

Calibration of LC 12

Date 3/19/04

Equipment used

Tinius Olsen

300 Kip load cell	Calibrated reference
LC 12	Load cell under calibration
LC 7	Normal reference 1
LC 10	Normal reference 2

2310 Conditioners

300 Kip	ref	S/N	088780	gain	492
LC 12	Ax	S/N	088786	gain	2500
	Sx	S/N	072584	gain	2875
	Mx	S/N	088767	gain	1750
LC 7	Ax	S/N	072482	gain	2350
LC 10	Ax	S/N	072432	gain	2340

Procedure.

Axial calibration.

The three load cells (lc7, lc10, and lc12) were placed on top of the reference load cell in the Tinius Olsen. The load cells were loaded several cycles to allow the gains of the amplifiers to be adjusted to match the calibrated reference. LC7 and LC 10 were calibrated to be used as normal force references 1 and 2 respectively.

Shear calibration.

The load cells were set up, as in figure 1, and loaded. The gain of the shear conditioner was adjusted such that the shear reading matched that of LC 10.

Moment calibration.

The load cells were set up as in figure 2, and loaded. The gain of the moment conditioner was adjusted such that the moment reading matched that of LC 10 times the distance from the point load to the moment strain gages.

figure 1

Shear

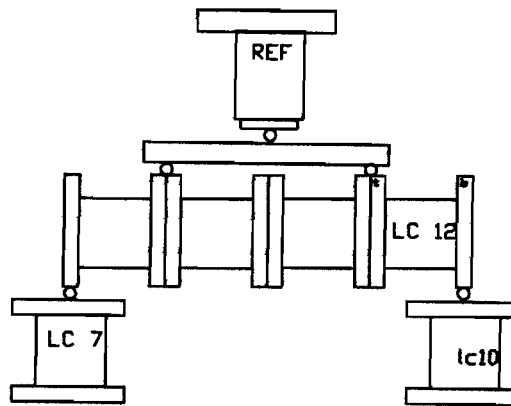
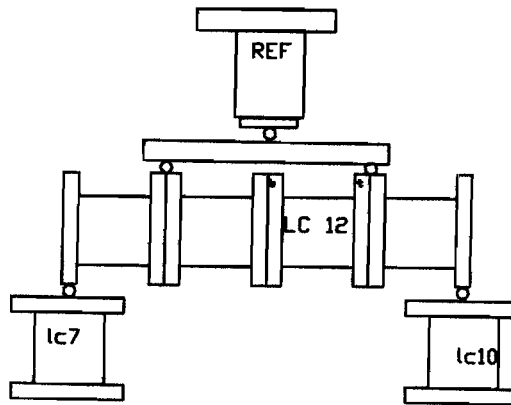


figure 2

Moment



Ref 300 kip load cell
3/19/2004

Normal Calibration of load cells

UUT LC #12

ref kip	uut kip	N_ref1 kip	N_ref2 kip	UUT deviation	N_ref_1 deviation	N_ref_2 deviation	UUT % error	N_ref_1 % error	N_ref_2 % error
0.07	0.01	0.00	0.00	0.05	0.07	0.06	0.18	0.23	0.22
1.11	1.15	1.04	1.08	-0.05	0.07	0.03	-0.15	0.22	0.10
1.88	2.02	1.87	1.94	-0.13	0.01	-0.06	-0.45	0.04	-0.18
2.99	3.19	2.99	3.06	-0.20	0.00	-0.07	-0.67	-0.01	-0.23
4.04	4.25	4.03	4.11	-0.21	0.01	-0.06	-0.71	0.03	-0.22
5.10	5.28	5.06	5.13	-0.18	0.04	-0.03	-0.60	0.14	-0.10
6.17	6.32	6.12	6.18	-0.15	0.05	-0.01	-0.51	0.17	-0.03
7.99	8.12	7.98	8.02	-0.13	0.01	-0.03	-0.44	0.02	-0.12
9.38	9.50	9.39	9.44	-0.11	-0.01	-0.05	-0.37	-0.02	-0.18
11.94	11.98	11.93	11.99	-0.03	0.01	-0.05	-0.11	0.05	-0.16
14.96	14.94	14.95	15.00	0.02	0.01	-0.04	0.08	0.05	-0.13
17.45	17.43	17.46	17.50	0.02	-0.02	-0.06	0.06	-0.06	-0.19
20.16	20.15	20.21	20.24	0.00	-0.05	-0.08	0.02	-0.17	-0.27
23.32	23.30	23.34	23.38	0.02	-0.03	-0.06	0.06	-0.10	-0.21
25.64	25.69	25.71	25.76	-0.05	-0.07	-0.12	-0.17	-0.24	-0.40
27.57	27.66	27.66	27.71	-0.09	-0.09	-0.14	-0.30	-0.28	-0.47
24.31	24.00	24.02	23.99	0.31	0.29	0.32	1.04	0.95	1.05
21.02	20.47	20.55	20.46	0.55	0.47	0.56	1.82	1.57	1.88
17.68	17.02	17.13	17.00	0.66	0.55	0.68	2.20	1.83	2.27
15.02	14.29	14.42	14.26	0.73	0.60	0.76	2.44	2.01	2.52
11.96	11.22	11.36	11.17	0.74	0.60	0.79	2.48	2.01	2.63
9.88	9.14	9.28	9.07	0.74	0.61	0.81	2.46	2.02	2.71
8.03	7.35	7.46	7.23	0.69	0.57	0.81	2.30	1.91	2.69
6.04	5.36	5.47	5.23	0.68	0.57	0.24	2.27	1.88	0.81
5.01	4.36	4.47	4.23	0.64	0.54	0.24	2.15	1.80	0.79
4.01	3.48	3.56	3.34	0.53	0.45	0.22	1.76	1.51	0.74
3.00	2.56	2.63	2.43	0.44	0.37	0.19	1.46	1.25	0.65
1.83	1.50	1.55	1.38	0.33	0.28	0.17	1.09	0.93	0.55
0.08	0.01	-0.01	0.00	0.08	0.09	-0.01	0.25	0.31	-0.02

Ref 300 kip load cell
UUT Ic 12

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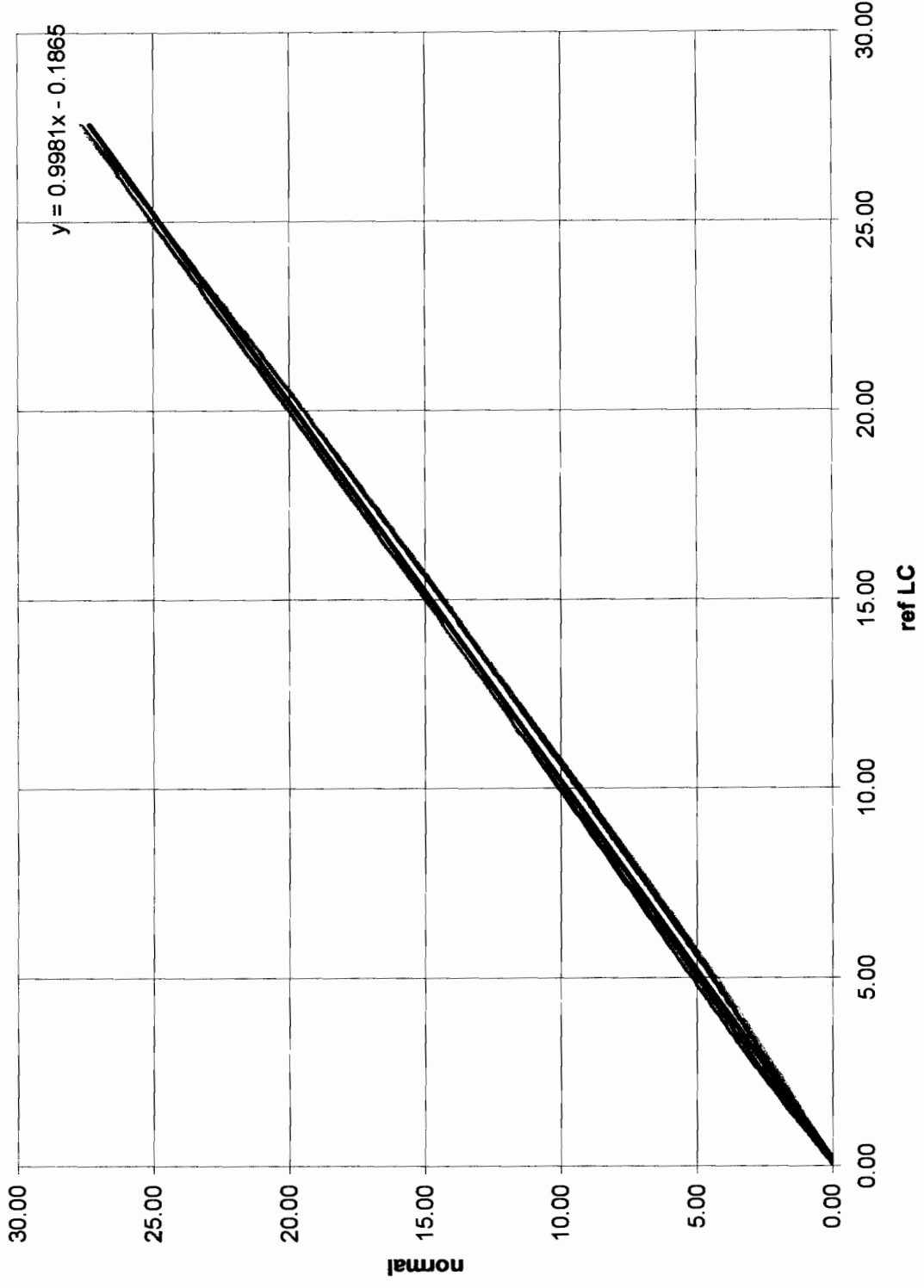
Shear Calibration

ref kip	Shear kip	N_REF2 kip	deviation	Shear % error
0.084	0.004	0.002	0.006	0.112
0.600	-0.261	0.272	0.011	0.213
1.247	-0.604	0.589	-0.015	-0.303
1.500	-0.769	0.730	-0.039	-0.775
2.006	-1.031	0.998	-0.032	-0.644
3.103	-1.614	1.598	-0.016	-0.319
4.013	-2.087	2.084	-0.003	-0.056
5.081	-2.647	2.659	0.012	0.231
6.075	-3.166	3.202	0.036	0.725
7.444	-3.903	3.964	0.061	1.216
8.606	-4.535	4.614	0.079	1.588
9.066	-4.812	4.817	0.005	0.100
8.044	-4.257	4.218	-0.040	-0.791
7.041	-3.727	3.654	-0.073	-1.453
6.019	-3.166	3.064	-0.102	-2.041
4.969	-2.599	2.475	-0.124	-2.481
3.750	-1.945	1.812	-0.133	-2.653
2.700	-1.412	1.284	-0.128	-2.556
1.313	-0.665	0.565	-0.099	-1.988
0.084	0.002	-0.001	0.002	0.031

Moment Calibration

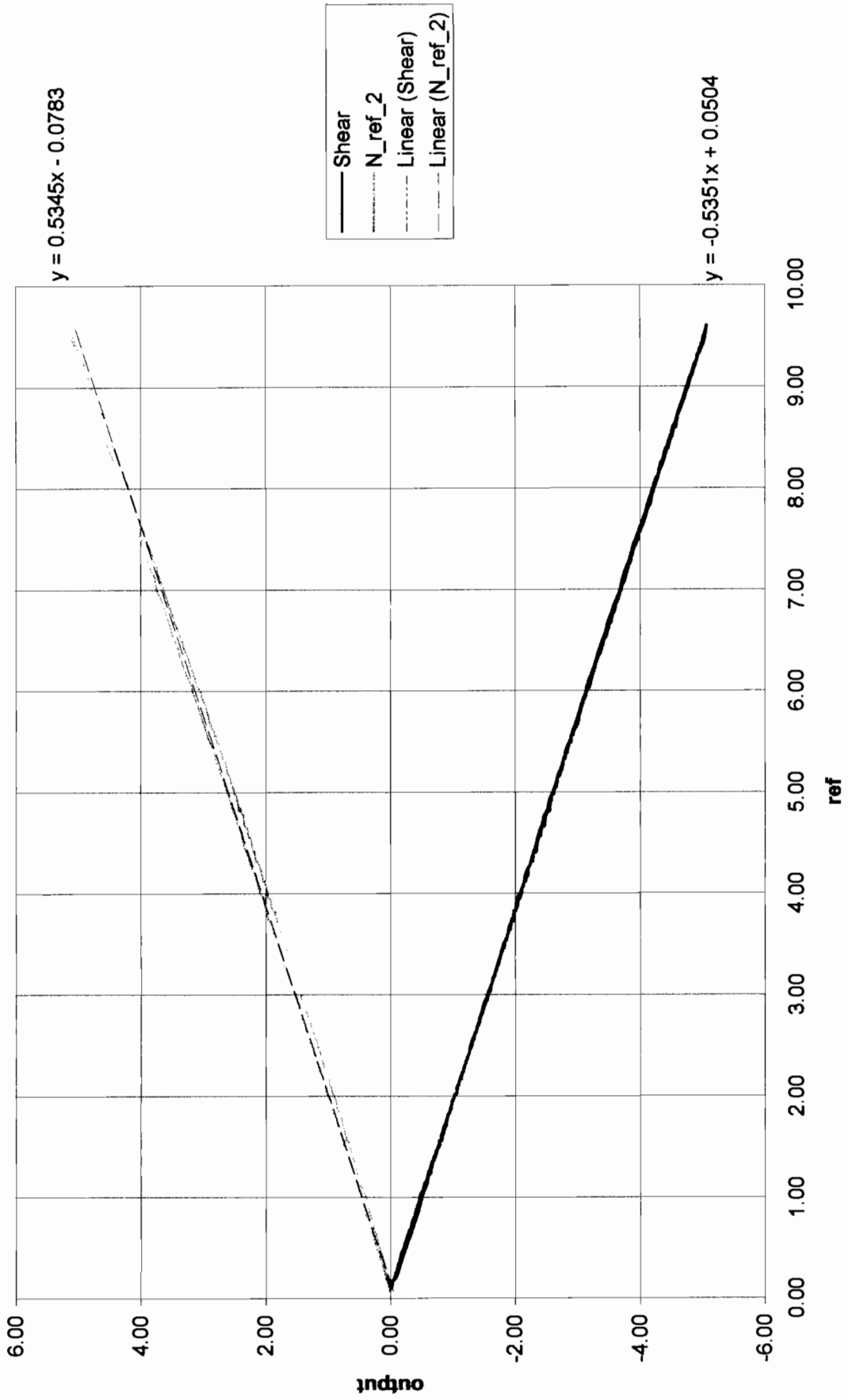
N ref 2 kip	Mx calculated	Mx kip-in	deviation	moment % error
0.091	0.750	0.103	0.647	2.16
0.575	4.741	4.480	0.261	0.87
0.752	6.203	5.950	0.253	0.84
1.001	8.260	8.057	0.203	0.68
1.252	10.333	10.152	0.181	0.60
1.515	12.499	12.308	0.191	0.64
1.755	14.479	14.262	0.217	0.72
2.020	16.668	16.494	0.173	0.58
2.258	18.632	18.558	0.074	0.25
2.503	20.651	20.578	0.073	0.24
2.755	22.731	22.681	0.050	0.17
3.003	24.773	24.748	0.025	0.08
2.749	22.677	23.433	-0.756	-2.52
2.505	20.666	21.830	-1.163	-3.88
2.259	18.640	20.210	-1.570	-5.23
2.003	16.521	18.395	-1.874	-6.25
1.756	14.486	16.528	-2.042	-6.81
1.514	12.491	14.599	-2.108	-7.03
1.258	10.380	12.481	-2.101	-7.00
1.004	8.284	10.113	-1.829	-6.10
0.743	6.126	7.468	-1.342	-4.47
0.498	4.107	4.778	-0.671	-2.24
0.210	1.732	1.611	0.122	0.41
0.082	0.673	0.078	0.595	1.98

Normal Calibration



- UUT
- - - N_ref1
- ... N_ref2
- Linear (N_ref2)

Shear calibration



Moment Calibration

