

# Overview of all bases for breeding values

## ▪ Introduction

This document describes the situation since April 2024, which bases are used, which base differences do exist, and which animals are published on which base.

## ▪ Definition of the four bases

On which base the breeding values of an animal are presented depends on the breed and colour of the animal. Starting April 2015, the name Black & White base has been replaced by Milk goal Black. The Red & White base is now called Milk goal Red, and local base was changed to Dual Purpose. Besides that, a new base has been added to the existing bases, this is the Belgian Blue base.

For traits like milk production, somatic cell count, conformation, milking speed, temperament, fertility, calving ease, beef traits, udder health, urea, persistency, rate of maturity, automatic milking traits, calf survival, claw health and longevity, breeding values are estimated simultaneously for cows and bulls using an animal model. For breeding values estimated with an animal model the following base definitions are used:

### *Milk goal Black (Z)*

Herd book-registered cows born in 2019 with at least 87.5% HF-blood and up to 12.5% FH-blood and hair colour black pied, with at least one observation in the genetic evaluation.

### *Milk goal Red (R)*

Herd book-registered cows born in 2019 with at least 87.5% HF-blood and up to 12.5% MRY-blood and hair colour red pied, with at least one observation in the genetic evaluation.

### *Dual purpose (D)*

Herd book-registered cows born in 2019 with at least 75% MRIJ-blood and 25% or less HF blood, with at least one observation in the genetic evaluation.

### *Belgian Blue (B)*

Herd book-registered cows born in 2019 with at least 87.5% Belgian Blue-blood, with at least one observation in the genetic evaluation.

An observation in the genetic evaluation can be:

Milk production:	test day record
Somatic cell count:	test day record
Urea:	test day record
Conformation:	classification
Milking speed:	a score
Temperament:	a score
Claw health:	a score for a claw disorder
Fertility:	an observation for one of the fertility traits
Beef index:	slaughter record
Udder health:	an observation for one of the udder health traits
Automatic Milking:	an observation for one of the automatic milking traits
Calf survival:	an observation

The Belgian Blue base is only determined by Belgian Blue animals for fertility, calving ease traits and beef index. For all other traits, the base formed by the Dual-purpose animals is used as reference.

The animals forming the Milk goal Black base determine the standard deviation for all bases, for all traits where cows determine the base and the breeding value of a trait is expressed as a relative breeding value. The advantage is that only a difference in level exists between bases and no difference in standard deviation.

**Table 1.** Overview of bases used for different traits.

Trait	Cow base prodgoal black	Cow base prodgoal red	Cow base Dual purpose	Cow base BBL
NVI	*	*	*	
Milk production	*	*	*	
Conformation	*	*	*	
Longevity	*	*	*	
Calving traits	*	*	*	*
Liveability	*	*	*	
Fertility	*	*	*	*
Somatic cell count	*	*	*	
Udder health	*	*	*	
Milking speed	*	*	*	
Temperament	*	*	*	
Beef index	*	*	*	*
Bodyweight	*	*	*	
Urea	*	*	*	
Calf survival	*	*	*	
AMS traits	*	*	*	
Claw health	*	*	*	
Lifetime production-index	*	*	*	
Feed intake	*	*	*	
Reproduction disorders	*	*	*	
Metabolic disorders	*	*	*	
Resilience	*	*	*	

## ▪ Base differences per April 2024

For all traits for which breeding values are published, differences in bases exist. In Table 2 the differences between the four bases are shown.

**Note.** The NVI is not in this Table. This is because of the differences in the formulas used to calculate these traits between different bases. The differences are therefore only to be calculated using the underlying formulas of the traits per base (see relevant E-chapter). Unknown base differences are indicated with ‘-’.

**Table 2.** Base differences between Milk goal Black (B), Milk goal Red (R), Dual purpose (D) and Belgian blue (B).

Trait	kind base <sup>(1)</sup>	Base difference <sup>(2)</sup>					
		Z=>R	Z=>D	Z=>B	R=>D	R=>B	D=>B
Milk production							
Overall							
Kg milk	C	552	2163	2163	1611	1611	0
Kg fat	C	12	78	78	66	66	0
Kg protein	C	13	64	64	51	51	0

Kg lactose	C	26	97	97	71	71	0
% fat <sup>(4)</sup>	C	-0.14	-0.21	-0.21	-0.07	-0.07	0
% protein <sup>(4)</sup>	C	-0.08	-0.18	-0.18	-0.10	-0.10	0
% lactose <sup>(4)</sup>	C	0.01	-0.04	-0.04	-0.05	-0.05	0
INET <sup>(4)</sup>	C	86	455	455	369	369	0
Lactation 1							
Kg milk	C	513	1861	1861	1348	1348	0
Kg fat	C	11	64	64	53	53	0
Kg protein	C	12	54	54	42	42	0
Kg lactose	C	24	84	84	60	60	0
% fat <sup>(4)</sup>	C	-0.16	-0.26	-0.26	-0.11	-0.11	0
% protein <sup>(4)</sup>	C	-0.09	-0.19	-0.19	-0.11	-0.11	0
% lactose <sup>(4)</sup>	C	0.00	-0.04	-0.04	-0.05	-0.05	0
INET <sup>(4)</sup>	C	80	381	381	302	302	0
Lactation 2							
Kg milk	C	593	2300	2300	1707	1707	0
Kg fat	C	13	81	81	68	68	0
Kg protein	C	14	70	70	56	56	0
Kg lactose	C	27	103	103	76	76	0
% fat <sup>(4)</sup>	C	-0.15	-0.25	-0.25	0.00	0.00	0
% protein <sup>(4)</sup>	C	-0.09	-0.18	-0.18	-0.03	-0.03	0
% lactose <sup>(4)</sup>	C	0.00	-0.09	-0.09	-0.03	-0.03	0
INET <sup>(4)</sup>	C	93	488	488	395	395	0
Lactation 3							
Kg milk	C	587	2377	2377	1790	1790	0
Kg fat	C	12	87	87	75	75	0
Kg protein	C	13	70	70	57	57	0
Kg lactose	C	28	107	107	79	79	0
% fat <sup>(4)</sup>	C	-0.15	-0.20	-0.20	-0.05	-0.05	0
% protein <sup>(4)</sup>	C	-0.09	-0.19	-0.19	-0.10	-0.10	0
% lactose <sup>(4)</sup>	C	-0.05	-0.10	-0.10	-0.03	-0.03	0
INET <sup>(4)</sup>	C	87	502	502	415	415	0
Lactation 4							
Kg milk	C	545	2304	2304	1759	1759	0
Kg fat	C	11	87	87	76	76	0
Kg protein	C	12	67	67	55	55	0
Kg lactose	C	26	104	104	78	78	0
% fat <sup>(4)</sup>	C	-0.14	-0.15	-0.15	-0.02	-0.02	0
% protein <sup>(4)</sup>	C	-0.08	-0.18	-0.18	-0.10	-0.10	0
% lactose <sup>(4)</sup>	C	0.02	-0.01	-0.01	-0.02	-0.02	0
INET <sup>(4)</sup>	C	80	489	489	409	409	0
Lactation 5							
Kg milk	C	510	2163	2163	1653	1653	0
Kg fat	C	10	83	83	73	73	0
Kg protein	C	11	62	62	51	51	0
Kg lactose	C	24	97	97	73	73	0
% fat <sup>(4)</sup>	C	-0.13	-0.12	-0.12	0.01	0.01	0
% protein <sup>(4)</sup>	C	-0.07	-0.18	-0.18	-0.01	-0.01	0
% lactose <sup>(4)</sup>	C	0.01	-0.11	-0.11	-0.02	-0.02	0
INET <sup>(4)</sup>	C	73	458	458	384	384	0
Maturity	C	0	0	0	0	0	0
Persistency	C	1	0	0	-1	-1	0
Persistency, lactation 1	C	1	2	2	1	1	0
Persistency, lactation 2	C	1	2	2	1	1	0
Persistency, lactation 3	C	1	2	2	1	1	0
Persistency, lactation 4	C	1	2	2	1	1	0
Persistency, lactation 5	C	1	2	2	1	1	0
<b>Conformation</b>							
Stature	C	3	14	14	11	11	0

Chest width	C	1	-6	-6	-7	-7	0
Body depth	C	3	11	11	8	8	0
Angularity	C	3	17	17	14	14	0
Condition score	C	-2	-11	-11	-9	-9	0
Rump angle	C	0	-7	-7	-7	-7	0
Rump width	C	1	2	2	1	1	0
Rear legs rear view	C	0	2	2	2	2	0
Rear legs side view	C	1	0	0	-1	-1	0
Foot angle	C	0	1	1	1	1	0
Front feet orientation	C	0	-3	-3	-3	-3	0
Locomotion	C	1	4	4	3	3	0
Fore udder attachment	C	0	12	12	12	12	0
Front teat placement	C	1	10	10	9	9	0
Teat length	C	1	0	0	-1	-1	0
Udder depth	C	1	12	12	11	11	0
Rear udder height	C	2	17	17	15	15	0
Central ligament	C	2	9	9	7	7	0
Rear teat placement	C	1	8	8	7	7	0
Udder balance	C	1	10	10	9	9	0
Frame <sup>(4)</sup>	C	2	-	-	-	-	0
Dairy strength <sup>(4)</sup>	C	1	-	-	-	-	0
Udder <sup>(4)</sup>	C	1	-	-	-	-	0
Feet and legs <sup>(4)</sup>	C	1	-	-	-	-	0
Muscularity <sup>(3) (4)</sup>	C	-	-	-	-	-	0
Overall conformation <sup>(4)</sup>	C	2	-	-	-	-	0
Longevity							
Longevity	C	80	490	490	410	410	0
Calving traits							
Overall index							
Calving index	0	1	6	1	6	5	0
Calving ease	0	2	67	2	67	65	0
Maternal calving ease	1	1	-4	0	-5	-5	1
Gestation length	-1	-2	-7	-1	-6	-5	-1
Gestation length maternal	1	3	12	2	11	9	1
Birth weight	0	0	-61	0	-61	-61	0
Birth weight maternal	1	3	12	2	11	9	1
Vitality	-2	1	1	3	3	0	-2
Vitality maternal	1	0	0	-1	-1	0	1
Heifers – parity =1							
Calving ease	0	2	67	2	67	65	0
Maternal calving ease	1	1	-4	0	-5	-5	1
Gestation length	-1	-2	-7	-1	-6	-5	-1
Gestation length maternal	1	3	12	2	11	9	1
Birth weight	0	0	-61	0	-61	-61	0
Birth weight maternal	1	3	12	2	11	9	1
Vitality	-2	1	1	3	3	0	-2
Vitality maternal	1	0	0	-1	-1	0	1
Cows – parity >1							
Calving ease	C	0	2	55	2	55	53
Maternal calving ease	C	1	3	49	2	48	46
Gestation length	C	-1	-1	-9	0	-8	-8
Gestation length maternal	C	1	1	9	0	8	8
Birth weight	C	0	-1	-42	-1	-42	-41
Birth weight maternal	C	0	0	-14	0	-14	-14
Vitality	C	-1	4	4	5	5	0
Vitality maternal	C	0	0	0	0	0	0
Fertility							
Overall							
FERT index <sup>(4)</sup>	C	0	-1	6	-1	6	7

Non return	C	-1	-4	1	-3	2	5
Interval calving-1 <sup>st</sup> insemination	C	0	-3	0	-3	0	3
Calving interval	C	-1	-4	3	-3	4	7
Interval 1 <sup>st</sup> -last insemination	C	-1	-3	4	-2	5	7
Open days	C	-1	-3	3	-2	4	6
Conception rate	C	0	-1	6	-1	6	7
Conception rate heifers	C	1	3	9	2	8	6
Age at 1 <sup>st</sup> insemination heifers	C	1	12	42	11	41	30
<b>Lactation 1</b>							
Non return	C	-1	-3	0	-2	1	3
Interval calving-1 <sup>st</sup> insemination	C	-1	-3	2	-2	3	5
Calving interval	C	-1	-4	4	-3	5	8
Interval 1 <sup>st</sup> -last insemination	C	0	-2	4	-2	4	6
Conception rate	C	0	0	6	0	6	6
<b>Lactation 2</b>							
Non return	C	-1	-4	1	-3	2	5
Interval calving-1 <sup>st</sup> insemination	C	0	-3	-1	-3	-1	2
Calving interval	C	-1	-4	2	-3	3	6
Interval 1 <sup>st</sup> -last insemination	C	-1	-3	3	-2	4	6
Conception rate	C	-1	-1	6	0	7	7
<b>Lactation 3</b>							
Non return	C	-1	-4	3	-3	4	7
Interval calving-1 <sup>st</sup> insemination	C	0	-2	-2	-2	-2	0
Calving interval	C	-1	-4	2	-3	3	6
Interval 1 <sup>st</sup> -last insemination	C	-1	-3	4	-2	5	7
Conception rate	C	-1	-2	7	-1	8	9
<b>Somatic cell count</b>							
Somatic cell count	C	1	3	3	2	2	0
Somatic cell count, lactation 1	C	1	3	3	2	2	0
Somatic cell count, lactation 2	C	1	3	3	2	2	0
Somatic cell count, lactation 3	C	0	3	3	3	3	0
Somatic cell count, lactation 4	C	0	3	3	3	3	0
Somatic cell count, lactation 5	C	0	3	3	3	3	0
<b>Udder health</b>							
Udder health <sup>(4)</sup>	C	-1	1	1	2	2	0
Clinical mastitis	C	0	4	4	4	4	0
Sub-clinical mastitis	C	-1	-1	-1	0	0	0
<b>Milking speed</b>							
Milking speed	C	0	0	0	0	0	0
<b>Temperament</b>							
Temperament	C	-1	0	0	1	1	0
<b>Beef index</b>							
Beef index	C	0	-7	-33	-7	-33	-26
Fleshiness cows	C	-3	-21	-119	-18	-116	-98
Fat covering cows	C	3	7	-2	4	-5	-9
Carcass weight cows	C	0	-4	-53	-4	-53	-49
Fleshiness veal calves	C	-1	-16	-65	-15	-64	-49
Fat covering veal calves	C	1	3	-11	2	-12	-14
Growth veal calves	C	0	-4	-14	-4	-14	-10
Meat colour veal calves	C	0	1	-4	1	-4	-5
Fleshiness beef bulls	C	-1	-15	-70	-14	-69	-55
Fat covering beef bulls	C	1	1	-15	0	-16	-16
Growth beef bulls	C	0	-5	-30	-5	-30	-25
<b>Body weight</b>							
Body weight	C	1	-2	-2	-3	-3	0
<b>Urea</b>							
Urea	C	1	-6	-6	-7	-7	0
Urea, lactation 1	C	1	-6	-6	-7	-7	0
Urea, lactation 2	C	1	-6	-6	-7	-7	0

Urea, lactation 3	C	1	-6	-6	-7	-7	0
Urea, lactation 4	C	0	-6	-6	-6	-6	0
Urea, lactation 5	C	0	-5	-5	-5	-5	0
Calf survival							
Calf survival 3-365	C	-1	2	2	3	3	0
Calf survival 3-14	C	-2	-2	-2	0	0	0
Calf survival 15-180	C	0	3	3	3	3	0
AMS traits							
Efficiency	C	1	2	2	1	1	0
Milking interval	C	0	9	9	9	9	0
Habituation of heifers	C	-1	-6	-6	-5	-5	0
Claw health							
Claw health	C	0	-1	-1	-1	-1	0
Sole haemorrhage	C	1	-1	-1	-2	-2	0
Digital Dermatitis	C	0	-1	-1	-1	-1	0
Interdigital Dermatitis	C	-1	-2	-2	-1	-1	0
Sole ulcer	C	0	1	1	1	1	0
Interdigital Hyperplasia	C	0	3	3	3	3	0
White line defect	C	0	2	2	2	2	0
Life production-index							
Kg milk	C	4639	24219	24219	18396	18396	0
Kg fat	C	152	941	941	755	755	0
Kg protein	C	132	789	789	627	627	0
INET	C	923	5540	5540	4406	4406	0
Dry matter intake							
DMI, lactation 1	C	0.38	2.56	2.56	2.18	2.18	0
DMI, lactation 2	C	0.44	2.85	2.85	2.41	2.41	0
DMI, lactation 3	C	0.48	3.12	3.12	2.64	2.64	0
DMI with predictors	C	0.43	2.80	2.80	2.37	2.37	0
Saved feed for maintenance <sup>(4)</sup>	C	0.17	0.29	0.29	0.12	0.12	0
Saved feed cost for maintenance <sup>(4)</sup>	C	10	17	17	7	7	0
Reproduction disorders							
Retained placenta	C	-1	0	0	1	1	0
Endometritis	C	1	1	1	0	0	0
Metritis	C	0	0	0	0	0	0
Cystic ovaries	C	2	1	1	-1	-1	0
Anoestrus	C	0	2	2	2	2	0
Index reproduction disorders	C	1	1	1	0	0	0
Metabolic disorders							
Milk fever	C	0	0	0	0	0	0
Clinical ketosis	C	-1	-3	-3	-2	-2	0
Subclinical ketosis	C	-1	-5	-5	-4	-4	0
Resilience							
Resilience index	C	-2	-6	-6	-4	-4	0
Recovery	C	0	-1	-1	-1	-1	0
Stability	C	-3	-7	-7	-4	-4	0
		<b>Z=&gt;R</b>	<b>Z=&gt;D</b>	<b>Z=&gt;B</b>	<b>R=&gt;D</b>	<b>R=&gt;B</b>	<b>D=&gt;B</b>

(1) C=cow base, B=bull base

(2) Z=Milk goal Black, R=Milk goal Red, D=Dual purpose, B=Belgian Blue

(3) Muscularity is only published on Dual purpose and Belgian Blue base.

(4) For the conversion of these trait first the underlying traits are converted, then the formula to derive the trait must be applied. The given base differences are an indication and only hold for the total population (not for an individual animal).

When converting indexes like INET, overall conformation traits, fertility index, calving index, and udder health index, first the underlying traits are converted before applying the formula for the index.

For the conversion of fat, protein, and lactose percentage, first the breeding values for milk yield, fat yield, protein yield and lactose yield are converted before applying the formula:

$$F_{\%fat} = \frac{F_{kgf} * 100 - F_{kgm} * P_{\%fat}}{F_{kgm} + P_{kgm}}$$

$$F_{\%protein} = \frac{F_{kgp} * 100 - F_{kgm} * P_{\%protein}}{F_{kgm} + P_{kgm}}$$

$$F_{\%lactose} = \frac{F_{kgl} * 100 - F_{kgm} * P_{\%lactose}}{F_{kgm} + P_{kgm}}$$

in which:

- P = average production of the base animals for the given traits;
- F = breeding value: kg milk, kg fat, kg protein or kg lactose, % fat, % protein or % lactose.

Values for P and F can be found in Table 6 in e-chapter 'Milkproduction'.

Base differences mentioned in Table 2 for INET, overall conformation traits, fertility index, calving index, udder health index, fat and protein percentage are an indication and should not be used to convert breeding values of animals from one base to the other.

### ▪ Which breeds on which base?

On which base breeding values of an animal are published depends on its breed composition and with some breeds also on the hair colour. When determining the base for an animal the following rules are used:

An animal is published on the Milk goal Black base:

- Black & White Holstein possessing at least 5/8 Holstein genes.

An animal is published on the Milk goal Red base:

- An animal belongs to a dairy breed and has a minimum of 62.5% genes of the following breeds: Red HF (If HF, coat colour red), RDC (=ZRB, NRB, DR, GUS, AYS, ANG), BSW, Jersey, Milking Shorthorn, Normande, Montbeliarde.

An animal is published on the Belgian Blue base:

- Animals with 5/8 Belgian Blue and/or West Flemish Beef breed and/or Verbeterd Roodbont.

All other animals are published on the dual-purpose base.

Table 3 shows which breed is published on which base. For a dairy breed it is possible that an animal is published on Milk goal Black base or on Milk goal Red base. This depends on the hair colour of the animal.

**Table 3.** Bases for publication of breeding values for different breeds. B= Milk goal Black, R= Milk goal Red, D= Dual Purpose, B= Belgian Blue.

Nr	Breed	Breed code	Basis
10	Dutch Friesian	FH	D

Nr		Breed code	Basis
11	Holstein Friesian	HF	Z,R
12	British Friesian	BF	D
13	New Zealand Friesian	NF	D
14	Friesian Red Pied	FR	D
19	Friesian Other	OF	D
20	Witrik	WR	D
21	Lakenvelder (Belted)	LV	D
22	Brand rood	BRR	D
24	Other dairy type	OM	D
25	Maas Rijn IJssel	MRY	D
26	Fleck Vieh	FLV	D
27	Brown Swiss	BS	R
28	Ayrshire	AYS	R
29	Guernsey	GUS	R
30	Swedish Red Pied	ZRB	R
31	Norwegian Red Pied	NRB	R
32	Danish Red Pied	DR	R
33	Belgian Red Pied	BR	D
35	Other Red Pied	OD	D
36	Glan Donnersberg	GDB	D
40	Blaarkop (Groninger)	G	D
41	Angler	ANG	R
42	Jersey	JER	R
43	Montbeliard	MON	R
44	Abondance	ABO	D
45	Tarentaise	TAR	D
46	Dexter	DEX	D
47	Salers	SAL	D
48	Milking Shorthorn	MSH	R
50	Pinzgauer	PIN	D
52	East Flemish White Red	BWR	D
53	West Flemish Red	BRD	D
54	Western Flanders Beef	BRV	B
55	Belgisch Blauw Mixed	WBD	D
56	Wagyu	WAG	D
57	Swedish lowlands	SLB	D
58	Kerry	KER	D
59	Garonnaise	GAR	D
60	Piemontese	PIM	D
61	Chianina	CHI	D
62	Charolais	CHL	D
63	Limousin	LIM	D
64	Belgian Blue	BBL	B
65	Aberdeen Angus	AA	D
66	Blonde d'Âquitaine	BA	D
67	Maine Anjou	MA	D
68	Romagnola	ROM	D
69	Normande	NOR	R
70	Marchigiana	MAR	D
71	Hereford	HER	D
72	Aubrac	AUB	D
73	Gasconne	GAS	D
74	Galloway	GAL	D
75	Welsh Black	WBL	D
76	Highland	HI	D
77	Devon	DEV	D
78	Dikbil	DIK	D



Nr		Breed code	Basis
79	Verbeterd Roodbont	VRB	B
80	Beef Shorthorn	BSH	D
81	Bazandaise	BAZ	D
82	Brahman	BRA	D
83	Belted Galloway	BGW	D
84	Buffelo	BUF	D
85	Simmental	SIM	D
86	Longhorn	LHO	D
87	Maraichine	MI	D
88	Parthenaise	PTN	D
89	Other beef types	OV	D
90	Unknown	ONB	D