



ADVANCED CARCASS FAT
MEASUREMENT
(ACFM)
- PORCINE P2 -
PARTICIPANTS WORKBOOK

JANUARY 2000

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1. OBJECTIVES OF THE COURSE

The objective of this course is to improve both your understanding of the importance of carcass fat measurement and your carcass fat measurement skills.

At the completion of this course you should be able to:

- ✓ Explain the importance of accurate P2 measurements.
 - ✓ Define and locate the P2 site.
 - ✓ Take P2 measurements that are within the performance standard.
 - ✓ Understand the P2 measurement monitoring process.
 - ✓ Explain possible causes of carcass fat measurement error.
-
- ☰ The ACFM-Porcine examination comprises of a multiple choice section, a demonstration of your pre-operational check of measuring instruments, P2 site location, and carcass measurement. The answers to the multiple-choice section are contained in this workbook.

2. Glossary of Terms

“**Alphanumeric**” means a combination of letters and numbers.

“**Cartilage**” means the flexible portion of bone usually found at the end of the bone, prominent in young animals.

“**Caudal**” means towards the tail end of the carcass.

“**Dorsal**” means towards the back of the carcass.

“**HSCW**” means the Hot Standard Carcass Weight, the weight of a carcass when trimmed to the defined standard and weighed within 2 hours of slaughter with no deductions for shrinkage.

“**Lateral**” means away from the midline towards the side of the carcass.

“**Ligament**” means the elastic or fibrous connective tissue attaching bone to bone.

“**Linear**” means a measurement of length.

“**Medial**” means towards the midline of the carcass.

“**Numeric**” means numbers.

“**Objective**” means existing independently of perception, emotion or personal bias.

“**Parallax**” means an apparent change in the position of an object resulting from a change in the position of the observer.

“**Parallel**” means separated by an equal distance at every point never touching and never intersecting.

“**Perpendicular**” means at right angles (90 degrees).

“**Regression**” means the measure of the association between one variable (the dependent) and other variables (independent).

“**Sawn Chine**” means sawn surface of the split vertebral column.

“**Subjective**” means an assessment based on a person's experience, emotions and personal bias.

“**Tendon**” means the white connective tissue, which attaches muscle to bone.

“**Ventral**” means towards the belly or lower side of the carcass.

3. PIG CARCASE FAT MEASUREMENT

3.1 Why Measure Fat Depth?

3.1.1 Classify carcasses

For producers supplying pigs to a processor 'over the hooks', the change of ownership of the pigs occurs **at the scales**. Carcase weight and fat depth determine the price paid by the processor for the carcase at the scales, thus accurate measurement becomes important to both the producer and the processor. If the measurement is inaccurate, the processor may pay more or less for a carcase than it is actually worth.

3.1.2 Producer feedback

Producers use the measurement from the processor to manage their breeding and feeding programs. They compare measurements with on-farm ultrasonic fat readings to determine the optimum time to market and monitor breeder performance.

3.1.3 Objective trading to retailers

Because consumer preference is for lean meat, over fat carcasses are of less value to the butcher or the processing works. Therefore fat depth is used to determine market destination and carcase value between processor and retailers or other end users.

3.2 Why measure at the P2 site?

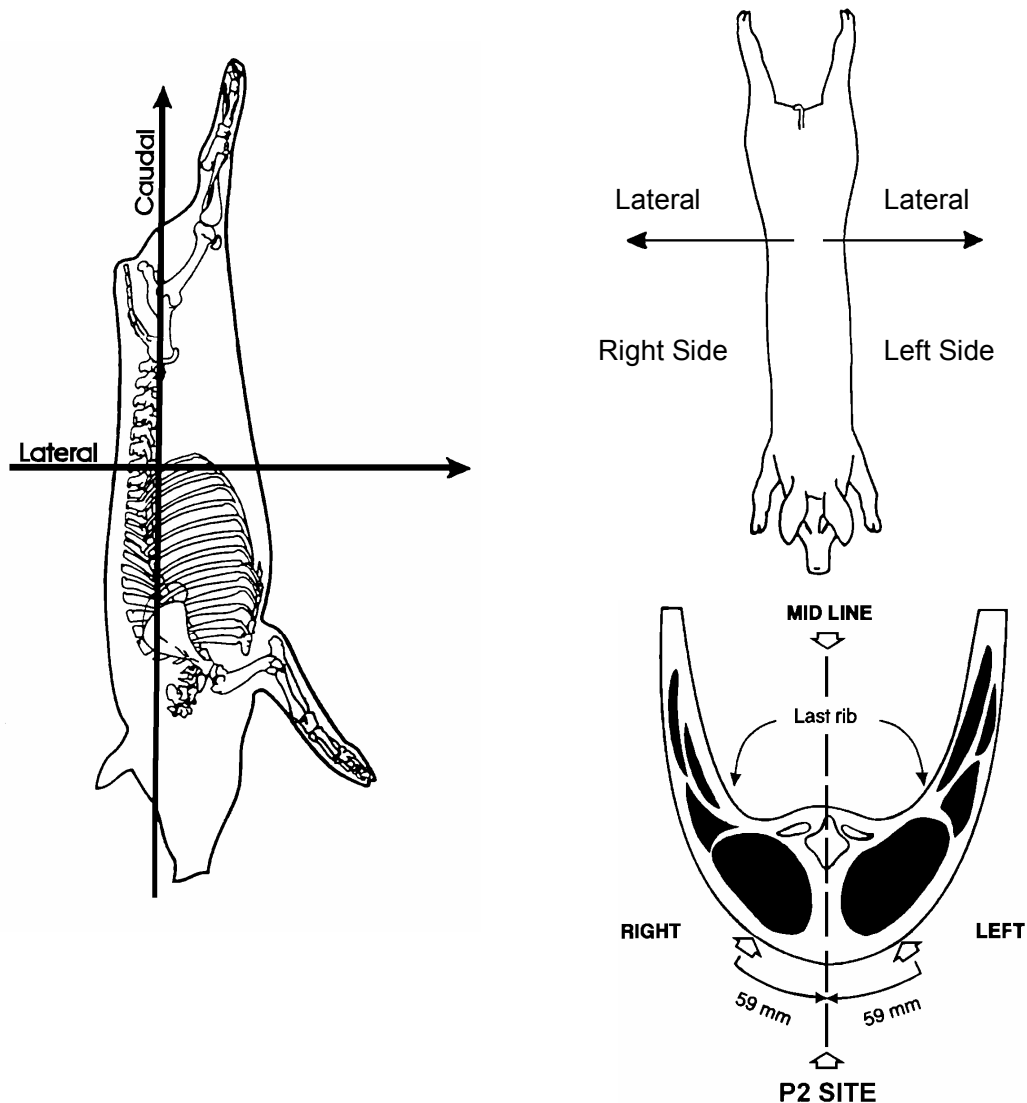
The P2 measurement is a measurement in millimetres (mm) of pig carcase fat depth over the 'eye muscle' (the large oval meat portion of a bacon rasher or loin pork chop) on the carcase. This measurement is taken on the slaughter floor. **It is the best single objective indicator of the lean meat yield of the pig carcase** and is recognised by industry as the standard objective measurement in this country.

4. LOCATION OF THE P2 SITE

The **P2** site is located at a point 59 mm from the midline of the carcass lateral to the head of and immediately caudal to the last rib on either side of the carcass.

On a split or backed off carcass the measurer must measure from the cut skin surface, this is due to the skin and attached fat moving after the carcass is split.

In the case of a carcass which has been split off centre, an estimate of the correct P2 site must be made.

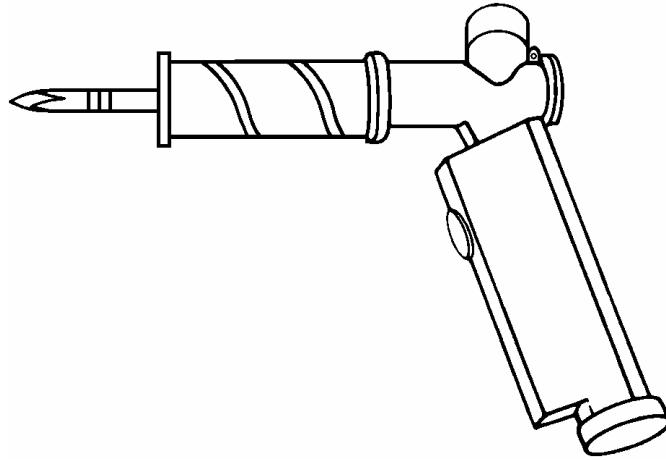


Note:

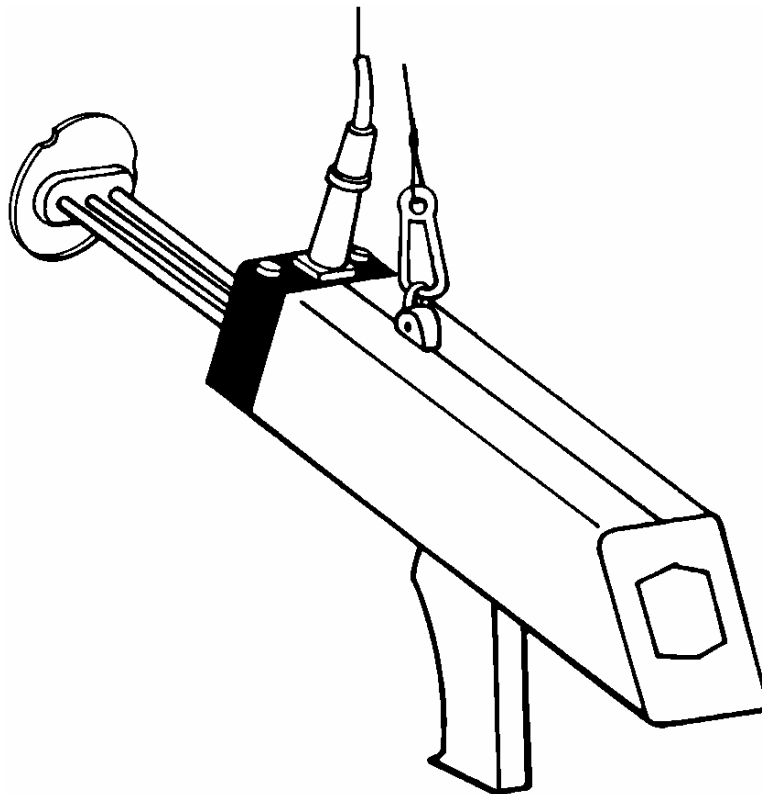
The number of ribs on Pig Carcasses often varies between 14 and 17. To determine the last rib it is important to avoid counting floating or false ribs. The minimum requirement for a true last rib is 60 mm in length and the rib must be firmly attached to the spinous process.

5. INSTRUMENTS FOR MEASURING AT THE P2 SITE

There are two instruments approved for use in Australia for taking P2 measurements. The first, the **Introscope** was developed in Europe and introduced in Australia in the 1970's.



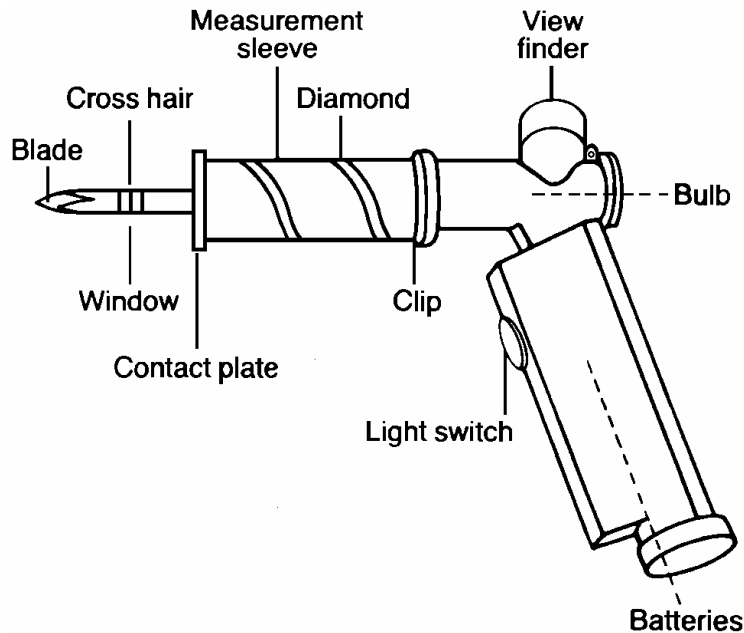
The second, the **Hennessy Grading Probe** was developed in New Zealand and Australia.



6. INTROSCOPE

The Introscope is used to locate the interface between the subcutaneous fat and the muscle at the **P2** site and thus to measure the depth of the fat.

6.1 Parts of the Introscope



6.2 Bench Test

1. Rotate the measurement sleeve to read 25 mm.
2. The distance from the cross hair to the face of the contact plate is measured using a steel ruler (ensure the sleeve is not moved). It should be 25 mm.
3. Repeat procedure for 20 mm, 15 mm and 10 mm.
4. If the measurement is inaccurate return the Introscope to a qualified service organisation for repair.

6.3 Pre-operational check

1. Ensure viewfinder and window are both clean and undamaged.
2. Ensure the blade is sharp.
3. Check batteries are charged and light bulb is operational.
4. Check the measurement sleeve rotates easily.

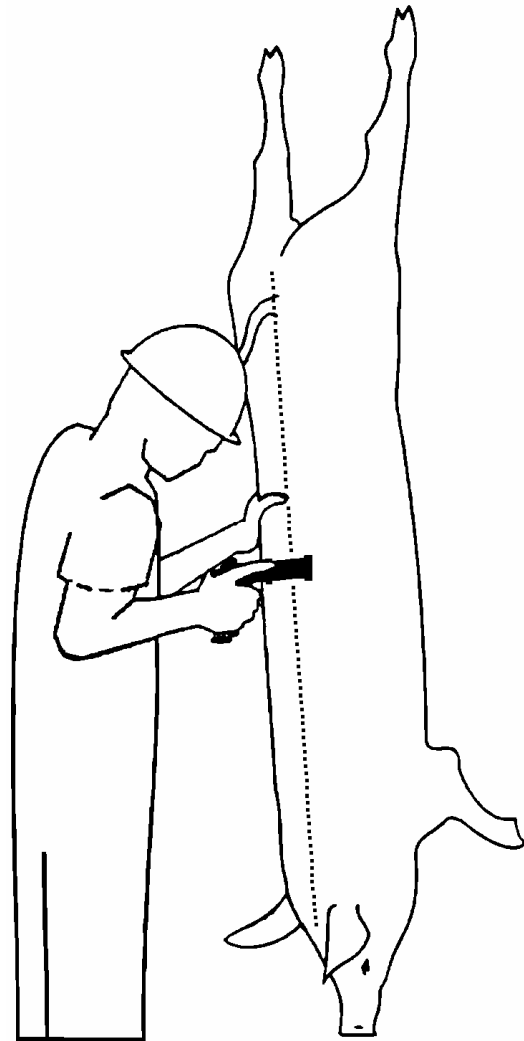
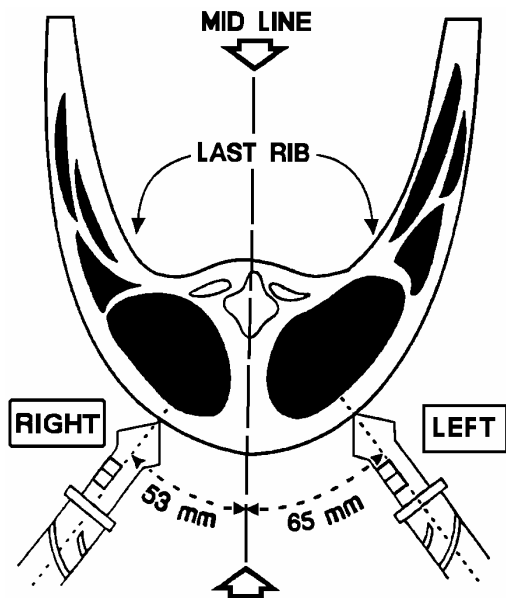
6.4 Operation of the Introscope

These instructions are for a right handed operator measuring on the left side of the carcass. It is extremely important to use the Introscope with one hand. Using two hands exerts too much pressure on the surface of the carcass. The left hand should be used to steady the carcass.

To locate the vertical position the left hand is used to find the caudal edge of the last rib.

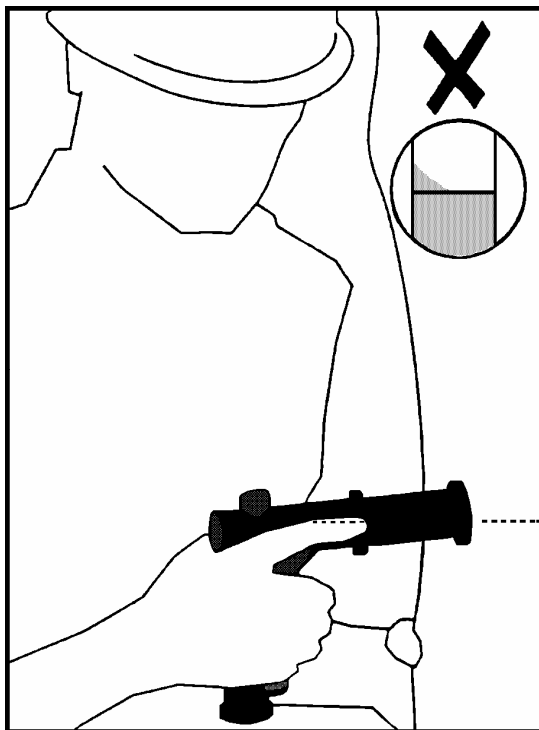
- 1 There are several methods for locating the correct insertion point (65 mm). The important thing to remember is that accurate P2 site location is crucial to accurate P2 measurements.
- 2 Push the blade steadily into the carcass at the P2 site at right angles to the carcass. Jerky movements in and out of the carcass can disturb the interface.

INTROSCOPE INSERTION SITE

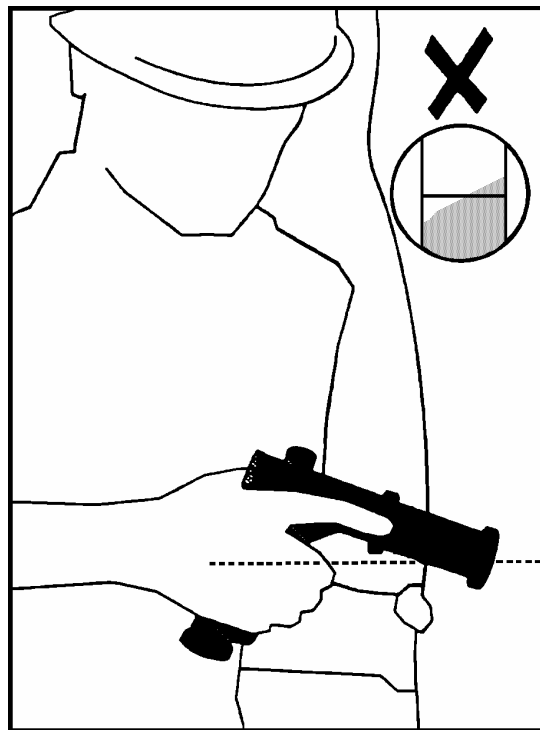


The diagram on the left shows the Introscope insertion point for both the left and right sides of the carcass. The difference in measurement from the midline is due to the position of the window on the blade being offset 6 mm.

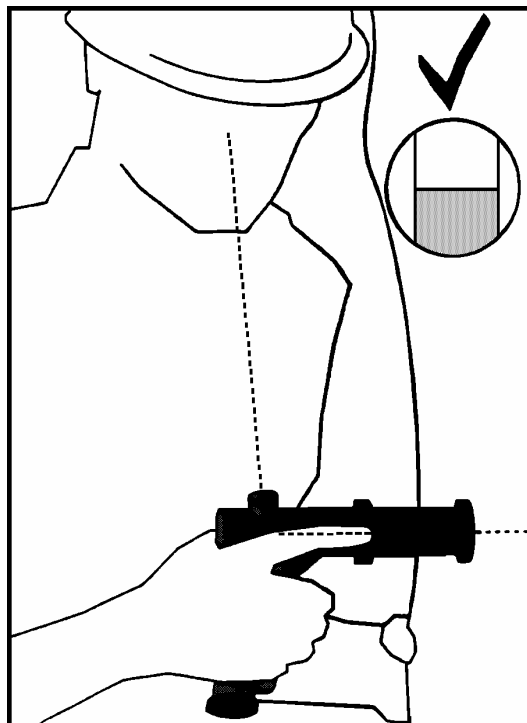
The diagrams below illustrate the angle of insertion of the Introscope. The view through the viewfinder is illustrated in the top right hand corner of each diagram.



INCORRECT - WRONG ANGLE

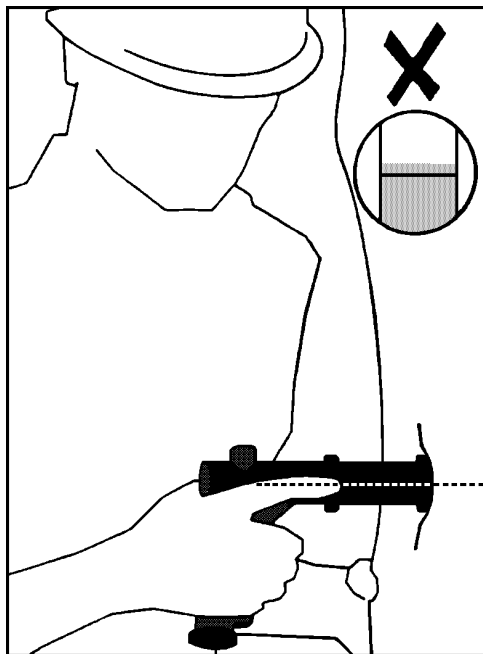


INCORRECT - WRONG ANGLE

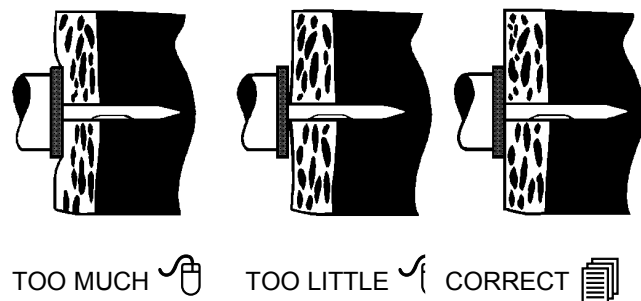


CORRECT

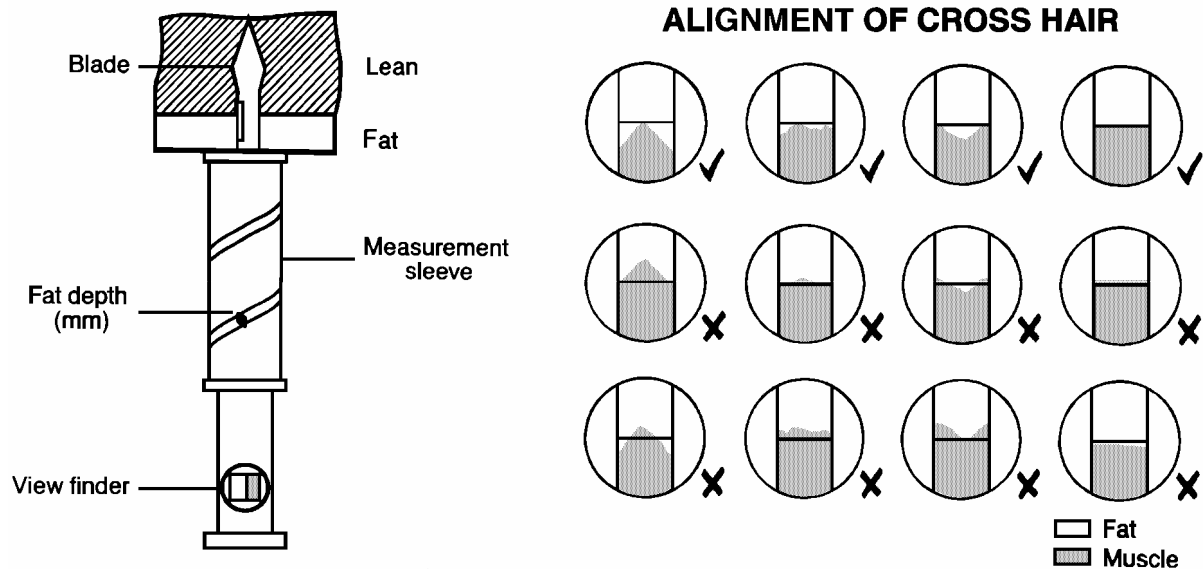
- 3 The measurer then depresses the light switch with the middle finger and looks into the viewfinder.
- 4 The window located on the blade must be within the muscle.
- 5 The measurer begins to withdraw the Introscope by turning the measurement sleeve downwards (clockwise) with the index finger whilst ensuring that the contact plate rests firmly but gently against the skin of the carcass.
- 6 When the interface between the fat and the muscle is lined up on the cross hair (as viewed through the viewfinder) withdrawal is stopped. The measurement is locked with the index finger.
- 7 Check that the pressure on the skin surface is not too light or heavy.



INCORRECT – TOO MUCH PRESSURE



- 8 The fat depth can now be read from the measurement sleeve.
- 9 Where an uneven distribution of fat and muscle is found, no part of the cross hair is to be within the muscle. The diagrams below show some common examples of the interface between fat and muscle seen through the viewfinder of the Introscope.



6.5 Recording measurements

15 mm is recorded as 15 mm

15.4 mm is recorded as 15 mm

15.5 mm is recorded as 16 mm

The Introscope is calibrated down to 8 mm.

Measurements of 7 mm can be estimated as 7 mm, any measurement deemed to be less than 7 mm should be recorded by the symbol "X".

Measurements which are not readable are recorded as 'NR' (or approved identification) and the carcass marked NR.

Any measurement above 50 mm should be recorded as 50+ mm.

6.6 Routine Maintenance

6.1 Cleaning

- 1 Do not use water, if moisture gets inside the Introscope leave it to dry.
- 2 After use, clean the Introscope with an approved non-abrasive cleaning fluid and a soft cloth or paper tissue. This cleaning should include removing the measurement sleeve and cleaning fat and tissue deposits which will accumulate by using a stiff nylon brush or scouring pad. This sleeve should only be removed if cleaning is required.
- 3 Regularly check the spring clip on the sleeve. If it becomes loose tighten or replace, otherwise the sleeve may fall off.

6.2 Sharpening

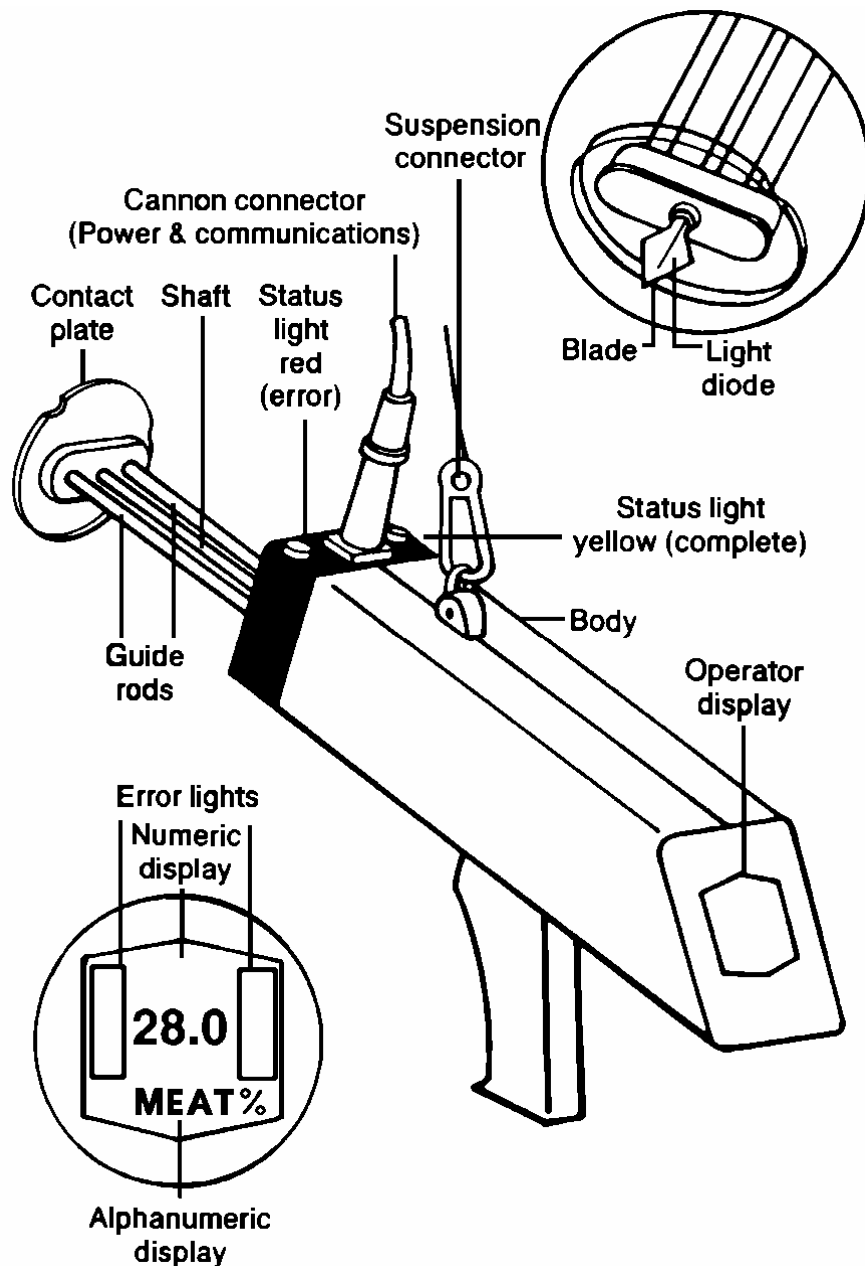
- 1 Do not sharpen the Introscope on a grinding wheel, as this is too severe and can cause damage to other parts of the Introscope.
- 2 A smooth oil stone is suitable for sharpening.
- 3 When sharpening, keep the edges straight - do not allow them to become rounded.

Note: If major maintenance is required, return to the supplier agent with a detailed description of the problem. Operators should not attempt maintenance themselves.

7. HENNESSY GRADING PROBE (HGP)

The Hennessy Grading Probe measures **fat depth, lean muscle depth and estimated lean meat percentage** by recording the depth at which changes of intensity of reflected light are caused by the different reflectivity of fat and meat. There is a light source and sensor mounted in the tip of the probe shaft, the fat and meat depth measurements are calculated by measuring the distance the light source and sensor travel relative to the surface of the carcase. This distance is translated to give actual fat and meat depth readings in millimetres. Readings are made as the probe is being withdrawn and recorded automatically by computer.

7.1 Parts of the Hennessy Grading Probe



7.2 Pre-operational Check

Contact Plate should be fully depressed before attempting to remove (practise to ensure guide rods are not handled).

Contact plate must be checked to ensure that it is screwed home (hand tight, not over tightened) and correctly fitted.

Light Source/Diode must be checked to ensure it is obstruction free.

Blade is sharp both front and back and secure.

- Probe is clean with no fat around contact plate or guide rods,
- Guide rods must move freely,
- Electrical connection is locked tight, and
- Alcohol is available to clean probe regularly.

7.3 Calibration

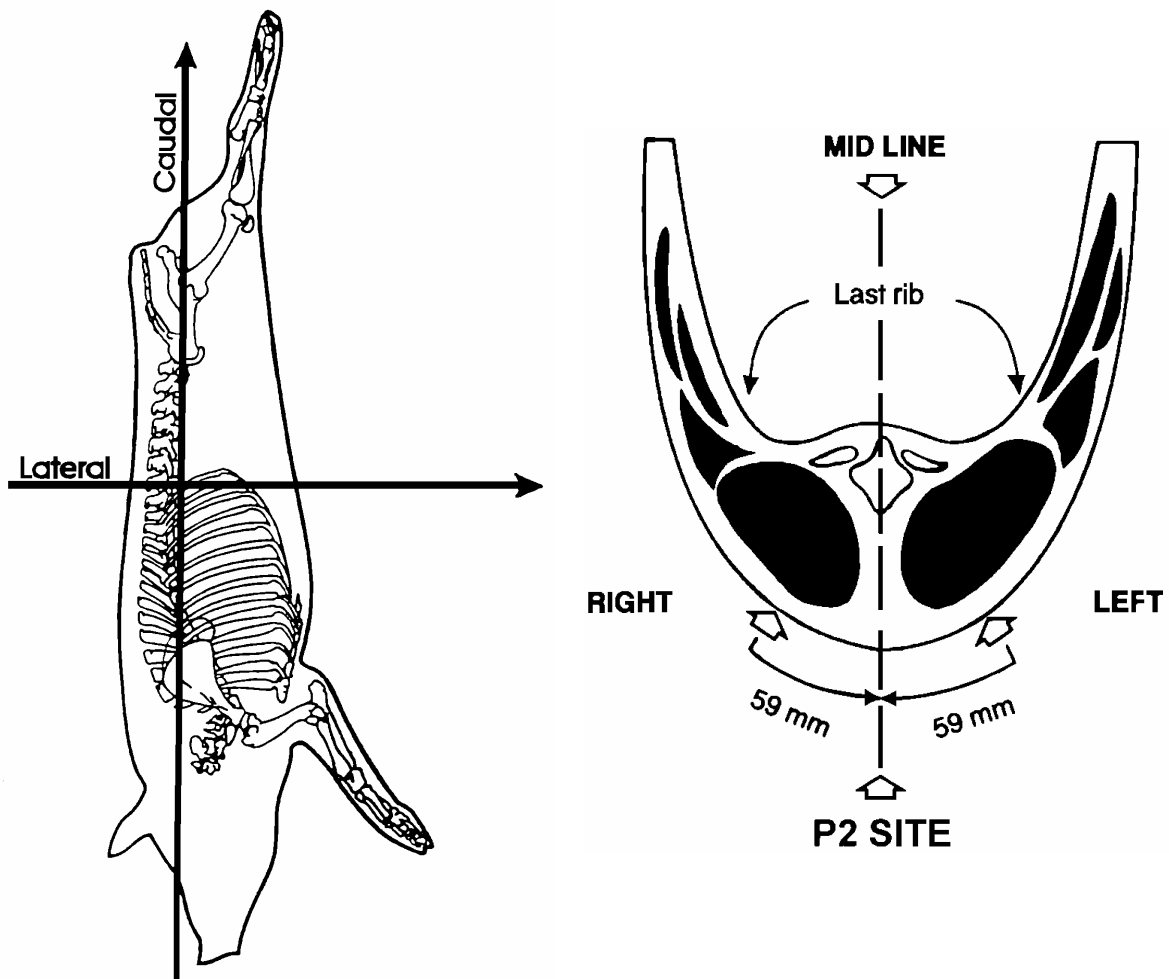
Every run the probe should be calibrated against the test block. Pre-operation Calibration checks should be logged and details should include:

- date and time,
- calibration result, and
- name and signature of checker.

If the HGP does not measure correctly to ± 0.4 mm, then management must withdraw the HGP from use and send it for servicing and re-calibration.

7.4 Operation of the HGP

- 1 Steady the carcass with the free hand.
- 2 Smooth out skin surface if necessary.
- 3 Locate the correct P2 site.
- 4 Hold the HGP horizontally and insert the probe shaft fully through the carcass ensuring it is held 90 degrees to the skin surface and the contact plate is flat against the surface.
- 5 Smoothly withdraw the probe completely from the carcass ensuring the contact plate remains flat against the surface.
- 6 Withdrawal at excessive speeds may cause the probe to indicate an error, if so the measurement should be repeated at a site immediately caudal to the previous insertion site.



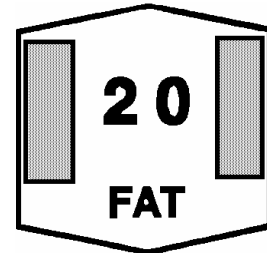
7.5 Reading the HGP Display

The Pig HGP displays 3 measurements. These are:

- Fat depth (in most establishments rounded to the nearest mm)
- Lean muscle depth (mm)
- Lean meat percentage

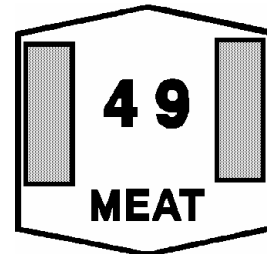
Fat Depth

The grading probe displays the fat content on the Numeric display and what the particular measurement taken is on the Alphanumeric display:



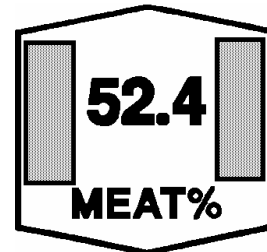
Lean Muscle Depth

If tilted to the right the lean depth measurement will be displayed:



Lean Meat Percentage

If tilted to the right again the carcass meat percentage will be displayed:



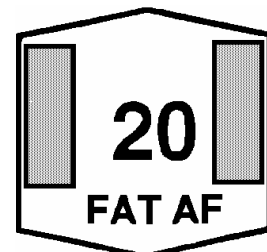
Finish Indicator

At the completion of the sequence the yellow status light is turned on and simultaneously the Alphanumeric display reads an "all finished" condition:

The probe is now ready for the next carcass.

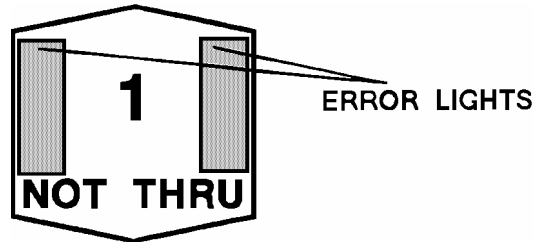
The "all finished" condition occurs 5 seconds after the completion of an error free measurement or the last tilt of the probe.

If the display has gone blank, the first tilt to the right will recall the last reading that was present prior to the display turning off.

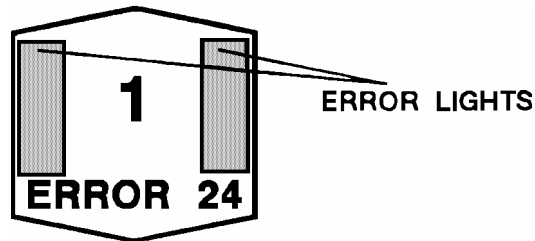


7.6 Incorrect Measurements

If an incorrect measurement is made or an error is detected by the HGP the red status light flashes simultaneously with the error lights on either end of the numeric display. An error message will be displayed eg:



If tilted to the right, an error number will be displayed:



Error number descriptions are available in the "Hennessy Grading Systems" training manual.

It is recommended that operators routinely compare the displayed Fat Depth reading with a visual estimate of the sawn fat surface (if possible). This practice may help in reducing obvious discrepancies.

7.7 Link-up with SAS Intern III

A buffer of 10 readings is provided for input from the HGP allowing probe operation to be positioned up to 10 carcasses ahead of the scale. When the Intern is first switched on the message window in the probe displays "INTERM?".

If the HGP was switched on before the Intern, Hello Scales and Systems Intern will be displayed while the Intern operator keys in the date and time.

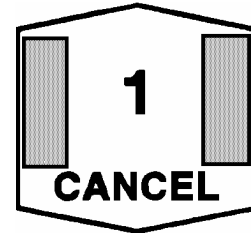
The probe operator must wait ("PLS WAIT" displayed in window) until the Intern operator has finished entering the time and date and is ready to accept readings from the HGP. When "PROCEED" is displayed in the window the operator can commence probing.

If probe operator attempts to enter more than 10 readings before the Intern operator, "PLS WAIT" will be displayed. "PROCEED" will be displayed when the Intern is ready to receive another measurement from the HGP.

7.8 Cancelling Measurements

Readings are cancelled by tilting the HGP to the left within 5 seconds after completing a measurement. This time factor is extended if the operator examines the other measurements.

After cancelling, the red status light flashes simultaneously with the error lights on either end of the Numeric display. This message will be displayed:



The measurement must now be repeated.

If the HGP is being used with a data collection device such as an InterM any cancellation by the operator will be transmitted to the computer.

It is important that an incorrect reading be cancelled immediately, as transmission of the measurement from the HGP to the computer is effected within a very short time. The correlation of measurement reading to carcass number could be out and go unnoticed causing obvious problems.

7.9 Routine Maintenance

Cleaning and Storage

The probe must look and feel clean, be free from fat, grease, tissue, blood etc. Guide rods must move freely up and down the full length of the shaft.

The probe must be cleaned regularly using a soft cloth or paper tissue soaked in Isopropyl Alcohol or similar approved edible degreasing agent. In large throughput plants the HGP should be cleaned every hour or earlier if problems are encountered.

The HGP is not Hose Proof and must never be hosed under any circumstances.

Every effort must be made to keep the HGP as dry as possible especially during storage.

At completion of use, check the following:

- **Cleanliness:** Fully depress contact plate and unscrew. Thoroughly clean as mentioned previously.
- **Electrical Connections:** Thoroughly clean using approved edible degreasing solvent and oil with small amount of silicone oil. Cover with sealed plug.

- At the completion of cleaning a single drop of silicone oil should be applied to the top and bottom of each guide rod, close to the probe body. The contact plate should be depressed several times to spread the silicone oil over the guide rods. Use a paper towel to remove any excess oil.
- After the above procedure has been completed the probe must be placed in the carry case provided and secured in a dry warm place. Rapid changes in temperature likely to cause condensation must be avoided.

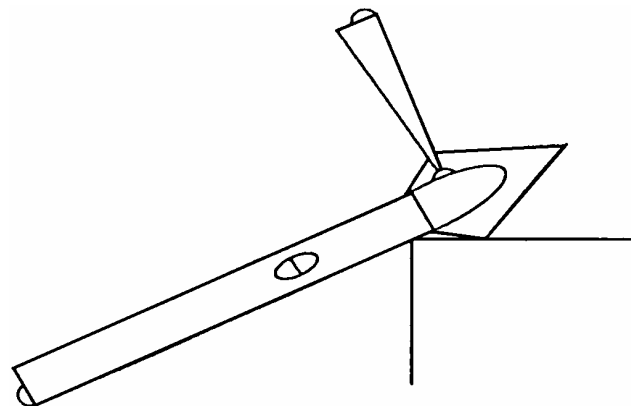
Sharpening

- Blade must be sharp, both front and back.
- Blade must be removed for sharpening using a small handstone or wetstone. Both front and back should be sharp and the latitudinal edges should be rounded off. A spare sharp blade should always be on hand.



Changing the blade

- 1 Press button on side of blade holder with tool provided
- 2 Pull blade free with fingers
- 3 Replace blade by pushing home firmly.



CHANGING THE BLADE

7.10 SASTEK Maintenance

- Operators should not attempt to make any adjustments or repairs to the HGP if faults are detected during usage or cleaning.
- The alignment of the guide rods, which support the contact plate-mounting bracket is critical and must be checked for damage and correct alignment.
- If the guide rods do not move freely after the application of silicone oil the probe must not be used and should be sent to SASTEK for realignment.
- Adjustment without the appropriate tools can cause permanent and expensive damage to the equipment.
- It is recommended that a full service and calibration check by the distributors, Sastek is carried out every 100,000 probing or 6 months whichever ever occurs first.

8 MONITORING P2 FAT DEPTH MEASUREMENTS

To gain confidence in the accuracy and precision of measurements used commercially it is necessary to establish that the measurements comply with industry agreed, objective performance standards.

P2 fat depth measurements must be regularly monitored by the Company Standards Officers.

This monitoring is conducted at the frequency laid down in the establishments Quality Systems Manual and must be approved by AUS-MEAT. The records of the monitoring must be retained for inspection by AUS-MEAT.

The standard sample size is 20 carcasses.

The check sheet below is an example of 20 carcasses checked by a standards officer (monitor).

	Measurer mm	Monitor mm	Difference mm		(HL – HR LL – LR)
1	14	14	0		
2	12	12	0		
3	14	16		-2	HL
4	18	17	+1		
5	11	10	+1		
6	12	12	0		
7	15	15	0		
8	15	15	0		
9	13	13	0		
10	19	18	+1		
11	19	20		-1	
12	16	15	+1		
13	13	13	0		
14	15	15	0		
15	12	12	0		
16	14	14	0		
17	14	16		-2	HL
18	18	16	+2		
19	14	14	0		
20	12	12	0		
		Consistency 11	+6	-5	Bias +1

8.1 Accuracy

There are two calculations that are made from the monitoring results to determine if the required level of accuracy has been achieved, these are consistency and bias.

8.1.1 Consistency

This is the total number of millimetre's difference between the monitor and the measurer disregarding whether it is above or below the monitor's measurement. The maximum consistency allowed is to be no more than 14 mm. The Monitor's measurement is always taken as being correct. The check sheet below shows consistency calculated.

	Measurer mm	Monitor mm	Difference mm		(HL – HR LL – LR)
1	14	14	0		
2	12	12	0		
3	14	16		-2	
4	18	17	+1		
5	11	10	+1		
6	12	12	0		
7	15	15	0		
8	15	15	0		
9	13	13	0		
10	19	18	+1		
11	19	20		-1	
12	16	15	+1		
13	13	13	0		
14	15	15	0		
15	12	12	0		
16	14	14	0		
17	14	16		-2	
18	18	16	+2		
19	14	14	0		
20	12	12	0		
		Consistency 11	+6	-5	
			TOTALS		

8.1.2 Bias

This is the sum of the differences between the measurements of the monitor and the measurer taking into account whether the differences are plus or minus. The maximum bias allowed is to be no more than +/- 5 mm.

The check sheet below shows the bias calculated.

	Measurer mm	Monitor mm	Difference mm		(HL – HR LL – LR)
1	14	14	0		
2	12	12	0		
3	14	16		-2	
4	18	17	+1		
5	11	10	+1		
6	12	12	0		
7	15	15	0		
8	15	15	0		
9	13	13	0		
10	19	18	+1		
11	19	20		-1	
12	16	15	+1		
13	13	13	0		
14	15	15	0		
15	12	12	0		
16	14	14	0		
17	14	16		-2	
18	18	16	+2		
19	14	14	0		
20	12	12	0		
		Consistency 11	+6	-5	Bias +1
			TOTALS		

8.1.3 On the check sheet below calculate:

- 1 the difference,
- 2 the consistency, and
- 3 the bias.

	Measurer mm	Monitor mm	Difference mm	(HL – HR LL – LR)
1	13	12		
2	15	14		
3	16	15		
4	14	15		
5	13	14		
6	15	15		
7	17	17		
8	19	18		
9	15	17		
10	14	13		
11	13	13		
12	12	12		
13	10	9		
14	8	8		
15	13	12		
16	14	13		
17	15	15		
18	17	16		
19	13	14		
20	14	15		
		Consistency		Bias
			TOTALS	

9 Troubleshooting

9.1 Possible causes of error in measuring fat depth using the Introscope.

- Faulty Instrument
- Indentation
- Thumb pressure (free hand)
- Rounding down ie 15.5 mm = 15 mm
- Blunt Point
- Incorrect alignment of crosshair
- Contact plate not flush to skin surface
- Parallax error
- Rounding up ie 15.4 mm = 16 mm
- incorrect site (lateral)
- Job stress

9.2 Possible causes of error in measuring fat depth using the Hennessy grading probe.

- Faulty probe eg calibration
- Indentation
- Incorrect measuring action
- Holding contact plate or free hand too close
- Blunt blade
- Not pushing shaft fully through carcass
- Not removing probe from carcass
- Dirty light diode
- Correlation error due to incomplete cancelling
- Parallax error
- Contact plate not flush with carcass surface