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Tests on puddle weld connections

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TESTS ON PUDDLE WELD CONNECTIONS

by

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PREFACE

This non-interpretive report contains the results of 90 tests on circular and oblong puddle weld connections. The connections involved test specimens constructed of flat steel plates and thin connecting sheets of varying thicknesses (10 to 28 gage) with the welds to be studied forming the bond between them. Testing consisted of tensile loading to ultimate failure.

This work was carried out under contract with the Engineering Division of the American Iron and Steel Institute.

TESTS ON
PUDDLE WELD CONNECTIONS

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I INTRODUCTION

The purpose of this report is to present the results of 90 tests on puddle welded connections.* The tests were conducted to augment previous studies of this series by providing further data on puddle welds (Ref. 1, 2). Four variables were investigated: edge distance, weld diameter, maximum cover plate thickness, and the use of oblong welds.

As shown in Figures 1 through 3, the specimens were fabricated by butting together two heavy plates (CP) and connecting them by puddle-welding cover plates (A-B and C-D) to their adjacent "top" and "bottom" surfaces. The connected plates were 7/16" thick, hot-rolled A36 steel plates. Since they are much stronger than the cover plates, they were not considered as variables. The connection sheets ranged in thickness from 0.0187" ± 0.0003 to 0.1382" ± 0.008; that is, from 10 to 28 gage as defined in Table 17 of ASTM A525-73.** Single and double thickness cover plates were used. All specimens were tested under a monontonically increasing static tensile load.

II MATERIAL

Seven different cover plate gages were investigated: 10, 12, 14, 18, 22, 24, and 28. All except the 24 and 28 gage sheets were of ASTM A446, Grade A steel The 24 and 28 gage sheets were ASTM A446, Grade E. All welds were made with E6010 Fleetweld 5P electrodes.

III NOTATION

Unless otherwise stated in this text, notations, variables, procedures and weld configurations are similar to those defined and used in References 1, 2, and 3. Specific notation is as follows:

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*AWS A 3.0-76, "Welding Terms and Definitions", refers to these as "arc spot" or "arc seam" welds. For simplicity, the commonly accepted trade term "puddle weld" will be used in this report as a generic descriptor of these welds.

**All use of the term "gage" in this report is in accordance with the definition in ASTM A525-73.

3.1 Specimen Designation

All specimens are typically designated as:

*A A/B 12/7 D(D-C) 1

where the terms are as defined in the following chart:

*A	A/B	12/7	D	(D-C)	1
Cover plate type	Cov. pl. material / Conn. pl. material	Cov. pl. gage / Conn. pl. thickness	Weld diameter category	(Edge distance-Weld diameter)	Spec. #
*A-single sheet *B-double sheet	A-A446, Gr A E-A446, Gr E ——— B-A36 (hot-rolled)	12-12 ga., etc. ——— 7-7/16"	C:0.5" - 0.8" D:08" - 1.5"	1st letter AA = 0.5" BB = 0.75" A = 1.0" B = 1.25" C = 1.30" D = 1.40" E = 1.60" F = 2.00" ——— 2nd letter A = 0.5" AA = 0.625" C = 0.8" CC = 0.875" D = 1.0" E = 1.25" ——— elliptical welds - X = $1\frac{1}{2}$" x $\frac{1}{2}$ Y = $\frac{3}{4}$" x $\frac{3}{8}$"	1-1st 2-2nd 3-3rd

3.2 Failure Mode Designation

The designations used to describe various failure modes of tested specimens are as follows. [Note: several of these modes are indicated diagrammatically in Figure 1.]

PC - Plate tearing along or adjacent to the weld contour.

PS - Longitudinal shearing of the cover plates along practically parallel planes whose distance equals the diameter of the puddle weld, similar to plate shearing failures observed in bolted connections (Reference 4).

PB - Shearing-tearing in two distinctly inclined planes with considerable piling up of the cover plate material in front of the puddle weld, similar to plate bearing failures observed in bolted connections (Reference 4).

PT - Transverse cover plate tearing, possibly at an angle to the applied stress.

PL - Out of plane plastic deformations, which may accompany the other modes of failure.

WS - Shearing of the weld material.

W - Any weld failure other than WS. An example is the failure caused by a peeling action due to the bending of the cover plate.

3.3 List of Symbols

σ_y - Yield stress of cover plate material

σ_{ult} - Ultimate strength of cover plate material

σ_{yt} - P_y/A_c

σ_{tt} - P_{ult}/A_c

σ_{ta} - Tensile strength of electrode-presumed to be 68.0 ksi for comparison with Ref. 1 (no tests made)

τ_{sa} - Presumptive shear strength of electrode - $\sigma_{ta}/\sqrt{3}$ = 39.2 ksi (see Ref. 1)

τ_{su} - P_{ult}/A_n (for sheared welds)

τ_{su} - $\frac{2}{3}\ \sigma_{ult}$ = Presumptive shear strength of cover plate material (suggested by Blodgett, Ref. 5)

A_c - Total cross-sectional area of the cover plates

A_g - The gross area of the faying surface of 2 sheared welds

A_n - The net area of the faying surface of 2 sheared welds

P_y - Yield load (of a specimen)

P_{ult} - Ultimate load (of a specimen)

L_{pl} - Length of cover plate

δ_u - Total elongation of ultimate load

d - Visible weld diameter (see Figures 1 and 2 - subscripts denote specific welds)

d_w - Average visible weld diameter (of a specimen)

d_a - d_w minus the thickness of one or two connecting plates (single and double plate connections, respectively)

d_{eg} - Diameter of a circle of area A_g

d_{en} - Diameter of a circle of area A_n

e - Edge distance (see Figures 1, 2, and 3 - subscripts denote specific welds)

e_{ab}, e_{cd} - Average edge distance for cover plates A-B and C-D, respectively

L_{ob} - Visible oblong weld width, measured between half-circle centers (see Figure 3 - subscripts denote specific welds)

d_{ob} - Visible oblong weld thickness (see Figure 3 - subscripts denote specific welds)

s - Width of cover plate(s) (see Figures 1, 2, and 3)

t - Thickness of cover plate(s) minus the thickness of galvanizing (see Figures 1, 2, and 3 - subscripts denote A-B or C-D cover plate)

IV TEST PROGRAM

Table 1 summarizes the types and number of specimens tested. The nomenclature used is as defined in Section 3.1.

All specimens were fabricated in Cornell University shops following procedures developed and prescribed by Mr. J. R. Stitt, welding consultant.

All specimens were tested on a Baldwin Southwark hydraulic testing machine under a static monotonically increasing load. All connection tests were conducted using an autographic extensometer and the deformation was measured over a length equal to $(L_{pl}+1)$ inches. From the load deformation curves, the deformation δ_u, at ultimate load P_{ult}, was recorded.

V TEST DATA AND RESULTS

5.1 Test Data and Tabulation of Results

The results of tensile coupon tests on each thickness of cover plate material are listed in Table 2.

Table 3 contains the basic measured geometrical data for all of the specimens tested.

Basic information on failure loads and failure modes is contained in Table 4. Data for two specimens are not recorded. For specimen A A/B 12/7 C(E-AA)1, failure due to weld shear occurred as the specimen was being placed in the machine, under a very small load. The shear area was found to be very small. For specimen B A/B 14/7 D(D-E)3, the testing machine malfunctioned and the failure load was not recorded. Note also that specimen *A A/B 22/7 Y1 had an inordinately low failure load due to cover plate burn-through along one side of a weld.

For cases in which failure was by simple weld shear, the quantity τ_{su} was calculated as described in the discussion of Table 6 in Section 5.2 to follow.

Figure 4 shows a typical PC+PS+W type of failure. In Figure 5, four definable modes have contributed to the failure (PC+W+PS+PL). Figure 6 illustrates the large out-of-plane plastic deformation that may occur. Figures 7 and 8 show pure weld shear. All connections failed primarily in one of the following modes: weld shearing, plate tearing, and plate shearing. All single-sheet connections using 10 and 12 gage cover plate material and all double-sheeted 14 gage connections failed in weld shear. All single sheet 18 gage specimens failed primarily by plate tearing along the weld toe contour as did most of the double sheet 18 gage specimens. The remainder of the double sheet 18 gage specimens failed in a combination of plate tearing and weld shearing. Plate shearing, along the sides of the weld, was primarily responsible for the failure of single sheet 24 and double sheet 28 gage specimens.

Failures for the oblong welded specimens were primarily combinations of parallel and transverse plate tearing for all connections tested, with some plate shearing occurring in the single-sheeted 18 gage specimens.

Typical load-deformation curves are shown in Figures 9 through 12.

5.2 Discussion of Test Results

Table 5 is a summary of results. To facilitate comparisons with previous studies it is presented in the same form as that used for summarizing results in Reference 1.

Results are summarized in a somewhat different form in Table 6. In this table, two columns, labelled A_g and A_n, have been added to the experimental data. A_g is the faying surface area of the two sheared welds for cases in which such failure occurred. A_n is the corresponding net area; that is, A_g minus the porosity of the faying surface weld metal. The area measurements were made by tracing the perimeter of the weld metal at the faying surface with a planimeter and then estimating porosity by tracing the perimeter of all voids in this metal. These measurements were made for every weld shear failure. The ultimate shearing stress, τ_{su}, tabulated in Table 4, was obtained by dividing P_{ult} by A_n.

In Reference 5, Mr. Omer Blodgett has proposed two equations for predicting the ultimate strength of puddle welded connections for both plate tearing and plate shearing types of failure. He suggests that when $d/t < 240/\sqrt{\sigma_y}$, failure will be by transverse tearing and the failure load may be estimated by the formula:

$$P_{ult} = 2(2.2)\ t d_a\ \sigma_{ult}. \tag{1}$$

When $d/t > 240/\sqrt{\sigma_y}$, he suggests that failure will be by longitudinal tearing and buckling and may be estimated by the formula:

$$P_{ult} = 2(1.4)\ t d_a\ \sigma_{ult}. \tag{2}$$

Based on the results of the present series of tests, the authors suggest that weld shear failures may be predicted by the formula:

$$P_{ult} = 2(\frac{\pi}{4}d_{en}^{2})(\frac{3}{4}\sigma_{ultw}) \qquad (3)$$

where σ_{ultw} is the nominal tensile strength of the deposited weld metal. For E60 electrodes this would be taken as 60 ksi. To establish d_{en}, the previously mentioned areas A_g and A_n were converted to circles of the same area. A least squares best fit approach was applied to the experimental data to determine the equations relating plate thickness, t, and the visible weld diameter, d, to the diameters of these gross and net areas, d_{eg} and d_{en}. The resulting equations are

$$d_{en} = 0.7d - 1.5\,t \qquad (4)$$

$$d_{eg} = 0.85d - 2t \qquad (5)$$

The degree of correlation is illustrated in Figures 13 and 14.

Blodgett also proposes in Ref. 5 that failure for oblong welds will result from the yielding of the cover plates along the length of the weld L_{ob} in shear and along the two half-circle ends of the weld in tension/compression. Based on his criteria, the ultimate load on the oblong weld specimens can be estimated by the formula:

$$P_{ult} = \tau_{ult}\,\Sigma t_a\,(L_{ob} + 1.6\,d_{ob}) \qquad (6)$$

where Σt is the sum of the AB and CD cover plate thicknesses. Table 7 summarizes the results of the oblong weld tests and includes the predicted ultimate loads as given by Equation (6).

VI CONCLUSIONS

1) The three prevalent failure modes appeared to segregate themselves according to cover plate thickness. Shearing of the welds was seen to be the dominant mode for the thicker gage specimens (from 10 gage on down to some of the double-sheet 18 gage connections). Plate tearing occurred in the single-

sheet 18 gage and most double-sheet 18 gage specimens. For the thinner-gage connections (i.e., all single-sheet 24 gage and double-sheet 28 gage specimens), plate shearing appeared to be responsible for failure.

2) Observed strengths were seen to have a large range of values in all circular-weld specimens and a moderate range in the oblong-weld specimens. For the circular-weld connections;

1) yield strength, σ_{yt}, averaged 0.61 σ_y with a range of 0.22 σ_y to 0.84 σ_y,
2) tensile strength, σ_{tt}, averaged 0.51 σ_y while ranging between 0.18 σ_{ult} to 0.71 σ_{ult},
3) shear strength of the welds, τ_{su}, averaged 1.31 τ_{sa} with a range of 0.97 τ_{sa} to 1.75 τ_{sa}.

For the oblong weld connections, the observed ultimate tensile load, P_{ult}, averaged 1.39 times the value predicted by Eq. (6), while ranging between 1.25 and 1.61 times the predictions.

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The authors also wish to express their gratitude to Mr. W.J. Faschan, a graduate student at Cornell, for his work in analyzing the test data and preparing the charts and tables.

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4. Winter, G., "Tests on Bolted Connections in Light Gage Steel", Proc. ASCE, Vol. 82, Paper No. 920, March 1956.

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TABLES

Table 1

WELDED CONNECTIONS STUDIED IN THIS INVESTIGATION

	Specimen Designation	No. of Specimens	
Group 1 (Effects of Edge Distance)	A A/B 12/7 D(B-C)	3	
	A A/B 12/7 D(F-C)	2	
	A A/B 12/7 D(E-C)	2	
	A A/B 18/7 D(B-C)	3	
	A A/B 18/7 D(F-C)	3	
	A A/B 18/7 D(E-C)	3	
	B A/B 14/7 D(A-C)	2	
	B A/B 14/7 D(D-C)	2	
	B A/B 14/7 D(F-C)	2	
	B A/B 18/7 D(A-C)	3	
	B A/B 18/7 D(D-C)	3	
	B A/B 18/7 D(F-C)	3	
	A A/B 12/7 D(AA-C)	3	
	A A/B 18/7 D(BB-C)	2	
			36
Group 2 (Effects of Weld Diameter)	A A/B 12/7 C(E-AA)	2	
	A A/B 12/7 D(E-D)	3	
	A A/B 18/7 C(E-AA)	3	
	A E/B 24/7 C(E-AA)	3	
	A E/B 24/7 D(E-C)	3	
	B A/B 14/7 D(D-E)	3	
	B E/B 28/7 C(C-AA)	3	
	B A/B 18/7 C(D-AA)	2	
	B A/B 18/7 D(D-D)	3	
			25
Group 3 (Maximum Cover Plate Thickness)	A A/B 10/7 D(E-CC)	2	
	A A/B 10/7 D(E-E)	2	
	B A/B 14/7 D(E-D)	2	
			6
Group 4 (Oblong Welds)	A A/B 18/7 X	3	
	A A/B 18/7 Y	2	
	A A/B 22/7 X	3	
	A A/B 22/7 Y	3	
	B A/B 18/7 X	3	
	B A/B 18/7 Y	3	
	B A/B 22/7 X	3	
	B A/B 22/7 Y	3	
			23
		Total =	90

Table 2

COVER PLATE MATERIAL TEST RESULTS

(1/2" Tensile Test Coupons)

Specimen	Area (Sq. in.)	Yield Load (lbs.)	Ultimate Load (lbs.)
* 10 gage A446 Grade A Steel *			
1	0.070	2700	3470
2	0.071	2730	3430
3	0.071	2750	3435
Average Yield Stress 38.6 ksi	Average Ultimate Stress 48.8 ksi		
* 12 gage A446 Grade A Steel *			
1	0.051	2160	2855
2	0.051	2070	2770
3	0.051	2050	2775
Average Yield Stress 41.05	Average Ultimate Stress 54.09 ksi		
* 14 gage A446 Grade A Steel *			
1	0.038	1500	1810
2	0.038	1480	1845
3	0.038	1470	1775
Average Yield Stress 39.0 ksi	Average Ultimate Stress 47.6 ksi		
* 18 gage A446 Grade A Steel *			
1	0.0235	1117	1380
2	0.0233	1115	1365
3	0.0232	1075	1385
Average Yield Stress 47.2 ksi	Average Ultimate Stress 59.0 ksi		
* 22 gage A446 Grade A Steel *			
1	0.0150	628	741
2	0.0150	632	745
3	0.0150	658	762
Average Yield Stress 42.6 ksi	Average Ultimate Stress 50.0 ksi		

Table 2 (continued)

COVER PLATE MATERIAL TEST RESULTS

Specimen	Area (Sq. in.)	Yield Load (lbs.)	Ultimate Load (lbs.)
	* 24 gage A446 Grade E Steel *		
1	0.0121	1355	1355
2	0.0123	1290	1310
3	0.0119	1195	1205
4	0.0119	1310	1315

Average Yield Stress 106.8 ksi Average Ultimate Stress 107.6 ksi

* 28 gage A446 Grade E Steel *

Yield stress (1 test) = 102.1 ksi
Ultimate Stress (1 test) = 105.4 ksi

Table 3

PUDDLE WELDS
GEOMETRICAL DIMENSIONS

Specimen Designation	COVER PLATE DIMENSIONS						VISIBLE WELD DIAMETERS				
	PLATE A-B			PLATE C-D							
	Width S in.	Edge Dist. e_{ab} in.	Thick. t_{ab} in.	Width S in.	Edge Dist. e_{cd} in.	Thick. t_{cd} in.	$(d)_a$ in.	$(d)_b$ in.	$(d)_c$ in.	$(d)_d$ in.	d_w (average) in.
GROUP 1 - EFFECTS OF EDGE DISTANCE											
A A/B 12/7 D(B-C)1	4.02	1.20	.101	4.02	1.20	.101	0.91	0.85	0.93	0.91	0.90
A A/B 12/7 D(B-C)2	4.01	1.27	.101	4.01	1.24	.101	0.92	0.92	0.90	0.97	0.92
A A/B 12/7 D(B-C)3	4.01	1.27	.102	4.01	1.12	.102	0.90	0.89	0.90	0.98	0.92
A A/B 12/7 D(F-C)1	4.01	2.08	.101	4.01	1.87	.101	0.95	0.89	0.94	0.90	0.92
A A/B 12/7 D(F-C)2	4.02	2.05	.101	4.02	2.04	.101	0.95	0.97	0.93	0.95	0.95
A A/B 12/7 D(E-C)1	4.01	1.52	.101	4.01	1.58	.101	0.97	0.98	0.97	0.88	0.95
A A/B 12/7 D(E-C)2	4.01	1.57	.102	4.01	1.41	.101	0.93	1.03	0.96	1.01	0.98
A A/B 18/7 D(B-C)1	4.00	1.28	.047	4.00	1.33	.047	0.79	0.89	0.78	0.75	0.80
A A/B 18/7 D(B-C)2	4.00	1.39	.047	4.00	1.17	.047	0.90	0.80	0.71	0.92	0.85
A A/B 18/7 D(B-C)3	4.00	1.27	.047	4.00	1.28	.047	0.75	0.77	0.78	0.84	0.79
A A/B 18/7 D(F-C)1	4.00	2.12	.047	4.00	1.99	.047	0.77	0.90	0.81	0.78	0.82
A A/B 18/7 D(F-C)2	4.00	2.11	.047	4.00	2.10	.047	0.87	0.83	0.86	0.79	0.84
A A/B 18/7 D(F-C)3	4.00	1.85	.047	4.00	2.07	.047	0.84	0.89	0.80	0.85	0.85
A A/B 18/7 D(E-C)1	4.00	1.76	.046	4.00	1.61	.047	0.85	0.91	0.89	0.83	0.87
A A/B 18/7 D(E-C)2	4.00	1.65	.046	4.00	1.71	.047	0.93	0.86	0.78	0.76	0.83
A A/B 18/7 D(E-C)3	4.00	1.76	.047	4.00	1.75	.047	0.79	0.91	0.83	0.90	0.86

Table 3 (continued)

PUDDLE WELDS
GEOMETRICAL DIMENSIONS

Specimen Designation	COVER PLATE DIMENSIONS: PLATE A-B: Width S in.	PLATE A-B: Edge Dist. e_{ab} in.	PLATE A-B: Thick. t_{ab} in.	PLATE C-D: Width S in.	PLATE C-D: Edge Dist. e_{cd} in.	PLATE C-D: Thick. t_{cd} in.	VISIBLE WELD DIAMETERS: $(d)_a$ in.	$(d)_b$ in.	$(d)_c$ in.	$(d)_d$ in.	d_w (average) in.
GROUP 1 - EFFECTS OF EDGE DISTANCE (continued)											
B A/B 14/7 D(A-C)1	4.01	0.99	.153	4.01	1.00	.154	0.99	0.98	1.03	1.02	1.01
B A/B 14/7 D(A-C)2	4.01	1.03	.154	4.01	0.88	.155	1.05	1.11	1.02	1.12	1.08
B A/B 14/7 D(D-C)1	4.00	1.58	.153	4.00	1.42	.154	1.01	1.09	1.06	0.99	1.04
B A/B 14/7 D(D-C)2	4.00	1.32	.153	4.00	1.33	.155	0.94	1.03	0.87	0.94	0.95
B A/B 14/7 D(F-C)1	4.00	2.02	.153	4.00	1.96	.155	0.89	1.07	1.03	1.01	1.00
B A/B 14/7 D(F-C)2	4.00	1.96	.153	4.00	2.07	.153	0.98	0.92	0.91	1.01	0.96
B A/B 18/7 D(A-C)1	4.00	1.14	.095	4.00	1.00	.093	0.91	0.88	0.97	1.09	0.96
B A/B 18/7 D(A-C)2	4.00	1.04	.095	4.00	1.10	.092	1.09	0.89	0.99	1.01	1.00
B A/B 18/7 D(A-C)3	4.00	1.09	.093	4.00	1.26	.095	0.98	0.85	0.99	0.96	0.95
B A/B 18/7 D(D-C)1	4.00	1.66	.092	4.00	1.48	.093	0.92	1.31	0.93	0.88	1.01
B A/B 18/7 D(D-C)2	4.00	1.69	.093	4.00	1.37	.095	0.95	0.96	0.89	0.95	0.94
B A/B 18/7 D(D-C)3	4.00	1.47	.093	4.00	1.40	.095	0.91	0.94	0.94	0.89	0.92
B A/B 18/7 D(F-C)1	3.99	2.01	.093	3.99	2.09	.093	0.95	0.99	1.20	1.02	1.04
B A/B 18/7 D(F-C)2	4.00	2.13	.093	4.00	1.86	.092	0.98	0.98	1.04	1.07	1.02
B A/B 18/7 D(F-C)3	3.99	2.00	.092	3.99	1.98	.092	0.99	0.96	1.01	0.97	0.98
A A/B 12/7 D(AA-C)1	4.00	0.61	.101	4.00	0.85	.101	1.01	1.14	1.00	1.00	1.04
A A/B 12/7 D(AA-C)2	4.00	0.65	.101	4.00	0.71	.101	0.94	0.94	0.96	0.99	0.96
A A/B 12/7 D(AA-C)3	4.00	0.57	.101	4.00	0.71	.101	0.91	0.92	0.88	0.90	0.90
A A/B 18/7 D(BB-C)1	3.99	0.77	.0479	3.99	0.83	.0477	0.83	0.86	0.89	0.80	0.85
A A/B 18/7 D(BB-C)2	4.00	0.82	.0478	4.00	0.88	.0478	0.72	0.74	0.78	0.77	0.75

Table 3 (continued)

PUDDLE WELDS
GEOMETRICAL DIMENSIONS

Specimen Designation	COVER PLATE DIMENSIONS: PLATE A-B Width S in.	Edge Dist. e_{ab} in.	Thick. t_{ab} in.	PLATE C-D Width S in.	Edge Dist. e_{cd} in.	Thick. t_{cd} in.	VISIBLE WELD DIAMETERS: $(d)_a$ in.	$(d)_b$ in.	$(d)_c$ in.	$(d)_d$ in.	d_w (average) in.
GROUP 2 - EFFECTS OF WELD DIAMETER											
A A/B 12/7 C(E-AA)1	4.00	1.57	.101	4.00	1.63	.102	0.81	0.78	0.88	0.85	0.83
A A/B 12/7 C(E-AA)2	4.00	1.57	.101	4.00	1.64	.101	0.78	0.88	0.79	0.95	0.85
A A/B 12/7 D(E-D)1	4.00	1.46	.101	4.00	1.61	.101	0.95	1.00	1.01	1.02	1.00
A A/B 12/7 D(E-D)2	4.00	1.69	.101	4.00	1.66	.101	0.95	0.97	0.98	0.97	0.97
A A/B 12/7 D(E-D)3	4.00	1.62	.101	4.00	1.68	.101	0.97	0.96	0.98	1.03	0.99
A A/B 18/7 C(E-AA)1	4.00	1.65	.0471	4.00	1.60	.0474	0.63	0.62	0.65	0.67	0.64
A A/B 18/7 C(E-AA)2	4.00	1.62	.0468	4.00	1.66	.0462	0.60	0.61	0.68	0.60	0.62
A A/B 18/7 C(E-AA)3	4.00	1.64	.0463	4.00	1.69	.0468	0.66	0.66	0.65	0.61	0.65
A E/B 24/7 C(E-AA)1	4.00	1.53	.0239	4.00	1.56	.0241	0.59	0.54	0.55	0.49	0.54
A E/B 24/7 C(E-AA)2	4.00	1.56	.0240	4.00	1.65	.0239	0.59	0.56	0.57	0.52	0.56
A E/B 24/7 C(E-AA)3	4.00	1.57	.0240	4.00	1.56	.0239	0.59	0.56	0.57	0.52	0.56
A E/B 24/7 D(E-C)1	4.00	1.53	.0240	4.00	1.60	.0240	0.68	0.77	0.72	0.70	0.72
A E/B 24/7 D(E-C)2	4.00	1.53	.0242	4.00	1.56	.0239	0.67	0.77	0.75	0.64	0.71
A E/B 24/7 D(E-C)3	4.00	1.51	.0240	4.00	1.61	.0240	0.76	0.79	0.69	0.67	0.73
B A/B 14/7 D(D-E)1	4.00	1.34	.152	4.00	1.57	.154	1.21	1.13	1.17	1.11	1.16
B A/B 14/7 D(D-E)2	4.00	1.42	.153	4.00	1.57	.153	1.09	1.05	1.30	1.25	1.17
B A/B 14/7 D(D-E)3	4.00	1.43	.153	4.00	1.49	.152	1.07	1.12	1.22	1.04	1.11

Table 3 (continued)

PUDDLE WELDS
GEOMETRICAL DIMENSIONS

Specimen Designation	COVER PLATE DIMENSIONS						VISIBLE WELD DIAMETERS				d_w (average)
	PLATE A-B			PLATE C-D							
	Width S	Edge Dist. e_{ab}	Thick. t_{ab}	Width S	Edge Dist. e_{cd}	Thick. t_{cd}	$(d)_a$	$(d)_b$	$(d)_c$	$(d)_d$	
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
GROUP 2 - EFFECTS OF WELD DIAMETER (continued)											
B E/B 28/7 C(C-AA)1	4.00	1.30	.0392	4.00	1.31	.0390	0.75	0.69	0.71	0.64	0.70
B E/B 28/7 C(C-AA)2	4.00	1.29	.0390	4.00	1.26	.0394	0.72	0.78	0.76	0.61	0.72
B E/B 28/7 C(C-AA)3	4.00	1.28	.0392	4.00	1.33	.0390	0.76	0.75	0.74	0.67	0.73
B A/B 18/7 C(D-AA)1	4.00	1.36	.0940	4.00	1.44	.0927	0.68	0.75	0.78	0.78	0.75
B A/B 18/7 C(D-AA)2	4.00	1.32	.0934	4.00	1.48	.0935	0.70	0.69	0.76	0.81	0.74
B A/B 18/7 D(D-D)1	4.00	1.56	.0938	4.00	1.40	.0942	1.32	1.12	1.16	1.21	1.20
B A/B 18/7 D(D-D)2	4.00	1.41	.0936	4.00	1.45	.0936	1.12	1.13	1.28	1.31	1.20
B A/B 18/7 D(D-D)3	4.00	1.35	.0931	4.00	1.45	.0937	1.08	1.18	1.22	1.31	1.20
GROUP 3 - MAXIMUM COVER PLATE THICKNESS											
A A/B 10/7 D(E-CC)1	4.00	1.55	.1388	4.00	1.61	.1388	1.06	1.00	1.04	1.05	1.04
A A/B 10/7 D(E-CC)2	4.00	1.63	.1391	4.00	1.59	.1391	1.07	0.99	1.11	1.04	1.05
A A/B 10/7 D(E-E)1	4.00	1.59	.1391	4.00	1.54	.1393	1.15	1.13	1.11	1.16	1.14
A A/B 10/7 D(E-E)2	4.00	1.52	.1394	4.00	1.64	.1396	1.27	1.18	1.20	1.31	1.24
B A/B 14/7 D(E-D)1	4.00	1.44	.152	4.00	1.67	.153	0.98	1.10	1.12	1.12	1.09
B A/B 14/7 D(E-D)2	4.00	1.70	.153	4.00	1.78	.154	1.06	1.06	1.04	1.17	1.08

Table 3 (continued)

PUDDLE WELDS
GEOMETRICAL DIMENSIONS

Specimen Designation	COVER PLATE DIMENSIONS						VISIBLE WELD DIMENSIONS				$\frac{L_{ob}}{d_{ob}}$
	PLATE A-B			PLATE C-D			$\frac{(L_{ob})_a}{(d_{ob})_a}$	$\frac{(L_{ob})_b}{(d_{ob})_b}$	$\frac{(L_{ob})_c}{(d_{ob})_c}$	$\frac{(L_{ob})_d}{(d_{ob})_d}$	Average
	Width	Edge Dist.	Thick.	Width	Edge Dist.	Thick.	Length/Width	Length/Width	Length/Width	Length/Width	Length/Width
	S	e_{ab}	t_{ab}	S	e_{cd}	t_{cd}					
	in.	in.	in.	in.	in.	in.	in./in.	in./in.	in./in.	in./in.	in./in.
GROUP 4 - OBLONG WELDS											
A A/B 18/7 X1	4.00	1.70	.048	4.00	1.78	.047	2.05/0.59	1.92/0.58	1.88/0.53	2.00/0.60	1.96/0.58
A A/B 18/7 X2	4.00	1.81	.047	4.00	1.66	.047	2.02/0.58	1.74/0.60	1.90/0.62	1.87/0.72	1.88/0.63
A A/B 18/7 X3	4.00	1.73	.047	4.00	1.80	.047	2.00/0.54	1.97/0.49	2.09/0.49	1.96/0.56	2.01/0.52
A A/B 18/7 Y1	4.00	1.53	.047	4.00	1.59	.047	1.47/0.52	1.43/0.51	1.25/0.56	1.28/0.58	1.36/0.54
A A/B 18/7 Y3	4.00	1.54	.046	4.00	1.61	.046	1.35/0.55	1.34/0.60	1.34/0.58	1.28/0.57	1.33/0.58
A A/B 22/7 X1	4.00	1.41	.030	4.00	1.64	.030	2.44/0.39	2.18/0.49	1.82/0.53	2.17/0.47	2.15/0.47
A A/B 22/7 X2	4.00	1.56	.030	4.00	1.49	.030	2.03/0.42	2.27/0.49	2.20/0.52	2.33/0.43	2.21/0.47
A A/B 22/7 X3	4.00	1.65	.030	4.00	1.65	.029	1.81/0.42	2.14/0.45	1.91/0.41	1.95/0.39	1.95/0.42
A A/B 22/7 Y1	4.00	1.93	.030	4.00	1.81	.030	1.29/0.42	1.41/0.42	1.27/0.42	1.46/0.40	1.36/0.42

Table 3 (continued)

PUDDLE WELDS
GEOMETRICAL DIMENSIONS

Specimen Designation	COVER PLATE DIMENSIONS: PLATE A-B: Width S in.	PLATE A-B: Edge Dist. e_{ab} in.	PLATE A-B: Thick. t_{ab} in.	PLATE C-D: Width S in.	PLATE C-D: Edge Dist. e_{cd} in.	PLATE C-D: Thick. t_{cd} in.	VISIBLE WELD DIMENSIONS: $\frac{(L_{ob})_a}{(d_{ob})_a}$ $\frac{Length}{Width}$ $\frac{in.}{in.}$	$\frac{(L_{ob})_b}{(d_{ob})_b}$ $\frac{Length}{Width}$ $\frac{in.}{in.}$	$\frac{(L_{ob})_c}{(d_{ob})_c}$ $\frac{Length}{Width}$ $\frac{in.}{in.}$	$\frac{(L_{ob})_d}{(d_{ob})_d}$ $\frac{Length}{Width}$ $\frac{in.}{in.}$	$\frac{L_{ob}}{d_{ob}}$ Average $\frac{Length}{Width}$ $\frac{in.}{in.}$
GROUP 4 - OBLONG WELDS (continued)											
A A/B 22/7 Y2	4.00	2.02	.030	4.00	1.99	.028	1.33/0.42	1.29/0.40	1.31/0.35	1.25/0.44	1.30/0.40
A A/B 22/7 Y3	4.00	2.10	.029	4.00	2.06	.030	1.18/0.50	1.28/0.44	1.35/0.41	1.15/0.39	1.24/0.44
B A/B 18/7 X1	4.00	1.81	.094	4.00	1.67	.094	1.97/0.64	2.02/0.66	2.28/0.68	1.98/0.60	1.91/0.65
B A/B 18/7 X2	4.00	1.76	.094	4.00	1.79	.094	1.93/0.72	1.82/0.73	2.08/0.60	1.82/0.71	1.91/0.69
B A/B 18/7 X3	4.00	1.80	.093	4.00	1.75	.094	1.96/0.67	1.92/0.61	2.13/0.67	2.02/0.62	2.01/0.64
B A/B 18/7 Y1	4.00	1.37	.094	4.00	1.61	.093	1.57/0.54	1.27/0.59	1.18/0.67	1.18/0.58	1.30/0.60
B A/B 18/7 Y2	4.00	1.61	.092	4.00	1.54	.093	1.50/0.59	1.42/0.60	1.34/0.54	1.28/0.60	1.39/0.58
B A/B 18/7 Y3	4.00	1.72	.093	4.00	1.54	.093	1.42/0.54	1.27/0.59	1.48/0.58	1.43/0.59	1.40/0.58
B A/B 22/7 X1	4.00	1.61	.060	4.00	1.62	.060	2.16/0.44	2.02/0.48	1.93/0.48	2.14/0.43	2.06/0.46
B A/B 22/7 X2	4.00	1.66	.060	4.00	1.56	.060	2.05/0.47	1.98/0.50	2.17/0.43	2.07/0.47	2.07/0.47

Table 3 (continued)

PUDDLE WELDS
GEOMETRICAL DIMENSIONS

Specimen Designation	COVER PLATE DIMENSIONS: PLATE A-B: Width S in.	Edge Dist. e_{ab} in.	Thick. t_{ab} in.	PLATE C-D: Width S in.	Edge Dist. e_{cd} in.	Thick. t_{cd} in.	VISIBLE WELD DIMENSIONS: $\frac{(L_{ob})_a}{(d_{ob})_a}$ Length/Width in./in.	$\frac{(L_{ob})_b}{(d_{ob})_b}$ Length/Width in./in.	$\frac{(L_{ob})_c}{(d_{ob})_c}$ Length/Width in./in.	$\frac{(L_{ob})_d}{(d_{ob})_d}$ Length/Width in./in.	$\frac{L_{ob}}{d_{ob}}$ Average Length/Width in./in.
Group 4 - OBLONG WELDS (continued)											
B A/B 22/7 X3	4.00	1.63	.060	4.00	1.71	.060	2.06/0.47	2.18/0.53	2.03/0.43	1.98/0.47	2.06/0.48
B A/B 22/7 Y1	4.00	2.01	.060	4.00	2.11	.060	1.94/0.46	1.24/0.45	1.24/0.51	1.26/0.56	1.42/0.50
B A/B 22/7 Y2	4.00	2.06	.060	4.00	2.01	.060	1.18/0.51	1.26/0.47	1.34/0.49	1.17/0.47	1.24/0.49
B A/A 22/7 Y3	4.00	2.00	.060	4.00	1.95	.060	1.32/0.47	1.34/0.49	1.32/0.51	1.34/0.52	1.33/0.50

TABLE 4

PUDDLE WELDS

EXPERIMENTAL DATA

Specimen Designation	Area of Critical Section	AV. MATERIAL PROPS. COVER PLATE Yield Str.	COVER PLATE Ult. Str.	WELD Shear Str. of Weld	LOADS Yield	LOADS Ult.	STRESSES COVER PLATE Yield	COVER PLATE Ult.	WELD Weld Shear	Def. at Final Load	Mode of Failure	Failure Occurred at Welds
	A_c	σ_y	σ_{ult}	τ_{sa}	P_y	P_{ult}	σ_{yt}	σ_{tt}	τ_{su}	δ_f		
	sq. in.	ksi	ksi	ksi	kips	kips	ksi	ksi	ksi	in.	Type	
GROUP 1 - EFFECTS OF EDGE DISTANCE												
A A/B 12/7 D(B-C)1	.812	41.05	54.90	39.20	-	20.60	-	-	46.8	-	WS	B+C
A A/B 12/7 D(B-C)2	.810	41.05	54.90	39.20	-	24.80	-	-	60.5	-	WS	A+C
A A/B 12/7 D(B-C)3	.818	41.05	54.90	39.20	-	20.30	-	-	54.9	-	WS	B+C
A A/B 12/7 D(F-C)1	.810	41.05	54.90	39.20	-	24.10	-	-	50.2	-	WS	B+D
A A/B 12/7 D(F-C)2	.812	41.05	54.90	39.20	-	24.90	-	-	47.0	-	WS	A+C
A A/B 12/7 D(E-C)1	.811	41.05	54.90	39.20	-	24.10	-	-	-	-	W+WS	A+D
A A/B 12/7 D(E-C)2	.810	41.05	54.90	39.20	23.30	24.10	-	-	45.5	-	WS	A+C
A A/B 18/7 D(B-C)1	.379	47.24	59.00	39.20	10.60	11.70	28.0	30.9	-	1.02	PC+PL+W	A+D
A A/B 18/7 D(B-C)2	.378	47.24	59.00	39.20	9.950	9.950	26.3	26.3	-	0.92	PC+PL+W	B+C
A A/B 18/7 D(B-C)3	.379	47.24	59.00	39.20	9.660	9.680	25.5	25.5	-	0.70	PC+PL+PS+W	A+C
A A/B 18/7 D(F-C)1	.377	47.24	59.00	39.20	11.10	11.10	29.4	29.4	-	0.97	PC+W+PS+PL	A+D
A A/B 18/7 D(F-C)2	.377	47.24	59.00	39.20	10.84	12.66	29.0	33.6	-	1.05	PC+W+PS+PL	A+D
A A/B 18/7 D(F-C)3	.375	47.24	59.00	39.20	11.72	11.80	31.3	31.5	-	0.60	PC+PL+W	B+C
A A/B 18/7 D(E-C)1	.372	47.24	59.00	39.20	9.70	9.74	26.1	26.2	-	0.66	PC+W+PL	A+D
A A/B 18/7 D(E-C)2	.372	47.24	59.00	39.20	11.50	11.50	30.9	30.9	-	0.99	PC+W+PL	B+D
A A/B 18/7 D(E-C)3	.378	47.24	59.00	39.20	10.76	10.76	28.5	28.5	-	0.53	PC+W+PL	A+D

Table 4 (continued)

PUDDLE WELDS

EXPERIMENTAL DATA

Specimen Designation	Area of Critical Section	AV. MATERIAL PROPS. COVER PLATE Yield Str.	AV. MATERIAL PROPS. COVER PLATE Ult. Str.	AV. MATERIAL PROPS. WELD Shear Str. of Weld	LOADS Yield	LOADS Ult.	STRESSES COVER PLATE Yield	STRESSES COVER PLATE Ult.	STRESSES WELD Weld Shear	Def. at Final Load	Mode of Failure	Failure Occurred at Welds
	A_c	σ_y	σ_{ult}	τ_{sa}	P_y	P_{ult}	σ_{yt}	σ_{tt}	τ_{su}	δ_f		
	sq. in.	ksi	ksi	ksi	kips	kips	ksi	ksi	ksi	in.	Type	
GROUP 1 - EFFECTS OF EDGE DISTANCE (continued)												
B A/B 14/7 D(A-C)1	1.23	39.04	47.63	39.20	-	17.20	-	-	46.7	-	WS	A+D
B A/B 14/7 D(A-C)2	1.23	39.04	47.63	39.20	-	20.90	-	-	48.6	-	WS	A+D
B A/B 14/7 D(D-C)1	1.23	39.04	47.63	39.20	-	16.10	-	-	53.7	-	WS	B+C
B A/B 14/7 D(D-C)2	1.23	39.04	47.63	39.20	-	11.80	-	-	39.1	-	WS	B+D
B A/B 14/7 D(F-C)1	1.23	39.04	47.63	39.20	-	14.80	-	-	52.9	-	WS	B+D
B A/B 14/7 D(F-C)2	1.22	39.04	47.63	39.20	-	16.50	-	-	63.5	-	WS	B+C
B A/B 18/7 D(A-C)1	0.750	47.24	59.00	39.20	22.00	22.40	29.33	29.87	56.0	-	WS @ A PC+PL+W+PT	A+D
B A/B 18/7 D(A-C)2	0.747	47.24	59.00	39.20	23.20	24.50	31.06	32.80	-	-	PC+PS+PL	A+D
B A/B 18/7 D(A-C)3	0.751	47.24	59.00	39.20	21.70	21.70	28.89	28.89	-	0.60	PC+PL+W+PS	B+C
B A/B 18/7 D(D-C)1	0.742	47.24	59.00	39.20	22.70	23.40	30.59	31.54	-	0.38	PC+PS+W+PL	A+C
B A/B 18/7 D(D-C)2	0.752	47.24	59.00	39.20	-	24.10	-	32.0	-	0.50	WS+PC+PL	A+C
B A/B 18/7 D(D-C)3	0.751	47.24	59.00	39.20	21.80	22.20	29.0	29.6	-	0.47	PC+PS+W	B+C
B A/B 18/7 D(F-C)1	0.745	47.24	59.00	39.20	23.70	24.90	31.8	33.4	-	0.38	PC+PS+PL	A+D
B A/B 18/7 D(F-C)2	0.738	47.24	59.00	39.20	24.50	24.50	33.2	33.2	-	0.38	PC+PL+W+PL	A+D
B A/B 18/7 D(F-C)3	0.737	47.24	59.00	39.20	23.50	24.00	31.9	32.6	-	0.58	PC+PL+W	A+C
A A/B 12/7 D(AA-C)1	0.806	41.05	54.90	39.20	24.50	24.50	-	-	68.7	-	WS	B+C
A A/B 12/7 D(AA-C)2	0.808	41.05	54.90	39.20	20.30	22.50	25.1	27.8	50.0	-	WS+PS+PB	A+C
A A/B 12/7 D(AA-C)3	0.809	41.05	54.90	39.20	14.00	14.00	-	-	48.3	-	WS	A+C
A A/B 18/7 D(BB-C)1	0.382	47.24	59.00	39.20	12.56	12.58	32.9	32.9	-	0.38	PC+PS+W	B+D
A A/B 18/7 D(BB-C)2	0.382	47.24	59.00	39.20	10.22	11.08	26.8	29.0	-	0.37	PC+PS+W	A+C

TABLE 4 (continued)

PUDDLE WELDS

EXPERIMENTAL DATA

Specimen Designation	Area of Critical Section	AV. MATERIAL PROPS. COVER PLATE Yield Str.	AV. MATERIAL PROPS. COVER PLATE Ult. Str.	AV. MATERIAL PROPS. WELD Shear Str. of Weld	LOADS Yield	LOADS Ult.	STRESSES COVER PLATE Yield	STRESSES COVER PLATE Ult.	STRESSES WELD Weld Shear	Def. at Final Load	Mode of Failure	Failure Occurred at Welds
	A_c	σ_y	σ_{ult}	τ_{sa}	P_y	P_{ult}	σ_{yt}	σ_{tt}	τ_{su}	δ_f		
	sq. in.	ksi	ksi	ksi	kips	kips	ksi	ksi	ksi	in.	Type	
GROUP 2 - EFFECTS OF WELD DIAMETER (continued)												
B E/B 28/7 C(C-AA)1	.313	102.1	105.4	39.20	9.14	9.18	29.2	24.3	-	0.26	PS+PB+W	B+D
B E/B 28/7 C(C-AA)2	.314	102.1	105.4	39.20	8.84	8.84	28.2	28.2	-	0.23	PS+PB+W	B+D
B E/B 28/7 C(C-AA)3	.313	102.1	105.4	39.20	9.42	9.54	30.1	30.5	-	0.18	PS+PB+W	B+D
B A/B 18/7 C(D-AA)1	.747	47.24	59.00	39.20	17.40	18.90	-	-	57.3		WS	A+D
B A/B 18/7 C(D-AA)2	.748	47.24	59.00	39.20	11.50	12.60	-	-	52.1	-	WS	A+C
B A/B 18/7 D(D-D)1	.752	47.2	59.0	39.20	28.60	28.60	37.5	38.0	-	0.38	PC+PS+W	B+D
B A/B 18/7 D(D-D)2	.747	47.2	59.00	39.20	29.40	30.10	39.3	40.2	-	0.41	PC+PS+W	B+D
B A/B 18/7 D(D-D)3	.747	47.2	59.00	39.20	29.70	31.00	39.8	41.5	-	0.37	PC+PS+W	B+D
GROUP 3 - MAXIMUM COVER PLATE Thickness												
A A/B 10/7 D(E-CC)1	1.110	38.6	48.8	39.20	26.10	26.10	-	-	43.5	-	WS	A+D
A A/B 10/7 D(E-CC)2	1.113	38.6	48.8	39.20	20.90	20.90	-	-	40.2	-	WS	B+D
A A/B 10/7 D(E-E)1	1.114	38.6	48.8	39.20	34.50	34.50	-	-	59.5	-	WS	A+D
A A/B 10/7 D(E-E)2	1.116	38.6	48.8	39.20	28.30	28.30	-	-	49.6	-	WS	B+D

TABLE 4 (continued)

PUDDLE WELDS

EXPERIMENTAL DATA

Specimen Designation	Area of Critical Section	AV. MATERIAL PROPS. COVER PLATE Yield Str.	AV. MATERIAL PROPS. COVER PLATE Ult. Str.	AV. MATERIAL PROPS. WELD Shear Str. of Weld	LOADS Yield	LOADS Ult.	STRESSES COVER PLATE Yield	STRESSES COVER PLATE Ult.	STRESSES WELD Weld Shear	Def. at Final Load	Mode of Failure	Failure Occurred at Welds
	A_c	σ_y	σ_{ult}	τ_{sa}	P_y	P_{ult}	σ_{yt}	σ_{tt}	τ_{su}	δ_f		
	sq. in.	ksi	ksi	ksi	kips	kips	ksi	ksi	ksi	in.	Type	
GROUP 3 - MAXIMUM COVER PLATE Thickness (continued)												
B A/B 14/7 D(E-D)1	1.220	39.0	47.6	39.20	18.80	18.80	-	-	55.3	-	WS	A+C
B A/B 14/7 D(E-D)2	1.228	39.0	47.6	39.20	22.50	22.50	-	-	45.9	-	WS	B+C
GROUP 4 - OBLONG WELDS												
A A/B 18/7 X1	0.376	47.24	59.00	39.20	14.20	15.60	37.77	41.49	-	0.43	PC+PS+PL	B+C
A A/B 18/7 X2	0.375	47.24	59.00	39.20	14.30	15.50	38.13	41.33	-	0.42	PC+PT+PS+PL	B+D
A A/B 18/7 X3	0.374	47.24	59.00	39.20	14.60	15.00	39.04	40.11	-	0.60	PC+PT+PL	A+D
A A/B 18/7 Y1	0.378	47.24	59.00	39.20	12.00	13.10	31.85	34.66	-	0.36	PC+PT	B+D
A A/B 18/7 Y3	0.370	47.24	59.00	39.20	10.86	10.90	29.35	29.46	-	0.34	PC+PS+W+PT	B+C
A A/B 22/7 X1	0.237	42.62	49.96	39.20	7.40	7.61	31.22	32.11	-	0.51	PC+PT+PL	A+C
A A/B 22/7 X2	0.238	42.62	49.96	39.20	7.46	7.50	31.34	31.51	-	0.48	PC+PT+PL	B
A A/B 22/7 X3	0.236	42.62	49.96	39.20	6.88	7.06	29.15	29.92	-	0.44	PC+PT+PL	A+D
A A/B 22/7 Y1	0.238	42.62	49.96	39.20	-	3.90	-	16.39	-	0.47	PC+PT+W	A+C
A A/B 22/7 Y2	0.231	42.62	49.96	39.20	6.02	6.04	26.06	26.15	-	0.45	PC+PT+PS	B+D
A A/B 22/7 Y3	0.237	42.62	49.96	39.20	4.66	4.76	19.66	20.08	-	0.35	PC+PT+W	A+D

TABLE 4 (continued)

PUDDLE WELDS

EXPERIMENTAL DATA

Specimen Designation	Area of Critical Section	AV. MATERIAL PROPS.			LOADS		STRESSES			Def. at Final Load	Mode of Failure	Failure Occurred at Welds
		COVER PLATE		WELD			COVER PLATE		WELD			
		Yield Str.	Ult. Str.	Shear Str. of Weld	Yield	Ult.	Yield	Ult.	Weld Shear			
	A_c	σ_y	σ_{ult}	τ_{sa}	P_y	P_{ult}	σ_{yt}	σ_{tt}	τ_{su}	δ_f		
	sq. in.	ksi	ksi	ksi	kips	kips	ksi	ksi	ksi	in.	Type	
GROUP 4 - OBLONG WELDS (continued)												
B A/B 18/7 X1	0.752	47.24	59.00	39.20	29.30	30.20	38.96	40.16	-	0.47	PC+PT+PL	B+D
B A/B 18/7 X2	0.748	47.24	59.00	39.20	29.80	31.10	39.84	41.58	-	0.42	PC+PT+W	B+D
B A/B 18/7 X3	0.749	47.24	59.00	39.20	29.70	31.00	39.65	41.39	-	0.43	PC+PS+PT	B+D
B A/B 18/7 Y1	0.744	47.24	59.00	39.20	23.80	23.90	31.99	32.12	-	0.32	PC+W+PT	B+D
B A/B 18/7 Y2	0.739	47.24	59.00	39.20	25.10	25.70	33.96	34.78	-	0.41	PC+W+PT	B+C
B A/B 18/7 Y3	0.743	47.24	59.00	39.20	24.30	24.90	32.71	33.51	-	0.33	PC	B
B A/B 22/7 X1	0.479	42.62	49.96	39.20	15.30	15.60	31.94	32.57	-	0.55	PC+PT+PL	B+C
B A/B 22/7 X2	0.471	42.62	49.96	39.20	14.90	15.10	31.63	32.06	-	0.49	PC+PT+PL	B+D
B A/B 22/7 X3	0.478	42.62	49.96	39.20	15.20	15.40	31.80	32.22	-	0.51	PC+PT+PL	B+D
B A/B 22/7 Y1	0.478	42.62	49.96	39.20	12.08	12.10	25.27	25.31	-	0.41	PC+PT+W	B+C
B A/B 22/7 Y2	0.477	42.62	49.96	39.20	12.28	12.40	25.74	26.00	-	0.46	PC+PT	B+D
B A/B 22/7 Y3	0.478	42.62	49.96	39.20	-	11.20	-	23.43	-	0.43	PC+PT+W	A+D

Table 5

PUDDLE WELDS
SUMMARY OF RESULTS

Specimen Designation	Yield Stress Ratio σ_{yt}/σ_y	Tensile Stress Ratio σ_{tt}/σ_{ult}	Shear Stress Ratio τ_{su}/τ_{sa}	Def. at ult. load δ_u	Mode of Failure Type
GROUP 1 - EFFECTS OF EDGE DISTANCE					
A A/B 12/7 D(B-C)1	-	-	1.19	-	WS
A A/B 12/7 D(B-C)2	-	-	1.54	-	WS
A A/B 12/7 D(B-C)3	-	-	1.40	-	WS
A A/B 12/7 D(F-C)1	-	-	1.28	-	WS
A A/B 12/7 D(F-C)2	-	-	1.20	-	WS
A A/B 12/7 D(E-C)1	-	-	-	-	W+WS
A A/B 12/7 D(E-C)2	-	-	1.16	-	WS
A A/B 18/7 D(B-C)1	0.59	0.52	-	-	PC+PL+W
A A/B 18/7 D(B-C)2	0.56	0.45	-	-	PC+PL+W
A A/B 18/7 D(B-C)3	0.54	0.43	-	-	PC+PL+PS+W
A A/B 18/7 D(F-C)1	0.62	0.50	-	-	PC+W+PS+PL
A A/B 18/7 D(F-C)2	0.61	0.57	-	-	PC+W+PS+PL
A A/B 18/7 D(F-C)3	0.66	0.53	-	-	PC+W+PL
A A/B 18/7 D(E-C)1	0.55	0.44	-	-	PC+W+PL
A A/B 18/7 D(E-C)2	0.65	0.52	-	-	PC+W+PL
A A/B 18/7 D(E-C)3	0.60	0.48	-	-	PC+W+PL
B A/B 14/7 D(A-C)1	-	-	1.19	-	WS
B A/B 14/7 D(A-C)2	-	-	1.24	-	WS
B A/B 14/7 D(D-C)1	-	-	1.37	-	WS
B A/B 14/7 D(D-C)2	-	-	0.97	-	WS
B A/B 14/7 D(F-C)1	-	-	1.35	-	WS
B A/B 14/7 D(F-C)2	-	-	1.62	-	WS
B A/B 18/7 D(A-C)1	0.62	0.51	1.43	-	[WS @ A PC+PL+W+PT]
B A/B 18/7 D(A-C)2	0.66	0.56	-	-	PC+PS+PL
B A/B 18/7 D(A-C)3	0.61	0.49	-	-	PC+PL+W+PS
B A/B 18/7 D(D-C)1	0.65	0.53	-	-	PC+PS+W+PL
B A/B 18/7 D(D-C)2	-	0.54	-	-	WS+PC+PL
B A/B 18/7 D(D-C)3	0.61	0.50	-	-	PC+PS+W
B A/B 18/7 D(F-C)1	0.67	0.57	-	-	PC+PS+PL
B A/B 18/7 D(F-C)2	0.70	0.56	-	-	PC+PS+W+PL
B A/B 18/7 D(F-C)3	0.68	0.55	-	-	PC+PS+W

Table 5 (continued)

PUDDLE WELDS

SUMMARY OF RESULTS

Specimen Designation	Yield Stress Ratio σ_{yt}/σ_y	Tensile Stress Ratio σ_{tt}/σ_{ult}	Shear Stress Ratio τ_{su}/τ_{sa}	Def. at ult. load δ_u	Mode of Failure Type
A A/B 12/7 D(AA-C)1	-	-	1.75	-	WS
A A/B 12/7 D(AA-C)2	0.61	0.51	1.28	-	WS+PS+PB
A A/B 12/7 D(AA-C)3	-	-	1.23	-	WS
A A/B 18/7 D(BB-C)1	0.70	0.56	-	-	PC+PS+W
A A/B 18/7 D(BB-C)2	0.57	0.49	-	-	PC+PS+W
GROUP 2 - EFFECTS OF WELD DIAMETER					
A A/B 12/7 C(E-AA)1	-	-	-	-	WS
A A/B 12/7 C(E-AA)2	-	-	1.05	-	WS
A A/B 12/7 D(E-D)1	-	-	1.33	-	WS+PC+W
A A/B 12/7 D(E-D)2	-	-	1.47	-	WS+PC+W+PL
A A/B 12/7 D(E-D)3	-	-	1.24	-	WS+PL
A A/B 18/7 C(E-AA)1	0.56	0.45	-	-	PC+W+PS
A A/B 18/7 C(E-AA)2	0.42	0.34	-	-	PC+PS+W
A A/B 18/7 C(E-AA)3	0.59	0.48	-	-	PC+PS+W
A E/B 24/7 C(E-AA)1	-	0.18	-	-	PS+PB
A E/B 24/7 C(E-AA)2	0.22	0.22	-	-	PS+PB
A E/B 24/7 C(E-AA)3	0.22	0.24	-	-	PS+PB
A E/B 24/7 D(E-C)1	0.29	0.29	-	-	PS+PT+PB+W
A E/B 24/7 D(E-C)2	0.30	0.31	-	-	PS+PB+W
A E/B 24/7 D(E-C)3	0.29	0.30	-	-	PS+PB+W
B A/B 14/7 D(D-E)1	-	-	1.02	-	WS
B A/B 14/7 D(D-E)2	-	-	1.65	-	WS+W
B A/B 14/7 D(D-E)3	-	-	-	-	WS
B E/B 28/7 C(C-AA)1	0.29	0.28	-	-	PS+PB+W
B E/B 28/7 C(C-AA)2	0.28	0.27	-	-	PS+PB+W
B E/B 28/7 C(C-AA)3	0.29	0.29	-	-	PS+PB+W
B A/B 18/7 C(D-AA)1	-	-	1.46	-	WS
B A/B 18/7 C(D-AA)2	-	-	1.33	-	WS
B A/B 18/7 D(D-D)1	0.79	0.64	-	-	PC+PS+W
B A/B 18/7 D(D-D)2	0.83	0.68	-	-	PC+PS+W
B A/B 18/7 D(D-D)3	0.84	0.70	-	-	PC+PS+W
GROUP 3 - MAXIMUM COVER PLATE THICKNESS					
A A/B 10/7 D(E-CC)1	-	-	1.11	-	WS
A A/B 10/7 D(E-CC)2	-	-	1.03	-	WS
A A/B 10/7 D(E-E)1	-	-	1.52	-	WS
A A/B 10/7 D(E-E)2	-	-	1.27	-	WS

Table 5 (continued)

PUDDLE WELDS

SUMMARY OF RESULTS

Specimen Designation	Yield Stress Ratio σ_{yt}/σ_y	Tensile Stress Ratio σ_{tt}/σ_{ult}	Shear Stress Ratio τ_{su}/τ_{sa}	Def. at ult. load δ_u	Mode of Failure Type
B A/B 14/7 D(E-D)1	-	-	1.41	-	WS
B A/B 14/7 D(E-D)2	-	-	1.17	-	WS
GROUP 4 - OBLONG WELDS					
A A/B 18/7 X1	0.80	0.70	-	-	PC+PS+PL
A A/B 18/7 X2	0.81	0.70	-	-	PC+PT+PS+PL
A A/B 18/7 X3	0.83	0.68	-	-	PC+PT+PL
A A/B 18/7 Y1	0.67	0.59	-	-	PC+PT
A A/B 18/7 Y3	0.62	0.50	-	-	PC+PS+W+PT
A A/B 22/7 X1	0.73	0.64	-	-	PC+PT+PL
A A/B 22/7 X2	0.74	0.63	-	-	PC+PT+PL
A A/B 22/7 X3	0.68	0.60	-	-	PC+PT+PL
A A/B 22/7 Y1	-	0.33	-	-	PC+PT+W
A A/B 22/7 Y2	0.61	0.52	-	-	PC+PT+PS
A A/B 22/7 Y3	0.46	0.40	-	-	PC+PT+W
B A/B 18/7 X1	0.82	0.68	-	-	PC+PT+PL
B A/B 18/7 X2	0.84	0.70	-	-	PC+PT+W
B A/B 18/7 X3	0.84	0.70	-	-	PC+PS+PT
B A/B 18/7 Y1	0.68	0.54	-	-	PC+W+PT
B A/B 18/7 Y2	0.72	0.59	-	-	PC+W+PT
B A/B 18/7 Y3	0.69	0.57	-	-	PC
B A/B 22/7 X1	0.75	0.65	-	-	PC+PT+PL
B A/B 22/7 X2	0.74	0.64	-	-	PC+PT+PL
B A/B 22/7 X3	0.75	0.64	-	-	PC+PT+PL
B A/B 22/7 Y1	0.59	0.51	-	-	PC+PT+W
B A/B 22/7 Y2	0.60	0.52	-	-	PC+PT
B A/B 22/7 Y3	-	0.47	-	-	PC+PT+W

TABLE 6

PUDDLE WELDS

COMPARISON OF CALCULATED AND OBSERVED RESULTS

Specimen Designation		Plate Thick. t in.	Weld Dia. d in.	A_g Sq. in.	A_n Sq. in.	A_n/A_g	d_{eg} (obs.) in.	d_{en} (obs.) in.	CALC. WELD FAIL. (Eq. 4) d_{en} (calc.) in.	CALC. WELD FAIL. (Eq. 3) P_{ult} (calc.) kips	CALC. COVER PLATE FAILURE $\frac{d}{t}$		CALC. COVER PLATE FAILURE $\frac{240}{\sqrt{\sigma_y}}$	CALC. COVER PLATE FAILURE (Eq. 1) P_{ult} (calc.) kips	CALC. COVER PLATE FAILURE (Eq. 2) P_{ult} (calc.) kips	P_{ult} (obs.) kips
A A/B 12/7	D(B-C)1	.101	0.89	0.55	0.44	0.81	0.59	0.53	0.47	15.7	8.81	<	37.46	19.2	-	20.6
σ_y = 41.05	D(B-C)2	.101	0.95	0.58	0.41	0.71	0.61	0.51	0.51	18.6	9.41	<	37.46	20.7	-	24.8
	D(B-C)3	.102	0.90	0.57	0.37	0.65	0.60	0.49	0.48	16.1	8.91	<	37.46	19.6	-	20.3
σ_{ult} = 54.90	D(F-C)1	.101	0.90	0.61	0.48	0.79	0.62	0.55	0.48	16.2	8.91	<	37.46	19.4	-	24.1
	D(F-C)2	.101	0.94	0.67	0.53	0.79	0.65	0.58	0.51	18.2	9.31	<	37.46	20.4	-	24.9
	D(E-C)1	.101	0.93	0.60	0.51	0.85	0.62	0.57	0.50	17.6	9.21	<	37.46	20.2	-	24.1
	D(E-C)2	.101	0.98	0.64	0.53	0.83	0.64	0.58	0.53	20.2	9.70	<	37.46	21.4	-	24.1
A A/B 18/7	D(B-C)1	.0474	0.77	-	-	-	-	-	0.47	15.5	16.20	<	34.92	8.9	-	11.7
σ_y = 47.24	D(B-C)2	.0473	0.76	-	-	-	-	-	0.46	15.0	16.10	<	34.92	8.7	-	9.95
	D(B-C)3	.0474	0.77	-	-	-	-	-	0.47	15.6	16.20	<	34.92	8.8	-	9.68
σ_{ult} = 59.00	D(F-C)1	.0472	0.78	-	-	-	-	-	0.48	16.3	16.50	<	34.92	8.9	-	11.1
	D(F-C)2	.0471	0.83	-	-	-	-	-	0.51	18.4	17.60	<	34.92	9.5	-	12.7
	D(F-C)3	.0469	0.85	-	-	-	-	-	0.52	19.1	18.10	<	34.92	9.7	-	11.8
	D(E-C)1	.0466	0.84	-	-	-	-	-	0.52	19.1	18.00	<	34.92	9.5	-	9.74
	D(E-C)2	.0465	0.81	-	-	-	-	-	0.50	17.7	17.40	<	34.92	9.2	-	11.5
	D(E-C)3	.0472	0.75	-	-	-	-	-	0.45	14.3	15.90	<	34.92	8.6	-	10.8
B A/B 14/7	D(A-C)1	.153	1.01	0.45	0.30	0.67	0.54	0.44	0.48	16.1	6.60	<	38.41	24.8	-	17.2
σ_y = 39.04	D(A-C)2	.154	1.09	0.50	0.43	0.86	0.56	0.52	0.53	20.0	7.08	<	38.41	25.2	-	20.9
	D(D-C)1	.153	1.08	0.37	0.30	0.81	0.49	0.44	0.53	19.6	6.54	<	38.41	24.8	-	16.1
σ_{ult} = 47.63	D(D-C)2	.155	0.99	0.35	0.31	0.86	0.47	0.44	0.46	15.0	6.39	<	38.41	22.1	-	11.8
	D(F-C)1	.154	1.04	0.41	0.28	0.68	0.51	0.42	0.50	17.5	6.75	<	38.41	23.6	-	14.8
	D(F-C)2	.153	0.92	0.38	0.26	0.67	0.49	0.40	0.41	12.1	6.01	<	38.41	19.7	-	16.5

Table 6 (continued)

PUDDLE WELDS

COMPARISON OF CALCULATED AND OBSERVED RESULTS

Specimen Designation		Plate Thick. t (in.)	Weld Dia. d (in.)	A_g (Sq. in.)	A_n (Sq. in.)	A_n/A_g	d_{eg} (obs.) (in.)	d_{en} (obs.) (in.)	CALC. WELD FAIL. (Eq. 4) d_{en} (calc.) (in.)	CALC. WELD FAIL. (Eq. 3) P_{ult} (calc.) (kips)	CALC. COVER PLATE FAILURE $\frac{d}{t}$	CALC. COVER PLATE FAILURE $\frac{240}{\sqrt{\sigma_y}}$	CALC. COVER PLATE FAILURE (Eq. 1) P_{ult} (calc.) (kips)	CALC. COVER PLATE FAILURE (Eq. 2) P_{ult} (calc.) (kips)	P_{ult} (obs.) (kips)
B A/B 18/7	D(A-C)1	.0934	1.00	0.58	0.40	0.69	0.61	0.50	0.56	22.2	10.70	< 34.92	19.7		22.4
σ_y = 47.24	D(A-C)2	.0934	1.05	-	-	-	-	-	0.59	25.0	11.20	< 34.92	20.9		24.5
	D(A-C)3	.0939	0.92	-	-	-	-	-	0.50	17.9	9.80	< 34.92	17.8		21.7
σ_{ult} = 59.00	D(D-C)1	.0928	0.93	-	-	-	-	-	0.51	18.4	10.00	< 34.92	17.9		23.4
	D(D-C)2	.0940	0.92	-	-	-	-	-	0.50	17.5	9.97	< 34.92	17.9		24.1
	D(D-C)3	.0939	0.94	-	-	-	-	-	0.52	19.1	10.00	< 34.92	18.3		22.2
	D(F-C)1	.0931	0.99	-	-	-	-	-	0.55	21.4	10.60	< 34.92	19.4		24.9
	D(F-C)2	.0923	1.03	-	-	-	-	-	0.58	23.8	11.20	< 34.92	20.3		24.5
	D(F-C)3	.0922	1.00	-	-	-	-	-	0.56	22.2	10.80	< 34.92	19.5		24.0
A A/B 12/7	D(AA-C)1	.101	1.07	0.69	0.36	0.52	0.66	0.48	0.60	25.4	10.59	< 37.46	23.6		24.5
	D(AA-C)2	.101	0.97	0.71	0.45	0.63	0.67	0.54	0.53	19.9	9.60	< 37.46	21.2		22.5
σ_{ult} = 54.90	D(AA-C)3	.101	0.90	0.55	0.30	0.55	0.59	0.44	0.48	16.3	8.91	< 37.46	19.4		14.0
σ_y = 41.05															
A A/B 18/7	D(BB-C)1	.0478	0.83	-	-	-	-	-	0.51	18.4	17.36	< 34.92	9.7		12.58
σ_y = 47.24	D(BB-C)2	.0478	0.75	-	-	-	-	-	0.45	14.3	15.69	< 34.92	8.7		11.08
σ_{ult} = 59.00															

Table 6 (continued)

PUDDLE WELDS

COMPARISON OF CALCULATED AND OBSERVED RESULTS

Specimen Designation		Plate Thick. t in.	Weld Dia. d in.	A_g Sq. in.	A_n Sq. in.	A_n/A_g	d_{eg} (obs.) in.	d_{en} (obs.) in.	CALC. WELD FAIL. (Eq. 4) d_{en} (calc.) in.	CALC. WELD FAIL. (Eq. 3) P_{ult} (calc.) kips	CALC. COVER PLATE FAILURE $\frac{d}{t}$		$\frac{240}{\sqrt{\sigma_y}}$	(Eq. 1) P_{ult} (calc.) kips	(Eq. 2) P_{ult} (calc.) kips	P_{ult} (obs.) kips
GROUP 2 - EFFECT OF WELD DIAMETER																
A A/B 12/7	C(E-AA)1	.101	0.82	0.21	0.18	0.86	0.37	0.34	0.42	12.5	8.12	<	37.46	17.5	-	-
σ_y = 41.05	C(E-AA)2	.101	0.87	0.32	0.26	0.81	0.45	0.40	0.46	15.0	8.61	<	37.46	18.7	-	10.7
	D(E-D)1	.101	0.98	0.66	0.55	0.83	0.65	0.59	0.53	19.9	9.70	<	37.46	21.4	-	28.7
σ_{ult} = 54.90	D(E-D)2	.101	0.98	0.53	0.46	0.87	0.58	0.54	0.53	19.9	9.70	<	37.46	21.4	-	26.5
	D(E-D)3	.101	0.97	0.78	0.60	0.77	0.70	0.62	0.53	19.9	9.60	<	37.46	21.2	-	29.1
A A/B 18/7	C(E-AA)1	.0473	0.64	-	-	-	-	-	0.38	10.2	13.53	<	34.92	7.2	-	8.98
σ_y = 47.24	C(E-AA)2	.0465	0.61	-	-	-	-	-	0.36	9.2	13.12	<	34.92	6.8	-	7.46
σ_{ult} = 59.00	C(E-AA)3	.0466	0.64	-	-	-	-	-	0.38	10.2	13.73	<	34.92	7.1	-	10.5
A E/B 24/7	C(E-AA)1	.0240	0.52	-	-	-	-	-	0.33	7.7	21.67	<	23.22	5.6	-	3.8
σ_y = 106.84	C(E-AA)2	.0240	0.54	-	-	-	-	-	0.34	8.2	22.50	<	23.22	5.8	-	4.48
	C(E-AA)3	.0240	0.54	-	-	-	-	-	0.34	8.2	22.50	<	23.22	5.8	-	4.9
σ_{ult} = 107.56	D(E-C)1	.0240	0.70	-	-	-	-	-	0.45	14.3	29.17	>	23.22	-	4.8	6.0
	D(E-C)2	.0241	0.66	-	-	-	-	-	0.43	13.1	27.39	>	23.22	-	4.5	6.3
	D(E-C)3	.0240	0.72	-	-	-	-	-	0.47	15.6	30.00	>	23.22	-	5.0	6.16

Table 6 (continued)

PUDDLE WELDS

COMPARISON OF CALCULATED AND OBSERVED RESULTS

Specimen Designation	Plate Thick. t in.	Weld Dia. d in.	A_g Sq. in.	A_n Sq. in.	A_n/A_g	d_{eg} (obs.) in.	d_{en} (obs.) in.	CALC. WELD FAIL. (Eq. 4) d_{en} (calc.) in.	CALC. WELD FAIL. (Eq. 3) P_{ult} (calc.) kips	CALC. COVER PLATE FAILURE $\frac{d}{t}$		$\frac{240}{\sqrt{\sigma_y}}$	(Eq. 1) P_{ult} (calc.) kips	(Eq. 2) P_{ult} (calc.) kips	P_{ult} (obs.) kips
B A/B 14/7 D(D-E)1	.153	1.12	0.97	0.76	0.82	0.79	0.70	0.55	21.4	7.32	<	38.41	26.1	16.6	38.9
σ_y = 39.04 D(D-E)2	.153	1.17	0.95	0.61	0.64	0.78	0.62	0.59	24.6	7.65	<	38.41	27.7	17.6	39.4
σ_{ult} = 47.63 D(D-E)3	.153	1.11	-	-	-	-	-	-	-	7.25	<	38.41	-	-	-
B E/B 28/7 C(C-AA)1	.0391	0.67	-	-	-	-	-	0.41	11.9	17.14	<	23.75	10.7	6.8	9.18
σ_y = 102.1 C(C-AA)2	.0392	0.70	-	-	-	-	-	0.43	13.1	17.86	<	23.75	11.3	7.2	8.84
σ_{ult} = 105.4 C(C-AA)3	.0391	0.71	-	-	-	-	-	0.44	13.7	18.16	<	23.75	11.5	7.3	9.54
B A/B 18/7 C(D-AA)1	.0934	0.73	0.34	0.33	0.97	0.47	0.46	0.37	9.7	7.82	<	34.92	13.2	8.4	18.9
σ_y = 47.24 C(D-AA)2	.0935	0.73	0.28	0.24	0.86	0.42	0.39	0.37	9.7	7.81	<	34.92	13.2	8.4	12.6
σ_{ult} = 59.00 C(D-AA)3	-	-	-	-	-	-	-	-	-	-		-	-	-	-
B A/B 18/7 D(D-D)1	.0940	1.14	-	-	-	-	-	0.66	30.8	12.13	<	34.92	23.2	14.8	28.6
σ_y = 47.24 D(D-D)2	.0936	1.13	-	-	-	-	-	0.65	29.9	12.07	<	34.92	22.9	14.6	30.1
σ_{ult} = 59.00 D(D-D)3	.0934	1.25	-	-	-	-	-	0.73	37.7	13.38	<	34.92	25.8	16.4	31.0
GROUP 3 - MAXIMUM COVER PLATE THICKNESS															
A A/B 10/7 D(E-CC)1	.1388	1.06	0.70	0.60	0.86	0.67	0.62	0.53	19.9	7.64	<	38.64	27.4	17.4	26.1
σ_y = 38.58 D(E-CC)2	.1391	1.02	0.70	0.52	0.74	0.67	0.58	0.51	18.4	7.33	<	38.64	26.3	16.7	20.9
σ_{ult} = 48.75 D(E-E)1	.1392	1.16	0.88	0.58	0.66	0.75	0.61	0.60	25.4	8.33	<	38.64	30.5	19.4	34.5
D(E-E)2	.0395	1.25	0.61	0.57	0.93	0.62	0.60	0.67	31.7	8.96	<	38.64	33.2	21.1	28.3
B A/B 14/7 D(E-D)1	.153	1.05	0.66	0.34	0.52	0.65	0.47	0.51	18.4	6.86	<	38.41	23.9	15.7	18.8
σ_y = 39.04 D(E-D)2	.154	1.05	0.63	0.49	0.78	0.63	0.56	0.50	17.7	6.82	<	38.41	23.9	15.2	22.5
σ_{ult} = 47.63															

Table 7

PUDDLE WELDS

OBLONG WELD RESULTS

Specimen Designation	Shear Str. of Cover Plate τ_{ult} (ksi)	Avg. Weld Length L_{ob} (in)	Avg. Weld Width d_{ob} (in)	Total Cover Plate Thick. Σt (in)	Predict. Failure Load (Eq. 6) P_{ult} (kips)	Observ. Failure Load P_{ult} (kips)	Mode of Failure Type
GROUP 4 - OBLONG WELDS							
A A/B 18/7 X1	39.33	1.96	0.58	0.095	10.79	15.60	B+C
A A/B 18/7 X2	39.33	1.88	0.63	0.094	10.68	15.50	B+D
A A/B 18/7 X3	39.33	2.01	0.52	0.094	10.51	15.00	A+D
A A/B 18/7 Y1	39.33	1.36	0.54	0.094	8.22	13.10	B+D
A A/B 18/7 Y3	39.33	1.33	0.58	0.092	8.17	10.90	B+C
A A/B 22/7 X1	33.31	2.15	0.47	0.060	5.80	7.61	A+C
A A/B 22/7 X2	33.31	2.21	0.47	0.060	5.92	7.50	B
A A/B 22/7 X3	33.31	1.95	0.42	0.059	5.16	7.06	A+D
A A/B 22/7 Y1	33.31	1.36	0.42	0.060	4.06	3.90	A+C
A A/B 22/7 Y2	33.31	1.30	0.40	0.058	3.75	6.04	B+D
A A/B 22/7 Y3	33.31	1.24	0.44	0.059	3.82	4.76	A+D
B A/B 18/7 X1	39.33	1.91	0.65	0.188	21.81	30.20	B+D
B A/B 18/7 X2	39.33	1.91	0.69	0.188	22.29	31.10	B+D
B A/B 18/7 X3	39.33	2.01	0.64	0.187	22.32	31.00	B+D
B A/B 18/7 Y1	39.33	1.30	0.60	0.187	16.62	23.90	B+D
B A/B 18/7 Y2	39.33	1.39	0.58	0.185	16.87	25.70	B+C
B A/B 18/7 Y3	39.33	1.40	0.58	0.186	17.03	24.90	B
B A/B 22/7 X1	33.31	2.06	0.46	0.120	11.18	15.60	B+C
B A/B 22/7 X2	33.31	2.07	0.47	0.120	11.28	15.10	B+C
B A/B 22/7 X3	33.31	2.06	0.48	0.120	11.31	15.40	B+D
B A/B 22/7 Y1	33.31	1.42	0.50	0.120	8.88	12.10	B+C
B A/B 22/7 Y2	33.31	1.24	0.49	0.120	8.09	12.40	B+D
B A/B 22/7 Y3	33.31	1.33	0.50	0.120	8.52	11.20	A+D

FIGURES

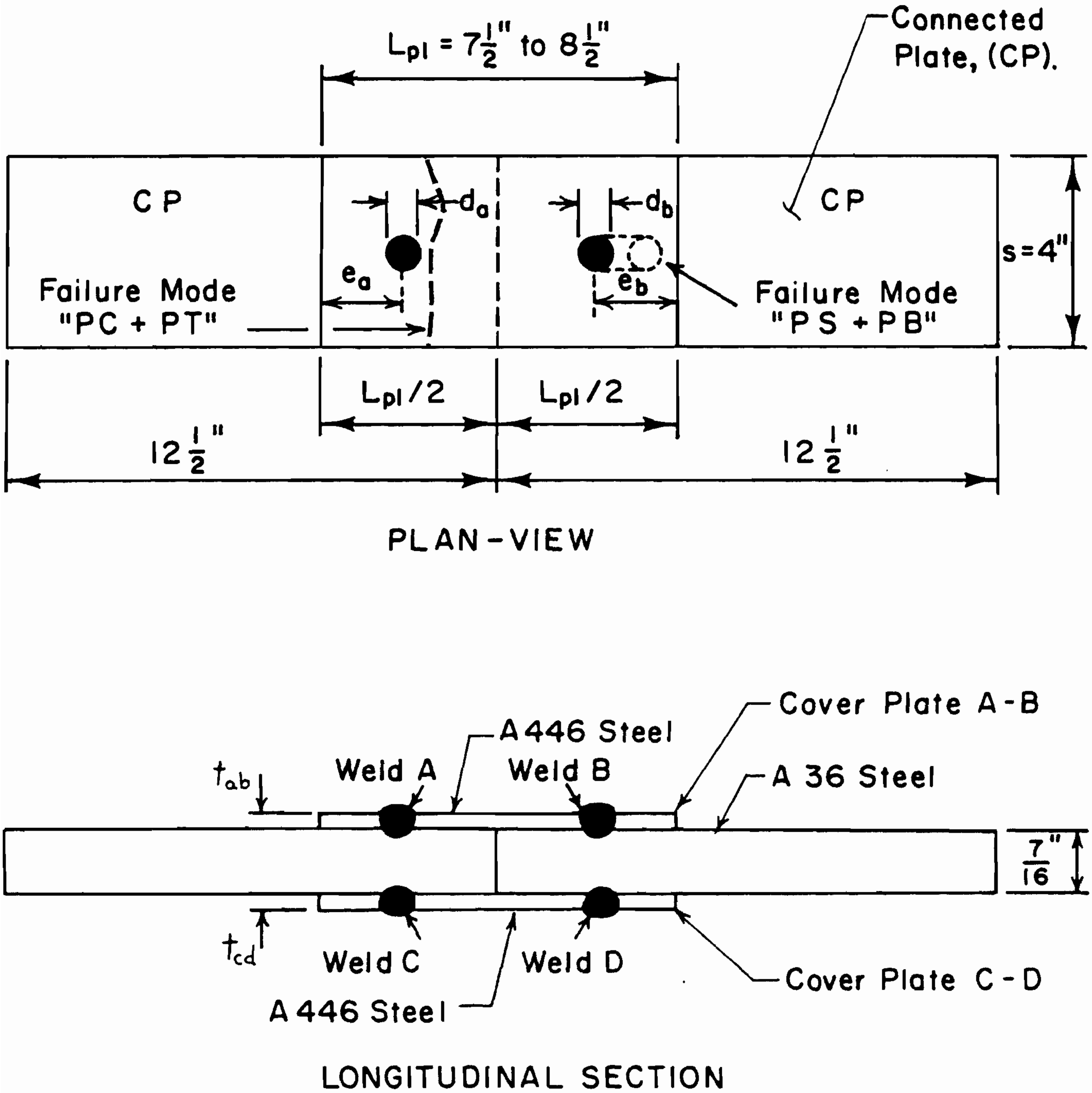


Figure 1: Single-Sheet Puddle Weld Connection

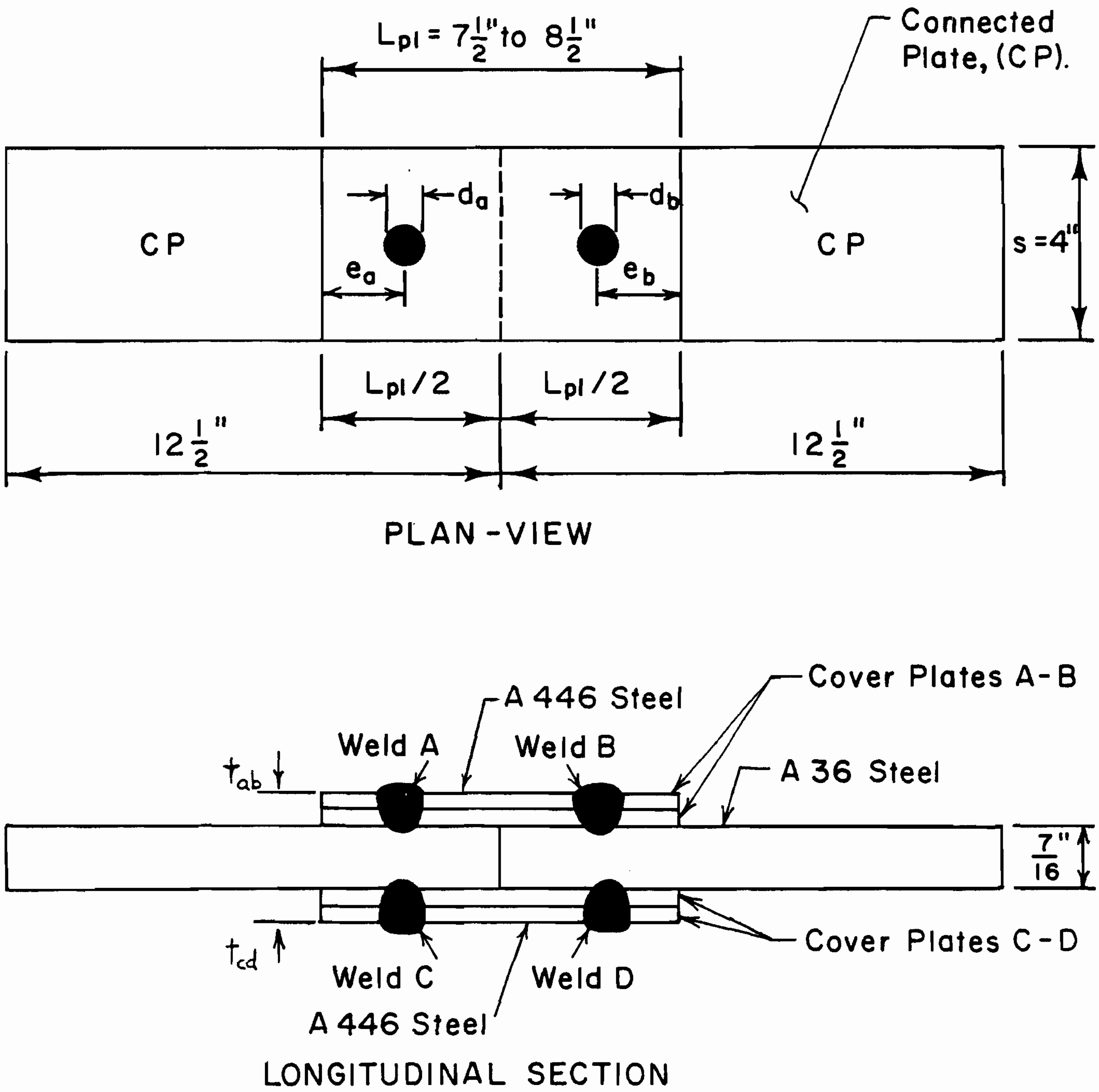


Figure 2: Double-Sheet Puddle Weld Connection

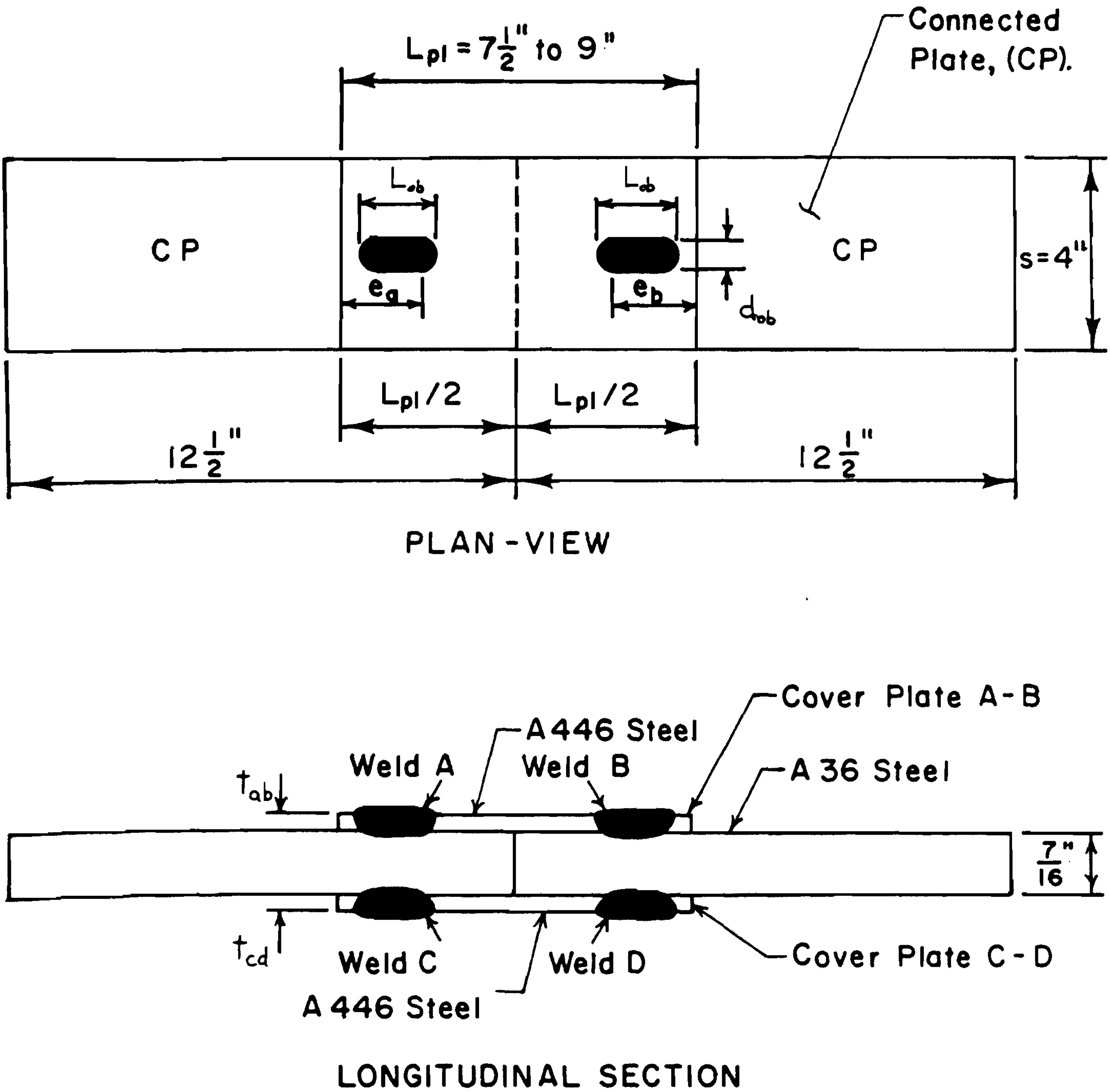


Figure 3: Single-Sheet Oblong Puddle Weld Connection

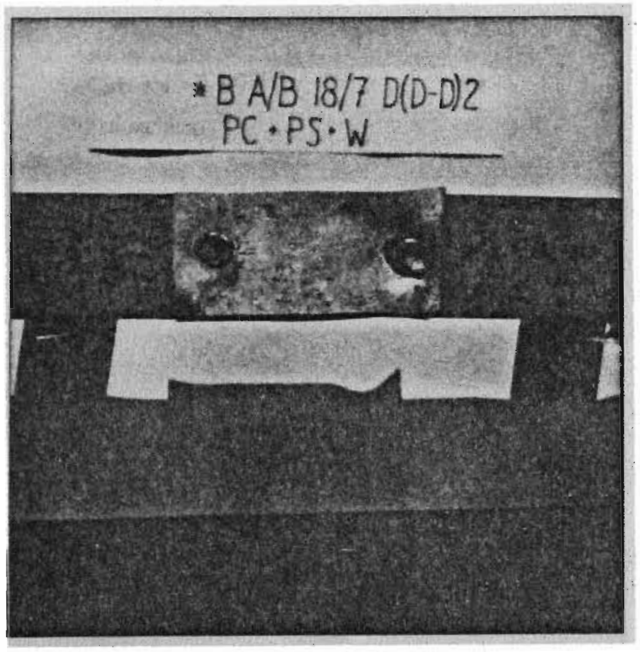


Figure 4 : Typical Plate Shearing and Tearing Failure

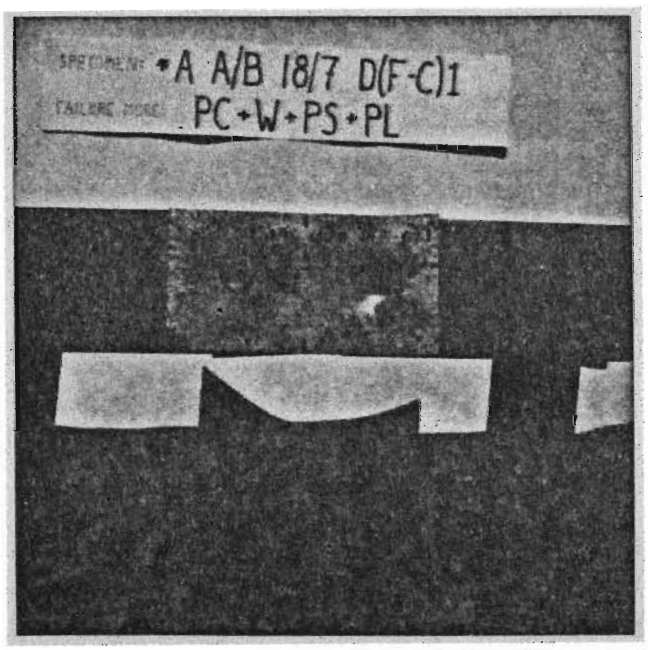


Figure 5 : Typical Multiple - Mode Failure

Figure 6 : Failure with Large Out-of-Plane Deformation

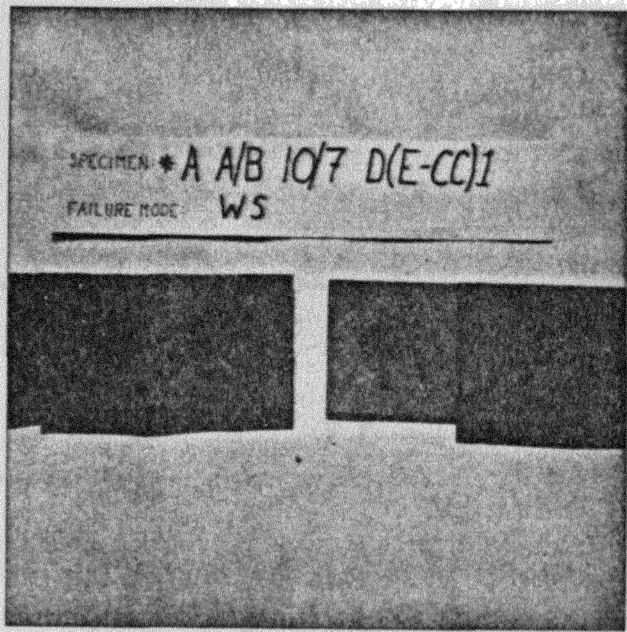


Figure 7 : Typical Weld Shear Failure

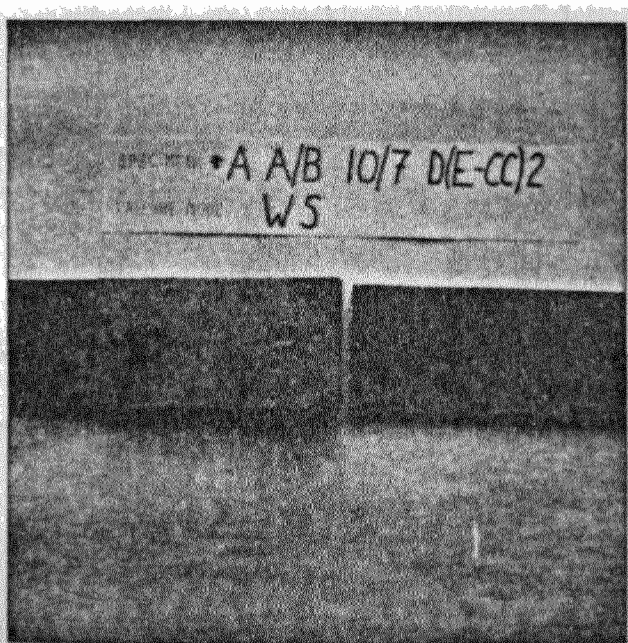


Figure 8 : Typical Weld Shear Failure

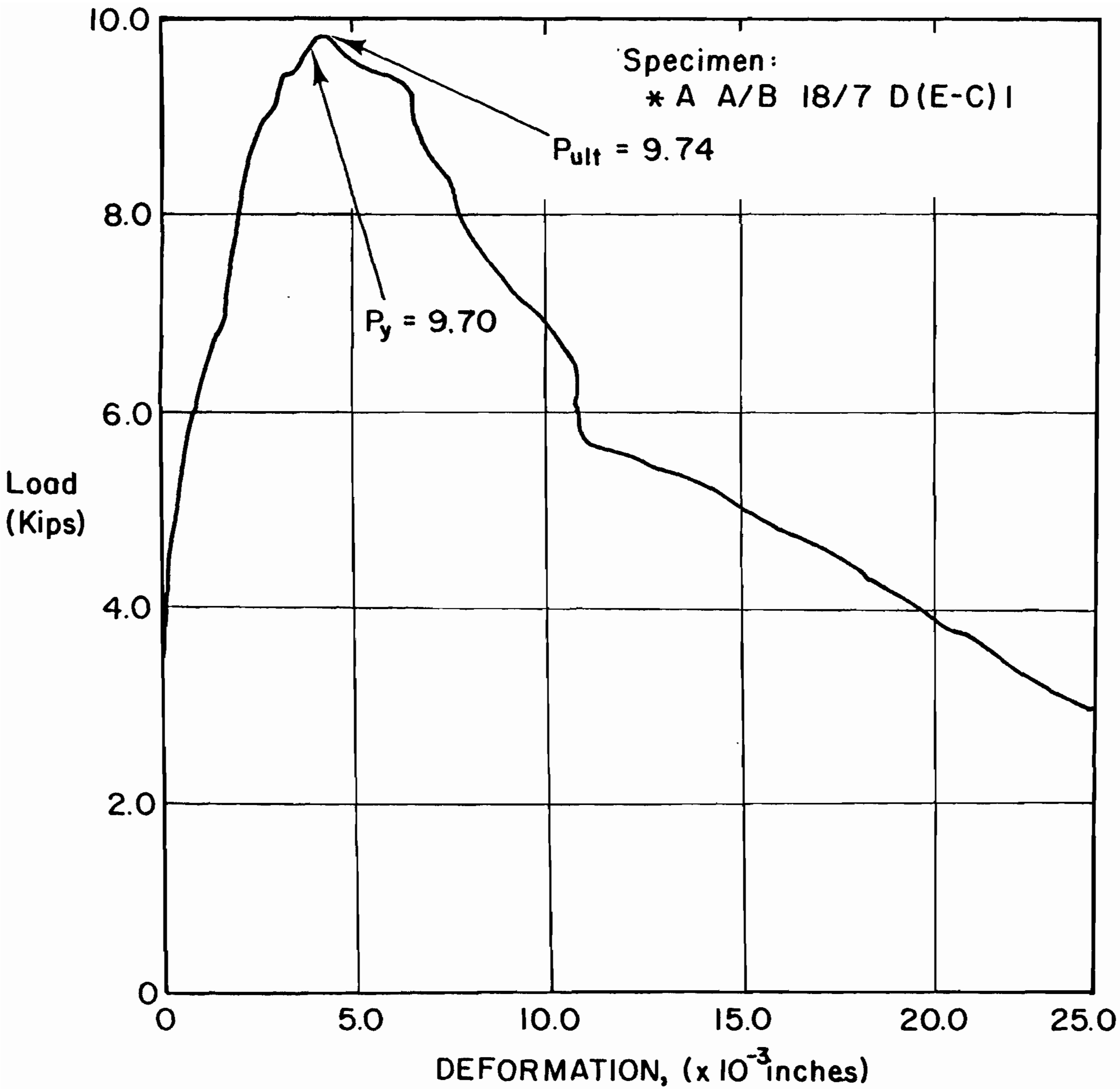


Figure 9: Typical Load-Deformation Curve for Primary Failure Mode: Plate Tearing (PC)

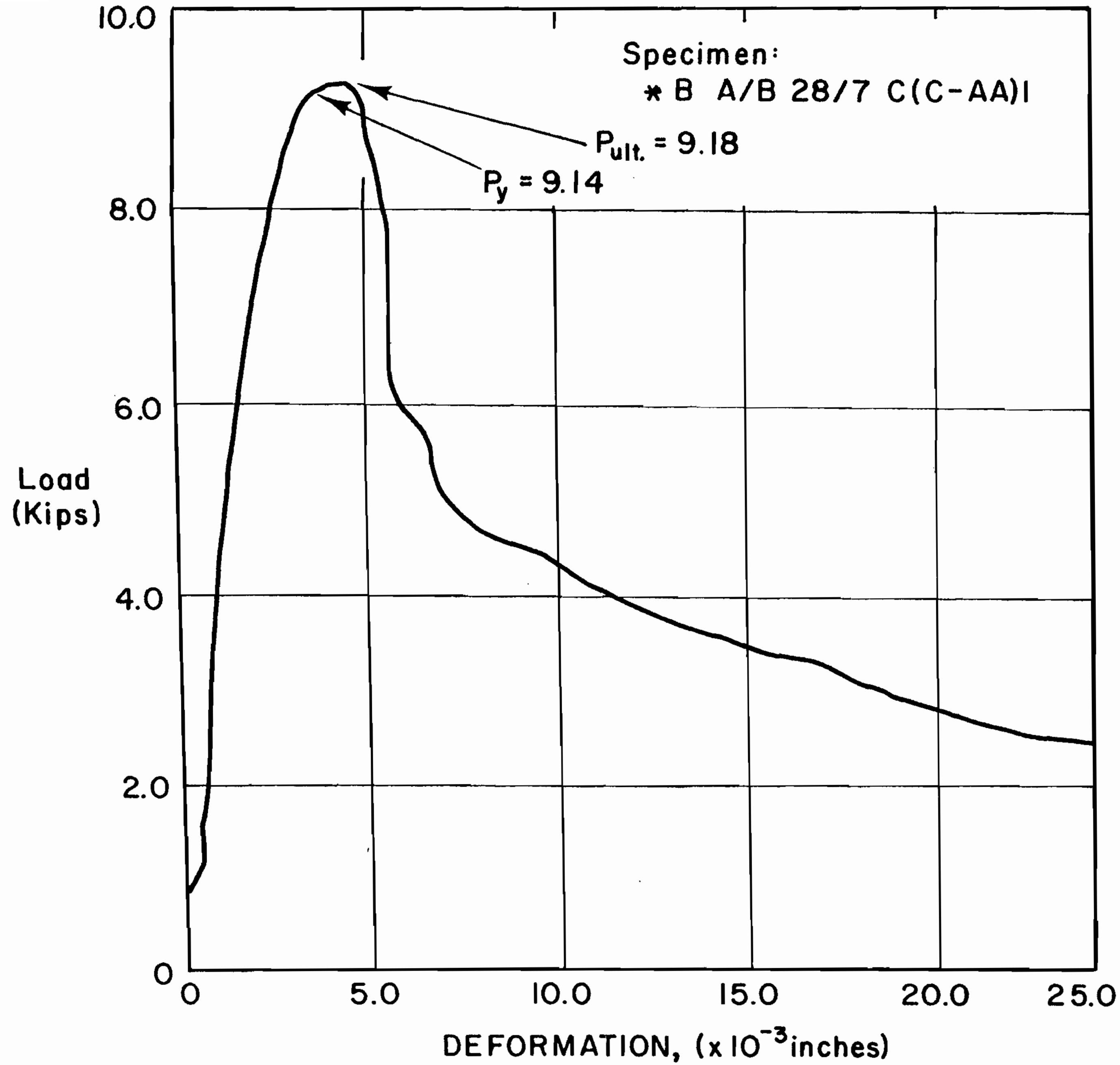


Figure 10: Typical Load-Deformation Curve for Primary Failure Mode: Plate Shear (PS)

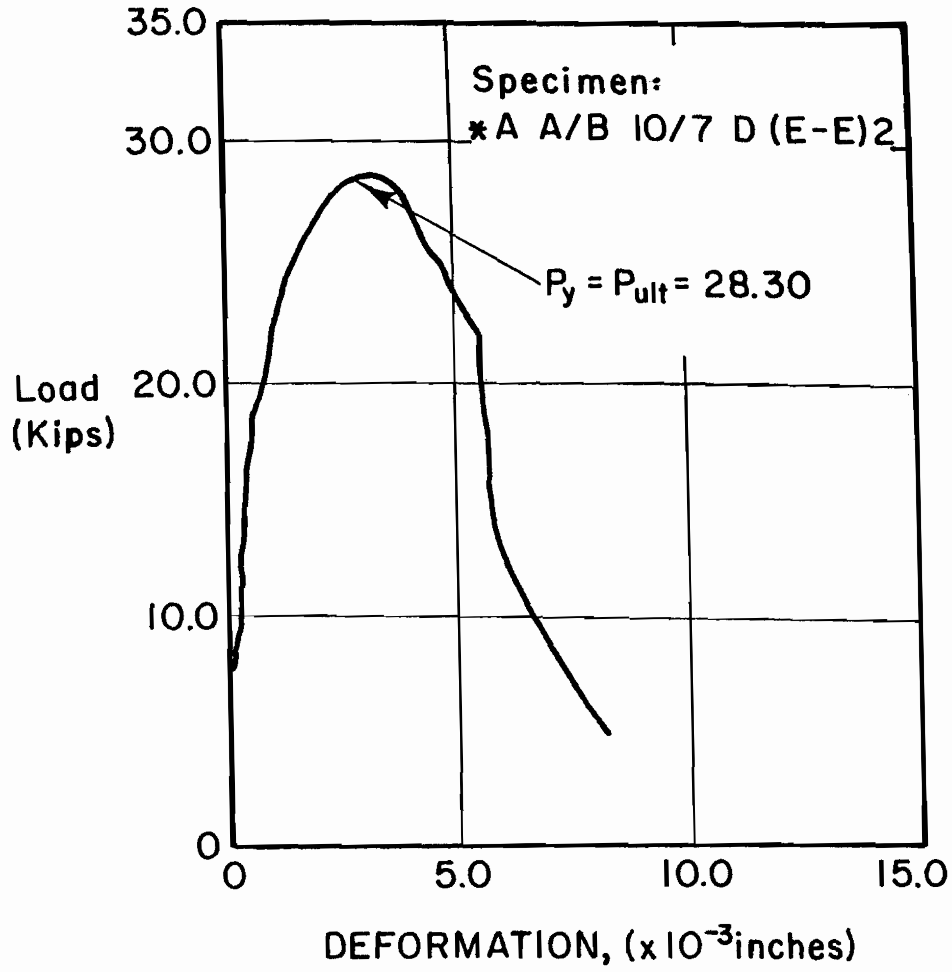
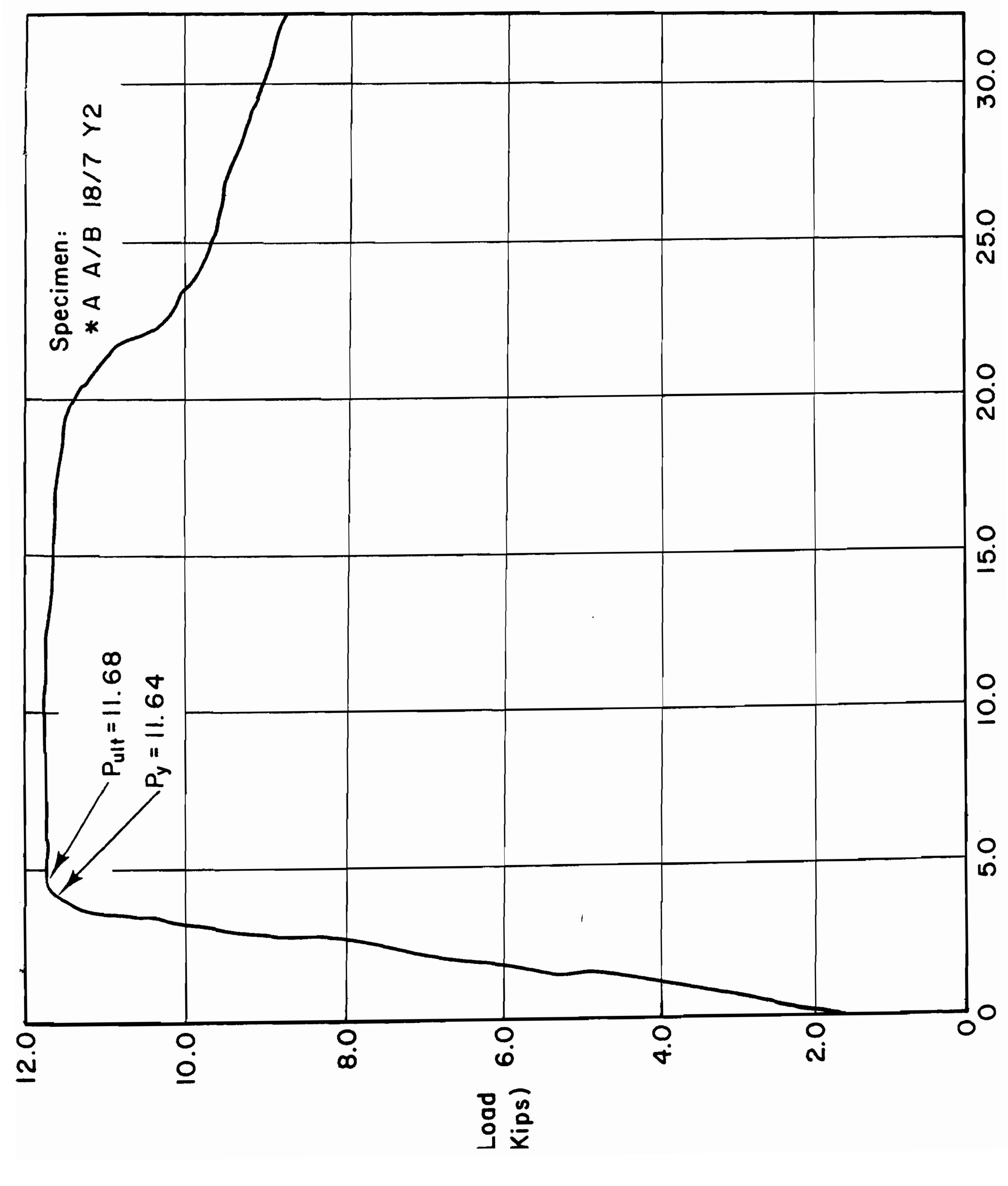


Figure 11: Typical Load-Deformation Curve for Primary Failure Mode: Weld Shear (WS)


Specimen:
* A A/B 18/7 Y2
P ult = 11.68
P y = 11.64
12.0
10.0
8.0
6.0
4.0
2.0
0
Load
Kips)
0
5.0
10.0
15.0
20.0
25.0
30.0

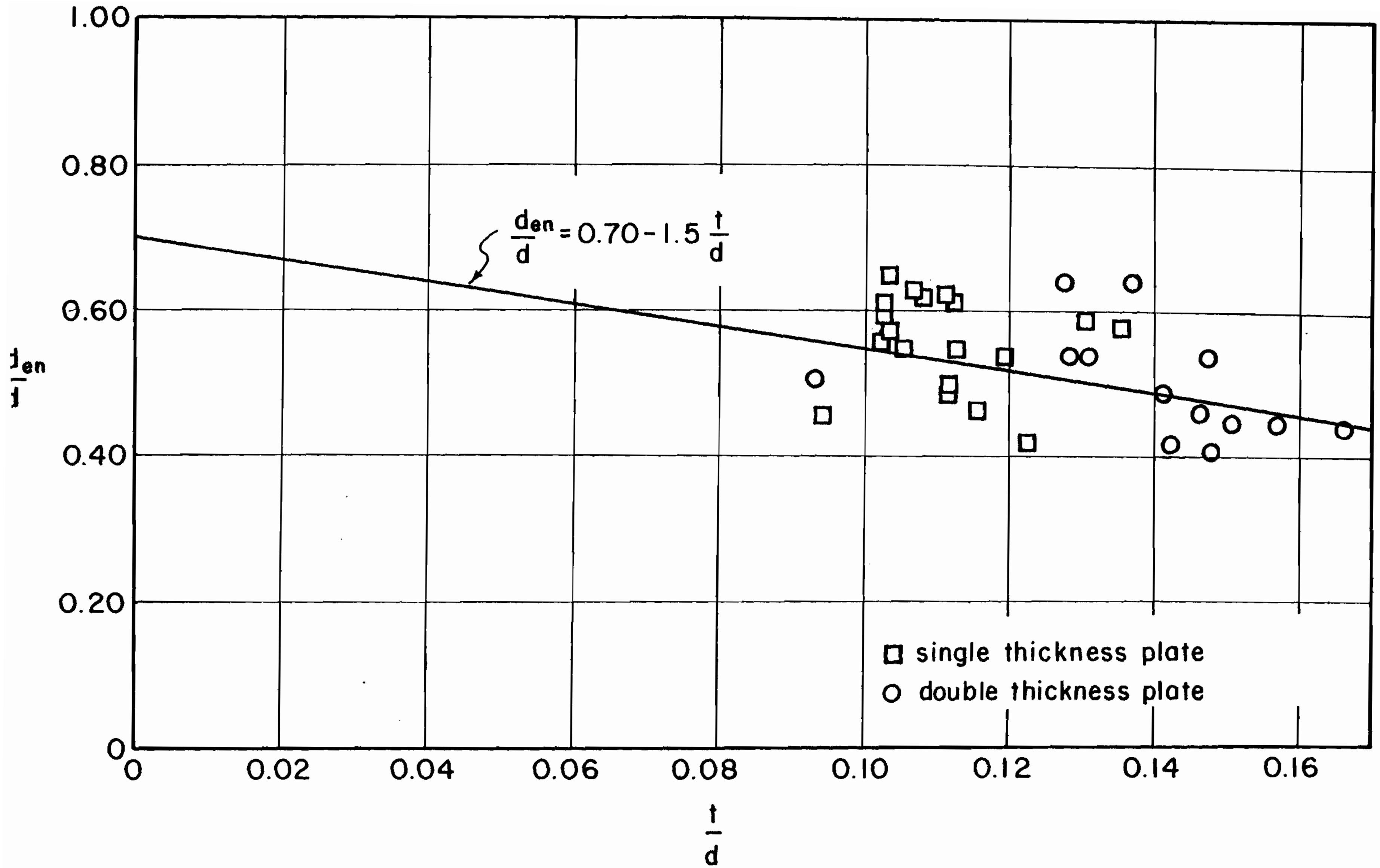
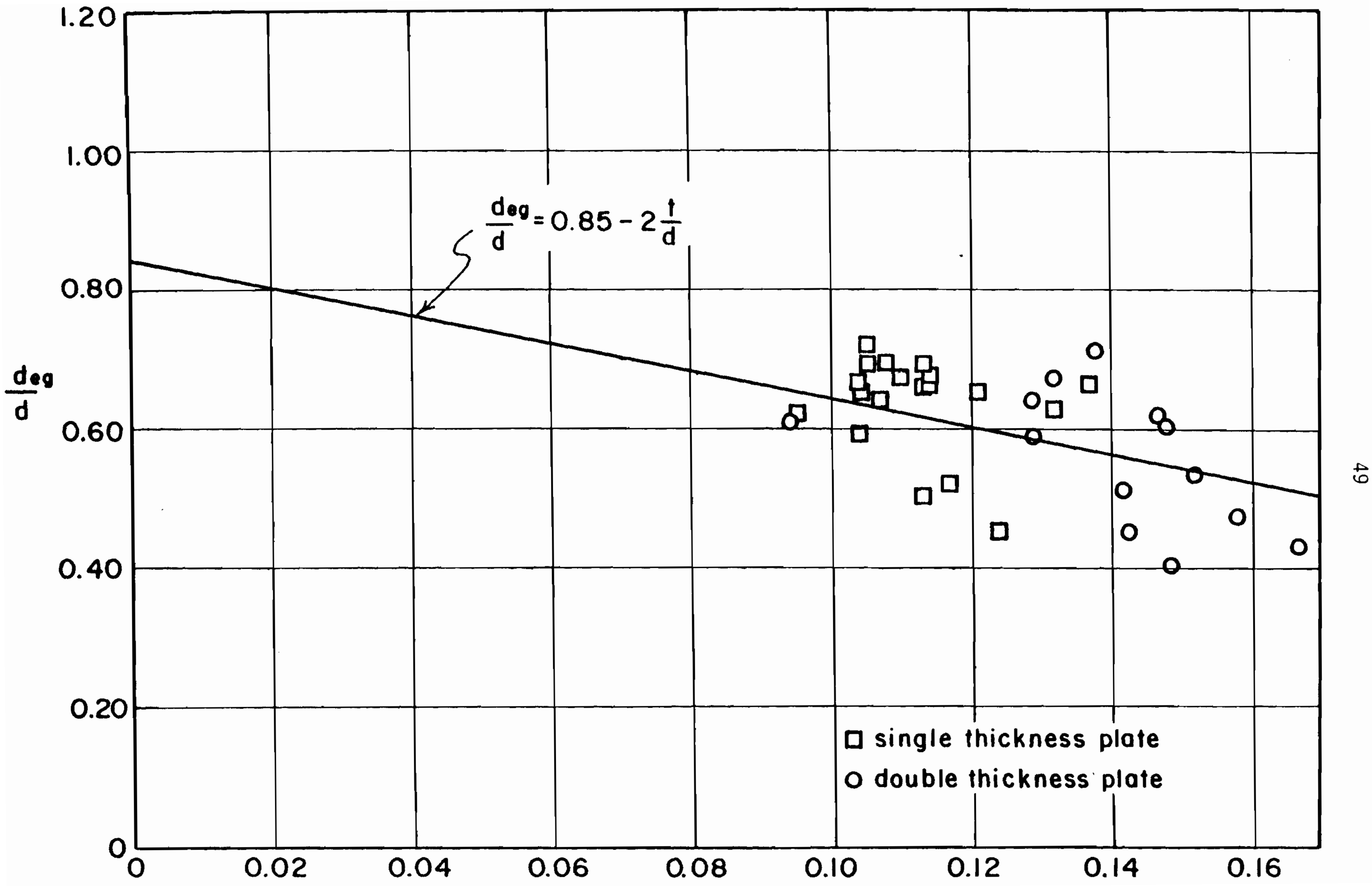


Figure 13: Effective Net Diameter Plotted Against Cover Plate Thickness



$\frac{d_{eq}}{d} = 0.85 - 2\frac{t}{d}$
$\frac{d_{eq}}{d}$
1.20
1.00
0.80
0.60
0.40
0.20
0
0
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
□ single thickness plate
○ double thickness plate