

Direct Investment costs for Reference Case (RC)

Hand method

Calculation of direct investment costs

Apparatus and equipment type	Price for equipment naked	cost multiplication factors F_E per product group	Resulting price
Distillation column	4.932 €	4.0	19.728 €
Pressure vessel	0 €	4.0	0 €
Heat exchanger	33.704 €	3.5	117.964 €
Furnace	40.761 €	2.0	81.522 €
Pump	2.780 €	4.0	11.120 €
Compressor	0 €	2.5	0 €
Instrumentaion	0 €	4.0	0 €
Other equipment	312.330 €	2.5	780.825 €
Total	394.507.00 €		1.011.159.00 €

Cost element F_x	Cost factor	of	Costs
Direct investment cost			1.011.159.00 €
Indirect investment cost	0.4	DI	404.463.60 €
Process investment cost	0.2	DI+II	283.124.52 €
Rist supplement	0.15	DI+II	212.343.39 €
Total Hand method			1.911.090.51 €

PCR method

Apparatus and equipment costs

Category	Cost distribution factor	Cost per category
Apparatus	39%	394.507 €
Foundations	4%	40.462 €
Insulation	4%	40.462 €
Site work	4%	40.462 €
Buildings	10%	101.156 €
Ductwork	1%	10.116 €
Wiring	8%	80.925 €
Instrumentaion	8%	80.925 €
Piping	22%	222.542 €
Total		1.011.556 €

Category	Cost distribution factor	Cost per category
Apparatus and equipment costs	28%	1.011.556 €
Process design costs	7.5%	270.953 €
Electrical & control	2%	72.254 €
Indirect site costs	5%	180.635 €
Staff costs construction site	5%	180.635 €
Material cost construction site	5%	180.635 €
Total PCR method		1.896.668 €

Direct Investment costs for Process Variant (PV)

Hand method

Calculation of direct investment costs

Apparatus and equipment type	Price for equipment naked	cost multiplication factors F_E per product group	Resulting price
Distillation column	4.932 €	4.0	19.728 €
Pressure vessel	0 €	4.0	0 €
Heat exchanger	53.949 €	3.5	188.822 €
Furnace	742.751 €	2.0	1.485.502 €
Pump	2.780 €	4.0	11.120 €
Compressor	0 €	2.5	0 €
Instrumentaion	0 €	4.0	0 €
Other equipment	292.569 €	2.5	731.423 €
Total	1.096.981.00 €		2.436.594.00 €

Cost element F_x	Cost factor	of	Costs
Direct investment cost			2.436.594.00 €
Indirect investment cost	0.3	DI	730.978.20 €
Process investment cost	0.15	DI+II	475.135.83 €
Rist supplement	0.1	DI+II	316.757.22 €
Total Hand method			3.959.465.25 €

PCR method

Apparatus and equipment costs

Category	Cost distribution factor	Cost per category
Apparatus	39%	1.096.981 €
Foundations	4%	112.511 €
Insulation	4%	112.511 €
Site work	4%	112.511 €
Buildings	10%	281.277 €
Ductwork	1%	28.128 €
Wiring	8%	225.022 €
Instrumentaion	8%	225.022 €
Piping	22%	618.810 €
Total		2.812.772 €

Category	Cost distribution factor	Cost per category
Apparatus and equipment costs	28%	2.812.772 €
Process design costs	3.8%	376.711 €
Electrical & control	1.5%	150.684 €
Indirect site costs	2.5%	251.140 €
Staff costs construction site	2.5%	254.154 €
Material cost construction site	2.5%	254.154 €
Total PCR method		4.099.615 €