	NCSX Work Approval	Form (WAF)	
Job Title:		Procurements (1352)	
Description:	This WBS element consists of the manufactur conductor assembly of the PF winding packs connections to power and cooling supply at the with the central solenoid structural elements.	including interface elements for he coils, and integration of the PF1a coils	
Schedule:	See Attached		
Approvals:	Job Manager	Date	
	Responsible Line Manager	Date	
	Project Manager	Date	
	Engineering Department Head	Date	

NCSX June 2007 ETC TABLE I - DESIGN LABOR

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NCSX June 2007 ETC TABLE II - Materials and Subcontracts

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 | _ | Travel to Evaluate Vendors (2trips)
Outokumpu (Luvata) estimate and internal calculation of weight of CU (adjusted for |
| 29.80 | | | | |
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 | | COMEX prices in mid-May 2007) - See Table V |
| 20.00 | | | | |
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 | _ | Outokumpu (Luvata) estimate and internal calculation of weight of CU (adjusted for |
| 38.20 | | | | |
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 | | COMEX prices in mid-May 2007) - See Table V |
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 | | Outokumpu (Luvata) estimate and internal calculation of weight of CU (adjusted for |
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 | | COMEX prices in mid-May 2007) - See Table V |
| 19.10 | | | | |
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 | | Enough copper to build one spare of any coil, Outokumpu (Luvata) estimate and |
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 | | internal calculation of weight of CU (adjusted for COMEX prices in mid-May |
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 | | 2007) - See Table V |
| 40.90 | | | | |
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 | _ | Internal PF4 Estimate - See Table V |
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 | _ | Internal PF5 Estimate - See Table V |
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 | | Internal PF6 Estimate - See Table V |
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 | | Everson e-mail (B. Umbenaur to M. Kalish) of 4/12/07 - see Table V |
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 | | Everson e-mail (B. Umbenaur to M. Kalish) of 4/12/07 - see Table V |
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 | | Everson e-mail (B. Umbenaur to M. Kalish) of 12/5/06 - see Table V |
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 | _ | Everson e-mail (B. Umbenaur to M. Kalish) of 12/5/06 - see Table V |
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 | | During fabrication at vendor, 2days per week +80hrs drafting. Based on experience |
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 | | supporting TF Coil Procurement, Coverage is 2 days per week instead of 2.5 because coi |
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 | | are simpler than TF Coils |
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 | _ | Based on engineering evaluation of condition of PF1A |
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 | _ | One week per fcoil set (upper & lower) for EMTB - basis of estimate |
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 | - | two technicians for two weeks with oversight - includes assembly of buswork but not |
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 | | fabrication of buswork, Based on engineering judgement and evaluation of the number of |
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40.90
52.77
42.00
72.00
72.00
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485.00 | S S S X ± 52 € 29.80 - - - 38.20 - - - 27.30 - - - 19.10 - - - 40.90 - - - 52.77 - - - 42.00 - - - 72.00 - - - 40.20 - - - | S S S K | S S XL ZE LG 29.80 5.00 5.00 5.00 29.80 27.30 5.00 5.00 19.10 5.277 5.00 5.277 42.00 72.00 72.00 72.00 40.20 415.00 5.00 5.00 | SNUM SNUM <th< td=""><td>S S M L L I</td><td>SWEP SWEP SUBJECT LOUID INNUM <th< td=""><td>SWE4 SWE4 LL
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NCSX June 2007 ETC TABLE III - Fabrication/Assembly Installation

In-house Fabrication and	Assemb	ly and Installat	ion					
Description: Incl in Field Period Asse	embly and	Machine Assembly Jo	bs		 			
	-							

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

WBS Number: 132 WBS Title: PF Coils Job Numbers: 1302 and 1352 Job Title: PF Coil Design (1302) and PF Coil Procurements (1352) Job Manager: Mike Kalish

Uncertainty of the Estin	nate				
				Uncertainty	
	High	Medium	Low	Range (%)	Comments/Other Considerations
Job 1302				-15%/+25%	
Design Maturity			х		Still in initial design phases - although much design work accomplished, still haven't held PDR. Interfaces with coil structures still not finalized.
Design Complexity			v		not imaized. PPPL has significant experience designing conventional solid copper round coils (e.g., TFTR, PLT, PBX-M, etc.)
Design Complexity			^		FFFL has significant experience designing conventional solid copper round cons (e.g., TFTK, FLT, FDA-W, etc.)
Job 1352				-15%/+25%	
Design Maturity			х		Still in initial design phases - although much design work accomplished, still haven't held PDR. Interfaces with coil structures still not
					determined.
Design Comlexity			х		Both PPPL and outside vendors have significant experience manufacturing conventional solid copper round coils (e.g., TFTR, PLT, PBX-M,
					etc.)

Other Comments: Have budget estimates from a single vendor, risk that final estimate could increase. See COMEX quote on 5/10/2007. Original pricing based on April COMEX quote @ \$3.14/lb => as of May 10, 2007, now at ~\$3,60/lb => used this COMEX quote as of mid-May.

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

<u>Residua</u>	al Impacts	Likelihood of			Cost Im	pact	Schedule Ir	npact
Job	Risk Description	Occurring	Mitigation Plan	Basis of estimate	Low	High	Low	High
1302 - N	IONE							
	F vendor produces a non-compliant coil requiring brication of an additional coil	VU	Conductor for extra coil will be procured in advance and available to wind a new coil if required. Float in schedule appears adequate to avoid critical path impact.	Increase PPPL Title III by ~1 man-month	+ \$15	+ \$35	+ 0.00	+ 0.00
	o suitable PF coil vendor submits bid. PC coils sed to be built in-house.	U	PF is last major, special procurement. Sources sought received two qualified respondants. Capability to build at PPPL exists if needed.	Cost impact estimated to be up to \$300k (1/3 of fabrication costs) for potentially higher labor rates at PPPL. No impact on critical path expected.	+ \$0	+ \$300	+ 0.00	+ 0.00

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 and schedule impacts are considered in maximum (rooper control) 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 reponsible 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=Unlikley (40%>P>10%), VU=Very Unlikely (P<10%), NC=Non-credible (P<1%)</p>

WBS Number: 132 WBS Title: PF Coils Job Numbers: 1302 and 1352 Job Title: PF Coil Design (1302) and PF Coil Procurements (1352) Job Manager: Mike Kalish

M&S Estimate Backup

Internal Estimate of Materials - based on quotes (Outokumpo), past procurements, & engineering

NCSX PF Fabrication Material Cost Estimate

and the second	1 1	PF4	PF5	PF6
II. Materials M&S			- 20 cl	
copper extrusion cost	S	\$Ag	S/kg	S/kg
Copper order factor		factor	factor	factor
copper cost., 2 colis ;	5	\$29,812	\$38,174	\$27,267
misc matl -S per lb of Cu in colls	2.0	\$/kg	S/ktt	S/kg
glass insul width	mm	25.4	25.4	25.4
turn insul.: lengtlymeter of cond./laver	m/m	3.15	3.15	3.15
turn ins. Tape Thickness	mm	0.19	0.19	0.19
No. half lapped layers	11	2	2	2
meters of ins. /roll	m	10.00	10.00	10.00
no rolls/coll	п	330.4	422.1	301.3
insulation waste factor	multipler	1.3	1.3	1.3
total rolls of turn ins. regd., 2 coils	п	858.9	1097.6	783.5
turn insulation cost per roll	\$/roll	4	4	4
Kapton insul width	mm	25.4	25.4	25.4
turn insul. length/meter of cond./layer	m/m	3.15	3.15	3.15
turn ins. Tape Thickness	mm	0.19	0.19	0.19
No. half lapped layers	п	1	1	1
meters of ins. Iroll	m	10.00	10.00	10.00
no. rolis/coil	п	165.2	211.1	150.7
insulation waste factor	multiplier	1.3	1.3	1.3
total rolls of turn ins. regd., 2 colls	п	429.5	548.8	391.7
tum insulation cost per roll	\$/roll	40	40	40
turn insulation total cost, 2 colls	\$	\$29,376	\$37,537	\$26,79
ground wall tape thickness	mm	0.38	0.38	0.38
No. half lapped layers	a	2.00	2.00	2.00
total ground wall thick.	mm	1.52	1.52	1.52
ground wall tape width	am	6	6	6
gw tape length reqd.	m	96	240	267
meters of ins. Iroli	m	10	10	10
no. rollis/coil		10	24	27
insulation waste factor	multiplier	1.30	1.30	1.30
no. rolls of GW insulation, pair of colls	n	25	62	69
GW tape cost per roll	\$	50	50	50
GW insulation cost, 2 coils	\$	\$1,880	\$4,716	\$5,241
Epoxy volume regd. (15% void fraction)	1 L 1	23	33	24
Epoxy cost/liter	S/I	30	30	30
Epoxy cost for pair of coils	S	\$2,096	\$2,963	\$2,175
Leads and coolant connections/coil	\$	2500	2500	2500
Leads & coolant con's., pair of colls	\$	\$7,550	\$7,550	\$7,550
Material Costs Inuslation and Leads Only, Coil Pair		\$40,902	\$52,766	\$41,761
Total Material Cost Including Copper Condutor		\$70,714	\$90,940	\$69.02

From: B. Umbenhaur [bumbenhaur@eversontesla.com] Sent: Tuesday, December 05, 2006 10:52 AM To: Michael R. Kalish; Rodney D. Templon Cc: jstafiniak@eversontesla.com Subject: PF Coils

Hi Mike,

For the PF Coil Budgetary, please use the following numbers based on some assumptions. The costs shown are for the coils only and no shipping or facilities related costs are included. The shipping costs will have an impact at the coils are so large. The coils are a little too large for the current configuration of the clean space we are using to wind the TF coils.

The coils are also too large for our ovens so we would plan to use steam to cure the coils during the VPI process. We have done this successfully in the past.

We have a material supply configuration as on the TF coils where the conductor and insulation is supplied by PPPL.

The current winding specification calls for a difficult winding scheme.

PF5 Coils (Quantity 2)

\$415,000 for two coils including tooling

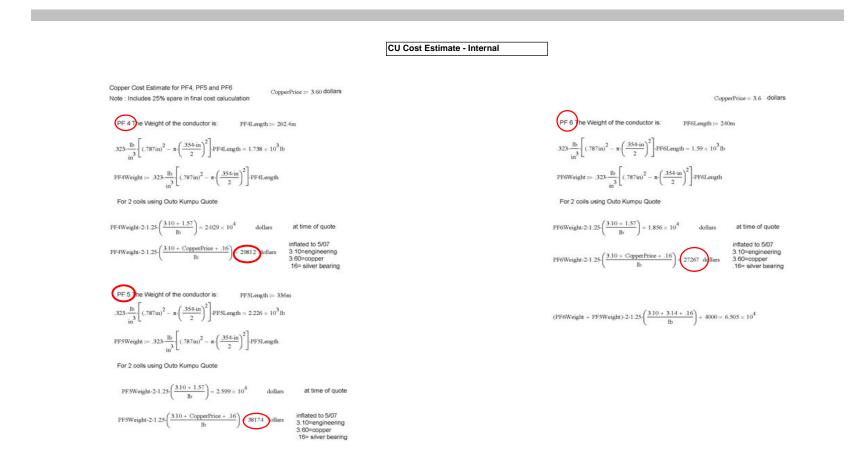
PF6 Coils (Quantity 2)

\$485,000 for two coils including tooling

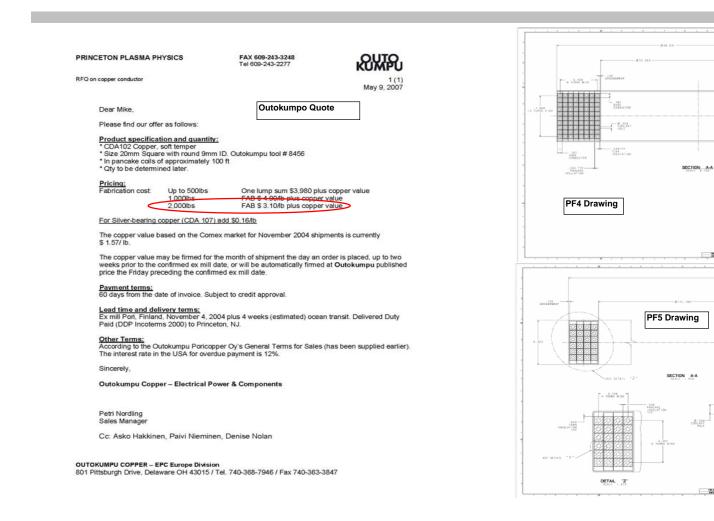
Please let me know if you have any questions or concerns. Thanks, Bill

Everson Quote on PF5 and PF6 Fabrication and Tooling

WBS Number: 132 WBS Title: PF Coils Job Numbers: 1302 and 1352 Job Title: PF Coil Design (1302) and PF Coil Procurements (1352) Job Manager: Mike Kalish



WBS Number: 132 WBS Title: PF Coils Job Numbers: 1302 and 1352 Job Title: PF Coil Design (1302) and PF Coil Procurements (1352) Job Manager: Mike Kalish

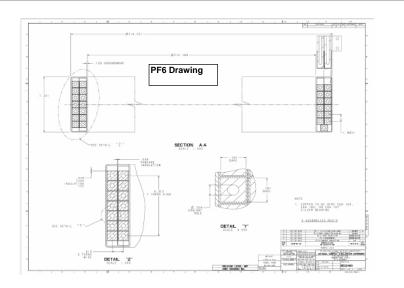


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WBS Number: 132 WBS Title: PF Coils Job Numbers: 1302 and 1352 Job Title: PF Coil Design (1302) and PF Coil Procurements (1352) Job Manager: Mike Kalish



		CC (Price quo	OM	EX Copper Hi	ty Futures Prid C opper gi Grade delayed at least lick here to refres	Hi 30 mir	igh (Grad	de mments)		
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list for that	Open	High	Low	Last	Time	Sett	Chg	Vol	Sett	OpInt	Options
May 07	3.6040	3.6040	3.5820	3.5820	May 10, 08:40		-0.0935	583	3.6755	-	Call Put
Jun 07	-	-		3.6780 *	May 09, 17:34			423	3.6780	-	Call Put
Jul 07	3.6275	3.6300	3.5750	3.6080	May 10, 09:21	12	-0.0710	13039	3.6790	14	Call Put
Aug 07	С.	14 C		3.6700 *	May 09, 17:34	12		100	3.6700	12	Call Put
Sep 07	8	18 <u>6</u> - 1	522	3.6600 *	May 09, 17:34	322		2323	3.6600	12	Call Put
Oct 07	2	14		3.6375 *	May 09, 17:34	12		(120)	3.6375	- 14 (j	Call Put
Nov 07	2		and i	3.6510 *	May 09, 17:35	12		1	3.6150	- ¥ ()	Call Put
Dec 07	2	-	<u></u>	3.5925 *	May 09, 17:34	1		510	3.5925		Call Put
<u>Jan 08</u>		-	- C20	3.6200 *	May 09, 17:35	1	(v)	122	3.5660	-	Call Put
Feb 08	2		- 010 J	3.5955 *	May 09, 17:34	1920		(22)	3.5390	1	Call Put
Mar 08	- 2	14	141	3.5100 *	May 09, 17:34			1.4	3.5100	- ¥ ()	Call Put
Apr 08		-	244	3.3855 *	May 09, 17:34	1		-	3.4785		Call Put
May 08		- A	191	3.4755 *	May 09, 17:34	j.		1.00	3.4465		Call Put
Jun 08		4	121	3.4735 *	May 09, 17:34	i.	-	-	3.4145		Call Put
<u>Jul 08</u>		-	346	3.3180 *	May 09, 17:34	194	. н		3.3825	-	Call Put
Aug 08	8	÷	395	2.3330 *	May 09, 17:34	(\mathbf{R})	Ξ.	-	3.3505	× .	Call Put
<u>Sep 08</u>	-	-	346	3.1900 *	May 09, 17:35	-		-	3.3185	-	Call Put
Oct 08	- E	-	340	3.0900 *	May 09, 17:34	10	-	-	3.2865	-	Call Put
Nov 08		-	388	3.0400 *	May 09, 17:34	100	-	100	3.2545	-	Call Put
Dec 08		-	3.75	3.1580 *	May 10, 09:22	100	-		3.2225	-	Call Put
Jan 09	-	-	3.00	3.0580 *	May 09, 17:35	100	-		3.1905	-	Call Put
Feb 09		-	340	2.4875 *	May 09, 17:34	100		-	3.1585		Call Put
Mar 09	- 5	-	1.00		May 09, 17:34		-	-	3.1265	-	Call Put
Apr 09	-	-		2.9735 *	May 09, 17:34				3.0945		Call Put

Click here to refresh data

Times indicate exchange local time. * An asterisk beside the last price indicates that the price is from a previous session

http://quotes.tradingcharts.com/futures/quotes/HG.html

5/10/2007

WBS Number: 132 WBS Title: PF Coils Job Numbers: 1302 and 1352 Job Title: PF Coil Design (1302) and PF Coil Procurements (1352) Job Manager: Mike Kalish

> Everson Quote on PF Fabrication and Tooling

From: B. Umbenhaur [bumbenhaur@eversontesla.com] Sent: Thursday, April 12, 2007 12:30 PM To: Michael R. Kalish Subject: PF4 Coil Hi Mike, Budgetary pricing for the PF4 Coil

Tooling: - \$72,000 PF4 Coil - \$20,100/coil (\$40,200 for two coils)

Thanks. Bill

Visit Everson Tesla Inc. on the web at http://www.eversontesla.com