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:

The external trim coil set is intended to provide low poloidal mode number (m=2,3) field error correction. These will be conventionally wound coils in a windowpane configuration. They are provided at the top, bottom, and outside perimeter of the Coil Support Structure (WBS 151) primarily to reduce low poloidal mode number (m) resonant errors that may result from manufacturing or assembly errors in the modular coil geometry.

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

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					HOURS																	Basis of Estimate
	41MS	48MS	37STK	35TRVL	31OT	ORNL EM	ORNL DSN	EMEM	EMSM	EMSB	EMTB	EAEM	EADM	EEEM	EESM	EESB	EETB	ECEM	ECSB	ECTB	RM2	RM3	
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)**
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	**2.5**																						One trip to west coast assuming vendor is in Ca (worst case assumption)
												244	**124**										

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TABLE II - Materials and Subcontracts

WBS Number: 133

WBS Title: External Trim Coils

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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
Procrurement & 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**
	33.70																									

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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

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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%)

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TABLE IV - Uncertainty of Estimate and Residual Risk Assessment

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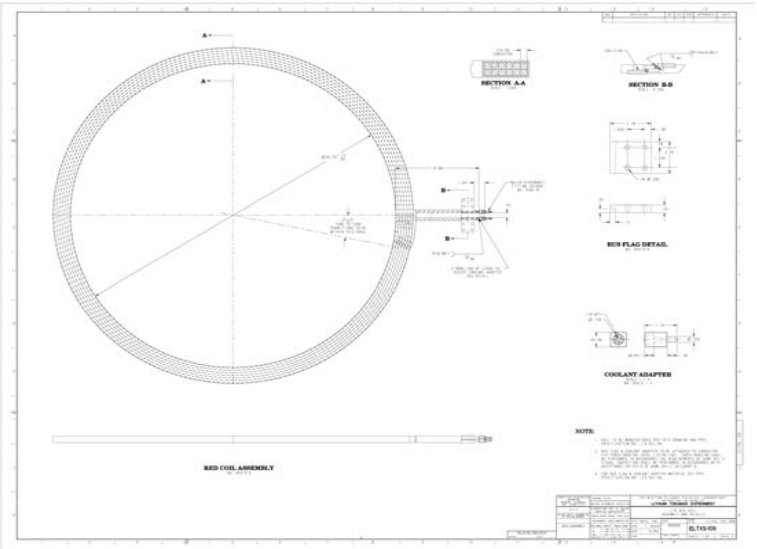
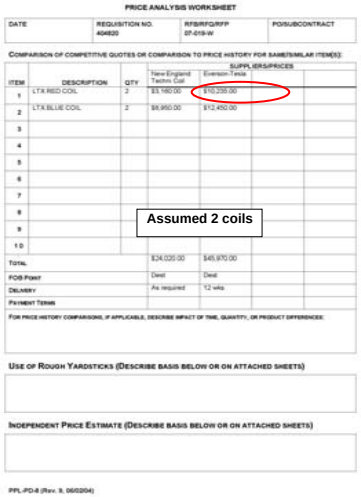
M&S Estimate Backup

Estimate for More Complex Coil (based on Jupiter II)

Drawing of 4th LTX Coil



Backup for LTX Costs



PRICE ANALYSIS WORKSHEET

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

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	$8,950.00	$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

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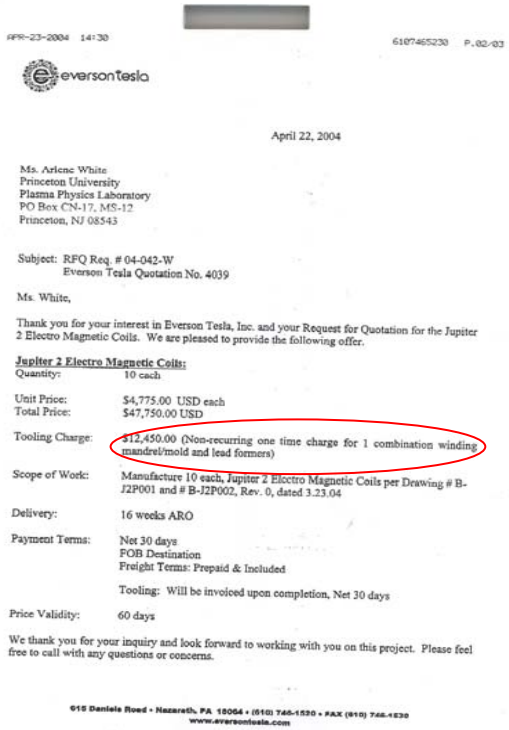
Basis of Tooling Estimate



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