

# CRACK PROPAGATION TEST REPORT & FINDINGS

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## MUNICIPAL PIPING SYSTEMS

### FUSIBLE BRUTE™

#### Objective:

Testing and analysis were performed to evaluate crack mode and propagation during excavation of 6" DR18 Fusible PVC™ pipe that was stressed in accordance with manufacturers' allowable bending radii and internal pressure requirements.

#### Setup:

A semi-circle of radius 144 feet (43.9m) was marked out in accordance with manufacturers recommended minimum bend radius for 6" DR18 C900 Fusible PVC™ pipe, a trench of four feet deep was then excavated using a Takeuchi TB-070 back hoe. 90% compaction of the 6" 2B limestone bedding and 18" 2B limestone cover was accomplished with a Mikasa 2250 compactor. The remaining trench depth was backfilled with topsoil and compacted with the Takeuchi TB-070. The seventeen (17) fusion welds placed intermittently along a 140' (42.7m) length of pipe were performed by a qualified fusion technician using a modified McElroy fusion machine and data-logger for fusion joint data recording. Six (6) corporation stops of 3/4" diameter were also connected to the fused pipe at varying intervals as close as 15" (375mm) within fusion joint locations. The pipe was then capped using standard MJ PVC caps and restraining mega lugs, filled with water, and finally placed under 100psi internal static pressure. See Photos 1 through 3.

#### Procedure:

Crack mode and propagation was tested by excavating a portion of the curvilinear pipeline and simulating an accidental impact using the TB-070 bucket. Seven tests were conducted in regular length intervals along the 140' length of pipe, with some of the impacts occurring on or near fuse joints and/or near corporation stops. Crack mode and length of propagation was recorded for each test and the damaged pipe was removed before the line was capped, filled, and pressurized before each new test.

#### Results:



Photo 1: Open cut trench



Photo 2: Six 3/4" taps and seventeen fusion joints were installed.



Photo 3: Bedded and covered pipe was capped, filled and pressurized.

TEMNFPIPO90103R

Table: Test Results

Test Number	Internal Pressure (psi)	Crack Length (inches)	Crack Modes Radial/linear/crushed	Location Of Impact On Pipe Alignment
1	100	53"	Crushed at impact then linear and radial away from impact	3' from tap and 6' from fusion joint
2	100	48"	Crushed at impact then linear and radial away from impact	Centered between 2 taps and 2 fusion joints over a 7' length
3	100	64"	Crushed at impact then linear and radial away from impact	Less than 2' from fusion joint
4	100	36"	Crushed at impact then linear and radial away from impact	No Fusions or Taps within 15'
6	100	60"	Crushed at impact then linear and radial away from impact	5' from fusion joint
7	100	32"	Crushed at impact then linear and radial away from impact	No Fusions or Taps within 15'

See over for Table of test results and corresponding photos.

**Analysis:**

Observing crack mode and propagation of the 6" DR18 C900 Fusible PVC™ suggests several interesting conclusions.

- Under the recommended bend radius, stress and internal pressure, crack propagation is most likely limited to impact area and magnitude.
- The existence of taps, valves, fusion joints and/or fittings appear to aid in stopping crack propagation
- Proper bedding and cover compaction may reduce propagation.

In order to confirm the test results, an additional test done at 200psi internal pressure was conducted to determine the effect of net forces on the pipe during impact. Crack propagation reached an overall length of twelve feet; however, since the internal pressure was well above the rated working pressure of 150psi for 6" DR18, the results were not listed in the table. This result further implies that when Fusible PVC™ is stressed under manufacturers recommended specifications, there is no reason to assume that crack propagation propensity is increased or that cracks could 'run' more than five or six feet.

It should also be noted that several tests did produce results of crack propagation through a fusion joint, however there was no evidence that could support a claim that a crack could propagate through several full length sticks of properly fused pipe, as long as the Fusible PVC™ pipe is installed according to manufacturer's specifications and manufactured according to the manufacturer's formulation.



Impact test 1



Impact test 2



Impact test 3



Impact test 4



Impact test 6



Impact test 7

