



Designation: E 1497 – 00

An American National Standard

Standard Practice for Safe Use of Water-Miscible Metal Removal Fluids¹

This standard is issued under the fixed designation E 1497; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice sets forth guidelines for the safe use of metal removal fluids, additives, and antimicrobials. This includes product selection, storage, dispensing, and maintenance.

1.2 Water-miscible metal removal fluids are typically used at high dilution and dilution rates vary widely. Additionally, there is potential for exposure to undiluted metal removal fluid as manufactured, as well as metal removal fluid additives and antimicrobials.

1.3 Straight oils generally consist of a severely solvent-refined or hydro-treated petroleum oil, a synthetic oil, or other oils of animal or vegetable origin. Straight oils are not intended to be diluted with water prior to use. Additives are often included in straight oil formulations.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

- D 3946 Test Method for Evaluating the Bacterial Resistance of Water-Dilutable Metalworking Fluids²
- E 686 Test Method for Evaluation of Antimicrobial Agents in Aqueous Metalworking Fluids³
- E 1302 Guide for Acute Animal Toxicity Testing of Water-Miscible Metalworking Fluids⁴
- E 1542 Terminology Relating to Occupational Health and Safety⁴
- E 1972 Practice for Minimizing Effects of Aerosols in the Wet Metal Removal Environment⁴
- PS 42 Provisional Test Method for Metal Removal Fluid Aerosol in Workplace Atmospheres⁵
- PS 94 Provisional Practice for Personal Sampling and

Analysis of Endotoxin in Metal Removal Fluid Aerosols in Workplace Atmospheres⁴

2.2 OSHA Standards (Occupational Safety and Health Administration):⁶

- 29 CFR 1910.1200 Hazard Communication
- 29 CFR 1910.133 Eye and Face Protection
- 29 CFR 1910.134 Respiratory Protection
- 29 CFR 1910.1048 Formaldehyde
- 29 CFR 1910 Appendix B to Subpart 1. Non-mandatory Compliance Guidelines for Hazard Assessment and Personal Protective Equipment Selection

3. Terminology

3.1 For definitions and terms relating to this practice, refer to Terminology E 1542.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *contaminant, n*—substances contained in in-use metal removal fluids that are not part of the as-received fluid, such as abrasive particles, tramp oils, cleaners, dirt, metal fines and shavings, dissolved metal and hard water salts, bacteria, fungi, micro biological decay products, and waste.

3.2.2 *control, v*—to prevent, eliminate or reduce hazards related to use of metal removal fluids in metal removal processes and to provide appropriate supplemental and/or interim protection, as necessary, to employees.

3.2.3 *dermatitis, n*—an inflammatory response of the skin

3.2.3.1 *Discussion*—Dermatitis can result from a wide variety of sources and processes. The most common origins are irritant or allergic responses to a chemical or physical agent. Signs and symptoms that typify the initial onset of dermatitis include: erythema (redness); edema (swelling; pruritis (itching); and, vesiculation (pimple-like eruptions). In more severe cases, fissures (deep cracks) and ulcers (open sores) may develop. The condition is usually reversible when exposure to the causative agent ceases. More severe cases may require more time and some medical attention. Some individuals may be at higher risk.

3.2.4 *emergency, n*—any occurrence, such as but not limited to equipment failure, rupture of containers, or failure of control equipment that results in an uncontrolled release of a significant amount of metal removal fluid.

¹ This test method is under the jurisdiction of ASTM Committee E-34 on Occupational Health and Safety and is the direct responsibility of Subcommittee E34.50 on Health and Safety Standards for Metalworking Fluids.

Current edition approved Feb. 10, 2000. Published April 2000. Originally published as E 1497 – 92. Last previous edition E 1497 – 94.

² Annual Book of ASTM Standards, Vol 05.02.

³ Annual Book of ASTM Standards, Vol 11.05.

⁴ Annual Book of ASTM Standards, Vol 11.03.

⁵ Discontinued, see 1998 Annual Book of ASTM Standards, Vol 11.03.

⁶ Code of Federal Regulations available from United States Government Printing Office, Washington, DC 20402.

3.2.5 *employee exposure, n*—the exposure to metal removal fluids and contaminants which would occur without corrections for protection provided by any respirator or other personal protective equipment that is in use.

3.2.6 *endotoxins, n*—a lipopolysaccharide derived from the outer membrane of Gram-negative bacteria.

3.2.7 *folliculitis, n*—an inflammatory reaction in hair follicles

3.2.8 *metal removal fluids, n*—the subset of metalworking fluids that are used for wet machining or grinding to produce the finished part.

3.2.8.1 *Discussion*—Metal removal fluids addressed by this practice include straight or neat oils, not intended for further dilution with water, and water-miscible soluble oils, semisynthetics, and synthetics, which are intended to be diluted with water before use. Metal removal fluids become contaminated during use in the workplace with a variety of workplace substances including, but not limited to, abrasive particles, tramp oils, cleaners, dirt, metal fines and shavings, dissolved metal and hard water salts, bacteria, fungi, microbiological decay products, and waste. These contaminants can cause changes in the lubricity and cooling ability of the metal removal fluid as well as have the potential to adversely affect the health and welfare of employees in contact with the contaminated metal removal fluid.

3.2.9 *metal removal process, n*—a manufacturing process that removes metal during shaping of a part, including machining processes, such as milling, drilling, turning, broaching, and tapping, and grinding processes, as well as honing and lapping, and other similar mechanical operations in which metal is removed to produce a finished part.

3.2.10 *tramp oil, n*—oil and oil-soluble additives, sometimes insoluble, resulting from leaking hydraulic, spindle, slide way, or gear oil into the metal removal fluid. Tramp oils may contaminate the metal removal fluid with components that are emulsifiable but which were not part of the metal removal fluid as formulated.

3.2.11 *wet metal removal fluid environment, n*—the workplace environment in which wet metal removal operations occur.

4. Significance and Use

4.1 Use of this practice will improve management and control of metal removal fluids. The proper management and use will reduce dermal and other occupational hazards associated with these fluids.

5. Routes of Metal Removal Fluid Exposure and Effects of Overexposure

5.1 Routes of exposure to metal removal fluids include eye contact, inhalation, ingestion, and dermal contact. Exposure may be through contact with the fluid or by contact with airborne fluid mists, vapor or fluid residue on machinery and on parts.

5.2 Eye contact may cause mild to severe irritation.

5.2.1 Prevent eye contact. Wear eye protection appropriate for the level of splashing or spraying encountered, such as safety glasses with side shields or goggles. See 29 CFR 1910.133.

5.3 Inhalation may cause respiratory irritation.

5.3.1 Minimize exposure to mists and vapors. Threshold limit values (American Conference of Governmental Industrial Hygienists) or permissible exposure levels (OSHA) of component ingredients shall not be exceeded. Engineering controls, such as machine enclosures and exhaust ventilation are preferred.

5.3.2 Method PS 42 may be used for the determination of both particulate total matter and extractable mass metal removal fluid aerosol concentrations in a range of 0.05 to 5 mg/m³ in workplace atmospheres.

5.3.3 See Practice E 1972 for guidelines for minimizing effects of aerosols in the wet metal removal environment.

5.3.4 For additional information, see Criteria for a Recommended standard Occupational Exposure to Metal Working Fluids.⁷

5.4 Ingestion may cause gastrointestinal disturbances.

5.5 Prolonged or repeated dermal contact may cause dry and cracked skin, rash, redness, burning, or itching. Skin abrasions can intensify the effects. Some metal removal fluids and additives may also cause a sensitizing reaction.

6. Fluid Product Selection

6.1 Proper product selection is fundamentally critical to reducing or eliminating occupational dermatitis associated with exposure to metal removal fluids. The metal removal fluids should perform as intended while providing the safest working conditions. The selection of a metal removal fluid for each different operation must fit the inherent limitations of the product. Water-miscible fluids not properly selected are likely to be used at higher concentrations than other products more appropriate to the operation.

6.1.1 Consult “Management of the Metal Removal Environment”⁸ and “Metalworking Fluids Evaluation Guide”⁹ for further information on selecting the proper fluid for the application. In addition, your fluid supplier should be able to provide information on the proper selection of the appropriate fluid and recommended concentration for use.

6.2 Potential health hazards can be minimized by careful fluid selection and substitution. See Guide E 1302.

6.3 The metal removal fluid manufacturer’s material safety data sheet (MSDS) and toxicological data on metal removal fluids, ingredients, and additives shall be reviewed in order to evaluate potential hazards and establish appropriate control procedures.

6.4 Additives, including rust inhibitors, product stabilizers, antimicrobials of all types, odorants, and dyes shall be reviewed for their impact on the metal removal fluid mixture to which they are added. Additives shall only be used with the agreement of the metalworking fluid manufacturer.

6.5 As supplied, antimicrobials and other additives for tankside addition may present greater health and safety risks

⁷ Available from U.S. Dept. of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, 4676 Columbia Pkwy., Cincinnati, OH 45226.

⁸ Available from Organization Resources Counselors, Inc., 1910 Sunderland Place, NW, Washington, DC 20036.

⁹ Available from National Center for Manufacturing Sciences, 3025 Boardwalk, Ann Arbor, MI 48108.