

**NCSX June 2007 ETC  
TABLE I - DESIGN LABOR**

**WBS Number: 22**  
**WBS Title: Vacuum Pumping System**  
**Job Number: 2201**  
**Job Title: Vacuum Pumping System**  
**Job Manager: Bill Blanchard**

**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		EEM	EMSM	EMSB	EMTB	EAE	EASB	EEEM	EESM	EESB	EETB	
<b>Title I and II Design</b>													<p>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&amp;ID drawings, weld drawings, fab drawings, calculations, two reviews (PDR &amp; 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.</p> <p>M&amp;S includes standard cabling, raceways, conduits, etc. For VPS M&amp;S includes piping and other miscellaneous items. Major components available from legacy equipment.</p>
<b><u>AC Power / Instrumentation</u></b>													
AC Power for Backing System	\$3.0K						72	16					
AC Power for Instrumentation Rack	\$3.0K						88	24					
Rack to Instrumentation	\$1.5K						40		48				
<b><u>VPS (Mechanical)</u></b>	\$10.0K	208		96			64		48				
<b>Subtotal Title I &amp; II Design</b>	<b>\$17.5K</b>	<b>208</b>	<b>0</b>	<b>96</b>	<b>0</b>	<b>0</b>	<b>264</b>	<b>40</b>	<b>96</b>	<b>0</b>	<b>0</b>	<b>0</b>	
<b>Title III</b>													<p>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.</p>
<b><u>AC Power / Instrumentation</u></b>													
AC Power for Backing System												104	
AC Power for Instrumentation Rack												144	
Rack to Instrumentation												112	
<b><u>VPS (Mechanical)</u></b>							232						
<b>Subtotal Title III</b>	<b>\$0.0K</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>232</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>360</b>	