# UL 209

## STANDARD FOR SAFETY

Cellular Metal Floor Raceways and Fittings

UL Standard for Safety for Cellular Metal Floor Raceways and Fittings, UL 209

Tenth Edition, Dated December 20, 2011

***Summary of Topics***

***This revision of ANSI/UL 209 dated April 18, 2024 is being issued to update the title page to reflect the most recent designation as a Reaffirmed American National Standard (ANS). No technical changes have been made.***

Text that has been changed in any manner or impacted by ULSE's electronic publishing system is marked with a vertical line in the margin.

The requirements are substantially in accordance with Proposal(s) on this subject dated March 1, 2024.

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# UL 209

## Standard for Cellular Metal Floor Raceways and Fittings

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The Department of Defense (DoD) has adopted UL 209 on May 18, 1987. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

Comments or proposals for revisions on any part of the Standard may be submitted to ULSE at any time. Proposals should be submitted via a Proposal Request in ULSE's Collaborative Standards Development System (CSDS) at https://csds.ul.com.

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## INTRODUCTION

### 1 Scope

1.1 These requirements cover cellular metal floor raceway systems intended to be installed as an integral part of the building structure and constructed for the installation of wires and cables in accordance with the National Electrical Code (NEC), NFPA 70.

1.2 These requirements do not cover rigid or flexible conduit, surface metal raceways and fittings, underfloor raceways and fittings, or other products of a similar nature.

1.3 These requirements do not cover the structural aspects or properties of cellular metal floor units – their load-carrying and fire-resistant capabilities or their physical dimensions with relation to mechanical strength.

1.4 Cellular metal floor raceways consist of the hollow spaces in cellular metal floors and associated fittings that serve as enclosures for wires and cables. A duct or cell is a single enclosed tubular space in a cellular floor unit with a longitudinal axis parallel to the longitudinal axis of the floor units. Header duct is an enclosed transverse wire raceway that, by providing access to predetermined cells of a cellular metal floor, facilitates the installation of wiring from a distribution center to the cells. Cellular metal floor raceway is always installed with concrete poured over the raceway and may be installed on top of a concrete slab.

Trench header is a transverse wire raceway that provides access to all cells of the cellular floor units it crosses. Trench header allows lay-in wiring along its length by providing removable cover plates at its top surface. Trench header may be the bottomless type allowing direct access for wiring into cells with factory punched holes or it may incorporate a bottom pan requiring field cut entry holes into cells.

### 2 General

#### 2.1 Undated references

2.1.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

#### 2.2 Units of measurement

2.2.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

2.2.2 Unless otherwise indicated, all voltage and current values mentioned in this standard are root-mean-square (rms).

## CONSTRUCTION

### 3 General

3.1 A cellular metal floor raceway system shall include the:

a) Cellular floor units with the closures necessary to keep foreign material out of the cells,

b) Header ducts or trench headers and accessories,

c) Conduit-to-cell fittings, pull boxes and fittings for the introduction of wires into the cells, and

d) All outlet fittings and devices installed at the point of power delivery.

The system shall afford a complete enclosure for the conductors, and there shall be provision for the complete mechanical and electrical separation of different wiring systems. Parts shall be constructed to achieve complete mechanical and electrical continuity of the entire system.

3.2 To determine whether a cellular metal floor raceways system complies with the requirements in this standard, a comprehensive study is to be made of an actual installation of the system or of a completely representative sample installation.

3.3 The materials used in cellular metal floor raceways and fittings shall be compatible with all other materials in the raceways and fittings system.

3.4 A component of a cellular metal floor raceways system shall comply with the requirements for the construction, performance, and use of that component.

3.5 Cellular floor units shall be made of sheet steel and shall have a uniform wall thickness at all points. Both inside and outside surfaces of each unit shall be cleaned of all scale and rust. The cleaning process shall leave the surface of the unit in a condition that results in the protective coating adhering firmly and having a smooth surface.

3.6 Ordinarily, scale is identified as a sharply defined edge or a rough surface extending for some distance along the unit or sheet, causing a slight but noticeable decrease in the internal dimensions. At the ends of the unit or any portion of the sheet, scale shall be identified by scraping the surface of the unit or sheet and thus removing the hard brittle film of the scale.

3.7 All header duct, trench header, duct, or cell fittings, and outlet (service) fittings shall be for use with the floor units of cellular metal floor raceways so that the complete assembly complies with the requirement in 3.1.

3.8 Duct or cell fittings (accessories or duct- or cell-system components) are fittings used in the duct or cell systems between a lighting or power panel and the individual cells of the floor units. These fittings include hand-hole and tee boxes, wall or vertical elbows, duct or cell couplings, end closures, and cell-to-conduit elbows and connectors.

3.9 Outlet (service) fittings are fittings used above the outlet openings in the individual cells, in connection with either present or afterset inserts. These fittings include floor-outlet inserts, receptacle outlets, receptacle covers, bushed outlets, afterset inserts, insert extensions, flanges, floor markers, insert caps, and insert-marker caps.

3.10 The construction of header duct or trench header, and all fittings shall exclude the entrance of concrete mix wherever joints are made in the actual installation (either between sections of duct or cell, between duct or cell and cellular floor units, or between duct or cell and boxes or other fittings).

3.11 All interior surfaces of header duct or trench header and fittings shall be smooth and without any burrs, fins, or other projections that can damage wires.

## 4 Grounding and Bonding

4.1 A path for electric current shall be provided between all parts of a system of metallic duct, cell or raceway and fittings while installed in the intended manner.

4.2 The connection of a metallic duct, cell or raceway with a fitting shall be tested in accordance with the Grounding and Bonding Test, Section 13.

4.3 A sheet metal screw shall not be used for the connection of an equipment grounding conductor.

## 5 Protective Coating

5.1 Both the interior and exterior surfaces of a cellular floor unit and all broad surfaces of the accessories mentioned in 6.7 shall be protected against corrosion by a coating of zinc and tested to the requirements in Protective Coating – Zinc, Section 14. The lower element of a floor unit may be protected against corrosion on both the interior and exterior by an enamel coating complying with the requirements in 15.1 – 15.3 if it is:

a) Integral with a structural member that protects it from below against physical damage during installation and

b) Constructed of sheet steel not less than 0.067 inch (1.7 mm) thick.

5.2 Both the inside and outside surfaces of header duct or trench headers shall be protected against corrosion. If zinc is used, the coating shall comply with the requirements in Protective Coating – Zinc, Section 14. If a metal other than zinc or if a nonmetallic material is used, the corrosion protection afforded by the coating shall not be less than that of the specified zinc coating. If enamel is used, the coating, at any time up to one year from the time of manufacture, shall comply with the requirements in Protective Coating – Enamel, Section 15.

## 6 Cellular Metal Floor Raceways

6.1 A cellular floor unit shall be made of sheet steel.

6.2 No element shall be thinner than 0.034 inch (0.86 mm) when measured after fabrication but, if the upper element is thinner than 0.056 inch (1.42 mm), the following restrictions apply to the unit:

a) If the upper element is thinner than 0.056 inch (1.42 mm), the installation instructions mentioned in 19.1 shall specify that the upper element is to be protected by at least 1 inch (25 mm) of concrete;

b) If the upper element is thinner than 0.045 inch (1.14 mm), it shall be strengthened so that a representative sample of the complete unit complies with the Load Test, Section 10. The cell width and cross-sectional area need not be specified;

c) If the upper element is thinner than 0.045 inch (1.14 mm) and is not strengthened so that a representative sample of the complete unit complies with the Load Test, Section 10, no cell shall be wider than 4 inches (102 mm) or larger in cross-sectional area than 10 inches$^2$ (64.5 cm$^2$).

6.3 The thicknesses of 0.034 – 0.056 inch (0.86 – 1.42 mm) that are mentioned in 6.2 are the minimum values for cellular floor units as raceways for electrical wiring. Units employing heavier steel are needed and are regularly furnished where greater mechanical strength is essential for structural purposes. These units shall be subjected to the Load Test, Section 10.

6.4 The upper and lower elements of the cellular floor units shall be fastened by spot welds or other fastenings of sufficient quantity to give the finished unit strength for the conditions of use. Spot welds shall comply with the Tension/Shear Test, Section 11 and Peel Test, Section 12.

6.5 The following shall be constructed of zinc-coated sheet steel of the same thickness as the upper element of the unit (see 6.2 and 6.3 for the specific thickness):

a) A cover plate for an end joint between units where the upper element is intentionally set back from the lower element,

b) An end closure for any type of unit, and

c) Flashing for any type of unit.

6.6 A cover plate for an end joint between units where the upper element is intentionally set back from the lower element shall be at least 3 inches (76 mm) wide plus the additional width necessary to make the cover plate overlap the upper element of each of the units on which it rests – at least 1 inch (25 mm).

6.7 The width of the top of each cell of a floor unit shall provide space for:

a) Inserts to which at least 3/4-inch (19-mm) standpipes can be fastened and

b) Access from header duct or trench header to the cell.

6.8 The length of a cellular floor unit is not specified, but all of the units intended for a particular installation in which they are to be assembled side by side shall be within 1/8 inch (3 mm) of being equal in length. See 6.10 (a).

6.9 Each end of a raceway of other than the type covered in 6.11 shall be at right angles to the longitudinal axis of the unit with a tolerance of 1/8 inch (3 mm) for each 2 feet (610 mm) of width, but for the overlapping type of unit, the tolerance is 1/2 inch (13 mm).

6.10 Other than under the conditions covered in 6.11, the following requirements apply to cellular floor units that are intended to be joined end to end so that the top element of adjacent units abut one another and the bottom elements do likewise:

a) The top and bottom elements in each unit shall be within 1/8 inch (3 mm) of being equal in length (see 6.8),

b) The ends of the top and bottom elements in each unit shall be at right angles to the longitudinal axis of the unit with a tolerance of 1/8 inch for each 2 feet (610 mm) of width, and

c) The top and bottom elements in each unit shall be centered laterally and longitudinally on one another.

6.11 The three requirements in 6.10 do not apply if steel cover plates are provided in a thickness complying with the first sentence in 6.5 and of a width – at least 3 inches (76 mm) – to overlap the ends of each cellular floor unit at least 1 inch (25 mm).

6.12 A cellular floor unit shall provide a smooth wireway for the pulling in of wires and cables and shall not have any burrs, fins, and other projections that can damage wires.

6.13 The partitions between cells of cellular floor units shall not have any openings through which wires or cables are likely to be passed from one cell to another in normal use. Cellular floor units constructed with internal partitions to create and separate individual cells must be provided with a method of cell separation at all joints to prevent wire crossover and insulation damage.

6.14 Cellular floor units shall be measured and visually inspected to determine compliance with the requirements in 6.1 – 6.12. No tolerances are acceptable below the minimum required values of thickness indicated in 6.2 and 6.3.

## 7 Header Duct or Trench Header

7.1 Header duct or trench header shall be sheet steel as specified in 7.2 – 7.5. The dimensions of the duct are not specified except that an individual section shall not be longer than 12 feet (366 cm), and the upper corners of a duct or cell intended to be covered with concrete (any duct or cell other than the flush type) shall be rounded to a radius of at least 3/16 inch (5 mm) measured outside. Each end of a section of duct or cell shall be at right angles (square) to the axis of the duct. A tolerance of 1/16 inch (1.5 mm) shall apply both to the width and the depth of a section of duct or cell.

7.2 Header shall be made of steel not less than 0.067 inch (1.70 mm) thick – 0.070 inch (1.78 mm) if made of galvanized sheet steel, except that:

a) The lower element of duct or cell of the channel type may be made of steel not less than 0.053 inch (1.35 mm) thick – 0.056 inch (1.42 mm) if made of galvanized sheet steel, and

b) A cover plate for a header duct or trench header may be made of a metal that is other than steel, is not less than 0.250 inch (6.35 mm) thick, and provides mechanical strength and rigidity.

All seams shall be made in a manner that provides mechanical strength in each length of duct or cell.

7.3 Header duct or trench header shall be so designed that when installed it is in close contact with the cellular floor units. The attachment means for header duct, trench header, duct or cell to floor units shall consist of a mechanically secure connection with permanent electrical bonding.

7.4 Each length of duct or cell shall be provided with junction units spaced on multiple centers so that, in conjunction with other headers, separation of the wires of different systems can be readily accomplished. Provision shall be made for bushing each opening from a junction unit to a cell in a floor unit.

7.5 Each junction unit shall be provided with a removable cover plate or similar mechanism that shall comply with the requirement in 8.6.

7.6 Header duct or trench header may have provision for junction units to be put into service after the floor has been completed if all such openings in the duct or cell are factory made and furnished with removable closures.

7.7 Header duct or trench header shall be measured and visually inspected to determine compliance with the requirements in 7.1 – 7.6. No tolerance is to be applied below the minimum thicknesses specified in 7.2.

7.8 The partitions between cells of a multicellular metallic duct cellular floor unit shall not have any openings through which wires or cables are likely to be passed from one cell to another in normal use.

7.9 Covers for header ducts or trench headers intended to be installed with their upper surfaces flush with finished concrete shall be tested to determine that they provide mechanical strength and rigidity for their intended use. These covers shall be subjected to the Rigidity of Cover Test, Section 16.

## 8 Duct or Cell Fittings

8.1 A duct or cell fitting (see 3.8) shall not be less than 0.125 inch (3.18 mm) thick at any point if constructed of cast metal, except that die-cast metal (not acceptable for corrosive applications) and malleable iron may be less than 0.125 inch (3.18 mm) thick but shall not be less than 0.094 inch (2.39 mm) thick. Cast metal at a threaded hole for conduit shall not be less than 0.250 inch (6.35 mm) thick. A sheet-steel fitting shall not be less than 0.053 inch (1.35 mm) thick – 0.056 inch (1.42 mm) if made of galvanized sheet steel.

8.2 A box for use with header duct or cell shall be provided with openings in the side for the permanent connection of duct or cell. Such an opening shall be provided with a smooth, well-rounded flange or stop on the inside of the box to facilitate entrance of the duct or cell for a distance of not less than 1/2 inch (13 mm). In the case of a sheet-metal box, a special duct-connecting or cell-connecting fitting may be used if it is acceptable for the particular application. The connection means for duct or cell to a box shall be mechanically secure and provide a permanent electrical bond.

8.3 Setscrews are acceptable as the means for bonding metal duct or cell to a junction box. If the acceptability of the connection cannot be determined by visual inspection, the bonding in question is to be investigated with particular reference to the reliability and resistance of joints. See Grounding and Bonding, Section 4.

8.4 An opening for conduit in a box that is made from sheet metal shall be in the form of a knockout. An opening for conduit in a box that is cast metal shall be provided with:

a) An end stop for the conduit,

b) A smooth and well-rounded bushing for the protection of entering wires,

c) No fewer than five full threads to engage the corresponding size of rigid metal conduit, except that the opening may be unthreaded if:

1) A special box that is acceptable for the purpose is used or

2) The corresponding size of conduit fits closely in the hole (see 8.13).

8.5 There shall be provision for closing each unused duct, cell, conduit, outlet, and other opening in a duct or cell fitting. A duct or cell fitting and its accessory parts shall be designed and constructed so that closures fit tightly, and joints are closed to exclude fresh concrete from entering the fitting. All metal parts (other than duct or cell or conduit closures) shall be electrically bonded. The thickness of a sheet-steel closure for an unused conduit, outlet, or duct opening shall not be less than indicated in Table 8.1.

**Table 8.1**
**Minimum thickness of a sheet-metal closure**

| Use of closure | Measurement made on closure after its fabrication from zinc-coated[a] sheet steel but before any coating in addition to the zinc is applied, | | Measurement made on closure after its fabrication from uncoated sheet steel but before addition of corrosion protection, | |
|---|---|---|---|---|
| | inch | (mm) | inch | (mm) |
| For an unused opening not larger than 3-1/2 inches$^2$ (22.6 cm$^2$) | 0.017 | 0.43 | 0.014 | 0.36 |
| For an unused opening larger than 3-1/2 inches$^2$ (22.6 cm$^2$) | 0.029 | 0.74 | 0.026 | 0.66 |

[a] Zinc applied by any method – for example, galvanizing, electroplating, cementation.

8.6 A box shall be provided with a hand hole or holes to give free access to the interior of the box. A cover plate shall be provided for each hand hole, constructed of metal, and capable of withstanding the Rigidity of Cover Test, Section 16.

8.7 A box shall be provided with leveling and height adjustments so that the cover can be flush with the surface of the floor.

8.8 A coupling for use with header duct or cell shall have a cross-sectional area for wires not less than that of the duct or cell itself. The coupling shall have means for permanent bonding and mechanical securement to the duct. See Grounding and Bonding, Section 4.

8.9 A wall or vertical elbow shall have a cross-sectional area for wires not less than that of the duct or cell itself, and shall have a center-line radius of not less than 3-3/4 inches (95 mm).

8.10 A box connector shall have a duct or cell stop and bushing.

8.11 An opening for conduit in a conduit-extension fitting that is made from sheet metal shall be in the form of a knockout. An opening for conduit in a conduit-extension fitting that is cast metal shall be provided with:

a) An end stop for the conduit,

b) A smooth and well-rounded bushing for the protection of entering wires,

c) No fewer than five full threads to engage the corresponding size of rigid metal conduit, except that the opening may be unthreaded if:

1) A special box that is acceptable for the purpose is used or

2) The corresponding size of conduit fits closely in the hole (see 8.13).

8.12 An opening in a cast or sheet-metal conduit-extension fitting through which wires pass from the fitting to the cell or duct shall be provided with a smooth, well-rounded bushing for the protection of wires.

8.13 The connection between a cast or sheet-metal conduit-extension fitting and a length of conduit and between the fitting and the cell or duct shall be electrically bonded and mechanically secure. Means other than direct-bearing setscrews shall be provided at unthreaded openings to provide permanent bonding.

8.14 There shall be a means available for closing each end of header duct or trench header to which a duct or cell fitting is not connected. Closures and duct shall be designed and constructed so that closures fit tightly to exclude fresh concrete from entering the duct or cell. The thickness shall not be less than shown in Table 8.1.

8.15 Fittings shall be available for panel connections.

8.16 A duct or cell fitting of iron or steel shall be protected against corrosion as specified in Protective Coatings Test – Enamel, Section 15.

## 9 Outlet Fittings

9.1 An outlet fitting shall have strength and rigidity to withstand the abuses to which the fitting is subjected during use. See 9.2 and 9.3.

9.2 A metal outlet fitting is acceptable if the fitting has at least the thickness indicated in Table 9.1.

**Table 9.1**
**Minimum thickness of metal outlet fittings**

| Material/part | | Surface area | Longest dimension | Minimum thickness at any point, inches | (mm) |
|---|---|---|---|---|---|
| a) Cast brass, aluminum cast by a process other than die casting, or nonmalleable cast iron | | – | – | 0.125 | 3.18 |
| b) Wrought iron, malleable cast iron, die-cast zinc alloy, die-cast aluminum, or extruded aluminum | | Not over 24 inches$^2$ (155 cm$^2$) | Not over 6 inches (152 mm) | 0.063 | 1.60 |
| | | | Over 6 inches (152 mm) | 0.094 | 2.39 |
| | | Over 24 inches$^2$ (155 cm$^2$) but not over 144 inches$^2$ (929 cm$^2$) | Any | 0.094 | 2.39 |
| | | Over 144 inches$^2$ (929 cm$^2$) | Any | Evaluation required | |
| c) Sheet aluminum | 1) Cover plate (such as a receptacle faceplate) | Less than 14 inches$^2$ (90.3 cm$^2$) | Less than 5 inches (127 mm) | 0.040 | 1.02 |
| | | | At least 5 inches (127 mm) | 0.090 | 2.29 |
| | | At least 14 inches$^2$ (90.3 cm$^2$) | Any | 0.090 | 2.29 |
| | 2) Parts other than cover plates | – | – | 0.090 | 2.29 |
| d) Sheet steel before application of protective coating | 1) Cover plate (such as receptacle faceplate) | Less than 14 inches$^2$ (90.3 cm$^2$) | Less than 5 inches (127 mm) | 0.030 | 0.76 |
| | | | At least 5 inches (127 mm) | 0.067 | 1.70 |
| | | At least 14 inches$^2$ (90.3 cm$^2$) | Any | 0.067 | 1.70 |
| | 2) Parts other than cover plates | – | – | 0.067 | 1.70 |
| | 3) Zinc-coated sheet steel | – | – | 0.70 | 1.78 |

9.3 A polymeric housing for a receptacle outlet (including a polymeric cover affording access to live parts) that supports a power wiring device shall be subjected to the Flame Test, Section 17 and comply with the applicable requirements in the Standard for Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers, UL 514C. A grounding jumper shall also be supplied with the housing for the connection of the power wiring device to the metal raceway system enclosure.

9.4 The parts of an outlet shall be designed for installation with either a preset or afterset insert. The assembled outlet, when installed in the intended manner, shall not admit surface water to the cellular metal floor raceway.

9.5 An outlet fitting shall provide a smooth bushing for wires entering the fitting from the raceway cell. The bushing shall protect the wire insulation so that, when installed as intended, it does not contact any sharp edge or other fault that could damage the insulation.

9.6 An outlet fitting, if made of iron or steel (other than stainless steel), shall be protected against corrosion by means of a zinc coating or other metal coating as specified in 5.1.

9.7 A wiring device cover constructed to support a flush duplex receptacle shall be provided with more than one securement point for the receptacle.

## PERFORMANCE

### 10 Load Test

10.1 The upper element of cellular raceway described in 6.3 shall be considered strengthened when subjected to a load of 500 lbf (2224 N or 227 kgf) applied to the center of the cell by means of a flat solid right-circular cylinder having a diameter of 2 inches (50.8 mm). The test specimen shall be a cellular unit at least 5 feet (1.5 m long). The force is to be applied at a point not closer than 1 foot (305 mm) to then end of the test specimen.

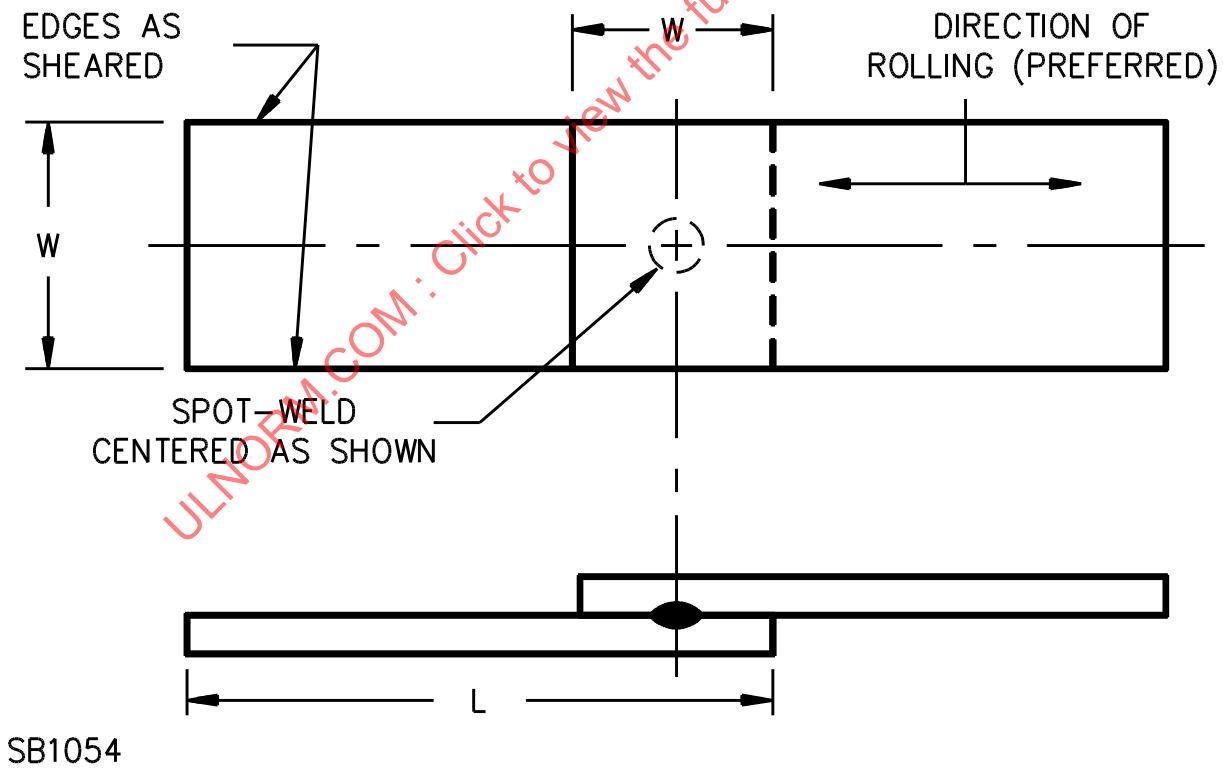
10.2 The application of the load shall not cause more than 1/8 inch (3 mm) of permanent deformation.

### 11 Tension/Shear Test

11.1 A test specimen of cellular metal floor raceway is to be subjected to this test. The test specimen is to be pulled apart on a standard testing machine, the test specimen obtained by lapping two strips of sheet steel and joining them by a single weld. The form and dimensions of the test specimen are to be as shown in Figure 11.1, where the length is 5 inches (127 mm) and width is 1.5 inches (38 mm).

**Figure 11.1**

**Tension/shear specimen**






11.2 The ultimate strength of the specimen is not to be less than 90 percent of the value indicated in Table 11.1. If the two pieces of sheet steel comprising the specimen are of different thicknesses (for example, if the specimen represents the welding of sheets of different thicknesses in the actual floor units), the thickness of the thinner sheet is to be used to determine the applicable shear-strength value.

**Table 11.1**
**Shear Strength**

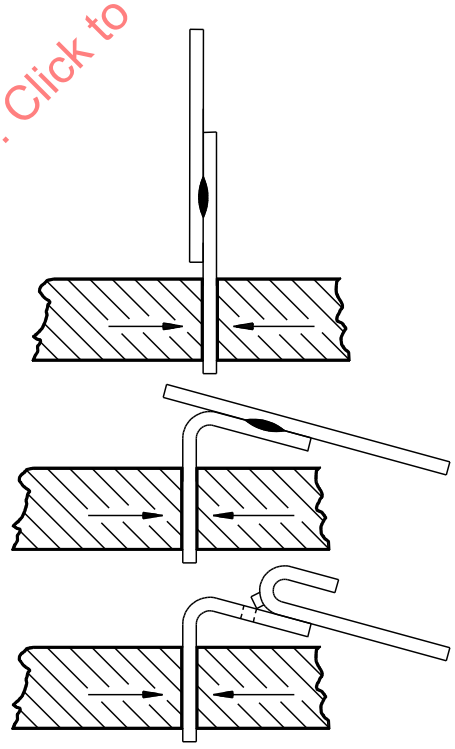
| Thickness of sheet steel, | | Minimum shear strength, | | |
|---|---|---|---|---|
| mils | (mm) | lbf | (N) | (kgf) |
| 41 – 50 | 1.04 – 1.30 | 1350 | 6005 | 612 |
| 51 – 62 | 1.31 – 1.60 | 1850 | 8229 | 839 |
| 63 – 78 | 1.61 – 2.25 | 2700 | 12010 | 1225 |
| 79 – 94 | 2.26 – 2.39 | 3450 | 15346 | 1565 |
| 95 – 109 | 2.40 – 2.77 | 4150 | 18460 | 1882 |

## 12 Peel Test

12.1 A test specimen of cellular metal floor raceway is to be subjected to this test. This test is to consist of peeling apart, to destruction, a test specimen obtained by lapping two strips of sheet steel that are 1.5 inches (38 mm) wide and approximately 4 inches (102 mm) long, and joining them by a single weld as shown in Figure 11.1.

12.2 The welded specimen is to be gripped in a vice or similar device and bent as shown in Figure 12.1. The two pieces are then to be peeled apart by means of pincers or a similar tool. Results do not comply if the weld is penetrated – if the metal of one piece is not torn out in its entirety or if the shape of the torn metal is irregular.

**Figure 12.1**
**Peel test**



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## 13 Grounding and Bonding Test

13.1 As specified in 4.1, a fitting is to be assembled to a section of metallic duct, cell or raceway in the intended manner, and a direct current of 30 A is to be passed from the duct, cell or raceway to the fitting. The resulting drop in potential is to be measured between a point (file mark) on the duct, cell or raceway 1/16 inch (1.5 mm) from the connection and a similar point on the fitting. The resistance in ohms is to be determined by dividing the drop in potential in volts by the current in amperes passing through the connection.

13.2 The resistance of the connection of a metallic duct, cell or raceway with a fitting shall not exceed 0.005 ohm.

## 14 Protective Coating Test – Zinc

14.1 A specimen of the finished cellular metal floor raceway shall not show a bright, adherent deposit of copper after two 60-second immersions in a solution of copper sulphate.

14.2 The solution of copper sulfate is to be made from distilled water and the American Chemical Society reagent grade of cupric sulfate (CuSO4). In a copper container or in a glass, polyethylene, or other chemically nonreactive container to which a bright piece of copper is added, a quantity of the cupric sulfate is to be dissolved in hot distilled water to obtain a solution that has a specific gravity slightly higher than 1.186 after the solution is cooled to a temperature of 18.3°C (65.0°F). Any free acid that might be present is to be neutralized by the addition of approximately 1 gram of cupric oxide (CuO) or 1 gram of cupric hydroxide [Cu(OH)2] per liter of solution. The solution is then to be diluted with distilled water to obtain a specific gravity of exactly 1.186 at a temperature of 18.3°C (65.0°F). The solution is then to be filtered.

14.3 Six 6-inch (150-mm) specimens are to be cut from a sample length of finished raceway or accessory. With prudent attention to health and fire risks, the specimens are to be cleaned with an organic solvent. Each specimen is to be examined for evidence of damage to the zinc coating, and only specimens that are not damaged are to be selected for use in the test.

14.4 The selected specimens are to be rinsed in water and all surfaces are to be dried with clean cheesecloth. As much of the water as possible is to be removed in the drying operation because water slows the reaction between the zinc and the solution, thereby adversely affecting the test results. The surface of the zinc is to be dry and clean before a specimen is immersed in the copper sulfate solution. The specimens are not to be touched by the hands or anything else that might contaminate or damage the surfaces.

14.5 A glass, polyethylene, or other chemically nonreactive beaker having a diameter equal to twice the diameter measured over the specimen is to be filled with the solution of copper sulfate to a depth of not less than 3 inches (76 mm). The temperature of the solution is to be maintained at 18.3 ±1.1°C (65.0 ±2.0°F). One of the selected specimens is to be immersed in the solution and supported on end in the center of the beaker so that not less than 2-1/2 inches (64 mm) of its length are immersed. The specimen is to remain in the solution for 60 seconds, during which time it is not to be removed nor is the solution to be stirred.

14.6 At the end of the 60-second period, the specimen is to be:

a) Removed from the beaker,

b) Rinsed immediately in running tap water,

c) Rubbed with clean cheesecloth until any loosely adhering deposits of copper are removed, and

d) Dried with clean cheesecloth.

Hands and other damaging and contaminating objects and substances are not to touch the surfaces that were immersed. The part of the specimen that was immersed is to be examined, considering each broad surface separately and disregarding all edges and the portions of the specimen within 1/2 inch (13 mm) of any edge cut in the process of preparing the specimen.

14.7 If the part of the specimen that was immersed has any bright deposit of firmly adhering metallic copper outside the 1/2-inch (13-mm) portions, an estimate is to be made and recorded of the percentage of each broad surface that is covered with copper.

14.8 Regardless of whether the first dip resulted in an adherent deposit of copper, the immersion, washing, rubbing, drying, examining, estimating, and recording operations are to be repeated once using the same specimen and beaker of solution. After the second dip, the solution in the beaker is to be discarded.

14.9 The remaining specimens are each to be subjected to the 2-dip procedure described in 14.6 – 14.8.

14.10 The raceway, or the accessory mentioned in 6.7, shall have no broad surface where there is any bright, adherent copper showing outside the 1/2-inch (13-mm) end portion of any specimen.

## 15 Protective Coating Test – Enamel

15.1 An enamel coating shall be of uniform quality throughout, shall have a smooth and even appearance, and shall not soften at a temperature of 49.0°C (120.2°F). The coating shall feel tough and have body but shall not feel hard and brittle.

15.2 A short piece of an enamel coating sliced from a sample of duct or cell by means of a sharp knife shall come off as a unit and show a tendency to curl as the knife edge travels along the sample.

15.3 A specimen of duct or cell is to be struck with the smooth surface of a piece of metal pipe 10 – 12 inches (250 – 300 mm) long and 1/2 inch (13 mm) in diameter. After the hard, unglancing blow, the coating is to show an unbroken surface even where the metal surface is slightly dented or flattened by the force of the blow.

## 16 Rigidity of Cover Test

16.1 A cover, as noted in 7.9, shall support a load of 300 lbf (1334 N or 136 kgf) without deflecting more than 1/8 inch (3 mm). The permanent deformation at any point on the header duct or trench header cover, exclusive of gasket depression, shall not exceed 1/32 inch (0.8 mm).

16.2 To determine the rigidity of the raceway cover, a load is to be applied by a weight that exerts 300 lbf (1334 N or 136 kgf) through the flat end of a cylinder 3 inches (76 mm) in diameter and 2 inches (51 mm) long. Before the pouring of concrete and loading, all adjusting screws are to be raised at least 1/8 inch (3 mm). The force is to be applied to the cover at any selected point that would suffer maximum deflection. During the test, two adjoining lengths of flush header duct or trench header are to be rigidly supported in concrete as they would be in the field. The concrete shall be given at least 28 days to cure.

## 17 Flame Test

17.1 The finished polymeric housing (including any polymeric cover for the polymeric housing if the cover affords access to live parts) shall not flame longer than 60 seconds following five 5-second applications of the test flame, the period between applications being 5 seconds. The housing shall not ignite combustible materials in its vicinity, and no hole(s) shall appear in the housing. The test is to be conducted as described in 17.2 – 17.9.