Overview of all bases for breeding values

This document describes the situation since December 2018, which bases are used, which base differences do exist and which animals are published on which base.

1. Definition of four bases

On which base the breeding values of an animal are presented depends on the breed and colour of the animal. Starting April 2017 the name Black & White base has been replaced by Milk goal Black.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, and claw health, 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)
Herdbook-registered cows born in 2010 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)
Herdbook-registered cows born in 2010 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)
Herdbook-registered cows born in 2010 with at least 75% MRIJ-blood and 25% or less HF blood, with at least one observation in the genetic evaluation.

Belgian Blue (B)
Herdbook-registered cows born in 2010 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:	testday record
Somatic cell count:	testday record
Urea:	testday 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.

For longevity and lifetime production index, breeding values are estimated only for bulls using a sire model. For breeding values estimated with a sire model the following base definition are applied:

Milk goal Black (Z)
AI-bulls born in 2006 and 2007, having at least 87.5% HF blood and 12.5% or less FH blood, and having a colour black and white and having an official breeding value for the trait.

Milk goal Red (R)
KI-stieren die geboren zijn in 2006 en 2007 met minimaal 87,5% HF-bloed en maximaal 12,5% MRIJ-bloed en haarkleur roodbont en officiële fokwaarde hebben voor het kenmerk.

Dual purpose (D)
AI-bulls born in the period 2006 and 2007, having at least 87.5 % MRY blood and 12.5% or less HF blood, and having an official breeding value for the trait.

Every 5 year, in a year ending with 0 of 5, the base reference year is moved 5 years upwards.

Table 1. Overview of bases used for different traits

Trait	Cowbase Milk goal Black	Cowbase Milk goal Red	Cowbase Dual purpose	Cowbase Belgian Blue	Bullbase Milk goal Black	Bullbase Milk goal Red	Bullbase Dual purpose
NVI	*	*	*				
Milk production	*	*	*				
Conformation	*	*	*				
Longevity					*	*	*
Fertility	*	*	*	*			
SCS	*	*	*				
Udder health	*	*	*				
Calving ease	*	*	*	*			
Vitality	*	*	*				
Temperament	*	*	*				
Milking speed	*	*	*				
Body weight	*	*	*				
Beef index	*	*	*	*			
Urea	*	*	*				
Claw health	*	*	*				
Calf survival	*	*	*				
Automatic Milking	*	*	*				
Lifetime production index					*	*	*
Dry matter intake	*	*	*				

2. Base differences per December 2018

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 traits NVI and overall conformation traits are not in this table. This is because of the differences in the formulas used to calculate these traits between diffent bases. The differences are therefore only to be calculated using the underlying formulas of the traits per base (see relevant E-chapter).

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

Trait	kind base[1]	Base difference[2]					
		Z=>R	**Z=>D**	**Z=>B**	**R=>D**	**R=>B**	**D=>B**
Milk production							
Overall							
Kg milk	C	+582	+1932	+1932	+1350	+1350	0
Kg fat	C	+8	+63	+63	+55	+55	0
Kg protein	C	+11	+50	+50	+39	+39	0
Kg lactose	C	+26	+78	+78	+52	+52	0
% fat[4]	C	-0.21	-0.29	-0.29	-0.08	-0.08	0
% protein[4]	C	-0.11	-0.26	-0.26	-0.14	-0.14	0
% lactose[4]	C	+0.01	-0.13	-0.13	-0.11	-0.11	0
INET[4]	C	+70	+361	+361	+291	+291	0
Lactation 1							
Kg milk	C	+546	+1651	+1651	+1105	+1105	0
Kg fat	C	+9	+49	+49	+40	+40	0
Kg protein	C	+12	+42	+42	+30	+30	0
Kg lactose	C	+24	+67	+67	+43	+43	0
% fat[4]	C	-0.20	-0.36	-0.36	-0.15	-0.15	0
% protein[4]	C	-0.10	-0.27	-0.27	-0.17	-0.17	0
% lactose[4]	C	-0.01	-0.14	-0.14	-0.13	-0.13	0
INET[4]	C	+75	+295	+295	+220	+220	0
Lactation 2							
Kg milk	C	+640	+2069	+2069	+1429	+1429	0
Kg fat	C	+9	+66	+66	+57	+57	0
Kg protein	C	+13	+55	+55	+42	+42	0
Kg lactose	C	+28	+85	+85	+57	+57	0
% fat[4]	C	-0.22	-0.31	-0.31	-0.09	-0.09	0
% protein[4]	C	-0.12	-0.25	-0.25	-0.15	-0.15	0
% lactose[4]	C	+0.00	-0.12	-0.12	-0.12	-0.12	0
INET[4]	C	+81	+390	+390	+309	+309	0
Lactation 3							
Kg milk	C	+621	+2126	+2126	+1505	+1505	0
Kg fat	C	+8	+70	+70	+62	+62	0
Kg protein	C	+12	+55	+55	+43	+43	0
Kg lactose	C	+27	+87	+87	+60	+60	0
% fat[4]	C	-0.21	-0.25	-0.25	-0.04	-0.04	0
% protein[4]	C	-0.11	-0.25	-0.25	-0.14	-0.14	0
% lactose[4]	C	+0.00	-0.10	-0.10	-0.10	-0.10	0
INET[4]	C	+74	+399	+399	+325	+325	0
Lactation 4							
Kg milk	C	+560	+2019	+2019	+1459	+1459	0
Kg fat	C	+7	+69	+69	+62	+62	0
Kg protein	C	+10	+51	+51	+41	+41	0
Kg lactose	C	+25	+83	+83	+58	+58	0
% fat[4]	C	-0.20	-0.21	-0.21	-0.01	-0.01	0

% protein[4]	C	-0.10	-0.24	-0.24	-0.15	-0.15	0
% lactose[4]	C	+0.00	-0.09	-0.09	-0.10	-0.10	0
INET[4]	C	+63	+379	+379	+316	+316	0
Lactation 5							
Kg milk	C	+496	+1990	+1990	+1494	+1494	0
Kg fat	C	+5	+70	+70	+65	+65	0
Kg protein	C	+8	+50	+50	+42	+42	0
Kg lactose	C	+23	+80	+80	+57	+57	0
% fat[4]	C	-0.19	-0.19	-0.19	+0.01	+0.01	0
% protein[4]	C	-0.11	-0.27	-0.27	-0.16	-0.16	0
% lactose[4]	C	+0.01	-0.08	-0.08	-0.08	-0.08	0
INET[4]	C	+50	+376	+376	+326	+326	0
Maturity	C	-2	+1	+1	+3	+3	0
Persistency	C	+3	+1	+1	-2	-2	0
Persistency, lactation 1	C	+2	+1	+1	-1	-1	0
Persistency, lactation 2	C	+3	+1	+1	-2	-2	0
Persistency, lactation 3	C	+3	+1	+1	-3	-3	0
Persistency, lactation 4	C	+4	+1	+1	-2	-2	0
Persistency, lactation 5	C	+4	+1	+1	-3	-3	0
Conformation							
Stature	C	2	12	12	10	10	0
Chest width	C	0	-7	-7	-7	-7	0
Body depth	C	1	8	8	7	7	0
Angularity	C	2	16	16	14	14	0
Condition score	C	-3	-13	-13	-10	-10	0
Rump angle	C	-1	-8	-8	-7	-7	0
Rump width	C	1	0	0	-1	-1	0
Rear legs rear view	C	0	0	0	0	0	0
Rear legs side view	C	1	2	2	1	1	0
Foot angle	C	0	-3	-3	-3	-3	0
Locomotion	C	0	1	1	1	1	0
Fore udder attachment	C	1	10	10	9	9	0
Front teat placement	C	0	8	8	8	8	0
Teat length	C	2	-2	-2	-4	-4	0
Udder depth	C	1	9	9	8	8	0
Rear udder height	C	2	17	17	15	15	0
Central ligament	C	2	9	9	7	7	0
Rear teat placement	C	2	8	8	6	6	0
Muscularity[3]	C	0	0	0	0	0	0
Longevity							
Longevity	B	50	280	280	230	230	0
Calving traits							
Overall index							
Calving index	C	0	1	1	1	1	0
Calving ease	C	0	-1	49	-1	49	50
Maternal calving process	C	1	1	7	0	6	6
Gestation length	C	-2	-1	-4	1	-2	-3
Gestation length maternal	C	-1	-1	4	0	5	5
Birth weight	C	0	2	-46	2	-46	-48
Birth weigth maternal	C	1	1	19	0	18	18
Vitality	C	-2	0	0	2	2	0
Vitality maternal	C	1	-2	-2	-3	-3	0
Heifers – parity =1							
Calving ease	C	0	-1	49	-1	49	50
Maternal calving process	C	1	1	7	0	6	6
Gestation length	C	-2	-1	-4	1	-2	-3
Gestation length maternal	C	-1	-1	4	0	5	5
Birth weight	C	0	2	-46	2	-46	-48
Birth weigth maternal	C	1	1	19	0	18	18

Vitality	C	-2	0	0	2	2	0
Vitality maternal	C	1	-2	-2	-3	-3	0
Cows – parity >1							
Calving ease	C	0	0	55	0	55	55
Maternal calving process	C	1	0	32	-1	31	32
Gestation length	C	-1	0	-6	1	-5	-6
Gestation length maternal	C	-1	-1	9	0	10	10
Birth weight	C	-1	-1	-39	0	-38	-38
Birth weigth maternal	C	0	0	9	0	9	9
Vitality	C	0	2	2	2	2	0
Vitality maternal	C	0	-2	-2	-2	-2	0
Fertility							
Overall							
FERT index[4]	C	-1	-7	-1	-6	0	6
Non return	C	-2	-4	2	-2	4	6
Interval afkalven-1e inseminatie	C	0	-5	-4	-5	-4	1
Calving interval	C	-1	-7	-2	-6	-1	5
Interval 1st-last insemination	C	-1	-7	0	-6	1	7
Pregnancy percentage	C	-1	-3	5	-2	6	8
Pregnancy percentage heifers	C	-1	2	9	3	10	7
Age at 1st insemination heifers	C	0	9	36	9	36	27
Lactation 1							
Non return	C	-1	-4	1	-3	2	5
Interval afkalven-1e inseminatie	C	-1	-6	-1	-5	0	5
Calving interval	C	-1	-7	0	-6	1	7
Interval 1st-last insemination	C	-1	-6	0	-5	1	6
Pregnancy percentage	C	-1	-3	5	-2	6	8
Lactation 2							
Non return	C	-2	-3	4	-1	6	7
Interval afkalven-1e inseminatie	C	0	-5	-5	-5	-5	0
Calving interval	C	-1	-7	-3	-6	-2	4
Interval 1st-last insemination	C	-2	-8	-1	-6	1	7
Pregnancy percentage	C	-1	-3	6	-2	7	9
Lactation 3							
Non return	C	-2	-4	3	-2	5	7
Interval afkalven-1e inseminatie	C	0	-5	-7	-5	-7	-2
Calving interval	C	-1	-7	-4	-6	-3	3
Interval 1st-last insemination	C	-2	-7	-1	-5	1	6
Pregnancy percentage	C	-1	-3	4	-2	5	7
Somatic cell count							
Somatic cell count	C	0	-1	-1	-1	-1	0
Somatic cell count, lactation 1	C	0	0	0	0	0	0
Somatic cell count, lactation 2	C	0	-1	-1	-1	-1	0
Somatic cell count, lactation 3	C	+1	0	0	-1	-1	0
Somatic cell count, lactation 4	C	+1	0	0	-1	-1	0
Somatic cell count, lactation 5	C	+1	0	0	-1	-1	0
Udder health							
Udder health[4]	C	-2	-1	-1	1	1	0
Clinical mastitis	C	-1	0	0	1	1	0
Sub-clinical mastitis	C	-2	-2	-2	0	0	0
Milking speed							
Milking speed	C	1	-2	-2	-3	-3	0
Temperament							
Temperament	C	0	0	0	0	0	0
Beef index							
Beef index	C	0	-7	-37	-7	-37	-30
Fleshiness cows	C	-3	-21	-117	-18	-114	-96
Fat covering cows	C	3	7	0	4	-3	-7
Carcass weight cows	C	-1	-5	-54	-4	-53	-49

Fleshiness veal calves	C	-1	-17	-70	-16	-69	-53
Fat covering veal calves	C	1	3	-12	2	-13	-15
Growth veal calves	C	0	-4	-15	-4	-15	-11
Meat colour veal calves	C	0	1	-4	1	-4	-5
Fleshiness beef bulls	C	-1	-14	-70	-13	-69	-56
Fat covering beef bulls	C	1	1	-13	0	-14	-14
Growth beef bulls	C	0	-6	-31	-6	-31	-25
Body weight							
Body weight	C	0	-3	-3	-3	-3	0
Urea							
Urea	C	-0.2	-0.7	-0.7	-0.5	-0.5	0
Urea, lactation 1	C	-0.2	-0.7	-0.7	-0.5	-0.5	0
Urea, lactation 2	C	-0.2	-0.6	-0.6	-0.4	-0.4	0
Urea, lactation 3	C	-0.2	-0.7	-0.7	-0.5	-0.5	0
Urea, lactation 4	C	-0.2	-0.6	-0.6	-0.4	-0.4	0
Urea, lactation 5	C	-0.2	-0.7	-0.7	-0.5	-0.5	0
Calf survival							
Calf survival 3-365	C	0	4	4	4	4	0
Calf survival 3-14	C	-1	-1	-1	0	0	0
Calf survival 15-180	C	1	2	2	1	1	0
Automatic milking							
Efficiency	C	3	2	2	-1	-1	0
Milking interval	C	2	9	9	7	7	0
Habituation of heifers	C	-2	-4	-4	-2	-2	0
Claw health							
Claw health	C	0	-3	-3	-3	-3	0
Sole haemorrhage	C	1	-1	-1	-2	-2	0
Digital Dermatitis	C	1	-2	-1	-3	-3	0
Interdigital Dermatitis	C	-1	-4	-4	-3	-3	0
Sole ulcer	C	0	-2	-2	-2	-2	0
Interdigital Hyperplasia	C	1	2	2	1	1	0
White line defect	C	-3	0	0	3	3	0
Levensproductie-index							
Kg milk	B	4357	12458	12458	8101	8101	0
Kg fat	B	122	442	442	320	320	0
Kg protein	B	122	371	371	249	249	0
Kg lactose	B	199	556	556	357	357	0
INET	B	816	2616	2616	1800	1800	0
Dry matter intake							
DMI, lactation 1	C	0.35	2.31	2.31	1.96	1.96	0
DMI, lactation 2	C	0.43	2.60	2.60	2.17	2.13	0
DMI, lactation 3	C	0.46	2.72	2.72	2.26	2.26	0
Saved feed for maintenance	C	0	0	0	0	0	0
Saved feed cost for maintenance	C	0	0	0	0	0	0

(1) C=cowbase, B=bullbase
(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 has to 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, 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 and factors mentioned in chapter E7, description of het genetic evaluation for milk production traits.

Base differences mentioned in table 2 for INET, 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.

3. **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 62.5% 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.

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 anima.

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		Rascode	Basis
10	Dutch Friesian	FH	D
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

Nr		Rascode	Basis
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'Áquitaine	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
79	Verbeterd Roodbont	VRB	D
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	Onbekend	ONB	D