Hydrostatic Test Considerations

Bill Maxey

Kiefner and Associates, Inc.

Environment

- Water Availability
- Leak Detection Additives
- Water Removal, Processing, and Disposal
- Permits
- Residual Pipeline Contaminants that May Dissolve in Hydrotest Water

Scheduling

- Product Shipper
- Product Receiver
- Storage Availability
- Weather
- Landowner Contacts
- Potential Crop Damage

Contractor Logistics

- Test Crew
- Leak Detection Crew
- Rupture Location Crew
- Dig-out and Repair Crew
- NDT Crew

Company Logistics

- Personnel Located at Valves
- Personnel Located at Road Crossings
- Hydrotest Procedure
- Isolate Test Sections
- Pretest Replacement Pipe
- Personnel to Contact Landowners
- Motels Scheduled for Affected landowners
- Management Coordination

Technology

- Gelblocks to Seal Gate Valves
- Freeze Plugs to Section Pipelines
- Trained Dogs to Detect Small Leaks from Special Additives in the Hydrotest Water

Reasons for Testing

- New Construction
- Retest of Existing Pipelines
- Testing to Control Time-Dependent Defect Growth

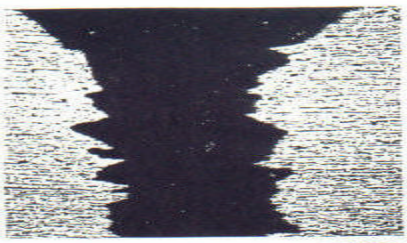
lydrostatic Test Parameters

- Test Pressure to Operating Pressure Ratio
- Hold Time
- Elevation Differences
- Test Section Length
- Maximum Test Pressure Level
- Data Recording

Research Findings

- Most Flaw Growth During Hold Time Occurs Within 2 Hours
- Pressure Reversals are Caused by Crack Growth Induced on a Previous Pressurization
- Deep Flaws Grow Faster than Shallow Flaws
- Deep Flaws Show Greater Tendency to Exhibit Pressure Reversals
- Lowering Test Pressure to 90 or 95 Percent o Maximum Limits Flaw Growth

Flaw Growth



a. 1F602

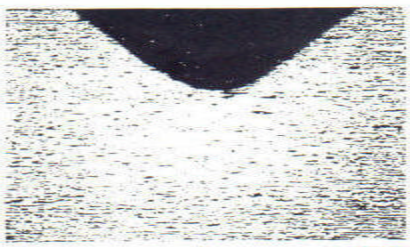
Defect No. 1. Failure (Leak)
(L x d, 4.4 x 0.195 inch)

b. 1F603

Defect No. 2. 97 Percent of
Failure Stress Level
(4.4 x 0.171 inch)

c. 1F604

Defect No. 4. 94 Percent of
Failure Stress Level
(4.4 x 0.142 inch)

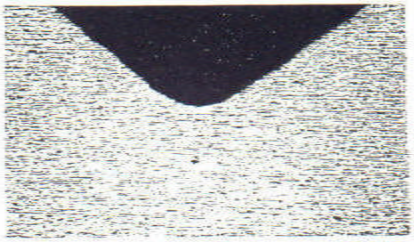


d. 1F605

Defect No. 4. 91 Percent of
Failure Stress Level
(4.4 x 0.125 inch)

e. 1F606

Defect No. 5. 89 Percent of
Failure Stress Level
(4.4 x 0.101 inch)



f. 1F607

Defect No. 6. 87 Percent of
Failure Stress Level
(4.4 x 0.078 inch)

FLAW GROWTH IN 4.4-INCH-LONG PART-THROUGH FLAWS IN 36 X 0.390-INCH X60 PIPE

Note: Loading consisted of —
1st cycle — 0 → 1330 psig with 30 sec hold
2nd cycle — 0 → 1300 psig with 30 sec hold
3rd cycle — 0 → 1230 psig with 30 sec hold

Failure Pressure Curve

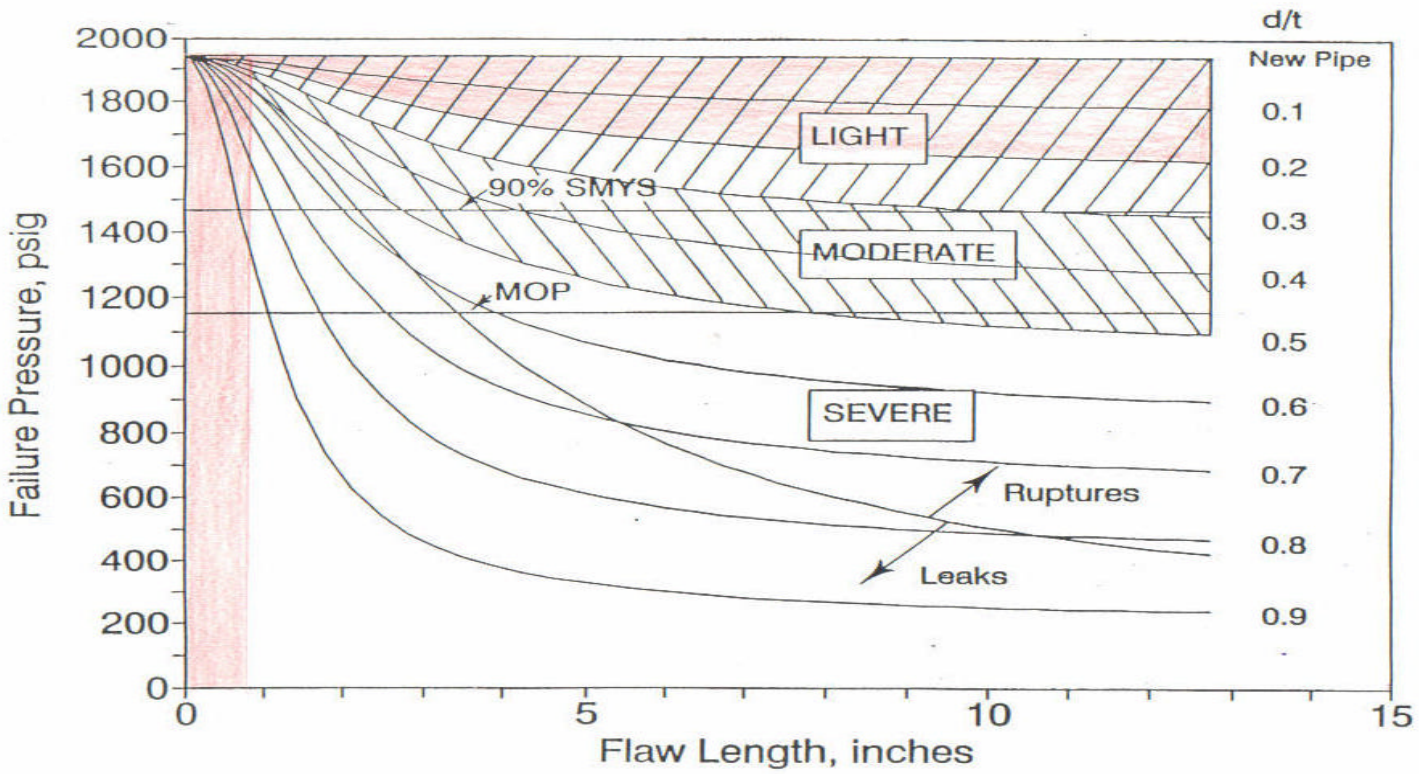


FIGURE 5. SIZES OF FLAWS LOCATED BY IN-LINE INSPECTION (CORROSION)
(16 INCH BY 0.250 INCH, X52, BLUNT DEFECTS)

Recommendations

- Test to the Maximum Pressure for a Short Time and Reduce to 0.9 times P_{max} for Leak Checks and Hold Periods as Desired or Required
- Avoid Large Test Pressure Cycles if Possible
- Optimum Value of Test Pressure Depends on Depths, Lengths, Numbers, and Distributions of Flaws