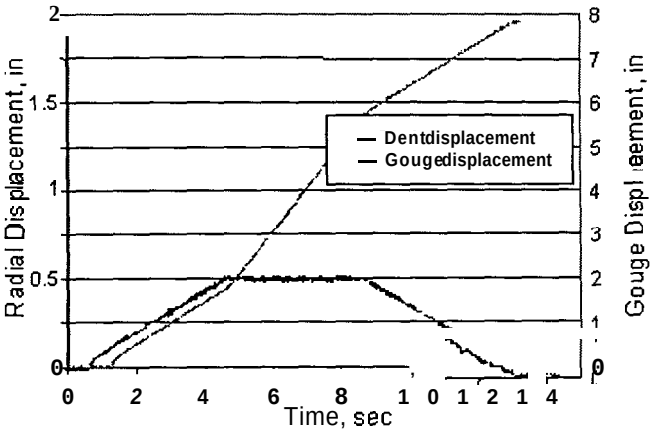
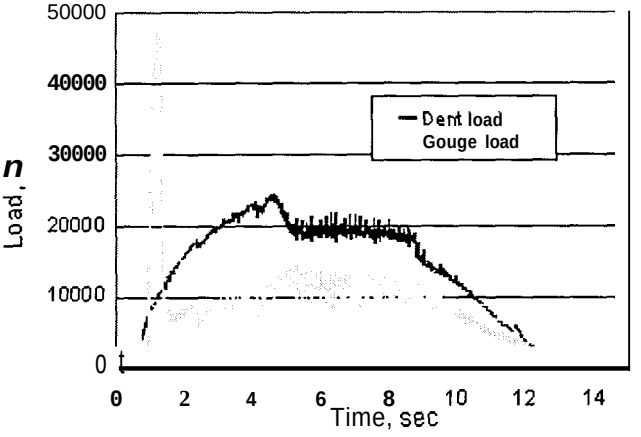
Load-Time-DeflectionMeasurements

A typical displacement-time plot is shown at right. The blue curve represents the radial or denting displacement, which reached a maximum of 0.5 inches (2% of the pipe diameter). The purple curve represents the axial or gouging displacement. Initially, the indentor moved in as it was moving along the pipe. Then, the indentor moved along the pipe without changing depth. Finally, the indentor moved out as it continued to move along the pipe. The time required to make this defect was roughly 13 seconds, and its overall length is 8 inches.

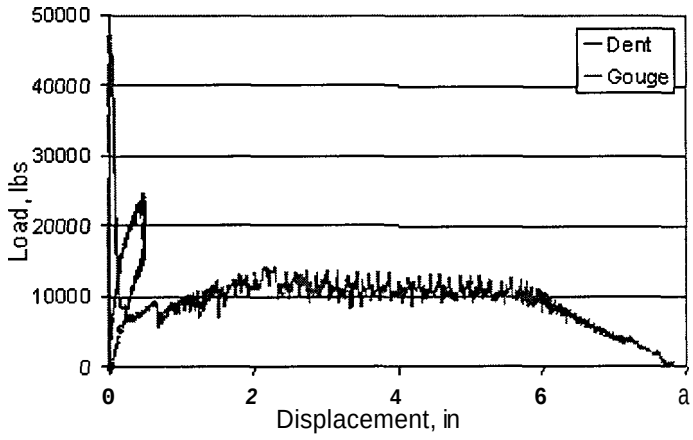


The load-time plot corresponding to the above displacement-time plot is shown at right. The radial or denting force is shown in green, and the axial or gouging force is shown in light blue.



The denting force is relatively well behaved. The denting force increases as the indentor moves into the pipe, reaching a maximum of around 24,000 pounds. The load drops to around 20,000 pounds as the indentor is moving along the pipe. Afterwards, the load decreases as the indentor is removed. The denting force is not constant during the middle portion of the gouge. The variation in denting force indicates that a "slip-stick" or chatter action is taking place. Slip-stick is a process where the indentor grabs the pipe, then jerks forward as metal gives way.

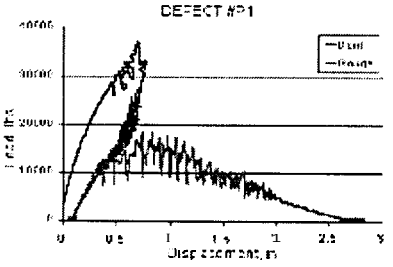
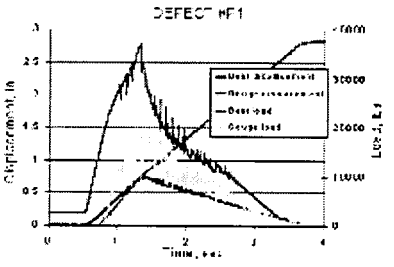
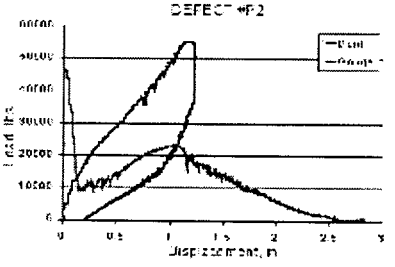
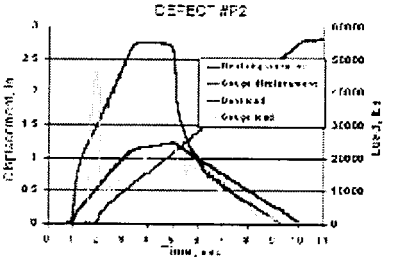
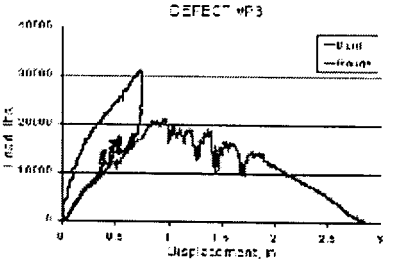
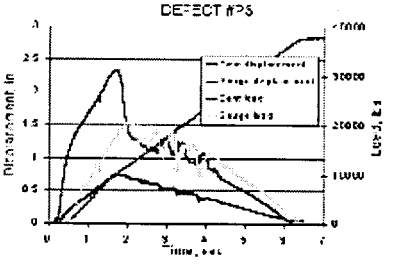
The axial or gouging force shows a spike at the beginning, after which the load follows a pattern similar to that for denting. The spike represents a time when the indentor digs into the pipe. The gouging force after the initial spike is around 10,000 to 13,000 pounds during most of the defect installation.

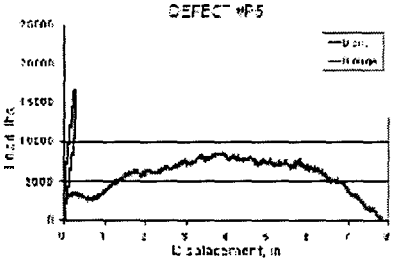
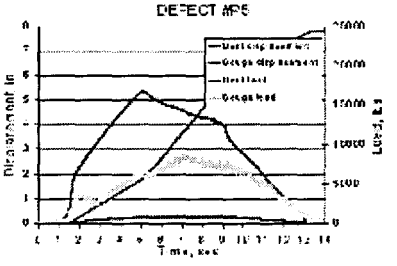
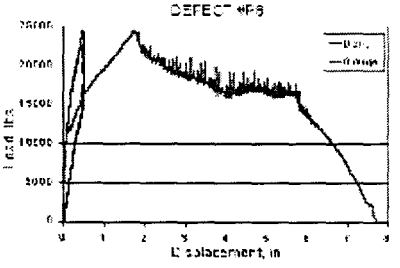
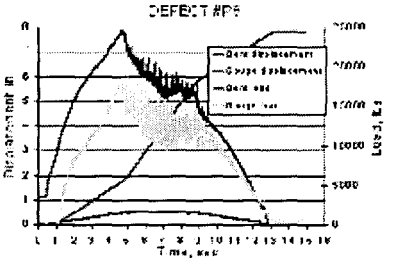
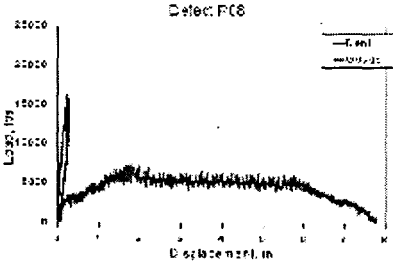
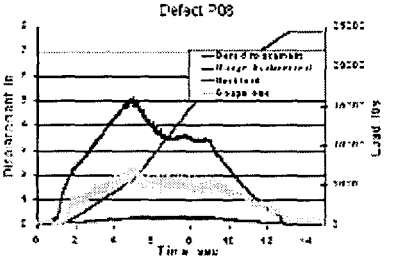


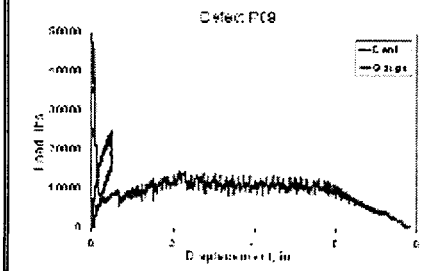
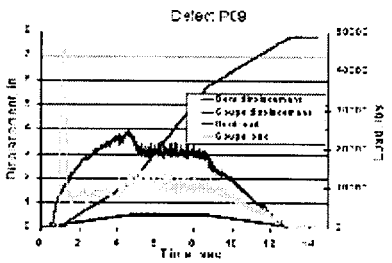
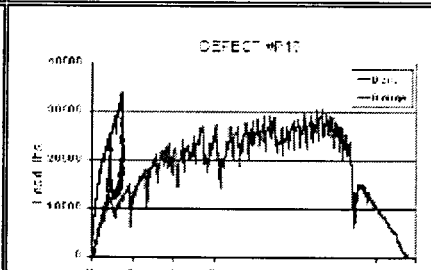
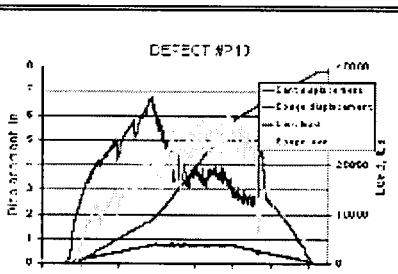
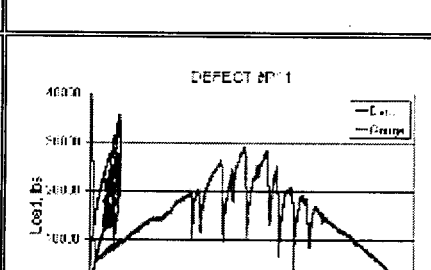
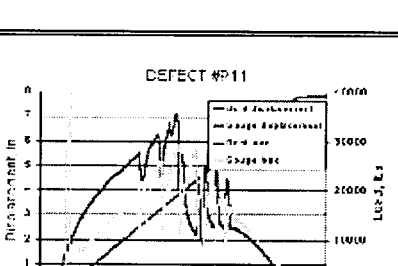
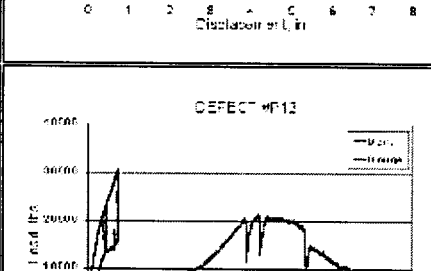
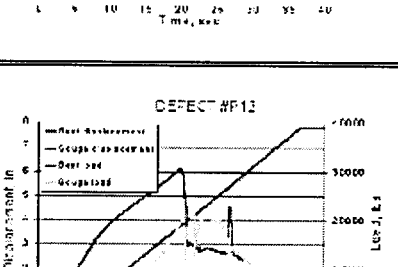
The load-displacement plot corresponding to the same defect are shown at right. The blue curve is the denting force, and the purple is the gouging force. Since this defect was installed at a constant axial gouging velocity, the gouge force-displacement and force-time plots are similar.

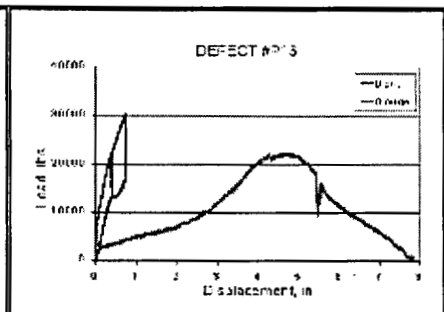
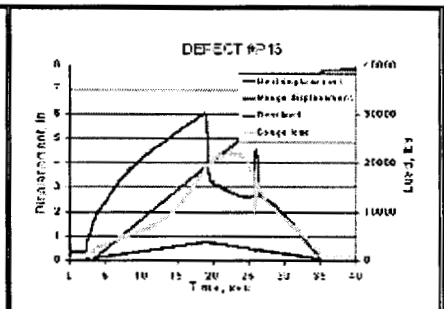
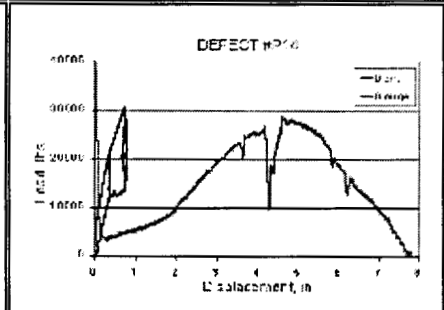
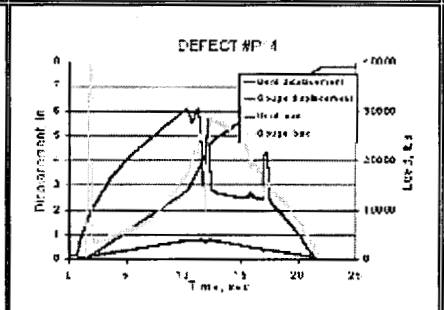
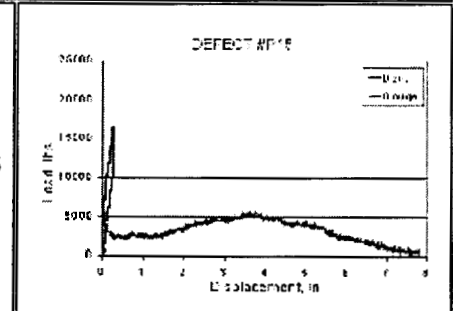
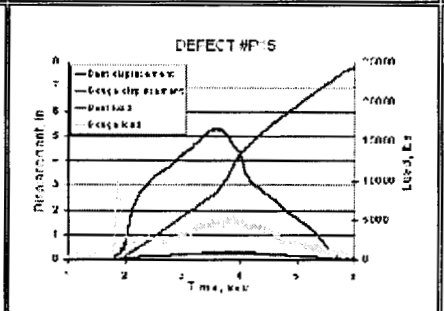
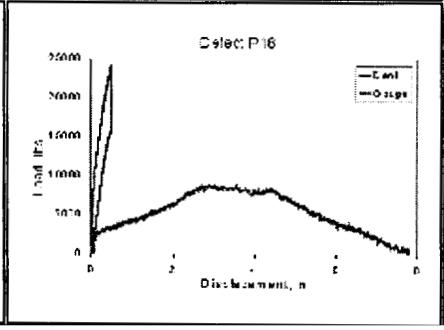
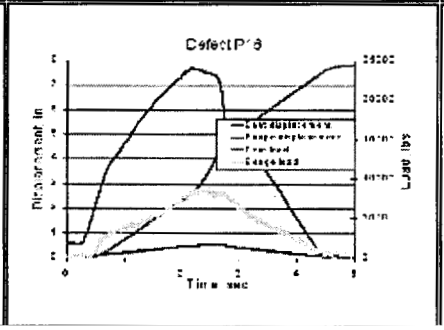
Defect Set 4 - Practice Defects
Load-Time-Deflection Plots

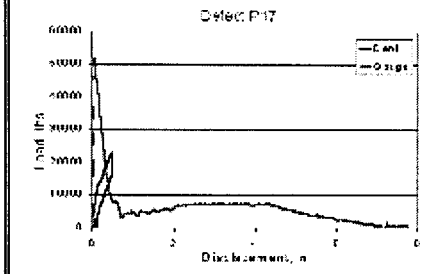
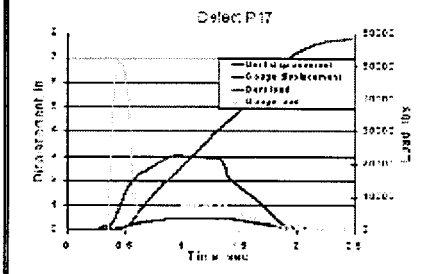
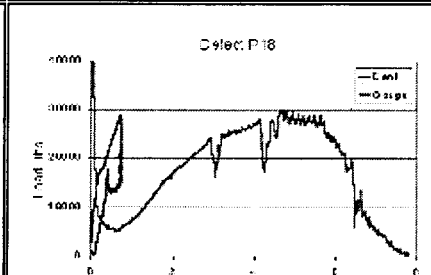
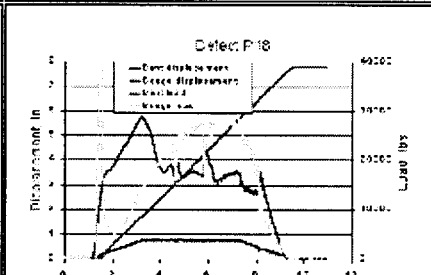
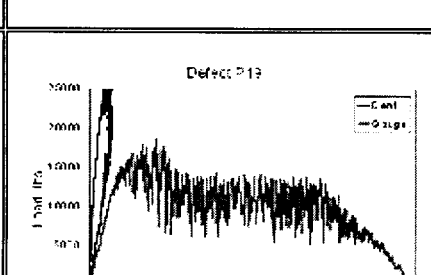
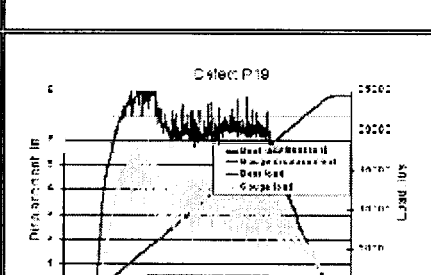
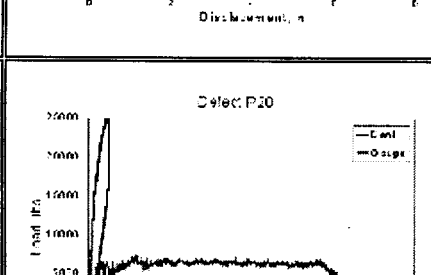
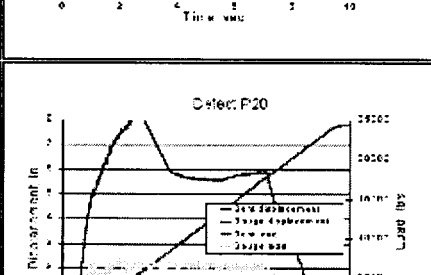
This defect set was used in the pull rig. For a layout map of the defects, click here. For a description of the variables included in this table, see the legend at the bottom of this page.

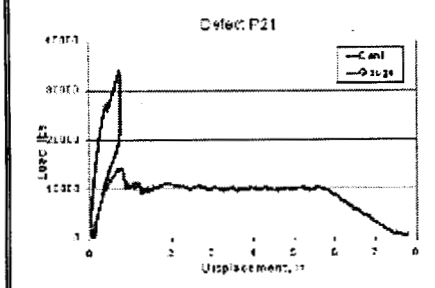
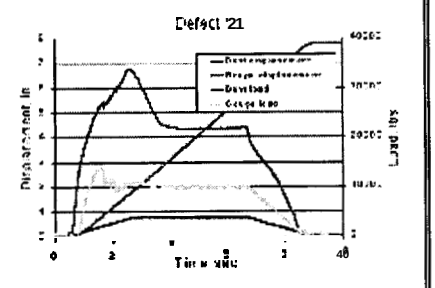
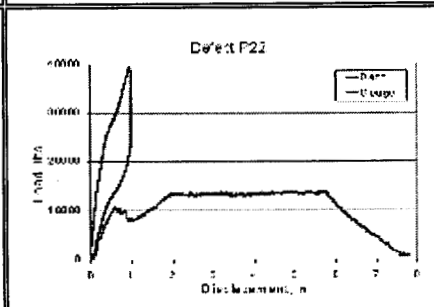
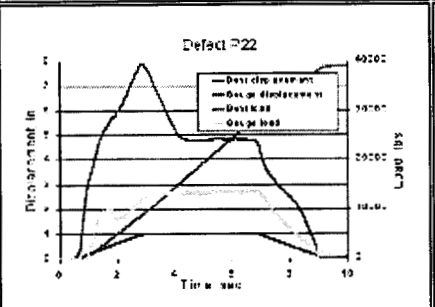
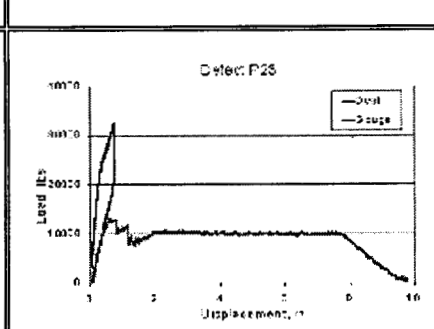
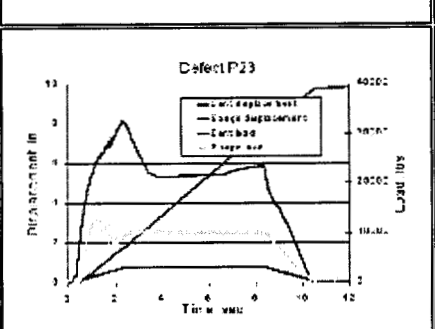
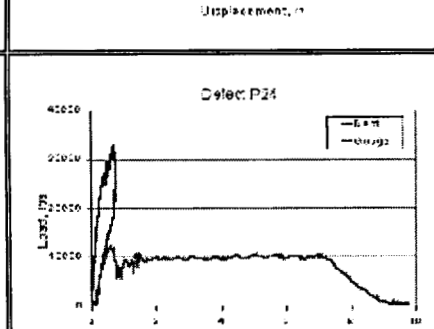
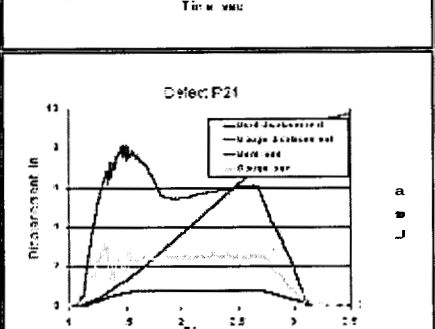
#	Load Disp Link	Load Time Link	D	L	FB	RI	RO	IW	IL	P	S
P01			3	3	0	1	2	0%	0%	60%	S
P02			6	3	0	1	2	0%	0%	60%	S
P03			3	3	0	1	2	1	0.5	60%	S
P04	NONE	NONE	3	7	4	1	2	0% w/10%	0% w/10%	60%	S

P04R	NONE	NONE	3	7	4	1	2	0% w/10%	0% w/10%	60%	S
P05			1	8	4	2	2	1	0.5	60%	S
P06			2	8	4	2	2	1	0.5	60%	S
P07	NONE	NONE	1	8	3	3	2	1	0.5	60%	S
P08			1	8	4	2	2	1	1	60%	S

P09			2	8	4	2	2	1	1	60%	S
P10			3	8	4	2	2	1	1	60%	S
P11			3	8	0	4	4	1	1	60%	S
P12			3	8	0	4	4	1	1	60%	S

P13			3	8	0	4	4	1	1	60%	S
P14			3	8	2	3	3	1	1	60%	S
P15			1	8	2	3	3	1	1	60%	Not F
P16			2	8	2	3	3	1	1	60%	Not F

P17			3	8	2	3	3	1	1	60%	F
P18			3	8	4	2	2	1	1	60%	S
P19			2	8	4	2	2	0%	0%	60%	S
P20			2	8	4	2	2	0%	0%	60%	S

P21			3	8	4	2	2	0%	0%	60%	S
P22			4	8	4	2	2	0%	0%	60%	S
P23			3	10	6	2	2	0%	0%	60%	S
P24			3	10	6	2	2	0%	0%	60%	F

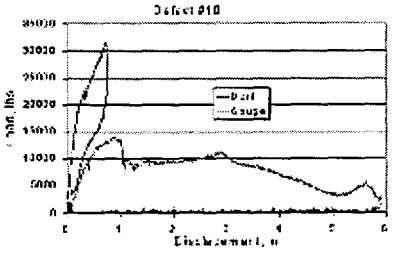
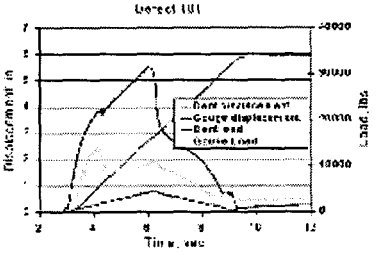
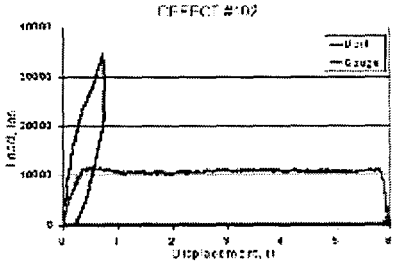
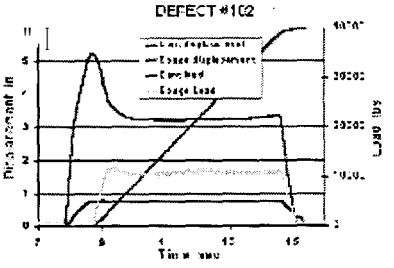
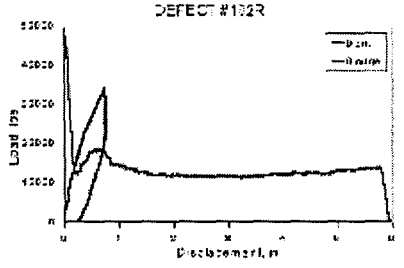
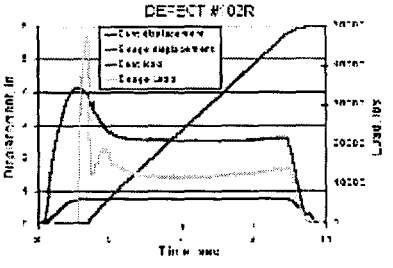
Legend:

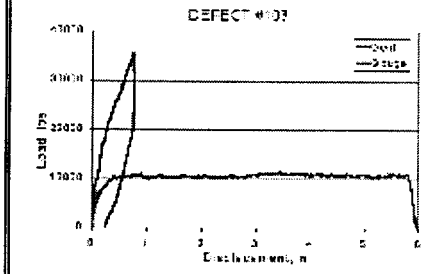
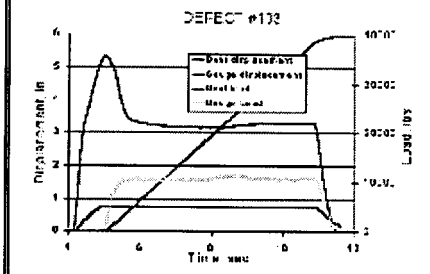
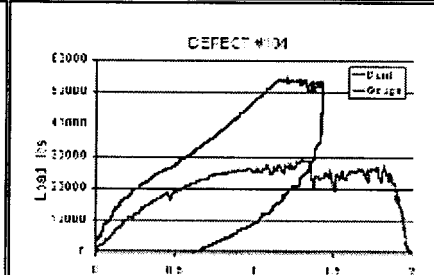
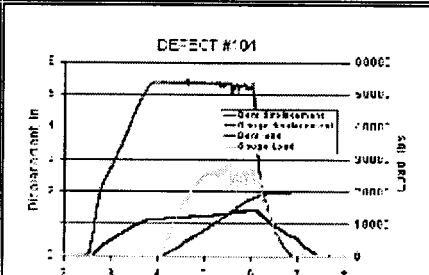
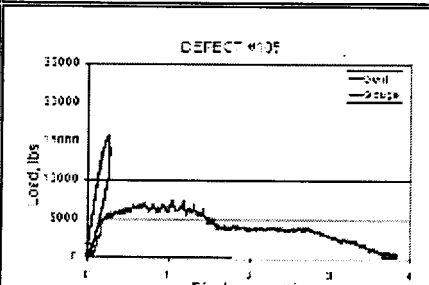
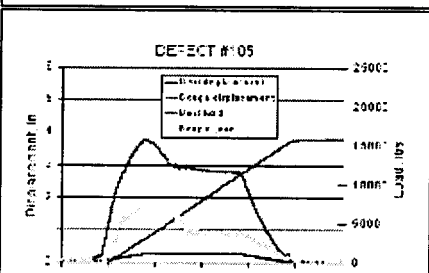
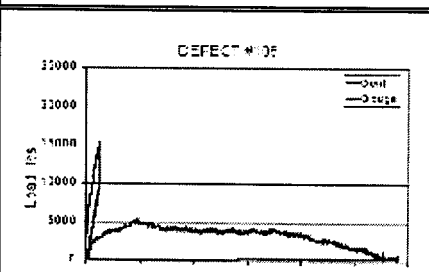
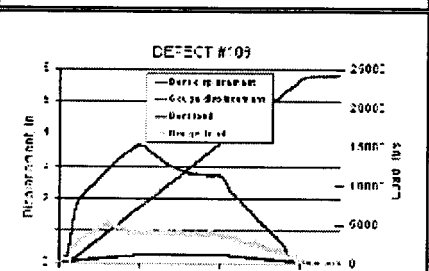
- # = Defect # is an arbitrary number identifying each defect
- D = Depth is the dent depth in percent of the diameter.
- L = Overall Length is the total length of the gouge in inches.
- FB = Flat Bottom Length is the length of the flat bottom portion of the gouge in inches.

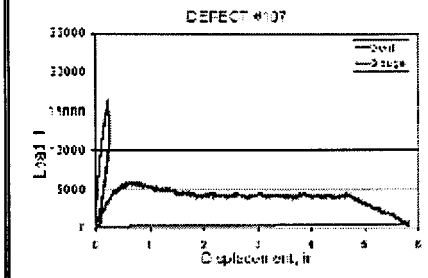
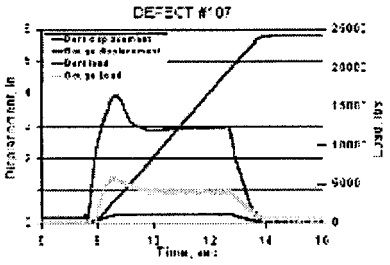
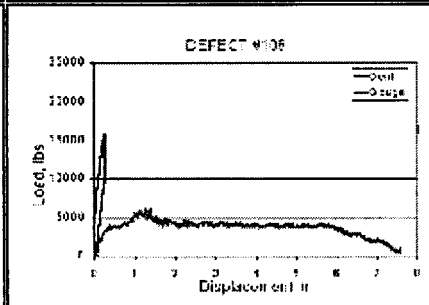
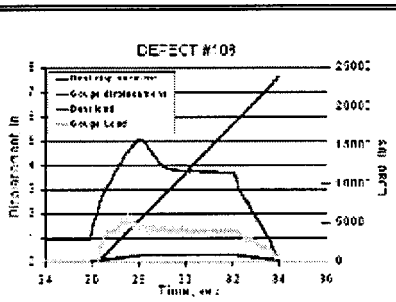
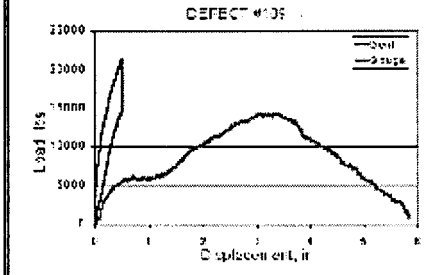
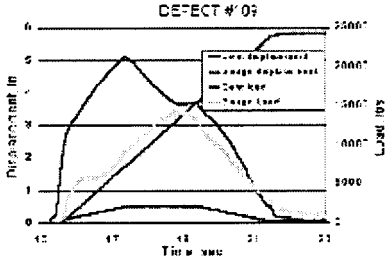
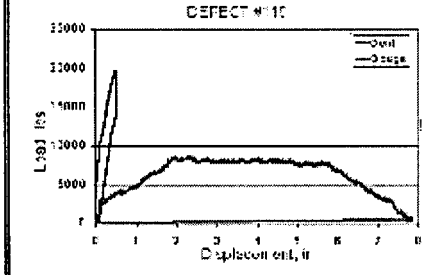
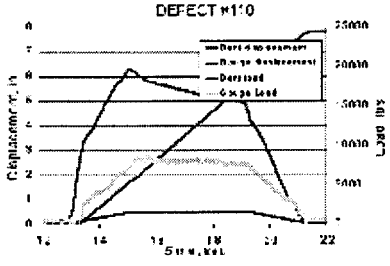
- RI = Ramp In and RO = Ramp Out are the distances on either side of the flat bottom used to ramp the indentor into and out of the pipe (the overall gouge length is the sum of the flat bottom length and the ramp in and ramp out lengths).
- IW = Indentor Width and IL = Indentor Length are the footprint dimensions of the indentor in inches; where x% is shown, the indentor was a 4-inch sphere with a sharp protruding cutter that extended x% of the wall thickness.
- P = Pressure is the internal pipe pressure in percent of specified minimum yield strength.
- S = Speed refers to the rate of axial movement of the indentor (S is 1 inch per second; F is 5 inches per second).

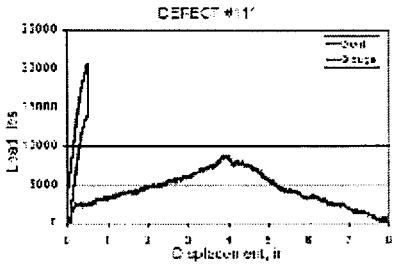
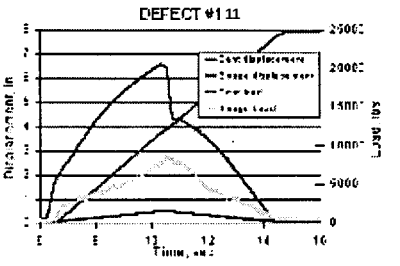
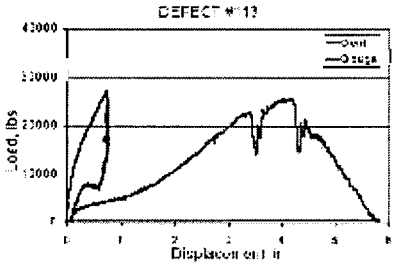
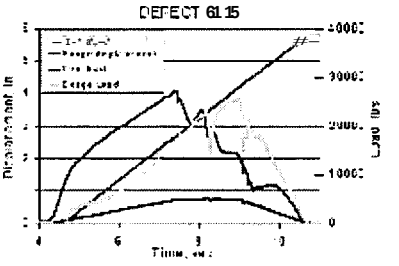
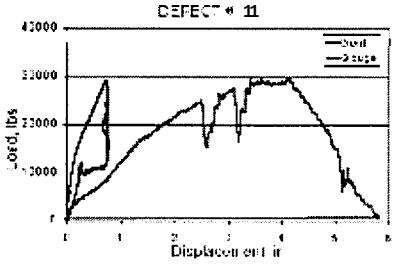
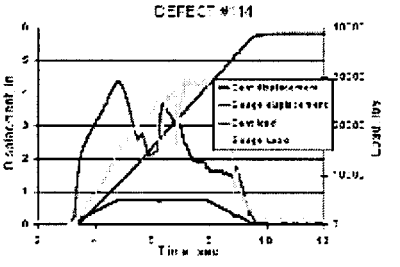
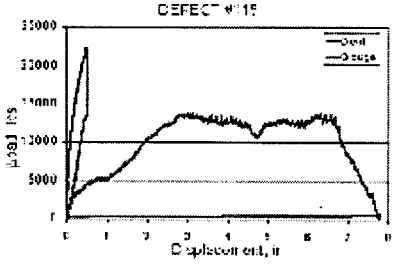
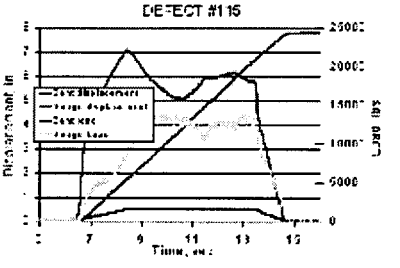
Defect Set 5 - Pull Rig Defects
Load-Time-Deflection Plots

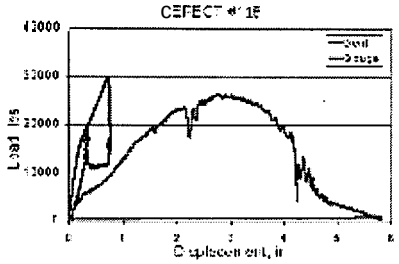
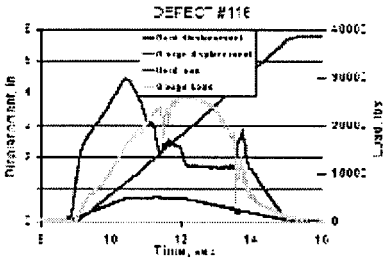
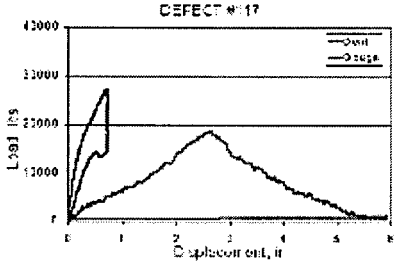
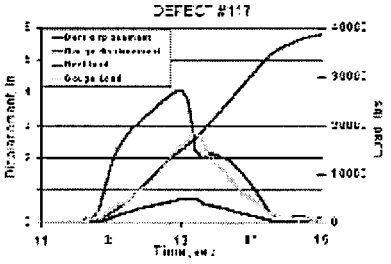
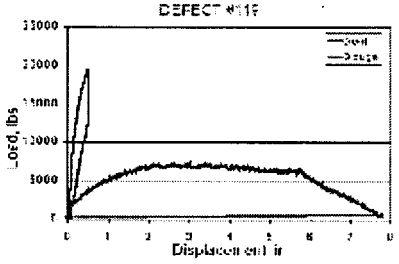
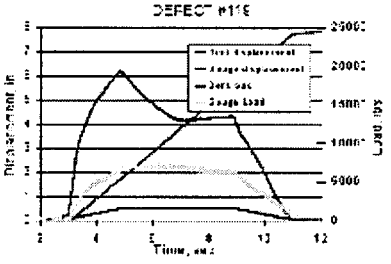
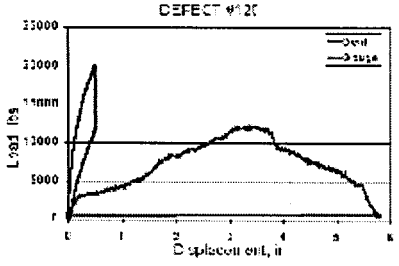
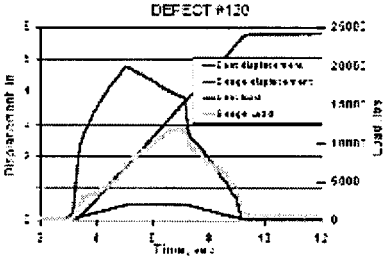
This defect set was used in the pull rig. For a layout map of the defects, click here. For a description of the variables included in this table, see the legend at the bottom of this page.

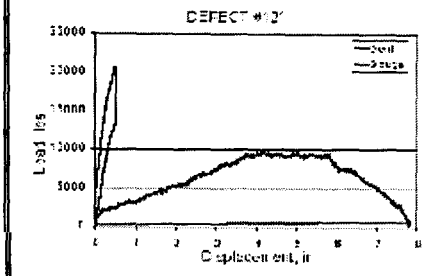
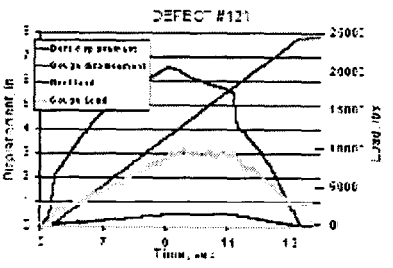
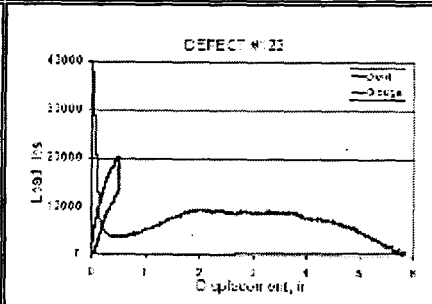
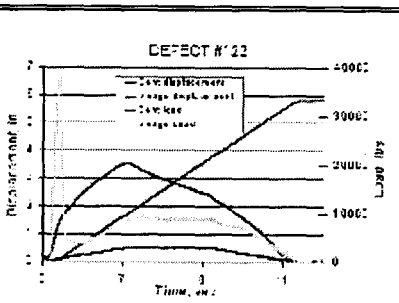
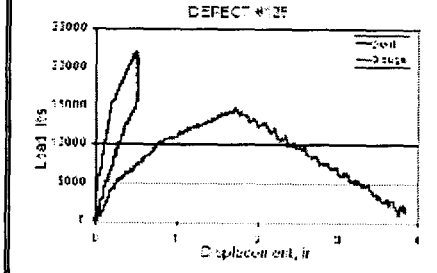
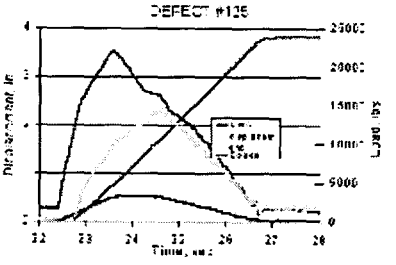
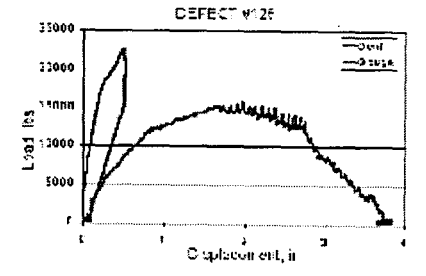
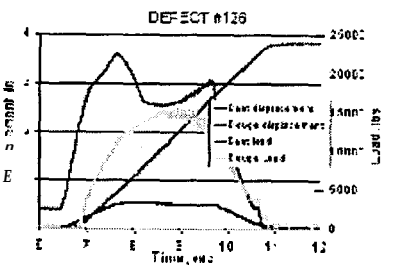
#	Load Disp Link	Load Time Link	D	L	FB	RI	RO	IW	IL	P	S
101			3	6	3	0	3	5%	5%	60%	S
102			3	6	0	6	0	5%	5%	60%	S
102r			3	6	0	6	0	5%	5%	60%	S
102rr	NONE	NONE	3	6	0	6	0	10%	10%	60%	S

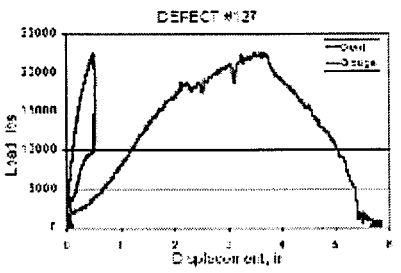
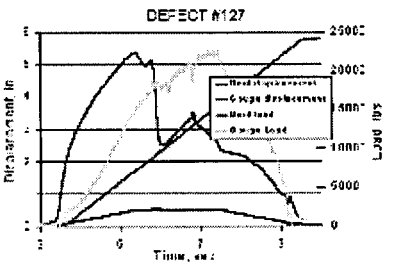
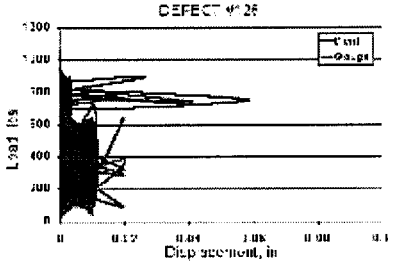
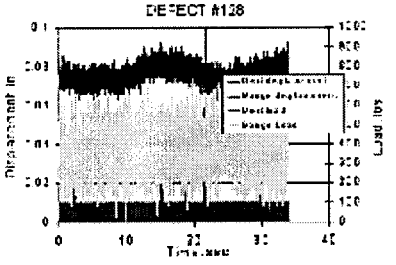
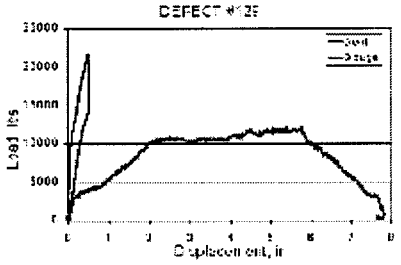
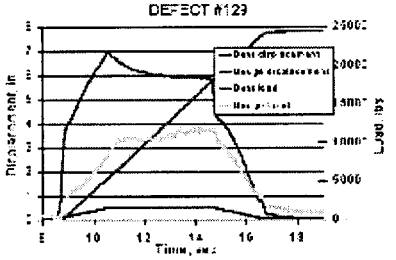
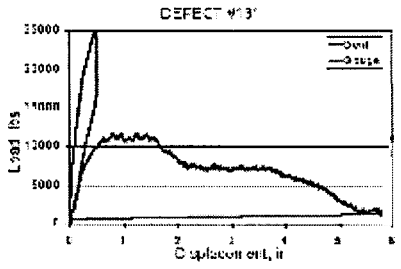
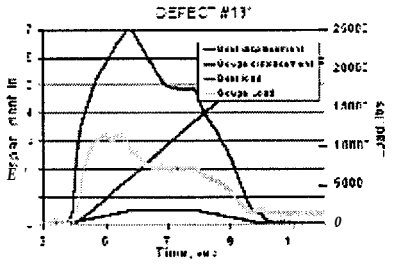
103			3	6	0	6	0	0%	0%	60%	S
104			6	2	0	2	0	0%	0%	60%	S
105			1	4	1	2	1	1	1	60%	S
106			1	6	2	2	2	1	1	60%	S

107			1	6	1	4	1	1	1	60%	S
108			1	8	2	4	2	1	1	60%	S
109			2	6	2	2	2	1	1	60%	S
110			2	8	2	4	2	1	1	60%	S

111			2	8	4	0	4	1	1	60%	S
113			3	6	3	1.5	1.5	1	1	60%	S
114			3	6	1.5	3	1.5	1	1	60%	S
115			2	8	2	5	1	1	1	60%	S

116			3	6	1.5	1.5	3	1	1	60%	S
117			3	6	3	0	3	1	1	60%	F
118	NONE	NONE	2	6	2	2	2	1	1	60%	F
119			2	8	2	4	2	1	1	30%	S
120			2	6	2	2	2	1	1	30%	S

121			2	8	4	2	2	1	0.5	60%	S
122			2	6	2	2	2	1	0.5	60%	S
124	NONE	NONE	2	6	2	2	2	1	1	60%	S
125			2	4	1	1	2	1	1	60%	S
126			2	4	1	2	1	0.5	1	60%	S

126r	NONE	NONE	2	4	1	2	1	1	1	60%	S
127			2	6	2	2	2	0.5	1	60%	S
128			2	6	1	3	2	1	1	60%	S
129			2	8	2	4	2	1	1	60%	S
131			2	6	2	2	2	0%	0%	60%	S

Legend:

- # = **Defect # is an arbitrary number identifying each defect**

- D = Depth is the dent depth in percent of the diameter.
- L = Overall Length is the total length of the gouge in inches.
- FB = Flat Bottom Length is the length of the flat bottom portion of the gouge in inches.
- RI = Ramp In and RO = Ramp Out are the distances on either side of the flat bottom used to ramp the indentor into and out of the pipe (the overall gouge length is the sum of the flat bottom length and the ramp in and ramp out lengths).
- IW = Indentor Width and IL = Indentor Length are the footprint dimensions of the indentor in inches; where x% is shown, the indentor was a 4-inch sphere with a sharp protruding cutter that extended x% of the wall thickness.
- P = Pressure is the internal pipe pressure in percent of specified minimum yield strength.
- ***S*** = Speed refers to the rate of axial movement of the indentor ***(S*** is 1 inch per second; **F** is 5 inches per second).