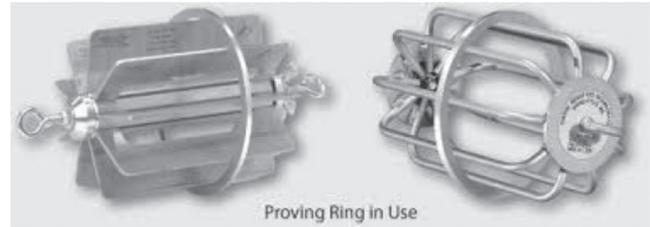


## WisDOT required deflection testing for polyethylene and polypropylene pipe installations

- A WisDOT approved mandrel must be used for testing.
- Deflection testing will be performed as directed by the engineer.
- 100% of installed pipe 24" or greater shall be tested.
- For pipe less than 24" in diameter, at least 10% of the installed pipe shall be tested.
- Pipe that does not pass mandrel testing shall be relayed or replaced.

- Ideally, mandrel testing should be performed 30 days after installation.



### Standard Specification 520 – Pipe Culverts

**520.3.7 Increase deflection testing for polyethylene and polypropylene pipe culverts. ASP 6 June 2020 let.**

#### 520.3.7 Deflection Testing

1. The department accepts polyethylene and polypropylene pipe based on testing with a department approved mandrel. Test pipe as the engineer directs after installation but before paving or finish grading.
2. Provide a mandrel with a diameter equal to 92.5 percent of the pipe's nominal diameter and having cable attachment points on each end of the core. Ensure that the mandrel has nine fins or legs permanently marked to designate the pipe size and the allowable percent deflection.
3. Test 100 percent of the installed length of pipe 24 inches or greater in diameter. Ensure that the mandrel passes through the entire section in one pass when pulled by hand without using excessive force. If the designated length of pipe fails, the engineer may require additional testing.
4. For pipe less than 24 inches in diameter, the engineer will designate at least 10 percent of the installed length of pipe for testing. The mandrel must pass through the entire section in one pass when pulled by hand without using excessive force. If the designated length of pipe fails, engineer may require additional testing.
5. Relay or replace pipe that does not pass deflection testing. Retest all relayed or replaced pipe.

### Standard Specification 608 – Storm Sewer

**608.3.7 Increase deflection testing for polyethylene and polypropylene storm sewer. ASP 6 June 2020 let.**

#### 608.3.7 Deflection Testing

1. The department accepts polyethylene and polypropylene pipe based on testing with a department approved mandrel. Test pipe as the engineer directs after installation but before paving or finish grading.
2. Provide a mandrel with a diameter equal to 92.5 percent of the pipe's nominal diameter and having cable attachment points on each end of the core. Ensure that the mandrel has nine fins or legs permanently marked to designate the pipe size and the allowable percent deflection.
3. Test 100 percent of the installed length of pipe 24 inches or greater in diameter. Ensure that the mandrel passes through the entire section in one pass when pulled by hand without using excessive force. If the designated length of pipe fails, the engineer may require additional testing.
4. For pipe less than 24 inches in diameter, the engineer will designate at least 10 percent of the installed length of pipe for testing. The mandrel must pass through the entire section in one pass when pulled by hand without using excessive force. If the designated length of pipe fails, engineer may require additional testing.
5. Relay or replace pipe that does not pass deflection testing. Retest all relayed or replaced pipe.

# WisDOT Pipe Deflection Testing Requirements



(Continued from page 1)

## Construction and Materials Manual 615 – Storm Sewer

### 615.7 Deflection Testing for Polyethylene and Polypropylene Pipe

Mandrel Testing is required for all polyethylene and polypropylene pipe culverts and storm sewers. Standard spec 608.3.7 and 550.9 describe the requirements for mandrel testing. If deflection testing fails or significant construction issues occur with polyethylene and polypropylene pipe, please notify the statewide drainage engineer in the Central Office Roadway Standards Development Unit.

## Construction and Materials Manual 550 – Pipe Culverts

### 550.9 Increase deflection testing for polyethylene and polypropylene pipe culverts and storm sewer.

### 550.9 Deflection Testing for Polyethylene and Polypropylene Pipe

Deflection testing is required for all polyethylene and polypropylene pipe culverts and storm sewers. Mandrels are used to test flexible pipes for variations in manufacturer tolerance, pipe roundness and deflection both from misaligned joints and backfill and construction loads.

Mandrels are typically manufactured from steel or aluminum and have nine legs (fins). Fins can be fixed or removable (figure 550-2). Mandrel kits with removable sets of fins can be used to test a variety of pipe sizes. Mandrels should be made available from the contractor, pipe supplier or manufacturer. The project engineer must approve the mandrel before testing. The mandrel must have nine fins or legs permanently marked to designate the nominal pipe diameter and mandrel diameter. Required mandrel size is shown in table 550-1.

### Typical Fixed and Removable Fin Mandrels (FIGURE 550-2)

The required mandrel is 92.5% of the nominal pipe diameter. This size mandrel accounts for 5% allowable deflection from installation plus allowable manufacturing tolerances. Unlike reinforced concrete pipe, polyethylene and polypropylene pipes are flexible and will deflect under load

without compromising their integrity. The department required mandrel size accounts for these material specific conditions. Table 550-1 lists the minimum allowable mandrel size for testing polyethylene or polypropylene culvert or storm sewer. Mandrels labeled ASTM F679 or ASTM D3034 are intended for PVC gravity sewer and may be smaller than the minimum sizes in table 550-1 and, if so, should be rejected.

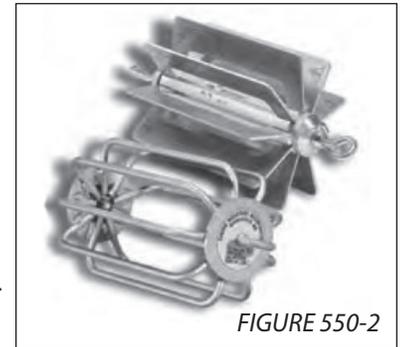


FIGURE 550-2

### Minimum Required Mandrel Size

Acceptable mandrels should be permanently labeled, at a minimum, with the nominal pipe diameter and the mandrel diameter. As a spot check, or if the mandrel appears otherwise questionable, the size can be verified by measurement using the values in table 550-1 as a guide. Fixed fin mandrels could be verified by flexible tape or by proofing ring. Removable fin mandrels can be checked by measuring two removable fins laid adjacent to one another and adding a constant width representative of the fixed base. The mandrel manufacturer should be able to supply the fixed base constant width.

Nominal Pipe Inside Diameter (inches)	Minimum Mandrel Outside Diameter (inches)*
12	11.10
15	13.88
18	16.65
21	19.43
24	22.20
27	24.98
30	27.75
36	33.30

TABLE 550-1 Minimum Required Mandrel Size

\* Values include both allowable manufacturing tolerances and allowable installed deflection.



(Continued on page 3)

(Continued from page 2)

## Construction and Materials Manual 550 – Pipe Culverts (cont.)

The percentage of pipe that requires mandrel testing, based on size, is specified in standard spec 520.3.7 for culvert pipe and in standard spec 608.3.7 for storm sewer. Where less than 100% testing is required, the project engineer, not the contractor, designates where and how much pipe to test. The engineer should concentrate testing on larger diameter pipe, critical locations, areas of poor soils, and areas where contractor installation methods were questioned or not fully observed.

Pipe is tested after installation but before paving or finish grading. Waiting as long as practical, ideally 30 days when not in conflict with scheduled paving operations, to mandrel test is advised to allow deflection development in the pipe from embankment loading. The mandrel is pulled through the entire pipe section in one pass when pulled by hand without using excessive force. If the designated length of pipe fails, the project engineer may require additional testing in addition to the initial designation. Pipe that does not pass deflection testing needs to be re-laid or replaced and retested.

If deflection testing fails or significant construction issues occur with polyethylene and polypropylene pipe, the engineer should notify the statewide drainage engineer in the central office roadway standards development unit.

## Trench Width

### Standard Specification 608.3.1.1(4)

### Standard Specification 520.3.1(4)

For concrete pipe, make the trench wide enough to allow for preparing the foundation, laying the pipe, and placing and compacting backfill, except that the trench width shall not exceed the pipe's outside diameter by more than 36 inches. For polyethylene and polypropylene pipe, conform to ASTM D2321 and ensure that the trench is as wide or wider than the pipe outside diameter plus 16 inches or the pipe outside diameter times 1.25 plus 12 inches whichever is wider.

## Fill Heights

### FDM 13-1 Attachment 25.2 Fill Height Table

Corrugated polyethylene and corrugated polypropylene pipe in these diameters are available for use under the Class III-A and Class III-B bid items as specified in FDM 13-1-15 and FDM 13-1-17. Minimum fill height shall be 24 inches and maximum fill height shall be 11 feet for polyethylene (Class III-A) and 15 feet for polypropylene (Class III-B). It is not necessary to specify thickness for polyethylene or polypropylene pipe.

## Use of Trench Boxes

### Construction and Materials Manual 615.2

In addition to the trench width limitations stated above, the contractor should excavate the trench below the top of pipe as vertical as possible when the final height of the proposed fill above the top of the pipe will exceed 6 ft. Sliding the trench box or shoring to a new location in the excavation, especially with polyethylene and polypropylene pipe, should be avoided unless special measures are taken to avoid disturbing the pipe and backfill or leaving voids as the shield is advanced. Such measures may include; using a subtrench, lifting the trench box during pipe installation to both conform with OSHA requirements and to properly backfill and compact the soil around the pipe, or other manufacturer approved methods. While following proper worker safety requirements, the trench box or shoring should be properly removed, and the resulting voids backfilled and compacted.

(Continued from page 3)

## Other Considerations

### 550.4 Storage and Handling of Pipe

Pipe delivered to the project site should be handled, and if not immediately installed, stored in a manner to prevent potential damage. Staging and storage areas should be flat, free of large rocks, rough surfaces, and debris. Storage areas should also be out of the way of construction traffic. Palletized pipe should remain on the pallet for jobsite storage. Consult manufacturer data for recommendations or prohibitions regarding stacking of loose pipe. Pipe gaskets, if provided should be protected from harmful substances such as dust and grit, solvents, and petroleum-based greases and oils. Some gaskets may need to be protected from sunlight (consult the manufacturer). Although often treated with black carbon and potentially other UV stabilizers, long term uncovered storage of polyethylene and polypropylene pipes on the jobsite may warrant reconsideration.

Polyethylene and polypropylene pipes should not be handled with chains. Individual lengths of pipe can typically be handled using a nylon sling or cushioned cable secured around the third points of the pipe.

Consult the manufacturer data for specific handling and storage requirements or additional information.

### FDM 15.2 Selection Standard

The four subclasses of Class III-A and Class III-B culverts, steel culverts and thermoplastic culverts are not allowed under Interstate Highways or divided US Highways unless for temporary use or at maintenance crossovers in the median.