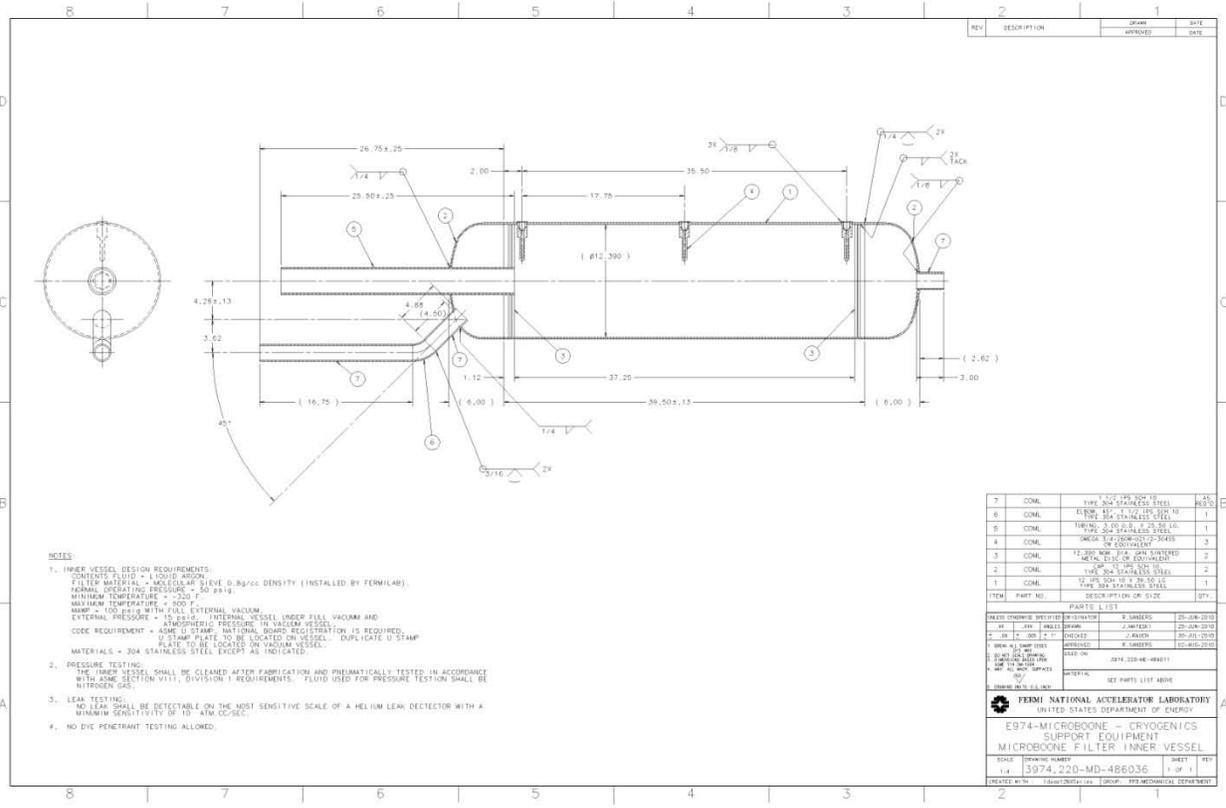


REV	DESCRIPTION	APPROVED	DATE

ITEM	PART NO.	DESCRIPTION OR SIZE	QTY.
4	CONL	CHANNEL, 3 X 4.12 X 36.00 LG.	4
3	CONL	CHANNEL, 3 X 4.12 X 55.00 LG.	6
2	CONL	CHANNEL, 3 X 4.12 X 75.00 LG.	4
1	CONL	CHANNEL, 3 X 4.12 X 68.00 LG.	4

DATE	DESIGNED BY	DESIGNATION	BY	DATE
18-JUN-2010	J. SANDERSON	8-486016	J. SANDERSON	18-JUN-2010
20-JUN-2010	J. SANDERSON	8-486016	J. SANDERSON	20-JUN-2010
20-JUN-2010	J. SANDERSON	8-486016	J. SANDERSON	20-JUN-2010

DRAWING NO. 8-486016
 SHEET NO. 1 OF 1
 PROJECT NO. 3974-220-MD-486016
 TITLE: E974-MICROBOONE - CRYOGENICS SUPPORT EQUIPMENT FILTER SKID FRAME
 SCALE: 1/8" = 1'-0"
 DRAWING NUMBER: 3974-220-MD-486016
 SHEET: 1 OF 1
 PROJECT: E974-MICROBOONE - CRYOGENICS SUPPORT EQUIPMENT



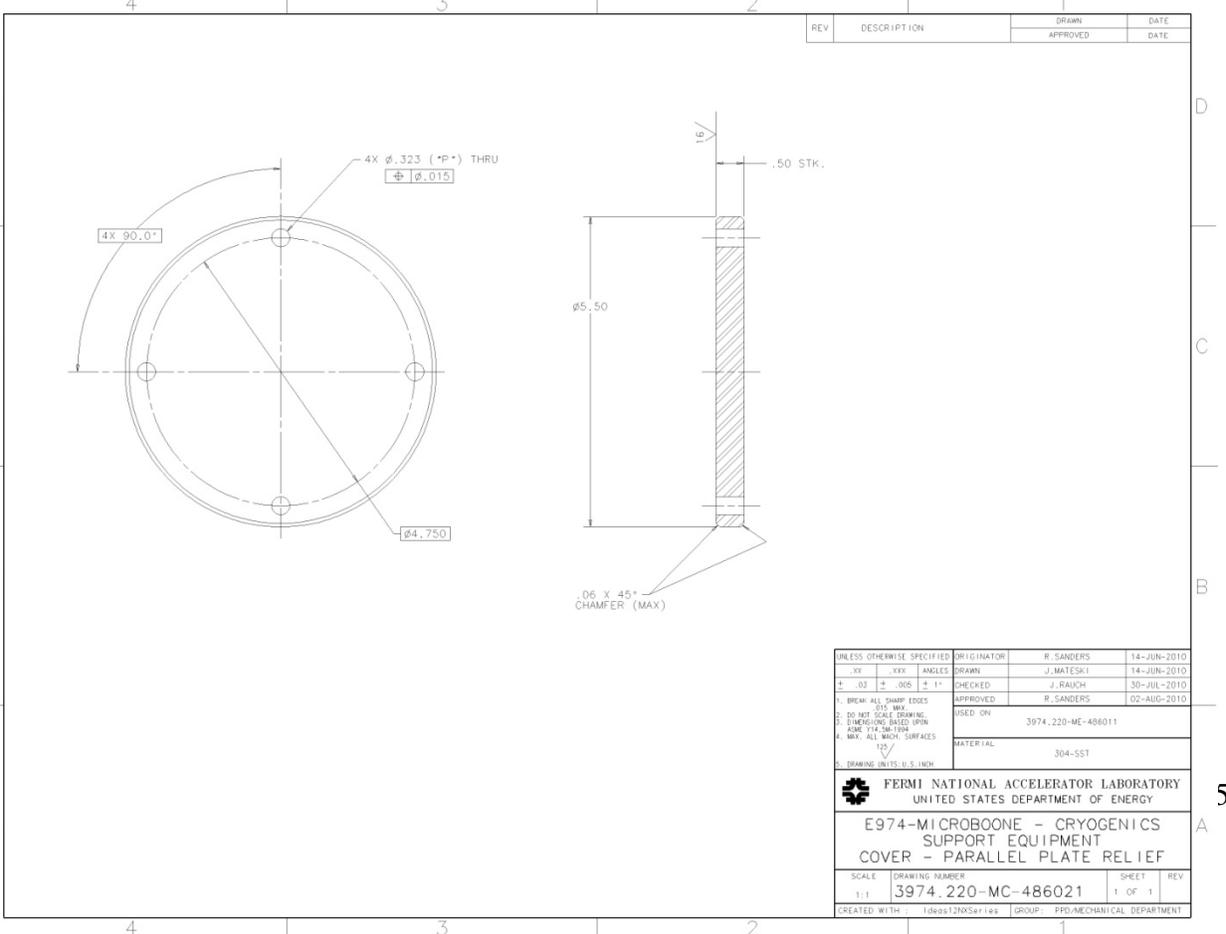
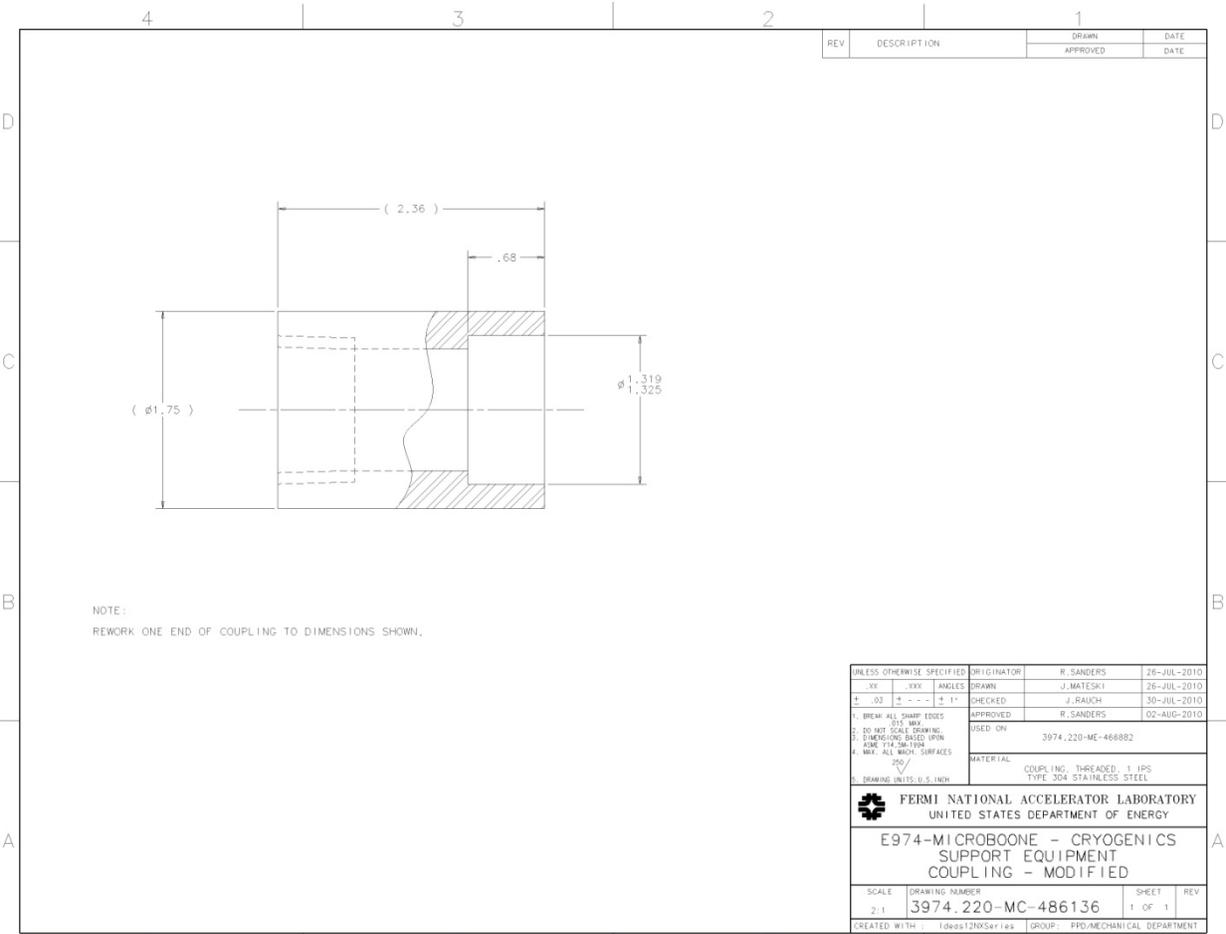
REV	DESCRIPTION	APPROVED	DATE

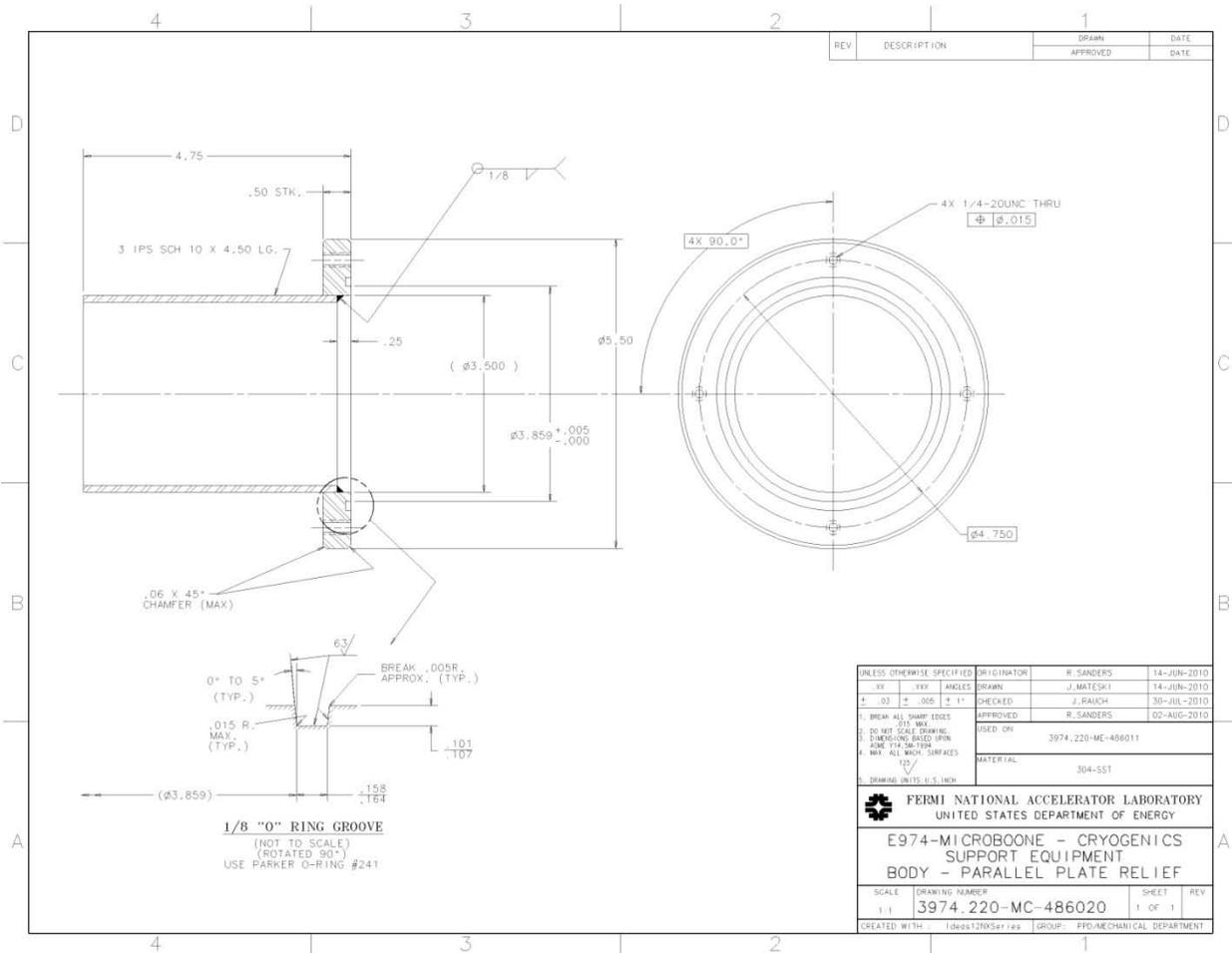
ITEM	PART NO.	DESCRIPTION OR SIZE	QTY.
7	CONL	FLANGE, 26.75 X 2.00 X 35.00 LG.	4
6	CONL	FLANGE, 25.90 X 2.00 X 35.00 LG.	4
5	CONL	FLANGE, 3.00 X 3.00 X 25.00 LG.	1
4	CONL	FLANGE, 3.00 X 3.00 X 25.00 LG.	1
3	CONL	FLANGE, 3.00 X 3.00 X 25.00 LG.	2
2	CONL	FLANGE, 3.00 X 3.00 X 25.00 LG.	2
1	CONL	FLANGE, 3.00 X 3.00 X 25.00 LG.	1

DATE	DESIGNED BY	DESIGNATION	BY	DATE
18-JUN-2010	J. SANDERSON	8-486036	J. SANDERSON	18-JUN-2010
20-JUN-2010	J. SANDERSON	8-486036	J. SANDERSON	20-JUN-2010
20-JUN-2010	J. SANDERSON	8-486036	J. SANDERSON	20-JUN-2010

DRAWING NO. 8-486036
 SHEET NO. 1 OF 1
 PROJECT NO. 3974-220-MD-486036
 TITLE: E974-MICROBOONE - CRYOGENICS SUPPORT EQUIPMENT MICROBOONE FILTER INNER VESSEL
 SCALE: 1/8" = 1'-0"
 DRAWING NUMBER: 3974-220-MD-486036
 SHEET: 1 OF 1
 PROJECT: E974-MICROBOONE - CRYOGENICS SUPPORT EQUIPMENT

NOTES:
 1. INNER VESSEL DESIGN REQUIREMENTS:
 CONTAINS FLUID - LIQUID ARGON.
 FILTER MATERIAL - MOLECULAR SIEVE (INSTALLED BY FERHILAR).
 FILTER MATERIAL - MOLECULAR SIEVE (D₈₀ DENSITY (INSTALLED BY FERHILAR)).
 NORMAL OPERATING PRESSURE - 2.50 PSIA.
 MINIMUM TEMPERATURE - 100 F.
 MAXIMUM TEMPERATURE - 200 F.
 MAMP - 100 PSIA WITH FULL EXTERNAL VACUUM.
 EXTERNAL PRESSURE - 15.0 PSIG (INTERNAL VESSEL UNDER FULL VACUUM AND AT ATMOSPHERIC PRESSURE IN VACUUM VESSEL).
 CODE REQUIREMENT - ASME (U) STAMP, NATIONAL BOARD REGISTRATION IS REQUIRED.
 STAMP PLATE TO BE LOCATED ON VESSEL. - OUTLINE U STAMP PLATE TO BE LOCATED ON VACUUM VESSEL.
 MATERIALS - 304 STAINLESS STEEL EXCEPT AS INDICATED.
 2. PRESSURE TESTING:
 THE INNER VESSEL SHALL BE CLEANED AFTER FABRICATION AND PNEUMATICALLY TESTED IN ACCORDANCE WITH ASME SECTION VIII, DIVISION 1 REQUIREMENTS. FLUID USED FOR PRESSURE TESTING SHALL BE NITROGEN GAS.
 3. LEAK TESTING:
 NO LEAK SHALL BE DETECTABLE ON THE MOST SENSITIVE SCALE OF A HELIUM LEAK DETECTOR WITH A MINIMUM SENSITIVITY OF 10⁻¹⁰ ATM.CC/SEC.
 4. NO DYE PENETRANT TESTING ALLOWED.





REV	DESCRIPTION	DRAWN	DATE
		APPROVED	DATE

UNLESS OTHERWISE SPECIFIED		ORIGINATOR	R. SANDERS	14-JUN-2010
XX	XXX	DRAWN	J. MATESKI	14-JUN-2010
± .02	± .005 ± 1°	CHECKED	J. RAUCH	30-JUL-2010
1. BREAK ALL SHARP EDGES .250 MAX.		APPROVED	R. SANDERS	02-AUG-2010
2. DO NOT SCALE DRAWING		USED ON	3974.220-ME-486011	
3. DIMENSIONS SHOWN FROM SURFACE UNLESS OTHERWISE NOTED		MATERIAL	304-SS1	
4. MAX. ALL MACH. SURFACES 12.5				
5. DRAWING UNITS: U.S. INCH				
FERMI NATIONAL ACCELERATOR LABORATORY UNITED STATES DEPARTMENT OF ENERGY				
E974-MICROBOONE - CRYOGENICS SUPPORT EQUIPMENT BODY - PARALLEL PLATE RELIEF				
SCALE	DRAWING NUMBER	SHEET	REV	
1:1	3974.220-MC-486020	1 OF 1		
CREATED WITH: Ideate2DXSeries		GROUP: PPD-MECHANICAL DEPARTMENT		

II. Filter skid frame parts pricing

The filter skid frame can be seen in dwg 486016, and calls for all 3 x 4.1 channels of four different lengths: 36'' long x 4, 33'' long x 6, 75'' long x 4, and 66'' long x 4. Hot rolled steel channels are readily available in 10 and 20 foot lengths. Four 20 foot and one 10 foot length will be sufficient for all sections. Pricing comes from two sources: Midwest Steel Supply, and Metals Depot.

Length/Source	10 feet (1)	20 feet (4)
Midwest Steel Supply	\$53.30	\$82.00
Metals Depot	\$36.90	\$59.00

Totals

Midwest Steel Supply: $53.30 + 82(4) = \$381.30$

Metals Depot: $36.90 + 59(4) = \$272.90$

Metals Depot is the cheaper option at **\$272.90** total for parts.

III. Filter skid parts pricing

The filter skid can be seen in dwg 466882. All items 1-22 will be priced with the exception of the inner vessel (#2), the skid frame (#1), the cryo valve (#7), and the 180° return (#18) which will be fabricated from two short radius elbows which are covered in item #3. Pricing comes from three sources: Global Industrial, McMaster Carr, and Grainger, all when available. All fittings are type 304 stainless steel schedule 10. Item # 7 (cryo valves) were quoted and priced in a separate note courtesy of Eric Voirin (Microboone-doc-1158). Acme brand was found to be cheapest and closest to specifications.

Item # and des./Source	Quantity	Global Industrial	McMaster Carr	Grainger
#3- IPS 4 short radius 90° elbow	8	\$60.95 WGB3157884	\$69.31 45735K23	\$96.20 1LVD5
#4- IPS 4 x 1-1/2 reducing tee	2	\$139.95 WGB315500	N/A	N/A
#5- IPS 4 x 2 reducing tee	1	\$110.95 WGB315501	N/A	N/A
#6- IPS 4 long radius 45° elbow	1	\$24.50 WGB315584	\$25.19 45735K239	\$36.90 1LVF5
#8- IPS 1 ½ pipe	24" x 1	*See filter vessel	*See filter vessel	*See filter vessel
#9- Tube ½" od x .035 wall	12" x 1	N/A	\$16.58 9773T181	N/A
#10- IPS 1 ½ short radius 90° elbow	2	\$34.95 WGB315780	\$39.49 45735K323	\$55.55 1LVC6
#11- IPS 2 short radius 90° elbow	1	\$30.95 WGB315781	\$34.65 45735K324	\$48.75 1LVC8
#12- IPS 2 pipe	12" x 1	N/A	\$25.72 4347K361	N/A
#13- IPS 1 pipe	36" x 1	N/A	\$36.33 4347K332	N/A
#14- IPS 1 tee	2	\$15.75 WGB315614	\$18.13 45735K253	\$25.60 1LVJ2
#15- IPS 1 slip on flange, 150#	1	\$20.25 WGB315238	\$38.22 43505K343	\$36.00 4HVP6
#16- IPS 1 long radius 90° elbow	2	\$5.70 WGB315575	\$5.64 45735K213	\$8.99 1LVA6
#17- IPS 4 pipe	10 ft. x 3	N/A	N/A	\$400.00 1RUR1
#18(#3)- IPS 4 short radius 90° elbow	4	\$60.95 WGB3157884	\$69.31 45735K23	\$96.20 1LVD5
#19- IPS 4 x 3 reducer	2	\$14.25 WGB315730	\$14.51 45735K437	\$21.61 1RRJ1
#20- IPS 3 short radius 90° elbow	1	\$47.95 WGB315783	\$54.40 45735K326	\$76.60 1LVD3
#21- IPS modified coupling	2	\$1.47 WGB352756	\$6.69 4464K226	N/A
#22- Hoist ring – provided on site.	1	N/A	\$115.42 3070T51	\$111.45 4R982

*The filter vessel assembly will have sufficient extra 1 ½" pipe for item #8.

Note: Cheaper prices in green.

Global Industries has the cheapest fittings, however does not carry pipe or tube. Short lengths of pipe are available from McMaster, and longer lengths from Grainger.

Totals:

Global Industrial: $\$60.95(8) + \$139.95(2) + \$110.95 + \$24.50 + \$34.95(2) + \$30.95 + \$15.75(2) + \$20.25 + \$5.70(2) + \$60.95(4) + \$14.25(2) + \$47.95 + \$1.47(2) = \$1,361.64$

McMaster Carr: $\$16.58 + \$25.72 + \$36.33 = \78.63

Grainger: $\$400.00(3) = \$1,200.00$

Acme brand cryogenic valves = $3,792.00(2) = \$7,584$

Total for filter skid parts = $1,361.64 + 78.63 + 1,200 + 7,584 = \text{\$10,224.27}$

*Does not include filter vessel which will be priced in the next section.

IV. Filter vessel parts pricing

The filter vessel is seen in dwg 486011. Items from this assembly drawing will be purchased from multiple sources depending availability and pricing. Due to the number of sources, items and prices will be listed individually. Item #1 is listed as the inner pressure vessel, and will be looked at separately. Item # 37 are listed as ¼-20UNF nuts which act as 3/16 spacers, however this nut thickness is not available. These spacer nuts will be replaced with a ceramic tube to be cut to appropriate lengths on site. Quantity's and totals to be doubled as two assemblies are required.

Item #/Desc.	Source	Part Number	Quantity	Price	
*2- Parellel plate relief	Flange body	McMaster	43505K348	1	\$88.49
	4.5 IPS pipe x 3.5 long	McMaster	4347K381	1 – 1 foot length	\$34.76
*3-Parellel plate relief, flange cover	McMaster	4305K388	1	\$99.42	
4-Spring, 3/8 od x 0.032 wire x 4'' lg	McMaster	9663K56 (or equivalent)	4	\$3.78	
5-Non rotatable vacuum flange, 3''	MDC Vacuum	130024 (or equivalent)	1	\$72.00	
6-Shoulder screw, 5/16 x ¼-20unc x 3 ½ long	McMaster	90298A579 (or equivalent)	4	\$7.82	
7-Type 304 stainless steel pipe sch. 10, 1 ½''	Grainger	2UE87	2 – 10 ft lengths	\$136.25	
8-Type 304 SS 90° sch. 10 IPS 1 ½ short radius elbow	Global Industrial	WGB315780	2	\$34.95	
9-Type 304 SS IPS 24 sch. 10 x 59.77'' lg	Napco Steel	N/A	1	\$1,898.85	
	StL pipe supply	N/A		\$1,615.00	
	Stainless and Alloy	N/A		\$2,094.00	
10-Type 304 SS sch. 10 IPS 24 cap	Stainless and Alloy	N/A	2	\$590.86	
	StL Pipe	N/A		\$680.00	
*11-Type 18-8 SS ¾-10unc-2A threaded rod, 10.25'' long	McMaster	98804A505	6 – 1 foot rods	\$11.80	
12-Type 18-8 SS ¾-10unc-2B hex nut	McMaster	91845A330	2 packs of 10	\$7.41	
13-NW40 SS long butt flange	Vacuum Shopper	NW-40-150-LF	6	\$19.00	
14-NW40 SS blank, vacuum	Vacuum Shopper	NW-40-150-SB	6	\$14.00	

essential				
15 -NW40 centering ring, Viton o-ring, type 304 SS	Vacuum Shopper	NW40-150-SR-V	6	\$12.00
16 -NW40 CNC Aluminum clamp	Vacuum Shopper	NW40-150-C	6	\$19.00
17 -Type 304 SS 2.5 x 2.5 x .25 thick angle x 13.13 long	Metals Depot	A421264	1 – four foot sec	\$92.24
18 -Type 304 SS plate, 4 x 6 x .38 thick	Metals Depot	F5384	1 – 2 foot long, 4 inch wide, .38 thick plate	\$57.36
19 -Ceramic spacer, ¼ od x .14 id x .5 long	McMaster	96109A170	20	\$2.17
20 -Ceramic spacer, ¼ od x .115 id x .25 long	McMaster	96109A115	4	\$2.32
21 -SS rod, 1/16 nd x 6’ long	McMaster	88915K37	4	\$10.56
22-34, 38	*see next section	*see next section	*see next section	*see next section
35 -Ceramic machine screw, hex head, 10-32unf-2A x 1.75 lg	Ortech Ceramics	N/A	8	\$26.45
36 -Ceramic hex nut, 10-32unf-2B (.19 thick)	Ortech Ceramics	N/A	28	\$11.80
**37 -Ceramic tube, .375 od x .25 id x 12 long	Ortech Ceramics	N/A	1	\$22.00
*39 -Type 18-8 SS threaded rod, 10-32UNF x 6.56 lg	McMaster	95412A470	1 pack of 5	\$7.62
40 -Type 18-8 SS coupling nut, 10-32UNF-2B	McMaster	90268A320	4	\$3.85
41 -IPS 4 type 304 SS pipe 5’’ long	McMaster	4347K391	1 – one foot section	\$39.32
42 -O-ring, Parker 2-241 or equivalent	Parker	2-241	1	\$1.00
43 -Type 304 SS bar, 1 x 1.5 x .25 thick	Metals Depot	F5141	1-2 foot section 1 wide x .25 thick	\$10.68

*Needs modification

**Original part replaced

Note: Where multiple vendors were quoted, lower prices listed in green.

Filter vessel parts total price (not including AL cylinders [a] or the pressure vessel [b]) = 88.49 + 99.42 + 3.78(4) + 72.00 + 7.82(4) + 136.25(2) + 34.95(2) + 11.80(6) + 7.41(2) + 19.00(6) + 14.00(6) + 12.00(6) + 19.00(6) + 92.24 + 57.36 + 2.17(20) + 2.32(4) + 10.56(4) + 26.45(8) + 11.80(28) + 22.00 + 7.62 + 3.85(4) + 39.32 + 1.00 + 10.68 + 1,898.85 + 590.86(2) = **\$4499.10**

a. Aluminum Cylinders

TECH - WELD, INC

801 E. North Street Elburn, IL 60119
 (630)365-3000 1(800) 521-TUBE (8823) Fax (630)365-0506
 Email: greg@techweld.net Website: www.techweld.net

Job Quotation

To: Fermilab Date: 12/3/2010
Attention: Mike Zuckerbrot
Quote : 9063
E-Mail: mzuck@fnal.gov

Phone: 630-840-4252 Agency: House

Fax: _____ Pages: 1 of 1

NOTE: Due to current worldwide material price volatility, all quotes are subject to reconfirmation prior to purchases.

We are pleased to submit the following quotation for your consideration.

Qty.	Part Description	Unit Price
Aluminum 3003-H14 Seam Welded Tubes		
1 pc	.032" Wall x 17.680" OD x 62.880" Long	\$221.33
1 pc	.032" Wall x 18.740" OD x 63.100" Long	\$221.33
1 pc	.032" Wall x 19.800" OD x 63.320" Long	\$221.33
1 pc	.032" Wall x 20.870" OD x 63.540" Long	\$224.33
1 pc	.032" Wall x 21.390" OD x 63.760" Long	\$224.33
1 pc	.032" Wall x 23.000" OD x 63.990" Long	\$299.13
1 pc	.032" Thick Disk 23.250"	\$35.50

Tolerances on all items above:

- +/- .015 on OD
- +/- .020 on Length
- Ovality +/- .062

Above Tubes will have 2 Seam Welds

Attitional Charge - Material for Disk & Labor to Tack Weld
 Disk to one end of Tube (8) Tacks per Disk \$75.00 each

DELIVERY: Three weeks from time of order

FOB Elburn, Illinois 60119 **Terms: 1% 10, Net 30 days.**

Orders placed against this quotation are accepted subject to credit approval. New customers COD until credit is approved. We look forward to favorable consideration of this offer. Please do not hesitate to contact us if you have any questions.

Signature: _____
 Greg LeSage

→Tech Weld – cylinder/welded caps/additional disks pricing total = \$221.33 + \$221.33 + \$221.33 + \$224.33 + \$224.33 + \$299.13 + \$35.50(7) + \$75(6) = **\$1,510.28**

-Cylinders have disks welded on one end, however will need additional holes to accommodate items 35 and 36.



Parker Fabrication, Inc.
 501 East Courtland
 Morton, IL 61550-9043

Ph: 309.266.8413
 Fax: 309.266.7231

Quote

Number: 53029 Date: 15-Dec-10

To

Parker Fabrication, Inc
 501 E Courtland St.
 Morton, IL 61550

Quote To

Parker Fabrication, Inc.
 501 E Courtland St.
 Morton, IL 61550

Ph: 309-266-8413

Fax: 309-266-7231

Ph: 309-266-8413

Fax: 309-266-7231

Terms		Ship Via		Salesperson
		Best Way		
Quantity	Description	Unit Price	Amount	
1	Line: 001 Part: FERMILAB TUBE LOT 0.032" 3003 ALUMINUM ea Expiration Date: 14-Jan-11 Rev:	\$2,647.50	\$2,647.50	
	LOT CONTAINS 1 EACH OF THE FOLLOWING: 17.68 +0 -0.13 o.d., 62.88 lg rolled & tack welded tube 18.74 +0 -0.13 o.d., 63.10 lg rolled & tack welded tube 19.80 +0 -0.13 o.d., 63.32 lg rolled & tack welded tube 20.87 +0 -0.13 o.d., 63.54 lg rolled & tack welded tube 21.39 +0 -0.13 o.d., 63.76 lg rolled & tack welded tube 23.00 +0 -0.13 o.d., 63.99 lg rolled & tack welded tube 23.250 o.d. +.13 -0 aluminum disc All tubes to be capped on 1 end. Caps to be tack welded every 45 degrees. All materials to be 0.032" thick 3003-H14 aluminum. Each tube to have 2 lap weld joints. Delivery - 2 - 3 weeks a.r.o. Shipping - F.O.B. Morton IL Terms - Net 30 days. We appreciate your business!	Total:	\$2,647.50	

V. In house labor costs

Description	Time (hours)	Base wage	Total labor price
Welding <u>Vessels</u>	200	\$51/hr	\$10,200
<u>Frame</u>			
<u>Piping</u>			
Vessel <u>Clean/Prep</u>	74	\$51/hr	\$3,774
<u>Layout/Machine/Assemble</u>			
<u>Machine reassemble/</u>			
<u>Inspect vacuum</u>			
<u>Assemble vacuum</u>			
Frame <u>Vacuum jacket piping</u>	80	\$51/hr	\$4,080
<u>Prep/assembly/weld/vacuum</u>			
<u>Insulate/vacuum weld</u>			
<u>Vacuum</u>			
Totals/ + 15%	354 / 407.1	\$51/hr	\$18,054/\$20,762

Total labor costs: \$18,054

Total labor costs [+ 15%]: \$20,762

VI. Total in house part and assembly costs

Description		Cost x quantity(if applicable)	Total Cost
Filter skid frame	Parts	\$272.90 x 1	\$272.90
Filter skid	Cryogenic Valves	\$3,792.00 x 2	\$7,584.00
	Parts	\$2,640.27 x 1	\$2,640.27
Filter vessel	Al cylinders	\$1,510.28 x 2	\$3,020.56
	Pressure vessels	\$7,098.75 x 2	\$14,197.50
	Parts	\$4,499.10 x 2	\$8,998.20
In house labor		-	*\$20,762.00
Total Cost		-	\$57,475.43

Total in house assembly and parts: \$57,475.43

***Some contingency should still be added to the total labor cost.**



VAL-FAB, Inc.

Custom Metal Fabricators

A Service-Disabled Veteran Owned Small Business
218 Jackson St. / Neenah, WI 54956
P.O. Box 877 / Neenah, WI 54957-0877
www.valfab.com

Phone: (920) 722-1009
Fax: (920) 722-1685

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Proposal
0008-706

Fermi National Accelerator Laboratory

Kirk Road and Pine Street
PO Box 500
Batavia, IL 60510

Date: August 17, 2010

Attn.: Ron Evans

Reference: Quote for (1) Filter Sieve Assembly that consists of (2) Filter Inner Vessels per drawing 3974.220-MD-486036 Rev. 0 dated 25-June-2010, (2) Filter Vessels per drawing 3974.220-ME-486011 Rev. 0 dated 03-June-2010 and (1) Filter Skid Frame per drawing 3974.220-MD-486016 Rev. 0 dated 09-June-2010.

THANK YOU FOR THE OPPORTUNITY TO PROVIDE THE FOLLOWING QUOTATION.

Item	Qty	Description
1	1 Lot	Vertical Tank and Skid, reference equipment data sheets and description below

Dimensions:

Skid: 36" Wide x 66" Long x 84" Tall, O.A.H
Filter Vessel: 24" OD (24" Pipe) x 59.77" (4'-11³/₄") Long, Tan to Tan 62³/₄" (5'-2³/₄")
Filter Inner Vessel: 12" OD (12" Pipe) x 39.50" (3'-3¹/₂") Long, Tan to Tan 42¹/₂" (3'-6¹/₂")

Design:

Filter Vessel: 100 PSIG with Full Vacuum in Vacuum Jacket @ 500⁰F with a min. temperature of (-320⁰ F.)
Filter Inner Vessel: 100 PSIG with Full Vacuum @ 500⁰F with a min. temperature of (-320⁰ F.)

Code:

ASME Section VIII, Div.1, Code Stamped and Registered with the National Board

Corr. Allow:

None

Wind Load:

None

NDE:

Spot X-ray

Snow Load:

None

Specific Gravity:

1.0

Seismic Zone:

None

Filter Vessel Materials:

(Top):	Pipe Cap 24" Sch. 10 (0.250" nom thickness)	(SA-403-304)
(Shell):	24" Sch. 10 Pipe (0.250" nom. thickness)	(SA-312-TP304 Smls)
(Bottom):	Pipe Cap 24" Sch. 10 (0.250" nom thickness)	(SA-403-304)
(Gasket):	None	
(Hardware):	Bolts: A193-Gr.B8, Nuts: A194-Gr.8	(S.S.)

Nozzles:

(1)-	4"	Sch. 10 Pipe w/PRYOGE XT Wrapping	(SA-312-TP304 Smls)
(1)-	3"	Tube x 0.18" Wall w/ MDC 130024 Flange	(SA-213-304, 304SS)
(1)-	3"	Sch. 10 Pipe w/Fabricated Parallel Plate	(SA-312-TP304, SA-240-304)
(7)-	1 ¹ / ₂ "	NW40 Long Butt Weld Flange w/ Viton Ring, Alum Clamp	(304SS)
(1)-	1 ¹ / ₂ "	Sch. 10 Pipe	(SA-312-TP304 Smls)

Internals:

(6)	Aluminum Cylinders, 0.032" Sheet, w/ Top & Bottom Discs	(6061 Aluminum)
(1)-	Internal Piping, 1 ¹ / ₂ "Sch. 10 w/ (2) Elbows 90° Sch. 10	(SA-312-TP304, SA-403-304)

"Skilled Tradesmen, Quality, & Service"



VAL-FAB, Inc.

Custom Metal Fabricators

A Service-Disabled Veteran Owned Small Business
218 Jackson St. / Neenah, WI 54956
P.O. Box 877 / Neenah, WI 54957-0877
www.valfab.com

Phone: (920) 722-1009

Fax: (920) 722-1685

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Externals:

- | | |
|--|---------------------|
| (3)- Support Legs, L2½" x 2½" x ¼" w/3/8" Base Plate | (304SS, SA-240-304) |
| (1)- Filter Skid Frame, C3x4.1 | (A36) |
| (2)- 4" Sch. 10 Piping Assemblies | (304SS) |
| (1)- 2" Sch. 10 Piping Assembly | (304SS) |
| (2)- 1½" Sch. 10 Piping Assemblies | (304SS) |

Inner Filter Vessel Materials:

- | | |
|---|---------------------|
| (Top): Pipe Cap 12" Sch. 10 (0.180" nom thickness) | (SA-403-304) |
| (Shell): 12" Sch. 10 Pipe (0.180" nom. thickness) | (SA-312-TP304 Smls) |
| (Bottom): Pipe Cap 12" Sch. 10 (0.180" nom thickness) | (SA-403-304) |
| (Gasket): None | |
| (Hardware): Bolts: A193-Gr.B8, Nuts: A194-Gr.8 | (S.S.) |

Manway:

None

Nozzles:

- | | |
|--|---------------------|
| (1)- 3" Tube x 0.18" Wall | (SA-213-304) |
| (1)- 1½" Sch. 10 Pipe | (SA-312-TP304 Smls) |
| (3)- ¾" Thermo-well, Omega Type ¾-260W-U21/2 | (304SS) |

Internals:

- | | |
|---|---------|
| (2) Perforated Discs, 12.39" OD, McMaster Carr #9358T371 | (304SS) |
| (2) Woven Wire Cloth, 12.39" OD, mesh 60X60 McMaster Carr #9358T371 | (304SS) |

Externals:

None

Finishes:

ID - Mill finish with welds color cleaned. Washed with detergent and degreased to remove all foreign materials. The vessel shall be rinsed (without allowing the vessel to dry between rinses) with distilled or demineralized water.

OD - Mill finish with welds color cleaned.

Exceptions:

ASME Data packages and data reports provided in electronic format only.

Weight:

2,184 lbs estimated empty weight each

Pricing:

\$108,376.00 Lot pricing of (1)

Notes on tank:

- Quote also includes shop drawings as required for ASME certification.
- Helium Leak testing included in quote.

Terms:

20% down with preliminary drawing submittal
50% at with Approved Drawings / Material Procurement
30% at Shipment
Net 30 Days



VAL-FAB, Inc.

Custom Metal Fabricators

A Service-Disabled Veteran Owned Small Business

218 Jackson St. / Neenah, WI 54956

P.O. Box 877 / Neenah, WI 54957-0877

www.valfab.com

Phone: (920) 722-1009

Fax: (920) 722-1685

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Shipment after receipt of final drawing approval:

VAL-FAB will order major materials at time of order.

VAL-FAB will produce drawings in **2-3 weeks** after receipt of purchase order.

VAL-FAB will ship in **12-13 weeks** after receipt of final approved for construction drawings and based on material availability at time of PO. Pipe and Fittings lead time is 8-9 weeks

F.O.B.:

Fermi National Labs, Batavia, IL

[Note: Due to the current volatility surrounding material surcharges, we reserve the right to review our price and delivery prior to the fabrication of your order.]

Materials will be ordered upon placement of your purchase order to meet the proposed shipment. This proposal is a budgetary quote and we reserve the right to re-quote after final design approval.

This proposal is valid for 15 days
Taxes are not included in this pricing.

Sincerely,

Bruce C. Robinson
Estimator

VIII. Conclusions

Source	Delivery Included	Lead time	Total
Fermi assembled	N	Delivery + 407 labor hours (about 11 weeks after materials are received)	*\$57,475.43
Val-Fab inc.	N	12-13 weeks	\$108,376.00
Ability Engineering	Y	12-14 weeks	\$85,613.40 - \$104,638.60

Having the Microboone filter skid assembly fabricated in house at Fermilab seems to be the cheapest option. In this scenario the inner pressure vessel will be fabricated off site and delivered; the inner aluminum cylinders will also be fabricated off site, but will require some minor modifications on site. The outer shell will be delivered in pieces and will require assembly and welding. The remaining parts are standard, off the shelf type parts and will be delivered directly to Fermilab.

***Note** some contingency should still be added to the total in house assembly cost to account for welders, part delivery, and other overhead costs not considered.