NCSX Work Approval Form (WAF)

WBS Number: 133
WBS Title: External Trim Coils
Job Number: 1354
Job Title: Trim Coil Design and Procurement
Job Manager: Mike Kalish

Description:

Includes all activities to design and fabricate/procure trim coils needed for field error correction.

Schedule:

See Attached

Approvals:

Michael Kalish
Digitally signed by Michael Kalish
DN: cn=Michael Kalish, c=US, o=PPPL, ou=Engineering, email=mkalish@pppl.gov
Date: 2007.07.31 09:09:06 -04'00'

Job Manager _____ Date _____

Wayne Reiersen
Digitally signed by Wayne Reiersen
DN: cn=Wayne Reiersen, c=US, o=PPPL
Date: 2007.07.31 15:49:34 -04'00'

Responsible Line Manager _____ Date _____

James L Anderson
Digitally signed by James L Anderson
DN: cn=James L Anderson, c=US, o=PPPL, ou=NCSX, email=jlanders@pppl.gov
Reason: I am approving this document
Date: 2007.07.31 16:52:21 -04'00'

Project Manager _____ Date _____

Mike Williams
Digitally signed by Mike Williams
DN: cn=Mike Williams, o=PPPL, ou=Engineering, email=williams@pppl.gov, c=US
Date: 2007.07.31 17:01:02 -04'00'

Engineering Department Head _____ Date _____

NCSX June 2007 ETC
TABLE I - DESIGN LABOR

WBS Number: 133

WBS Title: External Trim Coils

Job Number: 1354

Job Title: Trim Coil Design and Procurement

Job Manager: Mike Kalish

Description:

Title I and II Engineering for PF Coils and Title III Support of Fabrication Effort.

Task ID	FY07$K 41MS	48MS	37STK	35TRVL	31OT	HOURS ORNL EM	ORNL DSN	EMEM	EMSM	EMSB	EMTB	EAEM	EADM	EEEM	EESM	EESB	EETB	ECEM	ECSB	ECTB	RM2	RM3	Basis of Estimate
Title I & II Design																							
Complete PF Coil SRD												8											**Engineering Judgment - Past Experience (Jupiter 2)**
Analysis												40											**Engineering Judgment - Past Experience (Jupiter 2)**
FDR Dwgs													60										**Engineering Judgment - Past Experience (Jupiter 2)**
Prepare for FDR												16											**Engineering Judgment - Past Experience (Jupiter 2)**
FDR												8											**Engineering Judgment - Past Experience (Jupiter 2)**
Prepare Procurement Coil Spec												24											**Engineering Judgment - Past Experience (Jupiter 2)**
Detail Drawings													64										**4 drawings at 16 hours per drawing**
Disposition FDR Chits												8											**Engineering Judgment - Past Experience (Jupiter 2)**
Trim Coil Structure, Design																							Engineering Judgment
Subtotal Title I & II Design				***$0.0K***								***104***	***124***										
Title III Design																							
Coil Procurement Support												24											**Past experience in procuring simple coils**
Fabrication Support												116											3months, 1day per week, +20hrs drafting -**Minimal oversight due to simple conventional coil design, based on experience**
Fabrication Support Travel				$2.5K																			One trip to west coast assuming vendor is in Ca (worst case assumption)
Subtotal Title III Design				***$2.5K***								***140***	***0***										

NCSX June 2007 ETC
TABLE II - Materials and Subcontracts

WBS Number: 133
WBS Title: External Trim Coils
Job Number: 1354
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Job Manager: Mike Kalish

Materials and Subcontracts (M&S)

Description:	FY07$K					HOURS																	
	41MS	48MS	37STK	35TRVL	31OT	ORNLEM	ORNLDSN	EMEM	EMSM	EMSB	EMTB	EAEM	EASB	EEEM	EESM	EESB	EETB	ECEM	ECSB	ECTB	RM2	RM3	Basis of Estimate
Procurement & Fabrication																							
Conductor Procurement	0.7																						**Outokumpu Quote - see Table V**
Coil Tooling	12.5																						**Everson quote for Jupiter 2 Coil - see Table V**
Fabrication of Coil	20.5																						**Vendor Quote for Jupiter 2 Coil - see Table V**
Trim Coil Structure, Materials	5												24										Assumes Coils Bolted to Inconnel Plate and mounted on studs ($30/pound for Inconel Plate)
Trim Coil Structure, Fabricaton												40	16										Fab for Two plates
Trim Coil Structure Installation												80	24										Two Techs Installing two coils on two plates, Studs into Mod Coil Form
	38.70											120	64										

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TABLE III - Fabrication/Assembly Installation

In-house Fabrication and Assembly and Installation														
Description: Incl in M&S Table II														

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TABLE IV - Uncertainty of Estimate and Residual Risk Assessment

WBS Number: 133
WBS Title: External Trim Coils
Job Number: 1354
Job Title: Trim Coil Design and Procurement
Job Manager: Mike Kalish

Uncertainty of the Estimate

	High	Medium	Low	Uncertainty Range (%)	Comments/Other Considerations
Design Maturity		X		-10%/+15%	Early stages of determining trim coil requirements - but costs small (probably under $100K)
Design Complexity			X		Present requirement is for a round two turn coil. Simple coil design.

Other comments: Although price of Cu variable (see Job 1352 discussion), so little Cu needed for these coils, no considered a significant uncertainty

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

Residual Impacts

Job	Risk Description	Likelihood of Occurring	Mitigation Plan	Basis of estimate	Cost Impact Low	Cost Impact High	Schedule Impact Low	Schedule Impact High
1354	Additional trim coils may be required to suppress field errors from n>1 modes	U	Analysis being performed to firm up requirements	Costs could more than double the present estimate	+ $200	+ $400	+ 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 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%)

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

WBS Number: 133
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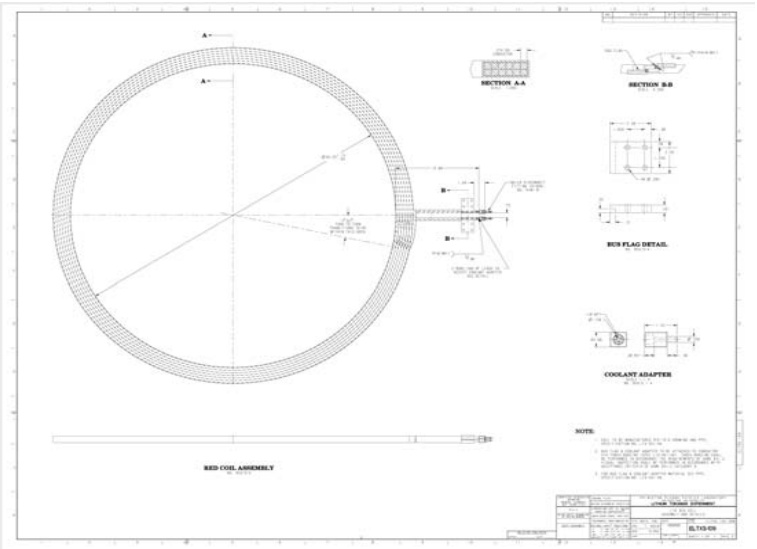
Job Manager: Mike Kalish

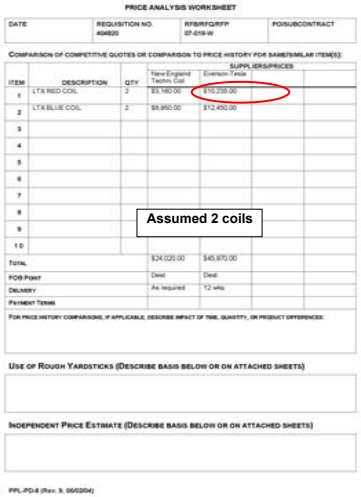
M&S Estimate Backup

Estimate for More Complex Coil (based on Jupiter II)

Drawing of 4th LTX Coil



Backup for LTX Costs



PRICE ANALYSIS WORKSHEET

DATE	REQUISITION NO.	RFB/RFQ/RFP	PO/SUBCONTRACT
	404820	07-019-W	

COMPARISON OF COMPETITIVE QUOTES OR COMPARISON TO PRICE HISTORY FOR SAME/SIMILAR ITEM(S):

ITEM	DESCRIPTION	QTY	SUPPLIERS/PRICES	
			New England Technic Coil	Everson-Tesla
1	LTX RED COIL	2	$23,160.00	$70,230.00
2	LTX BLUE COIL	2	$9,960.00	$72,450.00
3				
4				
5				
6				
7				
8				
9				
10				
TOTAL			$24,020.00	$45,970.00
FOB Point			Dest	Dest
DELIVERY			As required	12 wks
PAYMENT TERMS				

FOR PRICE HISTORY COMPARISONS, IF APPLICABLE, DESCRIBE IMPACT OF TIME, QUANTITY, OR PRODUCT DIFFERENCES:

USE OF ROUGH YARDSTICKS (DESCRIBE BASIS BELOW OR ON ATTACHED SHEETS)

INDEPENDENT PRICE ESTIMATE (DESCRIBE BASIS BELOW OR ON ATTACHED SHEETS)

PPL-PD-8 (Rev. 9, 06/02/04)

Assumed 2 coils

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Outomumpo Estimate

PRINCETON PLASMA PHYSICS FAX 609-243-3248
Tel 609-243-2277

OUTO KUMPU

RFQ on copper conductor

1 (1)
May 9, 2007

Dear Mike,

Please find our offer as follows:

Product specification and quantity:
* CDA102 Copper, soft temper
* Size 20mm Square with round 9mm ID. Outokumpu tool # 8456
* In pancake coils of approximately 100 ft
* Qty to be determined later.

Pricing:
Fabrication cost:

Up to 500lbs	One lump sum $3,980 plus copper value
1,000lbs	FAB $ 4.90/lb plus copper value
2,000lbs	FAB $ 3.10/lb plus copper value

For Silver-bearing copper (CDA 107) add $0.16/lb

The copper value based on the Comex market for November 2004 shipments is currently $ 1.57/ lb.

The copper value may be firmed for the month of shipment the day an order is placed, up to two weeks prior to the confirmed ex mill date, or will be automatically firmed at **Outokumpu** published price the Friday preceding the confirmed ex mill date.

Payment terms:
60 days from the date of invoice. Subject to credit approval.

Lead time and delivery terms:
Ex mill Pori, Finland, November 4, 2004 plus 4 weeks (estimated) ocean transit. Delivered Duty Paid (DDP Incoterms 2000) to Princeton, NJ.

Other Terms:
According to the Outokumpu Poricopper Oy's General Terms for Sales (has been supplied earlier). The interest rate in the USA for overdue payment is 12%.

Sincerely,

Outokumpu Copper – Electrical Power & Components

Petri Nordling
Sales Manager

Cc: Asko Hakkinen, Paivi Nieminen, Denise Nolan

OUTOKUMPU COPPER – EPC Europe Division
801 Pittsburgh Drive, Delaware OH 43015 / Tel. 740-368-7946 / Fax 740-363-3847

PPPL Calculation for Conductor Procurement

Copper Cost Estimate for Trim Coils
Note : Includes 25% spare in final cost caluculation

Circumference := (.5m)·π

Length := 4·Circumference

$$.323\frac{lb}{in^3}\left[(.787in)^2 - \pi\left(\frac{.354in}{2}\right)^2\right]\cdot Length = 41.624lb$$

$$Weight := .323\frac{lb}{in^3}\left[(.787in)^2 - \pi\left(\frac{.354in}{2}\right)^2\right]\cdot Length$$

For 2 coils using Outo Kumpu Quote

$$Weight\cdot 2\cdot 1.25\left(\frac{3.10 + 1.57}{lb}\right) = 485.958$$ dollars at time of quote

$$Weight\cdot 2\cdot 1.25\left(\frac{3.10 + 3.14 + .16}{lb}\right) = 665.98$$ dollars

inflated to 4/07
3.10=engineering
3.14=copper
.16= silever bearing

WBS Number: 133
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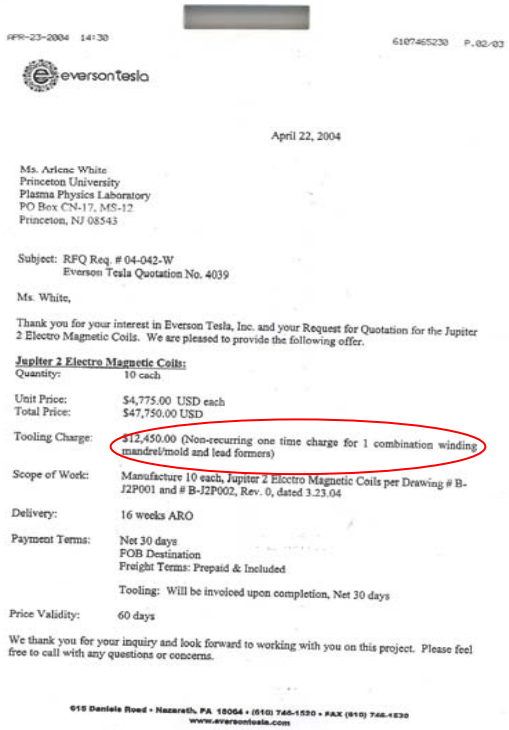
Basis of Tooling Estimate



APR-23-2004 14:30 6107465230 P.02/03

everson tesla

April 22, 2004

Ms. Arlene White
Princeton University
Plasma Physics Laboratory
PO Box CN-17, MS-12
Princeton, NJ 08543

Subject: RFQ Req. # 04-042-W
Everson Tesla Quotation No. 4039

Ms. White,

Thank you for your interest in Everson Tesla, Inc. and your Request for Quotation for the Jupiter 2 Electro Magnetic Coils. We are pleased to provide the following offer.

Jupiter 2 Electro Magnetic Coils:

Quantity:	10 each
Unit Price:	$4,775.00 USD each
Total Price:	$47,750.00 USD
Tooling Charge:	$12,450.00 (Non-recurring one time charge for 1 combination winding mandrel/mold and lead formers)
Scope of Work:	Manufacture 10 each, Jupiter 2 Elcctro Magnetic Coils per Drawing # B-J2P001 and # B-J2P002, Rev. 0, dated 3.23.04
Delivery:	16 weeks ARO
Payment Terms:	Net 30 days FOB Destination Freight Terms: Prepaid & Included Tooling: Will be invoiced upon completion, Net 30 days
Price Validity:	60 days

We thank you for your inquiry and look forward to working with you on this project. Please feel free to call with any questions or concerns.

615 Daniels Road • Nazareth, PA 18064 • (610) 746-1520 • FAX (610) 746-1530
www.eversontesla.com

Activity ID	MILE-stones (level 2 & 3)	Activity Description	Duration (work days	Baseline Start	Baseline Finish	Shifts	Total Float	% cmplt	Proposed Budgeted
Job: 1354 - Trim Coil Design &Procurement-KALISH									
Trim Coils									
1303-101		Complete Trim Coil SRD	10	01OCT08*	14OCT08		13		1,529.68
1303-103		Analysis	15	15OCT08*	04NOV08		13		15,296.80
1303-105		FDR Dwgs for coils and supports	20	05NOV08*	04DEC08		13		16,061.64
1303-107		Prepare for FDR	5	05DEC08*	11DEC08		13		3,059.36
1303-110		Trim Coil FDR	1	12DEC08*	12DEC08		13		1,529.68
1303-112		Prepare Procurement Coil Spec	5	15DEC08*	19DEC08		28		4,589.04
1303-114		Disposition FDR Chits	5	15DEC08*	19DEC08		28		1,529.68
1303-116		Detail Fabrication Drawings	20	15DEC08*	20JAN09		13		12,237.44
184-035		Bid & Award Ext Trim Coils	45	21JAN09	24MAR09		13		4,589.04
184-036		Award External Trim Coils	0	25MAR09	24MAR09		13		0.00
184-037		External Trim Coil & Supports Procurement	88	25MAR09	28JUL09		13		47,078.90
1303-040		Procure materials for supports	20	22DEC08	27JAN09		121		11,574.04
1303-041		Fabricate Supports	20	28JAN09	24FEB09		121		6,357.76
1303-042		Install supports onto coils	15	29JUL09	18AUG09		13		11,185.84
184-015		Title III WBS 133 Rxt Trim Coils	88	25MAR09	28JUL09		13	LOE	25,285.36
Subtotal			219	01OCT08	18AUG09		13		161,904.26