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ABSTRACT:
Steel pipe and tubing are often considered interchangeable in railing specifications. There are some important differences that make tubing more appropriate for most applications.

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REFERENCES:
ASTM A53/A53M Standard Specification for Pipe, Steel, Black, and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A500/A500M Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A513/A513M Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing

Steel Tubing vs Pipe for Railings

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Background

Pipe and tube are the same thing - hollow metal cylinders - right? Well, not exactly. Yes, they're both hollow metal cylinders, but there are specific standards and uses for each of them.

Most architectural details showing stair railing assemblies call out those railings as steel pipes, and they typically indicate an outside diameter for the railings. MasterSpec's specification section 05 52 13 "Pipe and Tube Railings" allows specifiers to interchange the two at will. So why would you pick one over the other? What's really the difference?

Steel Pipe

Pipes are tubular vessels intended to transport fluids or gases. The current specification for steel pipe is ASTM A53, which categorizes pipes by type and by grade. The types refer to the method by which the pipes are fabricated. Types F and E have a welded seam, while Type S is seamless. The grades refer to the chemical makeup of the steel alloy and thereby the tensile and yield strength. Most of the testing required by ASTM A53 concerns the pressure capacity of pipes.

The type and grade is not typically a part of a pipe railing specification. Pipe railings are typically Type S - Seamless, because this type of pipe can be bent. Rather than type, pipes are specified by NPS (nominal pipe size), a number referring to the nominal outside diameter of the pipe that is different from the measured outside diameter.

They are also specified by the Schedule number, either 40 or 80, referring to the wall thickness of the pipe. The nominal pipe size designation is used so that any pipe of the same NPS, no matter the wall thickness or type, can be joined by standard fittings designed for that pipe size.

For the purpose of railing design, it is important to remember that a pipe's nominal size is *not* its exact outside diameter. ADA and ICC accessibility codes require the gripping size of handrails be 1-1/4 inch to 1-1/2 inch across. Specifying a 1-1/4 inch Schedule 40 pipe does not comply with code because the actual outside diameter of the pipe is 1.660 inches. To pick the desired size pipe, designers must refer to the ASTM A53 chart and verify the actual diameters.

Pipe fabrication tolerance is also not ideal for handrails, which are required to be smooth, continuous gripping surfaces. Two lengths of pipe of identical specification may differ in outside diameter up to 1/64 inch, enough to catch someone's hand.

Steel Tubing

Tubing, unlike pipe, is generally used for structural purposes, and is made round, rectangular or square. The specification for structural tubing is ASTM A500, which includes uses for tubes as columns, stringers, beams, and other structural fabrications, but is available in railing sizes as well. The greater strength of structural tubing can be a benefit in allowing railings to span further or support greater loads.

The specification for non-structural tubing is ASTM A513. The primary difference between the standards is that ASTM A500 primarily focuses on the strength of the product, while ASTM A513 focuses on fabrication tolerance. For that reason, railing specifications typically rely on ASTM A513, though even non-structural steel tubing typically has greater structural capacity than steel pipe.

Whether structural or not, the size of a tube always exactly expresses its outside diameter or dimensions. A 1-1/4 inch round tube will always have an OD of exactly 1-1/4 inches, and adjusting the wall thickness only changes the inside diameter.

This is useful not only for railings, but for knowing what size structural tube will fit within a concealed space. For example, a 3.5 by 3.5 inch structural tube will always fit in a stud cavity, and by increasing the wall thickness the load-bearing capacity of the tube can be sized to meet the requirements.

The manufacturing tolerances for ASTM A513 tubing are significantly tighter than those provided for pipe. Where pipe is allowed to vary in diameter by 1/64 inch, tubing is tight to within 1/200 inch. The standard specification for tubing also has very strict required tolerances for roundness, straightness, smoothness, and finish, all of which are beneficial, especially for ornamental railings.

Specifying Railings

Given these differences in the products, tubing railings have significant advantages over those made from pipe, and should be specified in most situations, particularly where railing size and appearance are critical.

For enclosed egress stairs that are not highly finished, it may be acceptable to use pipe rails if other factors come into play, such as cost and availability. Pipe may be more readily available if it's stocked by local fabricators, and it may be less expensive per unit of length.

Pipe's lower strength may negate this possible saving if more rail supports must be used or if the pipes must be reinforced. This variable may not be resolved until the engineering design is completed; if the railing design is delegated to the contractor, it will appear on shop drawings. At that point switching between tubing and pipe may not be feasible.

Bending Railings

MasterSpec includes several methods for fabricating changes in directions in steel railings: bending to a radius, and flush (sharp angle) bends. Flush bends are made by cutting railings at an angle and fitting them together, then welding around the seam. They can also be made using a prefab-ricated connector. Radius bends can be made by bending railings on a bending machine or by using a connector.

Example of flush bend connector.

There is no functional or code compliance advantage to going with flush bending or radius bending; it is strictly an aesthetic design choice, though flush bends may be more labor intensive to fabricate and therefore more expensive.

Conclusion

If you are handed a length of hollow cylindrical metal, it may be possible to tell if it's tube or pipe without measuring, but only if the walls are very thin. Otherwise, the two products look nearly identical.

Both pipes and tubes can be galvanized and painted for a finished appearance. Both can be bent to precise radii and welded cleanly. But only tubing is made with tight tolerances that can make a big difference when appearance matters, and when specifying the exact size of the railing is important.

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