

Family Concept in Type Evaluation Testing for Continuous Totalizing Automatic Weighing Instruments (Belt Weighers)

Working Group Members:

1. United States (Chair)
2. The Netherlands
3. Denmark

Introduction:

During the TC9/SC2 meeting conducted February 4th and 5th, 2009, a proposal was put forth to include the concept of "family" or "type" of devices, when performing a type evaluation on these instruments.

The recommendation would involve the submission of multiple, similar devices within a "family" grouping, and requiring an evaluation on a representative model(s) rather than on each variation within the family. This evaluation could then be used to issue a certificate for the entire group based on common operating, metrological, and design principles.

This recommendation did not meet any opposition in principle, but the membership present at the meeting indicated that prior to any vote to include this concept in R50 more detail and clarification was needed. A work group was formed to develop the recommendation further, and its outcome will be submitted for consideration by TC9/SC2 membership.

The Recommendation:

It is a significant cost to a manufacturer to acquire a type approval for a legal-use weighing device. The associated costs of testing and the time involved from the submission of an application until the issuance of a certificate can create added expense to the manufacture of the device, which will most likely be passed on to the end consumer (device users/owners). Any means by which this process can be expedited will presumably manifest itself in the form of a lower cost to both manufacture and consumer.

The tendency of manufacturers to produce devices which target the specific needs of their users will make it necessary to produce a number of devices, each designed to fulfill the criteria of individual applications. These devices may not differ in significant

attributes, and in fact may only vary in properties related to size, capacity, speed of operation, etc. Although some features will differ, similar devices may be manufactured based on and incorporating the same principles involving operating controls, metrological blueprint, and basic architecture. Devices may also be manufactured using many of the same modular-type components used in other devices within the same type or group, thereby saving the cost of retooling production machinery.

It is therefore suggested that devices which do not vary in significant measures, and that share the same above listed principles, be evaluated for type approval on the basis of a representative device(s). The result of the evaluation would be based on the performance of the representative device(s) and the certificate issued afterwards would cover and include the entire "*family*" of instruments.

This concept is not unique or untried. The testing of families of devices is used by current certifying authorities, and examples may be found in OIML Recommendations (R76, R60), as well as the National Conference on Weights and Measures type evaluation program (NTEP) in the United States.

This concept has been applied to belt weighers in the U.S. where devices meeting a set of criteria are classified together within a family under a single Certificate of Approval.

Obviously there must be criteria applied to categorize measurement devices within one family or another.

Supporting Basis for the Proposal:

In OIML R60 load cells are grouped with regard to similarities such as:

- manufactured from the same material
- measurement technique (e.g. strain gauges bonded to metal)
- method of construction (e.g. shape, mounting method)
- used in a single or multiple cell application
- set of specifications (e.g. output rating, supply voltage, input impedance)

OIML R76 categorizes instruments into families using the following criteria:

- value of the verification scale interval
- capacity
- load cells used
- temperature and humidity limits
- instrument functions
- and other characteristics

Likewise in the U.S. type evaluations for families of devices may be based on similar criteria. For the categorization of belt weighers, the following aspects are considered:

- belt width
- belt speed
- belt loading capabilities
- weighbridge length
- number of idlers
- scale capacity

In “WELMEC 2.6 Guide for testing of automatic catchweighing instruments” the modular approach on load cells is limited due to dynamic influences. Based on that the following could be added to R50-1:

Load cells can be interchanged only if the following conditions are met:

- There is a OIML Certificate of Conformity (R60) issued for the load cell.
- The certificate contains the load cell types and the necessary load cell data required for the compatibility checking of modules (OIML R76-1 Ed 2006, Annex F), and any particular installation requirements. A load cell marked NH is allowed only if humidity testing to R76-1 has been conducted on this load cell.
- It is not a load cell with digital output.
- The characteristics of the replacement load cell such as nlc , Y, Z are the same or better than the load cell that is tested dynamically.
- The design of the load cells and the material are the same.
- No oil damper is used.

Appendix I:

(Inclusion of Denmark's submission with regard to "d")

Appendix II

Recommended Additions to OIML R50:

It is the intent of this recommendation to include the following entries regarding new terminology within OIML R50

T.3.14 Type

Definitive model of a weighing instrument or module (including a family of instruments or modules) of which all of the elements affecting its metrological properties are suitably defined.

T.3.15 Family

Identifiable group of weighing instruments or modules belonging to the same manufactured type that have the same design features and metrological principles for measurement (for example the same type of indicator, the same type of design of load cell and load transmitting device) but which may differ in some metrological and technical performance characteristics (e.g. Max, Min, e, d, accuracy class, ...).

The concept of family primarily aims at reducing the test effort at type examination. It does not preclude the possibility of listing more than one family in one certificate.

The following entries are suggested additions to metrological controls within R50:

5.1.6 Testing of a family of instruments or modules

Where a family of instruments (T.3.15) or modules of various capacities and characteristics is presented for type examination, the following provisions apply for selecting the Equipment Under Test (EUT).

5.1.6.1 Selection of EUTs

The selection of EUTs to be tested shall be such that their number is minimized but nevertheless sufficiently representative.

Approval of the most sensitive EUTs implies approval of the variants with lower characteristics. The EUTs with the highest metrological characteristics shall be selected for test.

5.1.6.2 Accuracy class

If an EUT of a family has been tested completely for one accuracy class, it is sufficient for an EUT of a lower class if only partial tests are carried out that are not yet covered.

5.1.6.3 Other features to be considered

All metrologically relevant features and functions have to be tested at least once in an EUT as far as applicable and as many as possible in the same EUT.

For example, it is not acceptable to test the temperature effect on no-load indication on one EUT and the combined effect on a different one. Variations in metrologically relevant features and functions such as different:

- housings;
- load receptors;
- displacement transducers;
- temperature and humidity ranges;
- instrument functions;
- indications; etc.;

may require additional partial testing of those factors which are influenced by that feature. These additional tests should preferably be carried out on the same EUT, but if this is not possible, tests on one or more additional EUTs may be performed under the responsibility of the testing authority.

5.1.6.4 Summary of relevant metrological characteristics

The EUTs must cover:

- lowest input signal, $\mu\text{V/d}$ (when using analog strain gauge load cells);
- all accuracy classes;
- all temperature ranges;
- single speed, variable or multiple speed instrument;
- maximum size of load receptor, if significant;
- metrologically relevant features (see 5.1.6.3);
- maximum number of instrument functions;
- maximum number of indications;
- maximum number of peripheral devices connected;
- maximum number of implemented digital devices;
- maximum number of digital interfaces;
- different types of displacement transducers;
- different types of load receptors; and
- different types of belt conveyors.

Appendix III

Question to be posed to TC9/SC2 Members:

Q1:

Is it possible to group instruments under an “umbrella” set of criteria based on common principles of operation and metrological design.

Yes No

Q2:

Should it be possible for an instrument manufacturer to submit a representative instrument for type evaluation, which would include other instruments from that manufacturer that are designated to be included within a “family”.

Yes No

Q3:

Should a type evaluation certificate that has been issued for an instrument be inclusive of other instruments from the same manufacturer that share the same operating, metrological, and design principles as outlined in the above proposal.

Yes No