EXAMPLE OF EXPONENT FACTOR

Where equipment scope and sizes vary from these within a definitive estimate, then the following method can be used to produce a factored type of estimate.

1. Produce a cost per piece of equipment using the cost data from a similar
2. Estimate adjusting the cost to suit the required technical data by applying capacity and cost factors where necessary. These are based on the "Plant Scale Factors" as example shown where:

    a. = Size of vessel (weight tonne) of which cost is known.
    b. = Size of vessel for which cost is required expressed in same terms as "a" above.
    c. = Actual cost of "a" above. The following method can be used to produce a Factored type of Estimate.
    d. = Cost being sought, i.e. estimate cost of vessel "b"

- **Then d = $(b/a)^{0.7} \times c$**

Example:

- d = $(60/40)^{0.7}$ x £180.000
- d = $(1.5)^{0.7}$ = 1.33 x £180.000 = **£239.400**

The exponent factor can vary for different types of equipment and plant. The tables that follow have been provided as a guide to what are generally used: -

Equipment Type	Capacity Exponent	Equipment Type	Capacity Exponent
Process Furnace	0.85	Hoppers	
		Conical	0.68
		Silos	0.90
Direct Fired Heater	0.85	Blowers & Fans	0.68
Boilers (Industrial)		Crystallisers	
15 psig	0.50	Growth	0.65
150 psig	0.50	Forced Circulation	0.55
300 psig	0.50	Batch	0.70
600 psig	0.50		
Package Boiler Unit	0.70	Filters	
Shell & Tube Exchangers	0.65	Plate & Press	0.58
Kettle Reboilers	0.65	Pressure Leaf (wet)	0.58
U Tube Exchanger	0.65	Pressure Leaf (dry)	0.53
Cooler	0.66	Rotary Drum	0.63
Cooling Towers	0.60	Rotary Disc	0.78
Tower with Trays	0.73	Dryers	
Pressure Vessel		Drum	0.45
Vertical	0.65	Pan	0.38
Horizontal	0.60	Rotary Vacuum	0.45
Storage Tanks	0.30		
Horizontal Storage Pressure Vessel	0.65		
Spherical Storage Pressure Vessel	0.70		
Centrifugal Pump			
Centrifugal/Motor	0.52		
Centrifugal/Turbine	0.52		
Reciprocating Pump			
Reciprocating/Motor	0.70		
Reciprocating/Steam	0.70		
Process Gas Compressor			
1000 psig	0.82		
Air Compressor			
125 psig	0.28		
Crushers			
Cone	0.85		
Gyratory	1.20		
Jaw	1.20		
Pulverisers	0.35		
Mills			
Ball	0.65		
Roller	0.65		
Hammer	0.85		
Evaporators			
Forced Circulation	0.70		
Vertical Tube	0.53		
Horizontal Tube	0.53		
Jacketed Vessel	0.60		

SCALE UP FACTORS FOR CHEMICAL PLANTS

Type of Plant	Exponent
Ethylene Oxide	0.79
Ethanol	0.60
Styrene	0.68
Butadiene	0.59
Delayed Coking	0.58
Formaldehyde	0.55
Benzene	0.61
Nitric Acid	0.56
Oxygen	0.64
Acetylene	0.75
Methanol	0.83
Butyl Alcohol	0.55
Isopropyl Alcohol	0.60
Caustic	0.35
Phosphoric Acid	0.58
Ammonium Nitrate	0.54
Urea	0.59
Sulphuric Acid (Contact)	0.62
Chlorine (electrolytic)	0.35
Hydrogen Cyanide	0.71
Ammonia (Steam Reformer Synthesis Gas)	0.74
Ethylene	0.58
Polyethylene (LP)	0.67
Polyethylene (HP)	0.90