



Updated MACE proofs codes

Introduction

In the Interbull MACE evaluation, three different code-categories are used to provide information about each individual proof that is submitted to the evaluation: type of proof, status of bull, and publication status. The codes are used to filter which proofs that are used in the evaluation, based on a set of criteria defined and published in Chapter 5 of the Interbull Code of Practice (https://interbull.org/ib/whole_cop).

With the exception of adding new codes for use in the GMACE evaluation, the different code options within each code category have not been updated since they were first introduced. With the introduction of genomic selection in the 2010s, the breeding schemes and use of AI-bulls in the cattle breeding industry have changed considerably. With this in mind, it was considered that all codes to describe the proof might not be relevant anymore. A working group was established to review the coding, as well as the criteria in Chapter 5 for inclusion of proofs to the MACE evaluation.

To investigate the use of the current codes, the distribution of submitted proofs from the most recent MACE evaluation (December 2023) was reviewed. A comparison was made to a MACE routine from 2009 to evaluate difference to the pre-genomic era. Before the final conclusions were made, a trial MACE-run with the proposed changes was performed to assess the impact.

Results

Type of proof

The codes for “Type of proof” and their descriptions (table 1) were originally created based on a standard scheme of progeny testing, where the bulls start with a first crop of daughters in their home country based on random use, and later a second crop of daughters and possibly export after selection based on their first merits. Today however, with genomic selection, the bulls are no longer randomly selected, and most bulls only get one crop of daughters, possibly in multiple countries as their semen might be exported based on genomic merits before producing daughters domestically. This was also seen in the investigations of the data, where in the 2023-data a bull could have proofs with a “Type of proof” code 11 from many countries, while in the 2009-data most bulls would have “Type of proof” code 11 from only one or a very few countries. The interpretation was that most countries today use Type of proof code 11 for





genomically selected bulls, no matter where the bulls were born, as young bulls now often are imported based on their genomic breeding values before they have offspring in their country of birth. To ensure the same practice of coding across countries, the description for “Type of proof” code 11 was updated to include “genomic imported bulls”. “Type of proof” code 12 was kept unchanged, to accommodate countries and breeds where genomic selection has not yet been implemented.

“Type of proof” code 22, indicating proofs based on mostly imported daughters or daughters born from imported embryos, was removed as a possible code for “Type of proof”. It was found that this code was only used by a very few countries and not for all breeds and represented a very limited amount of type of proof submitted to MACE. In the past it might have been important to make a distinction between imported sires, if their proof were based on use as AI or on imported daughters and embryos. However, it was concluded that this distinction is no longer relevant as long as the number of herds and daughters with recorded information reached the minimum requirement. “Type of proof” code 21 was kept for imported non-genomic bulls, but the description was updated to include the description previously used for “Type of proof” code 22. The previous and new coding for “Type of proof”, with descriptions of the codes, can be viewed in table 1.

Table 1: Description of previous and new codes for “Type of proof”, changes are highlighted with italic text.

Previous codes for types of proof	New codes for types of proof
00 (unknown)	00 (unknown)
11 (based on first crop sampling daughters)	11 (based on first crop sampling daughters, <i>and genomic imported bulls</i>)
12 (based on first and second crop daughters)	12 (based on first and second crop daughters)
21 (based on imported semen of proven bull, second crop daughters only)	21 (based on imported semen of proven bull, second crop daughters only, <i>and imported daughters and embryos</i>)
22 (<i>based on mostly, more than 50%, imported daughters or daughters born from imported embryos</i>)	

Status of bull

The codes for “Status of Bull” provides information on if the bull is an AI-bull, non-AI (other) or unknown. It was concluded that the importance distinction to be made for the status is if the bull is an AI-bull or not, and that a status of “other” was no longer relevant. Therefore, the “Status of Bull” code 20 (other bull) was removed as a possible





code for “Status of bull”, and the word “other” was added to the description for “Status of bull” code 00.

As bulls that are part of a genomic breeding scheme is not randomly selected, the word “randomly” was removed from the description of “Status of bull” code 10. The previous and new coding for “Status of bull”, with descriptions of the codes, can be viewed in table 2.

Table 2: Description of previous and new codes for “Status of bull”, changes are highlighted with italic text.

Previous codes for status of bull	New codes for status of bull
00 (unknown)	00 (unknown, other)
10 (bull randomly sampled through an official AI scheme)	10 (bull randomly sampled through an official AI scheme)
20 (other bull. Records with “20” in this file will be excluded from the international evaluation, unless type of proof is “21”).	

Publication status

The codes for *Publication status* provide information on whether or not the proof meets the standard for official publication in the country sending the proof. In addition to Y (yes) or N (no), the original codes also had the option P, indicating a bull part of a simultaneous progeny-testing program where the proof not yet was meeting the national standard for official publication. As simultaneous progeny testing is no longer relevant in the genomic era, this code was considered irrelevant and was decided to be removed. By looking at the submitted proofs, it was also found that the code was used by only a few countries and mostly on old bulls, indicating that the status might not be updated after the bulls have ended their progeny testing period. No changes were proposed in the code descriptions, as the previous description was found to be sufficient. The previous and new coding for “Publication status”, with descriptions of the codes, can be viewed in table 3.





Table 3: Description of previous and new codes for “Publication status”, changes are highlighted with italic text.

Previous codes for publication status	New codes for publication status
Y (if bull proof meets national standards for official publication in the country sending information.) <i>P</i> (if bull is part of a simultaneous progeny-testing program, but the proof does not yet meet national standards for official publication) N (otherwise).	Y (if bull proof meets national standards for official publication in the country sending information.) N (otherwise).

Inclusion criteria

The base requirement for accepting a proof into the MACE evaluation is that the proof must be based on daughters in at least 10 herds. For calving traits, a minimum of 50 daughters in 10 herds are required, and the same is true for countries that provide proofs based on real mastitis data in the mass-evaluation. There are also some additional requirements for proofs with Type of Proofs 21 and Publication Status N for all traits, where an additional number of daughters (or EDC) and herds are required, the minimum numbers are dependent on the breed, as described in Chapter 5 of the Interbull Code of Practice (https://interbull.org/ib/whole_cop).

A variety of options for a change in the requirements of daughters and herds were discussed; however, it was in the end agreed that changing the requirements for daughters and herds did not provide any benefits to the MACE evaluation. It was therefore decided to keep the requirements for daughters and herds as they appear in the current MACE evaluation for all codes, traits and breeds.

Trial run to investigate impact of changes

Interbull Centre performed a trial run to test the implications of the proposed changes in the codes. Data from the January 2025 test run was used, and the following assumptions and changes were made to the proofs:

“Type of proof” code 22 was changed to “Type of proof” code 21.

“Status of bull” code 20 was changed to “Status of bull” code 00

“Publication status” code P was changed to “Publication status” code N



These changes were chosen as they were considered the most conservative. When code changes are applied by the countries the proofs may be coded differently. Both the across-country correlations as well as the MACE EBVs were re-estimated for all breed-trait-country combinations and compared to the results from the January 2025 test run. Some changes were observed in the across country correlations for a few breed-trait-country combinations due to an increase in the number of common bulls with other populations due to the changes in coding. For most breed-trait-country combinations the across-country correlations showed no noticeable changes. The MACE-EBVs were similar to those calculated in the official routine run, showing that the effect in coding had little impact on most traits. A few breed-trait-combinations showed slightly more change in their EBVs due to the before-mentioned slight change in across-country correlations, but still within an acceptable range.

Conclusion and next steps

Three codes (“Type of proof” code 22, “Status of bull” code 20 and “Publication status” code P) was removed from possible options when coding proofs submitted for MACE.

Results of a trial run with such changes implemented showed satisfactory results for future official implementation.

The new coding will be official from the September 2026 test run, with the possibility for the countries to test their changes in any test run prior to official implementation to assess the impact.

