

Cleaning Cost Calculation Worksheet

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Ultrasonic Cleaning

Carburetors with Proprietary Cleaning Solution

Variable

Value

units

General

cycle time for ultrasonics	15	min/cycle
load/unload time	2	min/cycle
delay time	1	min/cycle
<i>total cycle time</i>	18	min/cycle
tank capacity	110	gallons/tank
batch size	3	parts/batch
# batches per day	15	# cycles
lifetime of cleaning bath (changeover period)	300	# cycles
working days per week	5	days/week
working weeks per year	50	weeks/year
<i>batches per year</i>	3750	batches/year
<i>parts cleaned per year</i>	11250	parts/year

Energy

# generators	4	#
power rating per generator	1.00	KW
<i>energy for ultrasonics consumed</i>	1.00	KWH/cycle
horsepower rating of pump	1	hp
mechanical efficiency	75.00%	%
<i>energy for pump consumed</i>	0.05	KWH/cycle
other power req (except heat)	0.1	KW
<i>other energy (except heat) consumed</i>	0.03	KWH/cycle
bath temperature	160	deg F
temperature of bath at startup	115	deg F
<i>initial heating energy consumed</i>	12.10	KWH
reheat adjustment factor	25.00%	% of single heat
<i>reheat energy consumed per cycle</i>	3.02	KWH/cycle
<i>total heat energy consumed per cycle</i>	3.83	KWH/cycle
<i>total energy consumed per cycle</i>	4.91	KWH/cycle
cost of electricity	\$0.10	\$/KWH
<i>cost of energy per cycle</i>	\$0.49	\$/cycle
<i>annual cost of energy</i>	\$1,841	\$/year

Labor

direct labor hours per cycle	2	min/cycle
direct labor hours per changeover	60	min/changeover
<i>total labor hours per cycle</i>	2.2	min/cycle
fully burdened labor rate	\$15.00	\$/hour
<i>cost of labor per cycle</i>	\$0.55	\$/cycle
<i>annual cost of labor</i>	\$2,063	\$/year

Materials

cost of cleaning agent	\$13.00	\$/gallon
concentration by volume	6.67%	% by volume
# replenishments between changeovers	1	# replenishments
replenishment quantity added	0.5	gal/replenishment
cost of water	\$2.00	\$/Kgal
water loss per cycle	2.50%	% of total solution
cost of other materials per changeover	\$6.00	\$/changeover
<i>cost of initial charge of cleaning agent</i>	\$95.38	\$/changeover
<i>cost of replenishments</i>	\$6.50	\$/changeover
<i>total cost of cleaning agent per cycle</i>	\$0.34	\$/cycle
<i>cost of initial charge of water</i>	\$0.21	\$/changeover
<i>cost of makeup water per cycle</i>	\$0.01	\$/cycle
<i>total cost of water per cycle</i>	\$0.01	\$/cycle
<i>cost of other materials per cycle</i>	\$0.02	\$/cycle
<i>total materials cost per cycle</i>	\$0.37	\$/cycle
<i>total materials cost per year</i>	\$1,372	\$/year

Waste Disposal

wastewater disposal costs	\$150.00	\$/55-gal drum
<i>waste disposal costs per changeover</i>	\$300.00	\$/changeover
<i>waste disposal costs per cycle</i>	\$1.00	\$/cycle
<i>annual cost of waste disposal</i>	\$3,750	\$/year

Capital Costs

purchased cost of machinery	\$15,000	\$
installation costs	\$3,000	\$
cost of initial training	\$500	\$
<i>total installed cost of equipment</i>	\$18,500	\$
cost of capital	15.00%	% per annum
life of equipment	10	years
salvage value at end of life	\$1,500	\$
<i>capital recovery factor</i>	0.199252	-
<i>discount factor for salvage value</i>	0.049252	-
<i>equivalent annual installed cost of equipment</i>	\$3,686	\$/year
<i>equivalent annual salvage value</i>	\$74	\$/year
<i>equivalent annual cost of equipment</i>	\$3,612	\$/year

Maintenance Costs

maintenance costs per year, materials & services	\$500	\$/year
maintenance labor per year, duration	20	hours/year
maintenance labor per year, cost	\$300	\$/year
<i>total maintenance costs per year</i>	\$800	\$/year

Cost of Quality

fraction of cleaned parts returned for recleaning	5.00%	%
cost of warranty returns	\$200.00	\$/part
fraction of warranty returns related to cleaning	0.25%	%
fraction of parts damaged in cleaning	0.50%	%
resale value of parts	\$100.00	\$/part
<i>parts cleaned per batch</i>	2.85	parts/batch
<i>parts cleaned per year</i>	10,688	parts/year

