

# MG 500 Rated Capacity Indicator System

Prototype Calibration and Testing for:

Machine Model	
Serial Number	
Tester	
Date	



## Introduction

This document describes the process by which MicroGuard systems using the “Supercal” concept are set up for use on a new crane model. If correctly followed, this procedure will ensure accurate and fast calibrations of subsequent calibrations on the same model machine.

Procedures within this document are intentionally written as a step-by-step guide to enable the calibrating engineer to correctly determine the characteristics of the machine. The calibrating engineer is further assumed to be conversant with calibration methods operated through the MG434 display panel as described within the MG434 / 500 Calibration procedure manual, and with the 5-Charts software used to create a capacity chip for the system.

Throughout the following procedures, certain checks are applied to data that should have already been entered as part of the capacity chip data entry (5-Charts). It is highly recommended that each of these checks are methodically applied in order to save time and problems with future installations.

It is intended that the calibrator use this document as a method to record measured dimensions and test results, in order that subsequent modifications to the capacity chip file can be made against this record. This further will provide an on-file record which may serve future upgrades and changes to MicroGuard designs.

### Notice

This document and resulting data about the crane are confidential. Copies of this document may not be distributed to third parties in any form without the prior written consent of the Greer Company and the crane manufacturer.

### Tools Required

PC with 5-Charts Software

EPROM programmer with link to above PC.

A copy of machine geometric data supplied by the crane data sheet (and within the 5-Charts capacity chip file for this machine).

Spare 27C020/27C002 EPROMS

Digital Volt/Ohmmeter

Inclinometer – accurate to 0.1degrees

Measuring tape

Hand tools

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## Preliminary checks

Before commencing calibration, it is important that certain checks of the machine geometry be made. Geometric values have been previously entered into the capacity chip from the crane application data sheet filled out by the crane manufacturers engineering department.

Measure the following dimensions and check against the values specified within the capacity chip file entered into the 5-charts program.

Note the dimensions measured and verify that they match data within the capacity chip file.

If any discrepancies are found, they must be immediately repaired and a new capacity chip created in order to continue. Establish the source of the error and ensure that if possible, it cannot occur again.

The following pages provide a list of measurement checks to be made. Measured values should be entered in the spaces provided.

The checks in the following pages include:

**Boom Hoist Geometry**

**Boom Hoist Cylinder**

**Winch #0 Geometry**

**Winch #1 Geometry**

If the measurements do not verify with the data contained within the capacity chip, **do not** continue with the calibration before ensuring that they are corrected and a new chip is programmed.

## Boom Hoist Geometry

Measure each dimension shown using a tape. It is at best, a difficult exercise to measure these dimensions, but still a necessary check. It is recommended that two people carry out this task and that care is taken to ensure that clear references are used to measure from.

**Dimension “L”** is the distance parallel to the boom center line between the center of the Boom pivot and the center of the upper Boom Hoist cylinder pivot.

**Dimension “J”** is the distance at 90 degrees to the boom center line between the center of the Boom pivot and the center of the upper Boom Hoist cylinder pivot.

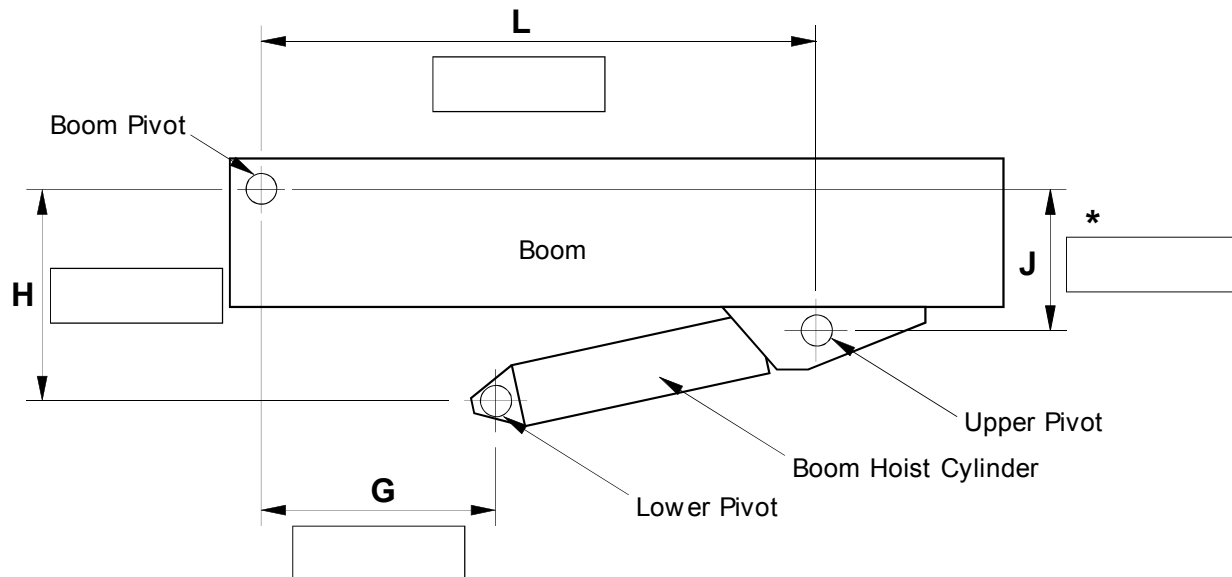
*J is negative when the Boom pivot is above the upper Boom Hoist cylinder pivot and positive when it is below.*

**Dimension “G”** is the horizontal distance between the center of the Boom Pivot and the center of the lower Boom Hoist cylinder pivot.

**Dimension “H”** is the vertical distance between the center of the Boom pivot and the center of the lower Boom Hoist pivot.

It is recommended that the boom is level when measuring dimensions “L” and “J”.  
The carrier is assumed to be level for the purposes of measuring dimensions “G” and “H”.

Enter the measured values into each of the gray boxes provided below.



\* If the boom foot pin is above the Boom Hoist cylinder Upper Pivot (as shown), dimension “J” is negative. **Clearly indicate “+” or “-”.** The above illustration shows dimension “J” as negative.

## Front Winch Geometry

Measure each dimension shown using a tape. It is at best, a difficult exercise to measure these dimensions, but still a necessary check. It is recommended that two people carry out this task and that care is taken to ensure that clear references are used to measure from.

The boom must be fully retracted and is recommended to be level during these measurements. The machine carrier is assumed to be level for the purposes of measuring dimensions "G" and "H".

**Dimension "L0"** is the distance parallel to the boom center line between the center of the Boom pivot and the point at which the hoist rope makes contact with the top sheave at the head of the main boom.

**Dimension "J0"** is the distance at 90 degrees to the boom center line between the center of the Boom pivot and the point at which the hoist rope makes contact with the top sheave at the head of the main boom.

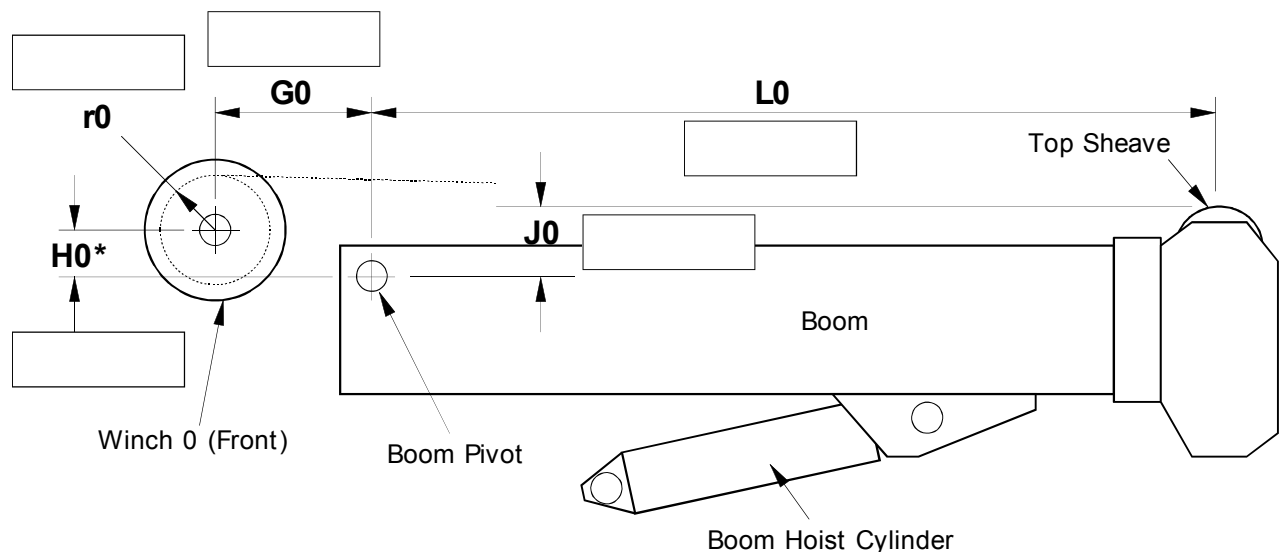
**Dimension "G0"** is the horizontal distance between the center of the Boom Pivot and the center of rotation of the winch.

**Dimension "H0"** is the vertical distance between the center of the Boom pivot and the center of rotation of the winch.

*H0 is negative when the center of the Boom pivot is above the center of rotation of the winch and positive when it is below.*

**Dimension "r0"** is the radius of the winch drum and should include two layers of rope.

Enter the measured values into each of the gray boxes provided below.



\* If the center of the boom pivot is above the center of rotation of the winch, dimension "H0" is negative. **Clearly indicate "+" or "-"**. The above illustration shows dimension "H0" as positive.

## Rear Winch Geometry

Measure each dimension shown using a tape. It is at best, a difficult exercise to measure these dimensions, but still a necessary check. It is recommended that two people carry out this task and that care is taken to ensure that clear references are used to measure from.

The boom must be fully retracted and is recommended to be level during these measurements. The machine carrier is assumed to be level for the purposes of measuring dimensions "G" and "H".

**Dimension "L1"** is the distance parallel to the boom center line between the center of the Boom pivot and the point at which the hoist rope makes contact with the top sheave at the head of the main boom.

**Dimension "J1"** is the distance at 90 degrees to the boom center line between the center of the Boom pivot and the point at which the hoist rope makes contact with the top sheave at the head of the main boom.

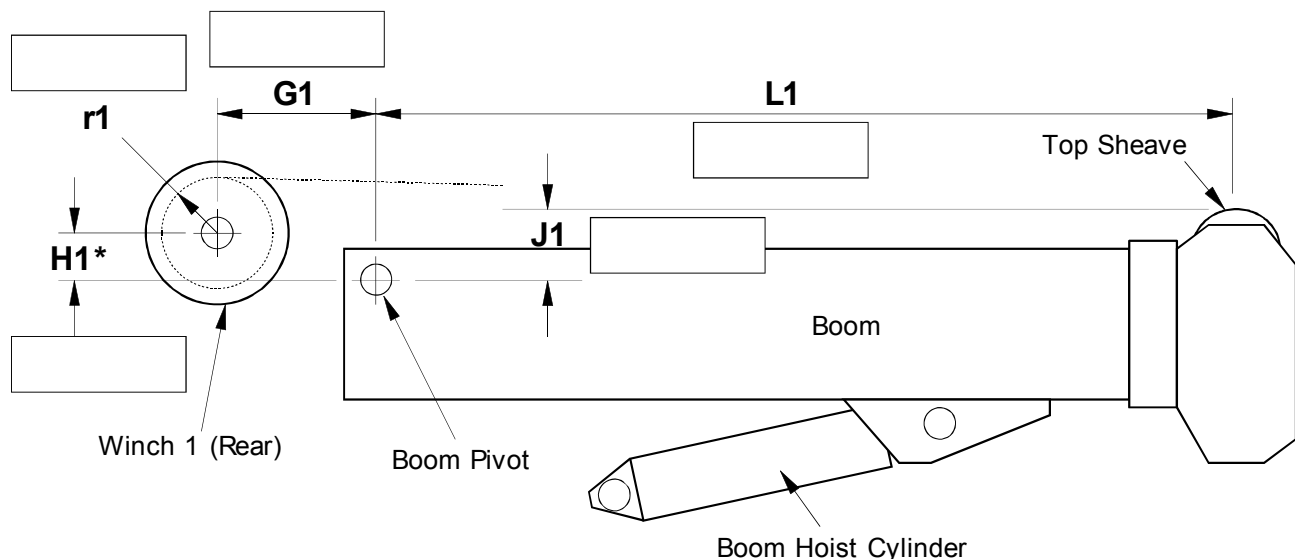
**Dimension "G1"** is the horizontal distance between the center of the Boom Pivot and the center of rotation of the winch.

**Dimension "H1"** is the vertical distance between the center of the Boom pivot and the center of rotation of the winch.

*H1 is negative when the center of the Boom pivot is above the center of rotation of the winch and positive when it is below.*

**Dimension "r1"** is the radius of the winch drum and should include two layers of rope.

Enter the measured values into each of the gray boxes provided below.

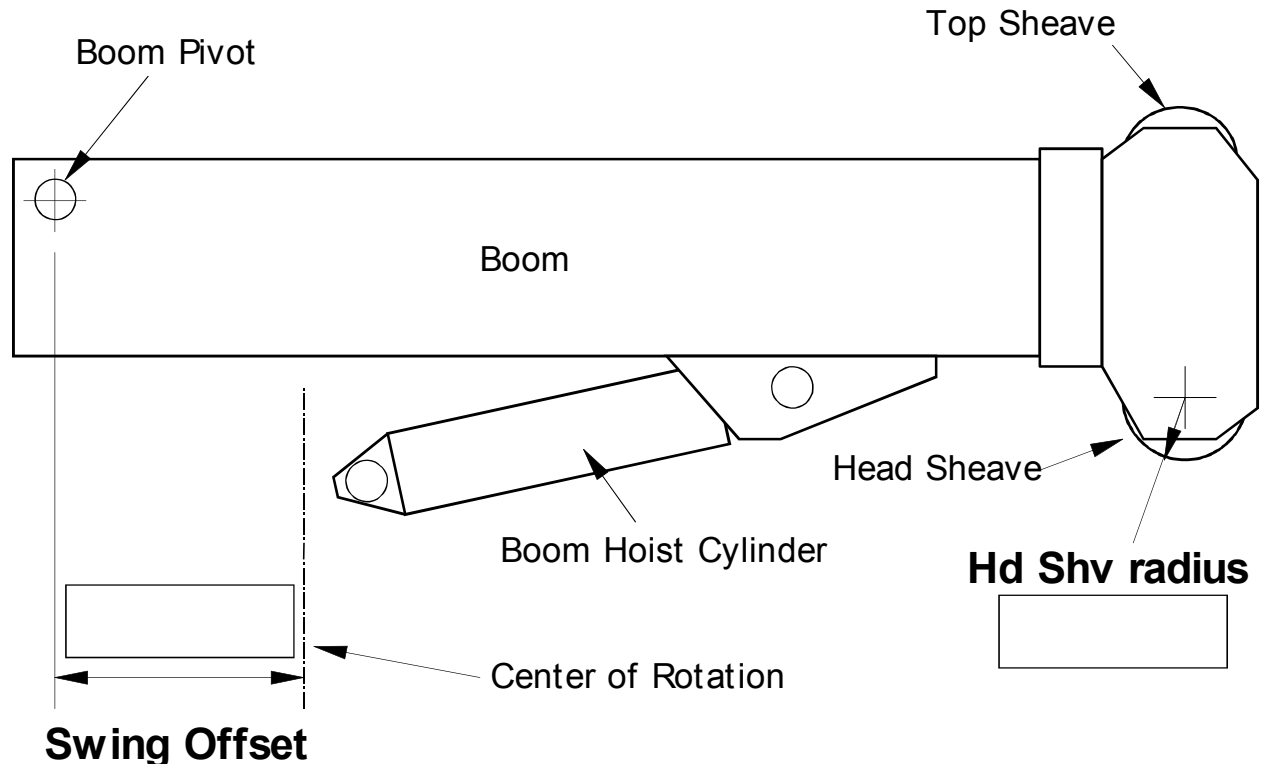


\* If the center of the boom pivot is above the center of rotation of the winch, dimension "H1" is negative. **Clearly indicate "+" or "-"**. The above illustration shows dimension "H1" as positive.

## Miscellaneous Data

The following checks are for Main Boom Head Sheave Radius and Swing Offset. Swing Offset is negative when the boom pivot is behind the center of rotation.

Enter the measured values into the gray boxes provided.



## Installation checks

**Before continuing, make sure any necessary changes to geometrical data found in the previous pages have been made to the capacity chip file and a new capacity chip has been created and installed.**

Check wiring and EPROM installations.

If swing switches are fitted, check that these operate correctly, by using the digital input monitor routine through the MicroGuard display.

Set the reeling Drum Clutch

## Reset Crane Data

Reset the systems crane data using the '**Reset Crane Personality Data**' routine in the calibration '**Crane Data**' menu selection. This process uses some of the geometric data entered in the capacity chip to prepare the system for calibration.

See the calibration manual for instructions on how to use the routine.

## Zero Angle sensor

Mechanically zero the Boom Angle Sensor. Instructions for setting the potentiometer are contained within the Extension Reel installation manual.

Double check that the boom has been set level prior to setting.

Set the angle sensor pot voltage to  $1/10^{\text{th}}$  of the drive voltage at the extension reel (0.5V nominal)

## Zero Extension Sensor

Mechanically zero the Boom Extension Sensor. Instructions for setting the potentiometer are contained within the Extension Reel installation manual.

Double check that the boom is fully retracted prior to setting.

Set the reeling Drum zero by measuring the drive voltage and adjusting the pot until the extension voltage is equal to  $1/20^{\text{th}}$  of the drive voltage (0.25V nominal)

## Span Angle Sensor

It is essential that the angle sensor is spanned as accurately as possible (preferably to within 0.1 degrees).

Boom up to at least 60 degrees and measure the boom angle with an inclinometer. Be careful to check that a correct reading is obtained from the inclinometer.

Calibrate the angle span.

Before continuing, check the angle at an intermediate point such as 35 degrees and ensure that the inclinometer and angle reading match within 0.2 degrees.

## Span Extension Sensor

Fully extend the boom and calibrate the span of the extension sensor. It may be necessary to check the actual extension by measuring with a tape. For this the boom may need to be flat to obtain a measurement (If it is possible).

For extension sensors measuring intermediate lengths, the extension should be known before spanning the sensor. It is always a good idea to check by taping with the boom flat if possible.

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## Set Zero and Direction of Swing Pot.

Set the machine to the over front swing area and zero the swing pot. Swing the machine in a clockwise direction (to the right) and set the direction indicator to '+'.

Check the swing angle shown increments as you swing the crane to the right, at 360 degrees the angle indicator will roll over to zero degrees and you should be back over the front of the machine again.

## Calibrate Main Boom(s)

It is necessary to calibrate radius, moment and deflection for each telescoping mode of the main boom. Almost all machines have two telescoping modes of operation for the boom. This would include:

Main boom – manual retracted  
Main boom – manual extended

Main boom – Power pinned section retracted  
Main boom – Power pinned section extended

Main boom mode A  
Main boom mode B

Up to four main booms may be calibrated (normally two). The correct configuration must be selected before carrying out each boom calibration.

Follow all steps – Radius/Moment, Boom deflection correction and Boom Head angle for each Main Boom Telescoping Mode.  
Make sure the correct Boom configuration is selected before continuing.

*Note: - Head angle calibration is also required for each boom mode that is capable of erecting a fly.*

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**Calibrate Radius/Moment**

Up to seven points may be calibrated for each boom-telescoping mode. These points must include fully retracted and fully extended. Intermediate points should be chosen to be where individual sections of the boom start to telescope and/or other sections stop telescoping as the boom is extended.

For booms that exhibit an appreciable amount of flexibility or droop, it may be necessary to include an extra point to improve accuracy, especially if there is a long distance between obvious points of calibration. This is usually pertinent for long proportional booms, which might only require a fully retracted and fully extended calibration.

Some booms exhibit a sudden droop near to fully telescoped, this is often due to the design and fitting of wear pads inside the boom, which allow sections to hang on each other when near to their fully telescoped limit. Though this has little affect on main boom radius accuracy, flys/jib radius may be affected by this characteristic. It is essential here to add an extra calibration point at about 90% of the boom extension.

Calibrate Radius/Moment by following the procedure in the calibration manual. Take care to accurately measure the radius at each calibration point. Using a single part of line will aid this.

When entering the Tare load in the calibration routine, it is usually a good idea to add a little to the hook weight. Adding 100 pounds (or 50 Kilos) will help guarantee a slightly positive load reading in all operating configurations.

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Boom \_\_\_\_\_

	Boom Extension 0	Boom Extension 1	Boom Extension 2	Boom Extension 3	Boom Extension 4	Boom Extension 5	Boom Extnsion 6
EXTN							
LEN_S							
WG							
WT							

Boom \_\_\_\_\_

	Boom Extension 0	Boom Extension 1	Boom Extension 2	Boom Extension 3	Boom Extension 4	Boom Extension 5	Boom Extnsion 6
EXTN							
LEN_S							
WG							
WT							

Boom \_\_\_\_\_

	Boom Extension 0	Boom Extension 1	Boom Extension 2	Boom Extension 3	Boom Extension 4	Boom Extension 5	Boom Extnsion 6
EXTN							
LEN_S							
WG							
WT							

Boom \_\_\_\_\_

	Boom Extension 0	Boom Extension 1	Boom Extension 2	Boom Extension 3	Boom Extension 4	Boom Extension 5	Boom Extnsion 6
EXTN							
LEN_S							
WG							
WT							

**Calibrate Boom deflection**

Fully extend the boom at a high angle of greater than 60 degrees and lift the same load used to calibrate the pressure. Calibrate the boom deflection by following the instructions in the calibration manual. It is a good idea to add 0.1ft or 0.1m to the radius when entering the radius in the calibration for boom deflection. This will help ensure a slightly positive radius in most operating conditions.

Record the deflection value (F factor) displayed in the calibration screen in the appropriate position below.

Boom \_\_\_\_\_ Deflection

Boom \_\_\_\_\_ Deflection

Boom \_\_\_\_\_ Deflection

Boom \_\_\_\_\_ Deflection

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## Calibrate Boom Head Offset

The boom head offset is required to aid the computer to correctly calculate the radius of flys/jibs. During the process of checking and recording the boom head angle the boom will need to be fully telescoped at zero degrees. Check that the machine can achieve this safely before continuing. If not the boom will need to be elevated and readings taken at higher boom angles.

Some booms exhibit a sudden droop near to fully telescoped, this is often due to the design and fitting of wear pads inside the boom, which allow sections to hang on each other when near to their fully telescoped limit. Though this has little affect on main boom radius accuracy, flys/jib radius may be affected by this characteristic. It is essential here to add an extra calibration point at about 90% of the boom extension.

Fully retract the boom and attach an inclinometer to the boom head.  
Set the boom level (0.0 degrees) and set the inclinometer to read 0.0 degrees (use zero reference button if the inclinometer has one).

Telescope the boom about 50% of it's max extension or for a boom mode with a sequence change, the first point of sequence change.

Record the extension value, the boom angle display and the inclinometer reading.

Telescope to the next step (or full extension) and record the new readings.

When all readings have been taken, subtract the boom angle value from the boom head inclinometer value to obtain the actual head offset and record this in the table.

Use the boom head calibration routine to enter the extension values and boom head angle. See the calibration manual for details on using the boom head calibration routine.

**Note:** The boom head angle goes more negative as the boom extends. The boom head angle to be entered will be negative for almost every known boom design.

Also note that no head angle calibration is required for boom s that do not allow a fly – jib erection.

Boom \_\_\_\_\_

Boom Extension	Boom Angle	Boom Head Angle	Difference

Boom \_\_\_\_\_

Boom Extension	Boom Angle	Boom Head Angle	Difference

Boom \_\_\_\_\_

Boom Extension	Boom Angle	Boom Head Angle	Difference

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## Test Attachments

There is little calibration required to set up fly's and jibs. The most likely requirement is for a deflection correction. The deflection correction may be applied to each attachment by calibrating with the bdc command. Do not calibrate bdc unless unloaded tests are complete and satisfactory, and the main boom radius accuracy is correct.

The angular offset of the fly is normally the dimension that requires change in the capacity chip during testing. Since all fly's fit to the boom head using the same physical attachments, the offset angle of all fly's with the same offset may be modified at the same time.

Test the longest fly at all of it's offsets before making corrections to the capacity chip and continuing with other attachment testing.

Data collected from the main boom calibrations may be added to the capacity chip at this time also.

### Test sequence

Start testing with the longest attachment at the straightest offset angle.

It is a good idea to check the length and vertical offset dimensions of the attachment with a tape before commencing tests. If necessary correct the values of these in the capacity chip.

The following tests should be done on each attachment:

Test	Fly Offset	Boom Length	Boom Angle	Load	Comments
1*	Straight	Retracted	0	Hook	Establish that fly length is correct through radius accuracy (+/-0.2ft)
2*	"	"	>60	"	Establish that fly offset angle is correct through radius accuracy (+/-0.2ft)
3*	"	Extended	>60	"	Establish Fly moment accuracy (-0 to +0.2lbs*1000)
4*	"	Retracted	>60	>50% Capacity	Attachment deflection correction <b>Note the bdc "F" factor</b>
5	"	"	Low to High 3-angles	"	Load Test
6	"	Mid-Range	"	"	Load Test
7	"	Fully Extended	"	"	Load Test
8*	First Offset	Retracted	>60	Hook	Establish that fly offset angle s correct through radius accuracy (+/-0.2ft)
9	"	"	Low to High 3-angles	"	Load Test
10	"	Mid-Range	"	"	Load Test
11	"	Fully Extended	"	"	Load Test
12*	Second Offset	Retracted	>60	Hook	Establish that fly offset angle is correct through radius accuracy (+/-0.2ft)
13	"	"	Low to High 3-angles	"	Load Test
14	"	Mid-Range	"	"	Load Test
15	"	Fully Extended	"	"	Load Test

- Indicates that an adjustment to the capacity chip data may be required following these checks.

















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## Completion

Before finishing, thoroughly check that all data from the calibration that needs to be entered into the capacity chip has been and that the latest copy of the chip is installed in the system computer. This will ensure that in the event of a future calibration, initialize will not cause calibration problems for this machine.

Seal up system