Replenishment E-coat Paint Feeder System

Product Information

January 2010

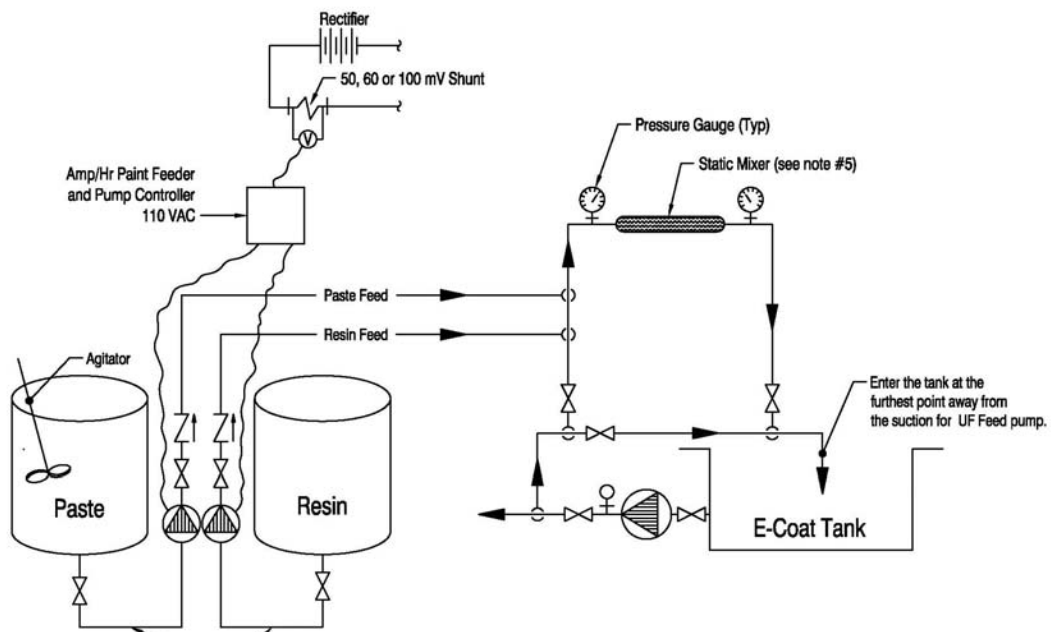
Paint Consumption

- Paint solids are being removed from the E-coat bath as film forms on the ware when DC current is flowing
- We know that E-coat film thickness can vary as the %NV changes during the day's production run
- Replenishment paint is required whenever the paint system is working, approx. ~175 ml for each amp hour consumed

Economic Factors

- Allowing the %NV to vary (during the production day) widely will adversely affect the film thickness & paint consumption
  - At low %NV the film thickness will be at its minimum
  - Just after a large slug of replenishment paint has been added, the film thickness will be at its maximum because the %NV is at its highest. This difference will cause an increase in the variable cost to operate the E-coat paint system
- Automatic paint additions occur when needed without additional or extra labor input

Process Schematic



Paint Feed System Schematic
(with Static Mixer)

Notes:

1. If pulling from the bottom of a tote / paint container, limit pump suction piping to be no more than 36". A 2" or larger suction line is recommended. Only reduce down the pipe at pump inlet if necessary.
2. Limit flow through static mixer so pressure drop is ~3.5-4.0 PSI.
3. Do not exceed 8-12 ft/sec for paint velocity in any pipe line.
4. Total replenishment paint feed flow rate is 1-3 gpm max.
5. Actual flow rate will depend on static mixer model.
6. The magnetic proximity switch should we wired up with 20 AWG twisted pair. The air solenoid valve (that controls delivery of air to the piston pump) needs AWG #12.

What do I need to order?

- 1 pump per E-coat paint component
  - 1 component replenishment paints need just one pump
  - 2 component replenishment paints need two pumps
- Each paste container must have an agitator.
- Amp-hour controller
  - Will control one or two pumps
  - If using 2 rectifiers then order the 2 rectifier option
- Static mixer
- Ask UFS and your E-coat paint company to assist with the location and design of paint side stream where the replenishment paint will be injected.

Payback

- Steady %NV will result in a more steady E-coat film thickness, less variable paint consumption costs and more predictable paint consumption
- Less direct manpower input required. Replenishment paint can automatically be added hourly or more often as required

Pump Selection

- Piston pumps deliver a known quantity of material for each displacement stroke (Note – paint is discharged during the ‘discharge’ stroke, no paint is discharged when the pump is in the ‘return’ stroke. A cycle is a discharge stroke + return stroke)
- Diaphragm pumps also deliver a constant quantity per cycle; however, can stall and not deliver the required volume, if this happens.

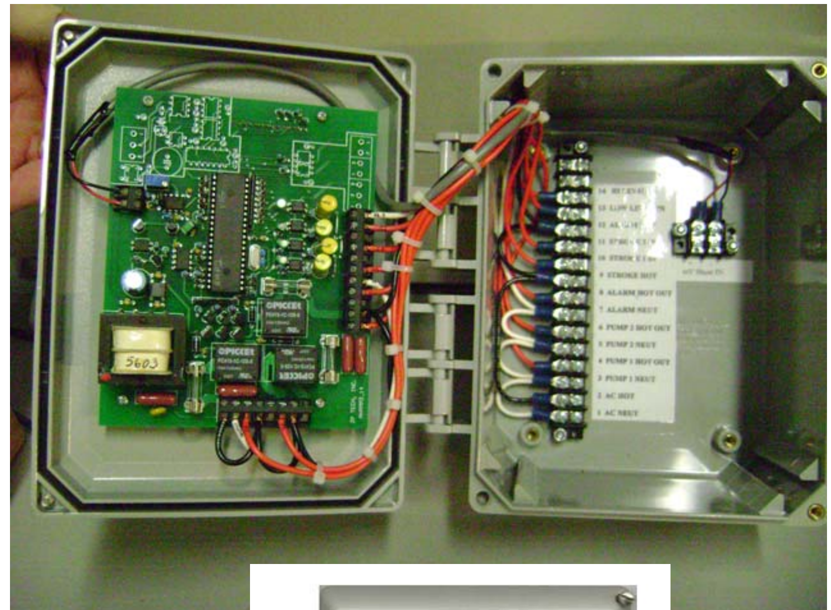
Alt Amp Hr Calculation

- What is typical SF of ware per hour?
  - What is the annual production?
  - How many days per year?
  - How many hours per day?
- What is theoretical volume of paint at required film thickness?
  - How many SF will one gallon cover at 1 mil?
  - How many amp hours are used to coat 1 gal of paint?
- What is discharge of piston pump?
  - How many pump cycles are required?
  - At a given supply air pressure, what is the elapsed time to deliver all the strokes?

	Replenishment Paint Feeder Worksheet and Data Form							
Customer:	Harley Davidson							
City:	KC					PPG Paint Code/Resin:	691/524	
-coat Line:	E-coat					PPG Paint Code/Paste:	691/524	
Date:	19-Jan-10							
Production Data			Units					Units
	Coated Surface Area:	4,400,000	SF			Estimated Coating Rate:	1250.00	SF/Hr
	nual Production Days:	220	Days/Yr					
	ly Hours of Operation:	16	Hrs/Day					
Paint Coverage Data @ 1.0 mil Thickness								
	stimated Volume/SF:	626	Gal/SF			Estimated Hourly Paint Vol	2.00	Gal/Hr
	Amp-hrs/Gal of Feed:	13.76				Est Amp hour per 60 minutes:	27.48	Amp-hr/Hr
Replenishment Paint Feeder Pump Data								
			in^3/cycle	Gal/Cycle				
		ARO #NM2304B-11-311:	8.2	0.035498				
		# Pump cycles to equal Cell #I17:	56.25147					
Amp-Hr Meter Input Data								
hunt size:		mV at Max amps						
ax Amps:		Amps (out from rectifier)						
our trigger:	27	Amp-hrs (enter interger values only)						
Reduce the Theoretical # of Pump Cycles by 5% so not too much is added.								
This will partially compenstate for the fewer # of amp hours since we round down.								
f # Cycles	54	# Pump cycles (i.e. discharge 'Strokes') rounding up						

Amp Hour Controller

- Input from rectifer shunt
- 110 VAC power input
- Output to control pump via air solenoid valve
- Input from pump to count strokes via magnetic proximity sensor

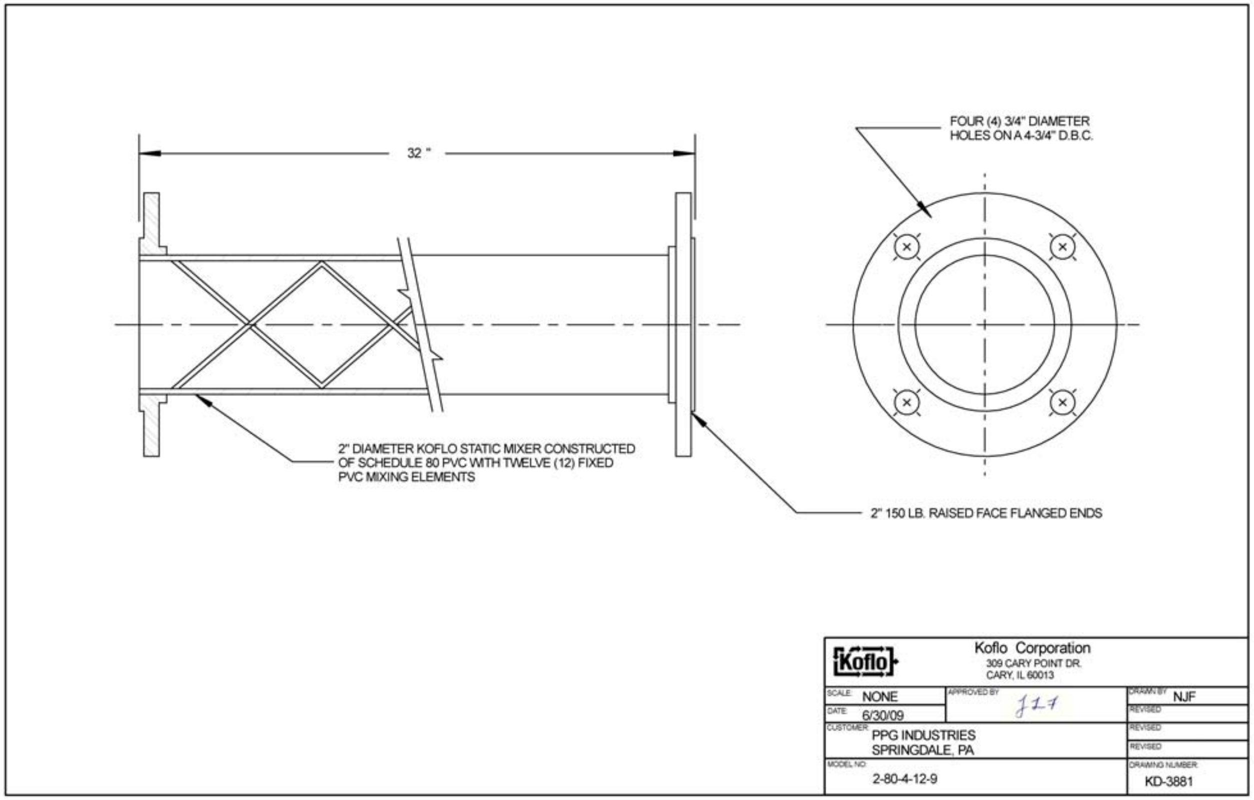


Typical Tote/Piston Pump

- Note - customer made this frame from included wall mount adapter
- Pump discharge is ¾" NPT
- Reduce suction to 1-1/4" NPT at pump
- Keep pump suction same as tote discharge & about 3 ft long

Static Mixer

- 2” pipe size
- Limit flow rate through static mixer so delta P does not exceed 4 or 5 psi



Manual Override

- There will be times that more paint has to be added.
- Maybe 22 gal of paint is required to raise the %NV by 1% for every 1000 gal of bath
- The amp-hr controller has to be placed in manual mode first, then enter the # of strokes needed.
- UFS will provide a chart of the number of strokes and the corresponding impact of %NV of the bath.
  - For example, a customer wants to take the % NV up by 0.1 %. This means 28 strokes will have to be added.
  - The JP Tech will allow manual additions up the pre-programmed value. This means sometimes more than one manual addition will have to be completed by the operator. The good news is that the controller will not allow an unreasonable amount of paint to be added, which makes the controller more robust

Not Included

- Wiring, conduit, fittings of amp hour controller and air solenoid valves
- Air supply lines to air motor
- Suitable support structure
  – floor mount/ support stand or wall mount.
- Discharge piping from pump to side stream piping
- 2” side stream piping, valves, check valves, pressure gauges, fittings, etc

Start up

- Review paint feeder worksheet with paint supplier and UFS
- Verify volume discharge per stroke of the selected pump(s)
- Program Amp Hour controller
  - Tell controller the size of the shunt (i.e. milliVolts at max amps) & max amps
  - Input the # of strokes required for the # amp hours desired (the fewer the # amp hours desired the more often the pump will operate) for pump #1
  - Repeat above step for Pump #2 if using two component paint
- Measure the time required for the pump to operate the requested # of strokes
  - Input this into the Amp Hour controller as a fail safe in the event the stroke count suffers a sensor failure and pump can then controlled on a time basis if the magnetic proximity sensor is not working or under going repairs
- Measure %NV twice a shift for first week of operation and verify the # strokes and adjust as required +/-.
- Use a portable flow meter to verify 25 gpm in the side stream and mark the pressure gauges for normal operation once the proper flow has been verified

How Often to Add Paint?

- We suggest you take the average hourly production and estimate how many amp hours are consumed in a typical 60 minute window.
- Use the figure of amp-hours to be the trigger point to make the additions. The # of strokes will be for the hour's worth of production.
- If after some time, you see that there is an observable decrease in the %NV during the 60 minutes, or so, between the feeds, use the amp-hours consumed in 45 minutes as the trigger point and reduce the # strokes accordingly. This should lead to a more steady %NV.

Maintenance

- Air operated pumps have moving parts, so inspect them per the manufactures PM schedule & be prepared to replace per manufacturer’s recommendations
  – Air motor replacement parts kit included
  – Pump end replacement parts kit included
- Fine tune # strokes and the # amp-hours to keep the %NV as steady as required.
- Calibrate pressure gauges in the side stream and verify flow once a year with portable flow meter

Hardware Notes

- Paste needs an agitator to stay mixed
- Paste drum also needs a lid/lift for Piston pumps due to weight and size of pump
- Diaphragm pumps can be used if budget is tight and preferred piston pump cannot be used.
- Static mixer can be avoided if there is enough cross-flow of E-coat bath as it enters tank ‘farthest’ away from the UF feed pump

Pre-order Checklist

- Do you have 1 component or 2 component replenish E-coat paint
- Do you use one or two DC rectifiers?
- Do you have a static mixer in place already? Is this part of an existing side stream where replenishment paint can be added?