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CALIBRATION INTERVALS AT BENDIX KANSAS CITY

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Calibration Intervals at Bendix, Kansas City

The Kansas City Division of the Bendix Corporation is a prime contractor for the Department of Energy (DOE). This division of Bendix began operation in 1949 as a contractor for the Atomic Energy Commission. Current employment is about 6400 with a peak in 1964 of over 8200. Over 100,000 pieces of equipment are presently on calibration schedule with about 4000 of these being measurement standards. There are four calibrating departments plus a Metrology laboratory devoted primarily to the calibration of measurement standards and administering the calibration program. This paper will be devoted to briefly describing the calibration interval evaluation methods and control in each calibrating department and providing a more detailed description of those employed in Metrology.

The Tool and Gage Inspection department is responsible for the calibration of non-electrical length, force and torque measuring instruments with a workload of about 90,000 calibrations per year. Calibrations are performed on three categories of equipment. Special design gages are used to measure or gage specific features on one part or product. These gages are assigned a calendar interval by the responsible design engineer with the majority on a six month interval. Most of these gages have been placed on a use log system which allows for a start/stop the clock over the assigned interval even though the gage is retained in the area of intended use. Monthly quality data reflecting the magnitude of out-of-tolerance, OOT, data is maintained. The second category of equipment is capital equipment which includes all commercially available devices costing over $500 such as comparators, measuring machines and rotary tables. A calendar interval is assigned and adjusted based on results of

recorded OOT data. The third category is standard gages which includes expense type commercial hand gages such as micrometers and plug gages. Intervals are assigned and controlled similar to capital equipment. After calibration each gage is sealed and stored until needed. The interval clock starts when the gage is checked out or when the seal is broken. Monthly quality data is also maintained and reported to enable evaluating the magnitude of OOT and intervals.

The Test Equipment department is responsible for electrical and physical measuring instruments used by production and inspection personnel. They perform about 25,000 calibrations per year, and calibration intervals are assigned by responsible engineers. These intervals are adjusted by calibration personnel based on decision tables. The interval is extended if the item is in-tolerance three consecutive times and is reduced if there is a single out-of-tolerance finding. There is a maximum interval of 52 weeks.

The Materials Evaluation Laboratory calibrating group is responsible for specialized laboratory measuring instruments. They perform about 5000 calibrations per year with all instruments being on a "calibrate before use" basis. Calibrations are normally performed by the instrument operator.

The fourth calibrating department is operated within the Purchased Material Quality Engineering organization. They are responsible for nuclear radiation, shock and vibration measuring instruments with about 500 calibrations being performed per year. All instruments are on a calendar interval established and adjusted by the engineer responsible for providing calibration procedures.

The Metrology organization is responsible for all measurement standards and any measuring instruments with requirements beyond the capability of the calibrating departments. About 6500 calibrations are performed per year with equipment on

a calendar interval that is reviewed and adjusted by the responsible engineer immediately following calibration and prior to assigning expiration date and certifying the device. A factor of two is normally used in adjusting the interval, however, a factor of one and one-half is also available to be applied.

There are two general requirements applicable to all calibrating organizations. Any interval call out in drawings or specifications take precedent and such intervals can not be changed regardless of calibration history. Recently, the DOE imposed a maximum interval of five years applicable to all equipment on calibration schedule.

It appears desirable to describe some pertinent historical information related to interval assignment and adjustment in Metrology. In 1960, manpower availability and workload increase prompted a decision to review calibration data on each instrument on schedule and to lengthen intervals unless there was good reason not to do so. Out of 1258 instruments reviewed, the interval was doubled on 793, left the same on 423 and shortened on 42. This resulted in a 23% reduction in yearly calibration time. At the end of one year, the OOT results were reviewed by interval action. Of those lengthened, 2.8% were OOT; of those shortened, 24.4% were OOT and of those retained the same, 7.9% were OOT. The total OOT was 7.9%. These statistics evidenced correct decisions had been made.

Since that time, similar records continue to be maintained and evaluated. This was done originally using manual means, but with the incorporation of ADP record system in the mid-1960's data was able to be sorted and analyzed more efficiently and effectively. Presently, each engineer receives periodic reports on the status and history of equipment for which he or she is responsible. Marginal tolerance data or lack of adequate history justifies retaining the existing interval, and an OOT condition justifies shortening the interval. This system of individual

review and adjustment has allowed adding instruments to schedule without a corresponding need to significantly change headcount. Also, it has been possible to maintain a predetermined goal of no more than 10% of the instruments on schedule to be OOT at the time of recalibration.

The method of establishing and revising intervals in Metrology, providing there is no drawing or specification specified interval, is to require the responsible engineer to designate the longest interval that can be assigned. The original assignment is based on judgement with guidance usually available on similar devices. Initial intervals of 1, 2, 3, 6, 9, 12, 18, 24, 36, or 60 months are available for assignment and for adjustment. Calibration records are maintained and reviewed to enable adjusting intervals in order to maintain an acceptable level of about 90% of the scheduled items to be in-tolerance at the time of recalibration. Doubling intervals is encouraged when lengthening intervals. Monthly ADP reports are prepared by area of measurement and by engineering assignment to show total percentage results as well as trend information. Quarterly ADP reports reflect the average intervals and the distribution of intervals by area of measurement. In addition, special reports are prepared such as OOT data by manufacturer and model number.

Historical data has been maintained for the past twenty years. The slope of the OOT curve is -0.14% per year while the slope of the interval curve is +0.3 months per year. (see figures **1** and **2** respectively). The average OOT for the past ten years has been approximately 6.9% and the average interval at the last quarter has increased to 13 months which compares to an average interval twenty years ago of about seven months. Based on data over the past two years, the percent OOT is significantly higher for instruments with short intervals. For example, 24.3% of the instruments on a one month interval were OOT; 17.3% were OOT on two month interval and 1.2% were OOT on a twelve month interval.

The significant data has been the calibration time man-hour savings for adjusting intervals. This has averaged approximately 1250 man-hours per year saved each year for the past ten. This is the net saving considering both the lengthening and the shortening of calibration intervals. The conclusions are, therefore, to continue present policies and efforts. It is also important to replace short interval items with more stable and reliable equipment and/or to relax certification of these items. Above all, it is important to continue efforts to lengthen intervals on equipment in order to maintain a compromise between workload control and quality of calibration efforts.

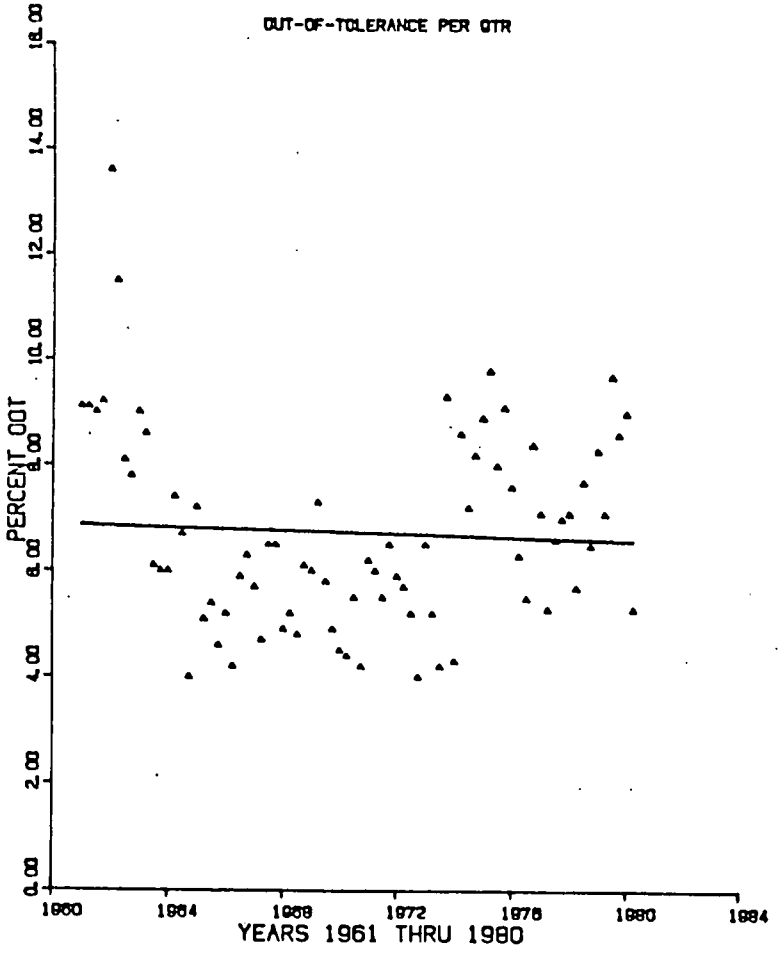

Figure 1

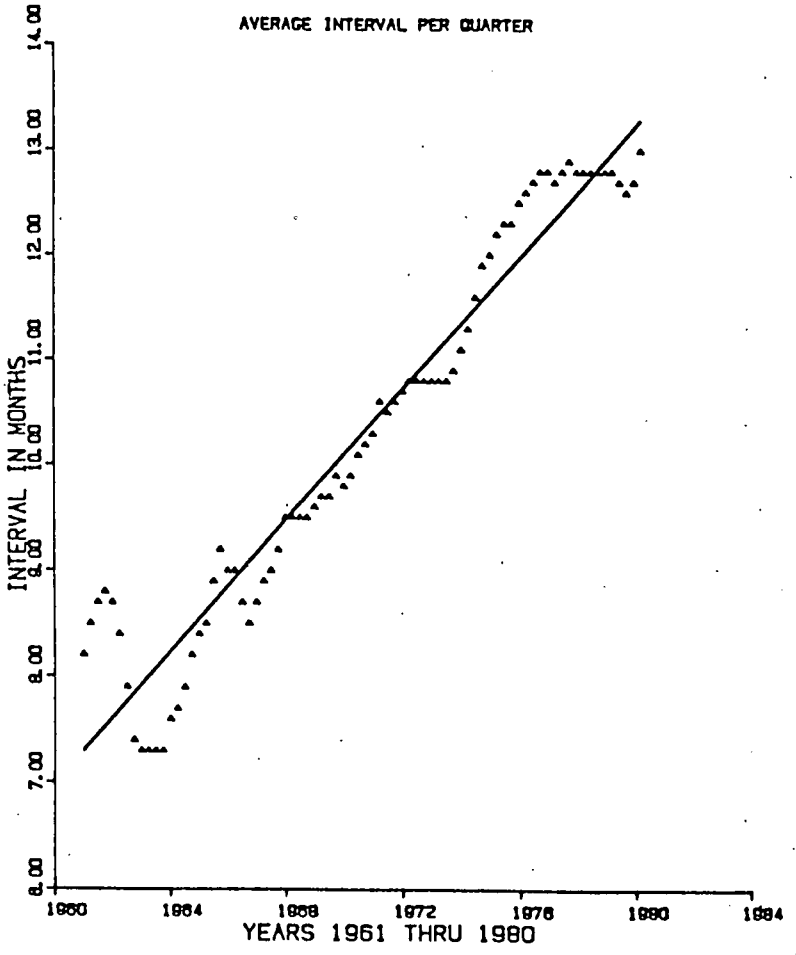

Figure 2