



Progress of type harmonisation

April 2024

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1. Introduction

One of the main activities of the WHFF is the harmonisation of procedures in Holstein breeding. The success of harmonized linear evaluation should be looked at as one of the greatest accomplishments of the Federation. Progress in harmonized type evaluation might seem slow to some, but in the 32 years since the first workshop for classifiers in Cremona (1990), giant strides have been made.

2. History

The first workshop was attended by participants from 14 countries. The one in Cremona, Italy (2024) 28 countries and 53 participants attended the workshop. In 1990 there were doubts on whether the countries could have high correlations measuring the same traits compared to other countries. We have seen linear correlations for type at the same level as production traits. This is very significant since classifiers only visually inspect the cow and the production traits are actually weighed and measured. I think we can all agree that from a beginning that was somewhat uncertain, we have universally developed a program that fits our breeder's needs.

3. Report of the 15th Workshop in Cremona, Italy 16th – 18th April 2024

1. In case of a trait definition change, like with Rib Structure, the scores based on former definition should be discarded in the genetic evaluation to improve the correlations in the Interbull evaluations. WHFF board is requested to stimulate the national breed associations to pay attention to this topic.
2. Extend the current official linear conformation trait list with front feet orientation and udder balance.
3. Share trait definitions and pictures of four extra traits with WHFF members by making the information available on the WHFF site
4. Share the document of conformation defects with the WHFF members by making the information available on the WHFF site.
5. Share phenotypic correlation among, body traits, feet and legs traits and udder traits. Based on the last 12 months of data.
6. Focus traits during the workshop Chest Width, Rib Structure, Rear Legs rear View, Foot Angle, Locomotion, Udder Support and the new traits Udder Balance and Front Feet Orientation.
7. Body depth should be scored independent from stature. Countries should be made aware they should score linear traits as one dimension trait. Make no combinations with other traits. It is the only way to increase correlations in Interbull evaluations.
8. Continue the program of Head Classifiers Workshop.

Explanation on Recommendations

- Ad1) The majority of the members have introduced the new definition of Rib Structure. Germany and the Netherlands have removed all scores based on previous definition from their national evaluation and provide these new breeding values to the Interbull MACE evaluations. The result is that the correlations with other countries dropped dramatically as other countries still provide breeding values based on the old definitions, even when they started to score according to the new definition. The correlations between countries

only will increase if all countries will remove scores based on previous definition.

- Ad2) Based on a survey carried out in 2022 among the WHFF members an inventory was made which traits are scored beside the 18 official WHFF linear traits. Based on aspects as described in appendix II the working group proposed to add front feet orientation and udder balance to the official list of WHFF linear conformation traits. The proposal was supported by the participants of the workshop.
- Ad3) Based on a survey carried out in 2022 among the WHFF members an inventory was made which traits are scored beside the 18 official WHFF linear traits. Four traits are scored commonly by the members. To improve harmonisation for these four traits the working group recommends to share the trait definition and pictures on the WHFF site.
- Ad4) The working group has carried out a survey on conformation defects scored by members of WHFF (see appendix III). Based on the survey a list of 20 defects are described to stimulate the understanding of what is scored and to harmonize. Members are not expected to score these traits, but in case they score is, the definition of WHFF could be followed.
- Ad5) For more understanding how the traits are scored by different countries, we request that countries send in the phenotypic correlations based on scores of 2025, before 1st of February 2026, to: raffaellafinocchiaro@anafib.it and gerben.de.jong@crv4all.com.
- Ad6) Interbull correlations below 0.80 for the current official WHFF linear traits
- Ad7) Based on the phenotypic correlation analysis, it appeared that some countries still score body depth relative to stature. It should be scored independent from stature as it is a linear trait.
- Ad8) The location of the next workshop will be Hungary.

Summary of the 15th WHFF World Classifiers Workshop, Cremona 16th-18th April 2024

1. In total 53 participants from 28 countries attended the workshop. List of participants, see appendix I.
Martin Cassandro, ANAFIBJ general manager gave an introduction to the Italian dairy industry.
2. Working Group meeting April 16th, present: Tony O'Connor (NZL), Corrado Zilocchi (ITA), Stefan Rensing (DEU), Thierry Menard (FRA), Pedro Guimaraes (BRA), Tamas Sebok (HUN), Dorothee Warder (DEU), Rafaella Finocchiaro (ITA) and Gerben de Jong (NLD) as chairman. Cy Letter (USA) and Bruno Jubinville (CAN) were absent due to health issues.
Also present as guest were John Steinhoff (USA) and Carolin Turner (CAN).
For Stefan Rensing it was his last meeting as he will retire. At the end of the workshop he received a plaque as token of appreciation of more than 20 years contribution to the working group.
3. In December 2022, 24 countries or country groups participated in the Interbull genetic evaluation for conformation traits. Six linear traits already have a correlation of least 0.90 but 7 are also lower than 0.80. In some cases the low average correlation is due to the fact that a number of countries do not score the actual trait definition. Some countries has stopped for example to score locomotion (DFS and USA) due to the fact that it costs too much time.

On average the correlation among countries stayed at the same level (0.82), but with some decrease (0.01) for rib structure, rump angle, rump width and foot angle. Further rear leg set rear view and central ligament show continuous decrease over time. Among eight large population countries, being part for all traits in the evaluation since the beginning, the correlation stayed on the same level compared to four years ago. These countries showed an average increase since 2001 of 0.01 (average correlation 0.87 to 0.88).

For rib structure some countries still use openness of ribs or use their own definition to make up the score: USA, CAN and EST.

Germany and the Netherlands use in their genetic evaluation for rib structure only scores based on the WHFF definition and have seen a large drop in correlation with other countries as these other countries still use data based not based on the WHFF definition.

4. Then analysis of phenotypic correlations was carried out by Stefan Rensing. He showed that these phenotypic correlations based on scores of 12 months period are a good help to analyse how certain traits are scores. 23 countries provided the phenotypic correlations. Rib structure, chest width and body depth seem to have most variability. The correlations show that not all countries follow the WHFF definition. Most countries say they made the change to the new definition of rib structure.

For body depth it is clear that some countries like CAN and CHE score body depth in relation with stature, resulting in a low correlation between stature and body depth scores. The expected phenotypic correlation between rib structure and BCS is around -0.15. Udder depth and central ligament: FRA and BEL should check the scale (seems scale was times -1)

The differences in phenotypic correlations can give hints where countries probably apply in practice different trait definition.

Countries finding very different correlations for specific combinations compared to other countries should try to find out what of the involved two traits is the reason and probably change the definition as applied.

5. Tamas Sebok gave a presentation on the relationship between linear conformation traits and functional traits like lifetime production, longevity, calving ease, claw disorders and somatic cell count. The presentation was based on analysis carried out by the ICAR Conformation working group, which have made graphs available based on a study of four populations, showing the value of conformation traits. It shows the phenotypic relationship between the scores and the functional traits.

See also: www.icar.org/Guidelines/05-Conformation-recording-Appendix-5.pdf

6. A session was organized on 'The role of classification in the future' with perspective from four parts of the world with presentations by David Tesson, Tony O'Connor, John Steinhoff and Pedro Guimaraes Ribas Neto, followed by an half hour discussion. At The end of the workshop all countries were asked to share what was new in their country since 2022. All countries made use of this opportunity.

Exchange this kind of information was an important part of the meeting and stimulated the discussion among participants.

All presentations has been shared with the participants.

7. On farm workshop. Both practical workshops on Cristella Farm in San Daniele Po and Sabbiona Farm in Brembio were very well prepare with loose cows and enough space around so groups could score and discuss animals easily.

On the first day at the beginning of the session all traits were demonstrated to the group by scoring one cow. After that the group was divided in 5 groups, and scored all traits on 4 cows. All cows were first calf heifers and were discussed with the group leaders. In total 20 cows were analysed by the participants.

On the second day, the discussions were centred on low correlation traits (chest width, rib structure, locomotion, rear legs rear view and udder support) and the new traits front feet orientation and udder balance.

8. All participants agree on the very positive discussions and on the clear definitions of all traits, including the new traits front feet orientation and udder balance. Everybody had the opinion that there was good unity in scoring of the traits, even the attention and new traits. It shows the value of this kind of workshops!
Topic of next workshop:
explain the value of discarding scores of previous trait definition in genetic evaluation to increase correlation in Interbull MACE evaluation.

4. Linear Definitions

One of the proactive steps taken by the WHFF was the publishing of the Standard Linear Traits and their definitions on the website they can be downloaded and printed out by anyone who wants them. All participants agree on the very positive discussions and on the clear definitions of all traits.

The following traits are approved standard traits:

- | | |
|------------------------|---------------------------|
| 1. Stature | 10. Locomotion |
| 2. Chest Width | 11. Fore Udder Attachment |
| 3. Body Depth | 12. Front Teat Position |
| 4. Rib Structure | 13. Teat Length |
| 5. Rump Angle | 14. Udder Depth |
| 6. Rump Width | 15. Rear Udder Height |
| 7. Rear Legs Rear View | 16. Central Ligament |
| 8. Rear Legs Set | 17. Rear Teat Position |
| 9. Foot Angle | 18. Body Condition |

Standard Trait Definition

The precise description of each trait is well defined and it is essential to use the full range of linear scores to identify the intermediate and extremes of each trait within its population. The assessment parameters for the calculations should be based on the expected biological extremes of two year-old heifers.

All countries at the WHFF conference in Sydney had approved and agreed to use the recommended standard linear traits, although some countries did not consider that all the traits were essential or have an economic value in their breeding programme. The position is that changes in the standard traits could occur based on scientific evidence or the requirement of the international dairy market for specific information. It is not always possible to have a single linear point of measurement, as with fore udder attachment and rib structure.

Note

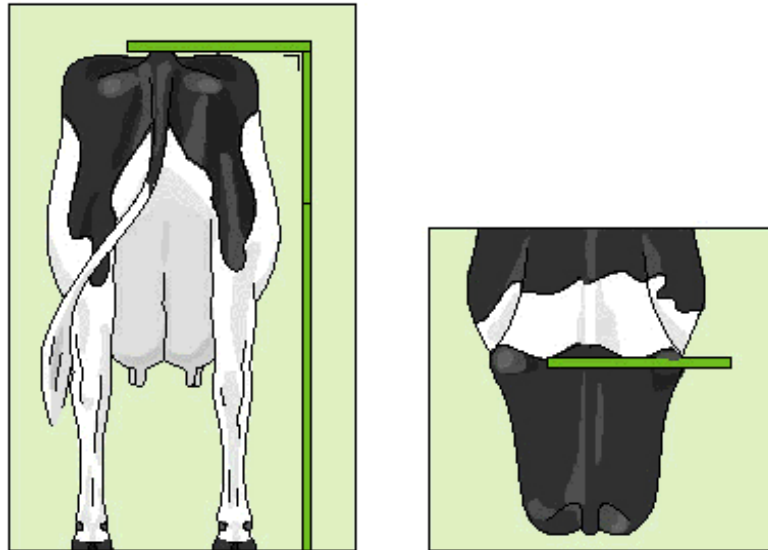
The linear scale used must cover the expected biological extremes of the population in the country of assessment. The precise measurements in the scale given, may be used as a guide and should not be treated as an exact recommendation.

1. Stature

Ref. point: Measured from top of the spine in between hips to ground.
Precise measurement in centimetres or inches, or linear scale.

- 1 Short
- 5 Intermediate
- 9 Tall

Reference scale: 3 cm per point

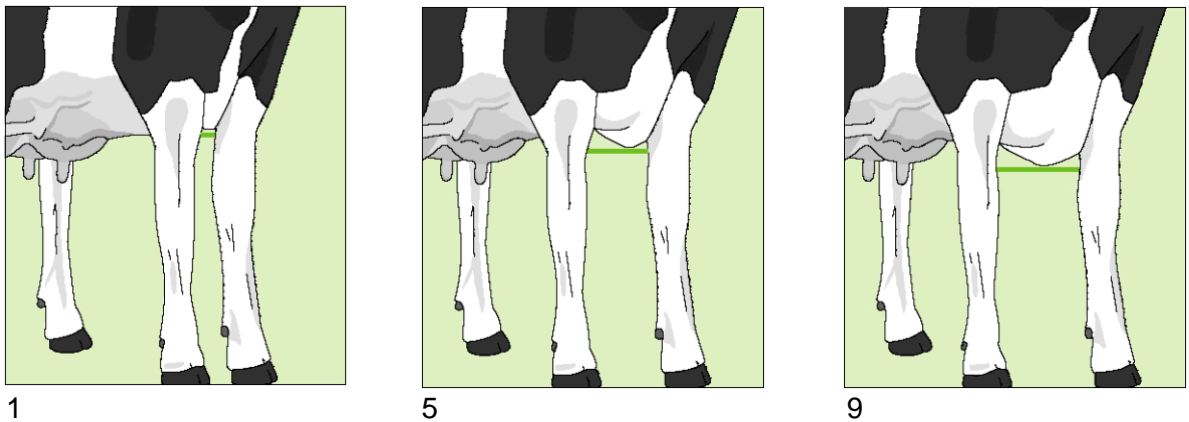


2. Chest Width

Ref. point: Measured from the inside surface between the top of the front legs.

- 1 – 3 Narrow
- 4 – 6 Intermediate
- 7 – 9 Wide

Reference scale: 13 cm – 29 cm; 2 cm per point

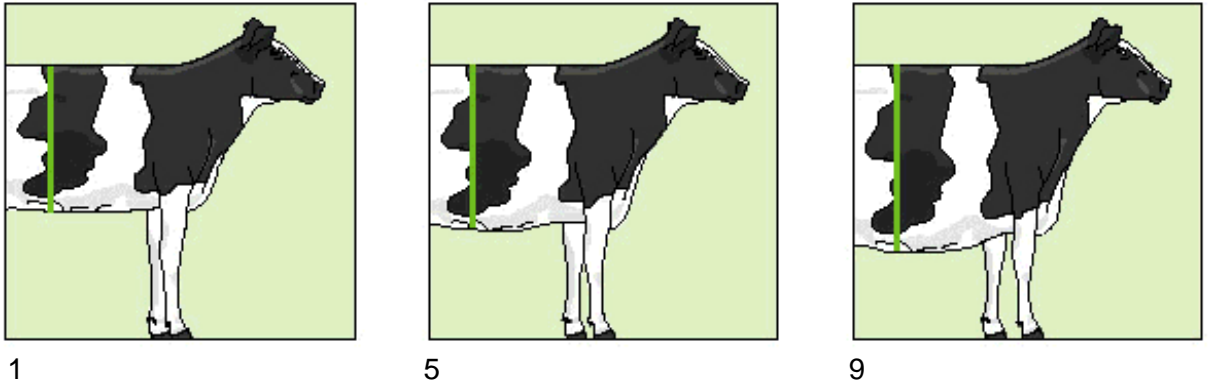


3. Body Depth

Ref. point: Distance between the top of spine and bottom of barrel at last rib – the deepest point. Independent of stature.

- 1 – 3 Shallow
- 4 – 6 Intermediate
- 7 – 9 Deep

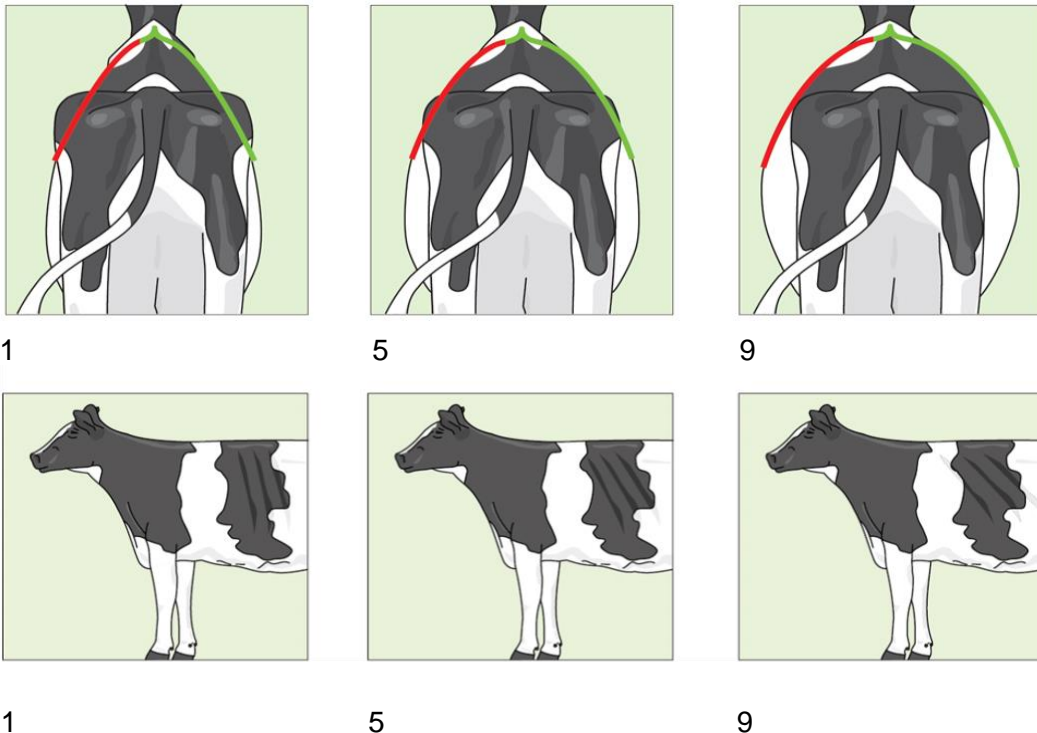
Reference scale: optical in relation with the balance of the animal



4. Rib Structure

Ref. point: The spring and angle of the ribs (60/40). Not a true linear trait. The best way to score spring, the arch of the ribs, is looking at the cow from behind. Angle is the direction of the ribs (side view). Openness is not part of the definition. Do the measurement on the left side of the body.

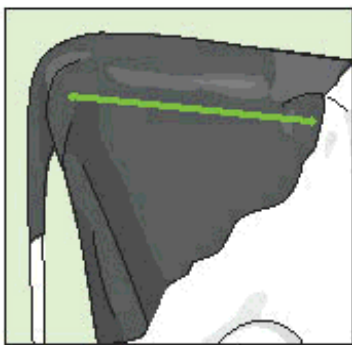
- 1 – 3 Lacks angularity (little spring of ribs and ribs are facing down)
- 4 – 6 Intermediate angularity
- 7 – 9 Very angular (much spring of ribs and ribs are pointing rearward)



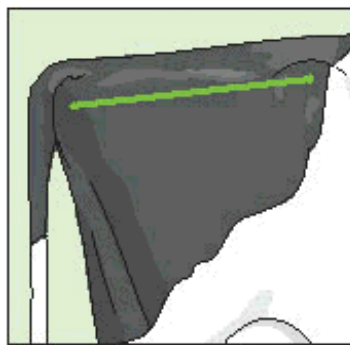
5. Rump Angle

Ref. point: Measured as the angle of the rump structure from hooks (hips) to pins.

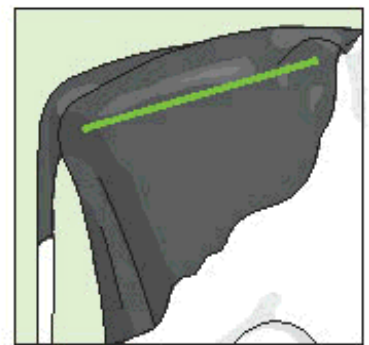
1 High Pins	(+4 cm)
2	(+2 cm)
3 Level	(+0 cm)
4 Slight slope	(-2 cm)
5 Intermediate	(-4 cm)
6	(-6 cm)
7	(-8 cm)
8	(-10 cm)
9 Extreme slope	(-12 cm)



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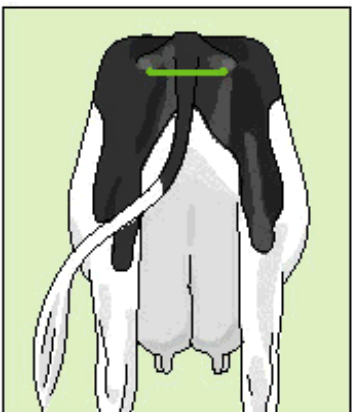
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6. Rump Width

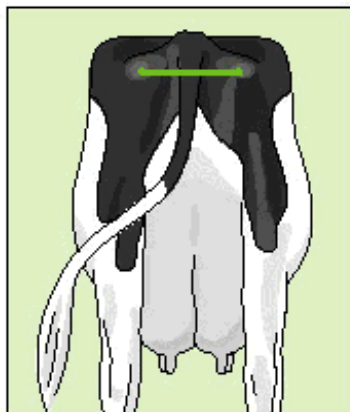
Ref. point: The distance between the most posterior point of pin bones.

- 1 – 3 Narrow
- 4 – 6 Intermediate
- 7 – 9 Wide

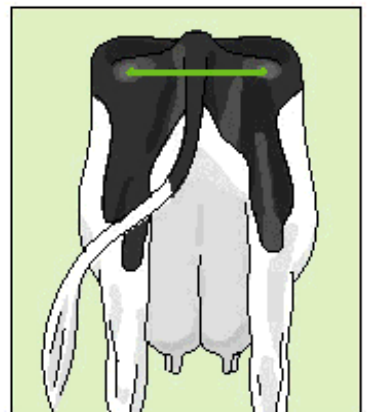
Reference scale: 10 cm – 26 cm; 2 cm per point



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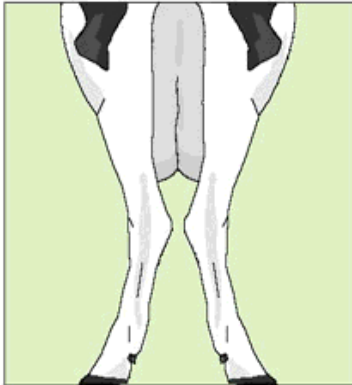


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7. Rear Legs Rear View

Ref. point: Direction of the rear feet when view from the rear.

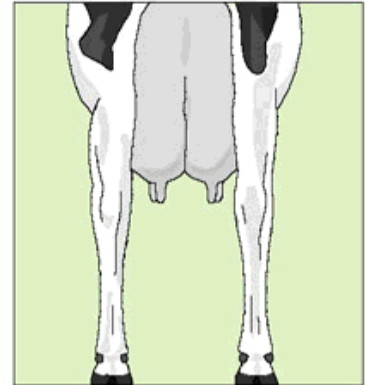
- 1 Extreme toe-out
- 5 Intermediate; slight toe-out
- 9 Parallel feet



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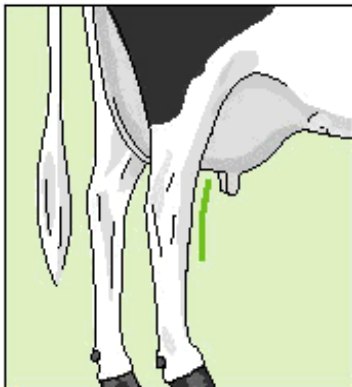


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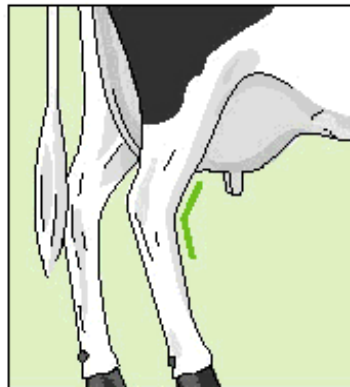
8. Rear Legs Set

Ref. point: Angle measured at the front of the hock.

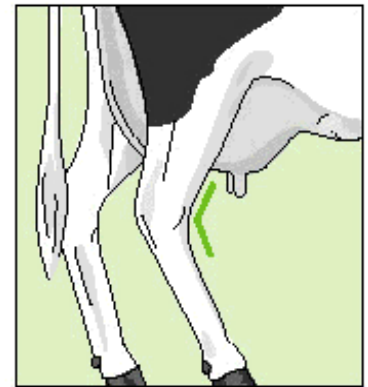
- 1 – 3 Straight (160 degrees)
- 4 – 6 Intermediate (147 degrees)
- 7 – 9 Sickie (134 degrees)



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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 – 3 Very low angle
- 4 – 6 Intermediate angle
- 7 – 9 Very steep

Reference scale: 1=15 degrees; 5=45 degrees; 9=65 degrees

If the Foot Angle is difficult to score because of hooftrimming, bedding, manure etc. it is also possible to look at the Angle of Hairline.



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10. Locomotion

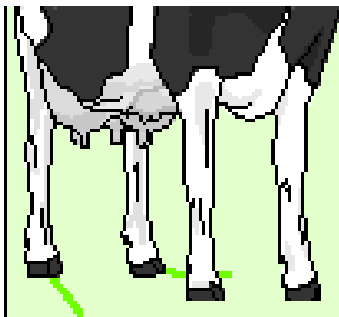
"The use of legs and feet, length and direction of the step". Not a true linear trait.

Ref. Point:

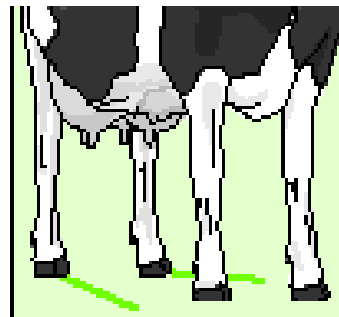
- 1 – 3 Severe abduction and short stride
- 4 – 6 Slight abduction and medium stride
- 7 – 9 No abduction and long stride

Abduction is the lateral deviation in respect to the straight line.

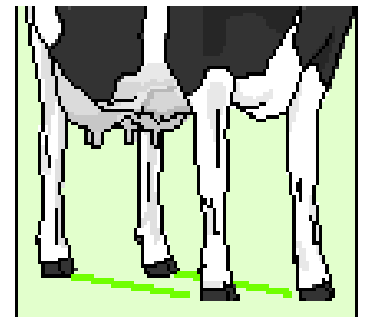
Can and should only be scored in herds where cow regularly do walk and has no lameness. If so, score all cows, be classified that day. The score of 9 means that the rear leg is put straight forward with force upon the step of the foreleg, and (extreme) lame cows getting score 1 because they have short strides.



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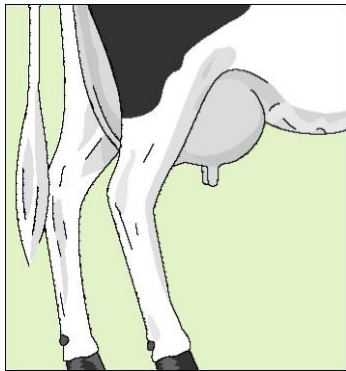
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11. Fore Udder Attachment

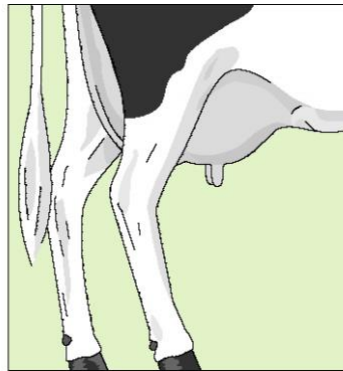
Ref. point: The strength of attachment of the fore udder to the abdominal wall.
Not a true linear trait.

- 1 – 3 Weak and loose
- 4 – 6 Intermediate acceptable
- 7 – 9 Extremely strong and tight

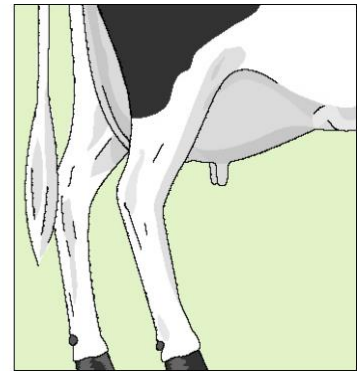
In case of a significant difference in the quality of udder attachment of both sides by scoring fore udder attachment, than the worse side must be scored. This only if the udder is healthy.



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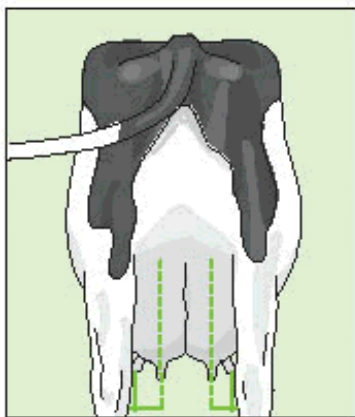


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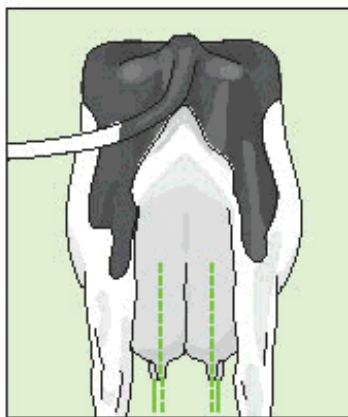
12. Front Teat Position

Ref. point: The position of the front teat from centre of quarter as viewed from the rear.

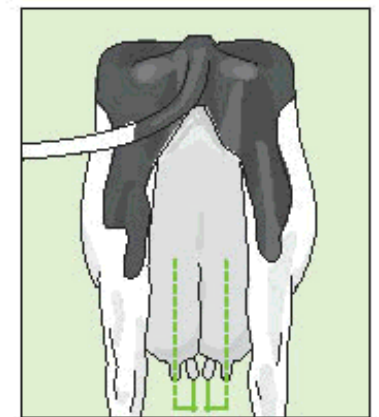
- 1 – 3 Outside of quarter
- 4 – 6 Middle of quarter
- 7 – 9 Inside of quarter



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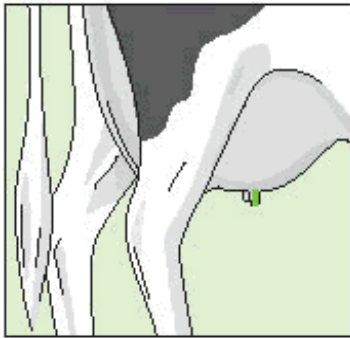
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13. Teat Length

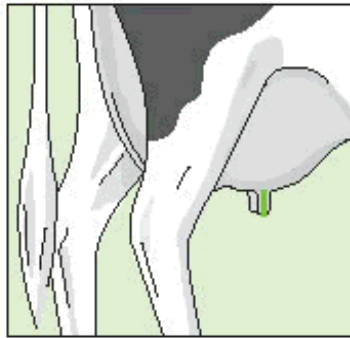
Ref. point: The length of the front teat.

- 1 – 3 Short
- 4 – 6 Intermediate
- 7 – 9 Long

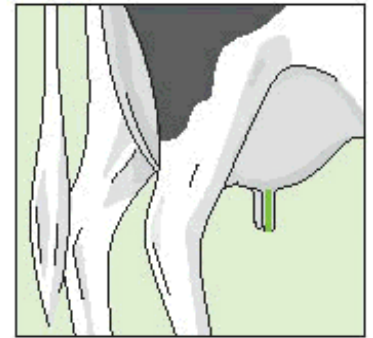
Reference scale: 1-9 cm; 1 cm per point



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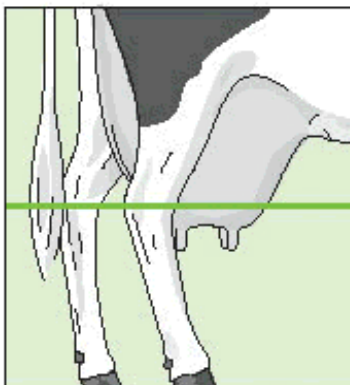
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14. Udder Depth

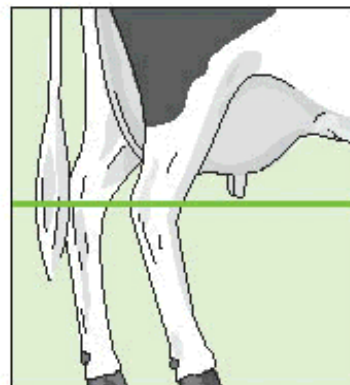
Ref. point: The distance from the lowest part of the udder floor to the hock.

- 1 Below hock
- 2 Level with hock
- 5 Intermediate
- 9 Shallow

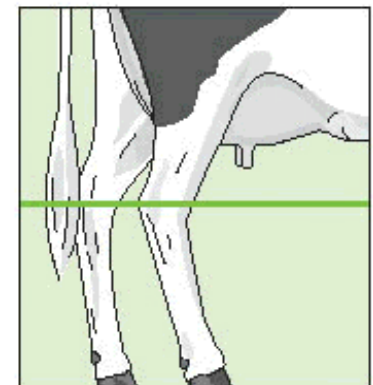
Reference scale: level=2 (0 cm); 3 per point



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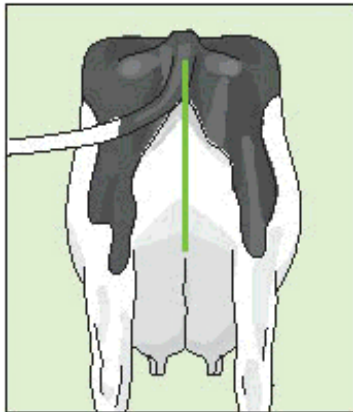
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15. Rear Udder Height

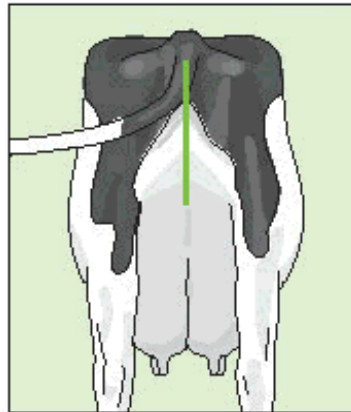
Ref. point: The distance between the bottom of the vulva and the milk secreting tissue: in relation to the height of the animal.

- 1 – 3 Very low
- 4 – 6 Intermediate
- 7 – 9 High

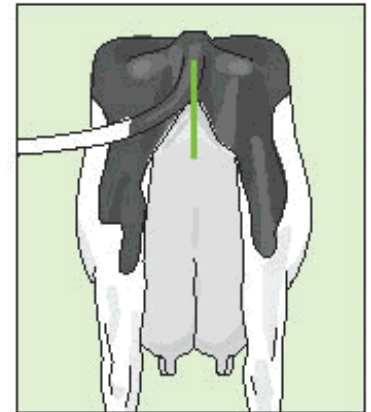
Reference scale: measured on a scale between the bottom of the vulva and the hock; the midpoint represents a score 4 (29 cm); 2 cm per point



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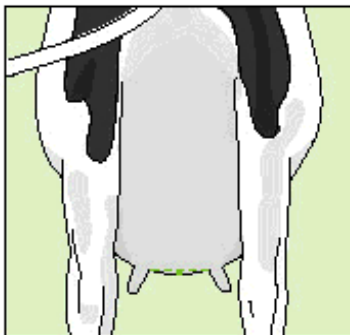


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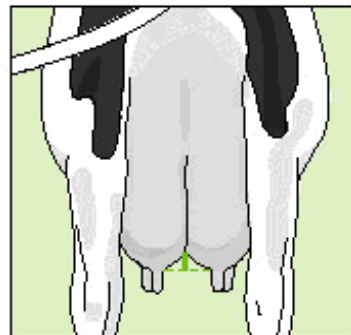
16. Central Ligament

Ref. point: The depth of cleft, measured at the base of the rear udder.

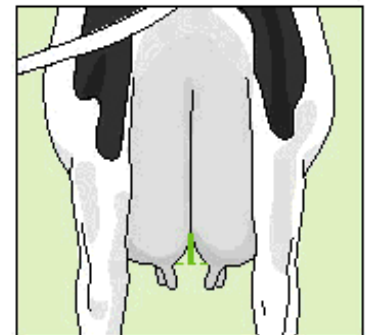
- 1 Convex to flat floor (+1 cm)
- 2 (+0.5 cm)
- 3 (+0 cm)
- 4 Slight definition (-1 cm)
- 5 (-2 cm)
- 6 (-3 cm)
- 7 Deep definition (-4 cm)
- 8 (-5 cm)
- 9 (-6 cm)



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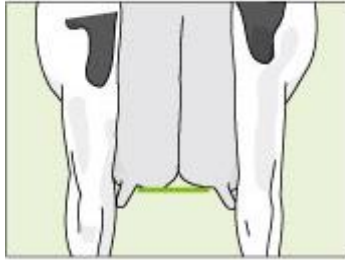
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17. Rear Teat Position

Ref. Point: The position of the rear teat from centre of quarter.

- 1 – 2 Outside
- 4 Mid point
- 7 – 9 Inside of quarter (8= touching, 9=crossing)

Reference scale: to obtain population distribution it is recommended that 4 represents mid point of the quarter



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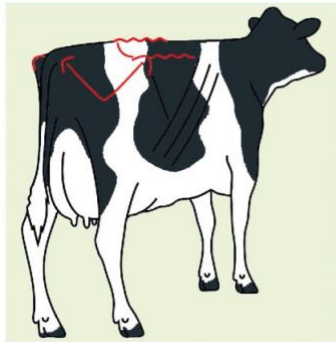
18. Body Condition Score

The covering of fat over the tail head and rump, not a true linear trait.

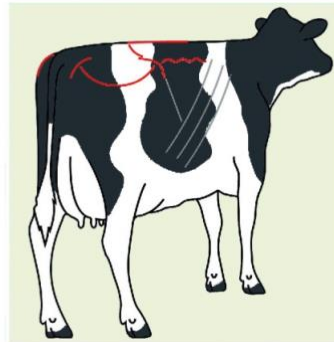
Ref. Point:

- 1 – 3 Poor
- 4 – 6 Intermediate
- 7 – 9 Grossly fat

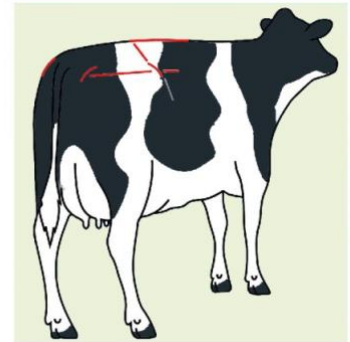
The loin is the main area to observe for scores 1-6, while the tail implant is important with the higher score (7 – 9)



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5. Genetic correlation

The average genetic correlation between countries for 21 traits, as analysed by Interbull. An average correlation is based on the average correlation one country has with all other countries.

Traits	Average correlation											
	May 2001	May 2002	Nov 2003	Sept 2005	Sept 2007	Jan 2010	Aug 2012	April 2014	Dec 2015	Apr 2018	Aug 2022	Dec 2023
Stature	0.89	0.92	0.91	0.92	0.92	0.91	0.91	0.90	0.90	0.91	0.91	0.91
Chest width	0.76	0.79	0.79	0.80	0.79	0.80	0.78	0.76	0.76	0.79	0.78	0.78
Body depth	0.75	0.79	0.80	0.82	0.81	0.81	0.81	0.81	0.80	0.82	0.81	0.81
Angularity	0.76	0.78	0.76	0.78	0.77	0.75	0.74	0.73	0.72	0.75	0.73	0.72
Rump angle	0.93	0.94	0.94	0.95	0.95	0.94	0.94	0.93	0.93	0.93	0.93	0.92
Rump width	0.75	0.83	0.84	0.84	0.84	0.87	0.87	0.86	0.86	0.87	0.86	0.85
Rear leg set side view	0.82	0.85	0.84	0.85	0.85	0.84	0.83	0.82	0.82	0.84	0.82	0.82
Rear leg rear view	0.77	0.79	0.76	0.76	0.74	0.74	0.74	0.72	0.72	0.72	0.70	0.70
Foot angle	0.57	0.68	0.66	0.68	0.72	0.74	0.73	0.72	0.73	0.75	0.75	0.74
Fore udder	0.74	0.79	0.80	0.83	0.84	0.83	0.83	0.79	0.78	0.80	0.78	0.78
Rear udder height	0.74	0.81	0.82	0.84	0.85	0.82	0.82	0.80	0.80	0.82	0.80	0.80
Central ligament	0.77	0.80	0.78	0.80	0.81	0.78	0.77	0.75	0.75	0.76	0.74	0.74
Udder depth	0.90	0.94	0.95	0.96	0.96	0.97	0.96	0.94	0.93	0.94	0.92	0.92
Teat placement	0.89	0.92	0.91	0.94	0.93	0.93	0.93	0.92	0.91	0.92	0.91	0.91
Teat length	0.96	0.96	0.95	0.96	0.96	0.94	0.94	0.94	0.94	0.94	0.93	0.93
Rear teat placement	--	--	0.96	0.96	0.96	0.90	0.89	0.91	0.92	0.94	0.92	0.92
Locomotion	--	--	--	--	--	0.72	0.66	0.65	0.65	0.64	0.64	0.64
Body condition	--	--	--	--	--	0.77	0.80	0.83	0.85	0.85	0.86	0.86
Overall conformation	0.67	0.73	0.70	0.73	0.75	0.74	0.74	0.70	0.70	0.74	0.69	0.68
Overall udder	0.74	0.77	0.76	0.78	0.81	0.81	0.80	0.77	0.77	0.79	0.79	0.79
Overall feet & legs	0.60	0.67	0.67	0.69	0.69	0.69	0.69	0.65	0.67	0.68	0.66	0.66
Number of countries/groups	18	18	22	19	20	20	22	25	24	23	24	24

6. Where do we go from here?

The working group had a very good workshop with more than 50 participants from all over the world in Cremona Italy. It was inspiring for all classifiers. During the workshop it was clear that scoring the linear traits was in line among all classifiers. A list with six extra linear traits was discussed which are scored by a large number of organizations, besides the 18 standard WHFF linear traits. To support the harmonization of linear traits, the working group presented a list of six traits with their description in wording and pictures. Two of them, front feet orientation and udder balance, were proposed to become part of the official list of WHFF linear traits. The next step is that the board of WHFF confirms this.

A list of conformation defects was presented, based on a survey carried out among the members. A document will be made available with descriptions and pictures to facilitate further harmonization on these defects for those organizations which want to score conformation defects.

During the next workshop attention is paid to show the importance of removing scores based on former definitions of a trait, from the genetic evaluation to improve the conversion of proofs between countries in the Interbull MACE evaluations.

The next workshop will be in Hungary in 2026, hosted by the Hungarian Holstein Association.

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World Holstein Friesian Federation website: <http://www.whff.info/>