



# Standard Practice for Prevention of Dermatitis in the Wet Metal Removal Fluid Environment<sup>1</sup>

This standard is issued under the fixed designation E2693; 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 reducing dermatitis caused by exposure to the wet metal removal environment. The scope of this practice does not include exposure to chemicals that enter the body through intact skin (cutaneous route), which has the potential to cause other toxic effects.

1.2 This practice incorporates means and mechanisms to reduce dermal exposure to the wet metal removal environment and to control factors in the wet metal removal environment that have the potential to cause dermatitis.

1.3 This practice focuses on employee exposure to the skin via contact and exposure to metal removal fluid (MRF).

1.4 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.5 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

[D1356 Terminology Relating to Sampling and Analysis of Atmospheres](#)

[D2881 Classification for Metalworking Fluids and Related Materials](#)

[E1302 Guide for Acute Animal Toxicity Testing of Water-Miscible Metalworking Fluids](#)

[E1497 Practice for Selection and Safe Use of Water-Miscible and Straight Oil Metal Removal Fluids](#)

[E1542 Terminology Relating to Occupational Health and Safety](#)

[E1972 Practice for Minimizing Effects of Aerosols in the Wet Metal Removal Environment \(Withdrawn 2017\)<sup>3</sup>](#)

[E2148 Guide for Using Documents Related to Metalworking or Metal Removal Fluid Health and Safety](#)

[E2169 Practice for Selecting Antimicrobial Pesticides for Use in Water-Miscible Metalworking Fluids](#)

[E2525 Test Method for Evaluation of the Effect of Nanoparticulate Materials on the Formation of Mouse Granulocyte-Macrophage Colonies](#)

[E2889 Practice for Control of Respiratory Hazards in the Metal Removal Fluid Environment](#)

### 2.2 OSHA Standards:<sup>4</sup>

[29 CFR 1910.132 Personal Protective Equipment: General Requirements](#)

[29 CFR 1910.133 Eye and Face Protection](#)

[29 CFR 1910.134 Respiratory Protection](#)

[29 CFR 1910.138 Hand Protection](#)

[29 CFR 1910.1048 Formaldehyde](#)

[29 CFR 1910.1200 Hazard Communication](#)

[29 CFR 1910 Appendix B to Subpart I Non-Mandatory Compliance Guidelines for Hazard Assessment and Personal Protective Equipment Selection](#)

### 2.3 Other Document:<sup>5</sup>

[ANSI B11 TR 2–1997 Mist Control Considerations for the Design, Installation and Use of Machine Tools Using Metalworking Fluids](#)

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee E34 on Occupational Health and Safety and is the direct responsibility of Subcommittee E34.50 on Health and Safety Standards for Metal Working Fluids.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

<sup>4</sup> Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, <http://www.access.gpo.gov>.

<sup>5</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

\*A Summary of Changes section appears at the end of this standard

### 3. Terminology

3.1 For definitions and terms relating to this practice, refer to Terminologies **D1356** and **E1542**.

#### 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 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. **E1497**

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 or interim protection, or both, as necessary, to employees. **E1497**

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) can develop. The condition is usually reversible when exposure to the causative agent ceases. More severe cases can require more time and some medical attention. Some individuals can be at higher risk. **E2525**

3.2.4 *dilution ventilation, n*—referring to the supply and exhaust of air with respect to an area, room, or building, the dilution of contaminated air with uncontaminated air for the purpose of controlling potential health hazards, fire and explosion conditions, odors, and nuisance-type contaminants, from *Industrial Ventilation: A Manual of Recommended Practice*.<sup>6</sup>

3.2.5 *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. **E1497**

3.2.6 *employee exposure, n*—contact with the metal removal fluid, components, and contaminants by inhalation, skin contact, eye contact, or accidental ingestion.

3.2.7 *extractable mass, n*—the material removed by liquid extraction of the sampling filter using a mixed-polarity solvent mixture as described in Test Method PS 42.

3.2.8 *folliculitis, n*—an inflammatory response to excess oil in hair follicles. **E1497**

3.2.9 *metal removal fluid (MRF), n*—any fluid in the subclass of metalworking fluids used to cut or otherwise take away material or piece of stock. **E2148**

3.2.9.1 *Discussion*—Metal removal fluids include straight or neat oils (Classification **D2881**), 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. **E2148**

3.2.10 *metal removal fluid aerosol, n*—aerosol generated by operation of the machine tool itself as well as from circulation and filtration systems associated with wet metal removal operations and can include airborne contaminants of a microbial origin. **E1972**

3.2.10.1 *Discussion*—Metal removal fluid aerosol does not include background aerosol in the workplace atmosphere, which can include suspended insoluble particulate. **E2525**

3.2.11 *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.

3.2.12 *total particulate matter, n*—the mass of material sampled through the 4-mm inlet of a standard 37-mm filter cassette when operated at 2.0 L/min, as described in Test Method PS 42.

3.2.12.1 *Discussion*—As defined in Test Method PS 42, total particulate matter is not a measure of the inhalable or thoracic particulate mass.

3.2.13 *tramp oil, n*—oil and oil-soluble additives, sometimes insoluble, resulting from leaking hydraulic or gear oil, or sacrificial spindle oil or slide way lubricant, that contaminate the metal removal fluid. **E1497**

3.2.13.1 *Discussion*—Tramp oils can contaminate the metal removal fluid with components that are emulsifiable but which were not part of the metal removal fluid as formulated. **E2525**

3.2.14 *wet metal removal fluid environment, n*—the work-place environment in which wet metalworking operations occur. **E1497**

### 4. Routes of Metal Removal Fluid Exposure and Effects of Overexposure

4.1 Routes of exposure to metal removal fluids include inhalation, ingestion, eye contact, and dermal contact. This practice focuses on exposure through dermal contact with the fluid, contact with residual fluid on machinery, parts, or clothing, and in some cases contact with fluid mists, splashes, or aerosols. Refer to Practice **E2889** for information about the health risks related to inhalation exposure and guidance on how to reduce these risks.

4.2 Prolonged or repeated dermal contact can cause dry and cracked skin, rash, redness, burning, or itching. Skin abrasions can intensify the effects. Some metal removal fluids and additives can sensitize the skin of affected employees, which can result in a response to very low levels of exposure. This practice defines dermatitis as an inflammatory response to the skin. Dermatitis can result from a wide variety of sources and

<sup>6</sup> Available from American Conference of Governmental Industrial Hygienists, Inc. (ACGIH), 1330 Kemper Meadow Dr., Cincinnati, OH 45240, <http://www.acgih.org>.

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) can develop. The condition is usually reversible when exposure to the causative agent ceases. More severe cases can require more time and some medical attention.

4.3 Aerosols, mist, and vapors can contact and expose the skin as well as contaminate clothing.

## 5. Significance and Use

5.1 Use of this practice is intended to reduce occupational dermatitis caused by exposure to the wet metal removal environment.

5.2 Complaints of dermatitis conditions are often associated with exposures to metal removal fluid.

5.3 Implementation of this practice and incorporation of metal removal fluid management program has the potential to reduce complaints of occupational dermatitis. Elements of an effective program include: understanding dermatitis and associated causes; prevention of dermatitis and exposure to metal removal fluids; appropriate product selection; good management of additives, microorganisms, and fluids; appropriate additive (including antimicrobial pesticides) selection and additive control; appropriate tool design and assessment; and control of metal removal fluid exposures, including aerosols.

## 6. Dermatitis and Associated Causes

6.1 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) can develop. The condition is usually reversible when exposure to the causative agent ceases. More severe cases can require more time and some medical attention.

6.2 Some examples of occupational dermatitis include:

- 6.2.1 Irritant contact dermatitis (from irritant chemicals or physical irritants),
- 6.2.2 Allergic contact dermatitis,
- 6.2.3 Folliculitis (oil acne),
- 6.2.4 Dyshyrotic eczema,
- 6.2.5 Keratoses,
- 6.2.6 Eczema,
- 6.2.7 Skin warts,
- 6.2.8 Pigment disorders,
- 6.2.9 Granuloma,
- 6.2.10 Erythematous papules,
- 6.2.11 Papulovesicles,
- 6.2.12 Chronic lichenified,
- 6.2.13 Fissured palmar eczema,
- 6.2.14 Discoid eczema,
- 6.2.15 Psoriasis,

- 6.2.16 Skin infections,
- 6.2.17 Skin burns,
- 6.2.18 Skin microtrauma and mechanical injury, and
- 6.2.19 Itchy nummular dermatitis.

6.3 Dermatitis resulting from exposure to metal removal fluids is usually either irritant contact dermatitis or allergic contact dermatitis.

6.4 Irritant contact dermatitis can be caused by two mechanisms, chemical and physical abrasion. Examples of a chemical mechanism include metal removal fluid concentrates, higher than recommended in-use metal removal fluid concentrations, high alkalinity, and solvents. Examples of physical abrasion include exposure to physical irritants such as metal shavings, turnings, or fines contained in the fluid from a malfunctioning filter; fines in dirty shop rags; and hand washing with abrasive soaps.

6.5 Allergic contact dermatitis can be caused by exposure of sensitive individuals to certain metal contaminants (for example, chromium, cobalt, or nickel) dissolved or suspended in the metal removal fluid, or to certain ingredients, including some antimicrobials or odorants. Some workers are sensitized to contaminants.

6.6 Microorganisms can grow in all metal removal fluids, often producing an unpleasant odor. Unless open cuts, wounds, or severe dermatitis are already present, microorganisms which commonly grow in water-miscible metal removal fluids are not frank pathogens and are not normally associated with onset of dermatitis.

6.7 The greater the concentration or duration of exposure to an irritant, the greater the possibility for skin irritation to develop or for skin sensitization to develop in sensitive individuals.

6.8 Consider activities outside work, such as gardening, painting, or car repair, which can contribute to dermatitis, when investigating potential dermatitis causes.

6.9 Any material or activity that abrades the skin or removes natural oils from skin can cause dermatitis or predispose skin to its onset. Environmental factors such as dry air, extreme cold, and changing humidity, or idiopathic factors, such as normal aging, can also predispose the skin to dermatitis.

6.10 Folliculitis (oil acne) can be caused by use of straight oils without proper skin protection.

6.11 Finding the cause of a worker's case of dermatitis can be a long, laborious process. Detecting an occupational dermal causative agent requires cooperation from the patient, the metal removal fluid manufacturer, workplace management, and specialized medical expertise.

6.12 Poor personal hygiene both on and off the job can influence development of dermatitis.

6.13 Dermatitis causation varies with worker population demographics. The frequency of exposure, the concentration of exposure, a person's predisposition to specific dermatitis, etc. with metal removal fluids all influence the outcome if dermatitis will develop. Occupational dermatitis exposure focuses on the hands, especially on the dorsal part of the hands as well as