

Amine Cycle Condensate Polishing

Condensate returns are routinely purified or “polished” by the use of ion exchange resins. Hot condensate (greater than 140°F) precludes the use of anion resins, so polishing is accomplished by cation resin in the sodium or amine form. Highly crosslinked macroporous cation resins, such as **ResinTech SACMP-CP**, usually work better than gel resins.

Sodium form resin will leak sodium as it exchanges for other cations in the condensate. Resin used in the amine form eliminates sodium leakage, and any amine leakage that occurs is beneficial to the steam cycle.

Neutralized amines are weakly ionized. Cation resin does not convert very well to the amine form unless it is first in the acid form. This means that a two-step regeneration is required, first converting the resin to the hydrogen form with an acid, either sulfuric or hydrochloric, and then converting it to the amine form with morpholine.

The high temperature of the condensate does not allow the use of lined polisher vessels; usually vessels have a corrosion allowance instead of a lining. Likewise, valves and piping are usually unlined. Strong acids should not come in contact with unlined steel, so the best way to get a high percent conversion to the amine form is to regenerate the resin external to the service vessel. External regeneration also eliminates the possibility of acid being released into the boiler.

There are patented amine regeneration techniques that take place in the polisher vessels. This involves soaking the resin in place with morpholine citrate.

Whichever method is used, success depends on getting a high percent conversion to the amine form initially.

The ionic load on the resin is normally very low and service runs can last from several weeks to several months. Subsequent regenerations require maintenance dosing at lower levels than the original conversion.

REGENERATION GUIDELINES

ACID	SULFURIC	HYDROCHLORIC	MORPHOLINE
Dose	15 lbs/cu.ft. H ₂ SO ₄	8 lb/ cu.ft. HCl	9 lbs/cu.ft.
Strength	2% (0.17 lbs/gal.)	5 - 10%	(8.4 lbs/gal.)
Time	30 - 60 minutes	30 - 60 minutes	2 hours*

*Recycle until pH of effluent is above 7.0. Morpholine is weakly ionized and does not go onto the resin quickly.

SIMPLIFIED REGENERATION SEQUENCE

1. Cool resin down to 140°F
2. Transfer resin to regeneration tank
3. Inject 2% sulfuric (or 5 to 10% HCl)
4. Rinse
5. Recycle morpholine
6. Fast rinse
7. Transfer resin to polisher vessel

AMINE	EQUIVALENT WEIGHT lbs. as CaCO ₃ /lb. 100%	RECOMMENDED DOSAGE lbs/cu.ft.	
		ResinTech CG8	ResinTech CG10
Ammonium Hydroxide	1.42	2	2.2
Morpholine	0.5739	9.25	10.2
Cyclohexylamine	0.5042	11	12.2

