Understanding Type ABVs
Technote #2 (updated December 2020)

HIGHLIGHTS

- DataGene publishes Type ABVs for 24 linear traits and five composite traits.
- The composite traits are: Overall Type, Mammary System, Feet & Legs, Rump and Dairy Strength.
- Breed organisations set the trait ideals and weightings (relative emphasis in composites) for type ABVs.
- For Type ABVs, the average is 100 and one standard deviation is set to 5.
- To improve type composites, use bulls with ABVs more than 100.
- For individual Type ABVs, consider the ideal for that trait, the average linear for that trait, and the direction for breeding.

Type – or conformation – affects a cow's functional performance in the dairy herd, so many dairy farmers consider type in their breeding decisions. Australian Breeding Values (ABVs) for type are a tool for breeding for improved type.

Breeding for improved type
DataGene publishes ABVs for 24 individual type traits, which are sometimes referred to as 'linears'.

Dairy farmers are often more interested in a group of traits which combine to affect a cow's functional performance in the herd. An ABV based on a combination of traits is referred to as a 'composite' trait. DataGene publishes ABVs for five composite type traits: Overall Type, Mammary System, Feet & Legs, Dairy Strength and Rump.

At this stage, the only composites published for Jerseys are Mammary System and Overall Type.

There are some variations in the composites provided to each breed as a result of differences in classification systems.

Composite type traits in Australian dairy cows

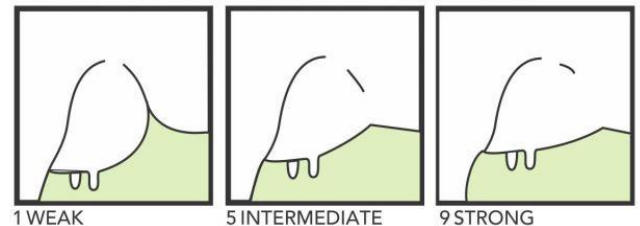Dairy Strength · Feet & Legs · Mammary System · Rump
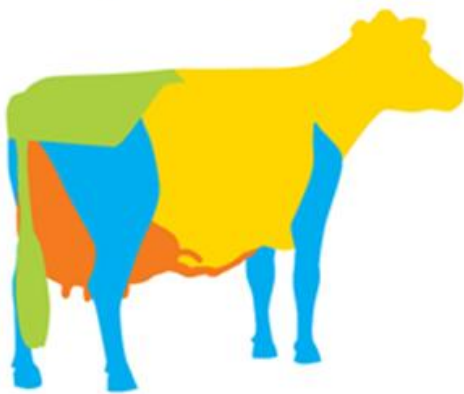
Using Type ABVs
Type ABVs are expressed against the breed average, which is set at 100 with a standard deviation set to 5; for example, an ABV of 105 is 1 standard deviation above average.

For many traits, an ABV of more than 100 indicates an animal that is greater than the breed average for that particular type trait. Take for example, fore udder attachment. A stronger fore udder attachment is desirable because it has a strong association with longevity in Holstein and Jersey cows (Pryce, 2014). The 'ideal' is therefore very strong fore attachment.

✓ To improve fore udder attachment: choose bulls with an ABV of greater than 100.

FORE ATTACHMENT attachment to abdominal wall
1 WEAK · 5 INTERMEDIATE · 9 STRONG

The same applies to the four composite traits (Mammary System, Feet & Legs, Dairy Strength and Rump) and Overall Type.

Australian breed associations set the ideals for each type trait.
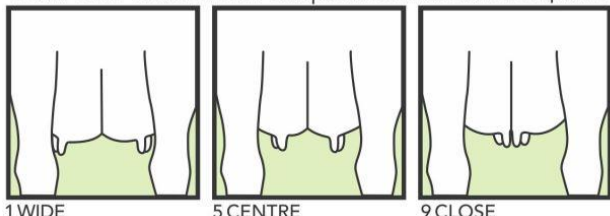
Intermediate ideals
More is not always better. For some traits the ideal is an intermediate score.

An example is rear teat placement, which refers to the placement of rear teats relative to the centre of the quarter. Rear teat placement affects the ease with which cups can be attached in the milking shed. Neither extreme is desirable: cups are difficult to attach if rear teats are too close or too wide. The

ideal position is intermediate. A bull with a Rear Teat Placement ABV of 100 is breed average but the ideal for your herd will depend on the direction you want to breed for. To breed to widen rear teat placement: select bulls with a Rear Teat Placement ABV of less than 100.

✓ To breed for closer rear teat placement: choose bulls with a Rear Teat Placement (Rear) ABV of greater than 100

REAR TEAT PLACEMENT teat placement from centre of quarter

1 WIDE   5 CENTRE   9 CLOSE

Traits with an intermediate ideal include udder depth, teat placement (front and rear), teat length, stature, chest width, body depth, bone quality, rump angle, foot angle and rear leg side view. The Jersey breed also has intermediate ideals for loin strength, rump length and heel depth.

Information behind type ABVs
Type is recorded by trained classifiers who visit farms and assess cows individually based on the biological range of each type trait.

Each individual trait is assessed against the linear range for that trait then that score is compared against the 'ideals' set by the breed association and recorded by the classifier. Results for individual traits are referred to as Linear Type scores. The ideals taken together describe how the ideal cow is put together.

Calculating composites
The individual linear trait scores are combined to calculate composite scores using the weighting for each trait. These, in turn, are combined into a score for overall type.

The following table shows the linear traits that contribute to each composite type ABV. Breed associations set the relative weightings of linear traits in each composite.

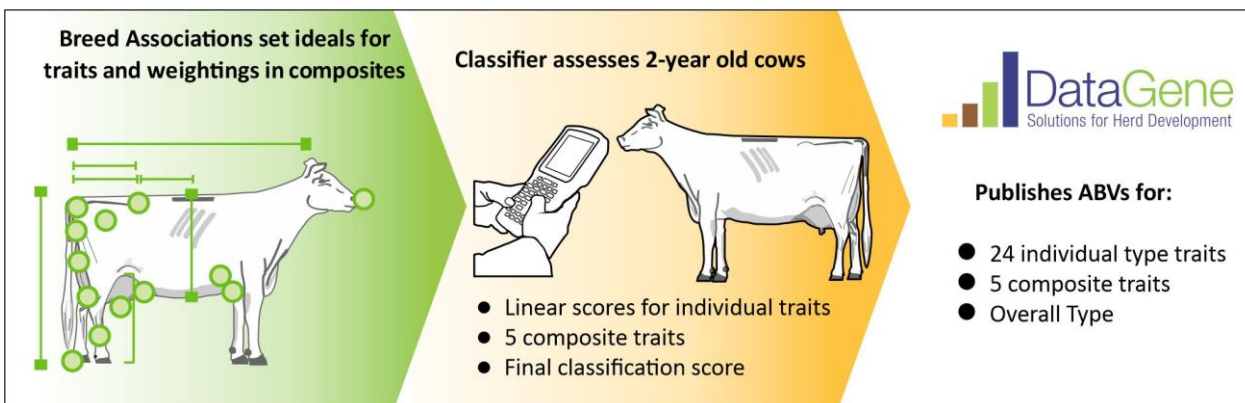| Traits included in composite Type ABVs from 2020 for Holsteins, Red Breeds and Guernseys	
For animals scored after 2007, the classification composite has the most influence on the ABV	
Mammary ABV	Mammary score, udder depth, teat length, fore attachment, fore and rear teat placement, rear attachment height and width, udder texture, central ligament
Feet & Leg ABV	Feet & Leg score, foot angle, heel depth, rear set, bone quality, rear leg view
Dairy Strength ABV	Dairy Strength score, stature, muzzle width, body depth, chest width, angularity and loin strength
Rump ABV	Rump score, pin set, pin width and loin strength
Overall Type ABV	Final score, old overall type, mammary composite, feet & leg composite, dairy strength composite, rump composite

Overall Type
The Overall Type ABV is based on final score and a combination of the four composite type ABVs. The weightings are set by breed associations.

Relative weightings of composite type traits in Overall Type ABV *as set by breed associations*					
	Holstein	Aussie Reds	Ayrshires	Illawarra	Guernsey
Mammary System	40%	40%	40%	40%	40%
Feet & Legs	25%	25%	15%	25%	25%
Dairy Strength	25%	25%	35%	25%	25%
Rump	10%	10%	10%	10%	10%

The Jersey weightings are: general appearance 30%, head 15%, conformation 20%, udder (vessel) 35%.

Type Flow Chart

Breed Associations set ideals for traits and weightings in composites

Classifier assesses 2-year old cows

- Linear scores for individual traits
- 5 composite traits
- Final classification score

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Solutions for Herd Development

Publishes ABVs for:
- 24 individual type traits
- 5 composite traits
- Overall Type

Indices: BPI, HWI

Overall Type, Mammary System, Udder Depth and Pin Set are included in Australia's two indices: Balanced Performance Index (BPI), Health Weighted Index (HWI).

Sources of information for bull ABVs

Through a bull's life, information used in genetic evaluation changes. Before he has any progeny, only pedigree and genomics are used for his breeding value. A bull may have daughters overseas and his Interbull information will be used in any trait where multi-country evaluations are available. Overall Type, Mammary System, Feet & Leg Composite and many linear traits include contributions from Interbull for bulls with daughters overseas.

As Australian daughters enter the milking herd, their information will begin to influence his breeding values. With enough Australian daughters, the most of a bull's breeding value comes from these Australian records.

Acknowledgement

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Holstein Australia supplied some of the graphics.

More information

ABV Fact Sheet: Type ABV improvements
Genetics Backgrounder: Type ABVs explained
Pryce, J (2014) Long lasting cows
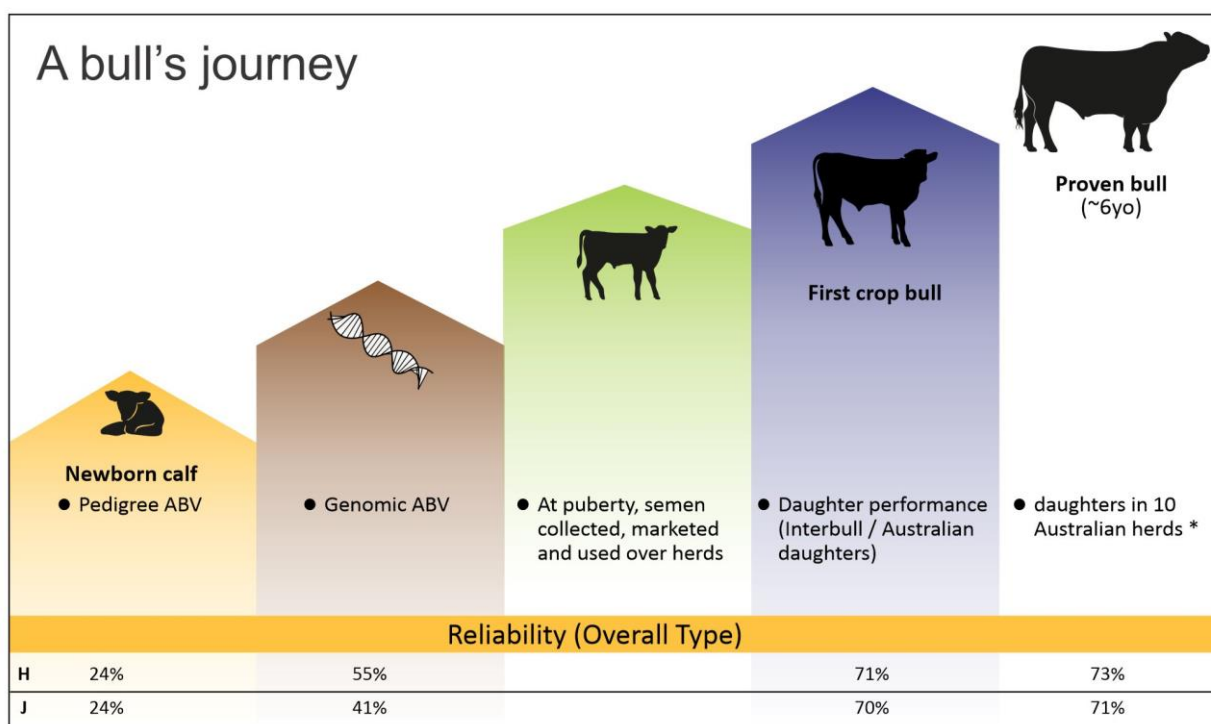Holstein Australia's classification system

About DataGene

DataGene is an independent and industry-owned organisation responsible for driving genetic gain and herd improvement in the Australian dairy industry. DataGene performs pre-competitive herd improvement functions such as genetic evaluation, herd testing and herd improvement software development and data systems. DataGene is a Dairy Australia and industry collaboration.
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A bull's journey

- **Newborn calf**
  ● Pedigree ABV
- ● Genomic ABV
- ● At puberty, semen collected, marketed and used over herds
- **First crop bull**
  ● Daughter performance (Interbull / Australian daughters)
- **Proven bull (~6yo)**
  ● daughters in 10 Australian herds *

Reliability (Overall Type)				
H	24%	55%	71%	73%
J	24%	41%	70%	71%

H - Holstein   J - Jersey

* the publishable criteria changes by trait and breed

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