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STATISTICAL ANALYSIS OF
WEIGHTS AND MEASURES
NATIONAL PILOT

Management Consulting Division.

November, 1973.

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RECOMMENDATIONS

1. A policy of selective inspection scheduling be adopted with priorities being based on non-equity.

2. That inspection cycles be set such that no more than 75% of available manpower be required to complete them.

3. That the other 25% of available manpower be used for policing type inspections.

4. That planning for this policy begin immediately and that it be implemented as soon as sufficient data is available.

5. Fees for scheduled inspection be eliminated.

6. Stronger enforcement action be taken wherever possible to encourage compliance.

7. The fees for request inspections be increased to cover the total direct cost of the service.

8. The feasibility of applying statistical sampling techniques be studied for the inspection of new devices.

INTRODUCTION

The Weights and Measures management information system was designed to provide information on which to base both policy and operating decisions. In June, 1972, management of the Consumer Bureau expressed a desire for information as early as possible, primarily to be used as input for policy decisions.

Therefore, in September, 1972, the new Weights and Measures Inspection Certificates (CCA-648 and 684) were implemented in all regions. Copies of these certificates were sent to Ottawa where the data was manually processed for 28 weeks. Processing consisted of the following data combinations:

1. As found error by device class.
2. As found error by trade.
3. As found error by device maker.
4. As found error by time since last verification.
5. Non-equity by class.
6. Average inspection time by class.
7. Average product value by trade.

Reports of these combinations were produced for each four-week period and copies were sent to managements of the Consumer Bureau and the Bureau of Field Operations including regions and districts.

Management Consulting Division has analyzed the resulting statistics for the purpose of obtaining answers to the following pertinent questions:

1. What is the present effectiveness (benefits) of the device inspection activity?
2. Can the effectiveness (benefits) be increased by changing the inspection patterns?
3. Can the effectiveness (benefits) be increased by changing or amending legislation and/or regulations?

The purpose of this report is to discuss the findings resulting from the statistical analysis as well as to make policy recommendations and to discuss the implications of these recommendations.

FINDINGS

As Found Errors

One of the major changes in reporting device inspections is that under the new system the inspector reports the condition of devices as he finds them (the "as found error"). This is in contrast to the previous system which reported only the condition of devices as the inspector leaves them.

Through a series of codes, the inspector reports those devices that over-indicate (short weight or measure), those that under-indicate (over weight or measure), as well as a number of other errors which contravene the Weights and Measures Act.

While the number of devices rejected (the "as left condition"), is about 4.5% of the total, the number of devices in error as found is 22.3% of the total (or, approx. 1 out of every 4 devices used in trade contravene the Weights and Measures Act.).

This error percentage varies greatly between different classes of devices. It ranges from a low of 1.1% for measures of static length to a high of 56.2% for railway track scales (Fig. 1). (For a complete list of the types of errors found see Appendix 5.)

AS FOUND ERRORS BY DEVICE CLASS DURING NATIONAL PILOT

lass	Description	Percentage in Error
)	Portable platform, steelyard and suspension	22.3
2	Dormant, under 6,000 lbs.	34.4
4	Dormant, 6,000 lbs. & over	39.9
5	Grain Elevators, Hopper	30.5
6	Vehicle Scales	54.5
7	Grain Elevators, Truck	39.8
8	Railway Track	56.2
)	Equal Arm & Spring	15.0
4	Computing	27.1
5	Automatic	42.9
9	Metric	8.6
)	Static Length	1.1
4	Mechanical Length	2.4
)	Static Volume	7.1
8	Oil Tanks & Tank Trucks	12.9
9	Visible & Self-Measuring Pumps	15.9
)	Slow Flow Meters	1.5
1	Propane Meters	8.1
2	Meter Pumps (Service Station)	16.7
4	Bulk Meters (Tank Trucks)	33.1
5	Bulk Meters (Large Capacity)	23.3
7	Milk Meters	83.3
OTAL ALL DEVICES		22.8

FIGURE 1

he percentage of error also varies significantly between various trades, even hough several classes of devices are often used within a trade. Here the range s from 12.9% in the retail drugs and cosmetics trade to 64.2 for those devices sed in road construction (Fig. 2). (For a complete list of performance by trade, ee Appendix 1).

AS FOUND ERROR BY CERTAIN TRADES DURING NATIONAL PILOT

Trade	Percentage in Error
Drugs & Cosmetics - retail	12.9
Gasoline	14.0
Canning & Food Processing	23.0
Groceries - chain	29.9
Feed, seed, fertilizers	33.7
Livestock - buying	34.3
Scrap Metal - buying	45.7
Road construction	64.2

FIGURE 2

A third variable by which the as found error was measures is the maker of the device. Figure 3 shows that some makes of devices are much more open to error than others ranging from less than 1% to over 50%. (For a complete list of performance by maker, see Appendix 2).

AS FOUND ERROR BY CERTAIN MAKERS DURING NATIONAL PILOT

Maker	Percentage in Error
Aro of Canada Ltd.	0
Astro Universal Ltd.	10.8
John Chatillon Co.	13.6
Hobart Manufacturing Ltd.	22.6
Toledo Scales Co.	28.4
Howe-Richardson Scale Co.	32.9
Canadian Scale Co.	38.7
Ralph N. Brodie & Co.	51.8

FIGURE 3

ength of Inspection Cycle

ne of the main objectives of the system was to determine if the length of nspection cycle has an effect on the number of devices in error. Or, does he percentage of devices in error increase as the length of time between nspections increases. The information gathered during this pilot shows that s indeed the case although the amount of increase varies between classes Figure 4 shows this for all devices and Appendix 3 contains charts for ndividual classes).

ERRORS BY LENGTH OF INSPECTION CYCLE DURING NATIONAL PILOT

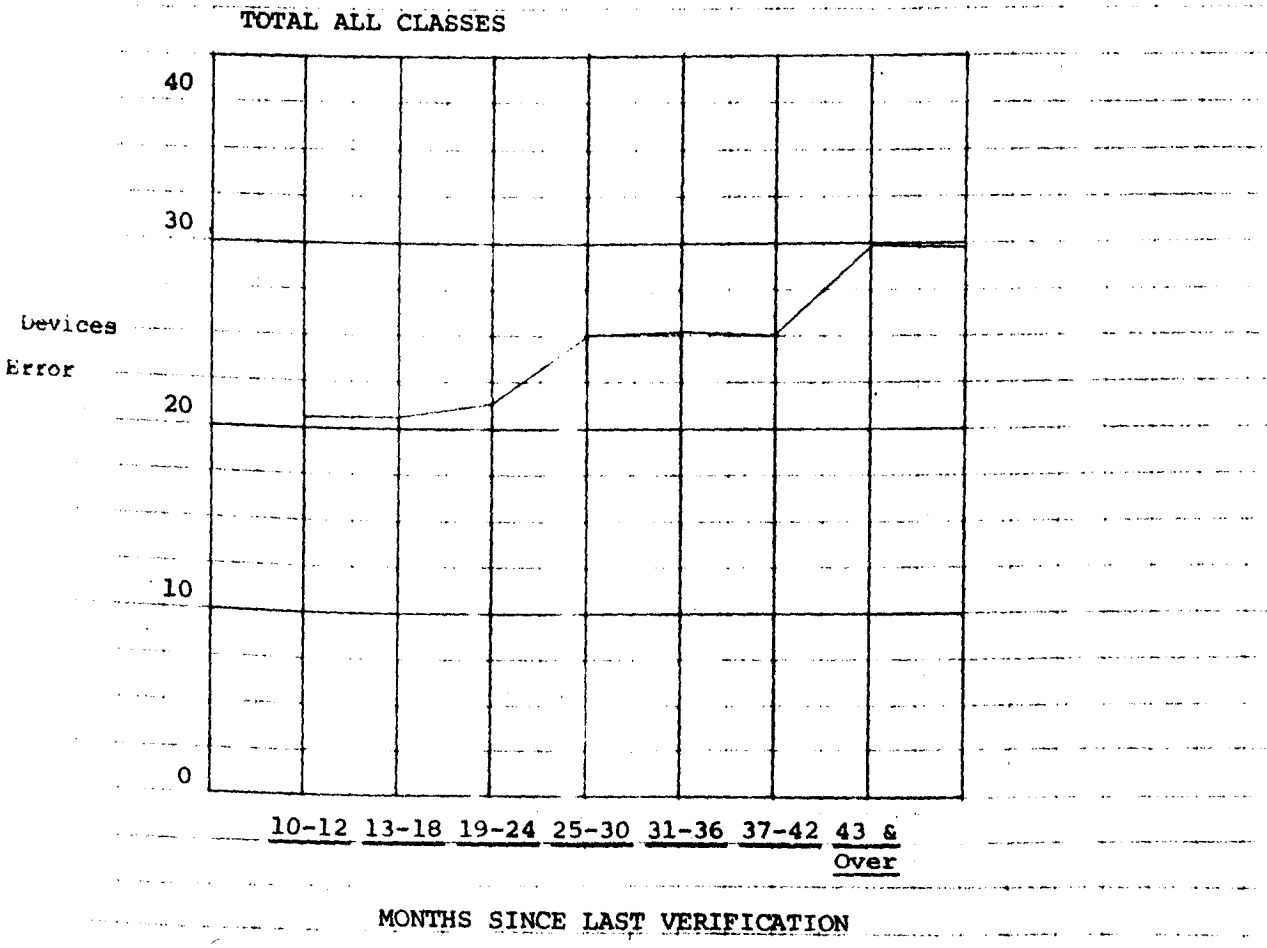


FIGURE 4

Average Inspection Time

Inspectors recorded the amount of time spent on inspections enabling us to calculate the average time for each class (Appendix 4). Unfortunately for some classes this average can be misleading since many of the present classes are not homogeneous in terms of effort and equipment required to inspect them. This problem has been resolved through the re-design of the class code.

Non-Equity

One additional data element reported is the annual dollar value of trade which passes over devices. By applying a percentage to each tolerance of over or under indication, and multiplying this by the product value we arrive at a potential annual non-equity figure in dollars for those devices. Using this formula, the measurable non-equity for the 28 week period was $7,616,000. Of this, approximately 55% was due to devices over-indicating, i.e. giving short weight or measures, and 45% was due to devices under-indicating, i.e. giving over weight or measure.

The above represents only a portion of the actual non-equity. It does not include those devices for which the inspector was unable to estimate the product value nor those devices which were in error but did not have the amount of tolerance error recorded. (The system has since been amended to ensure that all tolerance errors will be recorded). We estimate that the actual non-equity found during the pilot was in excess of $13,500,000 for 28 weeks.

This figure is at least a partial measure of the direct benefits resulting from device inspection, because, as non-equity is discovered by inspectors, they cause the situation to be corrected.

RECOMMENDATIONS AND POLICY IMPLICATIONS

As mentioned earlier, almost one out of every four devices presently contravene the Weights & Measures Act. This is an average for all inspections and includes scheduled inspections, request inspections, inspections of overhauled or repaired devices, and inspections of new devices. Separated by these inspection types the error percentages are:

Scheduled Inspections	-	23.4%
Request Inspections	-	25.0%
Overhauled or Repaired Devices	-	10.9%
New Devices	-	19.1%

Scheduled Inspections

Present legislation requires that devices used in trade must be inspected every year. However, in recent years this has become increasingly difficult for the inspection staff to do for a number of reasons, including:

- a growing population,
- increasing complexity of devices (taking longer to inspect),
- a rapidly growing number of request inspections, and
- constant staff.

As a result, the average time between scheduled inspections is now 20 months although this varies significantly between regions as follows:

Atlantic Region	-	17 months
Quebec Region	-	22 months
Ontario Region	-	23 months
Prairie Region	-	16 months
Pacific Region	-	27 months

Under the proposed regulations of the new Act the inspection cycle will be 2 years for all devices except measuring tanks and slow flow meters (5 years), and railway track scales and country grain elevators (1 year).

It is generally conceded that the 2 year cycle was introduced as a temporary measure, primarily to make the present situation legal. However, unless there are increases in staff, even this will not be possible in the near future (in Pacific Region it is already impossible with present staff).

Figure 4 shows that the error percentage (and the resulting non-equity) increases as the length of time between inspections increases. If we accept the premise that 22.3% contraventions resulting in over $13 million potential non-equity is somewhat less than acceptable then ways must be found to improve this. However, given present policy, it will deteriorate further rather than improve. We feel therefore that a radical change in inspection policy is needed.

Since some classes and some trades have a much higher non-equity than others it appears that more resources should be allocated to high problem areas and less to low problem areas. This means a much more selective inspection policy. For example, vehicle scales (54.5% errors with a high volume of trade) should be inspected more often than measures of static length (1.1% errors with a low volume of trade). Similarly, retail meat stores (30.8% errors with a high dollar volume) should be inspected more often than Post Offices (14.0% errors with a low dollar volume).

This type of selectivity must be extremely flexible to be effective. First, regional and district differences should be taken into account. Second, if through increased inspections, high problem areas improve but non-equity increases in some other areas, priorities must be changed to meet the new situation.

The primary criterion on which to base selective priorities should be the potential non-equity. For example, the gasoline trade has an error percentage of only 14% whereas the retail candy and confectionery trade has an error percentage of 23%. However, the potential non-equity per device in the gasoline trade is approximately $14.00 whereas in the retail candy and confectionery trade it is less than $2.00. This is due to the large difference in product value passing over the devices as well as the difference in the errors found. (The automated information system will have the capability to provide the non-equity per inspection by class, by trade, as well as by man hour of inspection time spent on various classes and trades).

All of the above should then be compared with the length of the inspection cycle (time between inspection). e.g. If the non-equity per inspection in a certain trade increases drastically as soon as more than one year has elapsed between inspections then the inspection cycle should be set at no more than one year. We therefore recommend that:

1. *A policy of selective inspection scheduling be adopted with priorities being based on non-equity.*

According to the new Act, the inspection cycle must be set in the Regulations. However, if as is presently the case, this cycle is such that it requires the entire inspection staff to follow its requirements then it will not be possible to react to new problem areas as they occur. We therefore suggest that the regulations specify cycles which would consume no more than about 75% of the available manpower. We further suggest that these cycles be determined on a much more selective basis, i.e. for some devices it may be 6 months and for others up to 5 years. This would be determined by the average non-equity per hour of inspection time for each type of device. The other 25% of the inspector manpower would be used to do primarily unscheduled inspections aimed at problem areas. We therefore recommend that:

2. *That inspection cycles be set such that no more than 75% of available manpower be required to complete them.*
3. *That the other 25% of available manpower be used for policing type inspections.*

Unfortunately, the national pilot did not provide sufficient detailed information to begin this policy immediately. While it does show that this type of policy is advisable all of the statistics are based on the traditional class structure. This structure has since been completely revised and statistics on the new structure will be needed to implement this policy. We feel that this will be possible within one year after implementation of the automated information system. The groundwork should be done prior to this, however, so that when sufficient data is available implementation can follow. The formula to determine the length of inspection cycles for each class of device will have to be determined and guidelines will have to be written for local field management to help them to

...hedule the 25% of their manpower. Within these guidelines, the ...heduling of this part of their resources should be the responsibility ... the District Inspector since he is closest to and most aware of local ...blems. We therefore recommend that:

4. *That planning for this policy begin immediately and that it be implemented as soon as sufficient data is available.*

...is policy of selective inspection scheduling should result in a significant ...crease in the number of devices in contravention to the Act, especially ... the types of devices where there is a marked increase in the error percentage ... the inspection cycle increases. (This applies primarily to Classes 10, 12, 14, 17, 20, 24 and 52 which is over 80% of all inspections.)

Fees

The adoption of a more selective inspection policy would have a direct implication on the present policy of charging fees for scheduled inspections. Some traders would have to pay fees far more frequently than others depending on the type of device used. This would not be equitable. This and other disadvantages of charging fees for scheduled inspections have been previously outlined in our "Paper on Weights & Measures Fee Policy". We therefore recommend that:

5. *Fees for scheduled inspection be eliminated.*

Selective inspection, although more effective than present policy, is not the complete answer to increasing compliance to the Act and reducing non-equity. Discussions with field staff invariably centre around another subject, i.e. better enforcement of the legislation. This is especially true of those large devices which have a high error percentage and non-equity. Some of these appear to be bad no matter how often they are inspected. (See Appendix 3, Classes 16, ..., 26, 54 and to some extent Class 56.) While the objective of the activity would not be to increase the number of prosecutions, it appears more prosecutions are needed in some areas to encourage traders to comply. When an inspector finds

a device which seriously contravenes the Act, he should reject it and seal it against use (sealing against use is not always done now). If the same situation occurs again, then prosecution action should be initiated. It is generally agreed that a couple of successful prosecutions would have a very significant effect on other traders in the vicinity. We therefore recommend that:

1. *Stronger enforcement action be taken wherever possible to encourage compliance.*

Request Inspections

The pilot showed that a large number of devices (almost 6,000) were inspected even though less than one year had elapsed since they had last been inspected. Most of these were done because the trader had requested it. This number of request inspections is increasing rapidly, especially in some areas, e.g. in Sudbury district almost all available resources are needed to meet trader requests with the result that almost no scheduled inspections are being done. Similar situations exist in several other districts.

Present policy dictates that request inspections take precedence over scheduled inspections, especially portable vehicle scales used by road construction contractors. Every time these scales are moved they have to be inspected (by law) before they can be used. Since a high percentage of these are in contravention many are rejected and must be re-inspected. This places an additional burden on the inspection staff. However, requests to inspect other types of devices are also increasing rapidly for several reasons:

a. Since we are taking longer and longer between scheduled inspections, many traders are concerned that they do not have a current inspection sticker on their device. (This is especially true in the grocery and other retail trades.) They feel that this sticker is proof to their customers that their devices are correct. It is generally agreed, however, that the public on the whole does not realize the significance of the sticker and, for the most part, are probably not aware that Weights & Measures inspections exist. Furthermore, the sticker is only proof that the device was correct at the time of the inspection. It does not mean that it has remained correct since then.

Under present policy, inspectors have little choice but to comply with these requests since the present Act states that we must inspect devices every year. The new Act should permit a lower priority to be placed on these requests.

6. The fees charged for request inspections have not been increased for a number of years. The present rate for an inspector's time is $2.50 per hour. It is obviously to the trader's advantage to call us rather than a device repair company who may charge from $10 to $15 per hour especially if he only wants to find out if his device is correct. The fees for request inspections should be raised so that they cover the total direct cost of the inspection on an hourly rate for the inspector's time plus any equipment required. This should reduce the number of request inspections considerably. We therefore recommend that:

7. *The fees for request inspections be increased to cover the total direct cost of the service.*

The financial and other implications of the above changes in fee policy have been previously outlined in our "Paper on Weights & Measures Fee Policy".

New Devices

Both the present and the new Weights & Measures Acts require that all new devices must be inspected and verified before they can be used in trade. Most small devices (gasoline dispensers, counter scales, etc.) are inspected in the manufacturer's plant prior to shipment and most larger devices (vehicle scales, etc.) are inspected after they have been installed and ready for use.

This inspection of small devices as it is presently being done is a very time consuming activity with questionable results. In Ontario, the inspection of new gasoline dispensers alone costs about 3 man years. In several cases, it appears that this activity takes the place of the manufacturer quality control. The number of incorrect devices found ranges from a low of 1% (where the manufacturer does its own quality control) to over 90% (where there is no quality control). These figures were taken from a survey of over 11,000 units inspected in Ontario in 1972. The statistics gathered during the national pilot show similar results (Fig. 5).

INSPECTION OF NEW DEVICES DURING NATIONAL PILOT

Class	Description	Quantity Inspected	Percentage in Error
10	Portable platform, steelyard and suspension	2363	8.9
12	Dormant, under 6,000 lbs.	180	28.9
14	Dormant, 6,000 lbs. & over	97	28.9
15	Grain Elevators, Hopper	12	25.0
16	Vehicle Scales	161	60.2
17	Grain Elevators, Truck	25	56.0
18	Railway Track	6	33.3
20	Equal Arm & Spring	421	4.0
24	Computing	3068	6.5
26	Automatic	12	33.3
29	Metric	421	2.1
30	Static Length	33	3.0
34	Mechanical Length	275	0
40	Static Volume	25	4.0
48	Oil Tanks & Tank Trucks	517	8.5
49	Visible & Self-Measuring Pumps	474	16.9
50	Slow Flow Meters	738	0
51	Propane Meters	36	2.8
52	Meter Pumps (Service Station)	3837	46.3
54	Bulk Meters (Tank Trucks)	325	16.0
56	Bulk Meters (Large Capacity)	950	7.9
TOTAL		13976	19.1

FIGURE 5

A further reason to question inspecting at this level is that these devices are crated and shipped to all parts of Canada, with the result that there is no guarantee that they are still correct when they are installed for use in trade.

There is, however, a requirement to police the device manufacturers to some extent. Otherwise many incorrect devices could be installed which would only worsen the situation. But it should not be necessary to do this by inspecting all devices. Inspecting on a sample basis should also bring adequate results provided the manufacturer is aware that it is his responsibility to ensure that devices are correct when they are shipped.

To be successful there must be prescribed penalties if he does not do this. Standards Branch has suggested that the mere threat of a penalty should be sufficient. If this inspection was considered part of the approval test rather than just an original verification, then any manufacturer who continually produced incorrect devices would be warned that this situation could result in withdrawal of the approval (in effect, they would have to cease production). While this appears to be a rather severe penalty, it would probably never have to be used since the warning alone should be a sufficient deterrent to non-compliance.

The new Weights & Measures Act can probably be interpreted to permit sample testing as long as samples of every lot are inspected and certificates written for all devices in the lot although this needs to be confirmed by the legal division. This change in policy should result in a significant time saving and, with effective policing, should reduce the number of devices in error at this level.

Each type of device will have to be studied from the viewpoint of the advisability of sample testing since it would not be practical in all cases, especially those large capacity devices the performance of which depends to a large extent on correct installation. We therefore recommend that:

8. *The feasibility of applying statistical sampling techniques be studied for the inspection of new devices.*

Conclusion

This concludes the analysis of the national pilot. We have outlined the highlights of the information gathered and have shown how these can be utilized to make the Weights & Measures inspection activity more effective. Further detailed findings are documented in the appendices to this report.

APPENDIX 1

AS FOUND ERROR BY TRADE DURING NATIONAL PILOT

Trade	Quantity Inspected	Percentage In Error
Bakeries & Baked Goods	906	25.0
Beverages, Breweries, Distilleries	629	32.0
Bottled Gas, except L.P.G.	107	25.2
Building Materials	893	29.3
Candies & Confectionery - Retail	1660	23.0
Canning & Food Processing	915	23.0
Cartage & Transportation	1136	32.1
Chemicals	607	33.1
Cleaning & Laundry	112	41.1
Coal & Coke	81	45.7
Construction (road)	374	64.2
Customs & Excise	79	20.3
Dairy Products - Retail	737	21.8
Dept. of Highways - Enforcement	146	45.9
Department Stores - Chain	1374	28.6
Department Stores - Independent	283	15.2
Drugs & Cosmetics	495	12.9
Feed, Seed, Fertilizers	2945	33.7
Fruits & Vegetables - Retail	488	30.3
Fruits & Vegetables - Wholesale	662	32.9
Fuel Oil	3582	31.2
Gasoline	27446	14.0
Grains	5144	26.8
Government Agencies - Other	1265	21.8
Groceries - Chain - (Small)	297	33.0
Groceries - Chain - (Medium)	1190	32.0
Groceries - Chain - (Large)	6166	26.4
Groceries - Independent Affiliate - (Small)	1023	18.2
Groceries - Independent Affiliate - (Medium)	1665	28.6
Groceries - Independent Affiliate - (Large)	931	32.2
Groceries - Independent - (Small)	8604	22.8
Groceries - Independent - (Medium)	2564	27.9
Groceries - Independent - (Large)	724	26.9
Groceries - Wholesale	560	21.8
Hardware	2021	19.7
Hides & Fur Buying	72	37.5
Hospitals, Schools, Institutions	198	18.2
Liquid Petroleum Gas	615	23.9
Livestock Buying	376	34.3

.... cont'd.

Trade	Quantity Inspected	Percentage In Error
Manufacturing - General	7597	27.4
Meats - Retail	2872	30.8
Meats - Wholesale	2175	25.7
Metals	596	40.8
Ores	60	48.3
Paper & Paper Products	542	30.1
Petroleum Products - Other	5909	24.8
Post Office	5651	14.0
Public Weighing & Custom Service	108	37.0
Rock, Fill, Gravel	387	60.5
Scrap Metal Buying	302	45.7
Sea Foods - Retail	183	21.9
Sea Foods - Wholesale	907	21.5
Storage	302	17.5
Weighing & Measuring Device Trade	16787	13.6
Other	5166	27.7

AS FOUND ERROR BY MAKER DURING NATIONAL PILOT

aker	Quantity Inspected	Percentage In Error
ro of Canada Ltd.	89	0
shworth, E. & A. Ltd.	13	84.6
stro Universal Ltd.	1673	10.8
tlas Engg. & Machine	26	88.4
utomatic Scale Co. Ltd.	12	50.0
very - Hardoll Ltd.	171	14.6
very, W. & T. Co. Ltd.	1354	22.8
adger Meter Mfg. Co	5	80.0
arnes Products Inc.	141	38.2
eath, W. D. & Son	2	100.0
ennington Scale Mfg. Co.	151	44.3
erkel Products Co.	2435	29.1
izerba Waagen	21	47.6
owser, S. F. Co. Ltd.	2759	20.0
recknell, Chas. W.	4	75.0
rodie, Ralph N. Co. Inc.	324	51.8
rooks Instruments Canada Inc.	3	0
uffalo Scale Co. Inc.	33	33.3
anadian Meter Co.	150	4.6
anadian Scale Co.	780	38.7
hatillon, John Co.	1956	13.6
lassic Pump Manufacturers Ltd.	254	28.7
etecto Scale Inc.	934	15.2
illon, W.C. & Co.	3	100.0
urant Mfg. Co.	19	5.2
astern Scale Works Ltd.	154	33.1
ntwistle Mfg. Corp.	25	16.0
rie Meter System Inc.	2	0
xach Weight Scale Co.	2079	12.2
airbanks-Morse (Canada) Ltd.	8770	25.6
airbanks-Morse Co. Ltd.	3718	32.0
riden Inc.	83	10.8
arvens Waagenfabrik	4	50.0
asboy of Canada Ltd.	68	14.7
ilbert & Barker Mfg. Co.	8931	16.8
lobe Slicing Machine	158	33.5
ranberg Corp.	7	28.5
ray Co. Inc.	5	40.0
urney Scale Co.	2195	29.4
riffiths, D. M.	15	46.6
adley, H. A. Assoc. Inc.	2	0
obart Mfg. Ltd.	4361	22.6
olm Automatic Scale Co.	4	50.0
oms Co.	35	28.5

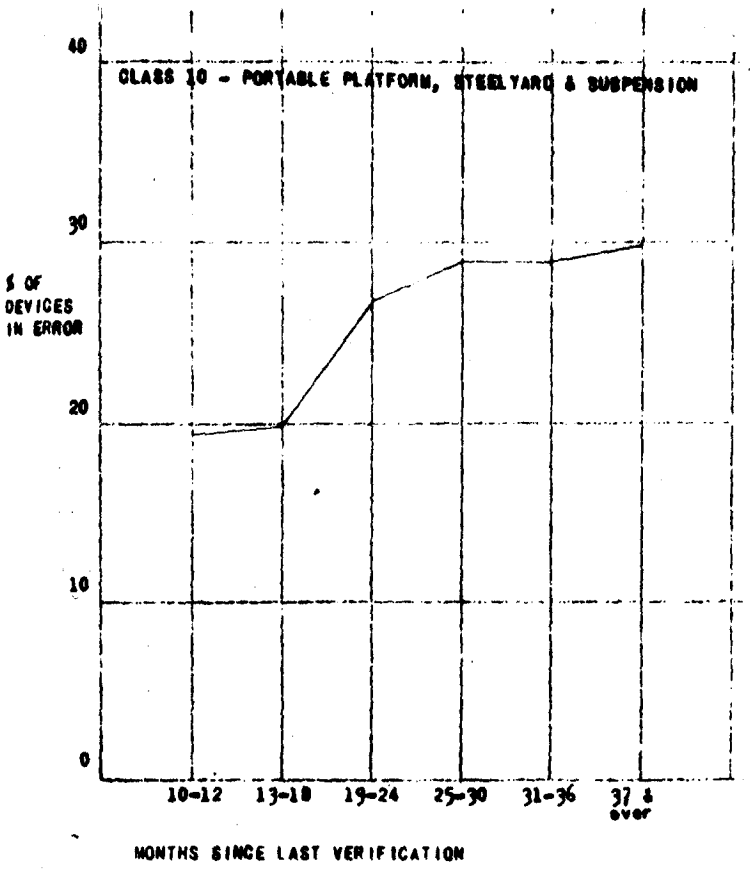
Maker	Quantity Inspected	Percentage In Error
[illegible]-Richardson Scale Co.	2492	32.9
[illegible], S. Co. Inc.	155	52.9
[illegible]strial Scale Co.	23	21.7
[illegible]ternational Scales & Equip.	52	34.6
[illegible]s Bros. Inc.	64	28.1
[illegible]eene of Canada Corp.	352	28.4
[illegible]ert, George (Canada) Ltd.	1	100.0
[illegible]ischer, E. A.	6	33.3
[illegible]incoln Engineering Co.	36	2.7
[illegible]indells Scale Mfg. Co.	16	37.5
[illegible]iquid Control Corp.	1673	35.8
[illegible]ungmans Verkstader	4	25.0
[illegible]anitoba Bridge & Iron Works	408	37.0
[illegible]artin Decker	23	0
[illegible]cDowell Co. Inc.	1	100.0
[illegible]cHenry Universel Ltd.	115	19.1
[illegible]easuregraph Co. Ltd.	66	3.0
[illegible]errick Scale Mfg. Co.	5	40.0
[illegible]ettler, E. Co.	10	10.0
[illegible]innespolis Electric	7	28.5
[illegible]olenschot, Jan & Son	41	17.0
[illegible]ational Scale Co.	39	35.8
[illegible]ational Store Specialty Co.	103	12.6
[illegible]eptune Meters Ltd.	7273	23.6
[illegible]ew Way Equipment Co.	7	28.5
[illegible]heus Scale Corp.	1473	5.7
[illegible]lympic Instruments Lab.	528	.7
[illegible]elouze Mfg. Co.	2	50.0
[illegible]ennsylvania Scale Co.	119	14.2
[illegible]etroquip Ltd.	187	12.8
[illegible]itney-Bowes Inc.	2507	10.0
[illegible]ower-Plus Corp.	1	0
[illegible]amsey, R. E. C. Ltd.	10	10.0
[illegible]enfrew Aircraft & Engg.	5	20.0
[illegible]enfrew Machinery Co. Ltd.	45	24.4
[illegible]ichardson Scale Co.	148	38.5
[illegible]ockwell Mfg. Co.	13	38.4
[illegible]alter, Gearge & Co.	251	32.2
[illegible]anitary Scale Co.	936	26.8
[illegible]artorium Werke	10	50.0
[illegible]auter, August, of New York	5	60.0
[illegible]chwelmer Eisenwerk	8	12.5
[illegible]iemens-De Laval	16	75.0
[illegible]kinner, Thomas & Son Ltd.	49	10.2
[illegible]mith, A. O. Corp.	718	34.5

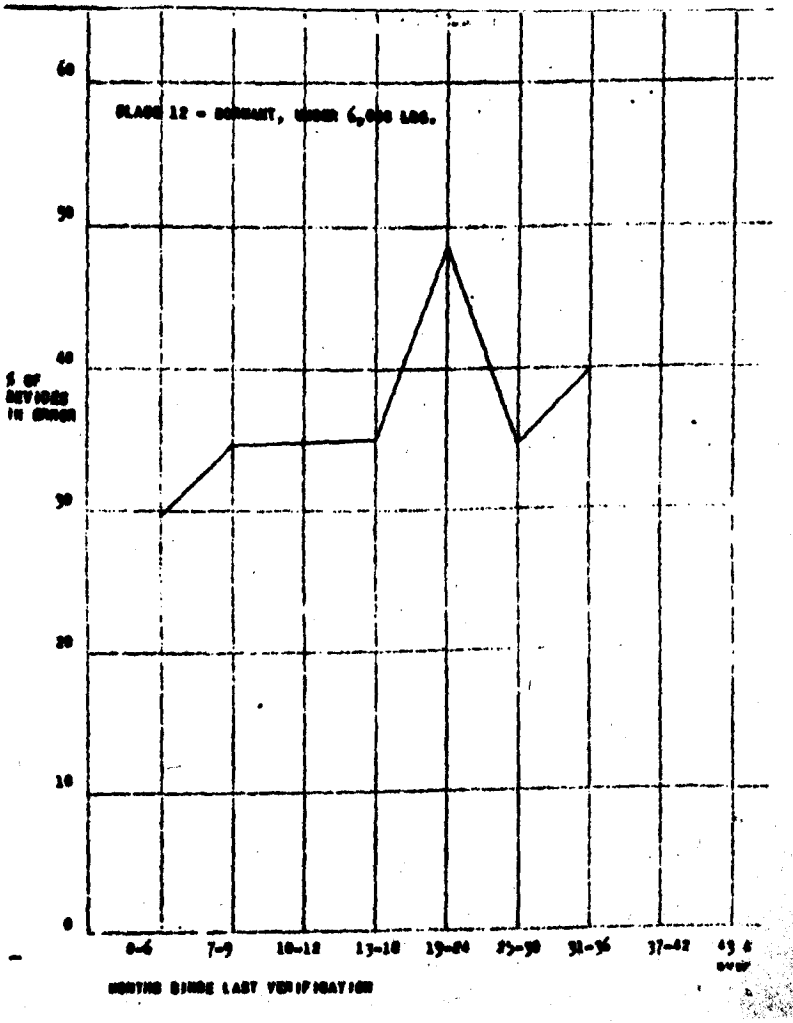
.... cont'd.

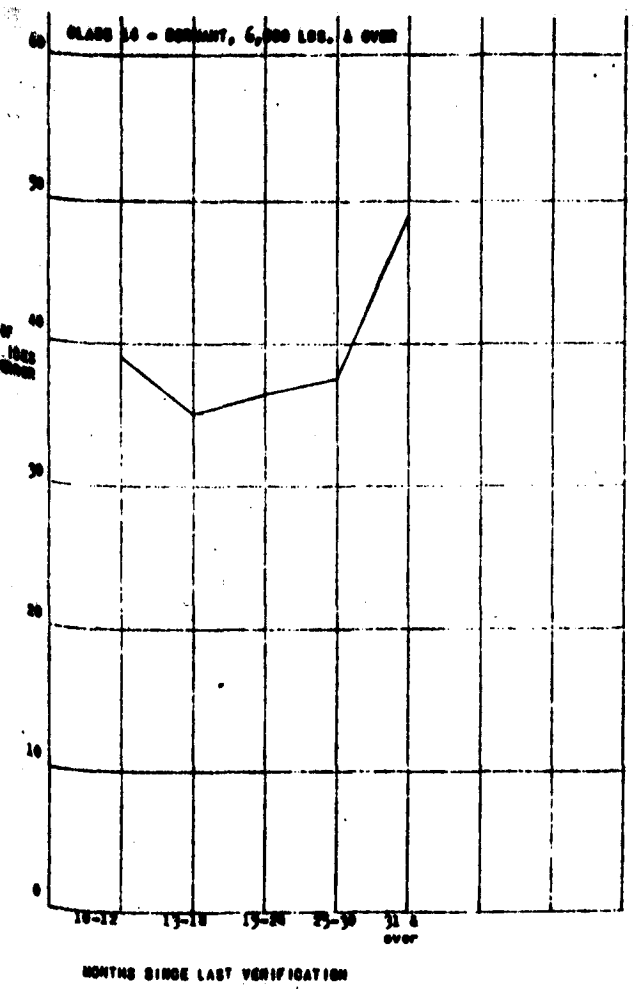
Maker	Quantity Inspected	Percentage In Error
Stathmos Aktiebolaget	403	19.3
Stewart-Warner-Alemite Corp.	336	20.5
Stimpson Computing Scale Co.	1136	29.1
Streeter-Amet	12	58.3
Swift & Swallow	10	50.0
Thorton, F. J. Co. Ltd.	286	17.1
Thurmann Machine Co.	94	51.0
Tokheim Corp.	4209	12.7
Toledo Scale Co. Ltd.	25429	28.4
Torsion Balance Co.	340	22.0
Trans-weigh Div. of Compudyne	4	50.0
Triner Scale Mfg. Co.	2623	14.2
Troemner, Henry Inc.	56	5.3
Trumeter Co. Inc.	3	33.3
VAF (Meters)	847	2.4
Wayne Pump Co.	6405	18.3
Webb Corp.	18	72.2
Weber Electric Mfg.	8	25.0
Western Scale Co. Ltd.	42	66.7
White, John & Son	13	30.7
Winslow Government Std. Scale	11	9.0
Wood, John Co.	7651	11.8
Yale & Towne Mfg. Co.	2	50.0
Yamato Scale Co.	1	0
Zhunsheng Scales	345	1.1
Other	7565	17.6

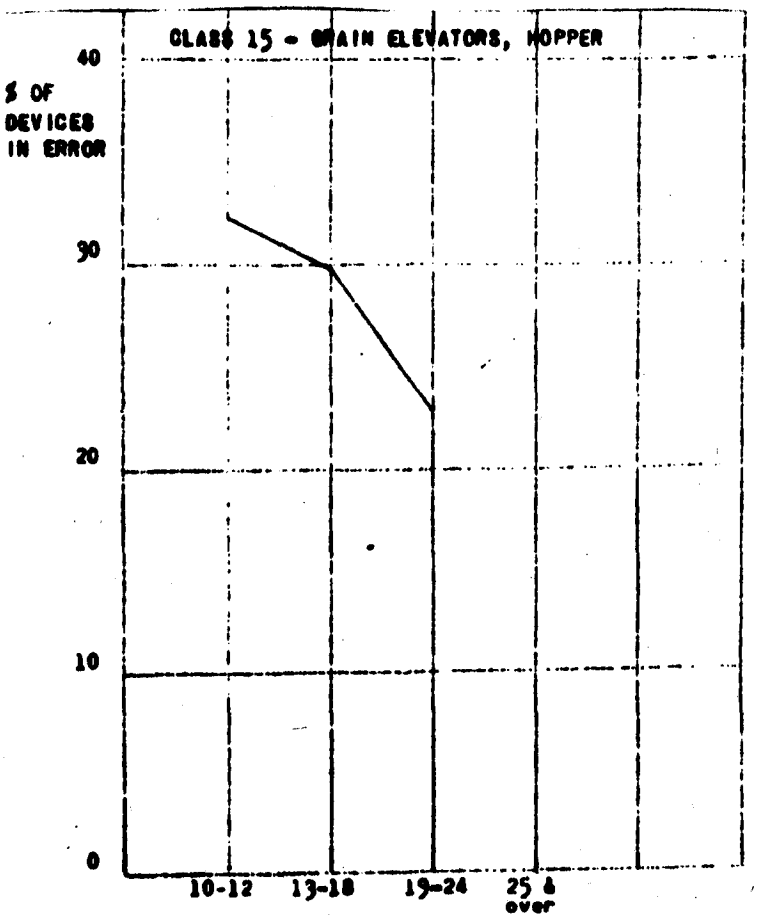
APPENDIX 3

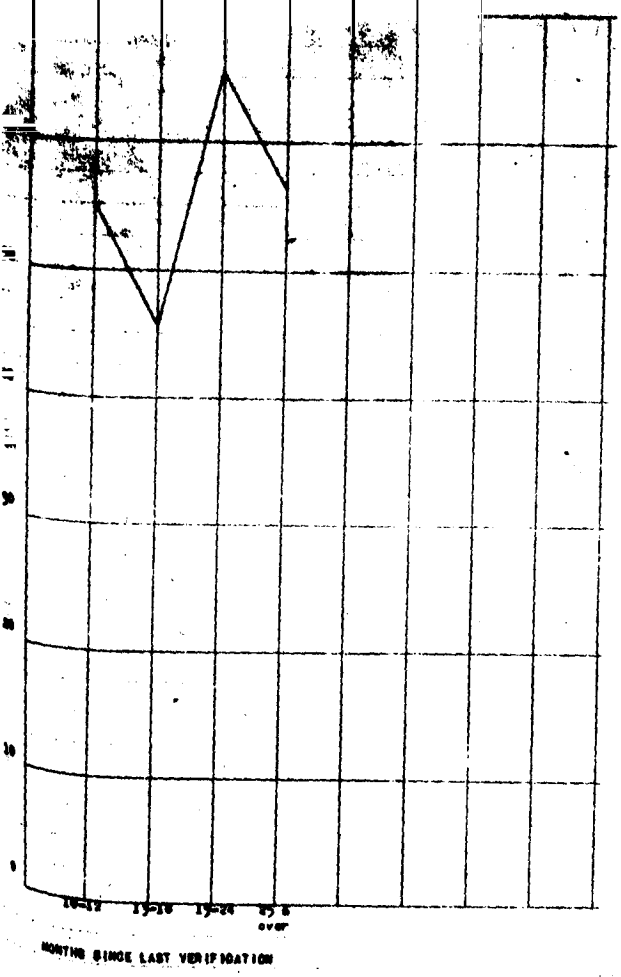
"ERRORS BY LENGTH OF INSPECTION CYCLE DURING NATIONAL PILOT"

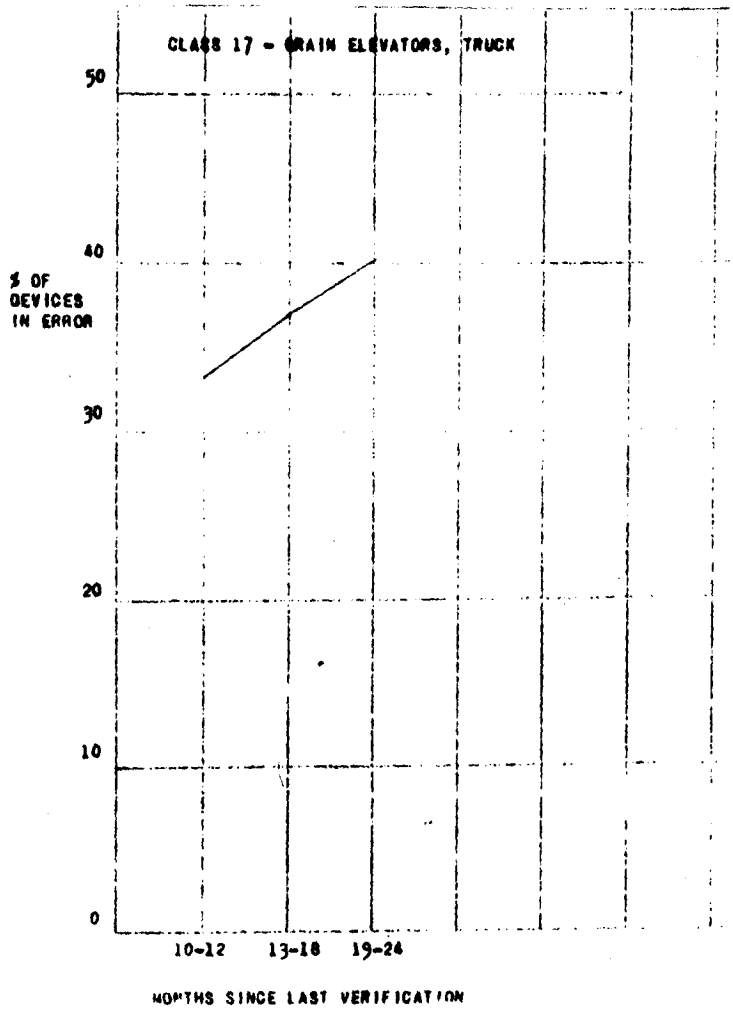




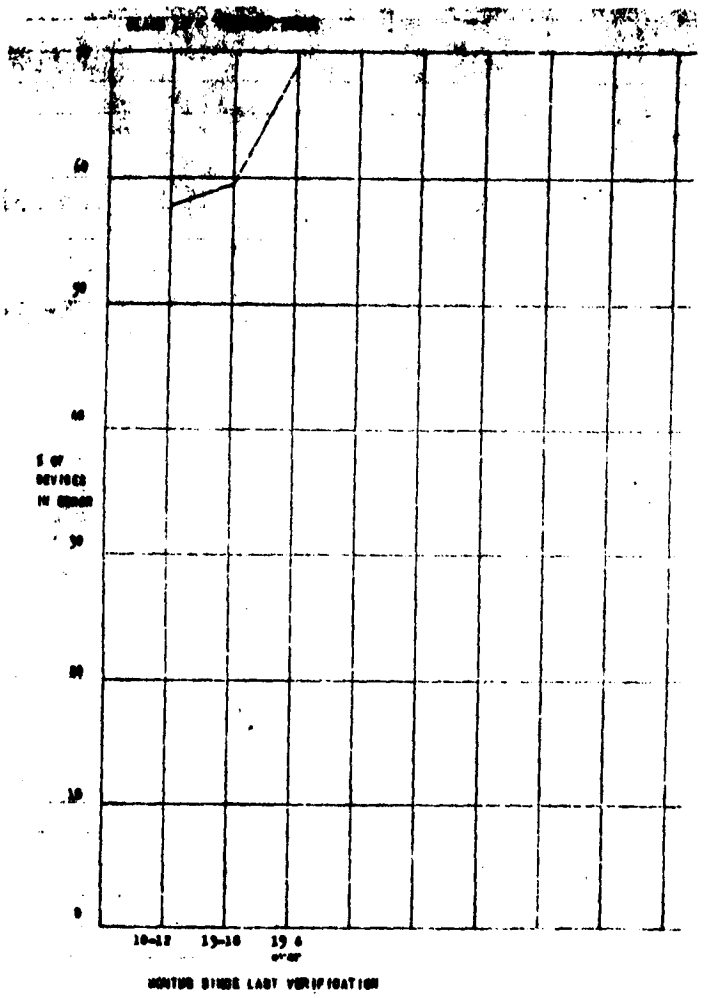

40
30
20
10
0
10-12
13-18
19-24
25-30
31 & over
MONTHS SINCE LAST VERIFICATION


CLASS 15 - GRAIN ELEVATORS, HOPPER
% OF DEVICES IN ERROR
40
30
20
10
0
10-12
13-18
19-24
25 & over
MONTHS SINCE LAST VERIFICATION

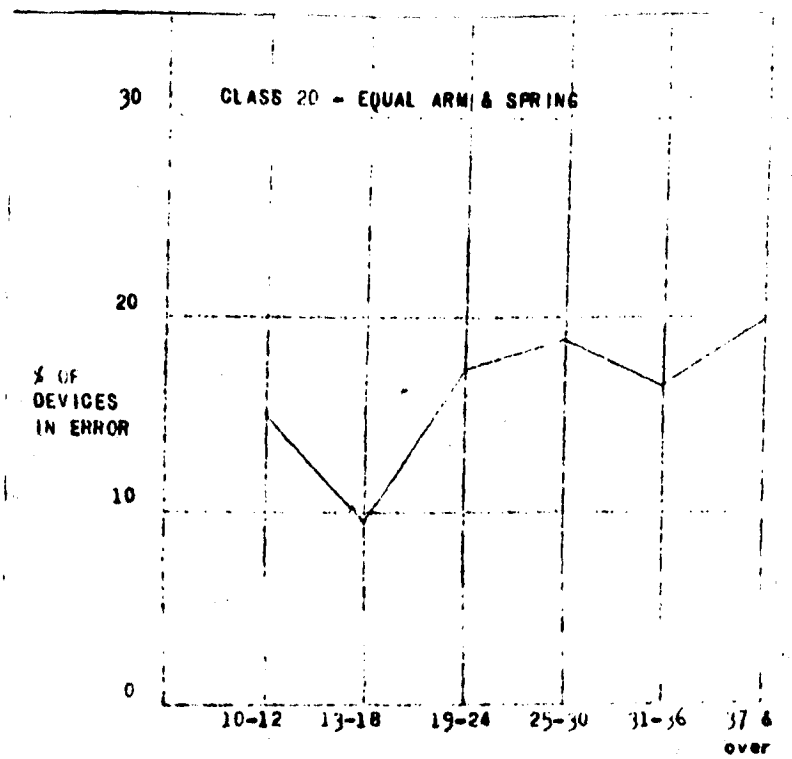

MONTHS SINCE LAST VERIFICATION

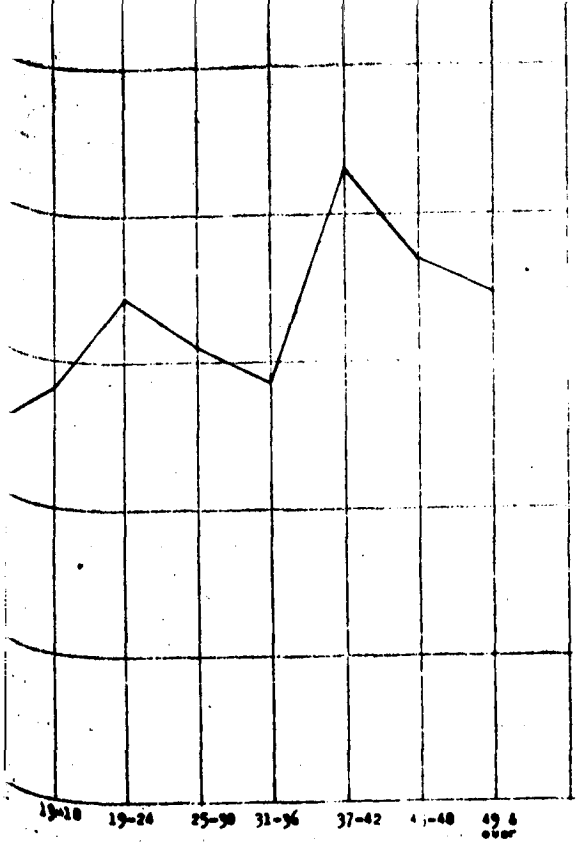

CLASS 17 - GRAIN ELEVATORS, TRUCK
50
40
30
20
10
0
% OF DEVICES IN ERROR
10-12
13-18
19-24
MONTHS SINCE LAST VERIFICATION

CLASS 18 - RAILWAY TRUCK

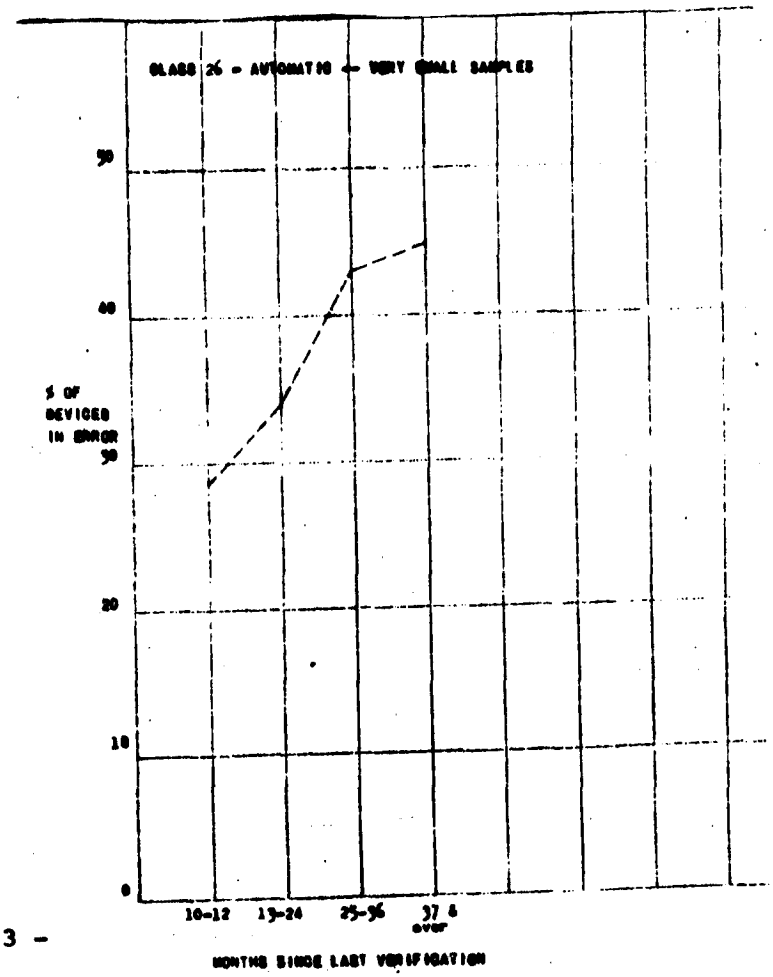


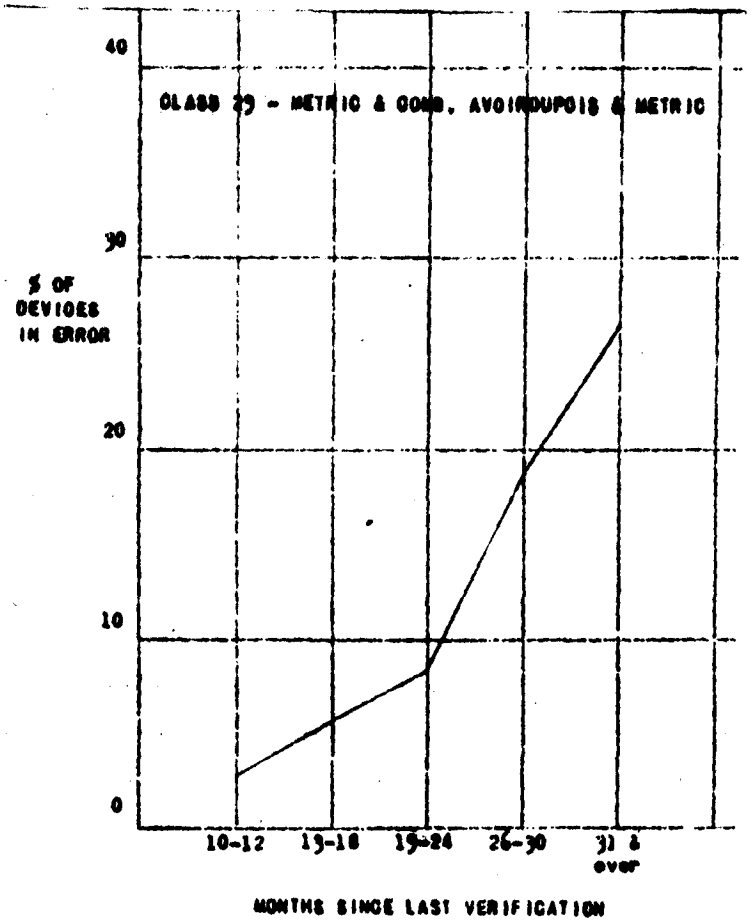
CLASS 20 - EQUAL ARM & SPRING

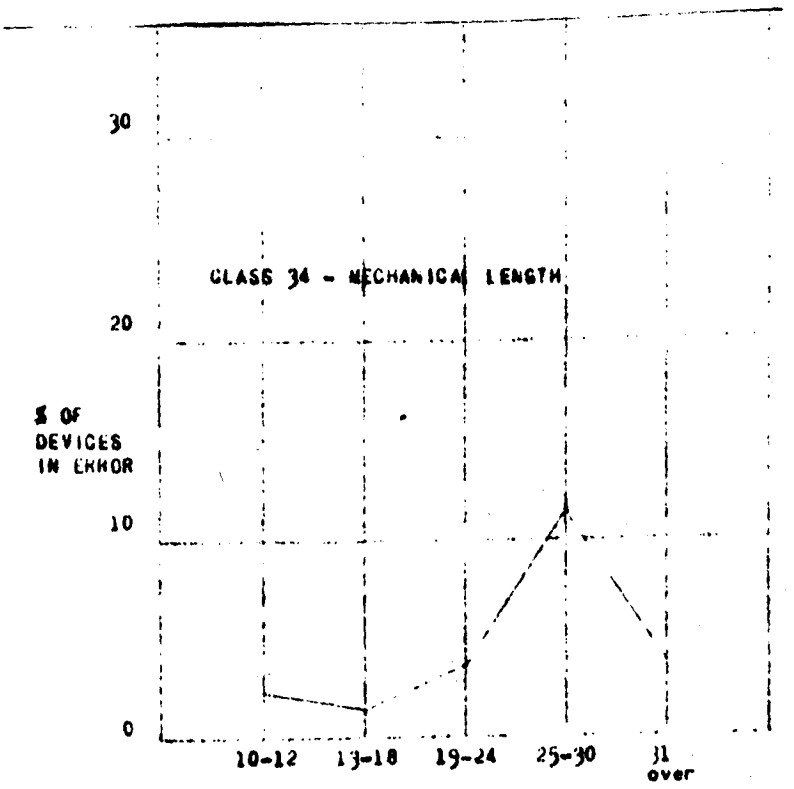


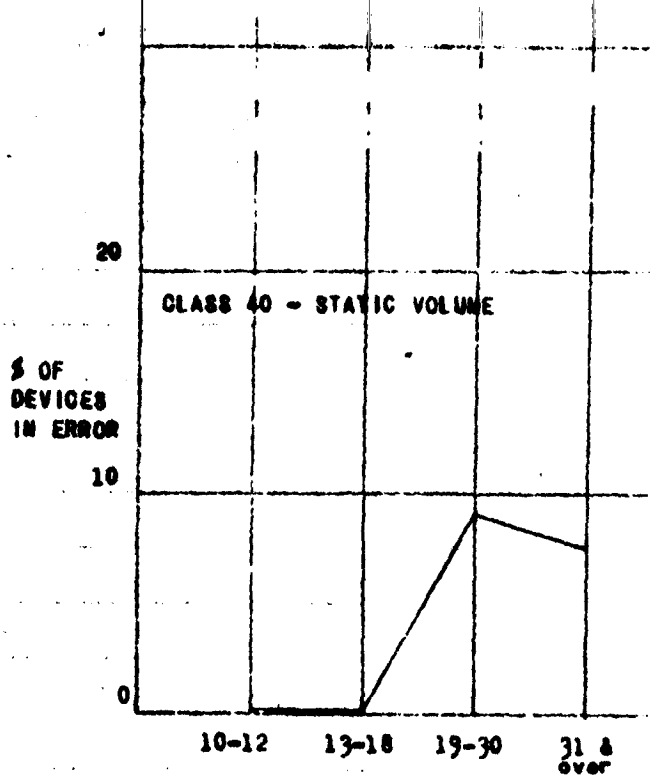


MONTHS SINCE LAST VERIFICATION

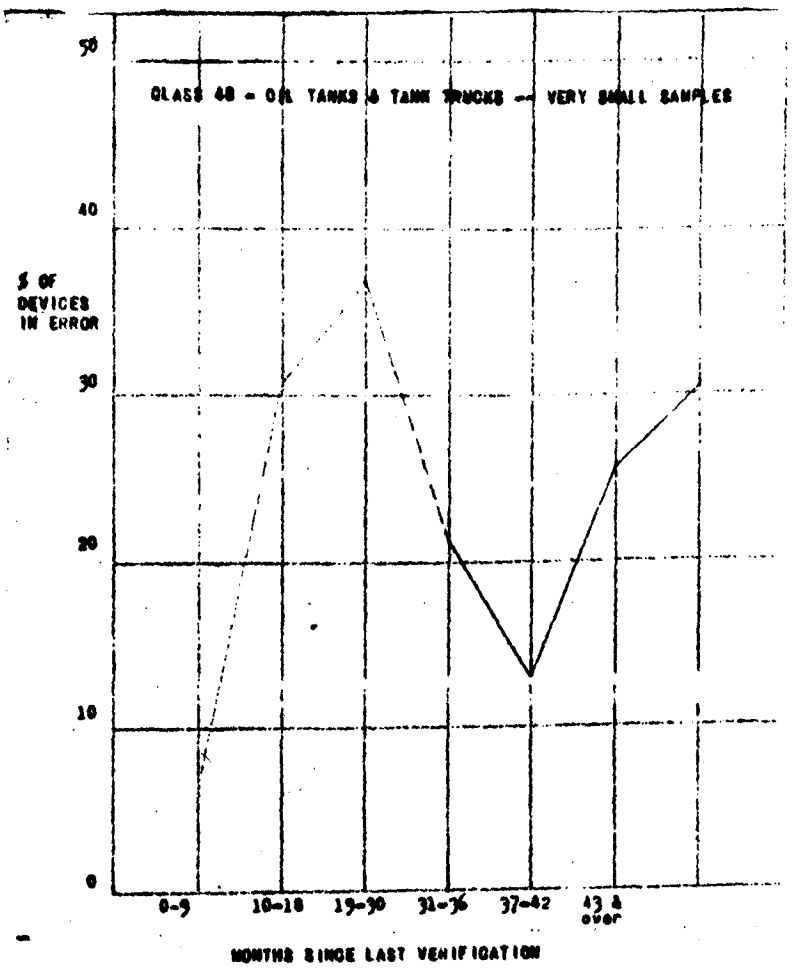



40
30
20
10
0
% OF DEVICES IN ERROR
10-12
13-18
19-24
25-30
31 & over
MONTHS SINCE LAST VERIFICATION

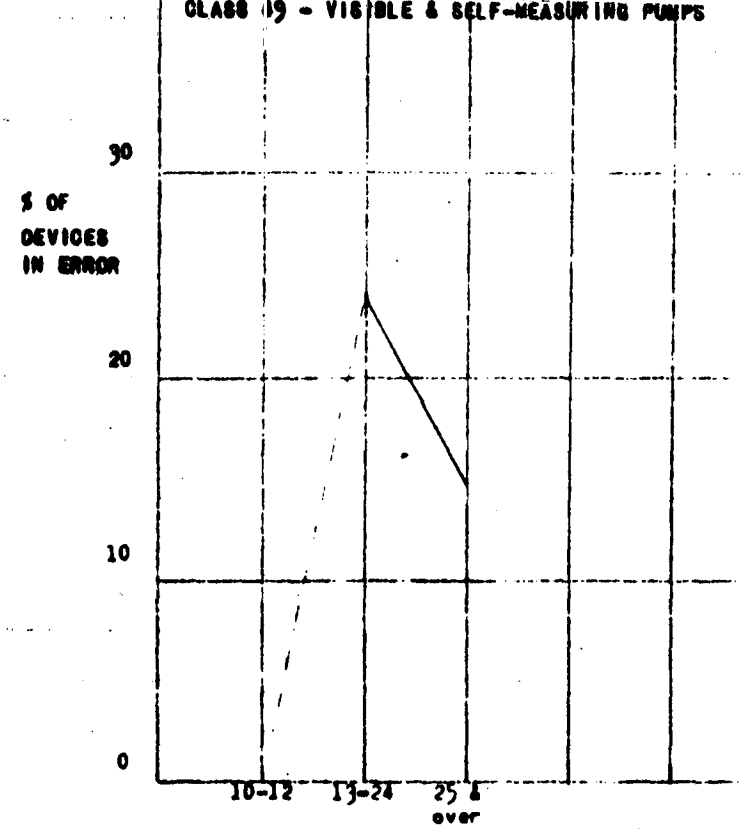

30
20
10
0
% OF DEVICES IN ERROR
10-12
13-18
19-24
25-30
31 over
MONTHS SINCE LAST VERIFICATION

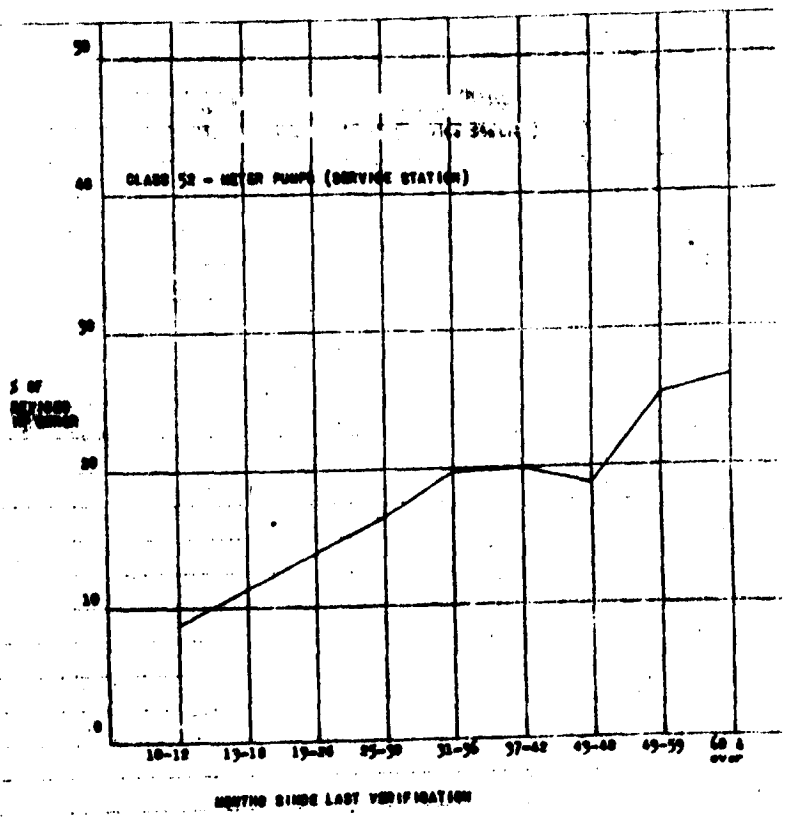


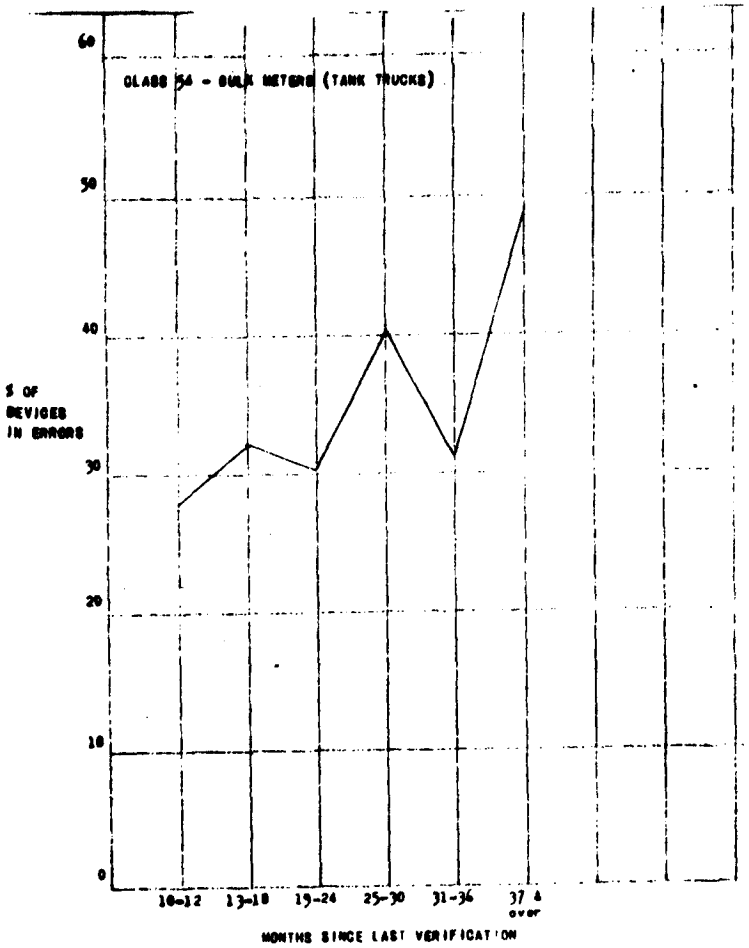
MONTHS SINCE LAST VERIFICATION

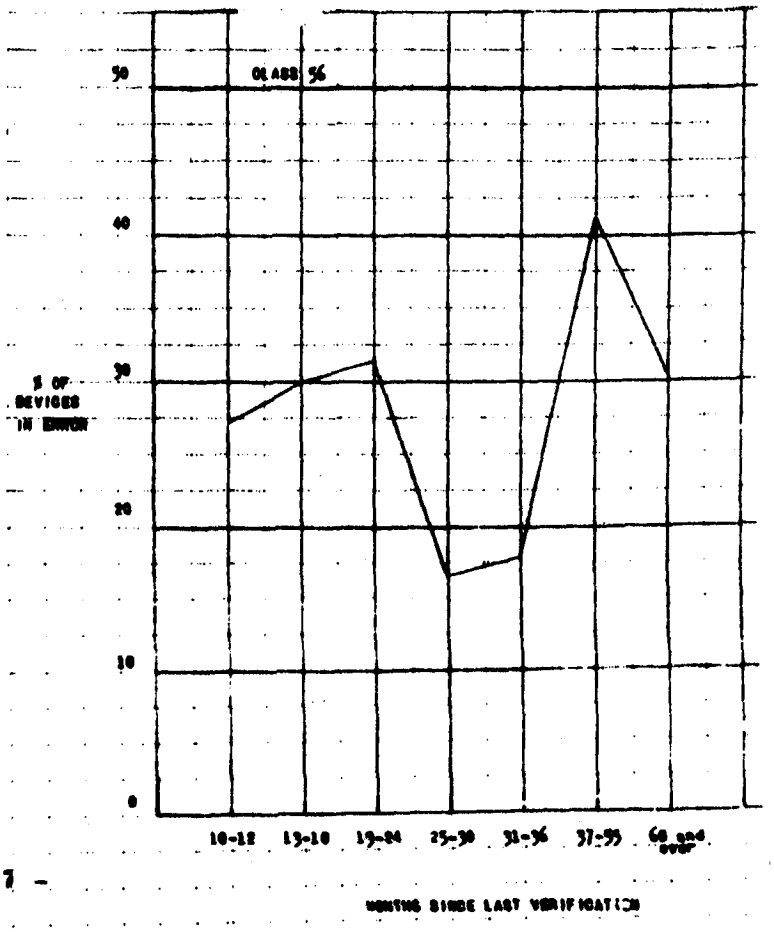


MONTHS SINCE LAST VERIFICATION


CLASS 19 - VISIBLE & SELF-MEASURING PUMPS
30
20
10
0
$ OF DEVICES IN ERROR
10-12
13-24
25 & over
MONTHS SINCE LAST VERIFICATION


50
40
30
20
10
0
10-12
13-18
19-26
27-30
31-36
37-42
43-48
49-59
60 & over


CLASS 56 - BULK METERS (TANK TRUCKS)
60
50
40
30
20
10
0
% OF DEVICES IN ERRORS
10-12
13-18
19-24
25-30
31-36
37 & over
MONTHS SINCE LAST VERIFICATION


CLASS 56
50
40
30
20
10
0
% OF DEVICES IN ERROR
10-12
13-18
19-24
25-30
31-36
37-59
60 and over
MONTHS SINCE LAST VERIFICATION

APPENDIX 4

AVERAGE INSPECTION TIME BY CLASS DURING NATIONAL PILOT

Class	Quantity	Average Time (min.)
Portable platform, Steelyard & Susp.	13348	17.5
Dormant, under 6,000 lbs.	1223	31.8
Dormant, 6,000 lbs. & over	870	79.7
Grain Elevators, hopper	309	79.7
Dormant Wagon or Truck	1958	105.7
Grain Elevators, truck	36	75.9
Dormant Railway Track	148	175.5
Equal Arm & Spring	798	11.7
Computing	13913	16.3
Automatic	44	79.4
Metric & Comb. avdp. metric	310	15.2
Static Length	1089	4.0
Mechanical Length	287	21.4
Static Volume	97	66.1
Oil Tanks & Tank Trucks	843	245.3
Visible & Self-measuring Pumps	428	21.7
Slow Flow Meters	697	12.2
Propane Meters	297	65.1
Meter Pumps (Service Station)	29445	17.9
Bulk Meters (Tank Trucks)	5181	48.0
Bulk Meters (Large Capacity or Others)	3104	66.9
Milk Meters	6	101.6

TYPE OF ERROR	Portable Platform, Steelyard Susp.	Dormant, under 6,000 lbs.	Dormant, 6,000 lbs. and over	Grain Elevators, Hopper	Dormant Wagon or Truck	Grain Elevators, Truck	Dormant Railway Track	Equal Arm and Spring	Computing	Automatic	Metric and comb. avdp. metric	Static Length	Mechanical Length	Static Volume	Oil Tanks & Tank Trucks	Visible & Self-Measuring Pumps	Slow Flow Meters	Propane Meters	Meter Pumps (Service Stn.)	Bulk Meters (Tank Trucks)	Bulk Meters (large capacity or others)	Milk Meters	
NO ERROR	21,434	1,706	917	1,322	1,007	979	78	4,632	20,657	72	2,143	526	651	156	827	527	991	317	28,482	3,920	3,201	3	95,129
SHORT BY 1 TOLERANCE	272	21	18	13	25	4	5	25	366	1	3		3	1	10	4	1	2	865	308	205		2,174
SHORT BY 2 TOLERANCES	215	31	31	12	38	18	3	19	324	1	6		4	1	3	3			586	225	85		1,609
SHORT BY 3 TOLERANCES	91	21	16	11	36	20	4	5	87	2	1		1		2			1	226	67	35		631
SHORT BY 4 OR MORE TOLERANCES	121	48	48	27	82	27	5	2	89	5	4	1			3		1		212	77	39		794
NON-CONFORMING LOCATION (cust. visibility, environment)	213	2	3	7	4			8	174										12	45	6		474
OFF ZERO-BALANCE	2,802	319	186	325	178	245	5	412	2,849	16	87	2			2	1			17	5	4		7,455
EXCESSIVE VARIATIONS IN CORNER OR SECTION TESTS	211	41	37	19	307	54	23	39	78										13				822
APPARENT BINDING IN DEVICE	422	83	59	61	168	67	16	90	493		6		1			2			18	5	2		1,493
ERRATIC INDICATIONS	278	69	42	26	67	18	7	30	465	3	2				6				58	33	25		1,130
SCALE WILL NOT WEIGH TO CAPACITY LOAD	61	13	2		5			1	125		1				1				2	8			219
OVER BY 1 TOLERANCE	92	15	12	14	17	14	4	17	188		1		1	2	4	4		2	507	178	78	1	1,157
OVER BY 2 TOLERANCES	134	27	24	5	34	59	7	12	202		5		2		6	4	1	5	602	250	92	2	1,484
OVER BY 3 TOLERANCES	78	17	15	8	27	34	6	5	90	1				1	1			2	199	64	21	2	573
OVER BY 4 OR MORE TOLERANCES	125	63	32	19	81	50	6	7	123	6	4		2		2	2		1	418	109	42	2	1,095
OTHER ERRORS	1,020	126	85	34	138	37	9	146	2,033	19	82	3	2	7	83	80	12	15	1,987	562	340	8	6,854
TOTAL INSPECTIONS	27,569	2,602	1,527	1,903	2,214	1,626	178	5,450	28,343	126	2,345	532	667	168	950	627	1,006	345	34,204	5,856	4,175	18	123,093
% IN ERROR	22.3	34.4	39.9	30.5	54.5	39.8	56.2	15.0	27.1	42.9	8.6	1.1	2.4	7.1	12.9	15.9	1.5	8.1	16.7	33.1	23.3	83.3	22.7

APPENDIX 5

AVERAGE PRODUCT VALUE PER DEVICE BY TRADE

Trade	Value
Bakeries & Baked Goods	47,857
Beverages, Breweries, Distilleries	374,544
Bottled Gas, except L.P.G.	181,452
Building Materials	101,974
Candies & Confectionery - Retail	19,193
Canning & Food Processing	121,036
Cartage & Transportation	153,750
Chemicals	225,434
Cleaning & Laundry	97,272
Coal & Coke	119,955
Construction (road)	284,114
Customs & Excise	236,444
Dairy Products - Retail	9,809
Dept. of Highways - Enforcement	604,500
Department Stores - Chain	52,340
Department Stores - Independent	29,565
Drugs & Cosmetics - Retail	14,692
Feed, Seed, Fertilizers	190,084
Fruits & Vegetables - Retail	32,972
Fruits & Vegetables - Wholesale	78,836
Fuel Oil	191,489
Gasoline	49,930
Grains	162,740
Government Agencies - Other	51,500
Groceries - Chain - Small	28,686
Groceries - Chain - Medium	71,294
Groceries - Chain - Large	88,263
Groceries - Independent Affiliate - Small	23,385
Groceries - Independent Affiliate - Medium	44,064
Groceries - Independent Affiliate - Large	60,703
Groceries - Independent - Small	13,674
Groceries - Independent - Medium	32,132
Groceries - Independent - Large	64,160
Groceries - Wholesale	86,618
Hardware	18,670
Hides & Fur Buying	150,531
Hospitals, Schools, Institutions	36,465
Liquid Petroleum Gas	79,812
Livestock Buying	308,623
Manufacturing - General	129,427

..... cont'd.

rade	Value
eats - Retail	54,448
eats - Wholesale	121,950
etals	283,125
res	550,263
aper & Paper Products	24,202
etroleum Products - Other	229,558
ost Office	23,716
ublic Weighing & Custom Service	132,844
ock, Fill, Gravel	391,725
crap Metal Buying	246,144
ea Foods - Retail	34,315
ea Foods - Wholesale	133,901
torage	176,645
eighing & Measuring Device Trade	373,785
ther	115,882
otal	89,567