Allan Edwards Manual Pipe Jack Test

Test Report

Prepared for Allan Edwards, Inc.

Report No. 100068-RP01-Rev0-052419

May 2019

Testing performed by ADV Integrity, Inc.

Friday, May 24, 2019 Document 100068-RP01-Rev0-052419

Allan Edwards
Attn: Mr. Chip Edwards, President
2505 South 33rd West Avenue | Tulsa, Oklahoma 74157
Phone: (918) 583-7184 | E-mail: cedwards@allanedwards.com

Dear Chip,

The following report documents a recent test performed by ADV Integrity, Inc. (ADV) on the Allan Edwards Manual Pipe Jack. The purpose of the test was to determine the relationship between applied torque and chain load in the pipe jack. A least-squares regression fitted to the test results indicated that a torque of 686 ft·lbf and 888 ft·lbf would be required to reach the rated load (33,400 lbf) and tensile load (43,100 lbf) respectively. As a simplified rule of thumb, every 10 ft·lbf applied to the jack results in 500 lbf in the chain.

Please contact me if you have any questions on this test report and thank you for the opportunity to perform this work.

Regards,



Chantz Denowh, PhD, PE
Senior Associate

ADV Integrity, Inc.
28246 FM 2920 | Waller, TX 7748
Cell: (406) 489-0718 **|** E-mail: chantz.denowh@advintegrity.com
Texas Registered Engineering Firm F-190

Reviewed by: Dr. Chris Alexander, PE, President

1.0 INTRODUCTION AND BACKGROUND

The purpose of this test program was to characterize the relationship between applied torque and chain tension via full scale testing of an Allan Edwards Manual Pipe Jack. Figure 1 illustrates the different components of the Manual Pipe Jack. The pipe jack transfers load to the repair sleeve and carrier pipe through an 80-2C roller chain. After the pipe jack is fitted to the repair sleeve / carrier pipe, compressive load is applied by tightening the 1-½ inch all-thread. This lifts the steel block (Part #B in Figure 1) away from the pipe and places the roller chain in tension. This test determined the relationship between the torque applied to 1-½ inch all-thread and tension in the chain.

The roller chain has a rated tensile load of 33,440 lbf. Allan Edwards has previous performed a destructive test of the roller chain which resulted in an ultimate tensile strength of 43,100 lbf (see attached for previous chain test report). To find the relationship between torque and chain tension, ADV utilized a 30,000 lbf compact load cell and 1,000 ft·lbf torque transducer. Torque was applied manually with a similar wrench that would be used in the field. The pipe jack was not loaded to failure of the bolt or chain, or past the load limits of the instrumentation.

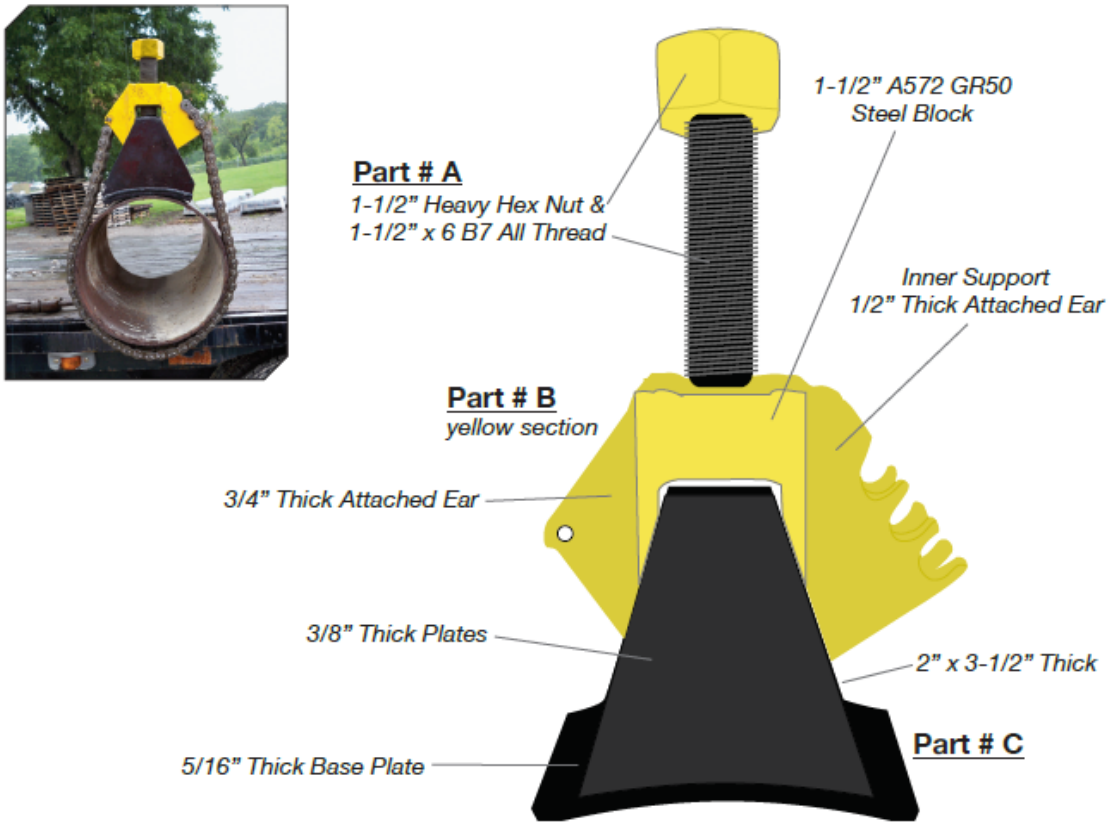


Figure 1: Allan Edwards Manual Pipe Jack

2.0 TEST SETUP AND PROCEDURE

Figure 2 illustrates the setup for the pipe jack test. The pipe jack was installed on a 12.75-inch OD x 0.375-inch WT, Grade X42 pipe section for the test. A small tack-weld between the base plate and carrier pipe prevented the pipe jack from rotating during the setup and test. The 30,000 lbf compact load cell was placed between the 1-½ inch stud and the base plate. The load cell in this position provided a direct measure of the chain tension (frictional effects are assumed to be minor and ignored). Torque was applied through the 1,000 ft·lbf torque cell using a 4-foot torque wrench. The toque wrench provided a check on the torque cell measurements during testing. See attached for torque and load cell calibration certificates.

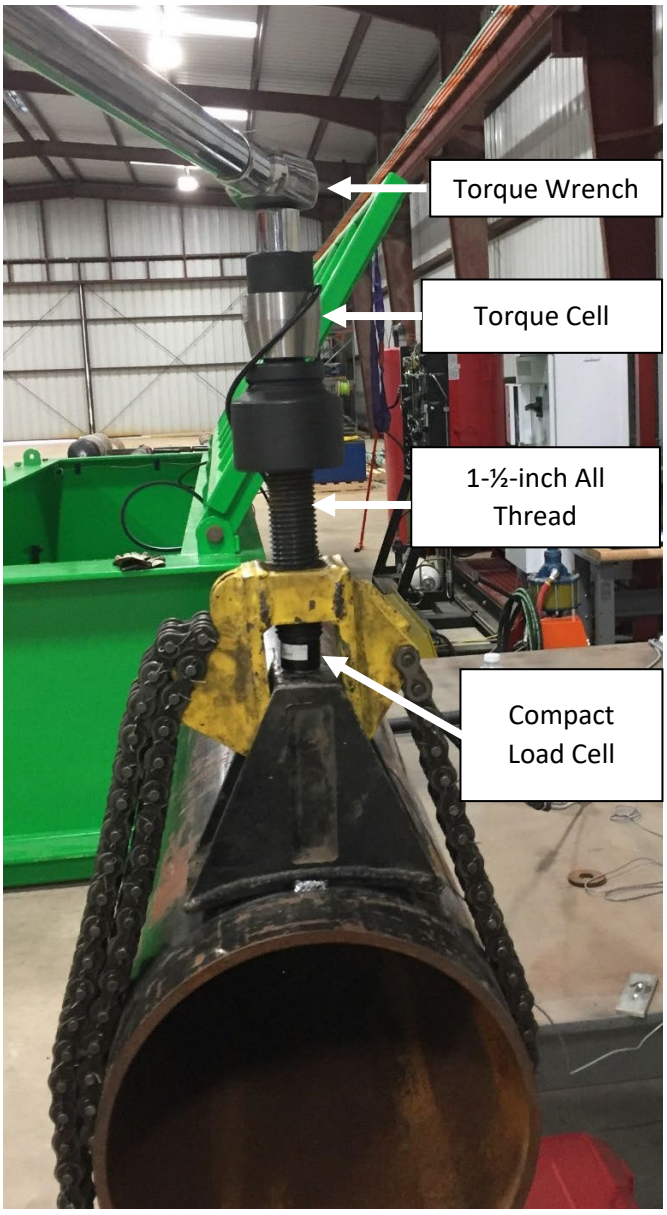


Figure 2: Test setup showing the Allan Edwards Manual Pipe Jack, load cell and torque cell

ADV followed the below procedure while completing Manual Pipe Jack test.

1. Installed Allan Edwards Manual Pipe Jack onto the 12.75-inch OD carrier pipe.
2. Connected and calibrated instrumentation.
3. Positioned the high capacity load cell and torque sensor.
4. Photographed test setup.
5. Started data acquisition equipment and acquire data at 10 scan per second.
6. Steadily increased bolt torque using the torque wrench.
    a. The test was stopped when either the maximum torque is reached on torque transducers (1,000 ft·lbf), the maximum load is reached on the load cell (30 kip), or it becomes unreasonable to apply additional torque manually.

3.0 TEST RSULTS AND DISCUSSSION

The Manual Pipe Jack test was completed at ADV's Full-Scale Test Facility on May 23, 2019. Figure 3 below plots the applied load and torque vs elapsed time for the test. The maximum torque and corresponding load reached during the test was 495 ft·lbf and 24.5 kips respectively. Approximately 500 ft·lbf was the practical limit for one person to apply using a 4-foot torque wrench. Several data points were pulled from Figure 3 to create the applied load vs torque plot shown in Figure 4. The results indicate a linear relationship between toque and load as expected.

Fitting the data with using a least-squares regression resulted in the below relationship between torque and load. Based on this relationship, the jack requires a torque of 686 ft·lbf to reach the chain rated capacity and 888 ft·lbf to reach the tensile capacity. Table 1 summarizes these calculations. This relationship can be simplified to a rule of thumb that every 10 ft·lbf equates to 500 lbf in the chain

$$Load\ (lbf) = 47.9 \times Torque\ (ft \cdot lbf) + 580$$

Table 1: Torque required to reach rated and tensile capacity

Loading	Chain Load (lbf)	Required Torque (ft·lbf)
Rated Capacity	33,440	686
Tensile Capacity	43,100	888

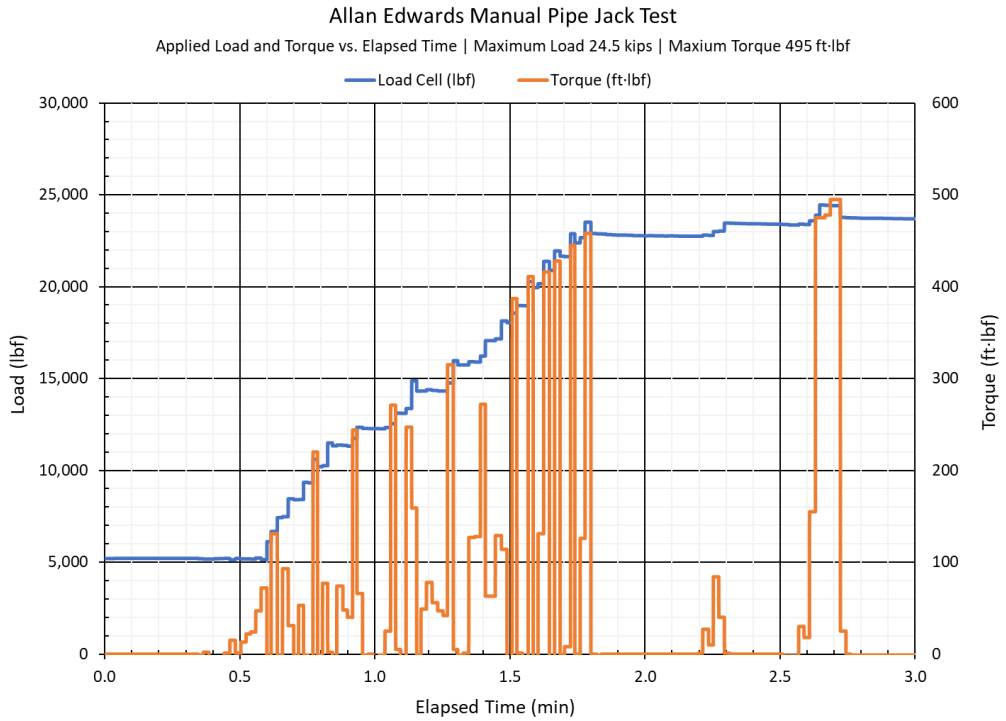


Figure 3: Applied load and torque vs elapsed time for Allan Edwards Manual Pipe Jack test

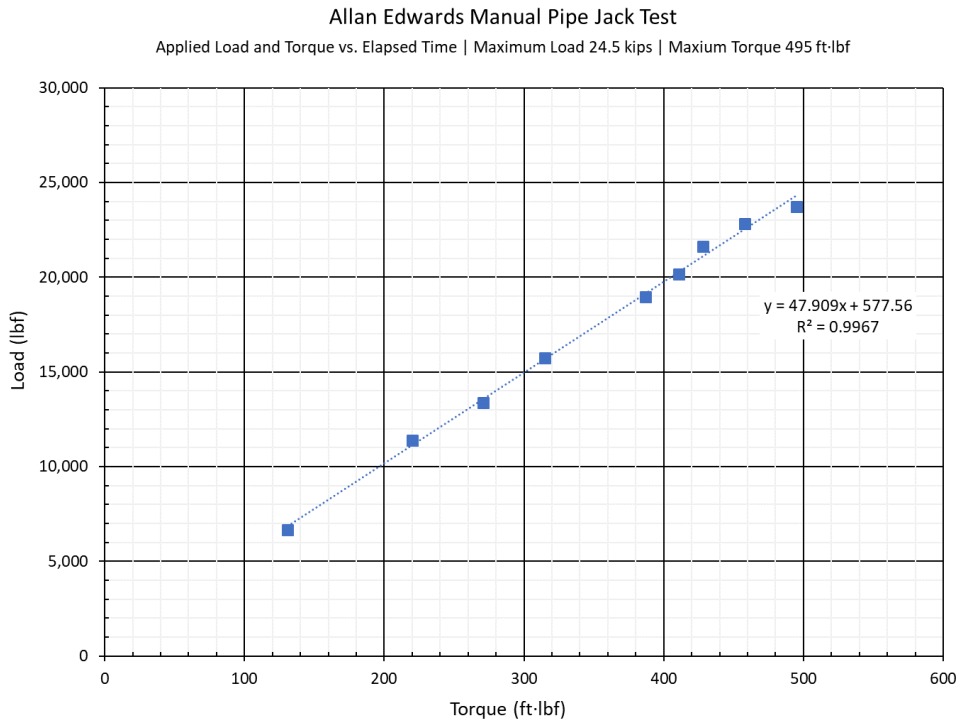


Figure 4: Applied torque vs load for Allan Edwards Manual Pipe Jack test (includes readings from torque cell and torque wrench)

ATTACHMENTS

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Tech Support
(800) 344-3965
(951) 719-3965
Fax (951) 719-3900
email: tti@ttloadcells.com

CERTIFICATE OF CALIBRATION

SERIAL NUMBER:	375475	DATE OF CALIBRATION:	5/6/2019
SENSOR MODEL:	MLC-30K	DATE OF RECALIBRATION	5/5/2020
JOB NUMBER:	130000		
TECHNICIAN:	JAS		

COMPRESSION LOAD LBS.	MV/V INC	MV/V DEC
0	0.0000	0.0000
15000	1.1171	1.1169
30000	2.2267	

NON-LINEARITY	-0.17	PCT FS
NON-REPEATABILITY	-0.07	PCT FS
HYSTERESIS	-0.01	PCT FS

SHUNT CALIBRATION

PCT LOAD	LOAD LBS.	SIGNAL MV/V	SHUNT K OHMS	SHUNT PINS
45.21	13562.94	1.0067	87.325	(-E,-S)
90.42	27125.89	2.0134	43.575	(-E,-S)

DPM-2 SCALE FACTOR 4.0418

CALIBRATION COMPUTED FROM THREE (3) RUNS INCREASING AND DECREASING
TRACEABLE TO NIST TEST # 58183
CALIBRATION PERFORMED A 10 VDC
MAXIMUM BRIDGE EXCITATION 12 VDC

WIRING

PIN	COLOR	CODE
N/A	RED	+EXCITATION
N/A	BLK	-EXCITATION
N/A	GRN	+SIGNAL
N/A	WHT	-SIGNAL
N/A	SHD	GROUND

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CERTIFICATE OF CALIBRATION

SERIAL NUMBER: 386380
SENSOR MODEL: SWS-1K
JOB NUMBER: 130000
TECHNICIAN: CJL

DATE OF CALIBRATION: 5/6/2019
DATE OF RECALIBRATION: 5/5/2020

Data Pt	Standard (ft-lbs)	Strain Gage Sensor (mV/Vdc)	Best Fit (ft-lbs)	Deviation (ft-lbs)
1	-0.00	0.0001	0.50	0.51
8	148.06	0.2992	147.68	-0.38
15	271.29	0.5498	270.97	-0.32
22	406.78	0.8251	406.46	-0.31
29	559.74	1.1361	559.50	-0.24
36	732.54	1.4873	732.29	-0.25
43	902.41	1.8332	902.48	0.07
50*	1007.42	2.0470	1007.69	0.27
57	1004.47	2.0413	1004.87	0.40
64	1000.57	2.0331	1000.87	0.30
71	884.33	1.7965	884.44	0.11
78	779.84	1.5836	779.69	-0.14
85	684.27	1.3889	683.87	-0.40
92	543.14	1.1023	542.85	-0.29
99	392.09	0.7951	391.67	-0.42
106	208.15	0.4212	207.71	-0.44
113	43.22	0.0876	43.53	0.31
120	10.06	0.0208	10.68	0.62

Sensitivity for CW-Torque= 492.0618 (ft-lbs)/(mV/Vdc)
Y-Intercept for CW-Torque= 0.45 (ft-lbs)
Coefficient of Determination (R square)= 1.0000
Reference: CW-32309

Input/Output Resistance: 700 +/-5 Ohms
Bridge to Ground/Shield Resistance:>10 M Ohms
Zero balance: 0.001 mV/V
Accuracy: +/-0.25% F.S. (Full Scale = 1000 ft-lbs.)
60K Ohm shunt Calibration: +Power to +Signal: +2.91 mV/V;
+Power to -Signal: -2.065 mV/V

Excitation Voltage: 10.00 Vdc
White: +Power
Red: -Signal
Green: -Power
Black: +Signal

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CERTIFICATE OF CALIBRATION

SERIAL NUMBER: 386380
SENSOR MODEL: SWS-1K
JOB NUMBER: 130000
TECHNICIAN: CJL

DATE OF CALIBRATION: 5/6/2019
DATE OF RECALIBRATION: 5/5/2020

Data Pt	Standard (ft-lbs)	Strain Gage Sensor (mV/Vdc)	Best Fit (ft-lbs)	Deviation (ft-lbs)
1	-0.14	-0.0001	-0.92	-0.78
8	109.75	-0.2254	109.62	-0.13
15	258.63	-0.5297	258.94	0.31
22	404.54	-0.8267	404.71	0.17
29	597.71	-1.2200	597.74	0.03
36	765.33	-1.5615	765.30	-0.03
43	912.03	-1.8602	911.89	-0.15
50	969.91	-1.9783	969.86	-0.05
53*	1009.41	-2.0584	1009.15	-0.26
57	1008.38	-2.0564	1008.17	-0.21
64	1006.72	-2.0531	1006.57	-0.15
71	1005.43	-2.0504	1005.24	-0.19
78	916.06	-1.8685	915.98	-0.08
85	760.48	-1.5525	760.91	0.42
92	568.53	-1.1615	569.01	0.47
99	338.16	-0.6921	338.65	0.49
106	147.14	-0.3025	147.46	0.32
113	28.28	-0.0595	28.20	-0.08
120	0.13	-0.0004	-0.79	-0.92

Sensitivity for CCW-Torque= -490.7547 (ft-lbs)/(mV/Vdc)
Y-Intercept for CCW-Torque= -0.99 (ft-lbs)
Coefficient of Determination (R square)= 1.0000
Reference: CCW32312

Input/Output Resistance: 700 +/-5 Ohms
Bridge to Ground/Shield Resistance: >10 M Ohms
Zero balance: 0.001 mV/V
Accuracy: +/-0.25% F.S. (Full Scale = 1000 ft-lbs.)
60K Ohm shunt Calibration: +Power to +Signal: +2.91 mV/V;
+Power to -Signal: -2.065 mV/V

Excitation Voltage: 10.00 Vdc
White: +Power
Red: -Signal
Green: -Power
Black: +Signal

Sherry Laboratories
3100 North Hemlock Circle
Broken Arrow, OK 74012-1115

Tel: 918-258-6066
800-982-8378
Fax: 918-258-1154

LABORATORY REPORT

Attn: Andrew Adams
Allan Edwards, Inc
2505 S. 33rd W Ave
Tulsa, OK 74157

Report No.: **B12110917**
Date Received: **11/15/2012**
Date Reported: **11/26/2012**
P.O. No.: **112-855**

Sample Description: Load pipe jack to failure

Background and Procedure

A pipe jack was submitted for load testing to failure. The jack was placed under an increasing tensile load using a Tinius Olsen testing machine, (Sherry Laboratory ID M108 calibration due date: 3/29/13). The load was applied in a manner that simulated the loading of a 24" pipe. See Figures 1 and 2. The load was increased until failure occurred. See Figures 3 and 4.

Results

The chain failed at a load of 43,100 lbs.

Note: The material will be discarded after sixty (60) days from the date of this report unless otherwise directed.

Approved By: W. Don Bunn

W. Don Bunn, PE
Project Engineer

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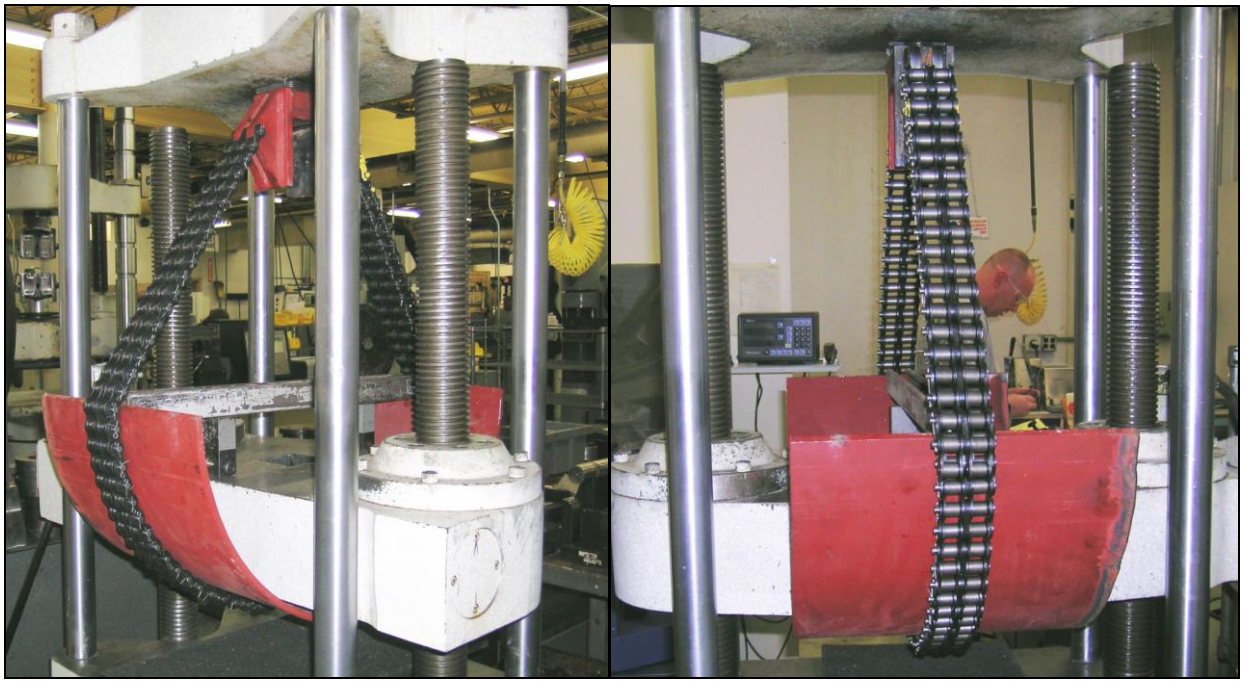


Figure 1, Test setup

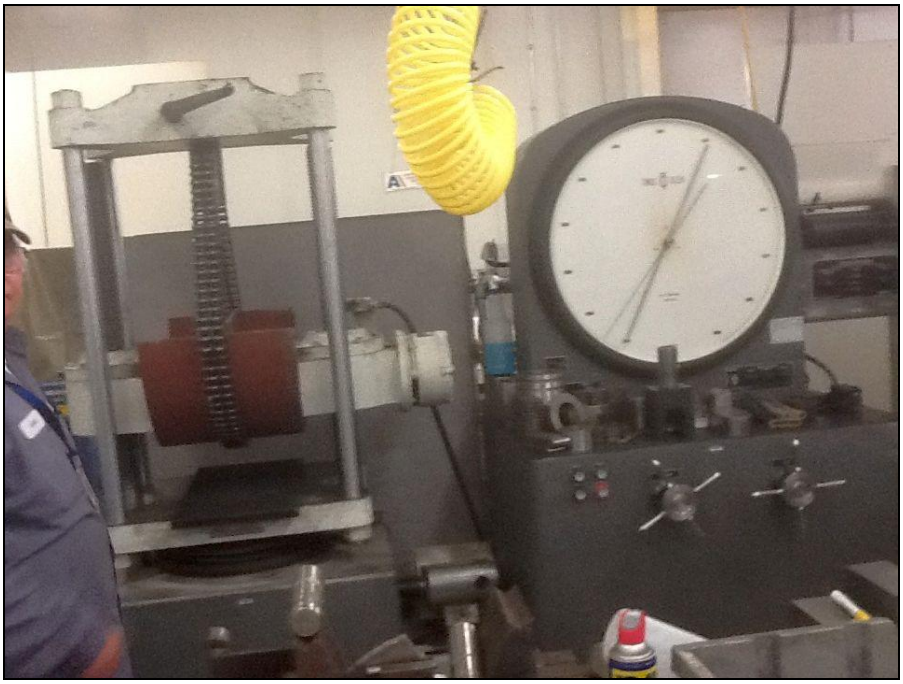


Figure 2, Test setup

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Figure 3 Failed chain



Figure 4, Location of failure

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