SECTION 5.1 CONFORMATION RECORDING OF DAIRY CATTLE

5.1.1 Introduction

The ICAR multi dairy breed conformation recording recommendation integrates with the World Holstein-Friesian Federation guidelines on the international harmonization of linear type assessment, trait definition, evaluation standards and publication of type proofs for bulls.

This document contains a list of approved standard traits, which is a list of traits which should be scored by all organisations in the same way to improve further harmonisation on international level, also on Interbull level. The data collected within these recommended standards qualifies for MACE evaluation by Interbull.

Further the document contains a list of 5 traits which are commonly used by organisations in the dairy and dual-purpose breeds world-wide. This list of common standard traits is added to improve harmonisation of these traits too.

Besides giving trait definitions on standard traits, recommendations are given on improvement and transparency of data collection and monitoring classifiers.

5.1.2 Traits definitions

Linear type traits are the basis of all modern type classification systems, and are the foundation of all systems for describing the dairy cow. Linear classification is based on measurements of individual type traits instead of opinions. It describes the degree of trait not the desirability.

Advantages of linear scoring are:

- Traits are scored individually.
- Scores cover a biological range.
- Variation within traits is identifiable.
- Degree rather than desirability is recorded.

5.1.3 International standard traits

The International standard traits satisfy the following definitions:

- Linear in a biological sense.
- Single trait.
- Heritable.
- Economic value; Direct or indirect with reference to the breeding goal.
- Possible to measure instead of score.
- Variation within the population.
- Each linear trait should describe a unique part of the cow which is not covered by a combination of the other linear traits.

Approved standard traits

1. Stature
2. Chest width
3. Body depth

4. Angularity
5. Rump angle
6. Rump width
7. Rear legs set
8. Rear legs rear view
9. Foot angle
10. Fore udder attachment
11. Rear udder height
12. Central ligament
13. Udder depth
14. Front teat position
15. Teat length
16. Rear teat position
17. Locomotion
18. Body condition score

Common standard traits

19. Hock development
20. Bone structure
21. Rear udder width
22. Teat thickness
23. Muscularity

5.1.4 Standard trait definition

The precise description of each trait is well defined and it is essential that the full range of linear scores to identify the intermediate and extremes of each trait be used. The assessment parameters for the calculations should be based on the expected biological extremes of a cow in the first lactation. The scale must cover the biological extremes of the current population.

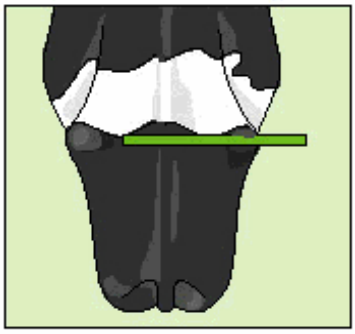
Recommended Scale 1 - 9

Note

The linear scale used, must cover the expected biological extremes of the population in the country of assessment.

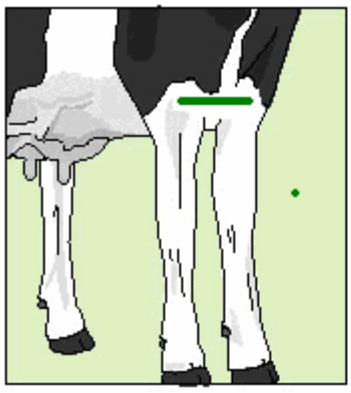
1.Stature

- Ref. point: Measured from the top of the spine in between hips to ground. Precise measurement in centimetres or inches, or linear scale.
  - 1 Short
  - 5 Intermediate
  - 9 Tall

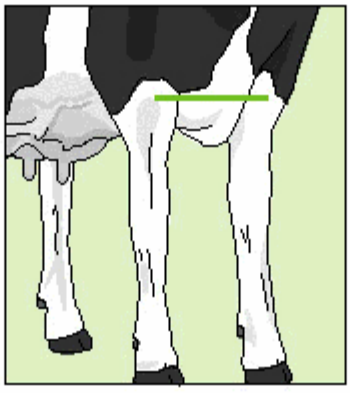


2. Chest width

- Ref. Point: Measured from the inside surface between the top of the front legs:
  - 1 Narrow
  - 5 Intermediate
  - 9 Wide



1
Narrow



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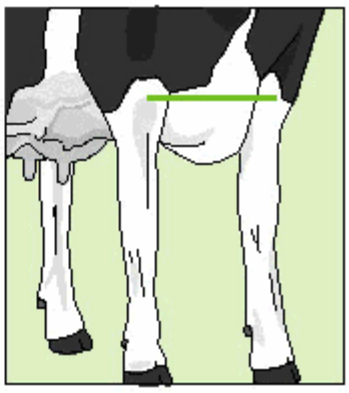
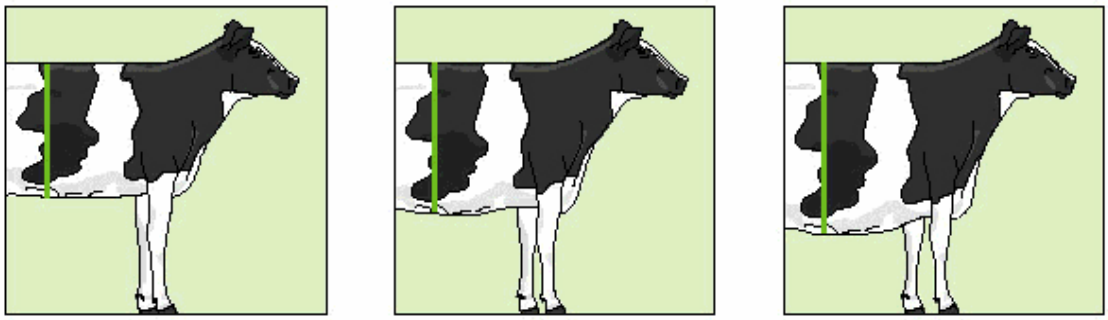


9
Wide

3. Body depth

- Ref. Point: Distance between top of spine and bottom of barrel at last rib - the deepest point: independent of stature:
  - 3 Shallow
  - 5 Intermediate
  - 9 Deep



1
Shallow

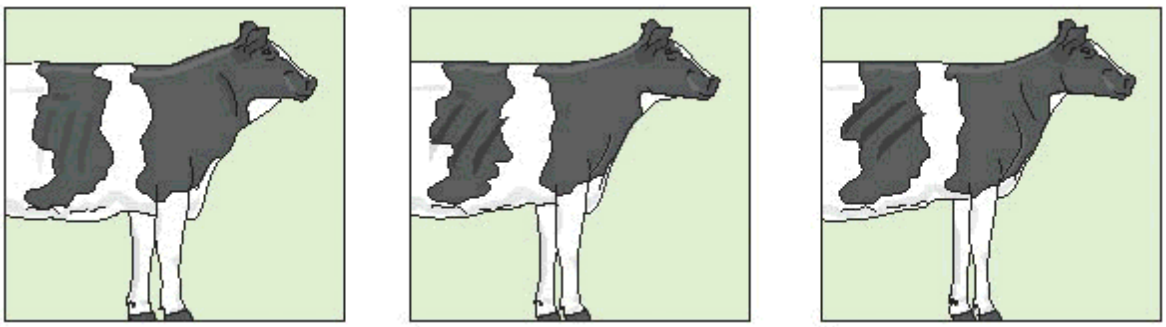
5

9
Deep

4. Angularity

- Ref. point: The angle and spring of the ribs; not a true linear trait:
  - 1 Lacks angularity: close ribs coarse bone
  - 5 Intermediate: with open rib
  - 9 Very angular: open ribbed flat bone

Reference scale: weighing of the two components; angle and spring of the ribs



1
(Close & Coarse)
Lacks angularity

5

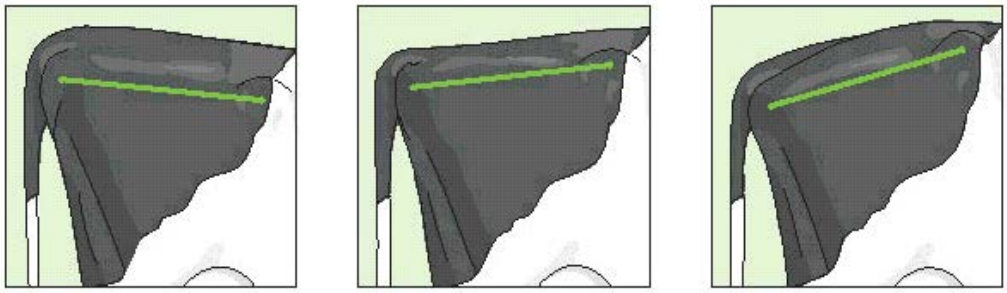
9
Open
Very angular

Defining "spring of ribs" is another way of referring to the degree of openess between the ribs. When the ribs are tight there is no opening. When the ribs spring apart or expands open, the space between ribs become greater.

5. Rump angle

- Ref. Point: Measured as the angle of the rump structure from hooks (hips) to pins:
  - 1 High pins
  - 5 Intermediate
  - 9 Extreme slope

Depending on the population rump angle can be scored level with a score in the range of 3-5.



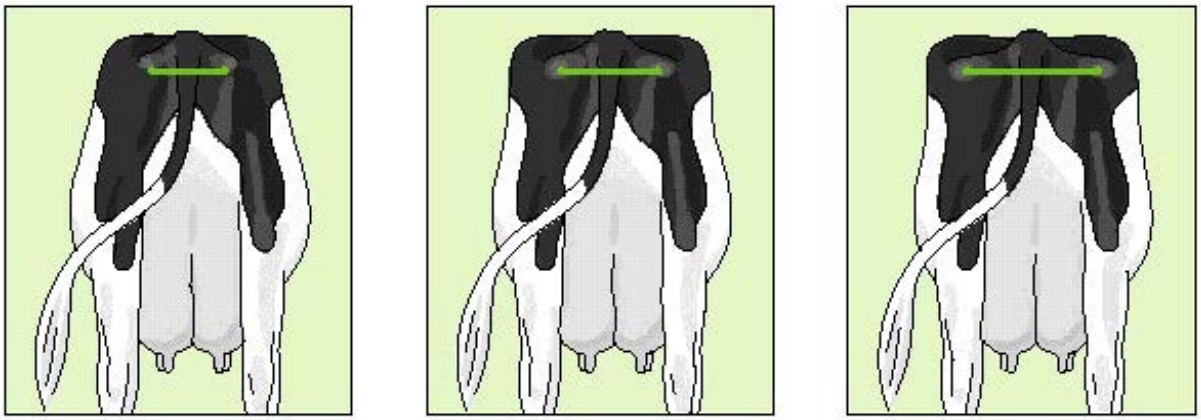
1
High Pins

5

9
Sloped

6. Rump width

- Ref. point: The distance between the most posterior point of pin bones.
  - 1 Narrow
  - 5 Intermediate
  - 9 Wide



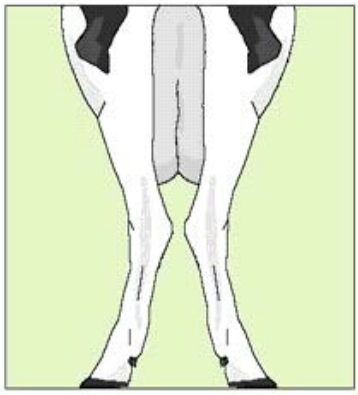
1
Narrow

5

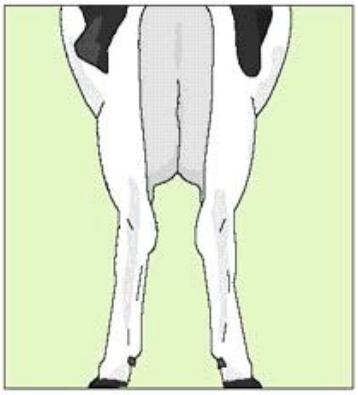
9
Wide

7. Rear legs rear view

- Ref. point: Direction of feet when viewed from the rear.
  - 1 Extreme toe-out
  - 5 Intermediate; slight toe-out
  - 9 Parallel feet



1
Hock In



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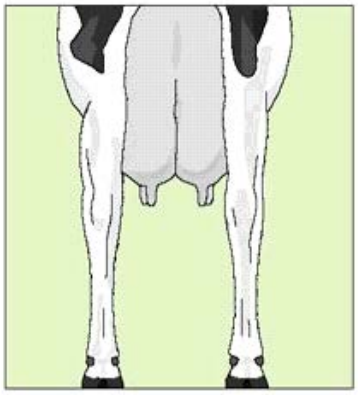
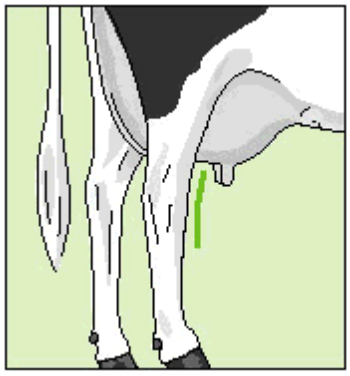


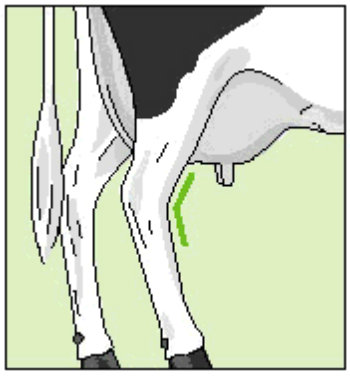
9
Parallel

8. Rear legs set

- Ref. point: Angle measured at the front of the hock.
  - 1 Straight
  - 5 Intermediate
  - 9 Sickle



1
Straight



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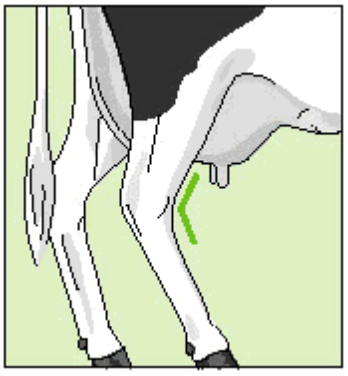
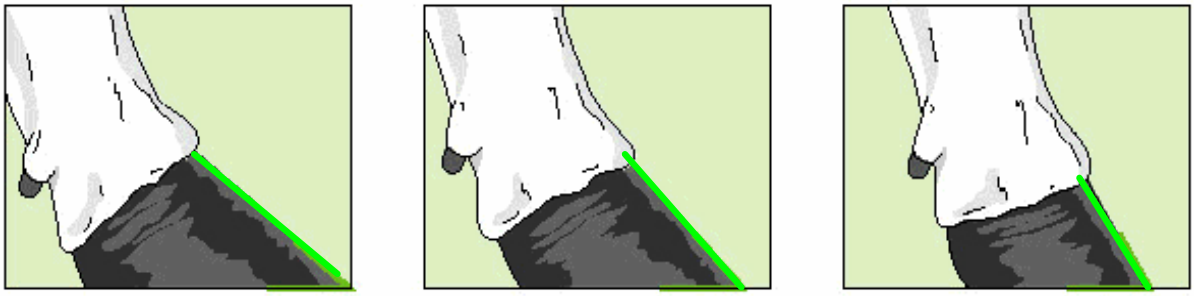


9
Sickled

If the rear legs set is different, the most extreme one should be scored.

9. Foot angle

- Ref. point: Angle at the front of the rear hoof measured from the floor to the hairline at the right hoof.
  - 1 Very low angle
  - 5 Intermediate angle
  - 9 Very steep



1
Low

5

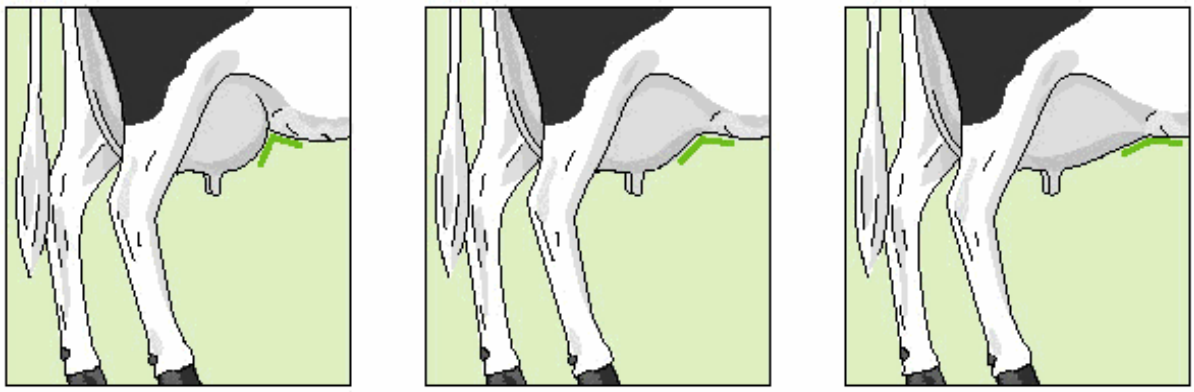
9
Steep

If the foot angle is different, the most extreme one should be scored.

If the foot angle is difficult to score because of hoof trimming, bedding, manure etc. It is also possible to look at the angle of hairline.

10. Fore udder attachment

- Ref. point: The strength of attachment of the fore udder to the abdominal wall.
  Not a true linear trait.
  - 1 Weak and loose
  - 5 Intermediate
  - 9 Extremely strong and tight



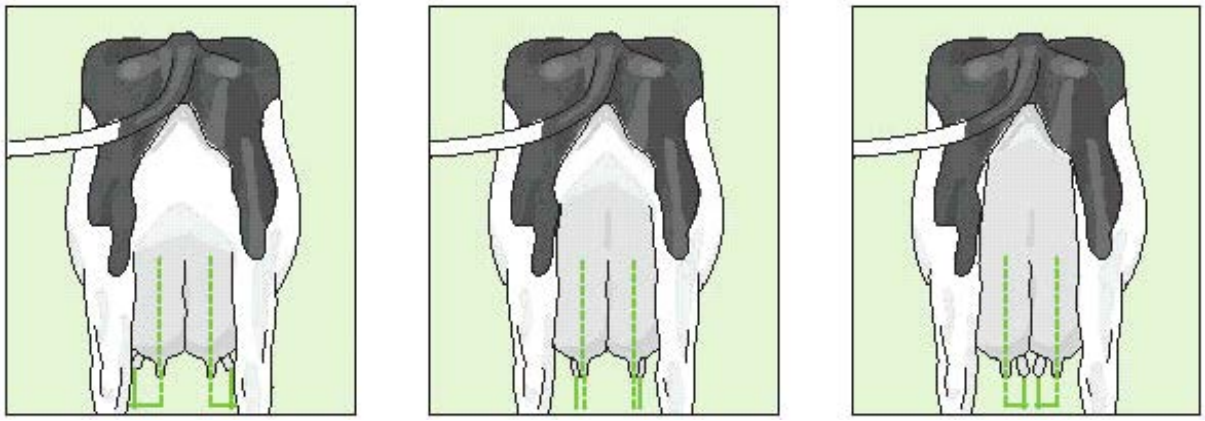
1
Loose

5

9
Strong

11. Front teat position

- Ref. point: The position of the centre of the front teat placement at the point of the udder as viewed from the rear.
  - 1 Outside of quarter
  - 5 Intermediate
  - 9 Inside of quarter



1
Outside

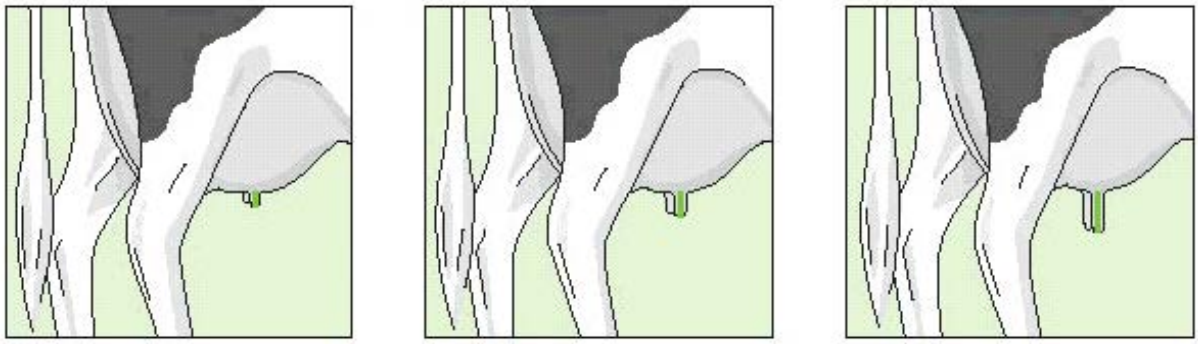
5

9
Inside

12. Teat length

- Ref. point: The length of the front teat.
  - 1 Short
  - 5 Intermediate
  - 9 Long

Instead of scoring front teat, the rear teat can be scored. The choice of front teat or rear teat should be consistent in the whole system.



1
Short

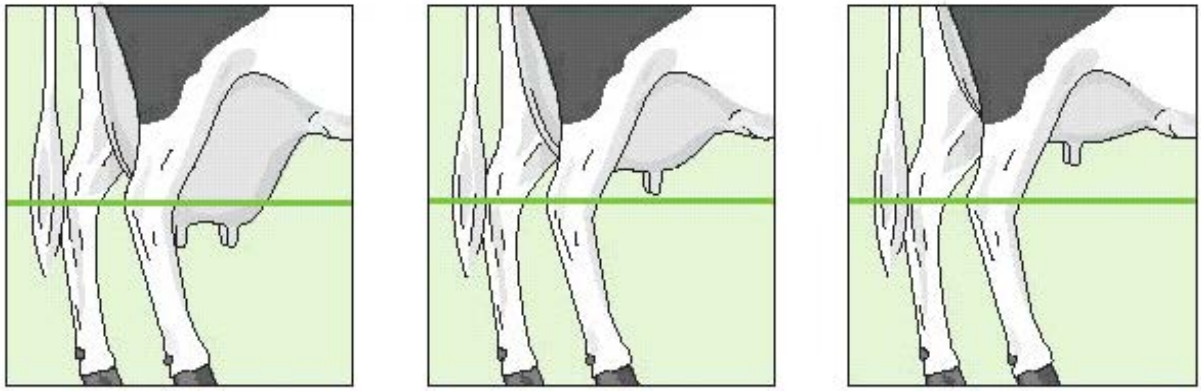
5

9
Long

13. Udder depth

- Ref. point: The distance from the lowest part of the udder floor to the hock.
  - 1 Deep
  - 5 Intermediate
  - 9 Shallow

Potential point of reference is the level with the hock.



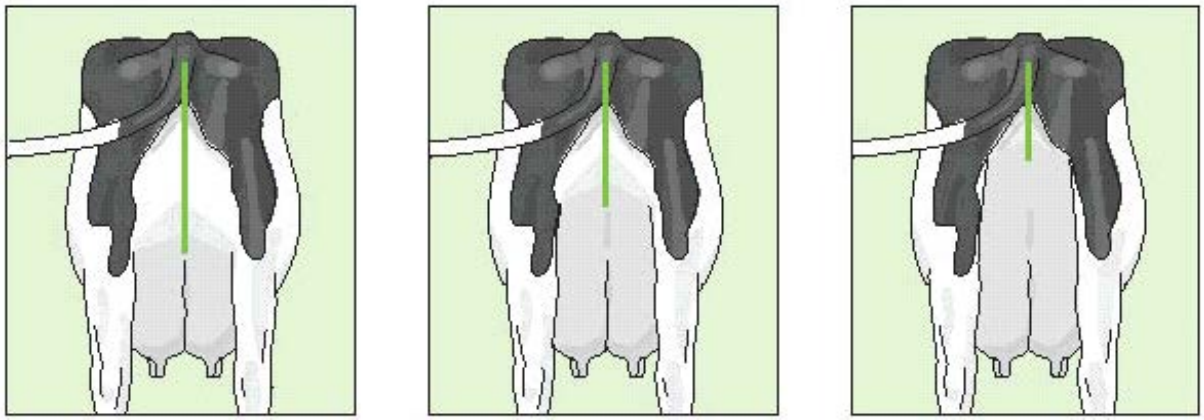
1
Deep

5

9
Shallow

14. Rear udder height

- Ref. point: The distance between the bottom of the vulva and the milk secreting tissue: in relation to the height of the animal.
  - 1 low
  - 5 Intermediate
  - 9 High



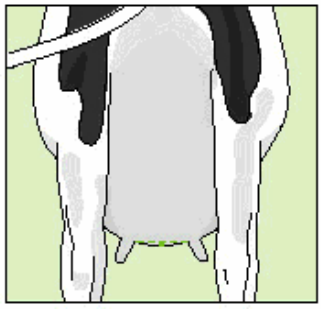
1
Low

5

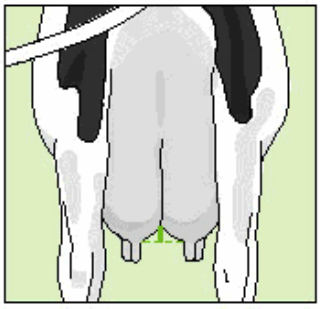
9
High

15. Central ligament

- Ref. point: The depth of cleft at the base of the rear udder.
  - 1 Convex to flat floor (flat), broken ligament
  - 5 Intermediate
  - 9 Deep cleft/strong ligament



1
Broken



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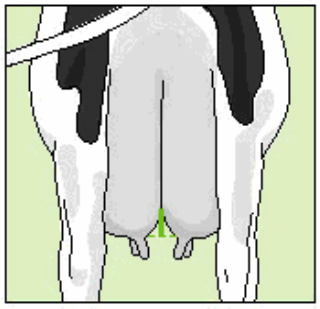
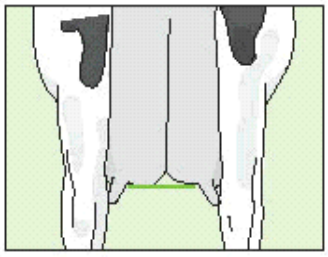


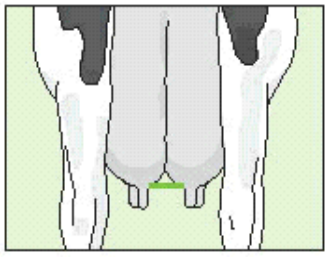
9
Strong

16. Rear teat position

- Ref. Point: The position of the rear teat from the centre of quarter:
  - 1 Outside of quarter
  - 5 Intermediate
  - 9 Inside of quarter



1
Outside



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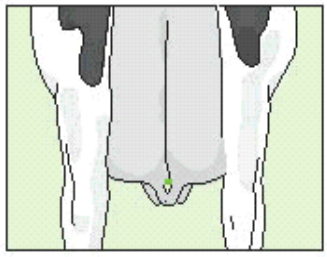


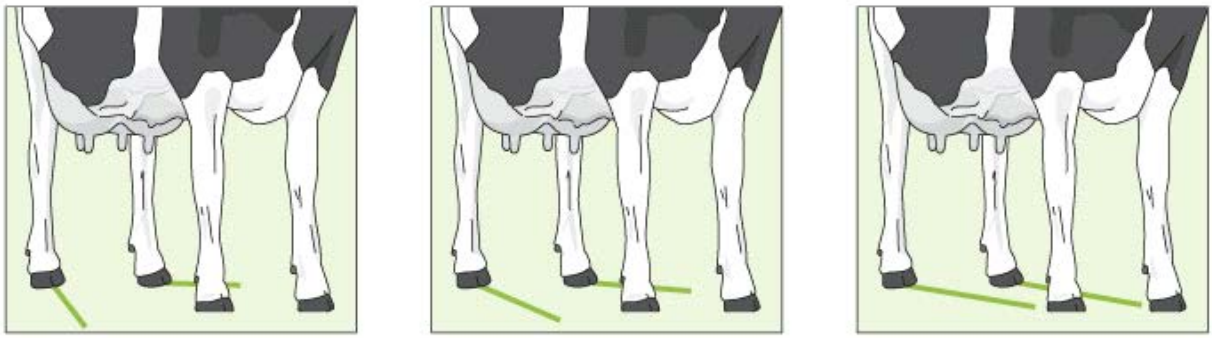
9
Inside

17. Locomotion

Ref. Point: The use of legs and feet, length and direction of the step

- 1 Severe Abduction - Short Stride
- 5 Slight Abduction - Medium Stride
- 9 No Abduction - long stride

Score only if the cow can walk (cow has no lameness).



1
Severe Abduction/Short Stride

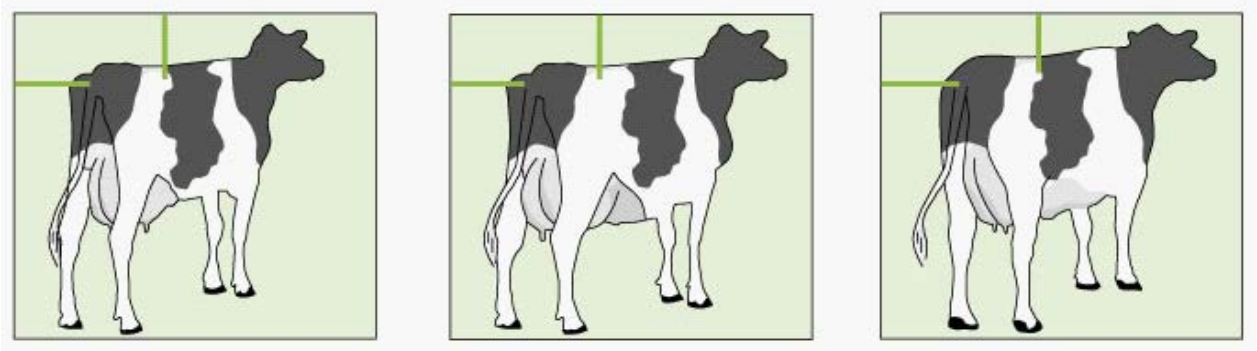
5

9
No Abduction/Long Stride

18. Body condition score

- Ref. Point: The covering of fat over the tail head & rump. Not a true linear trait.
  - 1 Poor
  - 5 Intermediate
  - 9 Grossly fat

With a score from 1-6 there mainly has to be looked at the loin, while the tail implant is important with the higher score (7-9).



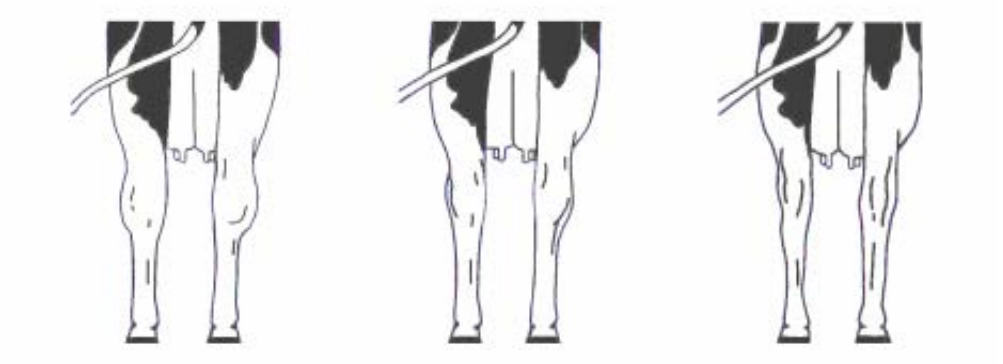
1
Poor

5

9
Grossly Fat

19. Hock development

- Ref. Point: Cleanness and dryness of the hock.
  - o 1 Hock with a lot of fluid
  - o 5 Intermediate
  - o 9 Complete clean and dry



1
A lot of Fluid

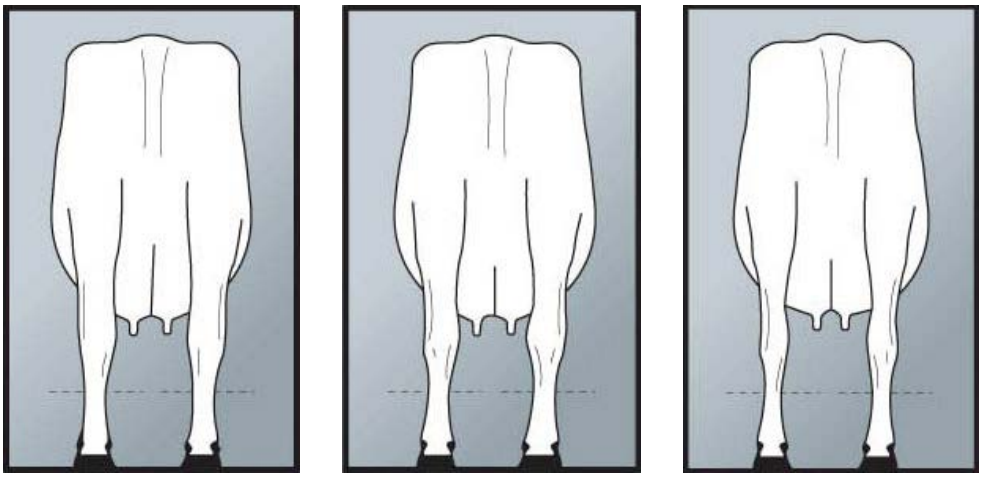
5

9
Clean and Dry

20. Bone structure

Ref. Point: The thickness and width of the bone structure, assessed by both examining the rear leg from the rear and from the side.

- o 1 Broad and thick
- o 5 Intermediate
- o 9 Flat



1
Broad and Thick

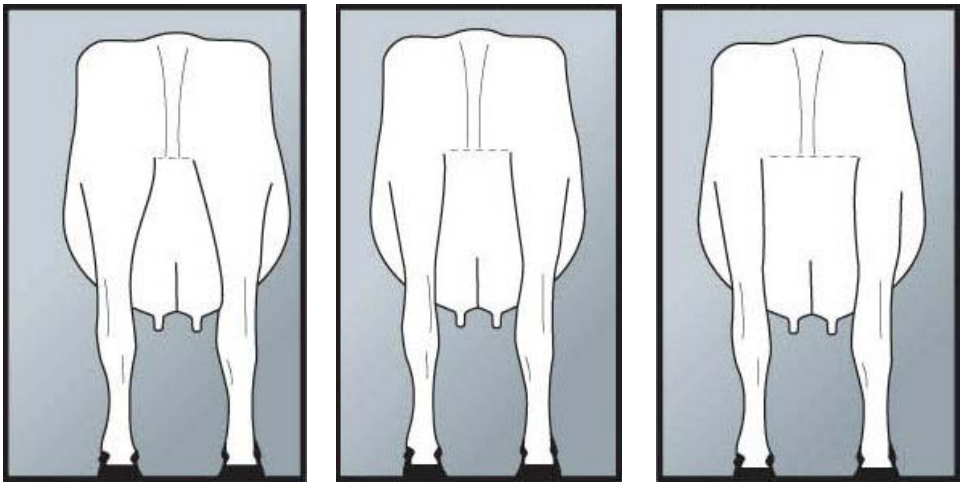
5

9
Flat

21. Rear udder width

Ref. Point: Width of the udder at the point where the milk secretion tissue is attached to the body.

- o 1 Narrow
- o 5 Intermediate
- o 9 Wide



1
Narrow

5

9
Wide

22. Teat thickness

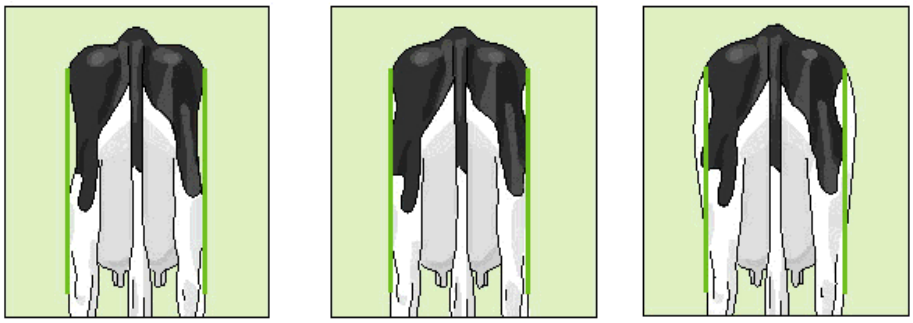
Ref. Point: Thickness of the teat in the middle of the front teat.

- o 1 Thin
- o 5 Intermediate
- o 9 Thick

23. Muscularity

Ref. Point: The amount of muscles as seen in the loins and thighs. Not a linear trait.

- 1 Poor
- 5 Intermediate
- 9 Grossly muscular



1
Poor

5

9
Grossly muscular

5.1.5 Genetic evaluation

5.1.5.1 Type inspection system - Genetic evaluation

1. Breeding values for bulls and cows to be based on the classification of cows in the first lactation scored in a herd evaluation system.
2. In a herd evaluation system all first lactating cows, which have not be previously evaluated, must be scored during the visit of the classifier
3. Additional classifications to obtain a bull proof may only be possible if completed by the same organisation and daughters are sampled randomly with sufficient number of herd mates (contemporaries) scored during the same visit. A minimum of 5 first lactating cows, which qualify for genetic evaluation, are inspected at the same visit

5.1.5 2 Evaluation model

1. Modern BLUP evaluation techniques should be used to obtain accurate unbiased evaluations.
2. Data should be corrected for influencing factors such as age, stage of lactation and season by the model. Classifiers should not make adjustments during scoring.
3. Corrections for variation between classifiers are required to avoid heterogeneity of variance.
4. Herd mates are defined as the contemporaries of the evaluated heifers in the same lactation, scored during the same visit by the same classifier.

5.1.5.3 Publication of information

1. Publish bull-proofs around an average of 0 and a genetic standard deviation of 1.0.

2. Proofs of widespread bulls should be published as bar graphs covering the range between +3 and -3 standard deviations.
3. OR: Mean of 100 & the standard deviation in the base population where this standard deviation is adjusted to the situation the proofs of cows have a reliability of 100%.
4. The base of sire and cow evaluation should follow the definition of the production proofs, given by Interbull. This includes a stepwise fixed base that should be renewed every five years. The base is defined by cows born 5 years previously.

5.1.6 Composite traits and general characteristics

5.1.6.1 Composite traits

1. Composite traits are groups of linear traits relating to one specific area.
2. The individual linear traits are weighted according to economic breeding objectives.
3. The main composite traits are - Frame including rump, dairy strength, mammary, feet/legs.

5.1.6.2 General characteristics or breakdown for non Linear traits

a. Type classification programmes also include phenotype assessment. These are described as general characteristics or combined traits, which are not linear in a biological sense. A subjective score is given for the desirability of the cow according to the breeding goal.

b. Female animals are inspected, classified and assigned grades/scores ranging from 50-97 points.

c. The most common scale for mature cows (second or more lactations) are:

Excellent	90 - 97 points
Very Good	85 - 89 points
Good Plus	80 - 84 points
Good	79 - 75 points
Fair/Poor/Insufficient	50 - 74 points

d. The awarding of classification grades varies in each country depending upon the breeding goals, and therefore classification scores must be considered in the context of the country of inspection.

e. The final class and score are derived from a breakdown of the main functional areas of the female:

- Frame including rump.
- Dairy strength.
- Mammary system.
- Legs/feet.

f. The weighting of the component breakdown scores should meet the breeding goals in the Country of inspection. It is recommended that for first lactating cows the range of scores used is 70 - 90 points. The average score is always in the middle of the maximum and minimum a first lactating cow can be awarded.

SECTION 5.2 RECOMMENDATIONS ON IMPROVING QUALITY AND TRANSPARENCY OF DATA COLLECTION AND MONITORING CLASSIFIERS

5.2.1 Introduction

When collecting data on animal performances on a routine basis it is important to do this in a consistent and transparent way. In this way quality of data can be guaranteed and for everybody it is clear how it is done. This is also important for scoring animals for conformation traits, which is normally done by classifiers, specially trained doing this job.

This chapter describes the improvement of quality and transparency of data collection for conformation traits.

5.2.2 Practical aspects on type classification system

a. One organisation should be in charge of classifications within each evaluating system.

b. There should be a head-classifier in charge of training and supervising other classifiers within the evaluating system to achieve and maintain a uniform level of classification. Additionally the exchange of information between head-classifiers from different systems/countries is recommended.

c. Individual full time professionals should complete classification. Classifiers should be independent of commercial interest in AI-bulls/studs.

d. Classifiers must record the trait as observed without adjustment e.g. Age, stage of lactation, sire or management system.

e. The working information provided for the classifier should make no reference to the pedigree or performance of the cow.

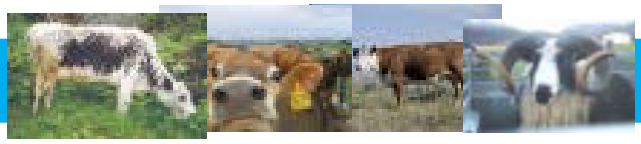
f. Classifiers should always rotate classification areas (herds and regions) to ensure a good data connection between regions and to minimise the sequential scoring of cows by the same classifier. This way of working reduces this risk of classifier*regional genetics interaction or classifier*herd interaction.

g. An advisory group can be installed with expertise in the field of conformation classification, statistics, breeding, training people, in order to monitor and advise on the improvement to the classification system.

h. The housing system and type of floor should be registered when a herd is visited. This makes it possible to find possible interactions between housing system and the trait scored. Types of housing can be free stall, tie stall, mixture (stall plus outside). Types of floors can be concrete, cement with groves, slats, sand, rubber, straw, pasture.

5.2.3 Training and monitoring of classifiers

The monitoring and performance evaluation of classifiers is an important part of the standardisation of the ICAR international type program.



Objectives

1. Improve accuracy of data collection, within country all classifiers should
    - Apply the same trait definition
    - Apply the same mean
    - Apply the same spread of scores
2. Improve the genetic correlation for linear traits between countries (Interbull evaluation)
    - Apply the same trait definition in all countries

Tools for objective 1

- National group training sessions
- Statistical monitoring of individual classifiers performance with reference to mean, spread and normal distribution of scores
- Compute the correlation between the scores of one classifier and the group by using bivariate analysis. This shows the quality of harmonisation of trait definition between classifiers

Tools for objective 2

- International training of head classifiers
- International group training sessions
- Audit system
- If a country decides to change the definition of a trait, it is recommended not to use previous scores or use only as a correlated trait in the national genetic evaluation system

5.2.3.1 National group training sessions

One way of improving harmonisation of scoring by classifiers is having regular training sessions with a group of classifiers.

There are many ways to accomplish trait harmonisation through training sessions. Normally a training session consists of scoring a group of cows and the scores of individual classifier are compared with the scores of the other classifiers and/or head classifier.

Attention points are:

- Use a group of cows for training session which is representative for the cow population classifiers have to score during their herd visits.
- Deviations of individual scores are discussed and it is made clear which is the correct score for a certain trait on a cow.
- Scores of each classifier are analysed per trait using some analysis tools.
- Compute the mean and standard deviation of the deviations of the scores on cows per trait, per classifier. The deviation is the difference between the score and the average group score for a trait, for a cow. This gives insight in the scoring of individual classifier: always above of below the mean, more variation in scoring a trait than the group/head classifier. (with a test it can be shown if the differences found are significant).

- Compute the spread of the deviation of scores given by classifier per trait. This gives insight in how consistent a classifier is scoring a trait. (with a test it can be shown if the differences found are significant)
- Instead of scoring a group of cows once, the cows can be scored twice by the classifiers, for example in the morning and in the afternoon. Based on these scores (approximately 20) the repeatability per classifier per trait can be computed.

5.2.3.2 Statistical monitoring of individual classifiers

The scores of a classifier from a certain period in time can be analysed. A period can be 12 or 6 months, for example.

From these scores the mean and standard deviation can be computed. The mean should be close to (maxscore-minscore)/2, and the standard deviation should be near (maxscore-minscore+1)/6, where minscore is the lowest score on the scale and maxscore is the highest score on the scale. For example: scoring a trait on a scale of 1-9, a mean is expected of 5 and a standard deviation of 1.5.

Another option is to compute the correlation between the scores of one classifier and the scores of rest of the group by using bivariate genetic analysis. This shows the quality of harmonisation of trait definition between classifiers (Veerkamp, R. F., C. L. M. Gerritsen, E. P. C. Koenen, A. Hamoen and G. de Jong. 2002. Evaluation of classifiers that score linear type traits and body condition score using common sires. JDS 85:976-983).

For this analysis, two data sets are created, one with scores of one classifier and the other with scores of all other classifiers from a certain period, for example 12 months. Both data sets can be analysed in a bivariate analysis, estimating different (genetic) parameters. The analysis can be carried out for each trait and for each classifier. From the bivariate analyses the following parameters can be derived:

- Heritabilit: the heritability estimated within each classifier can be used as criteria for the repeatability of scores within classifiers, albeit the optimum value is not unity but depends on the true heritability of each trait.
- Genetic correlation: the genetic correlation between two data sets can be used as a measure of the repeatability between classifiers, where a genetic correlation of one between classifiers is expected.
- Genetic standard deviation.
- Phenotypic standard deviation (= square root of genetic variance and error variance).

For the evaluation of each trait for each classifier the diagram in Figure 1 can be used.

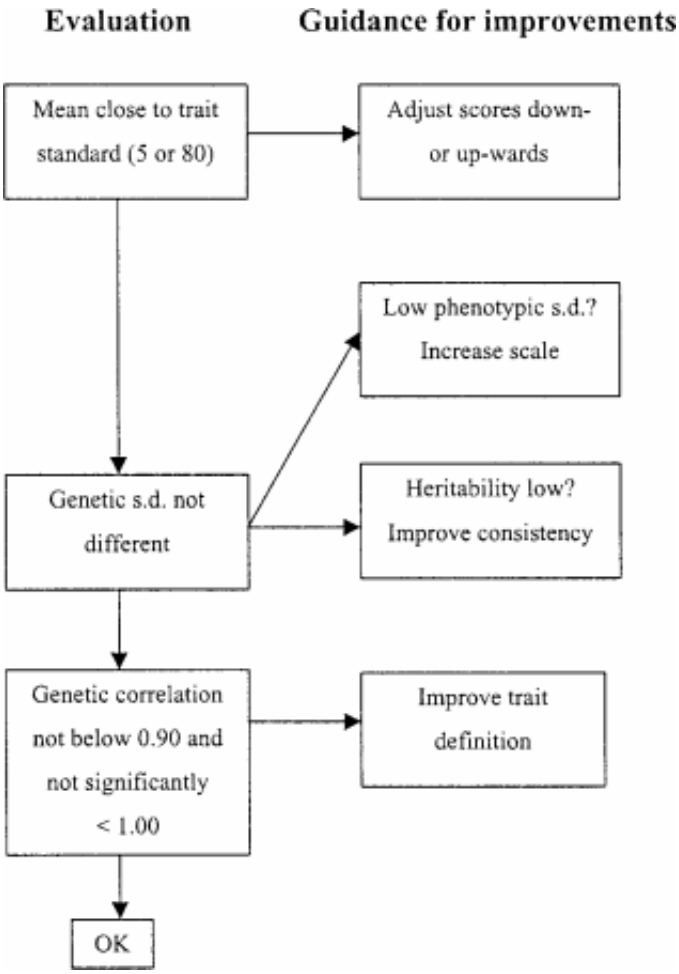


Figure 1. Scheme for evaluation trait by classifier combination using genetic parameters.

Evaluation obviously starts with the mean score for each classifier, i.e., the mean should be close to the trait standard (5 for linear traits and 80 for descriptive traits). Secondly, the genetic standard deviation should not be lower than the average.

If the genetic standard deviation is lower, this could be due to the scale used (measured by the phenotypic standard deviation), due to poor within classifier repeatability (a low heritability) or both. If the low genetic standard deviation goes together with a low phenotypic spread, the advice is the classifier should used the scale in a better way, use more the extreme scores. If the genetic spread goes together with a low heritability, then the classifier should score the trait more consistently, apply the same definition.

If the genetic correlation is too low the classifier is likely to score a trait different than other classifiers.

All the parameters from the system can be tested using the standard error on the parameters estimated. Every classifier can be tested against the average of the parameters of all classifiers for a certain trait. A classifier with a few scores may deviate a bit more from the average of the group, therefore taking the standard error into account in a statistical test is more fair.

5.2.3.3 Auditing a classification system

The Classification system applied can be further improved by using an audit system where experts familiar with the conformation classification in other countries or organisations, examine the situation in your organisation or country.

An important issue is that information is exchanged between people responsible for the classification system.

Different options to audit are:

- By using international workshops, in which information can be informally exchanged regarding how classifiers are trained and conduct their daily work
- By inviting classifiers and/or a head classifier from another country or organisation to participate in or lead group training sessions
- By having a group of experts visit an organisation responsible for classification, conduct a survey on methods and procedures, report their findings and makes suggestions for improvements.