Excerpt from the 2015 Multiple Dimension Measuring Device NTEP Work Group Meeting Summary (Agenda Item 8):

8. **Report on progress from multi-interval operation requirements subgroup**

   Source: **Multi-Interval Operation Requirements Subgroup**

   Background /Discussion: During the October 2014 meeting the Work Group (WG) agreed to form a small subgroup charged with the task to develop requirements that address multi-interval operation for inclusion into both HB-44 and Pub 14. Members of the subgroup are as follows: Mr. Darrell Flocken, Mr. Rick Harshman, Mr. Scott Davidson, Mr. Justin Rae, and Mr. Scott Wigginton. Although the WG neglected to assign a lead person, Mr. Harshman hosted a teleconference with members of the subgroup in April 2015. All members of the subgroup participated with the exception of Mr. Wigginton, who was unable to do so because of a work conflict. Ms. Isabelle Tremblay (MC) requested and was granted permission to participate in support of Mr. Rae.

   Members of the subgroup acknowledged that the MDMD Code of NIST Handbook 44 (HB 44) does not contain any requirements pertaining to the use of multi-intervals on an MDMD. It was agreed that before type evaluation criteria could be developed and added to NCWM Publication 14, requirements that address the use of multi-intervals would first need to be added to HB 44 and this then became the focus of the subgroup discussion. Mr. Rae summarized and explained MC's type evaluation criteria specifically pertaining to the use multi-intervals on MDMDs and how it compared to similar corresponding criteria in OIML R129. From the discussion that took place, members of the subgroup were able to identify five areas they believed would need to be addressed either by changing existing HB 44 MDMD code requirements or adding new code requirements as follows:

   1. HB 44 MDMD code paragraph T.2.3., despite its title (i.e., Multi-interval (Variable Division-Value) Devices) was never intended to apply to devices that measure using multi-intervals in two or more partial measuring ranges within the same axes. Instead, the paragraph applies to devices that measure to a different division value in at least one of the dimensioning axes in comparison to the other two. To differentiate between these two applications, the subgroup agreed to propose changes to T.2.3. and to propose a new paragraph be added that addresses the application of tolerances on "mixed interval devices."

   2. The subgroup considered whether or not additional requirements were needed in HB-44 to address the taking of tare on a multi-interval device. It was agreed that requirements were needed to address the following views of the subgroup:
      - The maximum allowable tare on a device with multi-interval should be the capacity of the lowest range of the axis in which the tare is to be taken.
      - The net value that results from subtracting a tare value in a lower partial measuring range from a gross value indication in a higher partial measuring range, should always be in correct mathematical agreement and to the nearest division of the measuring range in which the net value occurs. It was recommended that examples be provided to make clear correct mathematical agreement of the result after subtraction.

   3. Members of the subgroup agreed that Table S.4.1. a. Marking Requirements for Multiple Dimension Measuring Systems should be expanded to include the marking of the minimum and maximum dimensions for each range since multi-interval devices have more than one partial measuring range in at least one of the dimensioning axes.

   4. The subgroup felt there is a need to define the relationship of the different ranges that might use multi-intervals as is done in MC and OIML type evaluation criteria. The following are some example relationships specified in OIML R129 (note that similar relationships are expressed in MC standards):

- o   dx1 = dy1 = dz1, dx2 = dy2 = dz2, etc. (example if all 3 axes were multi-interval.)   This same relationship would apply if only 2 axes used multi-intervals. In that case dx1 = dy1, dx2 = dy2, etc.);
- o   scale intervals d1 < d2 < d3…dr;
- o   min = min1, max = max1, max1 = min 2, etc.

  Additionally, the subgroup believes HB 44 needs to specify which of the three axes are permitted to provide measurements using multi-intervals. Is it one, two, or all three?

5. The subgroup agreed with MC that the minimum of any particular partial measuring range can be no smaller than 12d, where "d" is the measurement interval of that range.   This requirement is similar to the minimum load requirement on a scale and takes into account the fact that large errors (as a percentage of the load being weighed) can result when small loads are weighed due to digital rounding and the allowable tolerance.

Mr. Harshman and Mr. Flocken volunteered to develop some draft proposals for the WG to consider that addressed each of the five items. Providing this work could be completed by the May 2015 WG meeting, it was agreed that the proposals would be presented to the WG for further consideration at that meeting.

Recommendation: At the May 2015 WG meeting, Mr. Harshman and Mr. Flocken summarized the discussions of the subgroup concerning the five areas that had been identified by the subgroup. A draft NCWM Form 15 proposal intended to address the first three areas of the five shown in the list above was circulated to members of the WG. Mr. Harshman summarized the proposal and explained why the subgroup believed the changes being proposed were needed. The WG agreed that the changes being proposed are needed and after suggesting some minor editorial changes to some of the draft language in the proposal, recommended it be submitted to the NCWM for consideration by the regional weights and measures associations during their fall 2015 meetings. The NCWM Form 15 proposal, as amended and accepted by the MDMD WG has been inserted as an attachment to this report.

With regard to items 4. and 5. on the list, it was believed that additional input from the WG was needed before proposals could be developed to address these areas. One concern raised by Mr. Flocken with respect to item 4. is if two boxes were run simultaneously through the measuring area, the first box in a higher measuring range then the second box, the second box could not be measured unless ready zero is first returned. With respect to item 5. some WG members questioned the purpose of restricting from use the first 12 divisions of each measuring range and how this is to be applied to the different partial measuring ranges of an MDMD with multi-intervals. Ms. Tremblay and Mr. Pascal Turgeon (MC) explained both the purpose of the requirement and how MC applies the 12d minimum to each partial measuring range of a multi-interval MDMD. Example illustrations of acceptable and unacceptable markings (min and max) of the different partial measuring ranges in relation to different values of "d" were also provided using a white board. In conclusion, the WG agreed that both items 4. and 5. also needed to be addressed in HB 44 and Mr. Flocken agreed to develop some draft language for the WG to consider at its next face to face meeting concerning these two remaining items.