

Evaluating the Fire Resistance of the Proposed Fire Barrier Wall for Highest Honor

A fire barrier (wall) is proposed to be installed between Zones C & D of the proposed renovations of the building at 34713 Dequidre Rd., Troy to isolate the northernmost 1000 sq. ft. for a separate tenant, which may have a different occupancy classification. The occupancy classification of Highest Honor is “F-1” and the likely occupancy classification for the separate tenant is likely to be “B” or “M”. Although code does not require a wall with a 2-hour fire resistance rating it is desired. See table 508.4 of the Michigan Building Code (MBC).

Methods for Determining Fire Resistance

According to section 703.3 of the MBC, there are six methods for determining fire resistance (see inset).

Normally, the easiest approach would be to find documentation of a design in an approved source or from an approved agency (methods #1 or #6). That is not possible in this situation because of the 5” steel poles

703.3 Methods for determining fire resistance.

The application of any of the methods listed in this section shall be based on the fire exposure and acceptance criteria specified in ASTM E119 or UL 263. The required *fire resistance* of a building element, component or assembly shall be permitted to be established by any of the following methods or procedures:

1. Fire-resistance designs documented in approved sources.
2. Prescriptive designs of fire-resistance-rated building elements, components or assemblies as prescribed in Section 721.
3. Calculations in accordance with Section 722.
4. Engineering analysis based on a comparison of building element, component or assemblies designs having *fire-resistance ratings* as determined by the test procedures set forth in ASTM E119 or UL 263.
5. Alternative protection methods as allowed by Section 104.11.
6. Fire-resistance designs certified by an approved agency.

which carry the load of the wall overhead and the ceiling. That precise configuration is too unique to ever appear in an approved source. The same is true for the prescriptive designs in Section 721 of the code (method #2).

The *Component Additive Method* cited in Section 722 is a simple and logical approach; unfortunately, 722.6.1.1 prevents that method from ever producing a rating higher than 1 hour for wood assemblies. Even so, there are many documented wood assemblies which have qualified for a rating higher than 1 hour (e.g., Item Number 14-1.5 in Table 721.1(2) has a rating of 2 hours).

722.6 Wood assemblies.

The provisions of this section contain procedures by which the *fire-resistance ratings* of wood assemblies are established by calculations.

722.6.1 General.

This section contains procedures for calculating the *fire-resistance ratings* of walls, floor/ceiling and roof/ceiling assemblies based in part on the standard method of testing referenced in Section 703.2.

722.6.1.1 Maximum fire-resistance rating.

Fire-resistance ratings calculated for assemblies using the methods in Section 722.6 shall be limited to a maximum of 1 hour.

Method #4 suggests “engineering analysis” based on relevant comparisons to assemblies that have been tested by approved methods. The remainder of this treatise will pursue that line of argument, supporting the proposed rating of 2 hours based on comparisons to similar tested designs and based on Harmathy’s 10 Rules of Fire Resistance Ratingⁱ.

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“Fire Resistance” is the period of time a building element, component or assembly maintains the ability to confine a fire, continues to perform a given structural function, or both. In this case, the barrier would keep fire from passing from one Zone to the other. Because the fire barrier portion of the wall is not load-bearing, it provides no structural function.

A specific fire barrier wall design is proposed (see Figure 1). The Type X gypsum will be installed vertically, with staggered joints that fall only on studs.

Already located in the wall line are 5” steel poles which support the wall above and ceiling weight. The wall is proposed to encapsulate those poles.

Comparisons

The proposed wall has a key element that is found in many wall designs rated for 2 hours or more: it has 2 layers of 5/8” Type X drywall on the wall surface. An example is Design No. U301ⁱⁱ.

A good demonstration of this point is found in the Gypsum Assemblies Library on the Georgia-Pacific website. They list 3 variants of wood-framed wallsⁱⁱⁱ, all with the two layers of Type X gypsum, all with a 2-hour fire resistance rating, and which span a significant range of wall widths and stud arrangement. The proposed design falls within that design range, and on that basis should also be rated as 2 hours.

Beyond that, the design adds mineral insulation on one side (added for the sound deadening benefit). Because the insulation is not intended for both sides of the wall, it does not officially contribute to the resistance rating. Also added is a 3/8” layer of drywall in the center behind the insulation, to restrict and protect the position of the insulation. Both additional layers should improve the wall’s actual fire resistance (see Harmathy’s Rule #1), although maybe not significantly. Separately, 3/8” gypsum has been finish rated at 10 minutes.^{iv}

The steel pole is not considered in the cited designs, but is effectively being covered with a 2-hour fire protection. Because it is in the center of the wall, more than ½” from the gypsum, it should have little effect on the actual fire resistance (see Harmathy’s Rule #5).

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ⁱ Ten Rules of Fire Resistance Rating <http://media.iccsafe.org/store/2015Handbook/TenRules.pdf>

ⁱⁱ Ultimate Fire Wizard <http://database.ul.com/cgi-bin/ulweb/LISEXT/1FRAME/FireResistanceWizard.html#>

ⁱⁱⁱ Gypsum Assemblies Library <http://www.buildgip.com/GypsumAssemblies.aspx?ShowAll=True>

^{iv} Table 1.5.1, continued (Finish Ratings—Inorganic Materials), pg. 96 <http://www.preservationnation.org/resources/disaster-recovery/additional-resources/HUD-Guidelines-on-Fire-Ratings-of-Archaic-Materials-and-Assemblies.pdf>

Figure 1: Proposed fire barrier design cross section

