

## JOINT RESTRAINT OPTIONS FOR PVC PIPE

### THRUST FORCES

Internal pressure causes longitudinal thrust forces in a piping system. Joint restraint or concrete thrust blocking should be provided to prevent movement of pipe, fittings, or appurtenances in response to these thrust forces. This document will focus on joint restraint rather than thrust blocking.

Thrust forces are developed at:

- Changes in direction at fittings (tees, bends, elbows, and crosses)
- Changes in pipe size (reducers)
- Dead ends (end caps, closed valves, and hydrants)

Joint-restraint design depends on:

- Pipe size
- System pressure (including field-testing pressures)
- Type of fitting or appurtenance
- Line profile (horizontal or vertical bends)
- Soil type
- Depth of cover

### TRENCHLESS CONSTRUCTION

Joint restraint is also necessary for installing pipe in trenchless applications. Restrained joints are necessary for:

- Pulling methods – to prevent pull-apart during pulling operations (e.g., horizontal directional drilling)
- Pushing techniques – to prevent over-belling during pushing operations (e.g., installing pipe through casings)

Trenchless joint-restraint design depends on the forces required to install the pipe. Information on how to calculate estimated forces, safe allowable stresses, and restrained-joint capacities may be obtained from the manufacturer or technology provider of the particular PVC pipe and restrained joining method used.

### RESTRAINT TYPES

Restraint methods fall into two broad categories:

- External joint-restraint devices (e.g., bell harness)
- PVC pipe restraint products:
  - \* Internally restrained gasketed joint
  - \* Spline-lock gasketed joint
  - \* Pin-and-groove gasketed joint
  - \* Butt-fused joint

### DESIGN

The purpose of restrained pipeline design is to determine the minimum length of restrained pipe necessary to safely distribute the thrust force to the adjacent soil. Computer programs are available to calculate required restrained lengths and guide the user to suggested configurations. [Click here](#) for thrust restraint calculation website. For the PVC pipe restraint products listed above, design methods are available from the manufacturers of the products.

*References:* Chapters 11 and 13; *Handbook of PVC Pipe*, Uni-Bell, and “Restraint Length Calculator Version 7.0,” EBAA Iron