SILOWEIGH

INSTALLATION INSTRUCTIONS

READ THIS MANUAL THOROUGHLY BEFORE YOU START. We are not responsible for mistakes made and material wasted as a result of incorrect installation. Call us if you are unsure, 514 634 7083.

1. INSTALLING WELDABLE GAUGES

Choosing position

In general, gauges are best positioned in the centre of an unobstructed run of support beam. Since the gauges will measure the load in the beam at the point of mounting, it is important to first ensure that the point you choose is bearing <u>all</u> the load of the silo and attachments. If the silo empties into a screw conveyor and the screw conveyor is supported by beams attached to the legs, the gauges must be installed under these beams to measure all of the load. Likewise, if there are load bearing struts from the silo or anything else to the legs, the gauges must be installed under these struts. Load bearing struts can be identified by their shape and cross section. If they are similar in cross section (thickness) to the legs, they are load bearing. If they are thin flat bars or light angle, they are cross braces and not load bearing. The gauges can be installed above the bottom ends of these type of struts. See examples in appendix 1 and chose the one that suits your setup the best.

In the example below opposite, they have been installed in the center of the leg section shown; you can see the box on the left leg, about 12 inches above level with the top of the ladder

If you are unsure, <u>CALL US</u>; this simple step can prevent big problems later!

It is more important to be able to see and work comfortably than it is to place the gauges in the exact centre of a run. Use the template (appendix 6) to mark out the drill centers and gauge locations.

Drill three 9/32" holes in the template positions. The two outside ones are for the cover mounting bolts and the centre one is for wiring; remove any burrs from this hole to prevent cutting into the wire insulation later.

Circular section legs - locate the boxes on each side of the leg, 180º apart and approximately East/West to minimize sunlight induced temperature differences. Position boxes so that the holes are vertically above one another; drill and tap the mounting holes so that the bolts can be screwed in directly. Omit the third hole (no interconnecting wires through the beam are used) and position the mounting tabs vertically so that the holes can be at right angles to the metal surface. Check that the covers are a good fit to the surface; you can shape them with a large piece of coarse sandpaper or emery cloth taped to the beam. Rub the cover, edge down, against it until the correct shape is obtained.

Surface preparation

Weldable gauges must be attached to a clean, flat surface, free of any pits or rust. grind the surface lightly with an electric grinder in small circular

motions to avoid cutting grooves in the surface. When all pits and rust have been removed, check that the gauge area feels flat to the touch. Further flatten and smooth the area with a sanding disk using sweeping strokes, covering the area in one direction and then again at right angles, until the area is flat and smooth.

Degrease the gauge area with alcohol or paint thinner on a paper towel.

Gauge welding

Prepare a test area on any convenient leg surface, away from the actual gauge location, for welding as above. Connect the ground clip of the welder to the silo support structure wherever convenient, after grinding off the paint to give a good connection. Set the welder to **20 watt seconds** and check the setting frequently - it can easily get moved. Following the instructions in appendix 2, tape the practice piece (the metal tab without gauges or wires) onto the test area. Turn the welder control to **WELD** and, using a magnifying visor, weld around the gauge areas (not round the entire metal piece) in the pattern shown in Appendix. Be very careful to hold the welder so that the electrode does not slide around as you apply pressure, since this could damage the gauges. The best method is to let the bottom of the handle rest against the metal surface; this stabilizes it. If you see a flash or blackened surface during welding, this indicates that the preparation was not done properly or that insufficient pressure was applied. Turn the welder **OFF** when not in use, to conserve the battery.

Carefully pull the test piece off the metal surface with pliers. If the welding was successful, it will leave little pieces of the test piece behind where welding took place.

Check the electrode before proceeding further; it should come to point with about the same sharpness as a fine ballpoint pen. Replace it or sharpen with a file if necessary (but not to a needle point).

Once you are confident with welding technique, select a gauged carrier. Note that in every set of two carriers, one has its template marked **FRONT OF LEG**, with wires colored black, red and white and the other marked **BACK OF LEG** with wires colored black, red and green. Note also that the one with the green wire has longer leads that the one with the white. Install the **FRONT** carrier with the white wire on the outer surface, where the external connections will eventually be made. Install the **BACK** carrier with the green wire on the rear; the leads will be brought

through the hole to the front for connection.

Gauges can be welded onto the silo leg when the silo is full, empty or part full, even during filling.

Orient the carrier as shown on the template and in appendices 3 and 4, with the sloping side to the right in each case. ***Caution! This step causes the most problems in installation. It is very easy to get the carrier welded in the wrong position. Check the templates for both front and back, plus the drawings***

and photographs in this manual, before you start welding. Re-check when you start each new leg. If a carrier is welded in the wrong position, your SiloWeigh will not perform properly. We are not responsible for mistakes made here and you will have to purchase new gauges!

Tape the top edge of the carrier carefully onto the surface, ensuring that one gauge is parallel to the beam and the other is at right angles, as judged by eye. Handle the connection cable carefully to avoid pulling its solder tag off the metal surface. Weld carefully in place in the order given in appendix 2, starting at the center of the edge of each gauge and working to the outside, being careful to avoid the thin connecting wires; these can be gently moved to one side with the welding electrode if they interfere with the proper welding pattern. *Do not weld around the edge of the metal carrier; it is essential to weld around the individual gauges (the brown rectangular devices).*

Take great care during the welding process; the accuracy of the system depends on this more than anything else.

Coat the whole carrier and 1/4" (5 mm) around it with M-Coat A, working it around the wires and connecting pads. Apply a second coat to the wire connecting pad and around the wires to anchor them securely. This is the first moisture seal and will prevent rusting under the carrier.

Gauge testing

If you have a digital voltmeter, test the gauges individually at this point. You should get resistance values as follows for each gauge:

WHITE (GREEN) TO RED 348 to 352 ohms

WHITE (GREEN) TO BLACK 348 to 352 ohms

WHITE (GREEN) TO LEG METAL greater than 20 Megohms. (Shows blank on 20 Megohm range).

If readings are not as above, you have damaged a gauge or gauge connecting wire during installation. Either replace the complete gauge assembly or replace the damaged connecting wire if possible.

2. WIRING AND WEATHERPROOFING

Gauge connections

Attach a sticky pad under the front carrier as shown. Steady the connecting pad on the carrier by pressing down on it with a finger and bend the wires carefully into the shape shown. Run the red, black and green wires from the rear carrier through the hole to the front, bend them down while still holding the connecting pad with a finger, then combine the wires from the front and rear carriers over the sticky pad and Tyrap them firmly into position. The loops in the wires remove the stress from the connecting pads and reduce the possibility of pulling them off the carriers, even if the free ends of the wires are pulled later.

Cut cable to length and fix to beam using Tyraps and pads. Run cables through the strain reliefs in the covers and attach a terminal block according to the circuit diagram. Connect the gauge wires to the other side of this terminal block, connecting like colours together. This will give four coloured wire connections and one more for the shield wire. Use some of the jacket stripped from the cable to insulate the shield wires and prevent it from touching the bare metal of the leg..

Repeat this procedure for all gauges and all legs. In the case of circular section legs, connect the front of the leg to the rear of the leg with a short piece of the same cable, looping the incoming cable to the front leg box, the short loop to the rear leg box and the

outgoing cable from the rear leg box. When complete, all gauges should be connected one to the other and a single cable should extend from the last box to the indicator.

Indicator connections

Mount the indicator cabinet on a convenient wall by use of the metal clips and screws supplied. Thread the cables from each silo through separate strain reliefs to the cabinet interior. Allowing plenty of slack cable to prevent it tightening when the door is open, cut the cable and strip 18 inches of insulation from it. Remove the aluminum shield and as with gauge connections, use cable jacket to insulate the shield wire. Connect all shields to the GROUND screw on the power supply frame, together with the green ground conductor from the power cable.

Run the inner conductors of each cable (being careful not to mix them) to the upper green screw connectors on each bar graph indicator. Connect the cable conductors as follows, together with the wires already connected to this connector:

RED	+ EXC	(2)
BLACK	- EXC	(4)
GREN	+ SIGNAL	(1)
WHITE	- SIGNAL	(3)
SHIELD	GROUND (power supply)	

If any existing wires fall out of the connector, replace them in the same way as other bar graphs in the cabinet or consult schematic provided.

Insulation test

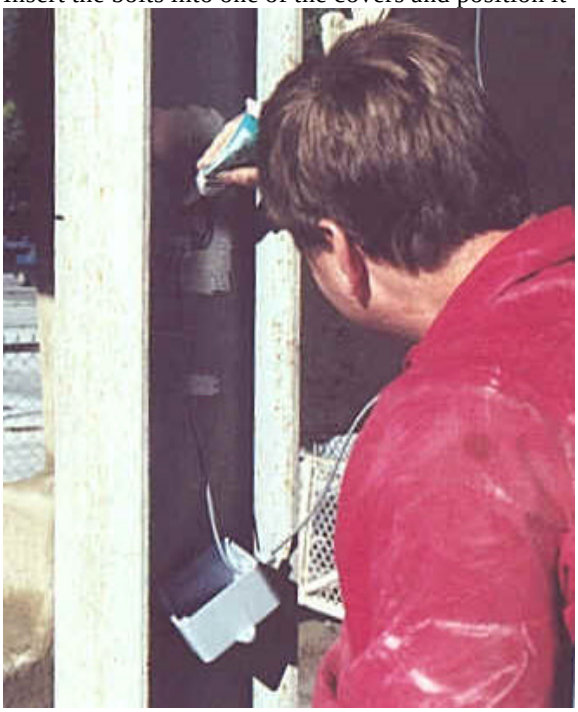
Test the complete installation by measuring the insulation resistance at the indicator end of the cable between any of the colored wires and ground (indicator case if plugged in, or the metal box of the power outlet). It should read greater than 20 Megohm as before. If you do not possess a digital multimeter, apply power to the indicator and read the weight value. Note the reading and connect the – EXC terminal (4) to the power ground or a convenient grounded object such as metal building supports or the silo frame. Note that the reading does not change by more than 10 graduations.

If the resistance is lower than 20 Megohm or the change in readings is more than the above value, disconnect gauges one at a time, starting at the far end of the cable, repeating the test at each stage. When the resistance shows above 20 Megohm (blank) or readings do not change, you have just disconnected the faulty gauge. It must be removed and replaced.

Gauge coating

Once the gauges have been verified, apply the weatherproof coating. Make sure that the gauges are dry before you start. Covering wet gauges will encourage rust and will destroy the gauges in a short time. Use the tube of Dow Corning 3145 RTV silicone; squeeze a layer back and forth across the gauge surface, extending this coat a little further than the M-coat A. Squeeze it through and behind the connecting wires to ensure this is watertight. The silicone can be moulded and flattened somewhat by dabbing with a wet finger if necessary; ensure that the coat is unbroken and even.

It is normally better to do the calibration before installing the covers but if this cannot be done immediately, it is better to weatherproof the system. Insert the bolts into one of the covers and position it



over the gauge, ensuring that you do not trap the wires under the rim. Do the same for the opposite cover, sliding the bolts through the cover lugs. Install lockwashers and nuts, leaving approximately 1/16" (2mm) slack at each side. Apply a bead of the 3145 RTV silicone along the edge of one box, where it nearly touches the leg. Run a finger around the box, squeezing the RTV into the gap. Push the box in place and repeat for the other box. Tighten the bolts carefully to avoid bending the plastic lugs; some of

the RTV should squeeze out of the joint as proof that the joint is completely filled

3. CALIBRATION

Initial setup

Determine the capacity of the silo in tons (or tonnes for metric measurement). One ton equals 2000 lb and one tonne equals 1000 kg. Silos up to 1200 tons (tonnes) can be displayed with one decimal, i.e. 200.0 tons. Capacities above 1200 must be displayed with no decimal.

Enter the calibration sub menu by pressing the **P** and up arrow buttons at the same time. Display toggles between [CAL] and [oFF].

Press the **P** button. Display toggles between [bHi] and previous setting.

Pressing and holding the up or down arrow button, adjust the display to the capacity of the silo, remembering that the decimal point is not shown, so that your setting must be 10 times the desired value (if one decimal is to be selected later).

Press the **P** button. Display toggles between [bLo] and the previous setting.

Pressing and holding the up or down arrow button, adjust the display to zero if not already at this value.

Press the **P** button. Display changes from [oFF] to [dP].

Pressing and holding the up or down arrow button, adjust the decimal point to the desired position.

Press the **P** button. Display toggles between [br] and the previous brightness setting.

Pressing and holding the up or down arrow button, adjust the display to the desired bar-graph brightness setting (4 is the brightest setting).

At this point, display setup is complete and if no analog output option is installed, pressing the P button will exit from the setup menu. Check the appearance of the display and repeat if necessary.

If the analog output option is installed, the display toggles between [Cto] and [oFF].

Pressing and holding the up or down arrow button, adjust the display to the capacity of the silo or the weight value at which the analog output will be at its full scale output, remembering that the decimal point is not shown , so that your setting must be 10 times the desired value.

Press the **P** button. Display toggles between [anLo] and the previous setting.

Pressing and holding the up or down arrow button, adjust the display to zero (or the desired weight value at which the analog output will be at its minimum value) if not already at this value.

Press the **P** button. The display exits the setup menu.

Preparation for calibration

Calibration consists of two operations: **Dead load** and **Span**. Ensure that the silo is empty before you start. Inspect the interior visually if necessary.

Span adjustment is done with trucks which have been weighed before delivery. The printed delivery ticket is the "calibration weight". If possible, have a delivery of material waiting so that the two steps can be done with as little delay as possible. This maximizes the accuracy of the calibration.

Dead load adjustment

Before the indicator is calibrated, the gauge output must be brought within range. This is accomplished with the supplied shunt resistors. First, measure the voltage between the + SIGNAL and - SIGNAL terminals on the indicator, using a digital voltmeter on the 200mV DC range; ensure that the red (positive) probe of the meter is connected to + SIGNAL. Estimate the fullness of the silo; the signal voltage should lie within the following limits:

Empty to half full:	-1 to +3mV
Half full to full	+3 to +7 mV

If the voltage lies within the limits, no further action is necessary. If not, add a resistor between + SIGNAL and + EXC to increase or + SIGNAL to - EXC to decrease. Two or more resistors can be used in parallel if necessary. When you are finished, RECORD THE MILLIVOLT READING for each silo; it can be used for fault diagnosis later if necessary.

Calibration – low adjustment

Ideally the silo should be empty before starting calibration. If the weight of the silo contents are known, can be closely estimated, or are available from a previous calibration, however, the calibration can be made equally well.

Enter calibration mode by pressing the **P** and up arrow buttons at the same time. Display toggles between [CAL] and [oFF].

Press and hold the up or down arrow button. Release button when display changes from [oFF] to [on].

Press the **P** button. Display toggles between [CAL] and [out].

If the analog output option is not present, this step is skipped and the display toggles between [ZEro] and the previous low setting.

If the analog output option is present, press the **P** button. Display toggles between [ZEro] and the previous low setting.

Pressing and holding the up or down arrow button, adjust the display to the weight in the silo (zero if empty), remembering that the decimal point is not shown, so that your setting must be 10 times the desired value (if one decimal is selected). Press the **P** button. Display toggles between [Span] and the previous span setting. *Go no further at this point; see Span, below. The display can be left indefinitely in this state, but do not remove power – the sequence will have to be restarted if you do*.

Span adjustment

Start the transfer of material from the truck into the silo. When loading is complete, check the millivolt reading again; the increase in reading caused by the loading must be greater than 0.4 mV for calibration to be accurate. If less than this amount, transfer a second load and check again before continuing. When loading is complete, Pressing and holding the up or down arrow button, adjust the display to the weight in the silo (obtained from the delivery ticket or sum of all tickets if more than one delivery, plus the initial amount in the silo, used for "zero" setting if not empty), remembering that the decimal point is not shown, so that your setting must be 10 times the desired value (if one decimal is selected).

Press the **P** button to complete calibration and exit.

Before doing anything else, RECORD THE MILLIVOLT READING, it can be used for fault diagnosis if necessary. Keep readings safe – inside the display cabinet is a good place for them.

ERROR indicates unsuccessful calibration. The new calibration values just entered will not take effect and the previously stored values will remain. The four most likely causes of this error are:

- Low and high signals too similar. Use a larger weight change for the calibration. Difference in signal voltage must be 0.2 mV or more.
- The input signal exceeds the requirements of the meter. Check the Dead Load setting above.
- No change in input signal due to incorrect installation of gauges. Call Scale-Tron for guidance.
- Incorrect values for Zero and Span. Span must be higher than Zero.

Relay setpoints

Four relay setpoints are available on each bar graph display (Option R14). Setpoints 1 and 2 have "form C" (SPDT) contacts and setpoints 3 and 4 have "form A" (SPST). All include MOV suppressors; max. switching is 10A for SP1,2 and 5A for SP3,4. Commons for SP1 and 3 are connected together, as are SP2 and 4. Connections are marked on the meter case.

Enter Setpoint mode by pressing the P and down arrow buttons at the same time. Display toggles between [SP1] and the previous SP1 setting.

Pressing and holding the up or down arrow button, adjust the display to the desired SP1 value, remembering that the decimal point is not shown, so that your setting must be 10 times the desired value (if one decimal has been selected).

Press the P button. Display toggles between [doM] and previous [doM] setting. Pressing and holding the up or down arrow button, adjust the display to the desired Delay-On-Make value (0 to 9999 seconds). The reading must continuously remain in an alarm condition until this delay has elapsed before the relay will close. It is normally set at 0.

Press the P button. Display toggles between [dob] and previous [dob] setting. Enter the Delay-On Break in the same way.

Press the P button. Display toggles between [hYSt] and previous [hYSt] setting. Using the up and down arrow buttons, select Hysteresis Off; Note: Hysteresis is used for specialized filling operations and does not normally apply. For full details see the FL-B101 D40 manual.

Press the P button and continue setting SP2, 3 and 4.

Press the P button. Display toggles between [rLYS] and previous relay setting. Using the up and down arrow buttons, select whether relays close on rising or

falling weight values. The display (LLLL) represents SP1 to 4 reading left to right and h represents rising while L represents falling.

Press the P button to exit.

Analog output

The Analog Output module is normally set for 4 – 20 mA. It can also be set to 0 – 10 V by snapping off the rear cover, pulling out the main board, locating the analog output piggyback board and changing the jumper position as marked. The output is isolated.

The analog output range settings appear as the first step in the Calibration Menu. Enter calibration mode by pressing the **P** and up arrow buttons at the same time. Display toggles between [CAL] and [oFF].

Press and hold the up or down arrow button. Release button when display changes from [oFF] to [on].

Press the **P** button. Display toggles between [CAL] and [out].

Press the **P** button while [out] is displayed. Display toggles between [cLo] and an internal scale factor. Set a multimeter to the 20 mA range (or 20 V range for voltage output) and connect it between pins 17 and 18 (as shown on meter cover).

Pressing and holding the up or down arrow button, adjust the display to the desired "low" value (normally 4.00 mA) The range is from –0.3 mA to 18 mA or -0.6 V to 8 V.

Press **P** button and repeat for the "high"value (normally 20 mA or 10 V). Range is 18 to 24 mA or 8 to 10.3 V.

Press **P** button to exit.

The weights that represents the analog "low" and "high" outputs are set from Calibration Mode. See Initial Setup, page 5. Following the decimal point and display brightness, enter the weights for the low and high output extremes (normally zero and the silo capacity, not forgetting to multiply by 10 because of the missing decimal point).

Finishing off

If you have not already installed the gauge covers, do so now. Insert the bolts into one of the covers and position it over the gauge, ensuring that you do not trap the wires under the rim. Do the same for the opposite cover, sliding the bolts through the cover lugs. Install lockwashers and nuts, leaving approximately 1/16" (2mm) slack at each side. Apply a bead of the 3145 RTV silicone along the edge of one box, where it nearly touches the leg. Run a finger around the box, squeezing the RTV into the gap. Push the box in place and repeat for the other box. Tighten the bolts carefully to avoid bending the plastic lugs; some of the RTV should squeeze out of the joint as proof that the joint is completely filled

Checking accuracy

Once calibration is complete, check the display as the contents are used and, if possible, return the silo to the empty condition to ensure that the reading returns to zero. Because the gauges and structure are not perfect, do not expect it to return exactly to zero. The average error for this type of system is in the 2% of full scale region when all legs are gauged and 4% when half the legs are gauged; the zero reading could be in error by this amount, depending on loading conditions and temperature. For example, 2% error for a 100 ton silo is 2 ton; if the reading returns to within ±2.0 ton, this is acceptable. Note, however, that the accuracy is not guaranteed; it depends on the structure on which the gauges are mounted as well as the workmanship during installation.

Whether or not the display is returned to zero, further deliveries can be used to check the accuracy. This check should be done from time to time as a verification of correct operation. The calibration can be corrected at any time by repeating the steps above.

Use the table (appendix 5) to record the deliveries and readings. This table also allows you to calculate the error on each delivery.

You will notice a drift in the reading during the day; this is normal and is due to a slight warping of the beams caused by sunlight. The amount of drift depends on the geometry of the beams and the heat rise; it can be reduced by insulating the beams from the sun. If desired, wrap the beam to a foot above and below the gauge assemblies with fiberglass or other insulation material.

4. FAULT FINDING

If everything has been done according to the instructions, the installation should last for many years. You can find simple problems like broken wires by testing with a resistance meter; the resistance

between the red and black or white and green wires, at the indicator, should be exactly 350 divided by the number of gauged legs.. Example: for a 4 leg installation, the resistance should be 87.5 ohm. It might be slightly higher if the cable run to the indicator is long, but both red/black and white/green should be the same.

If the indicator reading changes radically for no apparent reason or is seen to drift, check the millivolt reading that you recorded during calibration. If it appears normal, the indicator might be at fault. If the millivolt reading has also changed, the reason is either of two things:

1) moisture in gauge or wiring

2) bad weld causing electrical leakage

Moisture is much more likely than a bad weld because a bad weld would usually have appeared during installation.

Moisture leakage should be readable with a digital meter. Set it to 20 Megohm and disconnect all 4 wires from the connector of the indicator. Measure between any wire (red, black, green or white) and power ground - the green wire connected to the power supply frame in the indicator case. This assumes that there is a path between the power ground and the silo structure, through the earth. You should see no reading. Any reading indicates moisture leakage.

Alternatively, at the silo, measure between any conductor and the metal structure (silo leg or cable tray). There should be no reading.
Also check between any conductor and the cable shield. Again, there should be no reading. Additionally, there should be no reading between cable shield and silo structure if disconnected at the indicator.

If a reading indicates leakage, go to each silo leg in turn, starting with the one where the indicator cable connects. Remove cover, disconnect the wires from the connector and test each cable and each gauge in the same way as above. Repeat for each gauge and cable on each leg until the defective cable or gauge is found.

If a gauge is defective, it will have to be removed completely and replaced. Since the gauges are double sealed, if water ever enters the seal it is almost impossible to remove completely.

Cables can easily cause the same problem if the insulation is partially cut. Water enters through "wicking" action and fills the cable. The only solution is replacement of the defective section. Note that a wet cable can also fill the gauge covers with water through atmospheric pressure changes.

For the latest information and for other Scale-Tron products, see our web site:

www.scaletron.com

The picture shows the finished installation at Sinelli Concrete in suburban Detroit. Siloweigh is a durable installation which you can be proud of. It should run for many years without attention of any kind.

Should you need extra assistance or service, please contact us:

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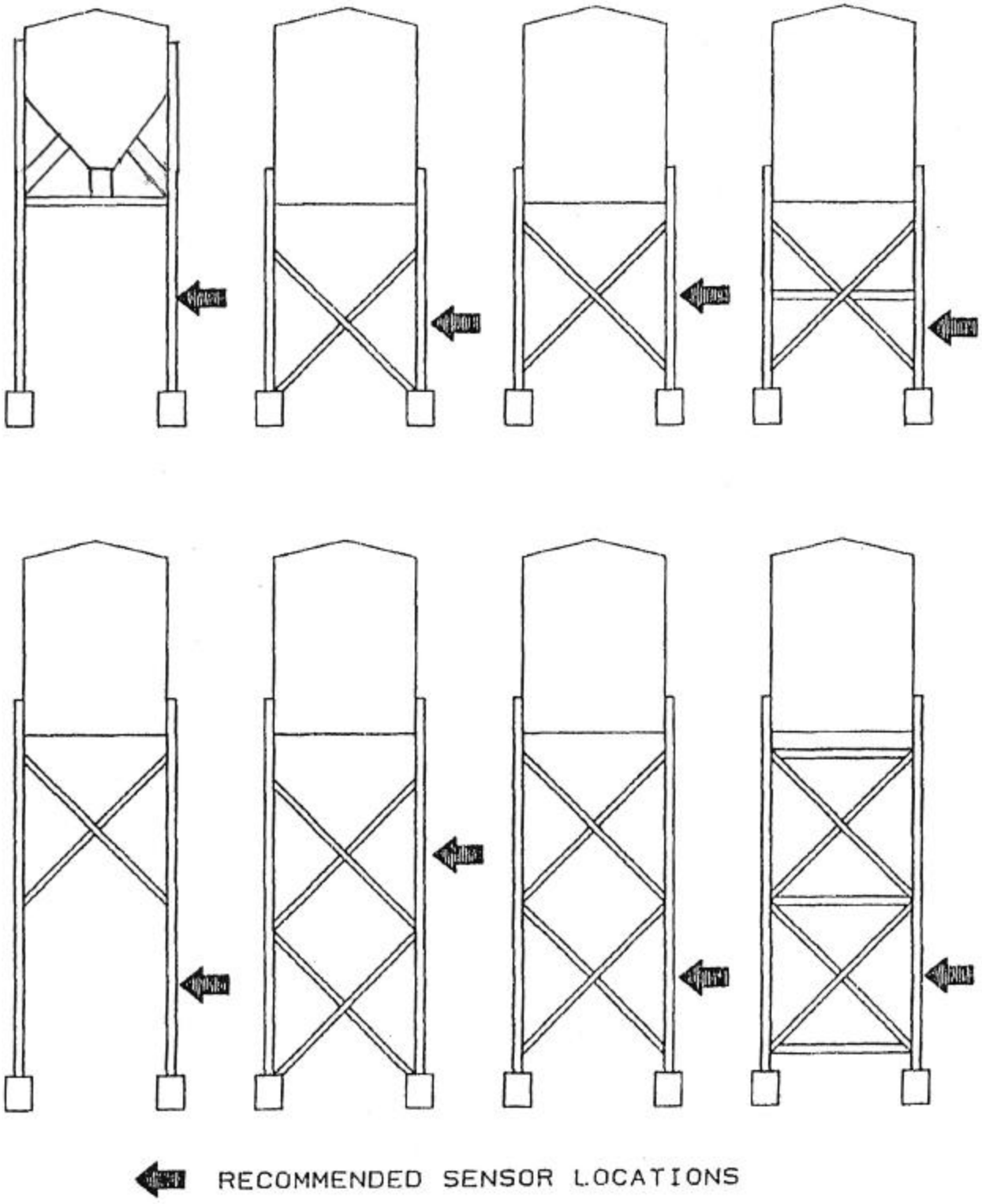
5. APPENDICES

Appendix 1



Appendix 2
GAUGE HANDLING AND WELDING PROCEDURE

A sample metal carrier is supplied with each SiloWeigh for practice welding. You should first determine the correct weld energy setting and electrode force. A setting of 10 to 25 Watt-seconds, with firm electrode force, will generally produce satisfactory results. After a practice weld, pull the metal carrier from the specimen surface; with a satisfactory weld, a small slug of metal will break away from either the carrier or the specimen at the weld. Try different energy settings to determine the best one. When you are satisfied, select a gauge carrier (see section 1) and ensure that you are installing it the correct way up.

Step 1

Align the gauge on the specimen surface by taping it across the top with masking tape.

Step 2

Tack the metal carrier in place with a single weld adjacent to the alignment triangles on each side of each gauge (the brown rectangular devices), close but not touching the gauge backing (fig. 1).

Step 3

Remove the masking tape by peeling it back directly over itself, being particularly careful not to distort the metal carrier or the brown connecting wires (fig.2).

Step 4

Continue welding, close to the gauge backing, welding from the center tacks to the ends of the carrier, completing one side at a time and spacing the welds 1/16" (1.6mm) apart. Weld across the top and bottom of the gauge (fig. 3)

Step 5

Complete the welding procedure by welding a second row 1/32" (0.8mm) outside the first row, spacing the welds as shown.

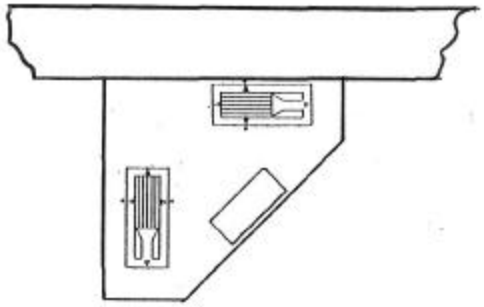


Fig.2. Removing tape

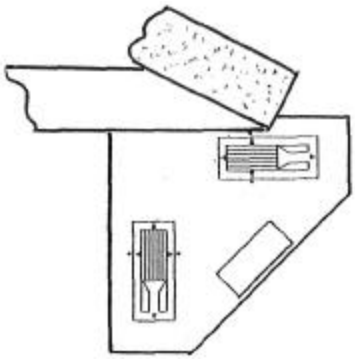


Fig.3. Welding around gauges

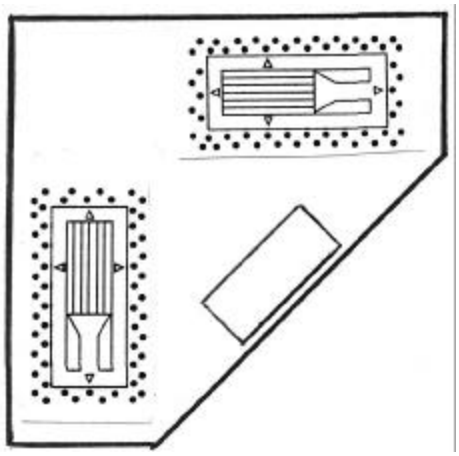
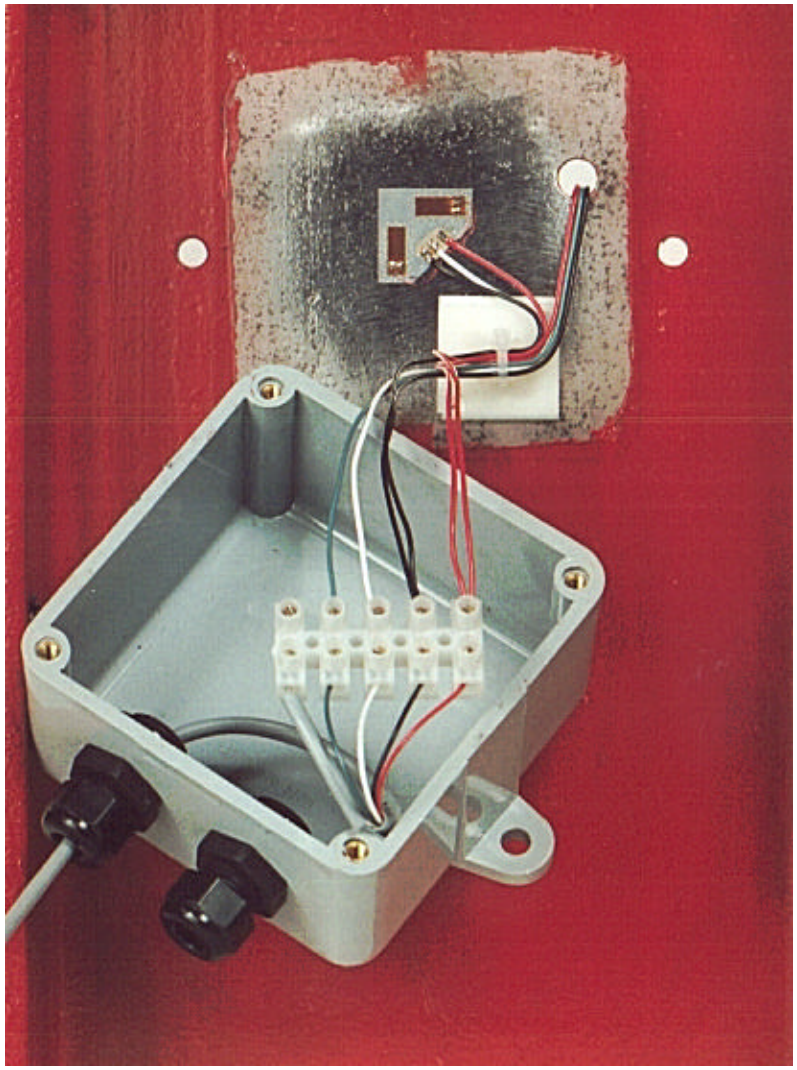


Fig.1. Positioning and first welds

Appendix 3

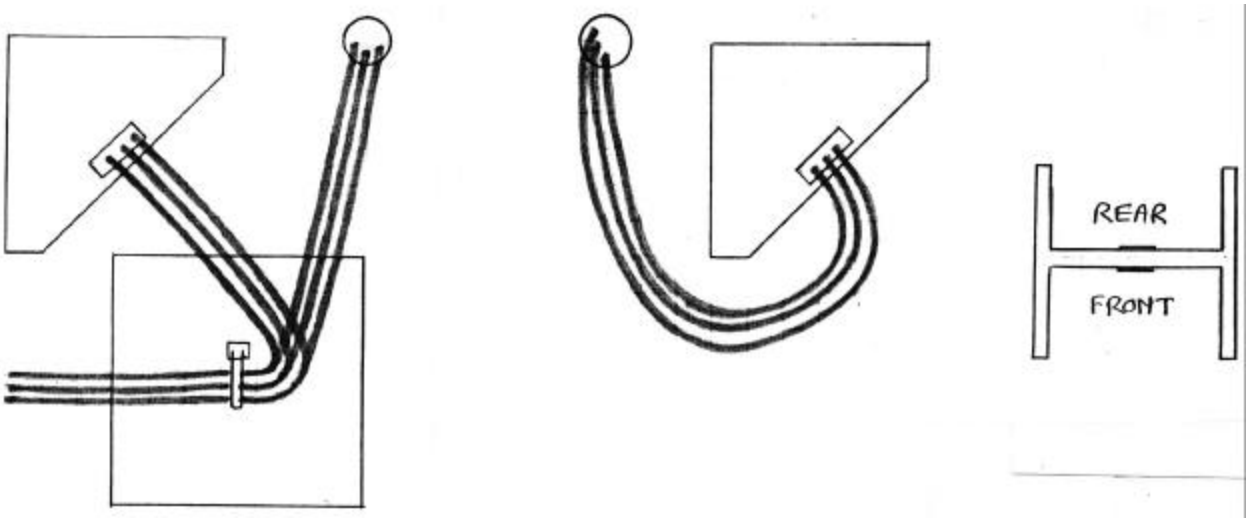
GAUGE & WIRING, OUTER (FRONT) GAUGE



FINISHED INSTALLATION SHOWING COVER & CABLES

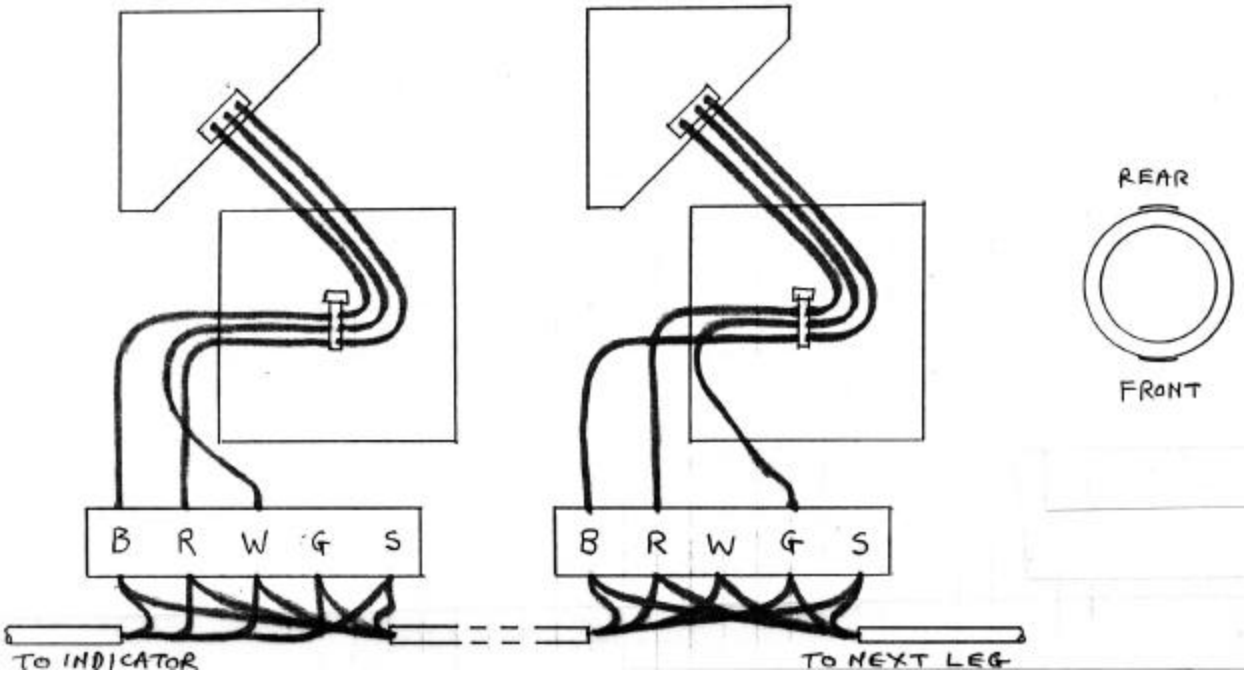
Appendix 4 GAUGE LAYOUT, H-BEAM INSTALLATIONS

OUTER (FRONT) ***REAR (BACK)***



GAUGE LAYOUT, O-BEAM INSTALLATIONS

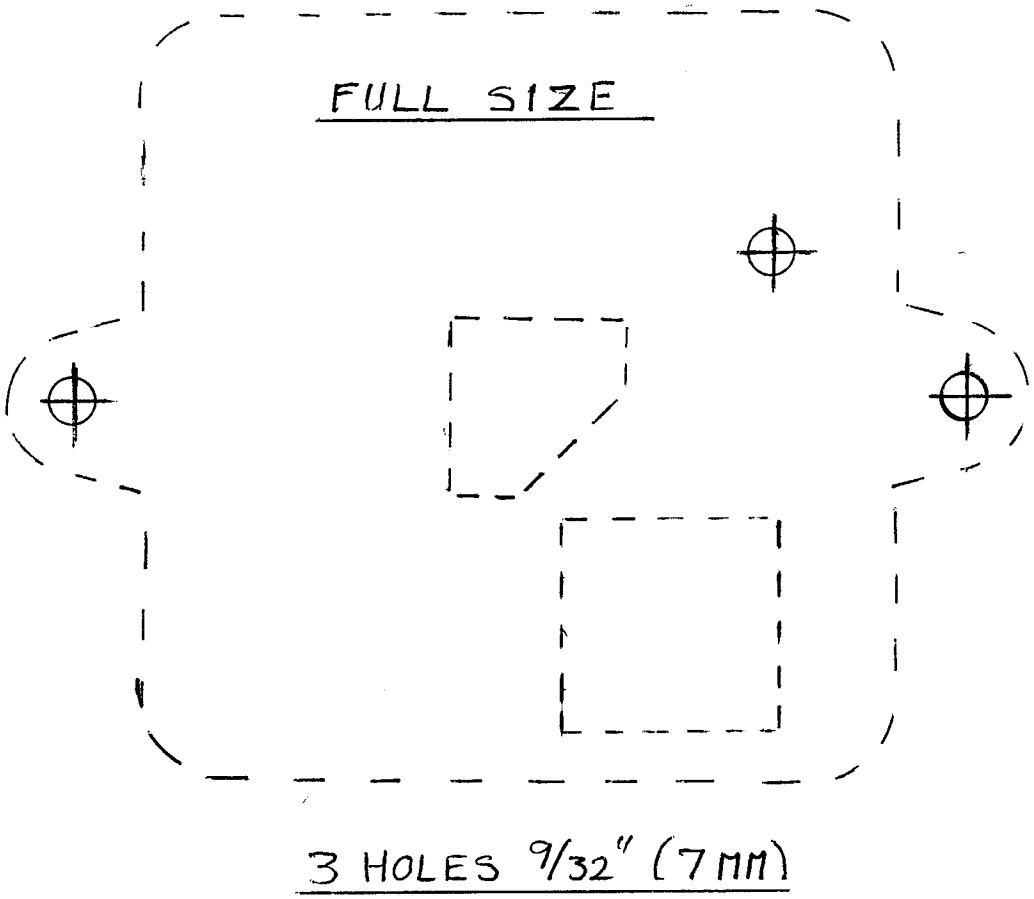
OUTER (FRONT) ***REAR (BACK)***



Appendix 5

DATE	TIME	Before fill reading B	After fill reading A	Change in reading C=A-B	Delivery amount D	Used during delivery U	Increase in weight I=D-U	Error % $E=\frac{C-I}{I} \times 100$	Temp. & Sun /no sun	COMMENTS (Silo empty etc..)

Appendix 6 DRILLING TEMPLATE, H-BEAM INSTALLATIONS
(For O-beam installations, delete inner hole and align outer holes vertically)



Appendix 7 *ELECTRICAL SCHEMATIC DIAGRAM*