

NCSX Work Approval Form (WAF)

WBS Number: 22

WBS Title: Vacuum Pumping System

Job Number: 2201

Job Title: Vacuum Pumping System

Job Manager: Bill Blanchard

Description:

The MIE project scope is limited to one TMP backed by an existing mechanical/booster pump system. Design, fabrication, installation, and system testing of equipment needed to implement the vacuum pumping system. In the future, NCSX Vacuum Pumping System will use as much as possible of the existing PBX-M vacuum pumping system hardware where it is cost effective to implement.

Schedule:

See Attached

Approvals:

_____ Date _____
Job Manager

_____ Date _____
Responsible Line Manager

_____ Date _____
Project Manager

_____ Date _____
Engineering Department Head

NCSX June 2007 ETC
TABLE I - DESIGN LABOR

WBS Number: 22
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Description:

The proposed design consists of a high vacuum system which is manually operated and includes an isolation valve, a vertical pumpduct on a lower P12 port cover and one 1500 l/s TMP. The TMP will be backed by an existing booster mechanical pump system. The system will also contain one unshielded RGA and one ion gauge with and a valved access port for initially roughing down the vacuum vessel.

Task ID	K\$		Hours										Basis of Estimate
	M&S		EMEM	EMSM	EMSB	EMTB	EAEM	EASB	EEEM	EESM	EESB	EETB	
Title I and II Design													This is a relatively simple vacuum pumping system that will utilize major components (TMP, isolation valves, booster and mechanical pump) already at PPPL. Estimate based on prior experience on similar systems (e.g., NSTX), adjusted for the simplicity of this system. Input from experienced engineers/personnel familiar with specific parts of this scope was used for estimates. Includes design activities, some P&ID drawings, weld drawings, fab drawings, calculations, two reviews (PDR & FDR), oversight and purchasing of components. The system should have an approximate pumping speed of 700 l/s for attaining 4e-7 Torr or less after the vacuum vessel has been baked out and the surfaces well conditioned.
<u>AC Power / Instrumentation</u>													
AC Power for Backing System	\$3.1K						72	16					
AC Power for Instrumentation Rack	\$3.1K						88	24					
Rack to Instrumentation	\$1.5K						40		48		16		
<u>VPS (Mechanical)</u>	\$10.0K	208		96			64		48				
Subtotal Title I & II Design	\$17.7K	208	0	96	0	0	264	40	96	0	16		
Title III													This effort includes both fabrication/welding/assembly, installation, oversight, leak checking of the subsystems, installation procedure, refurbishment of legacy equipment as required and initial operation and testing.
<u>AC Power / Instrumentation</u>													
AC Power for Backing System												104	
AC Power for Instrumentation Rack												144	
Rack to Instrumentation												112	
<u>VPS (Mechanical)</u>						232							
Subtotal Title III	\$0.0K	0	0	0	232	0	0	0	0	0	0	360	

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TABLE II - Materials and Subcontracts

WBS Number: 22
WBS Title: Torus Vacuum Pumping Systems
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Materials and Subcontracts (M&S)	Basis of Estimate
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Description:

Included in Table I

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TABLE III - Fabrication and Installation

WBS Number: 22

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Job Number: 2201

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In-house Fabrication and Assembly and Installation

Included in Table I

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TABLE IV - Uncertainty of Estimate and Residual Risk Assessment

WBS Number: 22
WBS Title: Torus Vacuum Pumping Systems
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<u>Uncertainty of the Estimate</u>					
	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Uncertainty Range (%)</u>	<u>Comments/Other Considerations</u>
Design Maturity		X		-10%/+15%	Although may be similar to previous designs, some design features (not yet defined)
Design Complexity			X		
Other Comments:					

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

<u>Residual Impacts</u>								
<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%)