Synergex™

Synergex™ T amine additive combined with MDEA

Economical emulsification and biostability in metalworking fluids

The combination of Synergex™ T and Amietol M12 (methyldiethanolamine or MDEA) allows for the economical and convenient formulation of formaldehyde-free and boron-free metalworking fluids.

Synergex T is:

- A low-VOC (< 25% volatile by ASTM E1868) amine additive for metalworking fluids
- A tertiary amine
- A pure amine (98%+)

MDEA is an ideal low-odor, low-VOC, value-priced alkanolamine that can be used to bring the pH of the operating fluid up to 9. Use MDEA instead of MEA, DEA, and TEA to improve performance at a reasonable cost.

Concentrates formulated with 5% Synergex T and either 10% phenoxyethanol or 10% phenoxypropanol-type biocontrol agent are recommended.

Observations

- When used with biocides, the combination of Synergex T and MDEA offers excellent biostability.
- Fluids containing Synergex T, MDEA, and appropriate levels of fungicide do not exhibit fungal growth.
- Synergex T can be used as part of a biostable, low-VOC metalworking fluid.
- Fluids based on the Synergex *N*-alkyl alkanolamines do not stain aluminum (Al 2024 pieces dipped in the fluids shown, MDEA for reference).

Conclusion

- Synergex T combined with MDEA can provide excellent fluids.

The following concentrate formula represents a good starting point for fully synthetic fluids based on Synergex T combined with MDEA.

Synergex T	5%
Amietol M12 (MDEA) from Eastman	10% + additional amount needed to reach desired pH in operating fluid
Isononanoic acid	8%
Polymeric ester	20%
Phenoxyethanol	Up to 10%
Water	≈ 50%

The biocontrol system can be changed from phenoxyethanol to 50 ppm BIT (diluted fluid); use water to adjust volumes. The phenoxyethanol biocontrol system can be swapped out for BIT (50 ppm effective concentration operating fluid; adjust concentrate volume with water). This concentrate can be diluted 20/1 to provide the operating fluid. The addition of preferred corrosion-inhibiting additive(s) and/or packages is recommended.

Note that tertiary diethanolamines like Synergex T are known to provide exceptional biostabilizing synergy in fully synthetic metalworking fluids (see Golec, K.; Hill, E.C.; Kazemi, P.; Skold, R. O.; *Tribology International* 1989, 22(6), 375–382.)

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Eastman Corporate Headquarters
P.O. Box 431
Kingsport, TN 37662-5280 U.S.A.

U.S.A. and Canada, 800-EASTMAN (800-327-8626)
Other Locations, +(1) 423-229-2000

www.eastman.com/locations

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