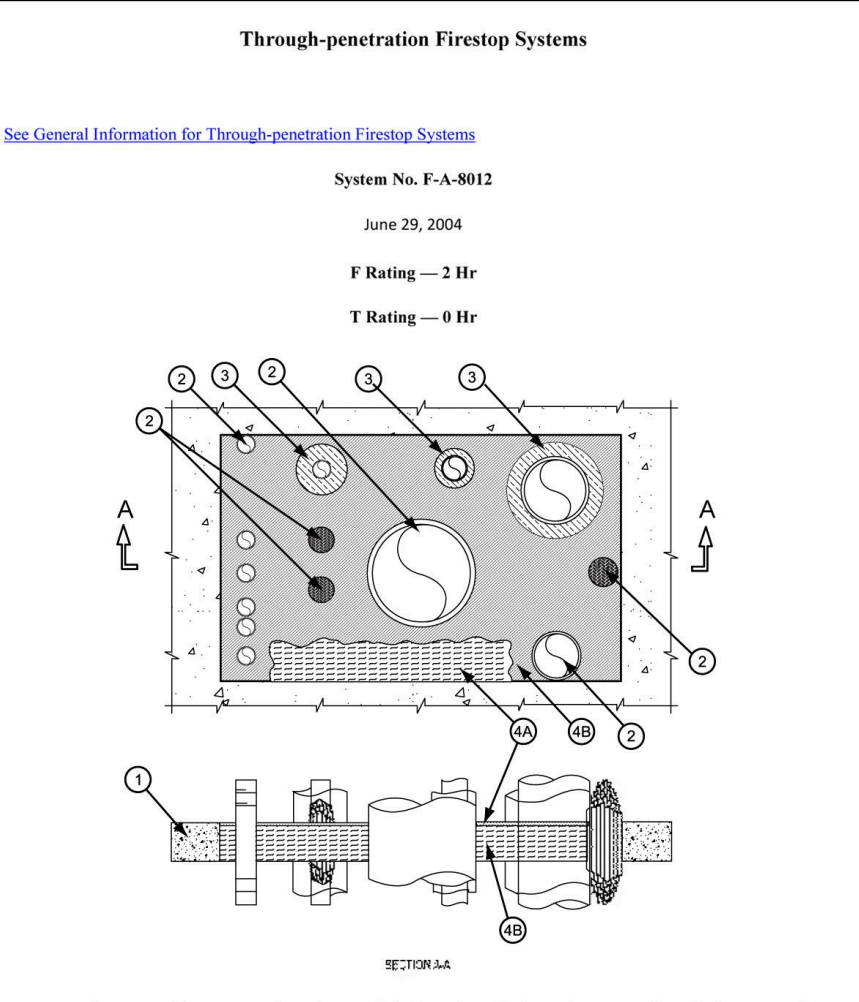


SYSTEM NO. F-A-8020



**Through-penetration Firestop Systems**  
 See General Information for Through-penetration Firestop Systems  
 System No. F-A-8020  
 June 29, 2004  
**F Rating — 2 Hr**  
**T Rating — 0 Hr**

**1. Floor Assembly** — Min 4-1/2 in. (114 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m<sup>3</sup>) concrete. Max size of opening is 1440 in.2 (9,200 cm<sup>2</sup>) with a max dimension of 48 in. (1219 mm).

**2. Through Penetrants** — One or more pipes, tubes or cable bundles to be installed within the opening. The total number of through penetrants is dependent on the size of the opening and types and sizes of the penetrants. Any combination of the penetrants described below may be used provided that the following parameters relative to the annular spaces are maintained: The annular space between cable bundles and other penetrants shall be a min 6 in. (152 mm). The annular space between metallic pipes, conduits and tubes shall be a min 2 in. (51 mm). The annular space between 2 in. (51 mm) diam (or smaller) metallic pipes, conduits and tubes shall be a min 0 in. (0 mm). The annular space between insulating penetrants and the periphery of opening shall be a min 1/2 in. (13 mm). The annular space between all other penetrants and the periphery of opening shall be a min 0 in. (0 mm) (point contact). A max annular space in the system shall be 12 in. (305 mm). Penetrants to be rigidly supported on both sides of floor assembly. The following types and sizes of penetrants may be used:

**A. Metallic Penetrants** — The following types of metallic pipes, conduits or tubes may be used:

- Copper Tubing** — Nom 6 in. (152 mm) diam (or smaller) Type 1 (or heavier) copper tube.
- Copper Pipe** — Nom 3 in. (76 mm) diam (or smaller) Regular (or heavier) copper pipe.
- Steel Pipe** — Nom 3 in. (76 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.
- Iron Pipe** — Nom 3 in. (76 mm) diam (or smaller) cast or ductile iron pipe.
- Conduit** — Nom 3 in. (76 mm) diam (or smaller) electric metallic tubing (EMT) or rigid steel conduit.
- Conduit** — Nom 4 in. (102 mm) diam (or smaller) steel electric metallic tubing (EMT) or nom 6 in. (152 mm) diam (or smaller) rigid steel conduit.

**B. Cable Bundles** — Max 4 in. (102 mm) diam tightly bundled cables. Any combination of the following types and sizes of cables may be used:

- Max 500 kcmil single copper or aluminum conductor power cable with thermoplastic insulation and polyvinyl chloride (PVC) jacket.
- Max 300 pair No. 24 AWG copper conductor telecommunication cables with PVC insulation and jacket material.
- Max 7/C copper conductor No. 12 AWG multi-conductor power and control cables with PVC or cross-linked polyethylene (XLPE) insulation and PVC jacket.
- Multiple fiber optical communication cables jacketed with PVC and having a max outside diam of 1/2 in.
- Max 3/C No. 12 AWG steel clad cable with copper conductors and PVC insulation material.

**C. Individual Cables** — Any of the following types and sizes of individual (non-bundled) cables may be used:

- Max 3/C No. 2/0 AWG (or smaller) copper conductor PVC jacketed aluminum clad or steel clad TECK 90 cable.
- Through Penetrating Product** — Any cables, Armored Cable or Metal Clad Cable currently Classified under the Through Penetrating Product category.
- See **Through Penetrating Product** (XHLTY) category in the Fire Resistance Directory for names of manufacturers.
- Max 500 kcmil single copper or aluminum conductor power cable with thermoplastic insulation and polyvinyl chloride (PVC) jacket.
- Max 300 pair No. 24 AWG copper conductor telecommunication cables with PVC insulation and jacket material.
- Max 7/C copper conductor No. 12 AWG multi-conductor power and control cables with PVC or cross-linked polyethylene (XLPE) insulation and PVC jacket.
- Multiple fiber optical communication cables jacketed with PVC and having a max outside diam of 1/2 in.
- Max 3/C No. 12 AWG steel clad cable with copper conductors and PVC insulation material.
- Max 4/C 750 kcmil (or smaller) aluminum or copper conductor metal clad cable with aluminum or steel armor, with or without PVC jacket.

**3. Pipe Insulation** — (Optional) — Pipes and tubes of the sizes noted below may be provided with one of the following types of pipe insulations:

**A. Pipe Covering** — Min 1 in. (25 mm) to max 2 in. (51 mm) thick hollow cylindrical heavy density min 3.5 pcf (56 kg/m<sup>3</sup>) glass fiber units jacketed on the outside with an all service jacket. Longitudinal joints sealed with metal fasteners or factory applied self-sealing tape. Transverse joints secured with metal fasteners or with butt tape supplied with the product.

**B. Tube Insulation-Plastics** — Min 1/2 in. (13 mm) to max 3/4 in. (19 mm) thick acryliclonitrile butadiene/polyvinyl chloride (AB/PVC) flexible foam furnished in the form of tubing.

**See **Plastics** (MHFZ) category in the Plastic Recognized Component Directory for names of manufacturers. Any Recognized Component tube insulation meeting the above specifications and having a UL 94 Flammability Classification of 94-V0 may be used.**

**C. Pipe Covering Materials** — Min 1 in. (25 mm) to max 2 in. (51 mm) thick unfaced mineral fiber pipe insulation having a nominal density of 3.5 pcf (56 kg/m<sup>3</sup>) or heavier and sized to fit the outside diam of pipe or tube. Pipe insulation secured with min 18 3/8W steel wire spaced 12 in. (305 mm) OC.

**HIG MINWOL, L. C. — High Temperature Pipe Insulation 1300, High Temperature Pipe Insulation BW-T and High Temperature Pipe Insulation Thermac.**

**CI. Sheathing Material** — (Not shown) — Optional, used in conjunction with item 3C. Foil-scrim-kraft or all service jacket material shall be wrapped around the outer circumference of the pipe covering material (item 3B) with the kraft side exposed. Longitudinal joints sealed with metal fasteners.

**See **Sheathing Materials** (BVTX) category in the Building Materials Directory for names of manufacturers. Any sheathing material meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index of 50 or less may be used.**

The annular space between the insulated penetrants and the periphery of the opening shall be min 0 in. (0 mm, point contact) to max 5 in. (127 mm). The separation between the insulated penetrants and the other penetrants shall be a min 1 in. (25 mm) to max 22 in. (560 mm). Any combination of the following types and sizes of cables may be used:

**A. Max 25 pair No. 24 AWG telephone cable with polyvinyl chloride (PVC) insulation and jacket.**

**B. Max 7/C No. 12 AWG copper conductor power and control cable with PVC or cross-linked polyethylene (XLPE) insulation and PVC jacket.**

**C. Multiple fiber optical communication cable jacketed with PVC and having a max outside diam of 1/2 in. (13 mm).**

**D. Max 3/C No. 8 AWG with bare aluminum ground, PVC insulated steel Metal Clad Cable currently Classified under the Through Penetrating Product (DHYV) category.**

**E. Max 3/C (with ground) No. 12 AWG (or smaller) nonmetallic sheathed (Romex) cable with PVC insulation and jacket material.**

**F. RG/U coaxial cable with polyethylene (PE) insulation and polyvinyl chloride (PVC) jacket having a max outside diam of 1/2 in. (13 mm).**

**4. Firestop System** — The firestop system shall consist of the following:

**A. Packing Material** — Min 4 in. (102 mm) thickness of 4 pcf (64 kg/m<sup>3</sup>) mineral wool batt insulation lightly packed into the opening as a permanent form. Packing material to be recessed from top surface of floor to accommodate the required thickness of fill material.

**B. Fill, Void or Cavity Material — Sealant** — Min 1/2 in. (13 mm) thickness of fill material applied within the annular flush with the top surface of wall.

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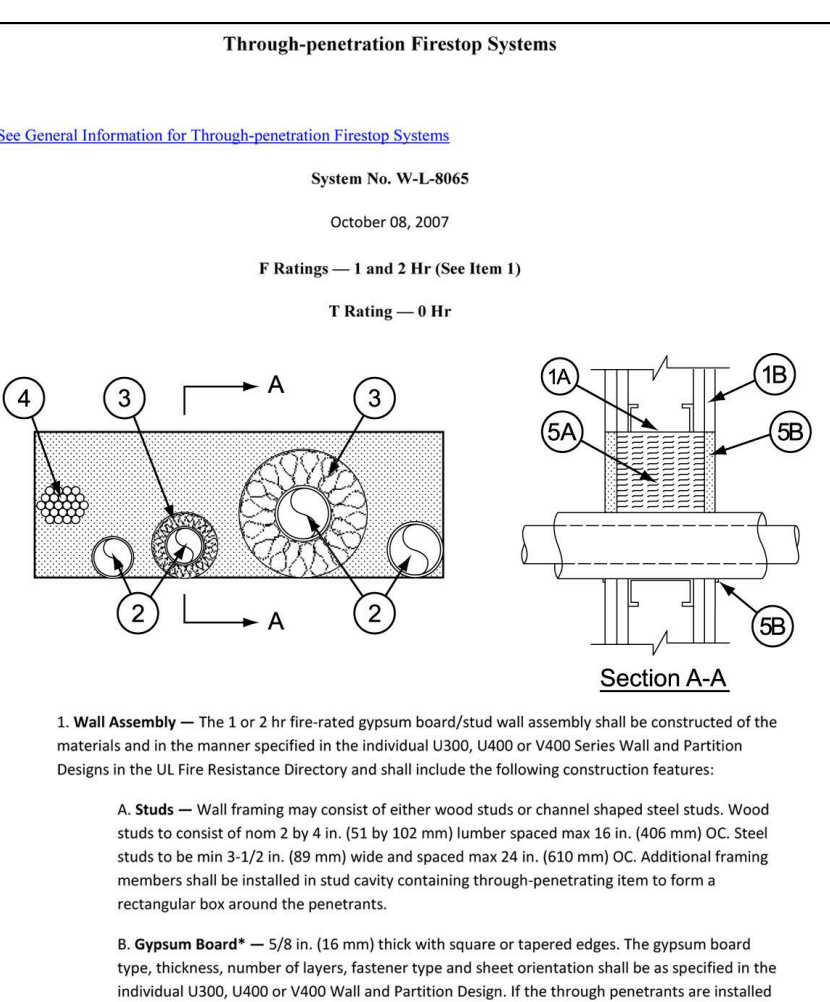
\*Bearing the UL Classification Mark

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#Bearing the UL Recognized Component Mark

Last Updated on 2004-06-29

SYSTEM NO. W-L-8065



**Through-penetration Firestop Systems**  
 See General Information for Through-penetration Firestop Systems  
 System No. W-L-8065  
 October 08, 2007  
**F Ratings — 1 and 2 Hr (See Item 1)**  
**T Rating — 0 Hr**

**1. Wall Assembly** — The 1 or 2 hr fire-rated gypsum board/steel wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400 or V400 Series Wall and Partition Design in the UL Fire Resistance Directory and shall incorporate the following construction features:

**A. Studs** — Wall framing may consist of either wood studs or channel shaped steel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced max 16 in. (406 mm) OC. Steel studs to be min 3-1/2 in. (89 mm) wide and spaced max 24 in. (610 mm) OC. Additional framing members shall be installed in stud cavity containing through penetrating item to form a rectangular box around the penetrants.

**B. Gypsum Board** — 5/8 in. (16 mm) thick with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U300, U400 or V400 Wall and Partition Design. If the through penetrants are installed in a steel stud/gypsum board assembly, the max area of opening is 136 in.2 (883 cm<sup>2</sup>) with max dimension of 14-1/2 in. (368 mm). If the through penetrants are installed in a steel stud/gypsum board assembly, max area of opening is 182 in.2 (1174 cm<sup>2</sup>) with max dimension of 22-3/4 in. (578 mm) wide.

**The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.**

**2. Through Penetrant** — One or more pipes, conduits or tubes to be installed within the opening. The total number of through penetrants is dependent on the size of the opening and the types and sizes of the penetrants. Any combination of the penetrants described below may be used provided that the following parameters relative to the annular spaces and the spacing between the through penetrants are maintained: The separation between the penetrants shall be min 1 in. (25 mm) to max 22 in. (560 mm). The annular space between all other penetrants and the periphery of opening shall be a min 0 in. (0 mm) (point contact). A max annular space in the system shall be 12 in. (305 mm). Penetrants to be rigidly supported on both sides of floor assembly. The following types and sizes of pipes, conduits or tubes may be used:

**A. Copper Tubing** — Nom 3 in. (76 mm) diam (or smaller) Type 1 (or heavier) copper tube.

**B. Copper Pipe** — Nom 3 in. (76 mm) diam (or smaller) Regular (or heavier) copper pipe.

**C. Steel Pipe** — Nom 3 in. (76 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.

**D. Iron Pipe** — Nom 3 in. (76 mm) diam (or smaller) cast or ductile iron pipe.

**E. Conduit** — Nom 3 in. (76 mm) diam (or smaller) electric metallic tubing (EMT) or rigid steel conduit.

**F. Polyvinyl Chloride (PVC) Pipe** — Nom 2 in. (51 mm) diam (or smaller) Schedule 40 cellular or solid core PVC pipe for use in closed (process or supply) or vented (drain, waste, or vent) piping systems.

**G. Chlorinated Polyvinyl Chloride (CPVC) Pipe** — Nom 2 in. (51 mm) diam (or smaller) SDR 33.5 CPVC pipe for use in closed (process or supply) piping systems.

**H. Rigid Nonmetallic Conduit (RNC)** — Nom 2 in. (51 mm) diam (or smaller) Schedule 40 PVC conduit installed in accordance with Articles 367 and 730 of the National Electrical Code (NECA No. 70).

**3. Pipe Insulation** — One or more metallic penetrants (pipe or tubing) may be insulated with the following types of pipe coverings:

**A. Pipe Covering** — Min 1 in. (25 mm) to max 2 in. (51 mm) thick hollow cylindrical heavy density min 3.5 pcf (56 kg/m<sup>3</sup>) glass fiber units jacketed on the outside with an all service jacket. Longitudinal joints sealed with metal fasteners or factory applied self-sealing tape. Transverse joints secured with metal fasteners or with butt tape supplied with the product.

**See **Pipe and Equipment Covering** — Materials (BRGCI) category in the Building Materials Directory for names of manufacturers. Any pipe covering material meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index of 50 or less may be used.**

**B. Tube Insulation-Plastics** — Min 1/2 in. (13 mm) to max 3/4 in. (19 mm) thick acryliclonitrile butadiene/polyvinyl chloride (AB/PVC) flexible foam furnished in the form of tubing.

**See **Plastics** (MHFZ) category in the Plastic Recognized Component Directory for names of manufacturers. Any Recognized Component tube insulation meeting the above specifications and having a UL 94 Flammability Classification of 94-V0 may be used.**

**C. Pipe Covering Materials** — Min 1 in. (25 mm) to max 2 in. (51 mm) thick unfaced mineral fiber pipe insulation having a nominal density of 3.5 pcf (56 kg/m<sup>3</sup>) or heavier and sized to fit the outside diam of pipe or tube. Pipe insulation secured with min 18 3/8W steel wire spaced 12 in. (305 mm) OC.

**HIG MINWOL, L. C. — High Temperature Pipe Insulation 1300, High Temperature Pipe Insulation BW-T and High Temperature Pipe Insulation Thermac.**

**CI. Sheathing Material** — (Not shown) — Optional, used in conjunction with item 3C. Foil-scrim-kraft or all service jacket material shall be wrapped around the outer circumference of the pipe covering material (item 3B) with the kraft side exposed. Longitudinal joints sealed with metal fasteners.

**See **Sheathing Materials** (BVTX) category in the Building Materials Directory for names of manufacturers. Any sheathing material meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index of 50 or less may be used.**

The annular space between the insulated penetrants and the periphery of the opening shall be min 0 in. (0 mm, point contact) to max 5 in. (127 mm). The separation between the insulated penetrants and the other penetrants shall be a min 1 in. (25 mm) to max 22 in. (560 mm). Any combination of the following types and sizes of cables may be used:

**A. Max 25 pair No. 24 AWG telephone cable with polyvinyl chloride (PVC) insulation and jacket.**

**B. Max 7/C No. 12 AWG copper conductor power and control cable with PVC or cross-linked polyethylene (XLPE) insulation and PVC jacket.**

**C. Multiple fiber optical communication cable jacketed with PVC and having a max outside diam of 1/2 in. (13 mm).**

**D. Max 3/C No. 8 AWG with bare aluminum ground, PVC insulated steel Metal Clad Cable currently Classified under the Through Penetrating Product (DHYV) category.**

**E. Max 3/C (with ground) No. 12 AWG (or smaller) nonmetallic sheathed (Romex) cable with PVC insulation and jacket material.**

**F. RG/U coaxial cable with polyethylene (PE) insulation and polyvinyl chloride (PVC) jacket having a max outside diam of 1/2 in. (13 mm).**

**4. Firestop System** — The firestop system shall consist of the following:

**A. Packing Material** — In 2 hr fire rated wall assemblies, min 4-3/4 in. (121 mm) thickness of min 4 pcf (64 kg/m<sup>3</sup>) mineral wool batt insulation firmly packed into opening as a permanent form. In 1 hr fire rated wall assemblies, min 3-1/2 in. (89 mm) thickness of min 4 pcf (64 kg/m<sup>3</sup>) mineral wool batt insulation firmly packed into opening as a permanent form. Packing material recessed from both surfaces of the wall to accommodate the required thickness of fill material.

**B. Fill, Void or Cavity Material — Sealant** — Min 5/8 in. (16 mm) thickness of fill material applied within annulus, flush with both surfaces of wall. At the point contact location between through penetrants and gypsum board, a min 1/4 in. (6 mm) diam bead of fill material shall be applied at the gypsum board/through penetrant interface on both surfaces of wall.

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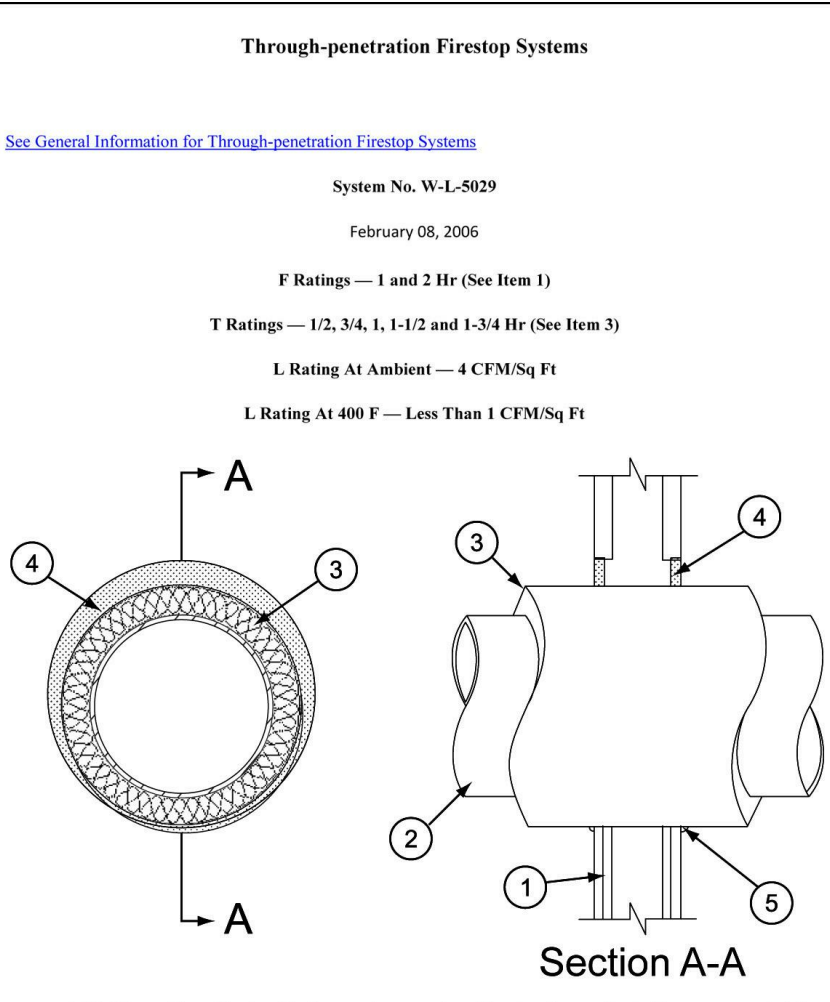
\*Bearing the UL Classification Mark

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#Bearing the UL Recognized Component Mark

Last Updated on 2007-10-08

SYSTEM NO. W-L-5029



**Through-penetration Firestop Systems**  
 See General Information for Through-penetration Firestop Systems  
 System No. W-L-5029  
 February 08, 2006  
**F Ratings — 1 and 2 Hr (See Item 1)**  
**T Rating — 0 Hr**

**1. Wall Assembly** — The 1 or 2 hr fire-rated gypsum board/steel wall assembly shall be constructed of the materials and in the manner specified in the individual U300 or U400 Series Wall and Partition Design in the UL Fire Resistance Directory and shall include the following construction features:

**A. Studs** — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. lumber spaced 16 in. OC. Steel studs to be min 3-1/2 in. wide and spaced max 24 in. OC.

**B. Gypsum Board** — 5/8 in. thick, 4 ft wide, with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual Wall and Partition Design. Max diam of circular cutout in gypsum board is 13 in.

**2. Through Penetrants** — One metallic pipe, conduit or tubing to be centered within the firestop system. Pipe or tubing to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes, conduits or tubing may be used:

**A. Steel Pipe** — Nom 12 in. diam (or smaller) Schedule 10 (or heavier) steel pipe.

**B. Iron Pipe** — Nom 12 in. diam (or smaller) cast or ductile iron pipe.

**C. Copper Tubing** — Nom 6 in. diam (or smaller) Type 1 (or heavier) copper tubing.

**D. Copper Pipe** — Nom 6 in. diam (or smaller) Regular (or heavier) copper pipe.

**3. Pipe Covering** — Nom 1-1/2 or 1-1/2 in. thick hollow cylindrical heavy density (min 3.5 pcf) glass fiber units jacketed on the outside with an all service jacket. Longitudinal joints sealed with metal fasteners or factory applied self-sealing tape. Transverse joints secured with metal fasteners or with butt tape supplied with the product.

**See **Pipe and Equipment Covering** — Materials (BRGCI) category in the Building Materials Directory for names of manufacturers. Any pipe covering material meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index of 50 or less may be used.**

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Last Updated on 2006-02-08

Wall Assembly Rating	Through Penetrant	Pipe Covering		Annular Space		T Rating Hr
		Type	Max Dia. In.	Min. In.	Max. In.	
1	A, B	4	1	0	1-1/2	1/2
1	C or D	2	1 or 1-1/2	0	1-1/2	1/2
1	A, B	4	1-1/2	0	1-1/2	1
1	A, B	12	2	0	1-7/8	3/4
1	C or D	6	2	0	1-7/8	1
2	A, B	4	1	0	1-1/2	1
2	C or D	4	1 or 1-1/2	0	1-1/2	1
2	A, B	6	2	0	1-7/8	1
2	A, B	4	1-1/2	0	1-1/2	1-1/4
2	A, B	12	2	0	1-7/8	1-1/2
2	C or D	6	2	0	1-7/8	1

\*1-Indicates penetrant type as itemized in Item 2.

\*3-Indicates penetrant type as itemized in Item 2.

**4. Firestop System** — The firestop system shall consist of the following:

**A. Packing Material** — In 2 hr fire rated wall assemblies, min 4-3/4 in. (121 mm) thickness of min 4 pcf (64 kg/m<sup>3</sup>) mineral wool batt insulation firmly packed into opening as a permanent form. In 1 hr fire rated wall assemblies, min 3-1/2 in. (89 mm) thickness of min 4 pcf (64 kg/m<sup>3</sup>) mineral wool batt insulation firmly packed into opening as a permanent form. Packing material recessed from both surfaces of the wall to accommodate the required thickness of fill material.

**B. Fill, Void or Cavity Material — Sealant** — Min 5/8 in. (16 mm) thickness of fill material applied within annulus, flush with both surfaces of wall. At the point contact location between through penetrants and gypsum board, a min 1/4 in. (6 mm) diam bead of fill material shall be applied at the gypsum board/through penetrant interface on both surfaces of wall.

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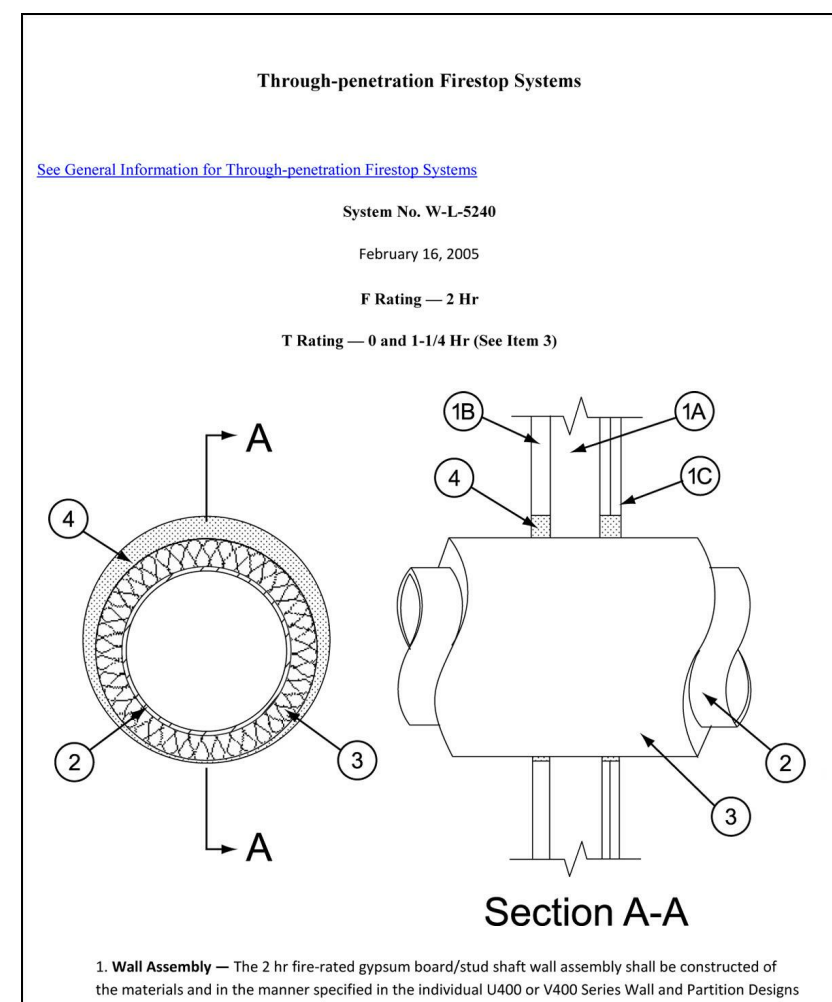
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#Bearing the UL Recognized Component Mark

Last Updated on 2006-02-08

SYSTEM NO. W-L-5240



**Through-penetration Firestop Systems**  
 See General Information for Through-penetration Firestop Systems  
 System No. W-L-5240  
 February 16, 2005  
**F Rating — 2 Hr**  
**T Rating — 0 Hr**

**1. Wall Assembly** — The 2 hr fire-rated gypsum board/steel wall assembly shall be constructed of the materials and in the manner specified in the individual U300 or U400 Series Wall and Partition Design in the UL Fire Resistance Directory and shall incorporate the following construction features:

**A. Studs** — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. lumber spaced 16 in. OC. Steel studs to be min 3-1/2 in. wide and spaced max 24 in. OC.

**B. Gypsum Board** — 1 in. thick, 24 in. wide gypsum liner panels installed vertically. Max diam of circular cutout in gypsum liner panel is 13 in.

**C. Gypsum Board** — 1/2 in. or 5/8 in. thick, 48 in. wide gypsum boards. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual Wall and Partition Design. Max diam of circular cutout in gypsum board is 13 in.

**2. Through Penetrants** — One metallic pipe, conduit or tubing to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes, conduits or tubing may be used:

**A. Steel Pipe** — Nom 8 in. diam (or smaller) Schedule 10 (or heavier) steel pipe.

**B. Iron Pipe** — Nom 8 in. diam (or smaller) cast or ductile iron pipe.

**C. Copper Tubing** — Nom 4 in. diam (or smaller) Type 1 (or heavier) copper tubing.

**D. Copper Pipe** — Nom 4 in. diam (or smaller) Regular (or heavier) copper pipe.

**3. Pipe Covering** — Nom 1-1/2 or 1-1/2 in. thick hollow cylindrical heavy density (min 3.5 pcf) glass fiber units jacketed on the outside with an all service jacket. Longitudinal joints sealed with metal fasteners or factory applied self-sealing tape. Transverse joints secured with metal fasteners or with butt tape supplied with the product. The annular space between the insulated pipe and the periphery of the opening shall be min 3/4 in. to max 1-1/8 in. When 1 in. thickness insulation is used, T Rating is 1/2 hr. When 1-1/2 in. insulation is used, T Rating is 1-1/4 hr.

**See **Pipe and Equipment Covering** — Materials (BRGCI) category in the Building Materials Directory for names of manufacturers. Any pipe covering material meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index of 50 or less may be used.**

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Last Updated on 2005-02-16

Wall Assembly Rating	Through Penetrant	Pipe Covering		Annular Space		T Rating Hr
		Type	Max Dia. In.	Min. In.	Max. In.	
1	A, B	4	1	0	1-1/2	1/2
1	C or D	2	1 or 1-1/2	0	1-1/2	1/2
1	A, B	4	1-1/2	0	1-1/2	1
1	A, B	12	2	0	1-7/8	3/4
1	C or D	6	2	0	1-7/8	1
2	A, B	4	1	0	1-1/2	1
2	C or D	4	1 or 1-1/2	0	1-1/2	1
2	A, B	6	2	0	1-7/8	1
2	A, B	4	1-1/2	0	1-1/2	1-1/4
2	A, B	12	2	0	1-7/8	1-1/2
2	C or D	6	2	0	1-7/8	1

**4. Firestop System** — The firestop system shall consist of the following:

**A. Packing Material** — In 2 hr fire rated wall assemblies, min 4-3/4 in. (121 mm) thickness of min 4 pcf (64 kg/m<sup>3</sup>) mineral wool batt insulation firmly packed into opening as a permanent form. In 1 hr fire rated wall assemblies, min 3-1/2 in. (89 mm) thickness of min 4 pcf (64 kg/m<sup>3</sup>) mineral wool batt insulation firmly packed into opening as a permanent form. Packing material recessed from both surfaces of the wall to accommodate the required thickness of fill material.

**B. Fill, Void or Cavity Material — Sealant** — Min 5/8 in. (16 mm) thickness of fill material applied within annulus, flush with both surfaces of wall. At the point contact location between through penetrants and gypsum board, a min 1/4 in. (6 mm) diam bead of fill material shall be applied at the gypsum board/through penetrant interface on both surfaces of wall.

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 HILTI INC — FS-One Sealant

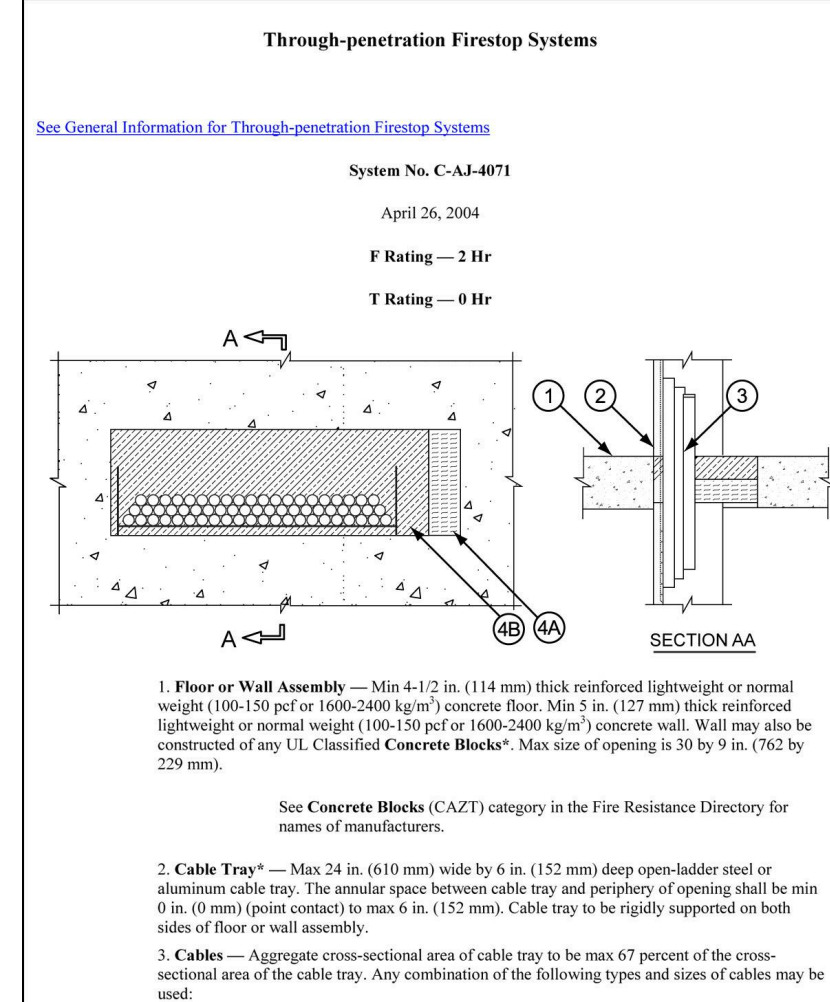
\*Bearing the UL Classification Mark

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#Bearing the UL Recognized Component Mark

Last Updated on 2005-02-16

SYSTEM NO. C-AJ-4071



**Through-penetration Firestop Systems**  
 See General Information for Through-penetration Firestop Systems  
 System No. C-AJ-4071  
 April 26, 2004  
**F Rating — 2 Hr**  
**T Rating — 0 Hr**

**1. Floor or Wall Assembly** — Min 4-1/2 in. (114 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m<sup>3</sup>) concrete. Floor: Min 5 in. (127 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m<sup>3</sup>) concrete wall. Wall may also be constructed of try UL Classified Concrete Blocks\*. Max size of opening is 30 by 9 in. (762 by 229 mm).

**2. Cable Tray** — Max 24 in. (610 mm) wide by 6 in. (152 mm) deep open-ladder steel or aluminum cable tray. The annular space between cable tray and periphery of opening shall be min 0 in. (0 mm) (point contact) to max 6 in. (152 mm) leading edge. Any combination of the following types and sizes of cables may be used:

**A. Max 300 pair No. 24 AWG telephone cable with polyvinyl chloride (PVC) insulation and jacket.**

**B. Max 500 kcmil single conductor copper or aluminum power cable with PVC jacket material.**

**C. Multiple fiber optical communication cable with PVC jacket and having a max OD of 1/2 in. (13 mm).**

**D. Max 3/C No. 12 AWG copper conductor steel clad cable with PVC insulation.**

**E. Max 3/C No. 12 AWG copper conductor cable jacketed with PVC.**

**3. Cables** — Aggregate cross-sectional area of cable tray to be max 40 percent of the cross-sectional area of the cable tray. Any combination of the following types and sizes of cables may be used:

**A. Max 300 pair No. 24 AWG telephone cable with polyvinyl chloride (PVC) insulation and jacket.**

**B. Max 500 kcmil single conductor copper or aluminum power cable with PVC jacket material.**

**C. Multiple fiber optical communication cable with PVC jacket and having a max OD of 1/2 in. (13 mm).**

**D. Max 3/C No. 12 AWG copper conductor steel clad cable with PVC insulation.**

**E. Max 3/C No. 12 AWG copper conductor cable jacketed with PVC.**

**4. Firestop System** — The firestop system shall consist of the following:

**A. Packing Material** — Min 4 in. (102 mm) thickness of 4 pcf (64 kg/m<sup>3</sup>) mineral wool batt insulation firmly packed into opening as a permanent form. Packing material to be recessed from top surface of floor or wall assembly. The following types and sizes of metallic pipes or conduits may be used:

**B. Fill, Void or Cavity Material — Sealant** — Min 1/2 in. (13 mm) thickness of fill material applied within the annulus, flush with the top surface of the floor or both surfaces of the wall.

**HILTI CONSTRUCTION CHEMICALS, DIV OF**  
 HILTI INC — FS-One Sealant

\*Bearing the UL Classification Mark

†Bearing the UL Listing Mark

#Bearing the UL Recognized Component Mark

Last Updated on 2004-04-26

Wall Assembly Rating	Through Penetrant	Pipe Covering		Annular Space		T Rating Hr
		Type	Max Dia. In.	Min. In.	Max. In.	
1	A, B	4	1	0	1-1/2	1/2
1	C or D	2	1 or 1-1/2	0	1-1/2	1/2
1	A, B	4	1-1/2	0	1-1/2	1
1	A, B	12	2	0	1-7/8	3/4
1	C or D	6	2	0	1-7/8	1
2	A, B	4	1	0	1-1/2	1
2	C or D	4	1 or 1-1/2	0	1-1/2	1
2	A, B	6	2	0	1-7/8	1
2	A, B	4	1-1/2	0	1-1/2	1-1/4
2	A, B	12	2	0	1-7/8	1-1/2
2	C or D	6	2	0	1-7/8	1

**4. Firestop System** — The firestop system shall consist of the following:

**A. Packing Material** — In 2 hr fire rated wall assemblies, min 4-3/4 in. (121 mm) thickness of min 4 pcf (64 kg/m<sup>3</sup>) mineral wool batt insulation firmly packed into opening as a permanent form. Packing material to be recessed from top surface of floor or wall assembly. The following types and sizes of metallic pipes or conduits may be used:

**B. Fill, Void or Cavity Material — Sealant** — Min 1/2 in. (13 mm) thickness of fill material applied within the annulus, flush with the top surface of the floor or both surfaces of the wall.

**HILTI CONSTRUCTION CHEMICALS, DIV OF**  
 HILTI INC — FS-One Sealant

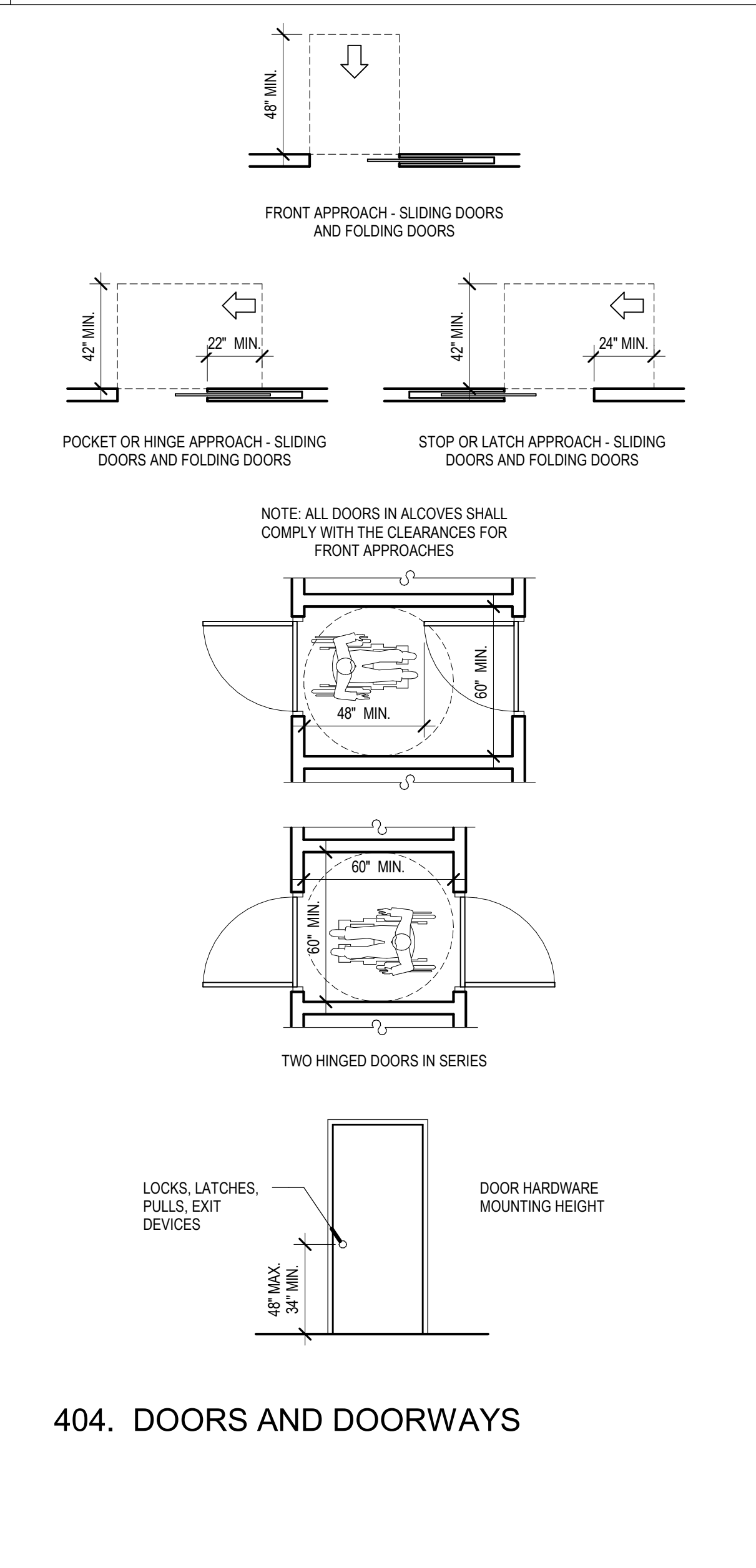
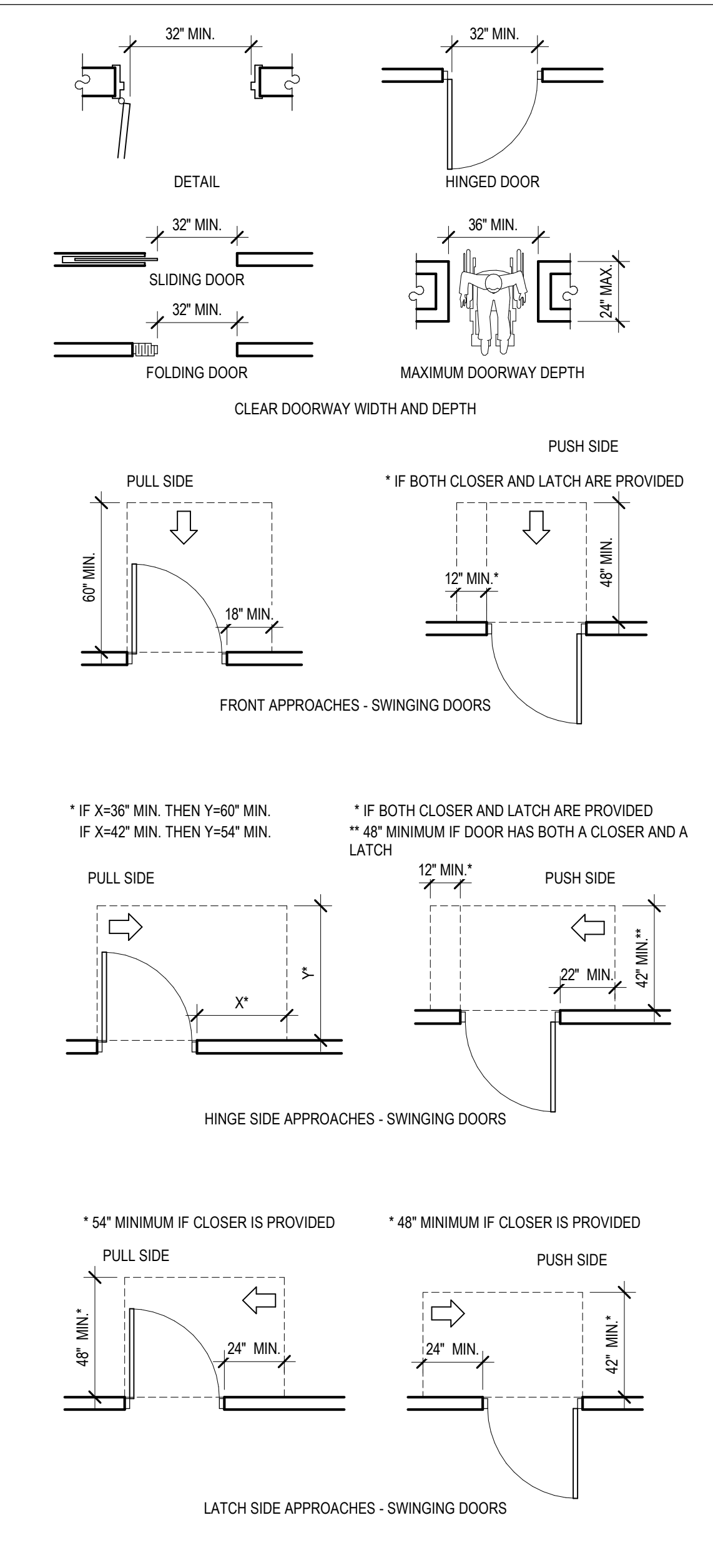
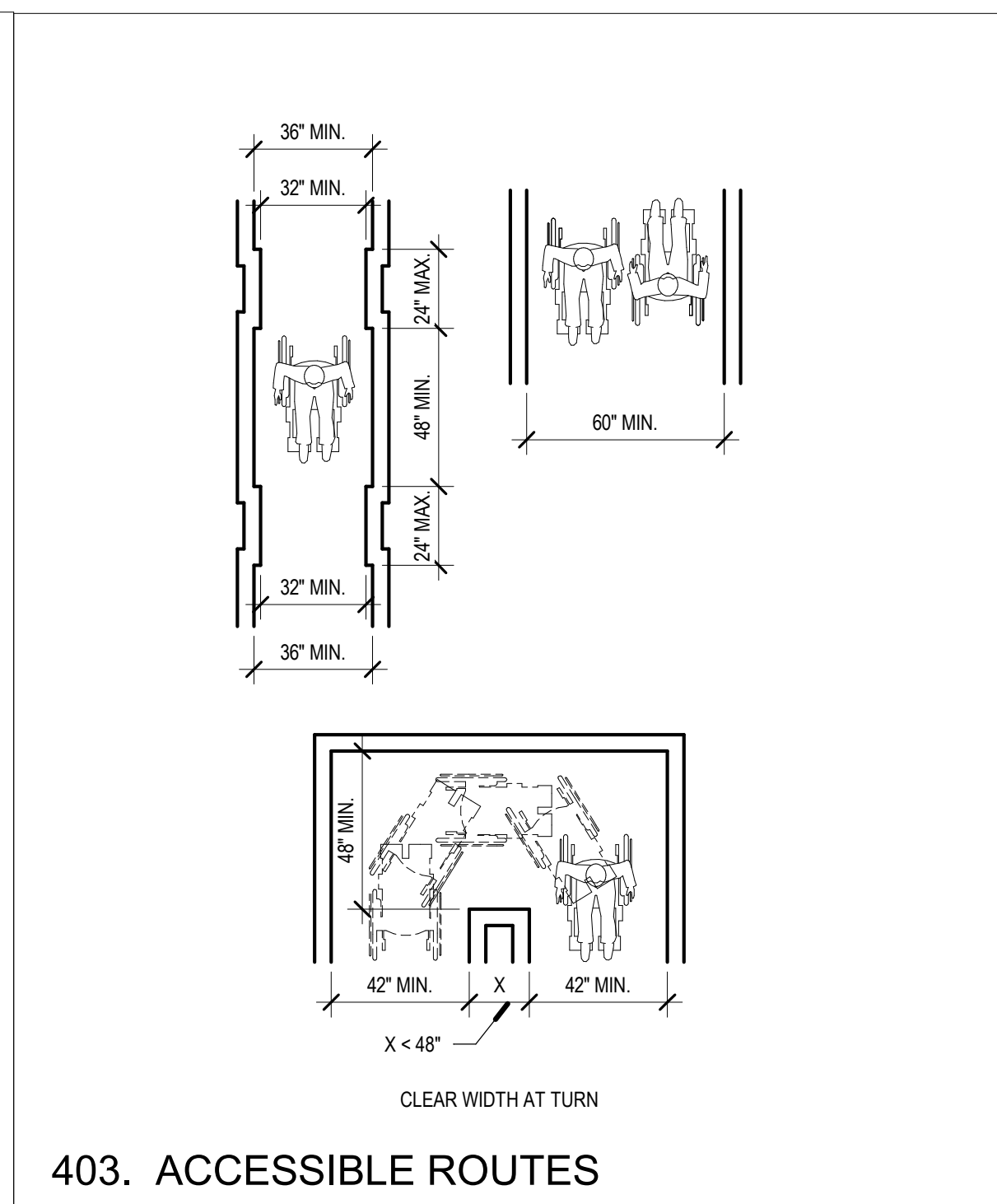
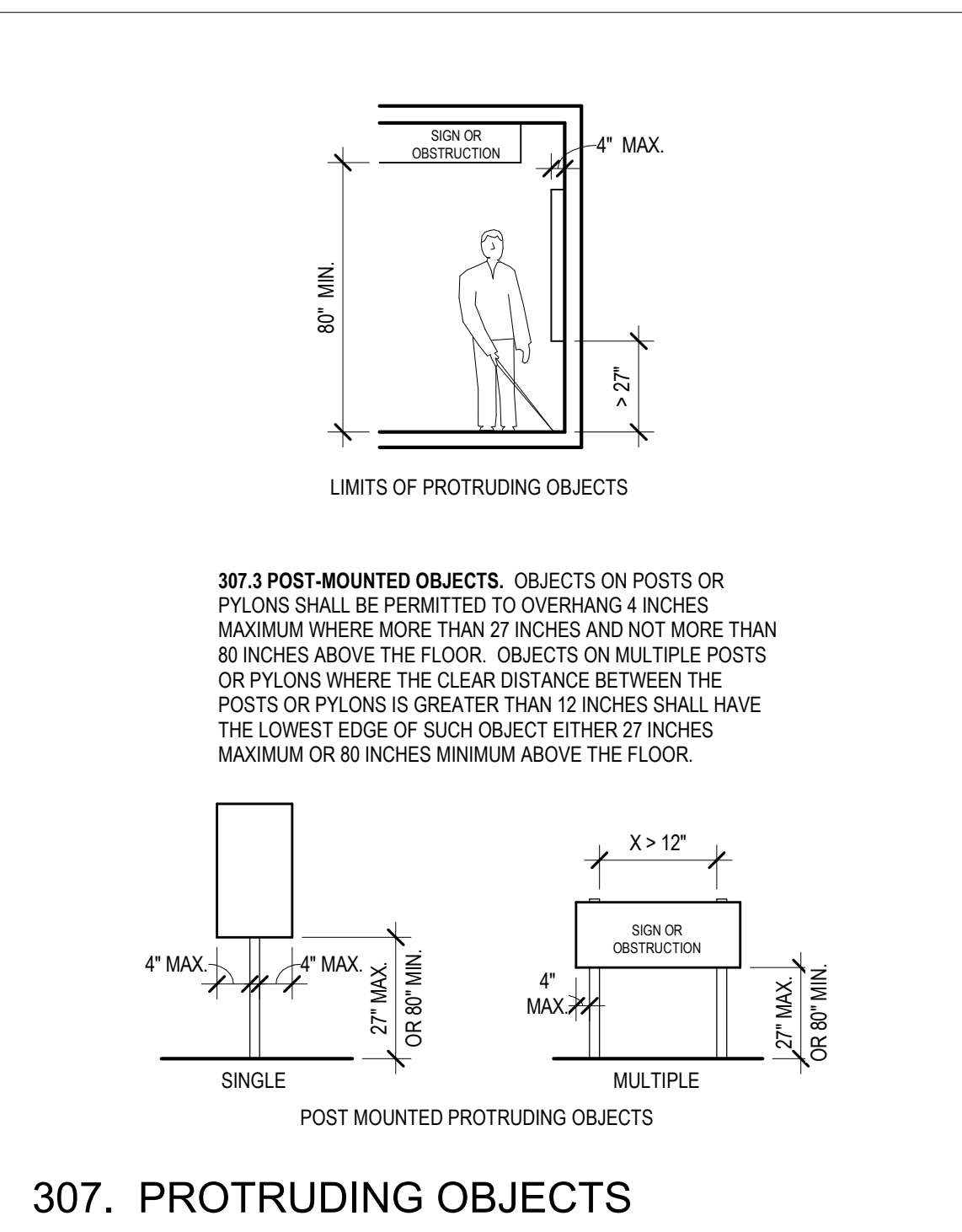
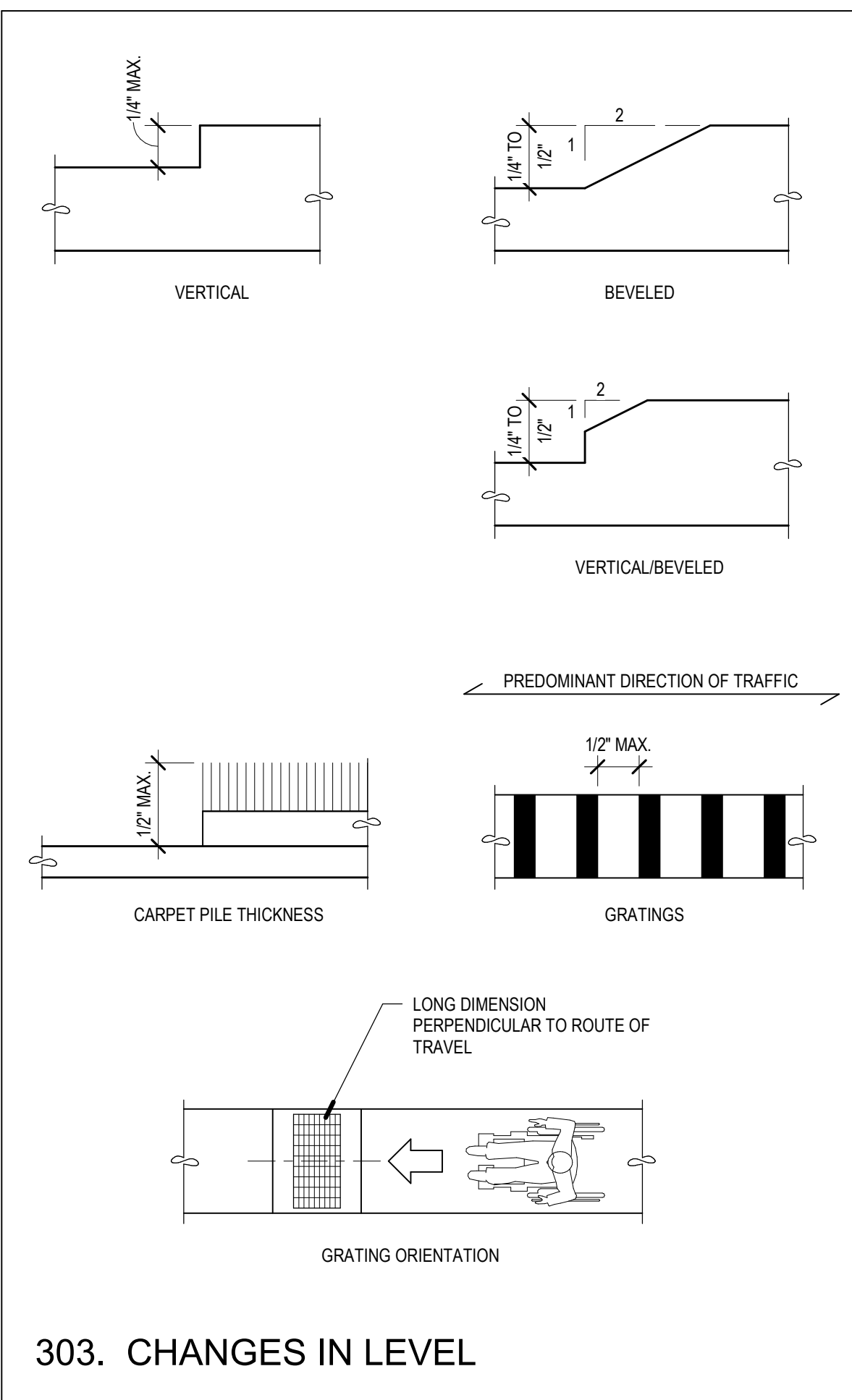
\*Bearing the UL Classification Mark

†Bearing the UL Listing Mark

#Bearing the UL Recognized Component Mark

Last Updated on 2004-04-26





REV	DATE	DESCRIPTION

VCBO NUMBER: 21560  
CLIENT NUMBER:  
DATE: JULY 27, 2021







Laboratory scale - Work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person. "Laboratory scale" excludes those workplaces whose function is to produce commercial quantities of materials.

Laboratory supervisor - An individual that has authority and responsibility for the personnel and procedures conducted in an individual laboratory.

Medical consultation - Consultation which takes place between a licensed physician and an employee [or student] for the purpose of determining what medical examinations or procedures, if any, are appropriate in cases where a significant exposure to a hazardous chemical may have taken place.

MSDS or SDS - Material Safety Data Sheets - available in paper form in the lab binder marked "Safety Data Sheets".

Particularly hazardous substances - These include "select carcinogens", "reproductive toxins", and "substances with a high degree of acute toxicity".

Permissible exposure level (PEL) - The maximum permitted 8-hour time-weighted average concentration of an airborne contaminant. Cal/OSHA lists these limits at [www.dir.ca.gov/Title8/5155table\\_a\\_c1.html](http://www.dir.ca.gov/Title8/5155table_a_c1.html)

Physical hazard - A substance for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive), or water-reactive.

Protective laboratory practices and equipment - Those laboratory procedures, practices and equipment accepted by laboratory health and safety experts as effective, or that the employer can show to be effective, in minimizing the potential for employee exposure to hazardous chemicals.

Reproductive toxins - Chemicals that affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis).

Select carcinogen - Any substance that meets one of the following criteria:

- It is listed under the category "known to be carcinogens", in Annual Report on Carcinogens by the National Toxicology Program (NTP) (latest ed., <http://ntp.niehs.nih.gov/?objectid=72016262-BDB7-CEBA-FA60E922B18C2540>); or
- It is listed under Group 1 ("carcinogenic to humans") by the International Agency for Research on Cancer Monographs (IARC) (Vol. 1-48 and Supplements 1-8); or
- It is listed in either Group 2A or 2B by IARC (<http://monographs.iarc.fr/>) or under the category, "reasonably anticipated to be carcinogens" by NTP (<http://ntp.niehs.nih.gov/?objectid=72016262-BDB7-CEBA-FA60E922B18C2540>) and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:
  - After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m<sup>3</sup>;
  - After repeated skin application of less than 300 mg/kg of body weight per week; or
  - After oral dosages of less than 50 mg/kg of body weight per day

Roles and Responsibilities

Lab Manager (LM) and Team Leads (TL)

The LM/TL has responsibility for implementation of the CHP in the Discovery Biology laboratory. The LM/TL shall:

- ensure that workers are trained and follow the CHP outlined in this document;
- ensure that the necessary protective and emergency equipment is available, in working order, and that appropriate training has been provided;
- ensure that periodic laboratory self inspections are performed;
- know current legal requirements concerning regulated substances;
- review and evaluate the effectiveness of laboratory specific chemical safety protocol at least annually and update as necessary.

Laboratory Employees are responsible for:

- planning and conducting each operation in accordance with practices and procedures established in this CHP;
- using equipment only for its designed purpose;

- being familiar with emergency procedures, including knowledge of the location and use of emergency equipment for the laboratory, as well as how to obtain additional help in an emergency;
- knowing the types of protective equipment available and using the proper type for each procedure;
- being alert to unsafe conditions and actions and calling attention to them so corrections can be made as soon as possible.

Chemical Hygiene Officer (CHO) is an employee designated by the employer who is qualified by training or experience to provide technical guidance in the development and implementation of the provisions of the CHP. The current Chemical Hygiene Officer for the Discovery Biology Labs is: Clifford Whatcott

The Chemical Hygiene Officer shall:

- assist LM/TL's and other laboratory employees with development and implementation of appropriate chemical hygiene procedures and practices, including providing consultation and information;
- keep abreast of legal requirements concerning regulated substances and communicate any changes to PI's and laboratory employees.
- seek ways to improve the overall chemical hygiene program.

Employee Information and Training

LM/TL shall ensure that information and training are provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations. Refresher information and training shall be conducted at least annually and documented.

Information: All laboratory personnel shall be informed of:

- Requirements of the OSHA Standard, "Occupational Exposure to Hazardous Chemicals in Laboratories";
- The contents and availability of this Chemical Hygiene Plan,
- Permissible Exposure Limits (PELs) for OSHA regulated substances or recommended exposure limits where there is no applicable OSHA standard,
- Signs and symptoms associated with exposures to hazardous chemicals used in their laboratory,
- The location of reference materials on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory including, but not limited to, Material Safety Data Sheets (MSDS's).

The applicable portions of the OSHA Hazard Communication standard (29CFR1910.1200).

Training: Employee training shall include:

- The physical and health hazards associated with chemicals stored and used in their work area,
- The contents of this Chemical Hygiene Plan,
- Methods and observations that may be used to detect the presence or release of a hazardous chemical; e.g., exposure monitoring conducted by the CHO, visual appearance or odor of hazardous chemicals when being released, etc.

Prior Approval Circumstances

Employees must obtain prior approval to proceed with a laboratory task from the PI or his/her designee when:

- Radioactive materials will be used,
- Recombinant DNA or biological material of Risk Group 3 or assigned Biosafety Level 3 or greater will be used,
- It is likely that exposure limit concentrations could be exceeded or that other harm is likely,
- There is failure of any equipment used in the process, especially of safeguards such as chemical fume hoods.
- Members of the laboratory staff become ill, suspect that they or others have been exposed, or otherwise suspect a failure of any safeguards.

Control Measures

Ventilation

Laboratory ventilation is normally designed to provide a minimum of eight air changes per hour. This flow is not necessarily sufficient to prevent accumulation of chemical vapors. Laboratory work shall be conducted in a fume hood, glove box, or similar device when:

- Procedures call for work with toxic substances which are volatile; i.e., evaporate at normal temperature and pressure, or
  - There is a possibility the action level or PEL will be exceeded.
- The protection provided by laboratory fume hoods is dependent upon two important factors:
  - proper use of the hood, and
  - maintenance of adequate airflow through the hood.

- The way the hood is used will determine the degree of protection it will provide. Each employee is responsible for implementing the following work practices when using a hood.
  - Continually monitor air being drawn into the hood. This can be done by attaching a lightweight strip of paper to the bottom of the sash.
  - Operate the hood at a sash position that will provide splash protection for the user; e.g. 10 -12 inch opening for hoods with vertical sliding (up and down) sashes and the sashes closed as much as possible for continuous air flow hoods with horizontal sliding (left and right) sashes. This helps to ensure optimum protection when conducting operations in the hood.
  - Avoid using the hood for storage of bottles and equipment, especially along the back wall. Any apparatus that must be housed within the hood should fit completely inside the hood. Elevate the apparatus on blocks (at least 2 inches off the bench top) to allow air to flow freely around and beneath.
  - Manipulations within the hood should be performed at least 6 inches inside the face of the hood or as far towards the back of the hood as possible. This minimizes the possibility of contaminants escaping from the hood.
  - Avoid things which cause air turbulence across the face of the hood such as fans, window air conditioning units, or excessive movement.
  - Exhaust hoods do not provide adequate protection for all operations involving toxic materials. A higher level of containment should be used for procedures where minor contamination can be serious. If you are in doubt about the level of containment needed for your operation, ask your LM or TL.
- Sumitomo Dainippon Pharma Oncology will conduct annual surveys of fume hoods to ensure adequate airflow is maintained through the hood face. Contact your LM/TL if you suspect the hood is not working properly.

Spill clean-up procedures

- Attend to anyone who may have been contaminated.
- Notify occupants in the immediate area about the spill.
- Evacuate all nonessential personnel from the spill area.
- If the spilled material is flammable, turn off all ignition and heat sources; including magnetic stirrers.
- Avoid breathing vapors of the spilled material. Evacuate and contact the CHO, LM/TL, or call the Lehi Police at (801) 768-7110, or at 911 if an emergency.
- Ensure that the fume hood(s) is on. Open windows where possible to increase exhaust ventilation.
- Secure cleanup supplies. Ensure protective apparel is resistant to the spill material.
- Confine or contain the spill to a small area.

Exposure monitoring

Exposure monitoring shall be performed when there is reason to believe that exposures are in excess of the action-level or the PEL. Materials which require monitoring under these conditions are listed in OSHA Regulations. If an employee would like to have an exposure assessment conducted, the CHO should be contacted. Exposure assessments and monitoring may be conducted by the CHO or qualified medical professional. Documentation of exposure monitoring shall be kept and maintained as part of each employee's personnel record.

General Laboratory Safety Rules

It is important that all employees know the location of emergency showers, eyewashes, first aid kits, emergency exits, spill kits, and fire extinguishers. Know the location of the nearest and the next-nearest telephone, eyewash, and emergency shower. In an emergency, dial 911.

- Know the location of Material Safety Data Sheets. Ensure that you have been trained on this Chemical Hygiene Plan.
- No food, beverage, smokeless tobacco, or application of cosmetics is allowed in the laboratory workbench areas. No smoking is allowed in any area of a laboratory. Always wash hands after working with chemicals, even when gloves have been used.
- Dress appropriately. (See appendix A).
- Appropriate eye protection (safety glasses at a minimum) will be worn at all times in laboratories; see Section below and any applicable SOPs.
- Wear the appropriate personal protective equipment for the chemicals you are working with. When wearing contact lenses, be sure to wear safety goggles to protect your sight.
- Comply with warning signs and labels.
- Do not directly smell or taste any chemical.
- Do not pipette or siphon by mouth.
- Containers shall be kept closed when not in active use.
- Perform only those experiments or procedures you are authorized to do by the person in charge of the lab.
- Report all injuries, fires, and accidents to your supervisor immediately. All fires use of fire extinguisher and must be reported to the CHO/LM/TL or Police, as soon as possible.
- If you have a question about a procedure or the hazards of a chemical, ask your supervisor before performing the procedure.

Labeling

All containers of hazardous substances shall be appropriately labeled. The manufacturer's label shall not be removed from a container as long as the material or residues of the material remain in the container. The following information is to be provided on the manufacturer's label:

- The identity of the hazardous substance.
- Appropriate warning words and statements.
- Appropriate precautionary measures.
- Name and address of manufacturer or importer.

The receiver will write the date received, and opened on the label of chemicals that expire or can convert to a reactive material upon standing, such as diethyl ether, tetrahydrofuran, 1,4-dioxane, diisopropyl ether and other peroxide-forming substances.

All containers into which hazardous substances are transferred or prepared shall be labeled with the following information:

- The identity and concentration of the hazardous substance.
- A description of the hazards and precautionary measures. In containers smaller than one quart, descriptions can be limited to signal words such as "FLAMMABLE, CORROSIVE, TOXIC"; consult a recent original container, the Aldrich Chemical catalog, or the MSDS.
- It is good practice to put the date received, prepared or transferred on the label. This is required for peroxidizable chemicals such as ethers.
- It is recommended that the responsible person's name be on the container label.

All containers in which hazardous waste is collected shall be labeled with a complete description of contents.

Labeling is not required for portable containers into which hazardous chemicals are transferred from labeled containers, and which are intended only for the immediate use of the individual who performs the transfer.

Medical consultations and examinations

Employees shall be provided an opportunity to receive medical attention, including any related follow-up examinations, at the company's expense, under the following circumstances:

- An individual develops signs or symptoms associated with exposure to hazardous chemicals in the laboratory.
- Exposure monitoring reveals an exposure level routinely above the action level or PEL for a UOSH regulated substance for which there are exposure monitoring and medical surveillance requirements.
- An accident such as a spill, leak, equipment failure, or explosion results in possible overexposure to hazardous chemicals.
- The PI is responsible for establishing and maintaining an accurate record of any medical consultations and examinations provided to an employee.

Select carcinogens, reproductive toxins, highly acute toxins

The procedures described in this section are mandatory when performing laboratory work with greater than 10 mg or 100 mL of any carcinogen, reproductive toxin, or substance that has a high degree of acute toxicity.

- Definitions
  - Select carcinogens: any substance defined as such by UOSH.
  - Reproductive toxins: chemicals which affect reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogens).
  - A Highly Acute Toxin is any substance for which:
    - The median oral LD50 is less than or equal to 50 mg/kg when administered orally to albino rats, or
    - the median inhalation lethal concentration, LC50, value is less than or equal to 200 ppm by volume of gas or vapor, or 2 mg/liter or less of dust, mist, or fume when administered continuously for one hour or less to albino rats, or the median LD50 is less than or equal to 200 mg/kg when administered by continuous contact for 24 hours or less with the bare skin of albino rabbits.
    - Designated area: a hood, glove box, portion of a laboratory, or an entire laboratory room, designated as the only area where work shall be conducted with quantities of select carcinogens, reproductive toxins, or highly acute toxins in excess of the limits specified above.
- Designated Area
  - Access to designated areas shall be restricted. Only trained employees will be allowed to work with chemicals in the designated area. All such persons will:
    - Use the smallest amount of chemical that is consistent with the requirement of the work to be done.
    - Always use these chemicals in a hood with adequate air flow (face velocity between 80 and 120 feet per minute) or other containment device for procedures which may result in the generation of aerosols or vapors containing the substance.
    - Use high-efficiency particulate air (HEPA) filters or high-efficiency scrubber systems to protect vacuum lines and pumps.



REV DATE DESCRIPTION

VCBO NUMBER: 21560  
CLIENT NUMBER:  
DATE: JULY 27, 2021

SUMITOMO DAINIPPON PHARMA

3900 TRAVERSE MOUNTAIN BLVD, SUITE 100, LEHI, UTAH 84043

PERMIT & BID SET

CHEMICAL HYGIENE PLAN

G401



- iv. Decontaminate designated areas before normal work is resumed there. This includes contaminated equipment.
- v. Remove any protective apparel, place it in an appropriately labeled container, and thoroughly wash hands, forearms, face, and neck on leaving a designated area.
- vi. Prepare wastes for disposal in accordance with Chemical Waste Disposal Guidelines
- vii. Do not wear jewelry when working in designated areas since decontamination of jewelry may be difficult or impossible.

Appendix A - Standard operating procedures

General Rules

1. For chemicals they are working with, all employees should know:
  - a. the chemical's hazards, as determined from MSDS and other appropriate references;
  - b. appropriate safeguards for using that chemical, including personal protective equipment;
  - c. how to properly store the chemical when it is not in use;
  - d. proper chemical waste disposal procedures;
  - e. proper personal hygiene practices;
  - f. appropriate procedures for emergencies, including first aid, evacuation routes, and spill cleanup procedures.
  - g. As part of the safety program, each lab is required to have a current chemical inventory.
2. Employees should avoid working alone. Arrangements should be made between individuals working in separate laboratories outside of regular working hours to crosscheck each other periodically. An employee who is alone in the laboratory should not undertake experiments known to be hazardous.

Personal Hygiene

1. Wash promptly whenever a chemical has contacted your skin. Flush for at least 15 minutes prior to seeking medical attention.
2. Avoid inhalation of chemicals. Do not "sniff" to test chemicals.
3. Do not use mouth suction to pipette anything. Pipetting aids must be used at all times.
4. Do not bring food (including gum and candy), beverages, tobacco, or cosmetic products into chemical storage or use areas. Eating, drinking, and applying cosmetics is allowed in designated areas only. Smoking is prohibited in all company facilities.
5. Wash well with soap and water before leaving the laboratory. Avoid the use of solvents for washing skin. Solvents remove the natural protective oils from skin and can cause

irritation and inflammation. In some cases, washing with solvent may facilitate absorption of toxic chemicals.

Housekeeping

Housekeeping is directly related to safety and must be given importance of equal value to other procedures. Lack of good housekeeping reduces work efficiency and may result in accidents. Laboratory personnel must adhere to the following:

1. Access to emergency equipment, showers, eyewashes, fire extinguishers, exits and circuit breakers shall never be blocked or obstructed.
2. Chemical containers should be regularly monitored for proper labeling and container integrity. Labels which are fading, falling off, or deteriorating must be promptly replaced. If abbreviations are used, they should be kept to a minimum and clearly identify the contents of the container as well as hazards associated with use; i.e., HgCl<sub>2</sub>/poison, HCl/corrosive, MeOH/flammable, H<sub>2</sub>O<sub>2</sub>/corrosive oxidizer, Nonhazardous buffer, etc. Improperly labeled or unlabeled chemicals make hazard identification and disposal difficult, and may create a hazard.
3. All chemicals should be placed in their proper storage areas at the end of each workday. Chemicals shall not be stored on desks, laboratory bench tops, floors, fume hoods or in aisles. Liquids should be stored below solids.
4. Each laboratory must have a puncture resistant (e.g., cardboard) container specifically designated for glassware disposal.
5. At the end of each workday, the contents of all unlabeled containers are to be considered waste and disposed of appropriately. Collection containers for wastes must be clearly labeled including hazard identification.
6. All work areas, especially laboratory bench tops, should be kept clear of clutter.
7. All aisles, corridors, stairs, and stairwells shall be kept clear of chemicals, equipment, supplies, boxes, and debris.
8. Overhead storage must be kept no closer than 18" to the ceiling for sprinkled rooms, 24" for non-sprinkled rooms.
9. Food and drink for human consumption shall not be kept in the same refrigerator used to store chemicals and laboratory samples. Eating and office areas must be clearly separated from laboratory and chemical storage areas.
10. Empty containers shall be treated in the following manner:
  - a. For water-soluble solvents: triple rinse, deface the label, relabel as "Empty" and dispose with normal trash.
  - b. For non water-soluble solvents: triple rinse using a solvent capable of removing the chemical. ALL rinsate must be collected in a hazardous waste disposal container. Deface the label, relabel as "Empty" and dispose with normal trash.

Protective Clothing and Equipment

1. Carefully inspect all protective equipment prior to use. Do not use defective equipment.
2. Eye protection (safety glasses, chemical-resistant goggles, or a face shield) shall be worn at all times in laboratories where chemicals are being used. This includes visitors. Ordinary prescription glasses are not considered effective eye protection since they lack

necessary shielding. Chemical-resistant goggles should be worn over the glasses or prescription safety glasses be provided to employees required to wear corrective lenses. The wearing of contact lenses in the laboratory is very controversial. Consult with an Optometrist prior to wear in the laboratory. Safety glasses or chemical resistant goggles shall be worn over contacts at all times.

4. When working with corrosive, toxic, allergenic, or sensitizing chemicals, rough or sharp-edged objects, very hot or very cold materials, gloves made of material known to be resistant to permeation by the substance shall be worn. No one glove can protect against all hazards. Refer to a glove selection guide. Consult the manufacturer's performance chart or contact the Chemical Hygiene Officer to determine the proper choice of glove material.
5. Low-heeled shoes with fully covered uppers shall be worn at all times in the laboratory. Shoes or sandals with open toes shall not be worn.
6. Long pants and long sleeves should be worn when working with or around chemicals.
7. Long hair should be held in place behind the head.
8. Loose clothing, especially loose trouser legs and sleeves, should not be worn in the laboratory.
9. A full-body-length rubber, plastic, or neoprene apron appropriate for the material being handled should be worn if there is risk of splash or spill.
10. A proper respirator must be worn whenever exposure by inhalation is likely to exceed the action level or Personnel Exposure Limit (PEL) and a fume hood is not accessible. Employees must be medically qualified, trained, and fit-tested prior to using a respirator. Consult your PI and/or the CHO before doing any such work.

Flammable Materials

Precautions for safe handling of flammable materials include the following:

1. Storage of flammable substances shall be limited to quantities specified in Table 1.
2. Flammable substances shall be handled only in areas free of ignition sources.
3. Flammable substances should never be heated by using an open flame. Preferred heat sources include steam baths, water baths, oil baths, heating mantles, and hot air baths. Class I liquids (see Table 1) shall not be transferred from one vessel to another in any exit way.
4. Transfer of flammable liquids from 5-gallon containers (or less) to smaller containers shall be conducted in a laboratory fume hood or an approved flammable liquid storage room.
5. Flammable liquids must not be stored in a refrigerator unless that refrigerator has been manufactured, purchased, and maintained as a flammable safe (also sometimes referred to as "laboratory-safe" or "flammable material") refrigerator. Flammable liquids must not be stored in an "ordinary" household-type refrigerator.

Reactive Chemicals

A reactive chemical is one that:

- p. Do not use copper (>65%) connectors or tubing with acetylene. Acetylene can form explosive compounds with copper, silver, and mercury.
  - q. Always leave at least 30 psi minimum pressure in all Empty cylinders.
  - r. Label all cylinders when "Empty". All cylinders are to be considered full unless labeled as empty by the user. Empty cylinders must be returned to the supplier and not accumulated.
  - s. Do not leave an empty cylinder attached to a pressurized system.
- NOTE: Sumitomo Dainippon Pharma Oncology discourages the use of lecture bottles if other cylinders are available. Lecture bottles are very difficult to dispose of and they use universal threads and valves (some of which are interchangeable), thus increasing the potential for unintentional mixing. If lecture bottles are used, label all associated equipment with the gas name to prevent unintentional mixing.

1. Fits the UOSH definition of "unstable" in 1910.1450(b): "Unstable (reactive) means a chemical which in the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure, or temperature
2. Is ranked by the National Fire Protection Association (NFPA) as 3 or 4 for reactivity,
3. Is identified by the Department of Transportation (DOT) as:
  - a. An oxidizer,
  - b. An organic peroxide, or
  - c. A class A, B, or C explosive,
4. Violently reacts with exposure to water or air.
5. Handle reactive chemicals with all proper safety precautions. This includes designating a separate storage area, monitoring periodically for degradation, and using appropriate personal protection.

Corrosive Chemicals

Materials are classified as corrosive if they:

- a. are capable of rapidly eroding building materials or metals, or
- b. burn, irritate or destructively attack organic tissues such as skin, eyes, lungs and stomach.

Examples of commonly used chemicals that have corrosive properties:

- glacial acetic acid
- hydrofluoric acid
- hydrochloric acid
- acetic anhydride
- nitric acid
- bromine
- potassium hydroxide
- chlorine
- sodium hydroxide
- fluorine
- sulfuric acid

Safe handling procedures will vary with each operation and the type and concentration of the corrosive chemical.

The following general guidelines should be followed for procedures involving acids and bases:

- a. Never pour water into acid. Slowly add the acid to the water and stir.

- b. Open bottles or carboys slowly and carefully, wearing protective equipment to guard hands, face, and body.
  - c. OSHA requires suitable facilities, such as a safety shower and eyewash, to be located within the work area. The American National Standards Institute (ANSI) recommends that the safety shower and eyewash be within 100 feet of the work area for quick drenching or flushing of the eyes and body.
- NOTE: Eyewash stations and Showers should be flushed on a monthly basis by laboratory personnel. Eyewash stations and showers are tested quarterly by company personnel.
- a. Procedures requiring the use of concentrated acids and bases must be conducted in a fume hood.
  - b. Never mix acid wastes with other materials such as solvents, metal contaminated solutions, etc. Noncontaminated acid wastes can be easily disposed by neutralization.
  - c. When disposable containers are completely emptied of their contents, flush them thoroughly with water before throwing them away.
  - d. Never dispose of acids or bases in the sanitary sewer system (i.e., down the drain) until neutralized (pH 6.0-8.0). Neutralization may be conducted in the laboratory when included as part of an experiment, and should be conducted in a fume hood. The solution should then be poured slowly down the drain with copious amounts of water; i.e., leave the water running for approximately 5 minutes.
  - e. Contact CHO for assistance with disposal of large quantities (more than 1 gallon or 1/2 pound) of acids and bases.
  - f. The laboratory should have access to a spill kit that includes acid and base neutralizer; Never use combustible organic materials (sawdust, excelsior, wood scraps and shavings, paper, rags, or burlap bags) to absorb or clean up spillage.

Compressed Gas Cylinders (Compressed Gas Standards)

Receiving and Storage

- a. Arrange a return agreement with suppliers prior to purchase.
- b. Ensure laboratory door placard is current each time gases are received.
- c. Cylinder contents must be clearly labeled. Color code does not constitute adequate labeling
- d. Valve caps shall be in place any time that the cylinder is not connected to a regulator.
- e. Always transport cylinders with valve caps securely in place.
- f. Do not accept cylinders which are damaged, not clearly labeled, or do not have a valve protection cap.
- g. Keep oxygen cylinders a minimum of twenty feet from flammable gas cylinders or combustible materials. If this can not be done, separation by a non-combustible barrier at least 5 feet high having a fire rating of at least one-half hour is required.
- h. Components used for other gases and purposes must never be interchanged.
- i. Cylinders, upon filling, should have a current hydrostatic test date (normally less than 5 years old for steel and 3 years old for aluminum) engraved on the cylinder.
- j. All gas cylinders shall be secured in an upright position with upper and lower restraints in racks, holders, or clamping devices. The lower restraint may be exempted only if impractical. When

- k. Do not place cylinders near heat, sparks, or flames or where they might become part of an electrical circuit.
- l. Do not store cylinders in exit or egress routes.
- m. Store cylinders in a well-ventilated area.

Handling and Use

- a. Wear sturdy shoes (no open-toed, sandals, etc.) when engaging in moving or transporting cylinders.
- b. Use a cylinder cart and secure cylinders with a chain during transport.
- c. Only Compressed Gas Association (CGA) fittings and components are permitted for use with gas cylinders. Only use regulators approved for the type of gas in the cylinder. Do not use adapters to interchange regulators.
- d. Gas lines must be labeled. Color-coding is not allowed.
- e. Contents of the cylinder must be visibly labeled as installed including hazard class (i.e., poison, flammable, inert, etc.). The label facing the wall is not acceptable.
- f. Ensure all connections are tight via leak testing. Cylinders, connections, and hoses should be checked regularly for leaks. Use a flammable gas leak detector (for flammable gases only) or soapy water, or a 50% glycerin-water solution and look for bubbles. At or below freezing temperatures, the glycerin solution should be used instead of soapy water.

NOTE: When the gas to be used is a flammable oxidizing or highly toxic gas, the system should be checked first for leaks with an inert gas (helium or nitrogen) before introducing the hazardous gas.

- g. Leak tests must be witnessed by a third party (e.g., Safety Coordinator or designee, safety committee representative, etc.) and logged.
- h. When a special wrench is required to open a cylinder or manifold valve, the wrench shall be left in place on the valve stem when in use; this precaution is taken so the gas supply can be shut off quickly in case of an emergency. Nothing shall be placed on top of or near a cylinder that may damage the safety device or interfere with the quick closing of the valve.
- i. Open cylinder valves slowly and away from the direction of people (including yourself). Never force a gas cylinder valve. If the valve cannot be opened by the wheel or small wrench provided, the cylinder should be returned; do not attempt to repair a cylinder valve or regulator yourself.
- j. No attempt shall be made to transfer gases from one cylinder to another, to refill cylinders, or to mix gases in a cylinder in the laboratory.
- k. Keep cylinder valves, regulators, couplings, hoses, and apparatus clean and free of oil and grease.
- l. Compressed gases must not be used to clean your skin or clothing.
- m. Never heat cylinders to raise internal pressure.
- n. Use flashback connectors and reverse-flow check valves to prevent flashback when using oxy-fuel systems.
- o. Regulators must be removed when moving cylinders, when work is completed, and when cylinders are empty.

- p. Do not use copper (>65%) connectors or tubing with acetylene. Acetylene can form explosive compounds with copper, silver, and mercury.
  - q. Always leave at least 30 psi minimum pressure in all Empty cylinders.
  - r. Label all cylinders when "Empty". All cylinders are to be considered full unless labeled as empty by the user. Empty cylinders must be returned to the supplier and not accumulated.
  - s. Do not leave an empty cylinder attached to a pressurized system.
- NOTE: Sumitomo Dainippon Pharma Oncology discourages the use of lecture bottles if other cylinders are available. Lecture bottles are very difficult to dispose of and they use universal threads and valves (some of which are interchangeable), thus increasing the potential for unintentional mixing. If lecture bottles are used, label all associated equipment with the gas name to prevent unintentional mixing.



REV	DATE	DESCRIPTION
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VCBO NUMBER: 21560  
CLIENT NUMBER:  
DATE: JULY 27, 2021