SEMI S17-0701
SAFETY GUIDELINE FOR UNMANNED TRANSPORT VEHICLE (UTV) SYSTEMS

This safety guideline was technically approved by the Global Environmental Health and Safety Committee and is the direct responsibility of the Japanese Environmental Health and Safety Committee. Current edition approved by the Japanese Regional Standards Committee on February 1, 2001. Initially available at www.semi.org April 2001; to be published July 2001.

NOTICE: Paragraphs entitled "NOTE:" are not an official part of this document and are not intended to modify or supersede the official guideline.

1 Purpose

1.1 These guidelines are intended as a set of environmental, safety, and health considerations for unmanned transport vehicle (UTV) systems. UTV systems are used to automate the movement of material within semiconductor factories. Unmanned transport vehicle systems include both floor-traveling vehicle systems and space-traveling vehicle systems.

2 Scope

2.1 This guideline applies to UTV systems used in semiconductor manufacturing.

2.2 This guideline addresses both floor-traveling and space-traveling UTV systems. Floor-traveling vehicle systems include automatic guided vehicle (AGV) systems and rail guided vehicle (RGV) systems. Space-traveling vehicle systems include interbay overhead transport vehicle systems and intrabay overhead hoist transport vehicle (OHT) systems.

2.3 Evaluations for conformance to this document should include all equipment that is provided by the UTV system supplier including separate items such as rails, control panels, power panels, and any other type of equipment necessary for operation of the unmanned transport vehicles.

2.4 This safety guideline does not purport to address all of the safety issues associated with its use. It is the responsibility of the users of this guideline to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2.5 This document contains the following sections:

- Purpose
- Scope
- Limitations
- Referenced Standards
- Terminology
- Equipment Evaluation
- Clearances and Interfaces
- Emergency Shutdown
- Manual Operation
- Vehicle Travel
- Material Protection
- Load/Unload Operation
- Hazard Indicators
- Hazardous Materials
- Related Documents

3 Limitations

3.1 This safety guideline may have only limited application to vehicles without on-board power (direct or induced) such as primary-grounded linear–motor-driven overhead transport vehicle systems used for interbay transport. Determinations of applicability should be made by section when evaluating such systems.

3.2 This safety guideline does not address rail-guided or robotic mechanisms included as part of semiconductor processing equipment. This type of equipment should be evaluated as part of the processing equipment per SEMI S2.

3.3 Person Guided Vehicles (PGVs) are not unmanned vehicles, therefore PGVs are not addressed by this standard.

3.4 This document does not supersede international, national or local codes, regulations and laws, which may impose separate requirements for assessing the safety of installations.

NOTE 1: Users should provide information to UTV suppliers about regulations for the location of use.

4 Referenced Standards

NOTE 2: Unless otherwise indicated, all documents cited shall be the latest published versions.

4.1 *SEMI Standards*

SEMI E15.1 — Specification for 300 mm Tool Load Port

SEMI E23 — Specification for Cassette Transfer Parallel I/O Interface

SEMI E84 — Specification for Enhanced Carrier Handoff Parallel I/O Interface

SEMI S2 — Environmental, Health, and Safety Guideline for Semiconductor Manufacturing Equipment

SEMI S8 — Safety Guidelines for Ergonomics Engineering of Semiconductor Manufacturing Equipment

4.2 *ANSI Standard*[1]

ANSI/RIA R15.06 — Industrial Robots and Robot Systems - Safety Requirements

4.3 *CENELEC Standards*[1]

EN775 — Manipulating Industrial Robots – Safety

4.4 *ISO Standards*[2]

ISO 10218 — Manipulating Industrial Robots – Safety

5 Terminology

5.1 *automated operation* — system operation under full pre-programmed control of the computer controller.

5.2 *automatic guided vehicle (AGV)* — a floor based vehicle, with or without robotic manipulators, used for transporting loads and operating without the need for assistance by factory personnel. AGVs travel without mechanical guidance.

5.3 *bumper* — a shock absorber for a UTV. A bumper is typically equipped with a contact switch or sensor on it. And if the bumper switch or sensor is activated, the UTV will stop immediately.

5.4 *EMO* — an actuator (e.g., button) which, when activated, places the equipment into a safe shutdown condition, without generating any additional hazard to personnel or the facility.

5.5 *E-Stop* — emergency stop feature provided to stop all moving parts but not necessarily isolating or controlling all energy sources.

5.6 *end user customer* — as related to UTVs, the company operating the factory in which the UTVs are installed.

5.7 *fault-tolerant* — designed so that a reasonably foreseeable single point failure does not result in an unsafe condition.

5.8 *floor-traveling vehicle* — a vehicle that automatically travels on the factory floor to a specified station where a load/unload operation is performed automatically or manually. Floor-traveling vehicles include automatic guided vehicles (AGV) and rail guided vehicles (RGV).

5.9 *hoist* — the assembly on a space-traveling vehicle that performs the load/unload operation by transferring a load [e.g., carrier(s), pod(s)] to and from an overhead vehicle.

5.10 *interbay transport* — movement of loads [e.g., carrier(s), cassette(s), reticle(s)] between functional work areas or bays.

5.11 *intrabay transport* — movement of loads [e.g., carrier(s), cassette(s), reticle pod(s)] within a functional work area or bay.

5.12 *load* — load is the object to be transported by UTV. Load includes a carrier (cassette, box, pod, etc.) and its contents.

5.13 *load/unload operation* — the action necessary to move a load [e.g., carrier(s), cassette(s) reticle pod(s)] to and from a vehicle. This operation may involve hoisting, manual, or robotic manipulation to transfer loads between a vehicle and semiconductor manufacturing equipment (such as process equipment or stockers). See Figure 1.

5.14 *manual operation* — defined as any control outside of automated operation.

5.15 *overhead hoist transport (OHT)* — a rail guided vehicle and hoist used to transport material above the factory floor over the heads of factory personnel.

5.16 *rail guided vehicle (RGV)* — a floor-based vehicle, with or without robotic manipulators, used to transport loads and operating on a guide rail without the need for assistance by factory personnel.

5.17 *space-traveling vehicle* — a vehicle that automatically travels through space, such as in the region just below a factory ceiling, to a specified station where a load/unload operation is performed automatically or manually. Space-traveling vehicles include interbay overhead transport vehicles and intrabay overhead hoist transport vehicles (OHT).

1 American National Standards Institute, 11 West 42nd St., 13th Floor, New York, NY 10036

2 International Organization for Standardization (ISO), 1 rue de Varembe, Case postale 56, CH-1211 Geneve 20, Switzerland

5.18 *station* — the destination point where an unmanned transport vehicle is programmed to stop for load/unload operation (also known as a control point).

5.19 *travel* — the automated motion of a vehicle along a rail or programmed path from one station to another station. Travel does not include load/unload operation. See Figure 1.

5.20 *unmanned transport vehicle (UTV)* — a vehicle used to automate the movement of production material within semiconductor factories. There are two types of UTVs, floor-traveling vehicles and space-traveling vehicles.

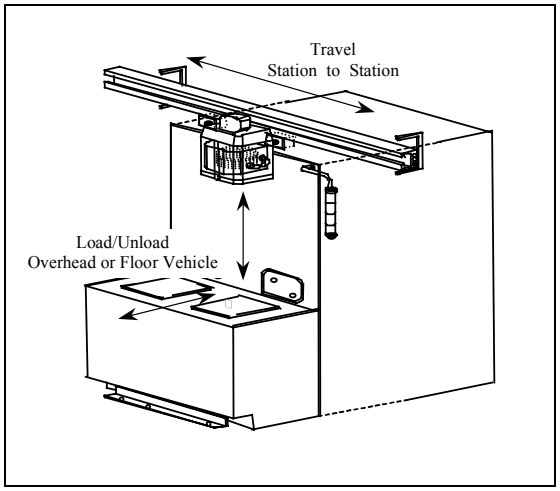

Figure 1
Delineation of Travel vs. Load/Unload

6 Equipment Evaluation

6.1 *Equipment Evaluation for both Floor-Traveling and Space-Traveling Vehicles* — All UTV equipment should be evaluated against the following referenced provisions.

6.2 All UTV equipment should be evaluated against appropriate sections of SEMI S2 for environmental, safety, and health considerations.

6.2.1 Evaluations to the provisions in the following sections of SEMI S2 are applicable to declare conformance to this document.

a) Electrical Design

b) Emergency Shutdown

c) Automated material handlers (This Automated material handlers section only applies to the robotics portion of UTV equipment, when provided.)

d) Hazard Warning Labels

e) Seismic Protection

f) Documents provided to User

6.2.2 At the discretion of the evaluator, additional provisions in SEMI S2 may be considered for evaluation based on the functionality of the UTV equipment.

6.3 All UTV equipment should be evaluated against SEMI S8 for ergonomic considerations.

6.4 All UTV equipment should be evaluated against the applicable Electro Magnetic Compatibility (EMC) regulations of the proposed installation site.

6.5 In addition to the provisions referenced in Section 6.1, UTV equipment should also be evaluated to the provisions contained in the following sections of this document.

7 Clearances and Interfaces

7.1 *Body Shape of both Floor-Traveling and Space-Traveling Vehicles* — The body of a UTV should be free of any dangerous parts such as sharp edges and protrusions. The UTV body surface should have a smooth finish.

7.2 *Minimum Clearance for Floor-Traveling Vehicles* — Where passageways are used for emergency egress, they should be provided on at least one side of the UTV. International, national or local codes, regulations, and laws should be used to determine passageway width.

7.3 *Minimum Clearance for Space-Traveling Vehicles* — The lowest part of the space-traveling vehicle, including the load, should maintain a minimum clearance of 2135 mm (7 feet) above the walking floor.

NOTE 3: Some end user customers may request a higher minimum clearance, or a minimum clearance between the space-traveling vehicle and the top of other equipment, to accommodate clearances specified by SEMI E15.1.

7.4 *Interfaces with Building Structures for both Floor-Traveling and Space-Traveling Vehicles* — UTV suppliers should provide for optional vehicle interfaces with building structures like doors, elevators, and walls.

7.4.1 If UTVs are required to operate in conjunction with building structures, such as automatic doors or elevators, UTVs should be capable of communicating with the facility to assure safe door opening/closing.

7.4.2 If it is necessary for a UTV to travel through a building firewall, the firewall pass through should be specified and/or designed to maintain the fire rating of the wall in the event of a fire.