to provide electrical continuity of the raceway system and for grounding of non–current-carrying metal parts.

511.9 Sealing. Seals complying with the requirements of 501.15 and 501.15(B)(2) shall be provided and shall apply to horizontal as well as vertical boundaries of the defined Class I locations.

Note that the general rules of 501.15(A)(4) and (B)(2) on providing seals at hazardous location boundaries apply where raceway installations in a commercial garage pass from classified to unclassified locations. In accordance with 501.15(A)(4), Exception No. 2, where a raceway runs from a Class I, Division 1 location into an underground unclassified location and then emerges from below ground into an unclassified location, the boundary seal is permitted to be located more than 10 feet from the actual boundary, provided the seal is the first fitting(s) at the point the conduit emerges from below ground into the unclassified location.

Exhibit 511.2 depicts two receptacle outlet enclosures that are located at least 12 inches above an area that has been classified as Class I. The rigid metal conduit passes unbroken from the outlet boxes through the Class I location into the unclassified underground location beneath the floor. The conduit coupling is located 12 inches or more from the penetration into the hazardous location. No seals are required for this installation in accordance with 501.15(A)(4), Exception No. 1.

511.10 Special Equipment.

(A) Battery Charging Equipment. Battery chargers and their control equipment, and batteries being charged, shall not be located within locations classified in 511.3.

(B) Electric Vehicle Charging Equipment.

(1) General. All electrical equipment and wiring shall be installed in accordance with Part III of Article 625, except as required by 511.10(B)(2) and (B)(3). Flexible cords shall be of a type identified for extra-hard usage.

(2) Connector Location. No connector shall be located within a Class I location as defined in 511.3.

(3) Plug Connections to Vehicles. Where the cord is suspended from overhead, it shall be arranged so that the lowest point of sag is at least 150 mm (6 in.) above the floor. Where an automatic arrangement is provided to pull both cord and plug beyond the range of physical damage, no additional connector shall be required in the cable or at the outlet.

511.12 Ground-Fault Circuit-Interrupter Protection for Personnel. Ground-fault circuit-interrupter protection for personnel shall be provided as required in 210.8(B).

511.16 Grounding and Bonding Requirements.

(A) General Grounding Requirements. All metal raceways, the metal armor or metallic sheath on cables, and all non–current-carrying metal parts of fixed or portable electrical equipment, regardless of voltage, shall be grounded.

(B) Supplying Circuits with Grounded and Grounding Conductors in Class I Locations. Grounding in Class I locations shall comply with 501.30.

Δ **(1) Circuits Supplying Portable Equipment or Pendants.** Where a circuit supplies portables or pendants and includes a grounded conductor in accordance with 200.3, receptacles, attachment plugs, connectors, and similar devices shall be of the grounding type and the grounded conductor of the flexible cord shall be connected to the screw shell of any lampholder or to the grounded terminal of any utilization equipment supplied.

(2) Approved Means. Approved means shall be provided for maintaining continuity of the equipment grounding conductor between the fixed wiring system and the non–current-carrying metal portions of pendant luminaires, portable luminaires, and portable utilization equipment.

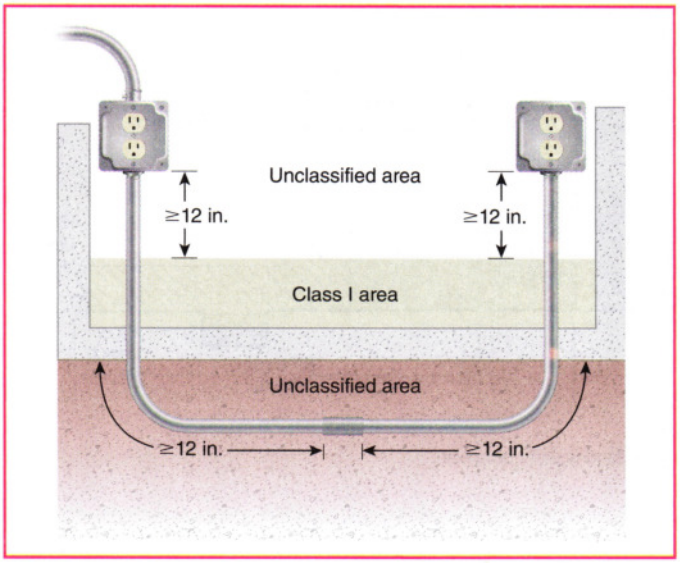


EXHIBIT 511.2 Seals not required for conduits that pass unbroken through the Class I location.

N ARTICLE 512

Cannabis Oil Equipment and Cannabis Oil Systems Using Flammable Materials

N Part I. General

N **512.1 Scope.** This article covers cannabis oil preparatory equipment, extraction equipment, booths, post-processing equipment, and systems using flammable materials (flammable gas, flammable liquid–produced vapor, combustible liquid–produced vapor) in commercial and industrial facilities.

Informational Note No. 1: See ANSI/UL 1389, *Plant Oil Extraction Equipment for Installation and Use in Ordinary*

(Unclassified) Locations and Hazardous (Classified) Locations, for information on cannabis oil equipment and systems for hazardous (classified) locations.

Informational Note No. 2: See NFPA 1, *Fire Code*; NFPA 55, *Compressed Gases and Cryogenic Fluids Code*; NFPA 58, *Liquefied Petroleum Gas Code*; and ICC IFC, *International Fire Code*, together with the manufacturer's installation instructions, for information on the installation of cannabis oil equipment and systems.

The extraction of cannabis oil can pose many safety issues, including the risk of fire and explosion. In many cases, the extraction process itself creates a hazardous (classified) location due to the use of flammable solvents such as butane, pentane, hexane, propane, and ethanol, which can be released during the processing and extraction of plant oils. Article 512 has been added to the *NEC*® to assist in the safe installation of equipment and systems utilized for cannabis oil extraction within commercial and industrial facilities.

N 512.2 Other Articles. In addition to the requirements of this article, cannabis oil equipment and cannabis oil systems using flammable materials shall comply with Table 512.2, as applicable, except as modified by this article.

N ***TABLE 512.2*** *Other Articles*

Requirement	Division Classified Locations	Zone Classified Locations
Area classification	500.5, 500.6	505.5, 505.6, 505.7
Equipment	Part III of 501, 500.7, 500.8, 501.5	505.8, 505.9, 505.20, 505.22
Wiring	Part II of 501	505.15, 505.16, 505.17, 505.18, 505.19, 505.26, 505.30

N 512.3 Classified Locations. Cannabis oil equipment and systems that can release flammable materials during operation shall be classified in accordance with 512.3(A) and (B).

Informational Note No. 1: Some cannabis oil applications can result in the release of heavier-than-air flammable gases or vapors into the surrounding atmosphere as a normal part of the overall extraction process (e.g., during disconnecting or opening of vessels containing flammable solvents, or during off-gassing of spent material or extracted plant oil). Cannabis oil equipment and systems can also include the connection of external containers, or other external sources, of flammable solvent.

Informational Note No. 2: See NFPA 30, *Flammable and Combustible Liquids Code*; NFPA 33, *Standard for Spray Application Using Flammable or Combustible Materials*; and NFPA 497, *Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas*, for information on area classification.

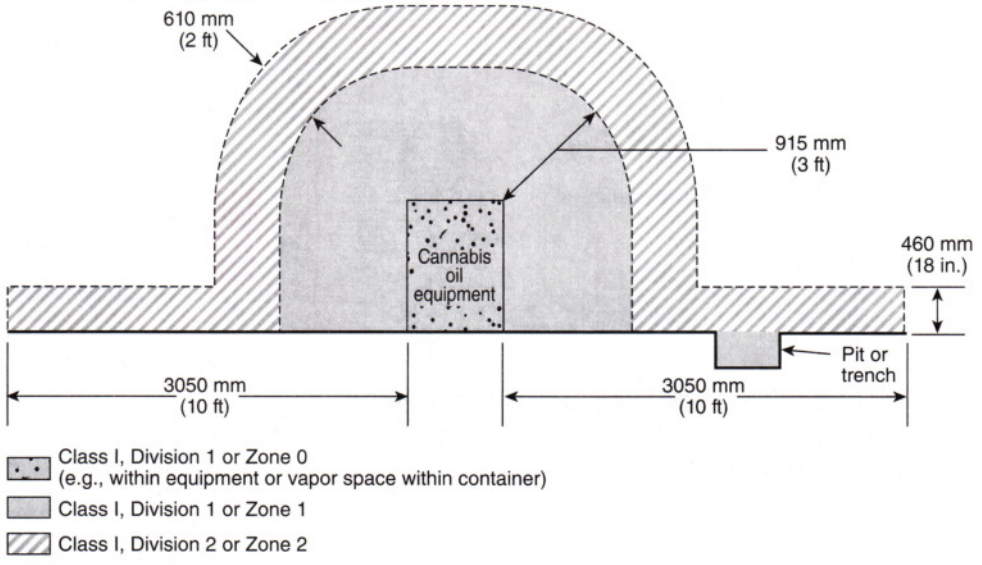
Informational Note No. 3: See NFPA 36, *Standard for Solvent Extraction Plants*, for information on area classification in commercial-scale extraction processes.

N (A) Cannabis Oil Equipment and Systems Other Than Booths.

N (1) Where Flammable Gases or Vapors Are Released. For sources of gases or vapors from a flammable material, the location shall be classified in accordance with the following and as shown in Figure 512.3(A)(1):

(1) The space within 915 mm (3 ft) in all directions from any such equipment or container and extending to the floor or grade level shall be classified as Class I, Division 1 or Zone 1, whichever is applicable.

(2) The space extending 610 mm (2 ft) beyond the Class I, Division 1 or Zone 1 location shall be classified as Class I, Division 2 or Zone 2, whichever is applicable.



N ***FIGURE 512.3(A)(1)*** *Area Classification for Equipment and Systems Other than Booths, Where Flammable Gases or Vapors Are Released.*

(3) The space extending 1525 mm (5 ft) horizontally beyond the space described in 512.3(A)(1)(2) up to a height of 460 mm (18 in.) above the floor or grade level shall be classified as Class I, Division 2 or Zone 2, whichever is applicable.
(4) The space inside of a tank or container and the inside of equipment that contains a flammable material shall be classified as Class I, Division 1 or Zone 0, whichever is applicable.
(5) Sumps, pits, or belowgrade channels within 3.05 m (10 ft) horizontally of a vapor source shall be classified as Class I, Division 1 or Zone 1. If the sump, pit, or channel extends beyond 3.05 m (10 ft) horizontally from the vapor source, it shall be provided with a vapor stop or classified as Class I, Division 1 or Zone 1 for its entire length.

N **(2) Where Flammable Gases or Vapors Are Not Released, Except During Disconnection or Opening.** Where listed equipment is marked to indicate that the level of release during disconnection or opening is maintained below 25 percent LFL without ventilation, flammable solvents shall not be released during the extraction process except during disconnecting or opening of vessels containing flammable solvents, or during off-gassing of spent material or extracted plant oil.

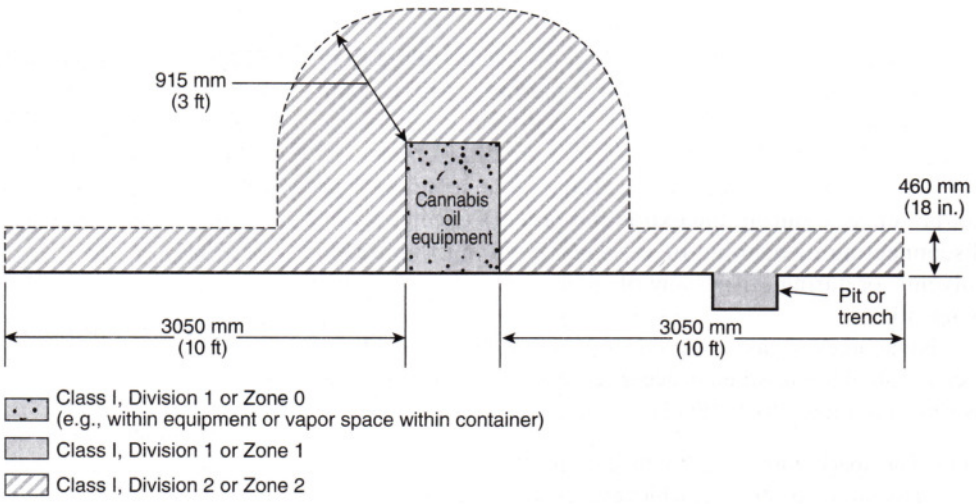
For sources of gas or vapor from a flammable material, the location shall be classified in accordance with the following and as shown in Figure 512.3(A)(2):

(1) The space within 915 mm (3 ft) in all directions from any such equipment or container and extending to the floor or grade level shall be classified as Class I, Division 2 or Zone 2, whichever is applicable.
(2) The space extending beyond the Division 2 or Zone 2 area shall be unclassified.
(3) The space inside of a tank or container and the inside of equipment that contains a flammable material shall be classified as Class I, Division 1 or Zone 0, whichever is applicable.
(4) The space extending 2134 mm (7 ft) horizontally beyond the space described in 512.3(A)(2)(1) up to a height of 460 mm (18 in.) above the floor or grade level shall be classified as Class I, Division 2 or Zone 2, whichever is applicable.
(5) Sumps, pits, or belowgrade channels within 3.05 m (10 ft) horizontally of a vapor source shall be classified as Class I, Division 1 or Zone 1. If the sump, pit, or channel extends beyond 3.05 m (10 ft) horizontally from the vapor source, it shall be provided with a vapor stop or it shall be classified as Class I, Division 1 or Zone 1 for its entire length.

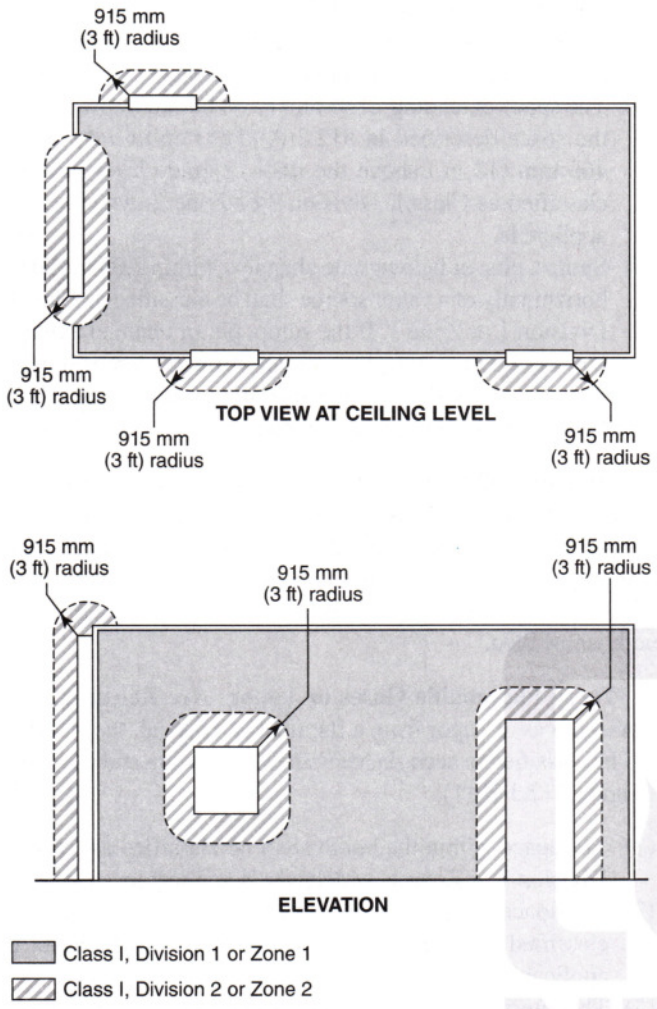
N **(B) Cannabis Oil Booths.** Air exhausted from the booths shall not be recirculated or exhausted from the booths into the room in which the booths are installed. Ventilation other than exhaust ventilation can be provided to the booth, but cannot be recirculated or exhausted from the booth into the room in which the booth is installed.

N **(1) Where Flammable Gases or Vapors Are Released.** For sources of gas or vapor from a flammable material, the location shall be classified in accordance with the following and as shown in Figure 512.3(B)(1):

(1) The space within the booth shall be classified as Class I, Division 1 or Zone 1, whichever is applicable.
(2) The space within 915 mm (3 ft) of any opening shall be classified as Class I, Division 2 or Zone 2, whichever is applicable.
(3) The interior of fresh air supply ducts and fresh air supply plenums shall be unclassified.



N ***FIGURE 512.3(A)(2)*** *Area Classification for Equipment and Systems Other than Booths, Where Flammable Gases or Vapors Are Not Released Except During Disconnection or Opening.*

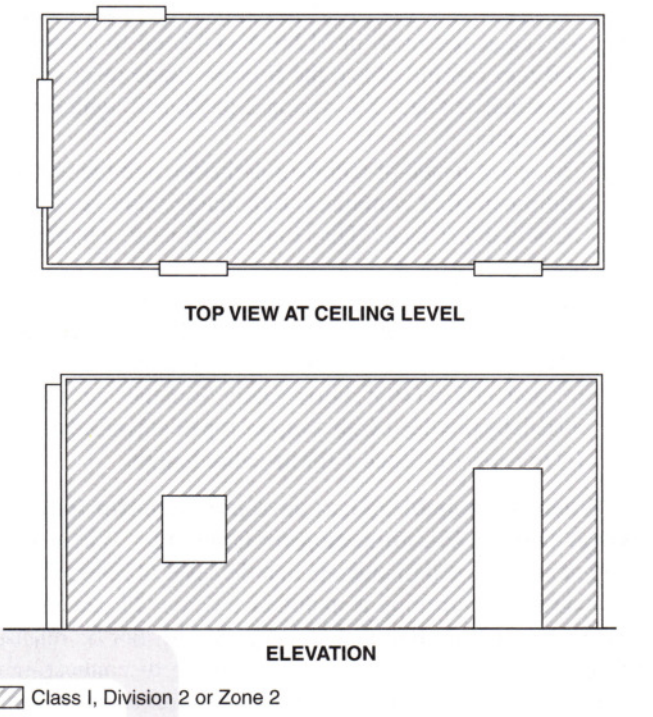


N *FIGURE 512.3(B)(1) Area Classification for Booths Where Flammable Gases or Vapors Are Released.*

N **(2) Where Flammable Gases or Vapors Are Not Released, Except During Disconnection or Opening.** Where listed equipment is marked to indicate that the level of release during disconnection or opening is maintained below 25 percent LFL without ventilation, flammable solvents shall not be released during the extraction process except during disconnecting or opening of vessels containing flammable solvents, or during off-gassing of spent material or extracted plant oil.

For sources of gas or vapor from a flammable material, the location shall be classified in accordance with the following and as shown in Figure 512.3(B)(2):

(1) The space within the booth shall be classified as Class I, Division 2 or Zone 2, whichever is applicable.
(2) The space outside any opening shall be unclassified.
(3) The interior of fresh air supply ducts and fresh air supply plenums shall be unclassified.



N *FIGURE 512.3(B)(2) Area Classification for Booths Where Flammable Gases or Vapors Are Not Released Except During Disconnection or Opening.*

N Part II. Wiring

N **512.10 Wiring Installation and Operation.** All wiring installed or operated within any of the hazardous (classified) locations defined in 512.3 shall comply with the requirements of Part II of Article 501 or 505.15, as applicable, for the division or zone location in which it is installed.

N **512.13 Wiring Installed Above Hazardous (Classified) Locations.** Other than above cannabis oil booths, all fixed wiring installed at an elevation above hazardous (classified) locations *[see Figure 512.3(A)(1) and Figure 512.3(A)(2)]* shall be in metal raceways, PVC conduit, RTRC conduit, or ENT conduit. Where used, cables shall be Type MI, Type TC, or Type MC.

N Part III. Equipment

N **512.20 Equipment and Systems.** Installation of cannabis oil equipment and systems shall be in a distinct room or area located at commercial or industrial facilities. Where all electrical equipment within cannabis oil booths is listed for Class I, Division 1 or Zone 1 locations, gas detection shall not be required to be provided within the booth. Where gas detection in accordance with 500.7(K) is provided within booths listed

for Class I, Division 2 or Zone 2 locations, electrical equipment shall be permitted.

N **(A) Cannabis Oil Preparatory Equipment.** Equipment that is used to prepare the plant material for subsequent extraction of the plant oil (e.g., trimming, deseeding, drying/curing) shall be listed for the location.

N **(B) Cannabis Oil Extraction Equipment.** Equipment that uses flammable materials (solvents) in the process of extracting the plant oil from the plant material shall be listed for the location.

Informational Note: Extraction equipment can use flammable materials as solvents to extract the plant oil from the plant material by saturating the plant material in a vented container, sealed container, or pressure vessel. Typical flammable materials used in the extraction process include butane, ethanol, hexane, pentane, propane, and LPG.

N **(C) Cannabis Oil Booths.** Enclosed areas used to house cannabis oil equipment and systems shall be listed for the location.

Informational Note: Cannabis oil booths can be designed to house a single piece or multiple pieces of cannabis oil equipment. Booths range in size and can be large enough to permit entrance of personnel to perform the processing tasks.

N **(D) Cannabis Oil Post-Processing Equipment.** Equipment that is used in the final processing stages of the extracted plant oil (e.g., vacuum ovens, rotary evaporators, solvent recovery pumps) shall be listed for the location.

N **(E) Cannabis Oil Systems.** Any combination of cannabis oil equipment needed for the overall extraction process (e.g., cannabis oil preparatory equipment, cannabis oil extraction equipment, cannabis oil booths, cannabis oil post-processing equipment) shall be listed for the location.

Informational Note: See NFPA 70B, *Recommended Practice for Electrical Equipment Maintenance*, for information related to general electrical equipment maintenance and developing an effective electrical preventive maintenance (EPM) program.

N **512.22 Equipment Installed in Hazardous (Classified) Locations.** All equipment installed or operated within any of the classified locations defined in 512.3 shall comply with the requirements of Part III of Article 501 or 505.9, as applicable, for the division or zone area in which they are used.

N **512.30 Equipment Installed Above Hazardous (Classified) Locations.** Equipment that could produce arcs, sparks, or hot metal particles, such as lamps and lampholders for fixed lighting, cutouts, switches, receptacles, motors, or other equipment having make-and-break or sliding contacts, where installed above a classified location other than cannabis oil booths, shall be of the totally enclosed type or be constructed to prevent the escape of sparks or hot metal particles.

N **512.32 Marking.** Cannabis oil preparatory equipment, extraction equipment, booths, and post-processing equipment shall be listed and marked to show the hazardous (classified) location for which it is permitted to be installed.

N **(A) Division Equipment.** Equipment for Class I, Division 1 or Class I, Division 2 shall be marked in accordance with 500.8(C).

N **(B) Zone Equipment.** Equipment for Zone 1 or Zone 2 shall be marked in accordance with 500.8(C)(2).

ARTICLE
513 Aircraft Hangars

Δ **513.1 Scope.** This article shall apply to buildings or structures in any part of which aircraft containing Class I (flammable) liquids or Class II (combustible) liquids whose temperatures are above their flash points are housed or stored and in which aircraft might undergo service, repairs, or alterations. It shall not apply to locations used exclusively for aircraft that have never contained fuel or unfueled aircraft.

Informational Note No. 1: See NFPA 409, *Standard on Aircraft Hangars*, for definitions of *aircraft hangar* and *unfueled aircraft*.

Informational Note No. 2: See NFPA 30, *Flammable and Combustible Liquids Code*, for information on fuel classification.

Article 513 does not apply to areas in which the only fuel contained in the aircraft is a Class II combustible liquid, unless the fuel will be used or stored above its flash point within the hangar. A Class II liquid has a closed-cup flash point at or above 100°F. Some aviation fuel, such as Jet-A, is a Class II combustible liquid. An aircraft manufacturing plant in which the aircraft under construction have never contained fuel is an example of a facility not covered by the requirements of Article 513.

Many steps are required to properly classify a hazardous location. Although the *NEC*® provides general area classifications in Articles 501, 502, 503, 505, and 506, it does not classify specific locations. The *NEC* classifications for specific occupancies or processes have been extracted from other NFPA documents. The classifications from those documents are based on the premise that all applicable requirements of the document have been met. Deviations in on-site conditions, such as process conditions, area ventilation, and room construction, from those assumed by the document may alter the general classification. Those responsible for the specific area classification must consider the basis for the general classifications to determine the applicability to a specific location.

N **513.2 Other Articles.** In addition to the requirements of this article, aircraft hangars shall comply with Table 513.2, as applicable, except as modified by this article.

513.3 Classification of Locations. Where the term "Class I" is used with respect to Zone classifications within this article of the Code, it shall apply to Zone 0, Zone 1, and Zone 2 designations.