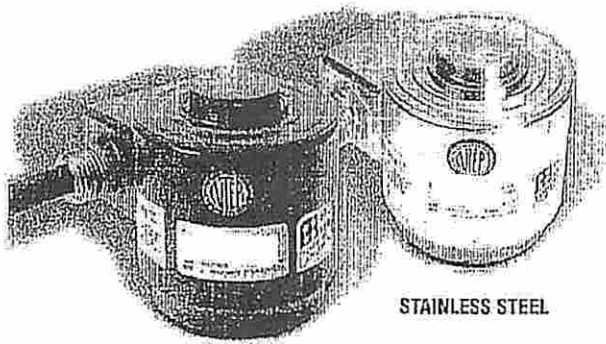


# INSTRUMENTS



STAINLESS STEEL

## Canister Load Cell

### FEATURES:

- 10K to 500K pounds capacities
- NTEP 25K, 50K, 100K, 200K
- Multi-Column Construction
- Directly replaces CSP
- Factory Mutual (F.M.) Approved
- Stainless Steel or Epoxy Enamel Paint

NTEP C.O.C. #95-092

### DESCRIPTION:

The Model 90310 is a hermetically sealed, multi-column canister cell that is ideally suited for harsh environmental conditions. The cell housing is available in mild steel with epoxy enamel paint or all stainless steel. Both versions have NTEP certification for the most commonly used capacities referenced above. The cell is recommended for tank, truck, track and hopper type industrial applications. The cell is supplied with an integral 30 foot cable, but other lengths are available on special order.

### PERFORMANCE SPECIFICATIONS

<b>Standard Capacities (lbs.):</b>	10K, 25K, 50K, 100K, 200K, 300K, 500K
<b>Excitation Voltage:</b>	20VDC
<b>Rated Output:</b>	2.0 ± .1% mv/v
<b>Non-Linearity:</b>	< 0.05% FSO (Full Scale Output)
<b>Hysteresis:</b>	< 0.02% FSO
<b>Non-Repeatability:</b>	< 0.01% FSO
<b>Zero Balance:</b>	± 1.0% FSO
<b>Bridge Resistance Input:</b>	450 ± 1% ohms
<b>Bridge Resistance Output:</b>	480 ± 1% ohms
<b>Safe Overload:</b>	150% of Rated Capacity
<b>Temperature:</b>	
<b>Compensated Range:</b>	0 - 150 deg. F
<b>Effect on Output:</b>	< 0.0008% FSO/deg. F
<b>Effect on Zero:</b>	< 0.0011% FSO/deg. F
<b>Finish:</b>	Stainless Steel or Epoxy Enamel



CAPACITY LBS.	A	B	C	D	E	F SPI RAD	G THD	H DEEP
10K - 50K	2.87	1.25	3.25	.40	1.28	6.00	1/2 - 20 UNF - 2B	.51
100K	4.12	2.31	5.00	.50	2.15	6.00	3/4 - 16 UNF - 2B	.55
200K - 300K	6.00	3.15	7.25	1.04	3.31	17.00	3/4 - 16 UNF - 2B	.75
500K	6.53	3.69	9.00	.58	4.25	17.00	3/4 - 16 UNF - 2B	.75

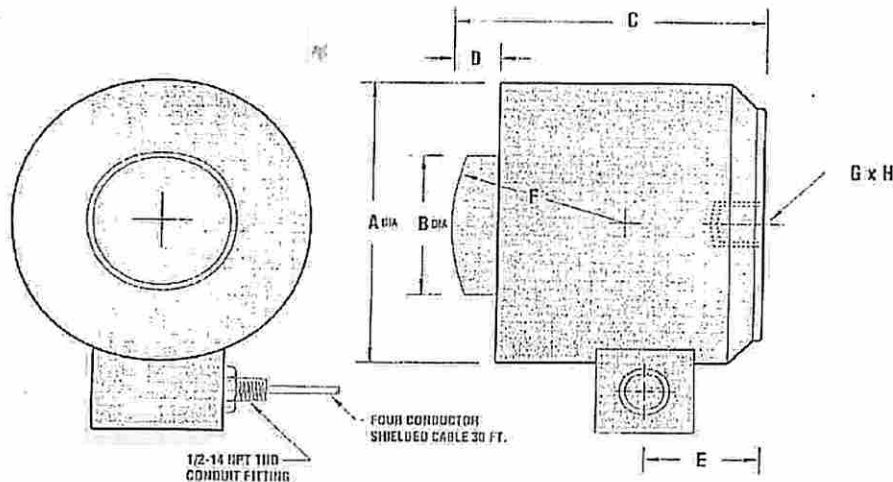
### ELECTRICAL TERMINATION

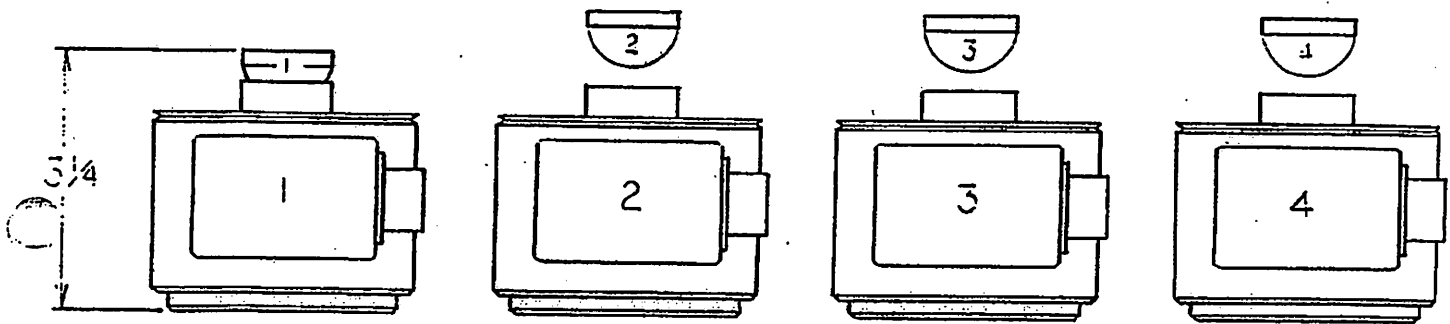
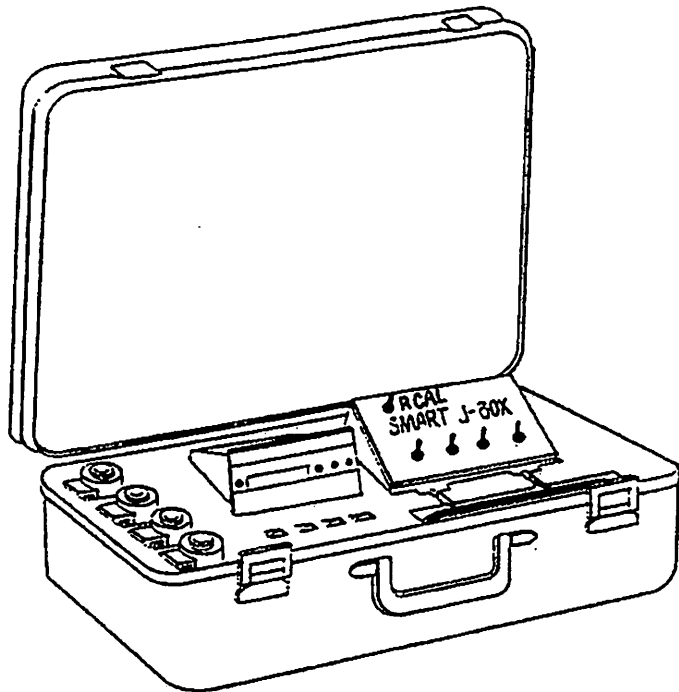
INPUT OUTPUT SHIELD

GREEN (+) WHITE (+)

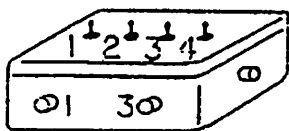
BLACK (-) RED (-)

COMPRESSION POSITIVE

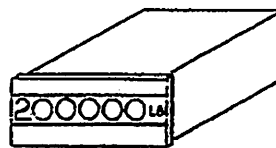




4-MODEL 320 C-50K PRECISION LOAD CELLS WITH MATCHED LOAD BUTTONS



SMART J-BOX WITH EXTERNAL SWITCHES



DIGITAL DISPLAY 200000x1 WITH KEYBOARD TARE



5-MATCHED CABLES WITH CONNECTOR

## **TABLE OF CONTENTS**

- 1.0 INTRODUCTION**
- 2.0 THEORY OF OPERATION**
- 3.0 INITIAL CALIBRATION**
- 4.0 CALIBRATION VERIFICATION**
- 5.0 R-CAL**
- 6.0 TROUBLESHOOTING**

**Drawings and Attachments**

**Warranty**

**NOTE:** Reference HI2151/20WC manual for questions pertaining to the HI2151/20WC Indicator.

**NOTE:** Reference Smart-J-Box manual for questions pertaining to the Smart-J-Box.

**Beowulf Corporation  
345 Nick Fitchard Rd.  
Huntsville, AL 35806  
205-859-0004**

**Revision B - September, 1992**

## 1.0 INTRODUCTION:

The Cal-Master <sup>TM</sup> is a portable electronic calibration kit specifically designed for true deadweight calibration. The Cal-Master kit can be used to calibrate one to eight load cell tension/compression scales. The standard kit contains 4 - 50K precision load cells with a system capacity of 200K, 150K for three cells, 100K for two cells, etc., (8K, 40K or 400K kits are optional). The kit may be used on any scale which has tension/compression Cal-stands, hydraulics, or other custom designed fixtures.

## 2.0 THEORY OF OPERATION:

The Cal-Master Kit is a true deadweight calibration standard which utilizes both the dead load and live load weight of the weighing vessel as the test weight. It also accomplishes a feat no other calibration method can claim. The series loading of the tension/compression stands place the standard cells into a series load string with the static cells, therefore, all external force factors (piping, floor shifting, etc.) may be accurately considered during calibration. The Cal-Master <sup>TM</sup> may also be used to check the linearity of the static system from 0 lbs. of live load to scale capacity.

## 3.0 INITIAL CALIBRATION USING TENSION/COMPRESSION CAL-STANDS

Remember: If a Cal-Master Cal kit is rated for 200K with all 4 load cells under load, then the same kit would be rated for 150K when only 3 load cells are used and so on.

**NOTE:** For hydraulic, loadlifter, and generic mount refer to drawings.

**NOTE:** All SJB switches should be on when calibrating a system with less than 4 load cells. All cables and load cells should be connected according to labeling regardless of the number of static system load cells. *The switches should be used for fault isolation only!!*

- A. Install cal-cells as depicted by the applicable Figure 1 "X". Be sure Cal-cell and load buttons agree (cell 1 to button 1).
- B. Connect the Cal-system Smart-J-Box to each load cell (cable 1 to cell 1).
- C. Be sure Cal-system Smart-J-Box switches S1 thru S4 are on.
- D. Apply power to the Cal-System and wait for 30 minutes for it to warm up.
- E. Empty the weighing vessel if it is not empty. The weight displayed by the Cal-system is the vessels dead load. Record the weight on a tag and attach it to the vessel for future calibrations. Place the H2151/20WC Indicator into net mode and press tare.
- F. Zero the static indicator and Smart-J-Box (if equipped), (see respective manuals).
- G. Apply weight to the weighing vessel by adding a material such as water or other available substances. Load the tank to at least 50% capacity.

**NOTE:** Do not overload Cal-system.

- H. Once tank is filled, calibrate the span of the static system to agree with the weight of the Cal-system. empty the vessel.

- I. Check zero. If zero is not acceptable, go to Step E.
- J. The static weighing system is now in calibration.
- K. Remove the Cal-cell and replace the spacers as depicted by the applicable Figure 1"X".
- L. Scale calibration is now complete.

#### **4.0 CALIBRATION VERIFICATION USING TENSION/COMPRESSION CAL-STANDS**

- A. Follow instructions for section 3.0 steps A thru D.
- B. Enter the dead load weight of the vessel (see tag attached to scale) via the keyboard tare of the Cal-system.
- C. The weight of the Cal-system and the static system should now be in agreement (within applicable tolerance).
- D. The vessel weight should be varied by using system in normal operation or other means.
- E. If the Cal-system and static system agree within applicable tolerances, the static weighing system is within calibration. Perform section 3.0, step K thru L.
- F. If the two systems do not agree within applicable tolerances, then empty the vessel (by normal operation if possible) and perform Section 3.0, steps F thru J.
- G. Scale recalibration is now complete.

#### **5.0 R-CAL**

A system R-CAL is provided for cal-system calibration verification.

- A. Depress the R-CAL pushbutton and hold.
- B. Insure that the previously recorded R-CAL number agrees with the current display on the HI2151/20WC indicator within applicable tolerances.
- C. Release the R-CAL pushbutton.
- D. If the two numbers agree the system may be considered as still in calibration. If the two numbers disagree are not within applicable tolerances the cal-system is not within calibration and should be returned to the factory for recalibration.

**6.0 TROUBLE SHOOTING:**

<b>SYMPTOM</b>	<b>POSSIBLE CAUSE</b>
<b>Zero's do not agree during maintenance cal.</b>	<ol style="list-style-type: none"><li><b>1. Vessel dead load may have changed</b></li><li><b>2. Base or overhead supports may have shifted.</b></li><li><b>3. Static system is out of calibration.</b></li></ol>
<b>Span's do not agree during maintenance cal.</b>	<ol style="list-style-type: none"><li><b>1. Vessel dead load may have changed</b></li><li><b>2. Base or overhead supports may have shifted.</b></li><li><b>3. Static system is out of calibration.</b></li></ol>
<b>Both systems agree at zero and span, but do not agree at some point(s) between zero and span.</b>	<ol style="list-style-type: none"><li><b>1. Poor static system tolerance due to nonlinearity and hysteresis.</b></li></ol>

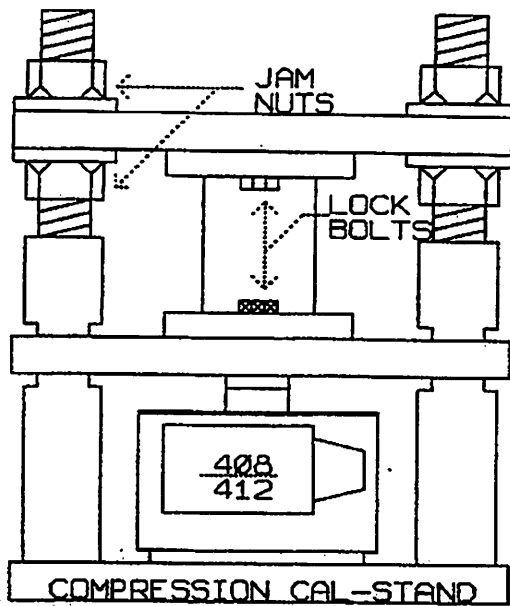


FIGURE 1A

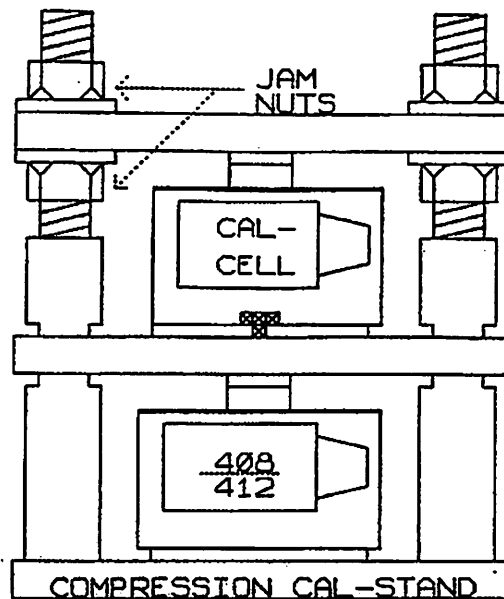


FIGURE 1B

### INSTRUCTIONS

- 1 REMOVE LOCK BOLTS AND RAISE TANK FOOT 1/8" USING JAM NUTS
- 2 REMOVE SPACER AND REPLACE IT WITH CAL-CELL
- 3 REPLACE LOCK BOLT AND LOWER JAM NUTS
- 4 REVERSE SEQUENCE TO REPLACE SPACER

NOTE: REFERENCE FIGURE 1A & 1B FOR  
COMPRESSION CAL-STAND MOUNT

BEOMULF CORP		
Title		
COMPRESSION CAL-STAND MOUNT		
Size/Document Number		
A	CAL2.SCH	REV A
Date: January 14, 1992 Sheet 1 of 1		

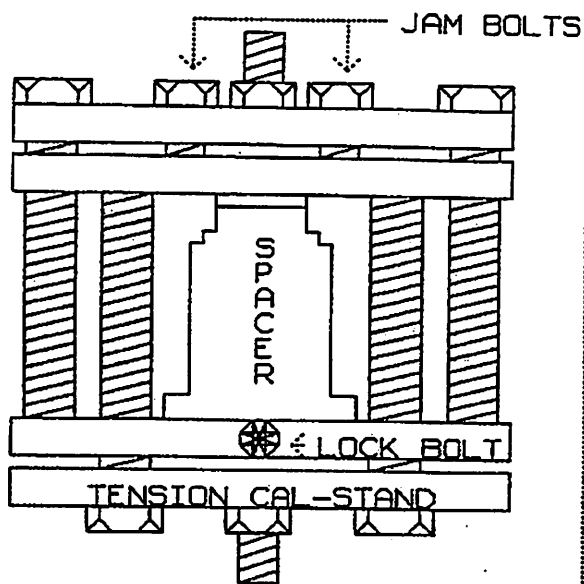


FIGURE 1C

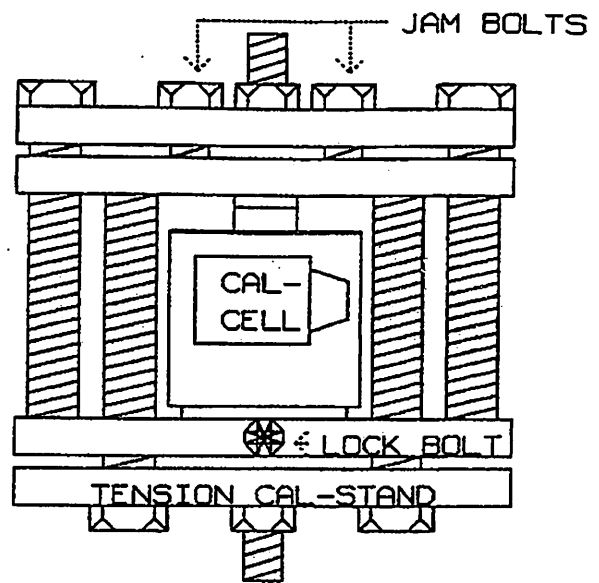


FIGURE 1D

### INSTRUCTIONS

- 1 REMOVE LOCK BOLT AND RAISE JAM 1/8" USING JAM BOLTS
- 2 REMOVE SPACER AND REPLACE IT WITH CAL-CELL
- 3 REPLACE LOCK BOLT AND LOWER JAM ONTO CAL-CELL
- 4 REVERSE SEQUENCE TO REPLACE SPACER

NOTE: REFERENCE FIGURE 1B & 1C FOR  
TENSION CAL-STAND MOUNT

BECHTEL CORPORATION		
Title		
TENSION CAL-STAND MOUNT		
Size Document Number		
A	CAL3.SCH	REV A
Date: January 15, 1992 Sheet		1 of 1



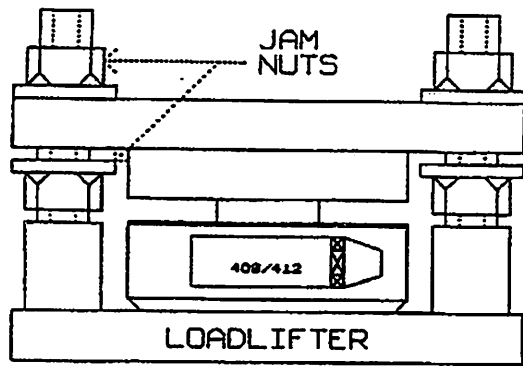


FIGURE 1E

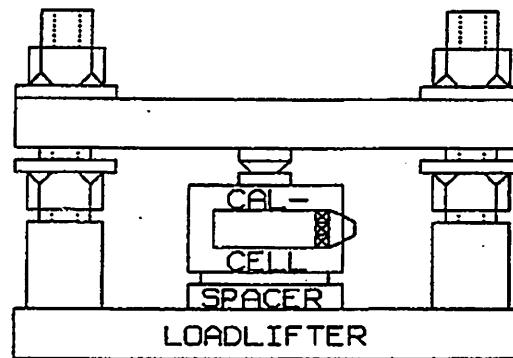


FIGURE 1F

### INSTRUCTIONS

- 1 REMOVE BOLTS HOLDING TANK FOOT TO LOADLIFTER
- 2 RAISE JAM NUTS UNTIL THE 412 IS NO LONGER IN CONTACT WITH TOP PLATE OF LOADLIFTER
- 3 REMOVE 412 AND REPLACE WITH CAL-CELL AND SPACER
- 4 LOWER JAM NUTS UNTIL ALL WEIGHT REST ON THE CAL-CELL
- 5 REVERSE SEQUENCE TO REPLACE 412

NOTE: REFERENCE FIGURE 1E & 1F  
FOR LOADLIFTER MOUNTING

BECHTEL CORPORATION		
Title		
LOADLIFTER MOUNT		
Size Document Number		
A	CAL-5CH	REV A
Date: January 16, 1992 Sheet 1 of 1		

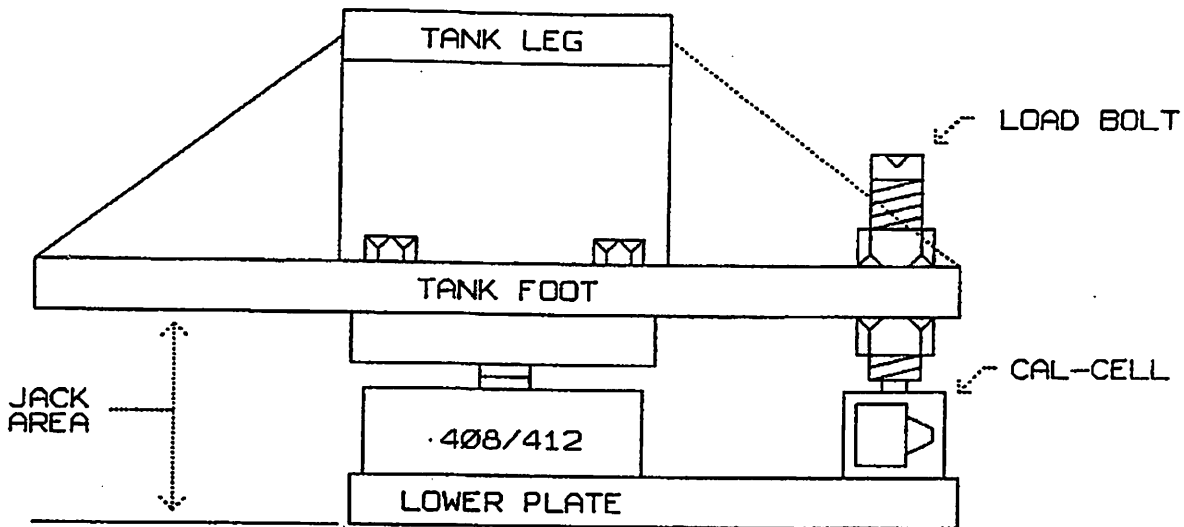


FIGURE 1G

INSTRUCTIONS

- 1 LOOSEN BOLTS HOLDING TANK FOOT TO 408/412
- 2 RAISE TANK FOOT USING A JACK AND INSERT CAL-CELL
- 3 REVERSE SEQUENCE TO REMOVE CAL-CELL

NOTE: REFERENCE FIGURE 1G FOR  
GENERIC MOUNT

BEOWULF CORPORATION		
Title		
GENERIC MOUNT		
Size Document Number		REV
A		A
Date: January 14, 1992		Sheet 1 of 1

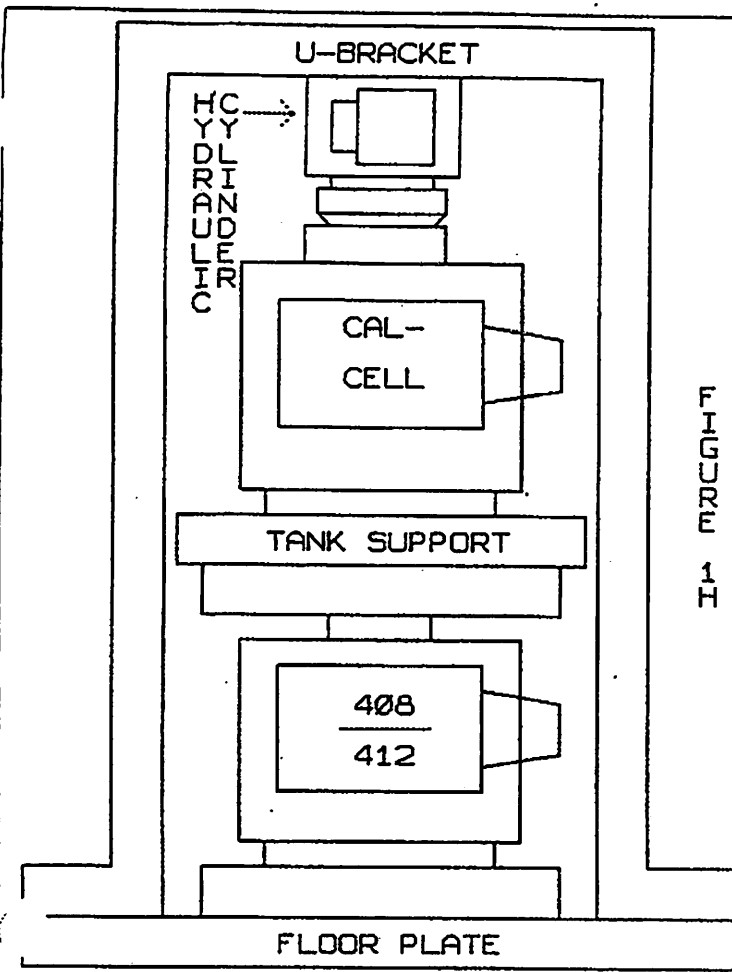


FIGURE 1H

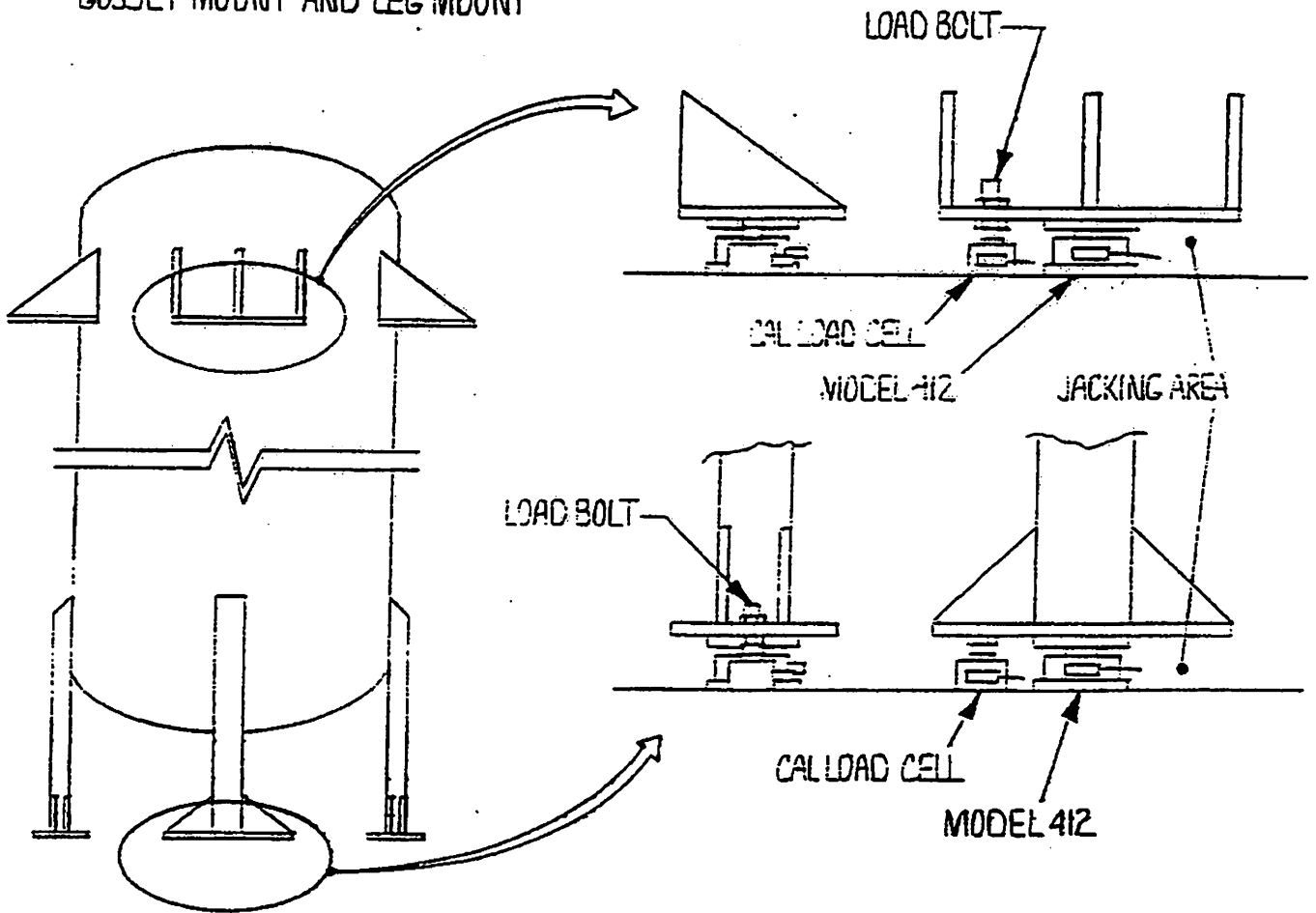
INSTRUCTIONS

- 1 PLACE U-BRACKET AS SHOWN AND SECURE TO FLOOR
- 2 PLACE HYDRAULIC CYLINDER AND CAL-CELL WITHIN BRACKET AS SHOWN
- 3 REVERSE SEQUENCE TO REMOVE U-BRACKET, CAL-CELL & HYDRAULIC CYLINDER

NOTE: REFERENCE FIGURE 1H FOR HYDRAULIC MOUNTING

BEOMERF CORPORATION	
Title HYDRAULIC MOUNTING	
Size Document Number	REV
A CAL1.SCH	A
Date: January 14, 1992	Sheet 1 of 1

TYPICAL TANK SCALE MOUNTS  
GUSSET MOUNT AND LEG MOUNT



## WARRANTY

**BEOWULF CORPORATION** warrants its new products to be free from defects in material and workmanship for twelve months after installation or fifteen months after shipment, whichever occurs first. Repaired load cells are warranted for six months after shipment from factory. Beowulf will provide factory service when warranted parts or equipment are returned to its plant, freight prepaid. Beowulf's liability under this warranty is limited to the repair or replacement of defective material and in no event shall it be liable for consequential, indirect, or contingent damages.

This warranty shall not apply to parts or equipment subject to accidental damage, misuse, alteration, overload, improper installation, uncontrollable acts of nature or deterioration due to extended storage or exposure.

This warranty constitutes Beowulf Corporation's exclusive warranty, there being no other warranties, expressed or implied, including any warranty of merchantability or fitness for a particular purpose.



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125	2-15-75	WJ	WJ	REVISED TO SHOW 2-15-75
126	3-15-75	WJ	WJ	REVISED TO SHOW 3-15-75
127	4-15-75	WJ	WJ	REVISED TO SHOW 4-15-75
128	5-15-75	WJ	WJ	REVISED TO SHOW 5-15-75
129	6-15-75	WJ	WJ	REVISED TO SHOW 6-15-75
130	7-15-75	WJ	WJ	REVISED TO SHOW 7-15-75
131	8-15-75	WJ	WJ	REVISED TO SHOW 8-15-75
132	9-15-75	WJ	WJ	REVISED TO SHOW 9-15-75
133	10-15-75	WJ	WJ	REVISED TO SHOW 10-15-75
134	11-15-75	WJ	WJ	REVISED TO SHOW 11-15-75
135	12-15-75	WJ	WJ	REVISED TO SHOW 12-15-75
136	1-15-76	WJ	WJ	REVISED TO SHOW 1-15-76
137	2-15-76	WJ	WJ	REVISED TO SHOW 2-15-76
138	3-15-76	WJ	WJ	REVISED TO SHOW 3-15-76
139	4-15-76	WJ	WJ	REVISED TO SHOW 4-15-76
140	5-15-76	WJ	WJ	REVISED TO SHOW 5-15-76
141	6-15-76	WJ	WJ	REVISED TO SHOW 6-15-76
142	7-15-76	WJ	WJ	REVISED TO SHOW 7-15-76
143	8-15-76	WJ	WJ	REVISED TO SHOW 8-15-76
144	9-15-76	WJ	WJ	REVISED TO SHOW 9-15-76
145	10-15-76	WJ	WJ	REVISED TO SHOW 10-15-76
146	11-15-76	WJ	WJ	REVISED TO SHOW 11-15-76
147	12-15-76	WJ	WJ	REVISED TO SHOW 12-15-76
148	1-15-77	WJ	WJ	REVISED TO SHOW 1-15-77
149	2-15-77	WJ	WJ	REVISED TO SHOW 2-15-77
150	3-15-77	WJ	WJ	REVISED TO SHOW 3-15-77
151	4-15-77	WJ	WJ	REVISED TO SHOW 4-15-77
152	5-15-77	WJ	WJ	REVISED TO SHOW 5-15-77
153	6-15-77	WJ	WJ	REVISED TO SHOW 6-15-77
154	7-15-77	WJ	WJ	REVISED TO SHOW 7-15-77
155	8-15-77	WJ	WJ	REVISED TO SHOW 8-15-77
156	9-15-77	WJ	WJ	REVISED TO SHOW 9-15-77
157	10-15-77	WJ	WJ	REVISED TO SHOW 10-15-77
158	11-15-77	WJ	WJ	REVISED TO SHOW 11-15-77
159	12-15-77	WJ	WJ	REVISED TO SHOW 12-15-77
160	1-15-78	WJ	WJ	REVISED TO SHOW 1-15-78
161	2-15-78	WJ	WJ	REVISED TO SHOW 2-15-78
162	3-15-78	WJ	WJ	REVISED TO SHOW 3-15-78
163	4-15-78	WJ	WJ	REVISED TO SHOW 4-15-78
164	5-15-78	WJ	WJ	REVISED TO SHOW 5-15-78
165	6-15-78	WJ	WJ	REVISED TO SHOW 6-15-78
166	7-15-78	WJ	WJ	REVISED TO SHOW 7-15-78
167	8-15-78	WJ	WJ	REVISED TO SHOW 8-15-78
168	9-15-78	WJ	WJ	REVISED TO SHOW 9-15-78
169	10-15-78	WJ	WJ	REVISED TO SHOW 10-15-78
170	11-15-78	WJ	WJ	REVISED TO SHOW 11-15-78
171	12-15-78	WJ	WJ	REVISED TO SHOW 12-15-78
172	1-15-79	WJ	WJ	REVISED TO SHOW 1-15-79
173	2-15-79	WJ	WJ	REVISED TO SHOW 2-15-79
174	3-15-79	WJ	WJ	REVISED TO SHOW 3-15-79
175	4-15-79	WJ	WJ	REVISED TO SHOW 4-15-79
176	5-15-79	WJ	WJ	REVISED TO SHOW 5-15-79
177	6-15-79	WJ	WJ	REVISED TO SHOW 6-15-79
178	7-15-79	WJ	WJ	REVISED TO SHOW 7-15-79
179	8-15-79	WJ	WJ	REVISED TO SHOW 8-15-79
180	9-15-79	WJ	WJ	REVISED TO SHOW 9-15-79
181	10-15-79	WJ	WJ	REVISED TO SHOW 10-15-79
182	11-15-79	WJ	WJ	REVISED TO SHOW 11-15-79
183	12-15-79	WJ	WJ	REVISED TO SHOW 12-15-79
184	1-15-80	WJ	WJ	REVISED TO SHOW 1-15-80
185	2-15-80	WJ	WJ	REVISED TO SHOW 2-15-80
186	3-15-80	WJ	WJ	REVISED TO SHOW 3-15-80
187	4-15-80	WJ	WJ	REVISED TO SHOW 4-15-80
188	5-15-80	WJ	WJ	REVISED TO SHOW 5-15-80
189	6-15-80	WJ	WJ	REVISED TO SHOW 6-15-80
190	7-15-80	WJ	WJ	REVISED TO SHOW 7-15-80
191	8-15-80	WJ	WJ	REVISED TO SHOW 8-15-80
192	9-15-80	WJ	WJ	REVISED TO SHOW 9-15-80
193	10-15-80	WJ	WJ	REVISED TO SHOW 10-15-80
194	11-15-80	WJ	WJ	REVISED TO SHOW 11-15-80
195	12-15-80	WJ	WJ	REVISED TO SHOW 12-15-80
196				