CALRES Tank Cost Comparison

Screen 1

The following information is required to run the tank design portion of the CALRES program:

1.0 Basic Design:

1.1 Life cycle time in years (minimum 1 year). _____

1.2 Tank capacity in US gallons. _____

Alternate: tank height in feet. _____

1.3 Tank diameter in feet. _____

1.4 Fluid density. _____

1.5 Roof Design
(either self-supporting “dome” or “cone”). _____

1.6 Up to six different materials may be chosen. Corrosion rate allowance (in mils, if known, should be included for each alloy. This will provide the corrosion allowance for the wall thickness calculation.

The choices are:

A516 grade 60____ A516 grade 70____

304L____ 316L____ 316LN____ 317LMN____

2202 (S32202) 2304 (S32304)____

2205 (S31803/S32205)____ 2507 (S32750) / Alloy 255 (S32550)____

904L (N08904)____ 6Mo (S31254)____ 6Mo (N08926)____

B66 (S31266) ____ B46 (S34565)____

1.6.1 Alternatively, stainless or carbon steel alloys not listed above may be included in the list of six materials. Mechanical properties (ASTM minimum yield and tensile, Young’s Modulus and material density) must be supplied for the additional materials in order to calculate API 650 design criteria.

1.7 If there is the possibility for corrosion or lining degradation in the wet/dry interface area an additional corrosion allowance may be added to the top shell area.

Maximum liquid height (in feet). _____

Minimum liquid height (in feet). _____

Corrosion allowance to be added (mils). _____

Screen 2

The following information is required to develop the basic plate layout and material requirements for the tank. Actual size information, based on the fabricator's handling capability, may be supplied or CALRES will calculate plate sizes based on economical mill plate production. In any case the plate sizes may not exceed the mill maximums provided.

2.0 Material Requirements

2.1 Plate dimensions (in feet).

2.1.1. Shell plate length (maximum of 39.4 ft). _____
2.1.2. Course height (maximum of 9.2 ft). _____
2.1.3. Bottom plate length (maximum of 32.8 ft). _____
2.1.4. Bottom plate width (maximum of 9.8 ft). _____
2.1.5. Annular ring plate length. _____

2.2 Cone roof.

2.2.1. Roof slope (9.5 to 37°). _____
2.2.2. Roof plate length (maximum 39.4 ft). _____
2.2.3. Roof sector width (maximum 9.8 ft). _____

2.3 Dome roof

2.3.1. Cap diameter (maximum 19.3 ft). _____
2.3.2. R/D ratio (curvature radius/tank diam). (R/D = 0.8 to 1.2). _____
2.3.3. Roof plate length. _____
2.3.4. Roof plate width. _____

2.4 Dimensional Tolerance.

2.4.1. Maximum below gauge allowance. (ASTM standard = .010) _____

Screen 3

3.0 Cost of construction materials. Actual cost information may be supplied or Industeel will use typical market value prices.

3.1 Price for plate material (up to six alloys). List alloy and $/#.

_____ _____ _____

_____ _____ _____

3.2 Price for welding materials (up to six alloys). List as $/1000 electrodes. Electrode diameters may be: 0.125, 0.156 or 0.188 or Industeel will use typical market value prices.

_____ _____ _____

_____ _____ _____

Screen 4

4.0 Internal coating costs. Actual cost information may be supplied or typical cost data supplied by Industeel {shown in brackets} will be used.

4.1 Determine which surfaces are to be coated.
Bottom yes / no Roof yes / no Shell yes / no

4.2 Choose type of liner and cost ($/sq ft).

100% epoxy	{$18.1}_____	Vinyl ester epoxy resin	{$24.1}_____
Rubber	{$30.2} _____	Chlorobutyl rubber	{$38.5} _____
Neoprene	{$46.7} _____	Fluoroelastomer	{$85.4} _____
Other	_____		

4.3 Increase shell plate thickness 25% for brittle coatings.

Yes _____ No _____

4.4 Maintenance costs for coating.

Estimated frequency for maintenance (years) _____

Percent of surface area repaired per maintenance event. _____

Cost to repair 1% of surface area as a percentage of initial cost. _____

Cost to repair 100% of surface area as a percentage of initial cost. _____

Cost of lost production per event in 1000$ _____

Screen 5

5.0 External painting costs. Actual cost information may be supplied or typical cost data supplied by Industeel {shown in brackets} will be used.

5.1 For carbon steel.

5.1.1 Maintenance frequency per event (in years). _____

5.1.2 Cost in $/sq ft of:

Surface preparation & Primer application {$3.1}_____

Intermediate preparation & application costs {$4.0}_____

Final coat application {$2.1}_____

5.1.3 Final coat quality factor (0.85 to 1.15). _____

5.2 For stainless steel.

5.2.1 Paint required? YES / NO

5.2.2 Frequency per maintenance event (in years). _____

5.2.3 Cost in $/sq ft of:

Surface preparation {$1.0} _____

Primer and final coat application {$4.0} _____

Screen 6

Actual cost information may be supplied or typical cost data supplied by Industeel {shown in brackets} will be used. This data is used in the calculation of the various fabrication, installation and maintenance costs for the tank.

6.0 Variable Costs

6.1 Labor costs (in $/hour).

Construction /Fabrication {$56.9}_____Welding {$63.2}_____

Inspection {$60}_____ Pickling ($58.5}_____

6.2 Indirect costs (in $ / ton).

Plate transportation_____ Scaffold erection_____

Crane leasing_____

Results of calculations

As a result of inputting this data, the program will provide the following information for each alloy in tabular format:

7.1 Plate thickness (per API calculation) and weights and metal costs.

7.2 Shell and roof forming costs and total forming cost.

7.3 Internal pickling, external weld pickling and total pickling cost.

7.4 **Shell welding cost including: edge preparation, dye penetrant inspection, installation, grinding, welding backing pass, final inspection and filler metal.**

7.5 Roof welding costs including: installation, welding, grinding, back passes, inspection and filler metal. Separate costs are calculated for the attachment of the shell plates to the annular plates and the roof plates.

7.6 Bottom welding costs including installation, welding, grinding and inspection for butt welding of the annular plates and lap welding of the center plates.

7.7 Maintenance costs including internal coating and/or external painting repairs for the expected tank life.

7.8 Total cost includes both an installed cost (all fabrication and materials) and a life cycle cost (installation and maintenance over the expected life).

7.9 The total cost results are also presented in graphical form.

7.10 There are also several sub screens, which present materials data, API formulas and design calculations as reference material.

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Please note: You may have several tank scenarios – varying dimensions, coated vs. uncoated, painted vs. unpainted etc. You may submit all of your options, and several cost evaluations can be completed for comparison.