REBUTTAL TESTIMONY OF GEORGE CLINTON BROWN

Mr. Bromley testified (Page 13, lines 6 - 11) that testing of 1V thermal demand meters has been conducted in compliance with FPSC rules. Do you agree with this testimony?

No. This issue is similar to one addressed in Mr. Matlock's testimony filed on behalf of PSC staff. Mr. Matlock recognized that FPSC rules do not specifically address how to determine the appropriate refund for over-registration by demand meters (Matlock Direct Testimony, Page 7-8, lines 24 - 1). Likewise, the FPSC rules do not specifically address how 1V thermal demand meters should be tested. Rule 25-6.052(2)(a) addresses the performance of thermal demand meters, but does not specify where on the meter's scale testing should be conducted. However, this issue is addressed by both ANSI Standard C12.1-2001 and the meter's manufacturer, Landis & Gyr. ANSI C12.1 states in section 5.2.1.2 that "[m]echanical or lagged thermal demand meters should be tested at load points at or above 50% of full scale." (See 013 TDM, attached hereto as Rebuttal Exhibit GB-1.) Likewise, Landis & Gyr, the manufacturer of the 1V thermal demand meters in this docket, also recommends that its thermal demand meters be tested at or above 50% of full scale. (See excerpt of Landis & Gyr Technical Manual, page 6, attached hereto as Rebuttal Exhibit GB-2.) While both of these sources recognize that a meter's performance is acceptable when full scale error is less than 4% when tested between 25% and 100% of full scale, they clearly recommend testing at loads between 50% and 100% of full scale.

What is your understanding as to why ANSI and Landis & Gyr recommend testing at or above 50% of full scale?

These entities recognize that the thermal demand meters are much more accurate when tested at higher load points. FPL has presumably known this since at least April 5, 1982, when it received a letter from Landis & Gyr addressing this issue (See 4829-4832 TDM, attached hereto as Rebuttal Exhibit GB-3.). In this letter, Landis & Gyr provides a chart which clearly depicts the relationship between meter error and "percent scale deflection," or percent of full scale. This chart clearly indicates that a meter tested at 50% of scale, and exhibiting 0.5 % error, would register 1% error when tested at full scale. Likewise, a meter tested at 25% of full scale, an exhibiting a 0.25% error, would register 1% error when tested at full scale. This chart tells us that a meter exhibiting a 4% full scale error when tested at 50% of full scale will exhibit an 8% full scale error when tested at 100%, and that a 4% error when tested at 25% of full scale will result in a 16% error when tested at 100%.

What else has the manufacturer of the meters in dispute, Landis & Gyr, done to indicate that a meter tested at a higher load is more accurate than a meter tested at a lower load?

This point is further emphasized by the letter sent by Landis & Gyr to FPL on May 28, 1982 (See 001-002 TDM, attached hereto as Rebuttal Exhibit GB-4). In this letter, Landis & Gyr notifies FPL that it has changed its calibration procedures so that thermal demand meters are tested at 75%, rather than 50%, of full scale, and states that this change has allowed Landis & Gyr to "improve the performance of this product." This letter also includes a "Calibration Warranty" for thermal demand meters, stating that meters are tested at 75% of full scale, and that calibration is maintained within plus or minus 1% of full scale. When this Calibration Warranty is viewed in conjunction with the chart attached to the April 5, 1982, letter (Rebuttal Exhibit GB-3), it is clear that the meter manufacturer has instituted a policy designed to provide meters that are accurate over the range of recommended test load points.

In conclusion, there is no FPSC Rule that specifies the manner in which thermal demand meters should be tested for accuracy. Therefore, Mr. Bromley's testimony that

FPL's testing was conducted in compliance with FPSC Rules is off base.

Mr. Bromley testified (Page 13, line 13 - Page 15, line 13) that FPL has recently modified its process for testing customer requests for thermal demand meter tests and that this change is consistent with the requirements of Rule 25-6.052. Do you agree with this testimony?

No. There are several things about this testimony that are incorrect. First, as discussed above, Rule 25-6.052 does not specify test requirements for thermal demand meters. This rule only addresses performance requirements of thermal demand meters. Mr. Bromley states (page 15, lines 12-13) that "Rule 25-6.052 state[s] that testing demand at any point between 25% and 100% of full scale is appropriate." This is simply incorrect. Rule 25-6.052 does not address test points - rather it addresses what constitutes acceptable performance. Again, there is a reason why ANSI and the manufacturer recommend testing at or above 50% of full scale - and that reason is that these entities recognize that, due to the inherent operating characteristics of these meters, testing at a low percentage of full scale provides no assurance that the meter will be accurate at higher points on the scale. In direct contrast to Mr. Bromley's view, Landis & Gyr's calibration warranty is premised on a test conducted at 75% of full scale, with a full scale accuracy of plus or minus 1 %. By testing at this point, at this level of accuracy, Landis and Gyr provides the best available assurance that its meters will meet the applicable performance standard (plus or minus 4% full scale error when tested between 25% and 100% of full scale) when tested.

Do you have concerns about FPL's recently "modified" test process for thermal demand meters?

Yes. The modification Mr. Bromley refers to is to test thermal demand meters at each customer's 24-month average demand. As Mr. Bromley's example indicates, this can result in testing conducted at less than 50% of full scale - testing which is not recommended by either the meter manufacturer or ANSI. Mr. Bromley's testimony conflates two very important - and very different - pieces of information that can be determined from FPL's testing of thermal demand meters. In any meter test, it is possible to determine <u>both</u> the meter's full scale accuracy and the meter's test point accuracy. This issue is discussed in more detail below.

Mr. Bromley testifies (Page 15, line 17 - Page 16, line 6) regarding which meters in this docket are entitled to refunds for testing outside of allowed tolerance levels. What is your reaction to this testimony?

I want to comment about the bent meter error found at a Target store, specifically, Target meter, serial # 23864871, company # 1V5871D, located at Fruitville Rd. Sarasota. This meter has two errors associated with its accuracy. The test records show a calibration error ranging from 2.21% to 3.57% depending on where the meter was tested by FPL on the full-scale. The other part of error in registration is due to a bent black maximum indication pointer. The pointer is bent outward toward the red instantaneous pointer, which causes the red pointer to strike the black pointer prematurely causing an erroneous deflection of approximately +2.5 divisions on the scale. That additional deflection amounts to +30 KWD anywhere on the scale.

What is the effect of this bent black maximum modification pointer?

SUSI has documented with photography over a period of April 2002 through August 2002 that the bent black pointer was never captured by the red pointer as FPL has claimed. In fact, on August 10, 2002, when the meter was independently tested by Mr. Bob Armstrong, the representatives from FPL, SUSI and the FPSC all witnessed the pointers being separated. Mr. DeMars, FPL's principle metering engineer was present and visually inspected the meter to identify this mal-adjustment. That point in time is recorded on video and is available for review if necessary.

The historic billing data following the change out of the disputed meter supports the combined error. Since the meter replacement there has been an average of 58 KWD monthly reductions. The full-scale of the meter is 7 with a multiplier constant of 120; therefore the full-scale value of this meter is 840 KWD. If the percentage error of 3.57% stated above is calculated to a value of full-scale, the error value is approximately 30 KWD. That 30 KWD combined with the mis-alignment error of 30 KWD equals a 60 KWD monthly error. The average monthly billing difference of -58 KWD is very convincing evidence that the pointers were never stuck together at any point through out the history of energy usage on this meter.

Does this then equate to a percentage of error for this meter?

Yes, according to my calculations, it equates to a 7.14% error as of full scale.

Mr. Bromley testifies (Page 18, line 19 - Page 19, line 23) that the full scale percent error is the appropriate error to be used for calculating refunds for demand over-registration. Do you agree with this testimony?

No. When a thermal demand meter is tested for as-found accuracy, three important pieces of information can be determined from that test. One is the full scale meter accuracy, the second is the test-point percent error, and the third is the zero error. As explained by Mr. Matlock in his testimony (Page 10, lines 3 - 11), basing a customer's refund on full scale error results in a refund that does not make the customer whole.

For example, if a meter with a full scale reading of 5 is tested, and the tested meter reads 2 while the standard meter reads 1, the following information can be determined:

Full scale error: [(Tested Meter) - (Reference Meter)] / Meter Full Scale

$$[(2 - 1)] / 5 = 1/5, \text{ or } 20\%$$

Test point error: [(Tested Meter) - (Reference Meter)] / Reference Meter

[(2 - 1)] / 1 = 1/1 = 100%

In this example, if the customer actually paid for two units of demand when only one unit of demand was actually used, the refund necessary to make the customer whole would be 100% of one unit of demand. Calculating the customer's refund based on the full scale error, and using FPL's methodology, would result in the following billing adjustment:

Correction Factor = 1 / (registration percentage) = 1 / 1.20 = 0.8333

Adjusted Demand = Billed Demand * Correction Factor

= (2) * (0.8333)

= 1.67

So, in this example, the customer's adjusted bill would be for 1.67 units of demand when only 1.0 unit of demand was used. If demand was billed, for example, at $10 per unit of demand, this customer's adjusted bill would be for $16.70, when only $10 worth of demand was actually used. In other words, rather than getting back $10.00, the amount overcharged, the customer would get back only $3.30. Clearly, this does not make the customer whole. Moreover, using full scale error to calculate customers' refunds fails to comply with the requirement of Rule 25-6.103 that refunds should be based on "the amount billed in error." In this example, the amount billed in error is one unit, or $10 worth of demand. Therefore, the appropriate refund is $10, not $3.30. It should also be noted that the meter manufacturer, Landis & Gyr, also recommends using the test point error as one component of a proper refund calculation. (See April 5, 1982 letter in Rebuttal Exhibit GB-3.)

What consideration should be given to zero error for refund calculation purposes?

Neither FPL nor Mr. Matlock have properly considered the effects of zero error for refund calculation purposes. As discussed by Landis & Gyr in its April 5, 1982, letter to FPL, a proper refund for demand over-registration is based on two components: the first is the "test load error" which is equivalent to the test-point error discussed above. The second is the zero error component. Zero error is the registration error that occurs when the indicating pointer is not on zero when the meter is energized, but with no current flowing through the meter. The total error is the sum of test load error and zero error.

Although the test-point percent error may better represent the actual impact on a customer from an over-registering meter than does the full-scale calibration error, it does not always best represent the actual impact on the customer from meter over-registration. In fact, FPL also recognizes that using the tested meter accuracy often greatly understates the impact on the customer from thermal demand meter over-registration. This is why FPL, in providing refunds for 1V meters that over-registered demand beyond an acceptable range of tolerance, based refunds on the higher of: 1) the test error; or 2) the actual percentage difference of the monthly demand readings of the new meter vs. the replaced meter.

In fact, for the 263 1V meters and for which FPL provided a customer refund for demand over-registration, at least one third of these refunds (approximately 93 meters) were based on the percentage difference of the monthly demand readings of the new meter vs. the replaced meter. (See FPL Response to Staff's Interrogatory No. 3, attached hereto as Rebuttal Exhibit GB-5). Of these one third, approximately one half of these refunds (approximately 47 meters) were for meter error determined to be greater than 10%.

Why is this significant?

Many refunds were based on meter error of at least 30%, and the highest refund was based on a meter error of over 63%. Given this information, it is not difficult to discern why FPL determined it would be more fair to these customers to calculate their refunds based on a comparison of the actual change that occurred when a thermal demand meter was replaced with an electronic demand meter.

A "before and after" demand comparison provides the best indication of the actual change in demand experienced by the customer. This comparison is based on actual billing history, not on the results of a single meter test which, experience has demonstrated, is dependent upon the percentage of full scale at which the meter is tested - and therefore, is subject to manipulation and variation. In stark contrast, historical billing information does not change based on any test point of full scale and can be uniformly, and consistently, analyzed.

Is there information filed in this case that provides a "before and after" review, similar to the "before and after" review FPL conducted on the accounts of other customers who had 1V Thermal demand meters?

Yes. Exhibit 5 to my direct testimony provides a "before and after" comparison of the change in demand that the customers in this docket experienced when their thermal demand meters were replaced with electronic demand meters. This analysis is based on the same process and procedure that FPL used in determining the change in demand that occurred for 1V thermal demand meters for other, similarly situated customers not represented by my company. This analysis graphically demonstrates a step-change in demand registration (decrease) that occurred upon meter replacement.

Should this "before and after" approach be used in considering the meters in this docket?

Yes, since it is a valuable source of information regarding the actual change in demand a customer experienced. Additionally, Florida Statute states "No public utility shall make or give any undue or unreasonable preference or advantage to any person or locality, or subject the same to any undue or unreasonable prejudice or disadvantage in any respect."

What is the best available information to use for refund calculation purposes?

The best available information for refund calculation purposes is not the full-scale error; rather, it is the historical billing information that shows the actual effects upon a customer when its thermal demand meter is replaced. Moreover, this approach is entirely consistent with FPL's stated goal for calculating refunds for demand over-registration. FPL witness Rosemary Morley testified in her direct testimony that "any refund amount should be based on the difference between the amount actually billed the customer less the amount which would have been billed if the meter had accurately measured the customer's kW demand and kW usage. Using this method, the customer's electric bill, less any refunds, is made equal to the electric bill which would have been rendered had the meter error not existed." (Morley, Page 2, line 23 - Page 3, line 5).

Is calculating refunds as suggested by Mr. Bromley's direct testimony consistent with Mrs. Morley's testimony?

No. For all the reasons identified above, calculating refunds based upon full-scale meter error (as Mr. Bromley suggests) can <u>never</u> accomplish Ms. Morley's above-stated objective. FPL's position in this docket does not "hold the customer harmless from the effects of the meter error and return the customer to a correctly billed status quo." (Morley Direct Testimony, Page 4, Lines 13 - 15).

Mr. Bromley testifies (Page 20, lines 1 - 8) that there are 12 accounts that are subject to refund in this proceeding. Do you agree with this testimony?

No. All 14 accounts in this proceeding are identified in Exhibit 5 to my direct testimony, and all these accounts are subject to refund. There is a mix-up regarding a Target account in Bonita Springs for the Target store on State Road 7 in Boca Raton. The Target

Bonita Springs store was identified in error in the Petition. The Target store located on State Road 7 in Boca Raton, Store number 21637, and meter 1V5885D is the meter in dispute. This meter tested at +4.85% on May 21, 2003. For the Target store in Sarasota, FPL has failed to recognize the results of independent, refereed testing which indicated demand over-registration greater than 4% of full scale.

Mr. Bromley testifies (Page 20, line 7 - Page 21, line 6) that the appropriate refund period for the meters in this docket is 12 months, and that this refund period is consistent with FPSC Rules. Do you agree with this testimony?

No. Rule 25-6.103(1) provides that refunds can exceed 12 months "if it can be shown that the error was due to some cause, the date of which can be fixed, the overcharges shall be computed back to but not beyond such date based on available records." This Rule does not specify who has the burden of demonstrating such "cause," or what standard should be applied to determining what constitutes adequate "cause," or to determining when a date can be "fixed." Because only the utility has custody and control of the meter and meter tests records, the utility will have most, if not all, of the information necessary to make this determination. Consequently, FPL should have the same burden of making reasonable efforts to fix a point in time the meter was in error.

Describe FPL's "process" for determining if a meter over-registered for longer than 12 months.

With regard to the 1V thermal demand meters, FPL has designed and effectuated a process that gives it very little incentive to investigate and determine a "cause" that would result in longer refunds. Obviously, it is not in FPL's financial interest to pursue a rigorous method or approach to determining a point in time when a meter began over-registering. So long as FPL cannot "determine" a point in time when the meter over-registered, FPL's refund liability is limited to 12 months. Consequently, it is not surprising that FPL has never been able to "determine" or pinpoint a date that would force it to provide more than a 12 month refund, not only for meters in this docket but for any thermal demand meter!

Additionally, FPL has conducted no investigation to determine the actual cause for the 1V meters to fail as a class, even though FPL has exclusive control over, and has warehoused, all 1V meters it has removed from service (except for the 60 or so 1V meters that it has "misplaced," and could not locate). FPL has conducted no physical investigation of the meters in this docket to determine why the meters in this docket over-registered demand in excess of allowable tolerance. FPL has not determined if a particular meter component, or components, have failed or have degraded, nor has it determined the effects on demand registration of such failure or degradation. Further, FPL has, to date, denied the customers access to their meters so that the customers and their experts could conduct this type of investigation. (Efforts to review and inspect these meters will continue so as to present complete evidence to the trier of fact.) Thus, FPL has elected not to obtain, and has refused to allow its customers to obtain, information that could establish the "cause" referenced in Rule 25-6.103(1). Further, Mr. Bromley states (Page 20, lines 13-19) that FPL could not determine a point-in-time where over-registering might have occurred, and that a "significant factor" in making this determination "is that factors such as weather, seasonal trends, and the customer's equipment tend to have a greater impact on demand than the 4-5% error determined by the meter test." However, during his deposition, Mr. Bromley admitted that FPL did not conduct any analysis regarding how these factors may have impacted the meters in this docket. Finally, FPL has apparently ignored the information in its possession from the manufacturer of thermal demand meters, Landis & Gyr. During discovery in this docket, FPL produced a Landis & Gyr document, Technical Bulletin 840, dated March 1, 1961 (Bates No. 003977 TDM - 004004 TDM). This document contains a page entitled "Interpretation of Bad Test Results," which provides a table with columns for "Conditions Found," "Possible Cause," and "Correction." A copy of this document is attached as Rebuttal Exhibit GB-6. This table provides a convenient reference for the cause and cure of various conditions. One such condition is identified (line F) as "Excessive Error (more than 3% at scale check points)." The number one cause for this condition is identified by the manufacturer as "Faulty Calibration," the reason that the Customers contend their meters overregistered since the date they were installed.

Tellingly, FPL has designed an evaluation process that does not rely on any objective criteria to determine whether sufficient "cause" exists to justify a longer refund. In fact, as testified to by Mr. Bromley in his deposition, this process, as applied to all 1V meters (including the meters in this docket) is, ultimately, entirely subjective as applied by FPL. I find it telling that FPL could not come up with any real objective standards to use in determining whether a refund beyond 12 months is warranted. As long as the FPC keeps the issue cloudy and confused, using "subjective" analysis, its potential liability does not exceed 12 months.

By using its subjective evaluation criteria to determine whether to issue a refund of longer than 12 months, not a single customer has received a refund longer than 12 months. This failure to award a refund longer than 12 months is based on 263 1V meters for which FPL has already provided limited refunds. This is true even for meters where the change in demand registration for the 12 month refund period exceeds 60%. It is not surprising that FPL has reached a similar conclusion for meters in this docket and refused to provide a refund beyond a 12 month period of time.

FPL contends it was never presented with information that demonstrated when a meter

error might have occurred. Do you agree with this?

No. Mr. Bromley testifies (Page 20, lines 19 - 21) that "there was no information brought to us by any customers or their representatives in this docket that demonstrated to us when a meter error might have occurred." FPL has been provided with reams of analyses indicating that a significant, consistent change in demand registration has occurred for each of the meters in this docket, and that this over-registration has occurred for the entire installed period of each meter. Apparently, this information did not meet FPL's subjective criteria. Attached as Rebuttal Exhibit GB-7 is a graphical summary of the information that has been provided to FPL for the meters in this docket, demonstrating the change in demand that has occurred after meter replacement as compared to before meter replacement. The customers contend this compelling evidence strongly suggests the meters in question have been over-registering to a date certain, namely the date of meter installation.

In conclusion, FPL has established a subjective, self-serving process that provides it with complete control and discretion to determine whether a refund longer than 12 months is warranted. Under these circumstances, it is not surprising that FPL has not identified a single 1V meter eligible for a refund longer than 12 months. An appropriate refund is one that satisfies the goal identified by Ms. Morley, i.e., "to hold the customer harmless from the meter error and return the customer to a correctly billed status quo." This is best accomplished through the methodology described in my direct testimony and should result in customers receiving full refunds, beyond a 12 month period of time.

FPL witness Rosemary Morley has also prefiled testimony in this docket. Have you reviewed this testimony?

Yes.

Ms. Morley testifies about how refunds should be calculated (Page 2, line 19 - Page 3,

line 5). Do you agree with this testimony.

Yes, in part. Ms. Morley recognizes in her testimony that the purpose of a refund is to put the customer in the position the customer would have been but for the meter error. This is entirely consistent with the requirement of Rule 25-6.103 that refunds should be based on "the amount billed in error." It is also consistent with the procedure FPL adopted for determining the percent change in demand (comparing actual demand readings "post" change out with actual demand readings "pre" change out, the "before and after" review) for all 1V meters that are not in this docket. However, this testimony is not consistent with FPL's practice of only providing one year refunds to 1V meters not in this docket, and is not consistent with the methodology (and the inputs) she actually uses to calculate refunds for the meters in this docket.

Ms. Morley testifies about how FPL has determined the amount which would have been billed if the meter was accurate (Page 3, lines 6 - 17). Do you agree with this testimony.

I agree that a correction factor is necessary to adjust the as-billed demand or kWhr consumption to what the demand or consumption would have been but for the meter error. I also agree that the amount of the refund should be based on this adjustment and application of the applicable rate schedule. I disagree with Ms. Morley on her choice of inputs to compute the correction factor and to her use of a different rate schedule than what the customer was actually billed under.

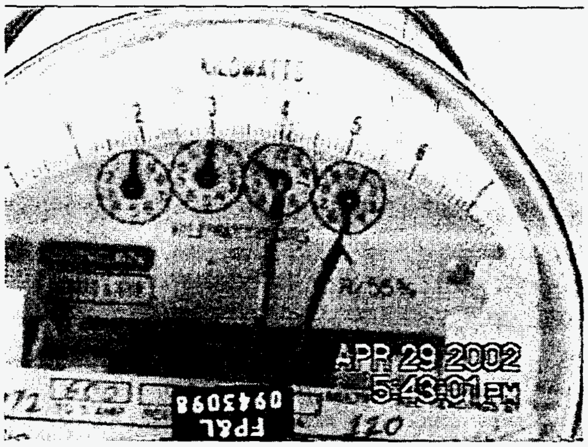
Why do you disagree?

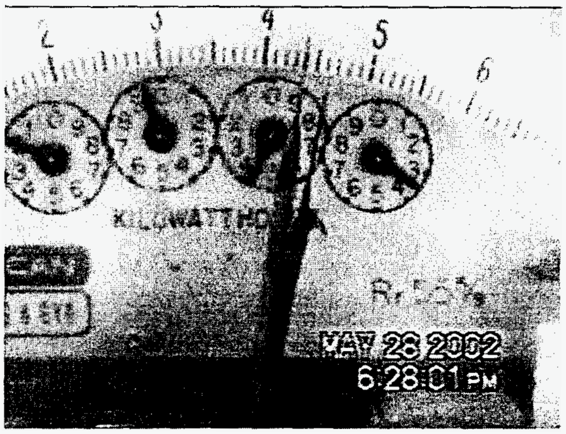
Ms. Morley has used the full-scale meter error as an input into determining the correction factor. As discussed earlier in my rebuttal testimony, using the full-scale meter error for refund calculation purposes results in the customer paying for demand and consumption that was not used. Therefore, this method fails to conform to Ms. Morley's stated goal; namely, to fully restore the customer to the position it would have been in but for the meter error. The test point error provides a truer indication of the actual over-registration felt by the customer; however, because these meters have a varying degree of error that is dependent upon the percentage of full scale at which the meter is operating, the test point error only provides a snapshot of what has actually occurred. The best way to determine the true amount of over-registration is to compare the actual decrease in demand that has occurred following replacement of the 1V meter with an electronic meter, i.e., the "before and after" review to which I refer in my testimony.

Do you agree with Ms. Morley's conclusion regarding the total refund due?

No. Ms. Morley has calculated no refund for Target Sarasota (FPL Account No. 49909-58540). The Target Sarasota meter has a bent maximum demand pointer that results in over-registration of actual demand. The photograph below was taken by me on 8/6/2002 four days prior the independent test on August 10, 2002.

Additional photographs were taken well before I could determine the needles were misaligned causing the erroneous over charges. On the photograph taken May 2, 2002, (the regular read date) it is believed the meter had just been read and the demand reset. It was then when I observed the needles captured for the first time. However on May 28, 2002 it was observed that the needles were again separated, as had always been the case.





This photograph shows the clockwise separation to the right (maximum demand) needle. The bend occurs about midway up the needle and results in an over-registration of 2 - 3 small scale divisions (e.g., the black needle reads 5.2 or 5.3 instead of 5.0). An independent test of this meter was conducted on August 10, 2002. In that test it was demonstrated that the needles were not stuck together, but were separated by 2 to 2.5 divisions. When this meter was shop tested by FPL, several sequential tests were conducted.

The purpose of these additional tests was to verify that the needles would separate. In each subsequent test the needles separated at a higher point on the scale. It is believed that if several additional tests would have been performed the red needle would have not captured the black needle on its rise up-scale. The same as would have occurred in actual operation at the customer location. For this meter, FPL's test results do not tell the whole story. This is just another example that demonstrates that the most accurate way to determine the actual meter error is by comparing before and after billing information.

Additionally, Ms. Morley's refund calculations are based on only a 12 month refund period. As explained in my pre-filed testimony, these meters all demonstrate a significant change in demand registration when compared with their entire billing histories. This conclusion is supported by the rebuttal testimony of Bill Gilmore. Therefore, each of these meters is entitled to a multi-year refund and the amount calculated by Ms. Morley significantly understates the amount of refund due to each customer that is necessary to "hold the customer harmless from the effects of the meter error and return the customer to a correctly billed status quo." (Morley, Page 4, lines 13-15).

Do you agree with Ms. Morley regarding how account number <u>90964-37216</u>, J.C. Penney's account, should be refunded?

No. Ms. Morley points out in her direct testimony that customers are charged a lower energy charge if their demand is over 500 kWd at least once very 12 months. In one instance, account number 90964-37216, J.C. Penney's, a meter erroneously over-registered demand at a rate greater 500 kW of demand. FPL wants to go back and recalculate its billing in such as way that would charge the customer more money for energy, using a demand of less than 500 kW of demand.

Why shouldn't FPL be able to do this?

It would be unfair to that particular customer, since it was given information that it qualified for the lower energy rate associated with the GSLD-1 (over 500 kW of demand) rate schedule. Ms. Morley failed to testify that customers such as this J.C. Penny account are able to contract for the GSLD rate should they so desire. If a customer's usage puts it close to the break point between the GSD-1 (25 kW of demand to 500 kW of demand) rate schedule and the GSLD-1 (over 500 kW of demand) rate schedule, it is free to contract for this GSLD-1 rate should it so desire. A decision as to whether or not to contract for the GSLD rate is invariably based on whether the customer's account exceeded 500 kW of demand within the past 12 months so that it automatically qualifies for the GSLD-1 rate schedule.

FPL provided faulty information regarding this J.C. Penney account, that it was registering over 500kW of demand. This key information can lead one to believe it qualified for a lower energy charge associated with the GSLD-1 rate schedule. However, this customer never was aware of its opportunity to contract for the GSLD-1 rate schedule, since its billing records showed it already qualified for this GSLD-1 rate. Accordingly, it would be unfair to the customer to now adjust its billing to force it to pay the higher energy charges of the GSD-1 rate schedule. At the very least this customer and any others similarly affected ought to be given a reasonable opportunity to retroactively contract for the GSLD-1 rate, and the lower energy charges associated with this rate, should FPL be permitted to make the adjustments suggested by Mrs. Morley.

Does this complete your rebuttal testimony?

Yes.

5.2 Mechanical and lagged demand registers and pulse recorders

5.2.1 Accuracy requirements

5.2.1.1 Acceptable performance

The performance of a mechanical or lagged demand register shall be acceptable when the error in demand registration does not exceed ±4 percent in terms of full-scale value when tested at any point between 25% and 100% of full-scale.

Under usual operating conditions, the performance of a pulse recording device shall be acceptable when the kilowatthours calculated from the pulse count do not differ by more than 2% from the corresponding kilowatthour meter registration. The device's timing error shall be no more than ±2 minutes per week.

5.2.1.2 Test points

Mechanical or lagged demand registers should be tested at load points at or above 50% of full scale.

5.2.1.3 Adjustment limits

When a test of a mechanical or lagged demand register indicates that the error in registration exceeds that specified in 5.2.1.1, the demand register shall be adjusted to within ±2% of full-scale value. When a timing element also serves to keep a record of the time of day at which the demand occurs, it shall be corrected if it is found to be in error by more than ±2 minutes per week.

5.3 Instrument transformers (magnetic)

5.3.1 Pre-installation tests, (section 5 shall apply)

Prior to installation, all new instrument transformers shall be tested for voltage withstand, ratio correction factor, and phase angle. These tests shall be performed in accordance with the criteria established in IEEE C57.13.

5.3.2 Instrument transformers removed from service

Instrument transformers removed from service can be retired or returned to service without further testing.

5.3.3 Performance tests

5.3.3.1 Periodic test schedules

Experience has demonstrated that instrument transformers maintain their accuracies, consequently, the periodic testing of instrument transformers is considered to be unnecessary.

5.3.3.2 Inspection

When metering installations are inspected the instrument transformers associated with the installations should receive a close visual inspection for correctness of connections and evidence of any damage.

5.3.3.3 Heavy burden test

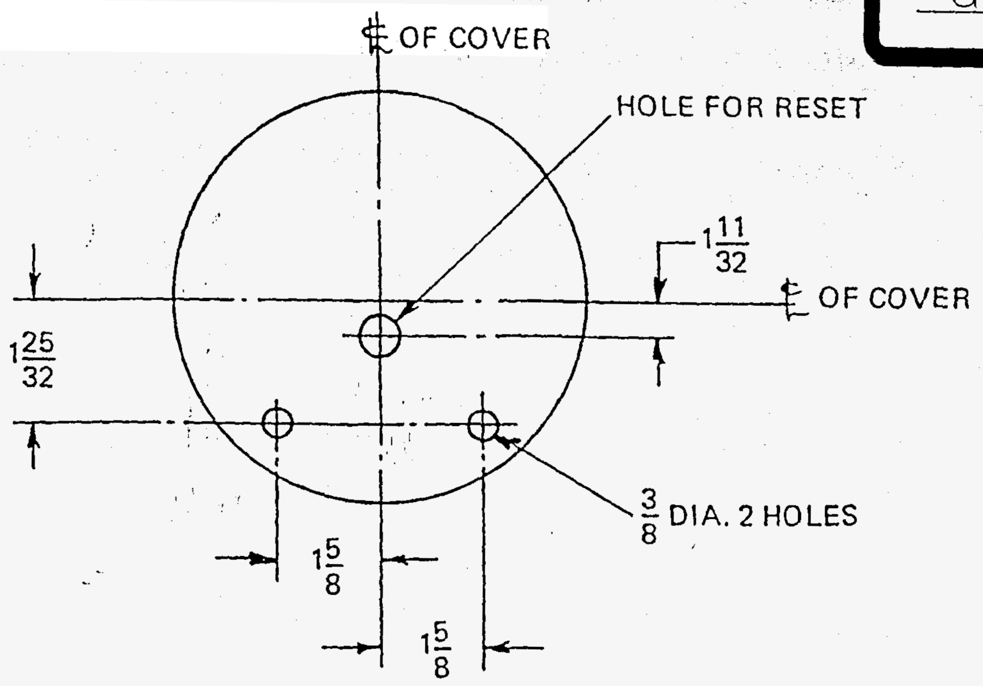
Current transformers may be tested, with a suitable variable burden device, to determine whether the windings of the secondary circuit have developed an open circuit, short circuit, or unwanted grounds.

5.3.3.4 Secondary voltage test

When the primary voltage is known, voltage transformers may be tested by measuring the secondary voltage and current to reveal defects in the transformer or secondary circuit that appreciably affect accuracies.

EXHIBIT

GB-2



TEST COVER FOR TMS & TMT METERS

FULL SCALE CALIBRATION

The calibration test point is a point on the scale at which the meter is adjusted to read correctly.

Thermal meters have two adjustments, namely, zero and the full scale adjustment. Normally when making acceptance and periodic checks, they are limited to these two points. However, when desired, additional checks may be made at 50% lagging power factor, and for equality of current circuits.

NOTE: All errors in registration are figured in % of full scale.

Example: A one division error any place on a 100 division scale would be an error of 1.0%

All external mounting dimensions, terminal arrangements and circuitry on thermal TMS and TMT meters are the same as their respective MS and MT watthour meters. See Pages 21 through 30 for wiring diagrams.

The calibration test point can be made at any point from 50% of full scale to 100% full scale. Duncan thermal meters are calibrated during factory calibration at 50% of full scale KW for the convenience of using this point on the scale as a comparison for other tests. The cover must be in place and the maximum pointer must be in contact with the indicating pointer for all tests other than zero.

It is possible to test polyphase thermal meters in the shop on polyphase loads, but the elaborate testing equipment needed for such tests is seldom warranted since singlephase test results can be correlated to polyphase performance. Therefore, polyphase meters are tested singlephase by connecting the potential circuits in parallel and the current

After the zero setting has been completed, the calibration test point can be checked by the following procedure:

Connect the potential circuits in parallel and the current circuits in series.

Suddenly apply a singlephase load at unity power factor equal to the KW desired to calibrate or check the meter under test. This load must be held for a minimum of 45 minutes. The accuracy of this load must be held, depending on the method being used for testing, as described in a previous paragraph.

Calibrate the meter at the KW selected for the calibration point by means of the full scale calibration adjusting screw, Item 3, Figure 2. When adjusting downscale, the indicating pointer should be moved downscale past the calibration points and then adjusted upscale very slowly to the calibration point with the maximum pointer in contact with the indicating pointer. Care must be taken not to wrap the calibration spring, Item 2, Figure 3, around the capstan, Item 3, Figure 3.

It will not be necessary to recheck the zero setting after the calibration point has been set since the zero and full scale adjustments are independent of each other.

An exception to the above procedure must be made when making the calibration test load or applying a singlephase load to the 3 phase, 4 wire wye, 2 stator meters, i.e., Forms 6S, 7S, and 14S. These meters have three current circuits, one of which is associated with both potential circuits. When applying a singlephase test load, this current circuit gives 50% full scale reading with only 75% of full scale current at unity power factor. The

Plaintiff/Defendant
Exhibit No. 11
7/23/04

DUNCAN ELECTRIC CO., INC.
a subsidiary of
LANDIS & GYR N. A., INC.
P. O. BOX 7180
LAFAYETTE, IN 47903
317+742-1001

April 5, 1982

Mr. Richard Miller
Florida Power & Light Company
P.O. Box 529100
Miami, Florida 33152

Subject: Duncan TMS and TMT Demand Meters

Dear Dick:

This is to confirm our telephone conversation regarding the effects of zero and full scale calibration errors on other load points on the scale.

The deflections adjustment on the TMS and TMT thermal demand element are designed such that the zero adjustment has no effect on the pointer deflection at full scale and the full scale adjustment has no effect on the deflection at no load.

The effects of an indication error at no load will be approximately inversely proportional to the scale deflection. If there is a 1% error at no load (potential only), the resulting error at 50% load will be 0.5%.

Errors due to full scale calibration are approximately proportional to scale deflection. A 1% error at full scale is 0.5% error at 50%.

Attached is a simple graph to show the magnitude of the two errors over the scale range.

In the example that you gave me where you had tested a meter because of a high bill complaint, the meter had a full scale of 96 kW. You tested the demand meter with a load of 72 kW. The demand meter indicated 76 kW with an error of +4 kW. The customer's indicated demand was 50 kW. The error for 50 kW indication would be:

$$4 \times \frac{50}{76} = 2.6 \text{ kW error.} \quad \text{Corrected demand} = 50 - 2.6 = 47.4 \text{ kW.}$$

As a matter of procedure for determining the demand error for bill complaints, the following steps should be taken:

1. Determine the zero error:

   a. Connect the meter potential coils in parallel and leave the current circuit open.

004829 TDM

EXHIBIT
GB-3

b. Apply nameplate potential for 2 hours.

c. Read the zero error magnitude and sign in kW. A reading above zero is plus.

2. Determine test load error.

a. Connect the meter current circuits in series.

b. Apply a steady load equal to the calibration point used.

c. Read the demand and calculate the error.

Test Load Error = Indicated kW - Test kW.

3. Determine correction to customer's billed demand kW.

a. Zero error correction calculation:

$$\text{Zero error at billed kW} = \text{Zero error kW} \left(1 - \frac{\text{Billed kW}}{\text{F.S. kW}}\right)$$

b. Test load error correction calculation:

$$\text{Test load correction in kW} = \text{Test load error kW} \times \frac{\text{Billed kW}}{\text{Test kW}}$$

c. Total error correction:

Total correction kW = Zero correction kW + Test load correction kW

d. Corrected customer demand:

True kW = Billed kW - Total error correction kW

The above procedure applies to the Duncan TMS and TMT thermal demand meters and other thermal meters that have helical calibration springs that are attached to a point on a radius of the thermal shaft. WESTINGH

Some meters use a hair spring for the zero calibration adjustment. All Duncan thermal demand meters prior to the TMS and TMT used this method on zero adjustment. With the hair spring design for zero adjustment, the zero error effect is constant all along the scale. In item 3.a above, the zero correction kW equals the zero error kW. SANGAMO

For convenience and clarity, all the above terms are in kW as read on the demand meter. This is to simplify the calculations required by the meter tester and avoid confusing anyone with percent of full scale.

Very truly yours,

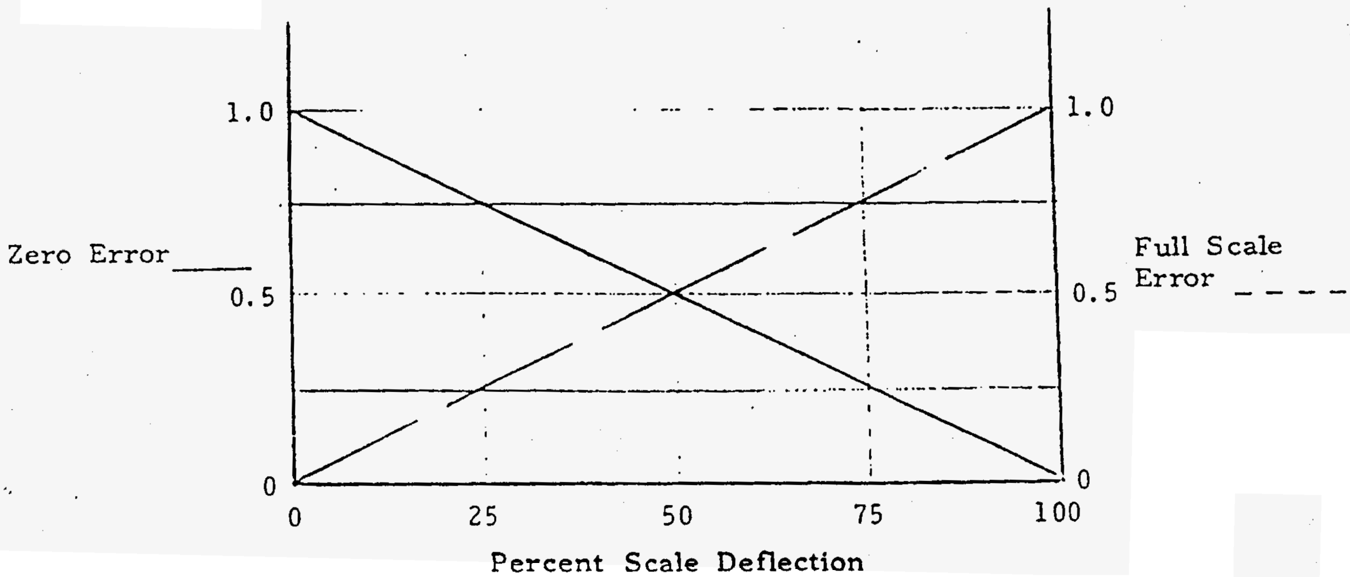
Chuck.

C. R. Collinsworth
Manager--Technical Services

CRC:WG

Enc.

cc: J.R.Argy



Note: Error scale is in units of 1% for convenience of calculating the error effect at points other than the test load.

ZERO ADJUSTMENT AND FULL SCALE ADJUSTMENT ERRORS
RELATIVE TO METER LOAD

CRC:WG

4/5/82

004832 TDM

MOYLE, FLANIGAN, KATZ, RAYMOND & SHEEHAN, P.A.
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JON C. MOYLE, JR.
E-mail: jmoylejr@moylelaw.com

August 18, 2004

VIA U.S. MAIL

Joe Regnery
Calpine Corporation
Island Center
2701 North Rocky Point Drive, Suite 1200
Tampa, Florida 33607

Re: Depositions taken in FPL Turkey Point Need Determination case

Dear Joe:

Enclosed please find two notebooks that may be helpful to you in the future, particularly if Calpine decides to respond to a future FPL Request for Proposal issued pursuant to Florida Public Service Commission rules. These notebooks contain the testimony of the following FPL witnesses: Steven Scroggs; Steven Sim; Moray Dewhurst; and René Silva.

I appreciated the opportunity to work with you, Tim and Calpine in this matter and hope that we could work together in the future.

Regards,

Jon C. Moyle, Jr.

JCMJr/adk

Enclosures

DUNCAN ELECTRIC CO., INC
a subsidiary of
LANDIS & GYR N. A., INC
P. O. BOX 7180
LAFAYETTE, IN 47903
317+742-1001

DIS & GYR

May 28, 1982

Mr. Dick Miller
Systems Operations Engineer
Florida Power and Light Company
Post Office Box 529100
Miami, Florida 33152

RE: Calibration Warranty, Thermal Demand Meters

Dear Dick:

You will be pleased to know that Duncan has reviewed its policy for calibration of thermal demand meters. With this letter, I am enclosing Duncan's new calibration warranty. This warranty is effective immediately for current production units.

Dick, you are aware this is a change from Duncan's past calibration practice. Thermal meters at Duncan have formerly been calibrated during production at 50% rather than at 75% of full scale. Multiple checks have also been made at other scale points to assure accuracy of calibration within acceptance limits.

Duncan has always checked the calibration accuracy of the flip scale at the calibration points, and will continue to do this under the new calibration warranty. No touch up or recalibration is required when the scale is reversed, allowing that proper techniques for scale reversal are followed.

Your work with us, and your cooperation and assistance in this matter have allowed Duncan to improve the performance of this product. We thank you for this.

Sincerely,

F. B. Breedlove
Manager - Metering Products

FBB:llc
Enclosure

cc: Dave Park

EXHIBIT
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GB-4

000001 TDM

DUNCAN ELECTRIC CO., INC.
a subsidiary of
LANDIS & GYR N. A., INC.
P. O. BOX 7180
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317+742-1001

DUNCAN
LANDIS & GYR

CALIBRATION WARRANTY

THERMAL DEMAND METERS

Thermal demand meters are calibrated as close as practicable at zero scale (potential only) and at 75% of full scale loads. At the two calibration points, the respective calibration adjustments, zero and full scale, are made to accurately set the indicating (red) pointer on the scale mark. The calibration of thermal meters is maintained within ±1% of full scale.

Accuracy of the meter loading equipment is maintained by transfer from Duncan's Primary Standards Laboratory and is precisely controlled for the calibration of thermal meters.

All other characteristics of the Duncan thermal demand meters are controlled to conform to the performance requirements of the American National Standard "Code for Electricity Metering."

DUNCAN ELECTRIC COMPANY, INC.

John C. Reich
Vice President and
Manager-Engineering

JCR:WG

May 27, 1982

Q.

Please indicate whether, in calendar years 2002 and 2003, FPL refunded/backbilled customers with type 1V thermal demand meters that were found to register demand outside the tolerance levels prescribed by Commission rule when tested as part of FPL's removal and retirement of those meters. If so, please respond to the following:

a. Provide the number of customers who received refunds.

b. Provide the number of customers who were backbilled.

c. Provide the amount of each refund and backbill and describe the manner in which each refund and backbill was calculated. If a percent error was used to calculate any of the amounts refunded or backbilled, please explain how the percent error was determined (i.e., what comprised the numerator and the denominator used in the calculation). If any amounts refunded or backbilled were determined based on a comparison of readings from a replacement electronic meter with readings from the thermal demand meter, please show the calculation of those refunds or backbills.

A.

a. **Provide the number of customers who received refunds.**

Two hundred and fifty seven (257) accounts received a refund.

b. **Provide the number of customers who were backbilled.**

None of the accounts were backbilled. Five accounts were associated with customers with multiple accounts. Meters that over-registered and under-registered out of tolerance, the billing were "netted".

c. **Provide the amount of each refund and back bill and describe the manner in which each refund and backbill was calculated.**

The credits on the accounts were based on either the meter test results or the historical information, whichever was the highest. All refunds were based on a one year period where data was available.

Six accounts had refunds associated with kWh.

For meters where meter test data was unavailable, FPL provided a 1 year refund using either 4% or the % change, new vs. old meter, whichever is higher. For those meters with an initial meter test result that over-registered (>100%) and no re-test meter result, FPL

EXHIBIT
tabbies
GB-5

provided a 1 year refund using 4%, the initial meter test result, or the % change, new vs. old meter, which ever is the highest.

Customers with multiple accounts that had meters that over-registered and under-registered out of tolerance would be "netted". For example, if a single customer had two accounts and one account over-registered requiring a refund of $1,000 and the other account under-registered requiring back-billing for $500, the customer would receive a "net" refund of $500. Under no condition would a customer with multiple accounts be "net" back-billed.

Interest Calculation was based on the 30 Day Commercial Paper Rate, per F.A.C. 25-6.109 (4)(a).

c. **If a percent error was used to calculate any of the amounts refunded or backbilled, please explain how the percent error was determined (i.e. what comprised the numerator and the denominator used in the calculation).**

Meter Test (Percent of error)

For the watthour/kWh portion of each meter, FPL utilized the test results derived from the weighed average of the three meter tests, the one light load test (weight of 1) and the two heavy load tests (one with a weight of 4 and the other with a weight of 2). The weighted average of these test results was then compared to the standard meter in order to obtain the error value. Meter tests results with readings greater than 102% (meter over-registering by more than 2%) were then eligible for refunds.

For the demand/kWd portion of each meter. FPL utilized the test results for each meter. All tests were preformed at either 40% or 80% full scale. The test reading for each meter was then compared to the standard meter in order to obtain a difference. This difference was then stated in terms of full scale. For example, a test of 5.8 is compared to the standard reading of 5.6. The difference of .2 is then divided by the full scale value of the meter that is subject of the test, in this example, 7. This would result in an error registration of +2.86%, in other words, this meter is over-registering by 2.86%.

c. If any amounts refunded or backbilled were determined based on a comparison of readings from a replacement electronic meter with readings from the thermal demand meter, please show the calculation of those refunds or backbill.

<u>Historical Information:</u> The months billed on the digital meter were compared with the same months on the thermal meter for the year prior.

Example: The digital meter was installed December 2003. The comparison takes place in May 2004. The comparison time frame for the digital months are January 2004 through May 2004 versus the thermal time from of January 2003 through May 2003. The average kWh and/or kWd is taken for the January to May billings. The digital meter average is compared to the thermal meter average. The calculation to determine percent of increase from the thermal to the digital meter is as follows:

(Digital average - thermal average) divided by thermal average = percent of increase/decrease. (215- 210) divided by 210 = 2.38% decrease in usage from thermal to digital.

See attachment for 1V thermal meter list of rebilled accounts.

Rec'd DEPCO 3/16/82

DUNCAN

LANDIS & GYR

TYPE TF, TK, TH, and TR

THERMAL DEMAND METERS

Note!

TR + TQ THERMAL DEMAND METER HAVE THE SAME THEMAL SECTION AS TH. METER —

SUGGESTED PROCEDURES FOR REPAIRING

DUNCAN ELECTRIC CO., INC., P. O. BOX 7180, LAFAYETTE, INDIANA 47903

A SUBSIDIARY OF LANDIS & GYR N. A., INC.

EXHIBIT

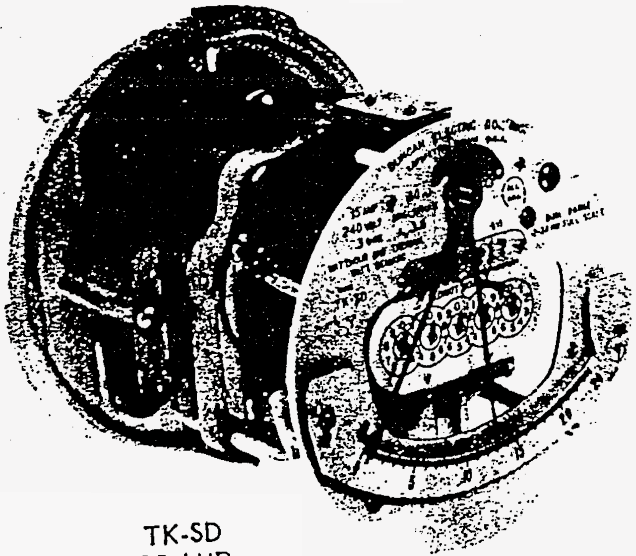
tabbies

GB-6

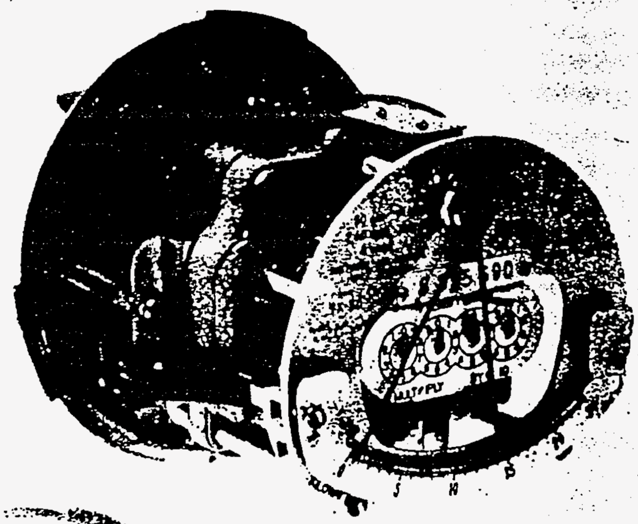
MARCH 1, 1961

TECHNICAL BULLETIN 840

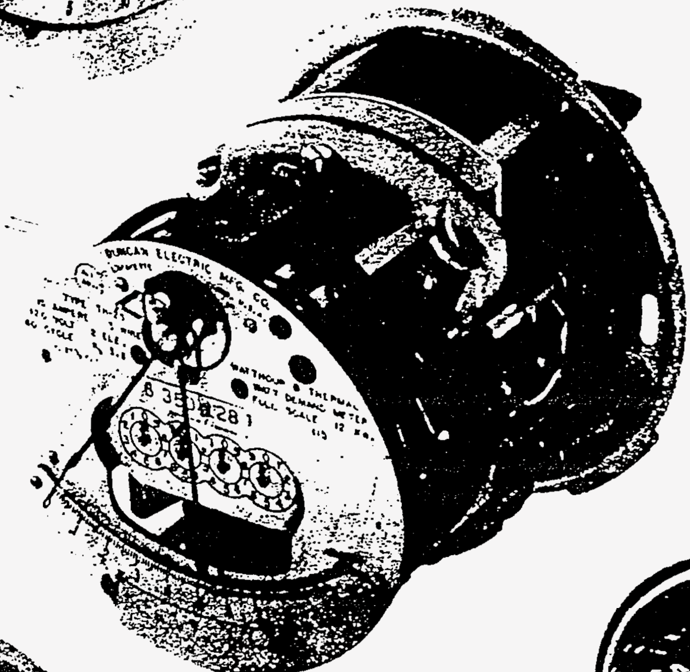
003977 TDM



TK-SD
15 AMP

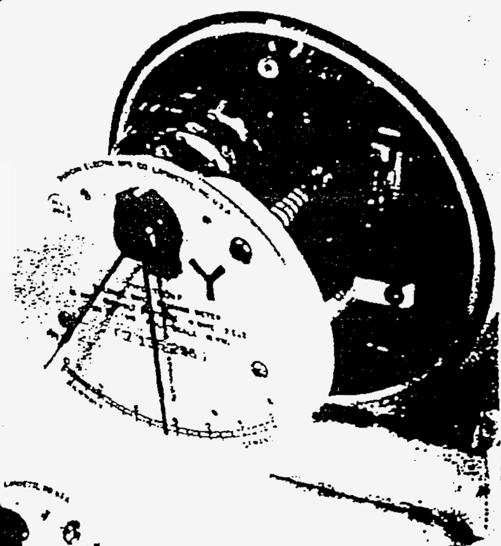


TK-SD
50 AMP

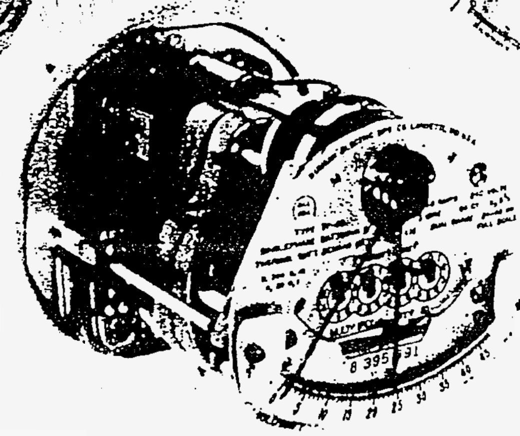


TH-2S

TF-S

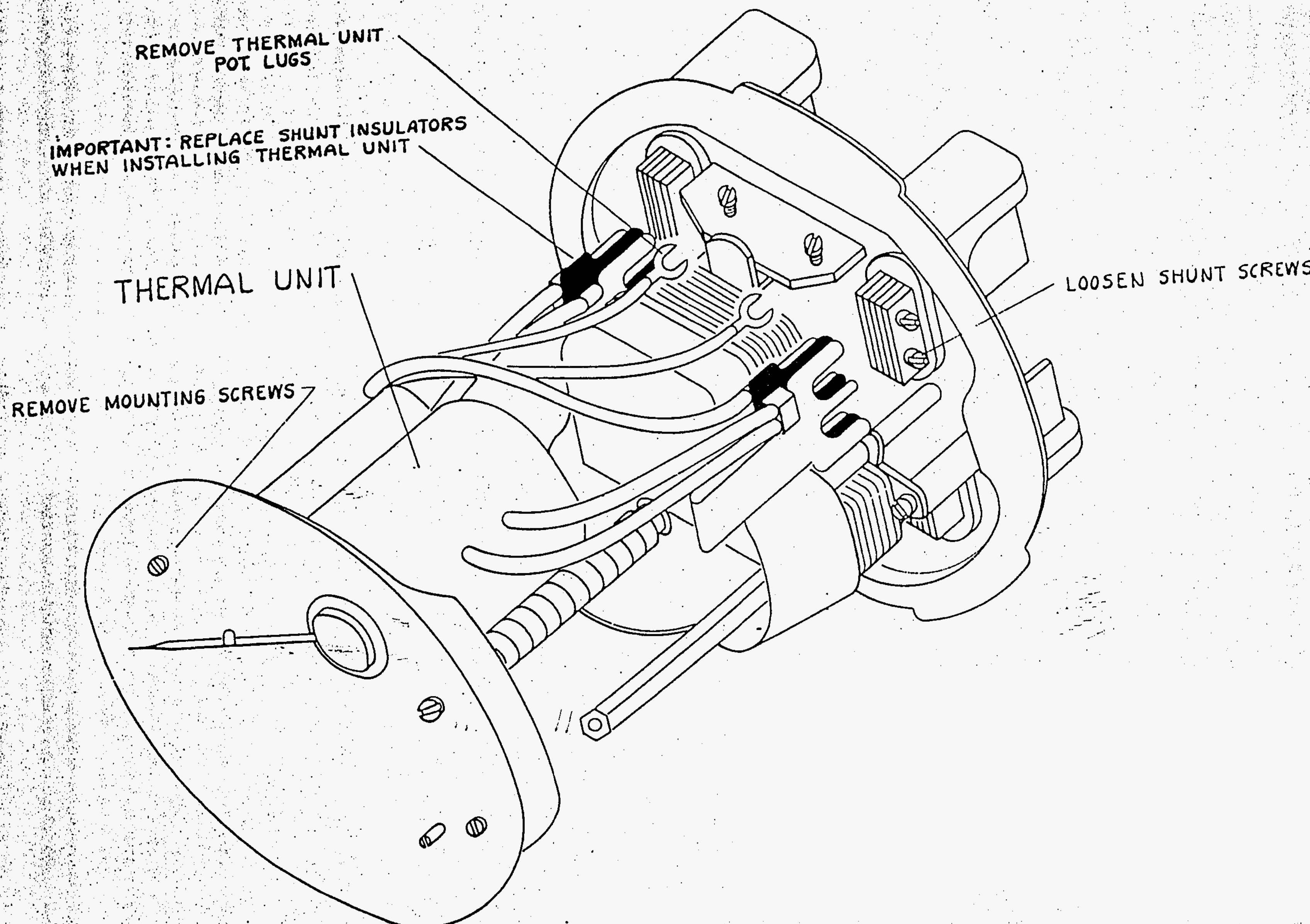


T-2½P

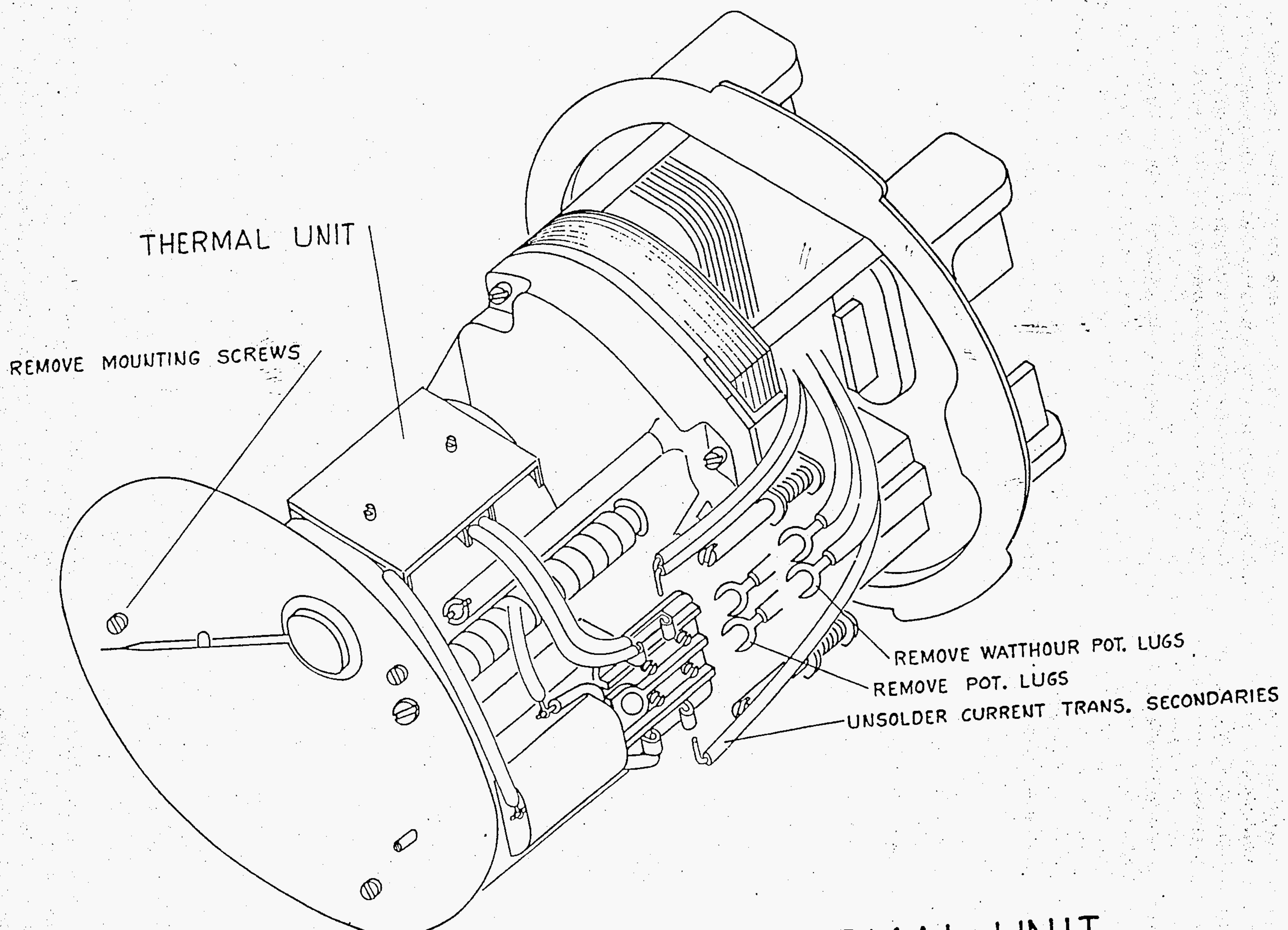


TF-SD

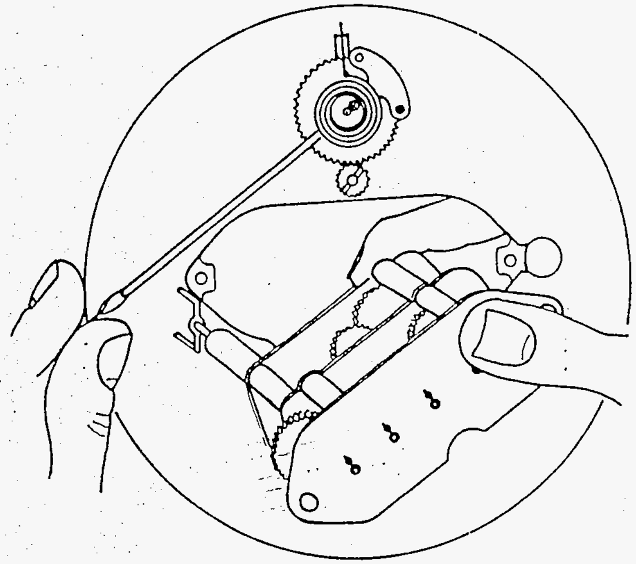
003978 TDM



REMOVAL OF TF THERMAL UNIT

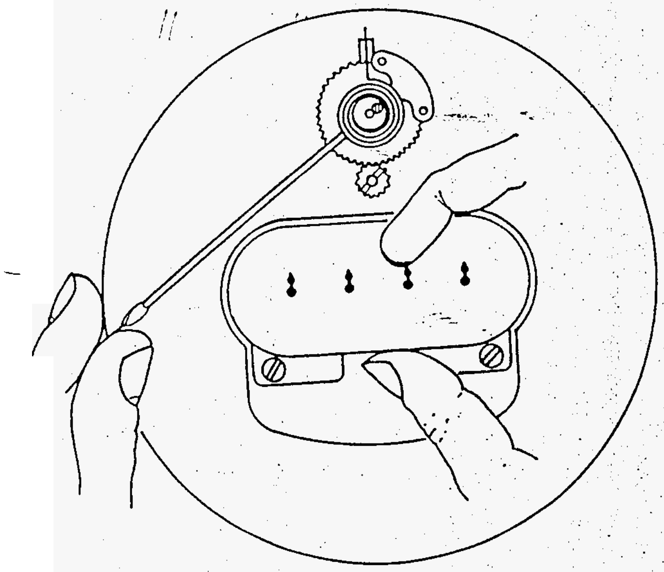


REMOVAL OF TH THERMAL UNIT

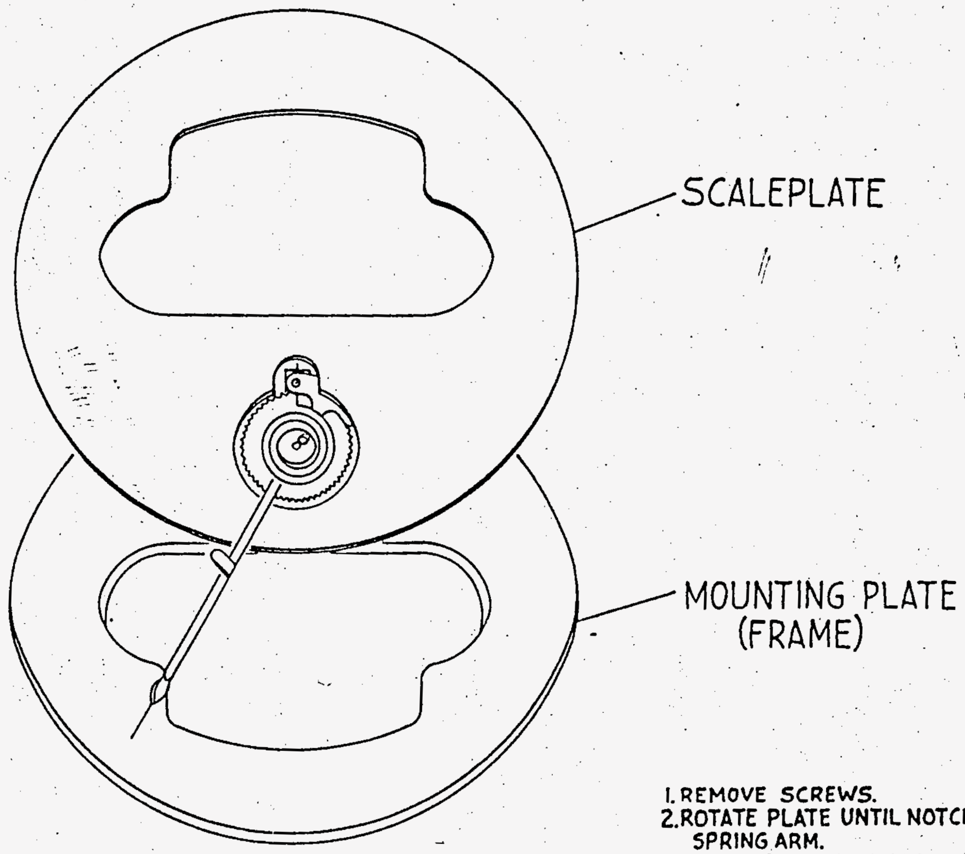


TF
AND
TK

REGISTER REMOVAL
THERMAL DEMAND

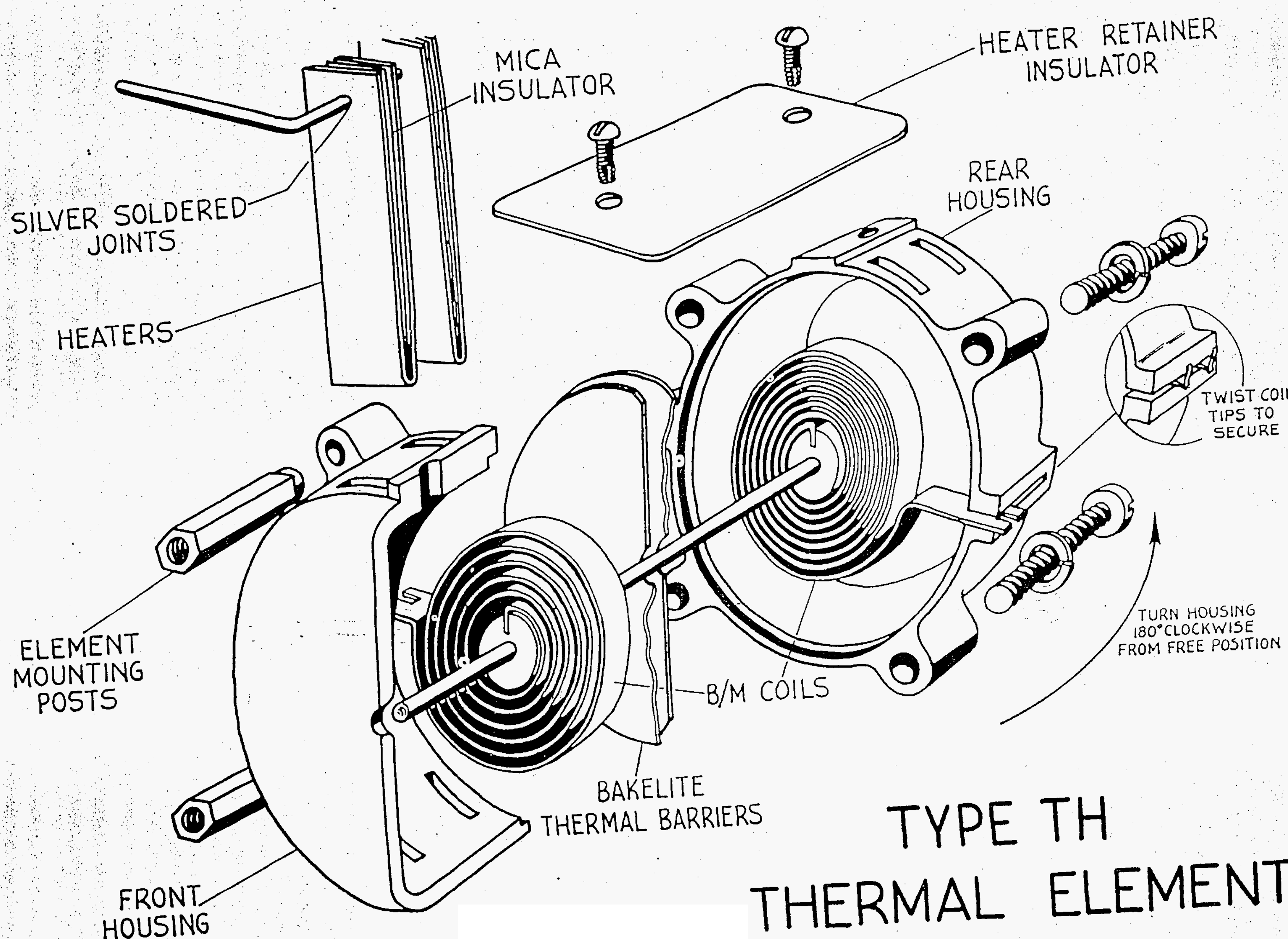


TH



1. REMOVE SCREWS.
2. ROTATE PLATE UNTIL NOTCH IS OPPOSITE SPRING ARM.
3. LIFT BACK EDGE OF PLATE AND SLIDE EDGE OF HOLE OVER THE COUNTERWEIGHT OF POINTERS.
POINTERS.
4. CAREFULLY SLIDE PLATE FORWARD UNDERNEATH ENDS OF POINTERS.

NAMEPLATE REMOVAL
THERMAL DEMAND
T, TH, & TF



TYPE TH THERMAL ELEMENT

THERMAL UNIT AND THERMAL ELEMENT REPAIR NOTES

1. The TH thermal element can readily be disassembled and assembled as illustrated on the opposite page. It is not generally recommended to disassemble or assemble the singlephase TF thermal elements, but in case of damage to any of the parts, to purchase factory-assembled thermal units of proper rating.

2. When assembling the thermal barrier in the TH element, it is recommended that the two slots be assembled 180° apart.

3. When securing the bi-metal spring to the TH housing, the bi-metal edge should be seated against the slot bottom and the first convolution against the inside boss. While in this position secure by twisting the bi-metal end as illustrated on the opposite page.

4. When securing the two housings, the direction of rotation, as illustrated on the opposite page, should be such that the bi-metals are wound (smaller spiral). In free position, the free ends of the coils should be approximately in line at room temperature.

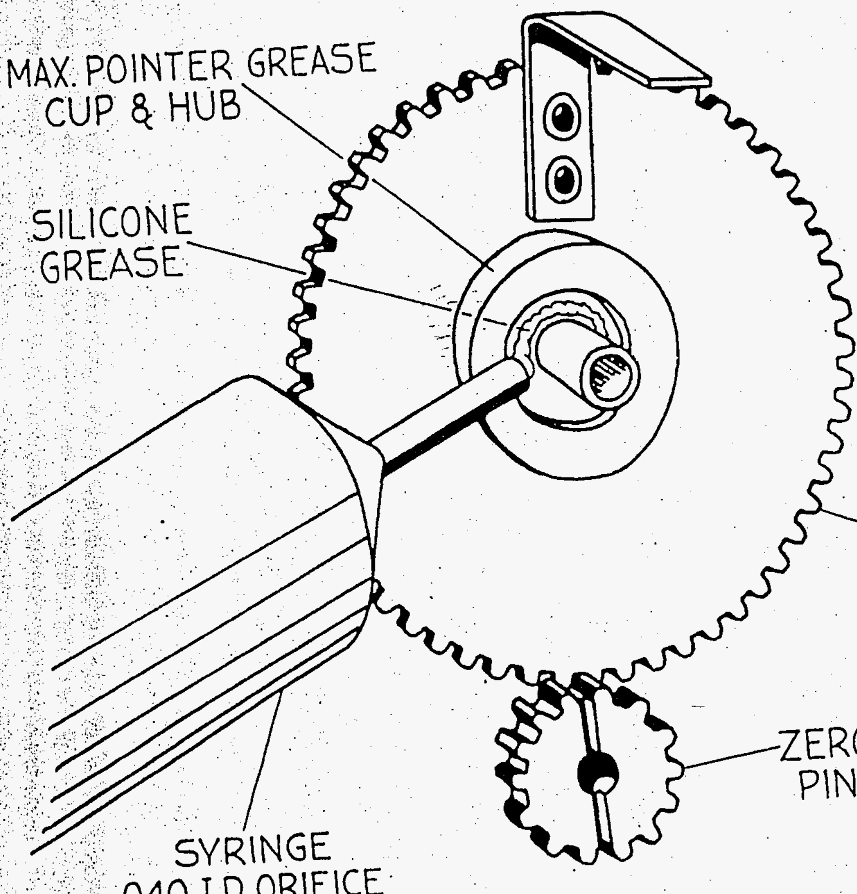
5. Current lead connections on the thermal unit terminal block should be soldered with special care. These connections are in the secondary circuit of a current transformer; therefore, special attention should be given to obtain lowest possible contact resistance. This is the main reason why clamp screw connections are not used for the current circuit.

6. Potential and current leads are colored for easy tracing and comparison with wiring diagrams. White markers on current transformer leads indicate polarity mark (black square on circuit diagrams), whether primary or secondary, size wire, and number of turns.

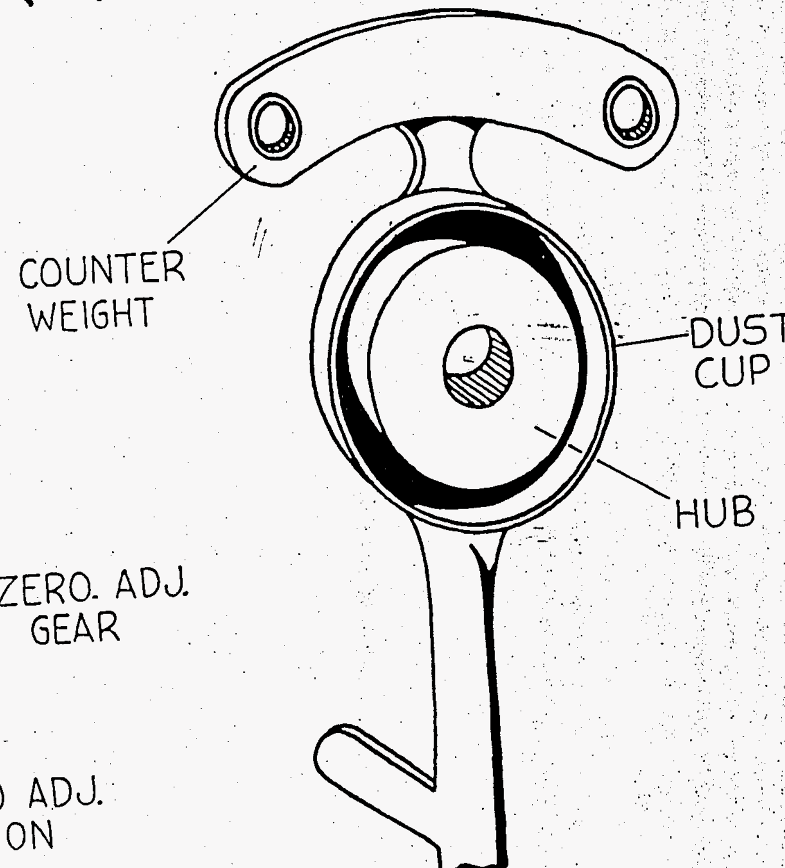
7. The bi-metal spiral is coiled with the expansive layer on the inside; therefore, heat applied to the spiral will cause the bi-metal coil to unwind.

For additional repair notes, see Bulletin 171.

DUNCAN THERMAL DEMAND MAX. POINTER ASSEMBLY



APPLICATION OF SILICONE GREASE



MAX. POINTER (BLACK) REAR VIEW

ASSEMBLY OF MAXIMUM (BLACK) POINTER

1. Clean grease cup and pointer hub with soft cloth or cotton swab. Carbon tetrachloride is a suitable solvent.

2. It is recommended that the grease groove around the hub be slightly over-filled with Dow Corning Silicone Grease XC-84 (can be obtained from Duncan). This grade of grease is specially compounded to prevent bleeding, and should always be used in this location. This can be done by using a syringe or hypodermic needle with approximately a .040 inch diameter orifice. Although not as convenient, a small spatula can be used.

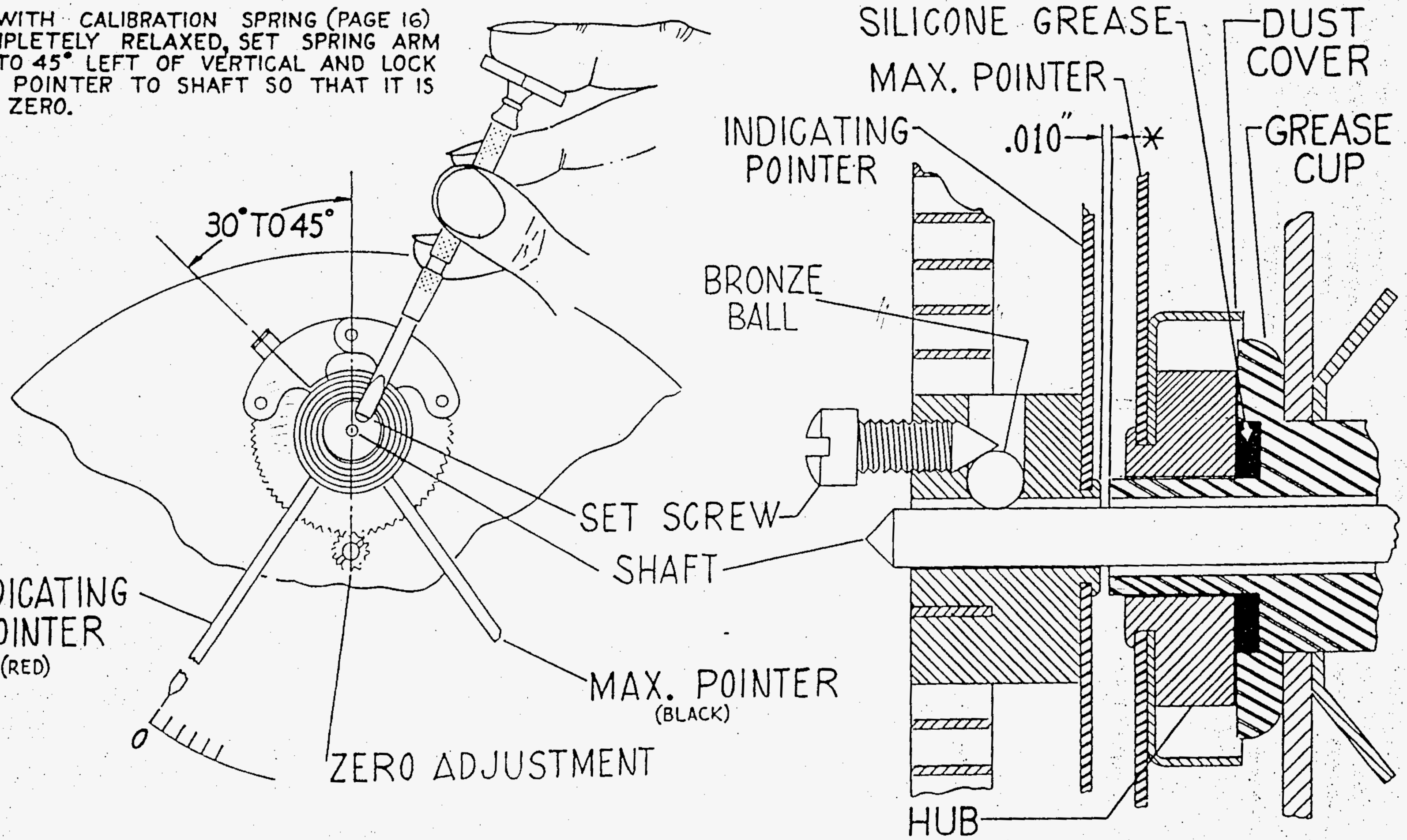
3. Thermals below serial number 5,900,000 will require reaming of the maximum pointer hub with a .125 to .127 taper reamer until a snug fit without excessive friction (see page 17) is obtained. Thermals above this serial number will fit without reaming.

4. After assembling the maximum pointer, it should be checked with the friction gage for a minimum of 1/2 division and a maximum of 2 divisions (see page 17). For excessive friction, remove dirt or ream hub. Reaming must be done with care in order to prevent excessive wobble. Except for hub and "flag", make sure the pointers do not touch each other or any other part of the meter.

5. Care should be taken not to get any grease (any sticky substance) on the maximum pointer "flag". This might cause the indicating pointer (red) to pull the maximum pointer down scale.

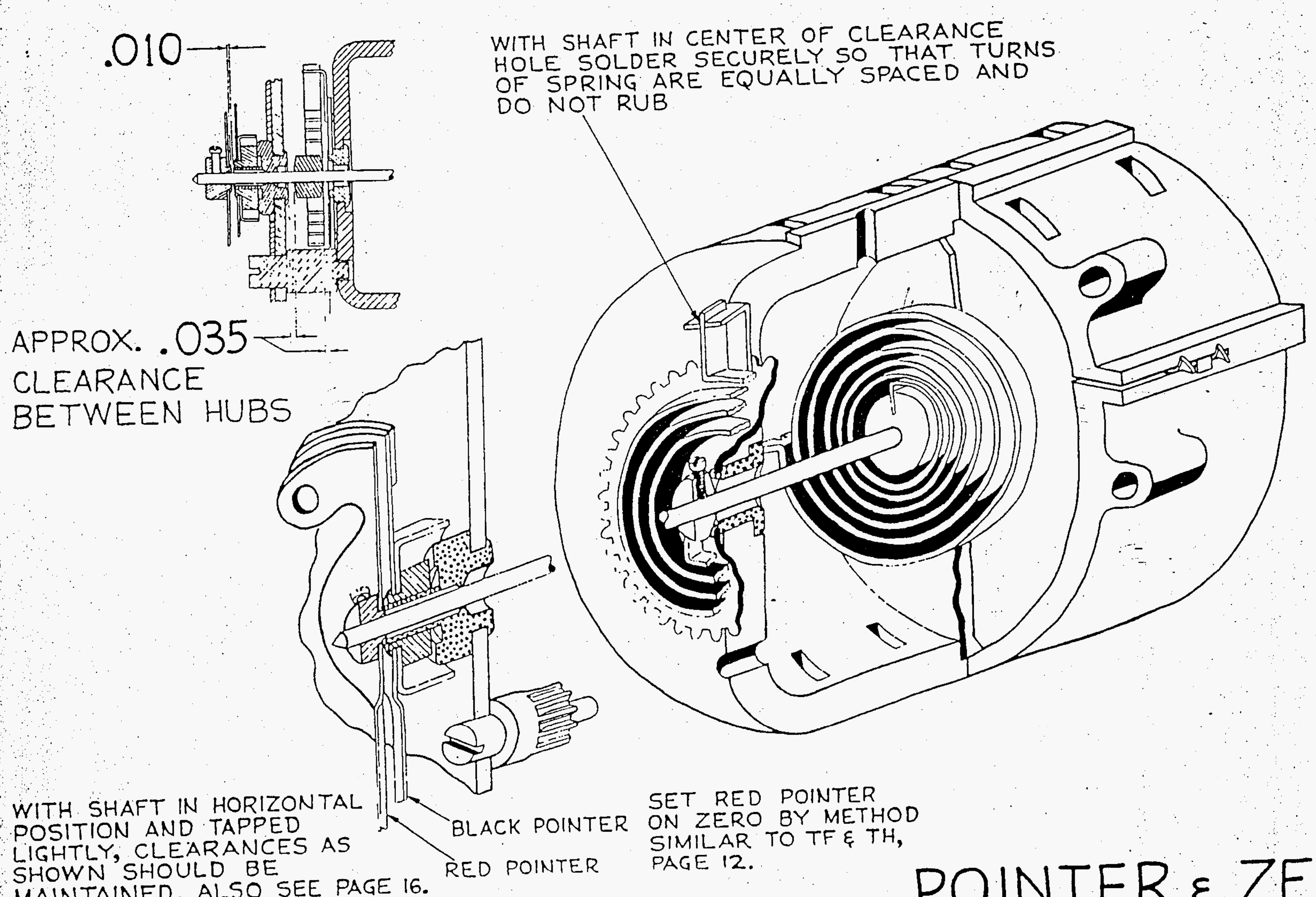
For additional information relating to repair and testing, see Bulletin 171.

WITH CALIBRATION SPRING (PAGE 16) COMPLETELY RELAXED, SET SPRING ARM 30° TO 45° LEFT OF VERTICAL AND LOCK RED POINTER TO SHAFT SO THAT IT IS ON ZERO.



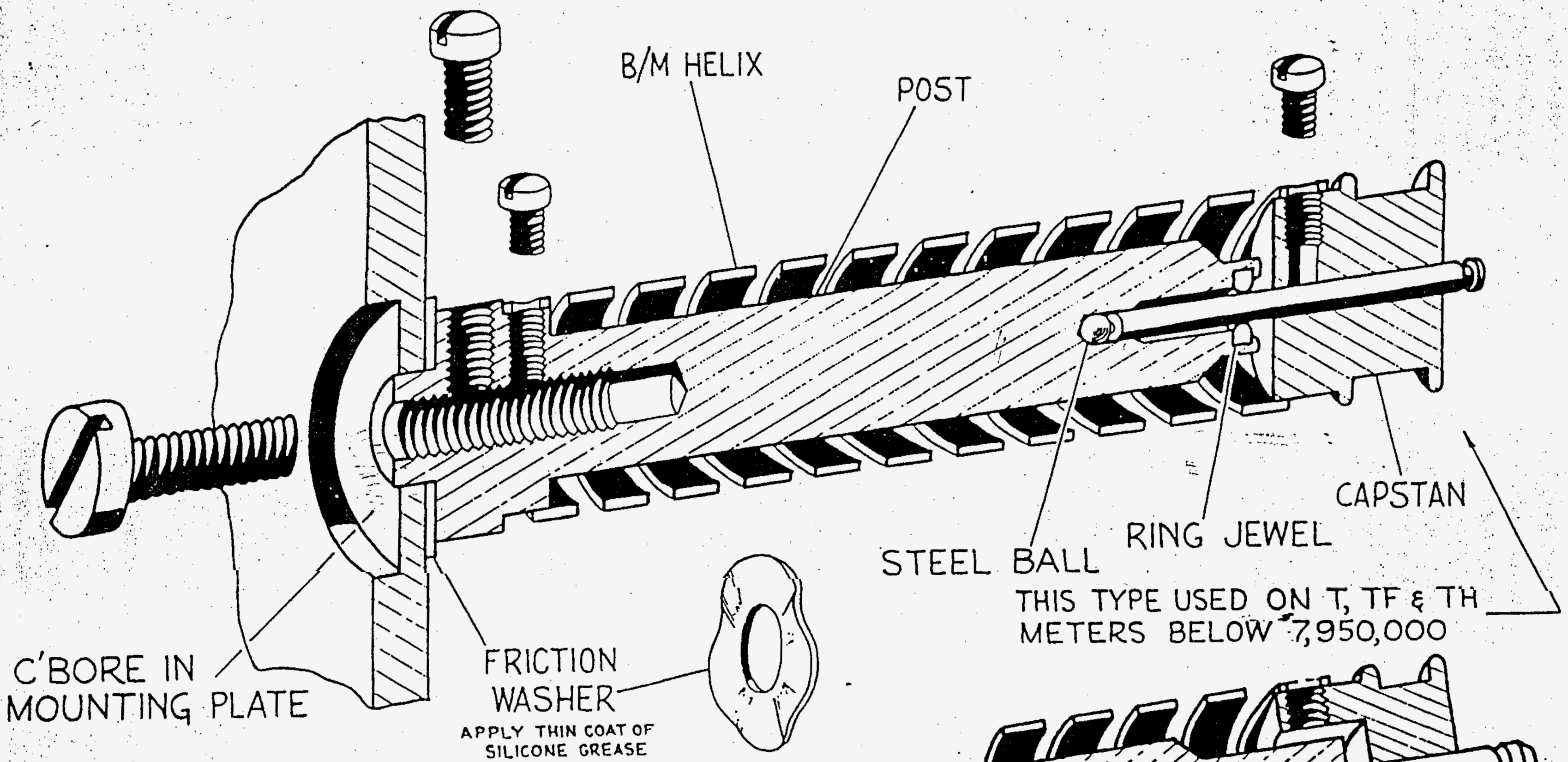
* WITH SHAFT IN HORIZONTAL POSITION, TAP METER LIGHTLY. HUB CLEARANCE SHOULD BE APPROXIMATELY .01 INCH AT BOTH ENDS OF SHAFT. SEE PAGE 16.

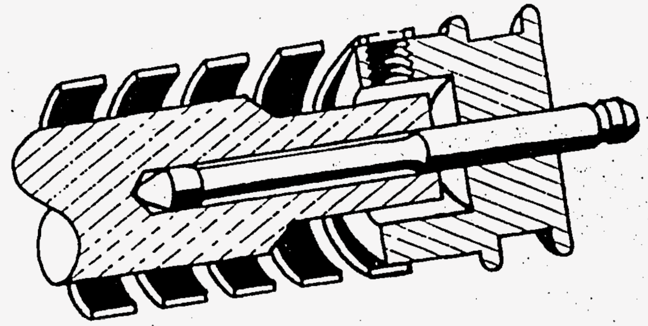
INDICATING POINTER ADJUSTMENT
T, TF & TH



POINTER & ZERO ADJUSTMENT
TYPE T.K

003988 TDM





THERMAL DEMAND

CALIBRATION ADJ. & TEMPERATURE COMPENSATION ASSEMBLY

CHECKS FOR CALIBRATION ADJUSTING ASSEMBLY

1. Since the calibration adjusting assembly also serves as a temperature compensating assembly, it is necessary to check the tightness of the calibration screw so that it does not revolve when the capstan is revolved 90 degrees in either direction. On the other hand, the calibration screw should not be too tight for convenient adjustment. Factory limits are minimum 2 inch-pounds and maximum 4 inch-pounds.

2. Be sure the filament or chain unwraps from the under side of the capstan. Filament turns should not overlap each other on the capstan.

3. The bi-metal helix is coiled with the expansive layer on the outside; therefore, heat applied to the helix will cause the bi-metal coil to wind up, and the filament on the capstan to unwind. (See Par. 7)

4. Except for the calibration screw in front, all screw tips should have one small drop of shellac placed on them before assembly.

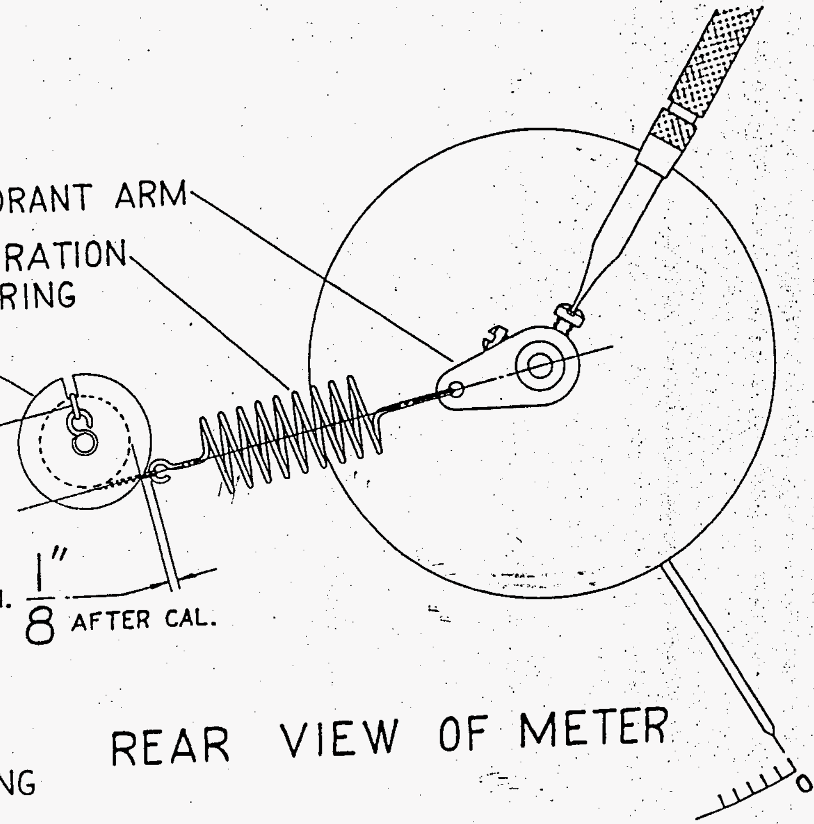
5. The type of silicone grease used on the friction washer in the calibration adjustment assembly (page 14) or knob in the cover reset assembly (page 18) is not important. Dow Corning's DC7 or stopcock grease are used in factory assembly.

6. The calibration spring eye, after calibration, must be a minimum of 1/8 inch from the capstan drum. This distance is needed in order that the calibration spring eye will not wrap around the capstan at low temperatures and cause faulty temperature compensation.

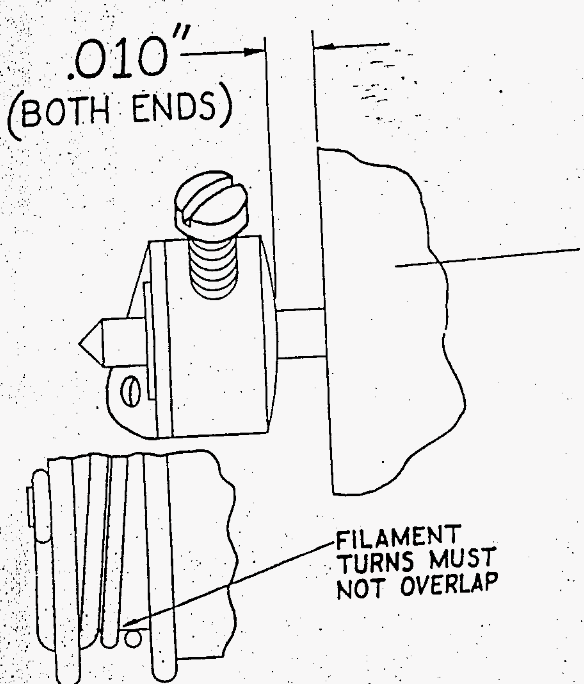
7. The complete assembly of the new type compensating post assembly may be used as a replacement on old meters. The bi-metal helix itself may be used on either old or new assemblies. The capstan and the post are not interchangeable--the new capstan does not fit the old post.

For additional information relating to repair and testing, see Bulletin 171.

THERMAL DEMAND CALIBRATION ASSEMBLY



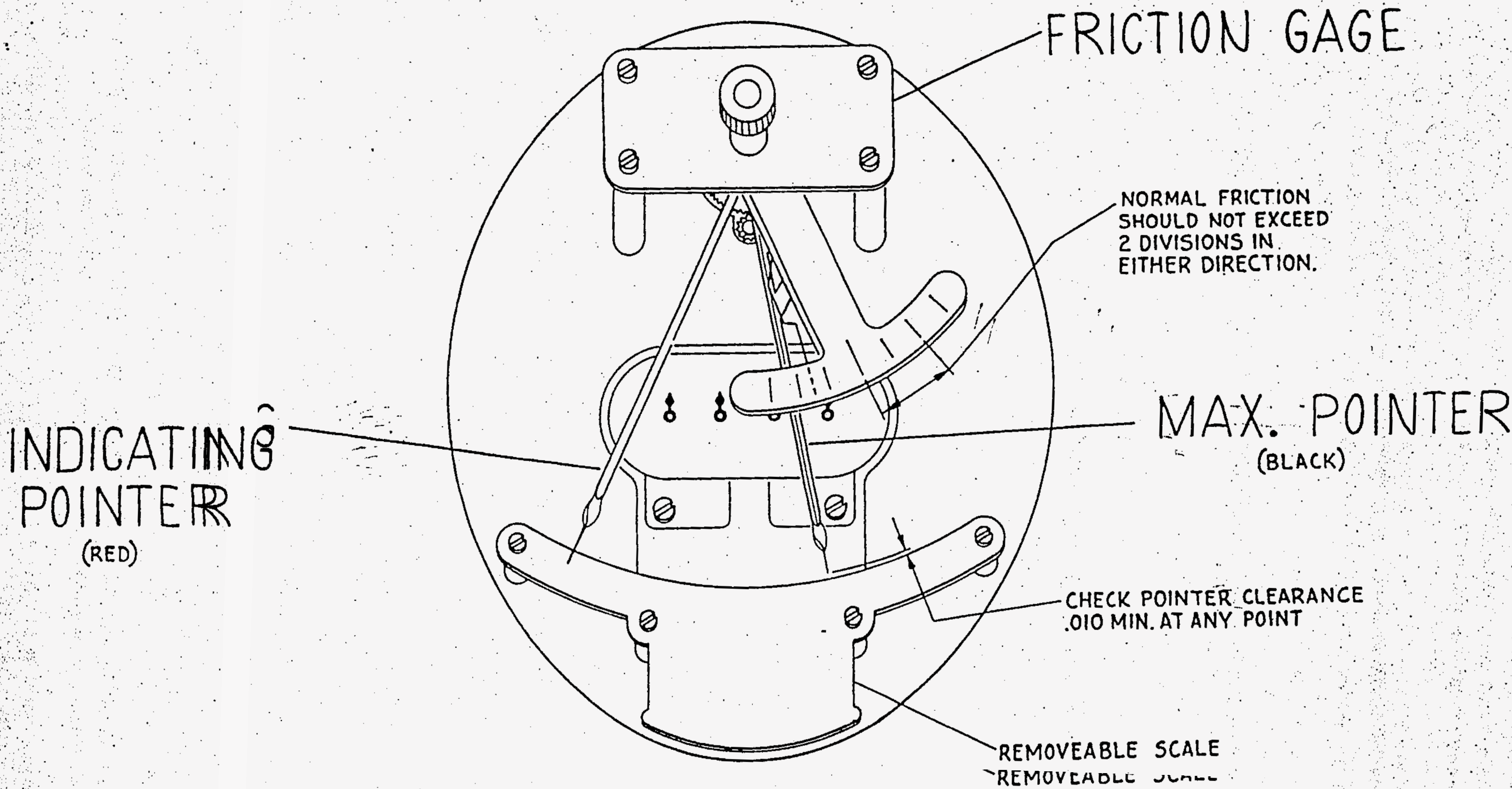
REAR VIEW OF METER



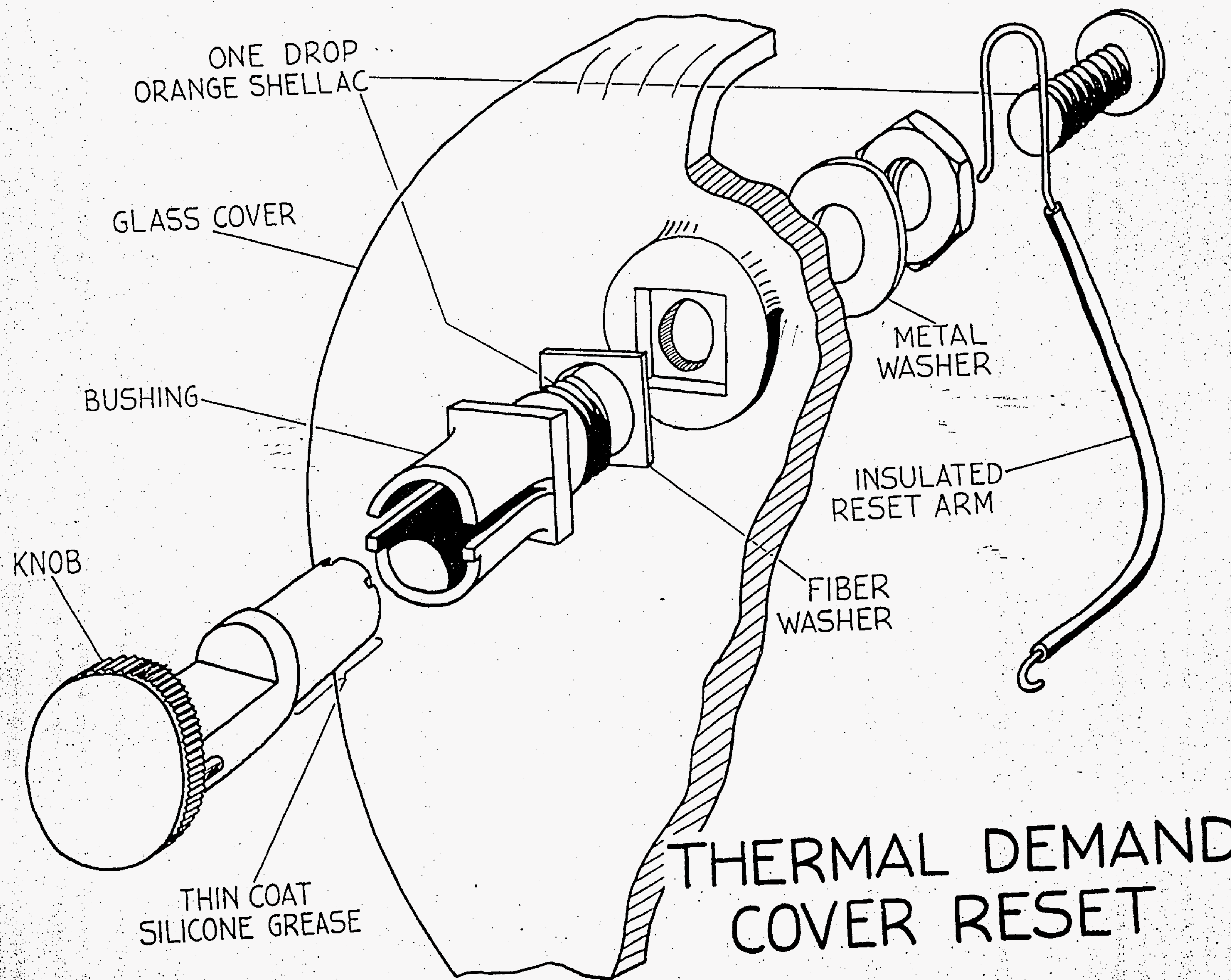
FILAMENT WAS USED INSTEAD OF CHAIN UP TO SER. NO. 8,400,000. CHAIN MAY BE USED FOR REPLACEMENT ON ALL MODELS.

AFTER ZERO ADJUSTING SPRING AND RED POINTER HAVE BEEN SET PER PAGE 12, TAP METER LIGHTLY WHILE TURNING CALIBRATION SCREW TO TAKE UP TENSION IN CALIBRATION SPRING. TIGHTEN SCREWS IN QUADRANT ARM, BEING CAREFUL TO MAINTAIN .01" CLEARANCE AT BOTH ENDS OF SHAFT.

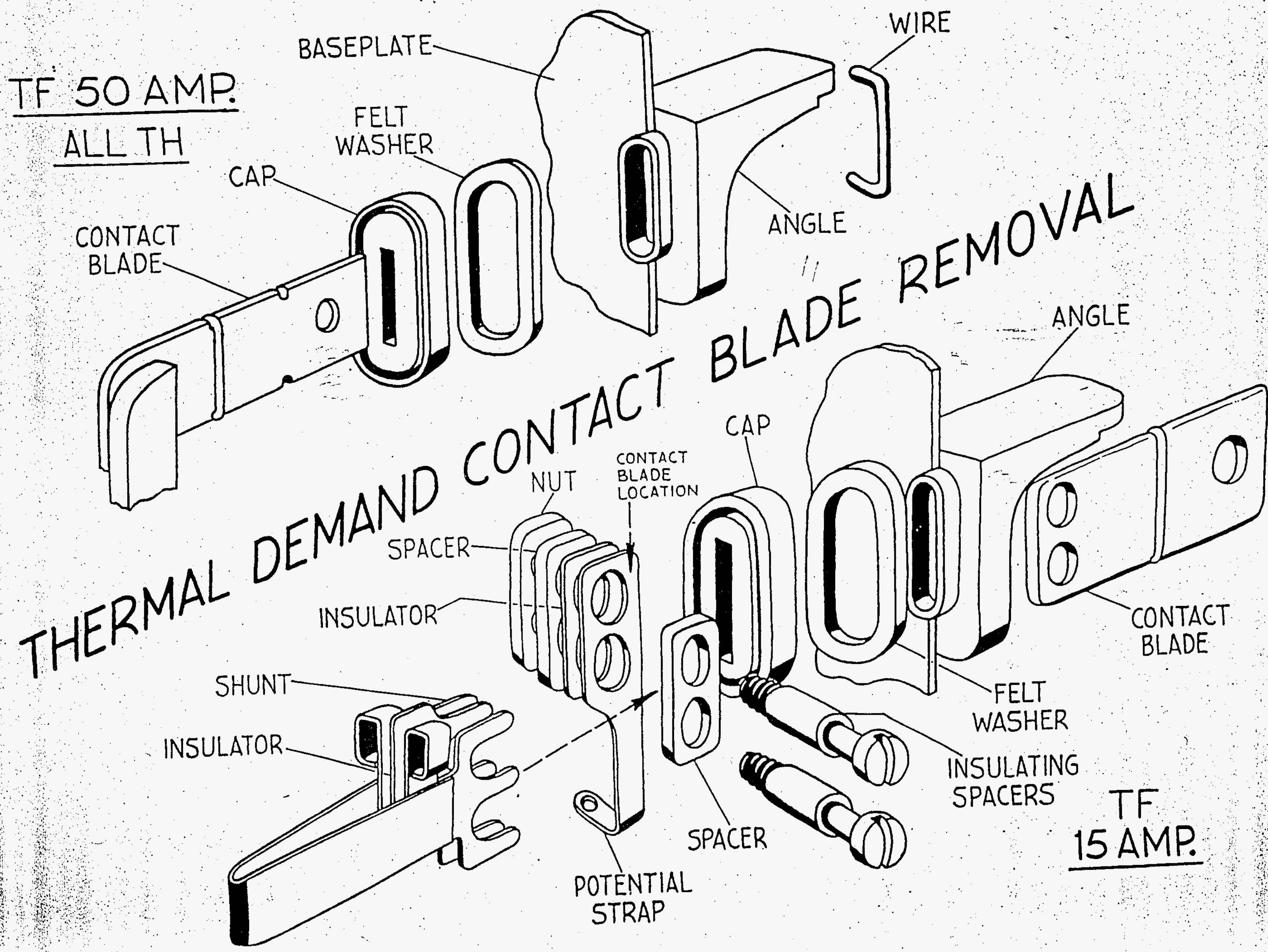
DRUM SURFACE OF CAPSTAN, SPRING, QUADRANT ARM, AND CENTER OF SHAFT MUST BE IN PERFECT LINE, SO THAT TIGHTENING OR LOOSENING CALIBRATION SPRING DOES NOT CAUSE MOVEMENT OF RED POINTER AWAY FROM ZERO.



MAX. POINTER FRICTION CHECK
THERMAL DEMAND

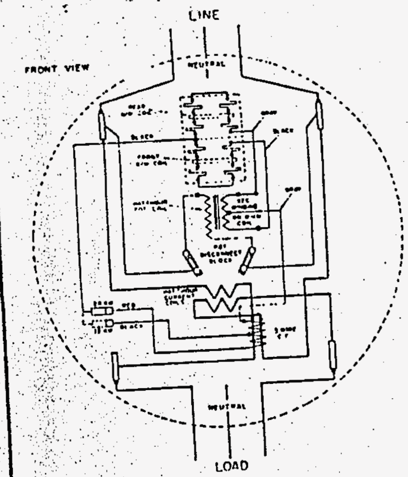


THERMAL DEMAND
COVER RESET

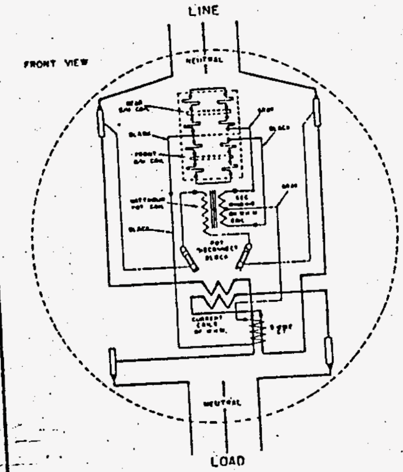

THERMAL DEMAND CONTACT BLADE REMOVAL
TF 50 AMP.
ALL TH
BASEPLATE
WIRE
FELT WASHER
CAP
CONTACT BLADE
ANGLE
ANGLE
CAP
CONTACT BLADE LOCATION
NUT
SPACER
INSULATOR
SHUNT
INSULATOR
POTENTIAL STRAP
SPACER
INSULATING SPACERS
FELT WASHER
CONTACT BLADE
TF
15 AMP.

0033994 TDM

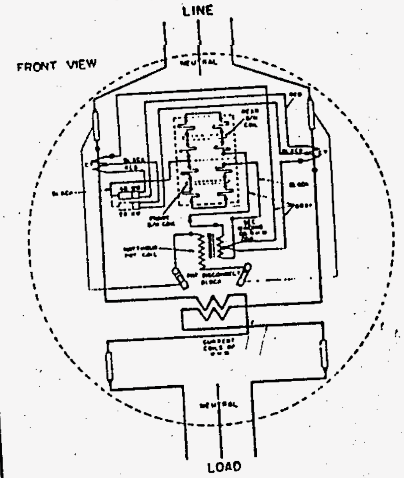
TYPE TK-SD
SINGLEPHASE WATTHOUR & THERMAL WATT DEMAND METER
(DUAL RANGE)
15 AMP, 3 WIRE, SELF CONTAINED



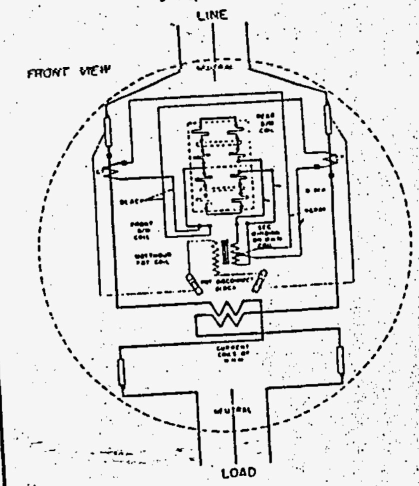
TYPE TK-S
SINGLEPHASE WATTHOUR & THERMAL WATT DEMAND METER
15 AMP
3 WIRE, SELF CONTAINED



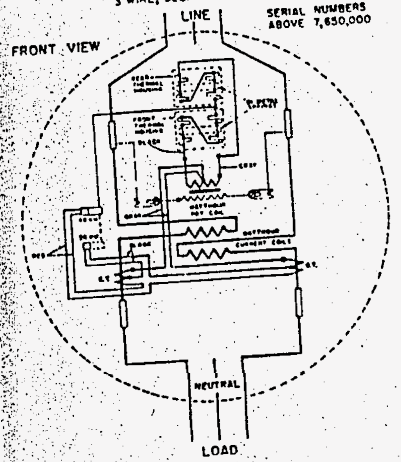
TYPE TK-SD
SINGLEPHASE WATTHOUR & THERMAL WATT DEMAND METER
(DUAL RANGE)
30 AMP, 3 WIRE, SELF CONTAINED



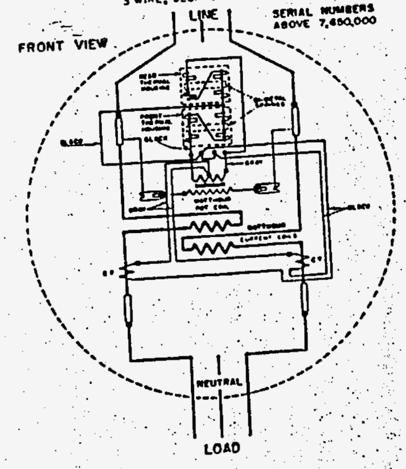
TYPE TK-S
SINGLEPHASE WATTHOUR & THERMAL WATT DEMAND METER
30 AMP
3 WIRE, SELF CONTAINED



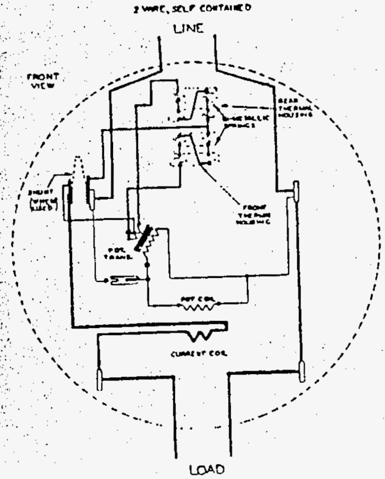
TYPE TF-SD
SINGLEPHASE WATTHOUR & THERMAL WATT
DEMAND METER
30 AMP, DUAL RANGE
3 WIRE, SELF CONTAINED



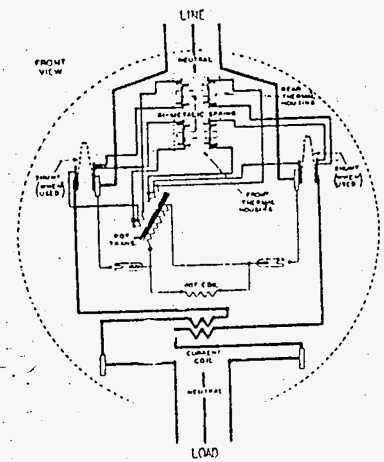
TYPE TF-S & TF-SE
SINGLEPHASE WATTHOUR & THERMAL WATT
DEMAND METER
30 AMP.
3 WIRE, SELF CONTAINED



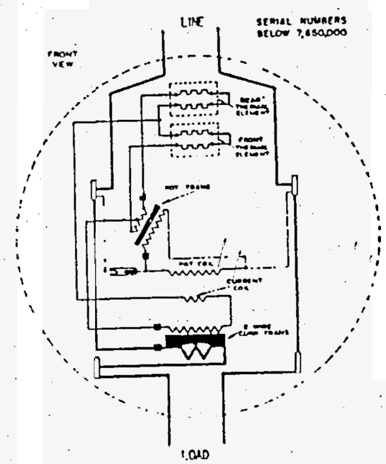
TYPE TF-S
SINGLEPHASE WATTHOUR & THERMAL WATT DEMAND METER
2½ TO 15 AMP. INCL.
2 WIRE, SELF CONTAINED



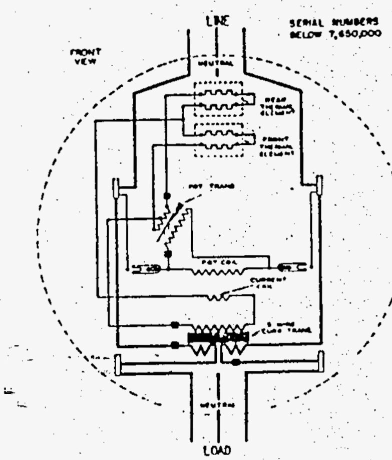
TYPE TF-S
SINGLEPHASE WATTHOUR & THERMAL WATT DEMAND METER
2½ TO 15 AMP INCL.
3 WIRE, SELF CONTAINED



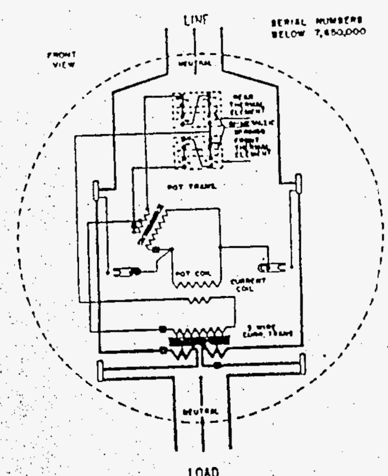
TYPE TF-S
SINGLEPHASE WATTHOUR & THERMAL WATT DEMAND METER
50 AMPERES
2 WIRE, SELF CONTAINED



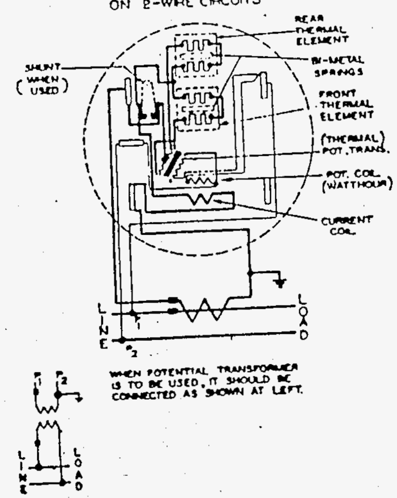
TYPE TF-S
SINGLEPHASE WATTHOUR & THERMAL WATT DEMAND METER
50 AMPERES
3 WIRE, SELF CONTAINED



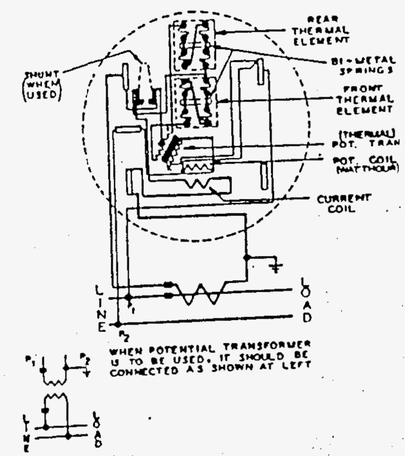
TYPE TF-SE
SINGLEPHASE WATTHOUR & THERMAL WATT DEMAND METER
50 AMPERES EXTENDED RANGE
3 WIRE, SELF CONTAINED



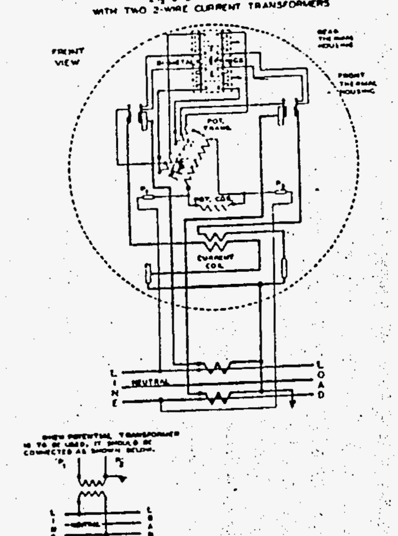
TYPE TF-ST SINGLEPHASE WATTHOUR
& THERMAL WATT DEMAND METER
2½ AMP 2 WIRE, FOR USE
WITH TWO-WIRE CURRENT TRANSFORMER
ON 2-WIRE CIRCUITS



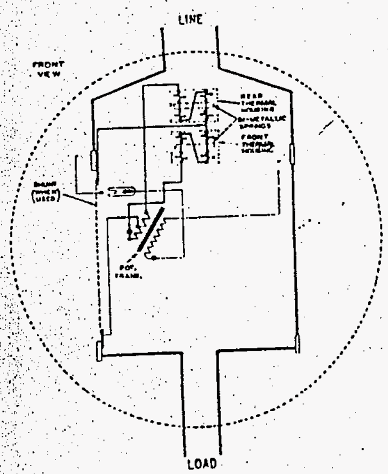
TYPE TF-ST SINGLEPHASE WATTHOUR
& THERMAL WATT DEMAND METER
5 AMP. 2 WIRE
WITH TWO-WIRE CURRENT TRANSFORMER



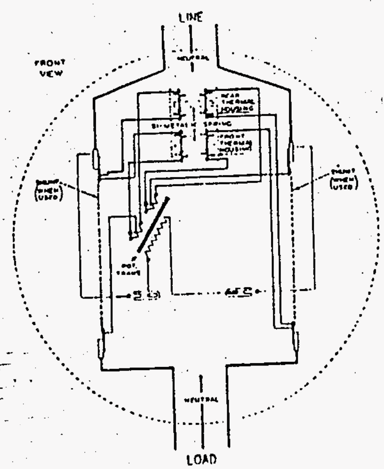
TYPE TF-ST
SINGLEPHASE WATTHOUR & THERMAL WATT DEMAND METER
2½ & 5 AMP. 3 WIRE
WITH TWO 2-WIRE CURRENT TRANSFORMERS



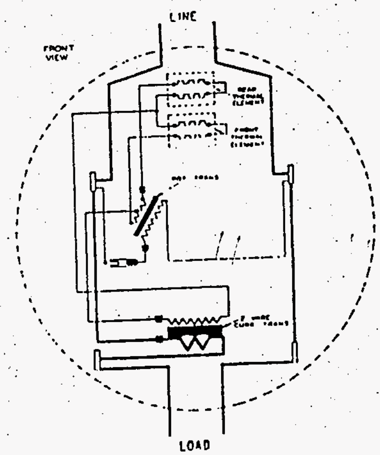
TYPE T-S
THERMAL WATT DEMAND METER
2½ TO 15 AMP. INCL.
2 WIRE, SELF CONTAINED



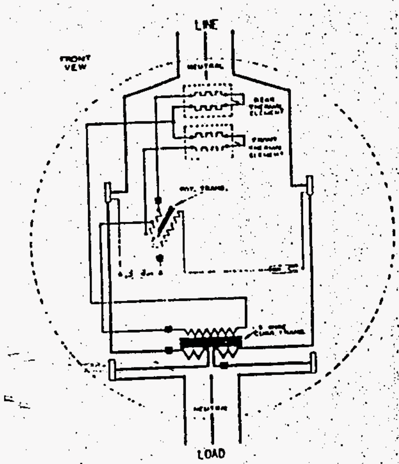
TYPE T-S
THERMAL WATT DEMAND METER
2½ TO 15 AMP. INCL.
3 WIRE, SELF CONTAINED



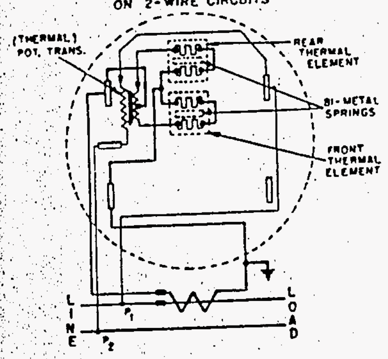
TYPE T-S
THERMAL WATT DEMAND METER
50 AMPERES
2 WIRE, SELF CONTAINED



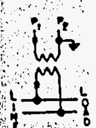
TYPE T-S
THERMAL WATT DEMAND METER
50 AMPERES
3 WIRE, SELF CONTAINED



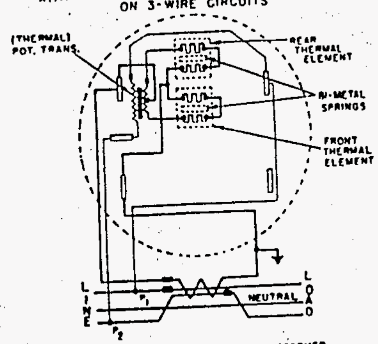
TYPE T-ST THERMAL WATT DEMAND METER
2½ AMP 2 WIRE, FOR USE
WITH TWO-WIRE CURRENT TRANSFORMER
ON 2-WIRE CIRCUITS



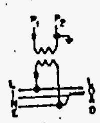
WHEN POTENTIAL TRANSFORMER IS TO BE USED, IT SHOULD BE CONNECTED AS SHOWN AT LEFT.



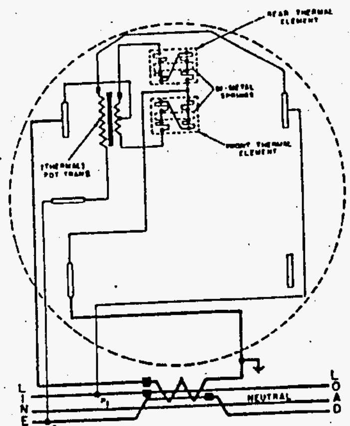
TYPE T-ST THERMAL WATT DEMAND METER
2½ AMP 2 WIRE, FOR USE
WITH THREE-WIRE CURRENT TRANSFORMER
ON 3-WIRE CIRCUITS



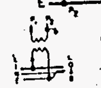
WHEN POTENTIAL TRANSFORMER IS TO BE USED, IT SHOULD BE CONNECTED AS SHOWN AT LEFT.



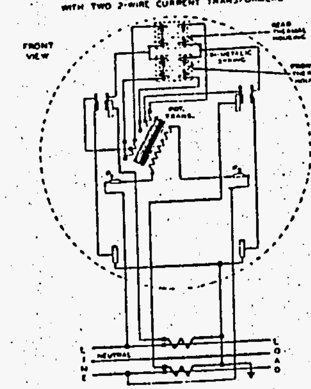
TYPE T-ST THERMAL WATT
DEMAND METER
5 AMP 2 WIRE, FOR USE
WITH THREE-WIRE CURRENT TRANSFORMER
ON 3-WIRE CIRCUITS



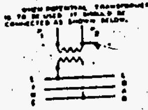
WHEN POTENTIAL TRANSFORMER IS TO BE USED, IT SHOULD BE CONNECTED AS SHOWN AT LEFT



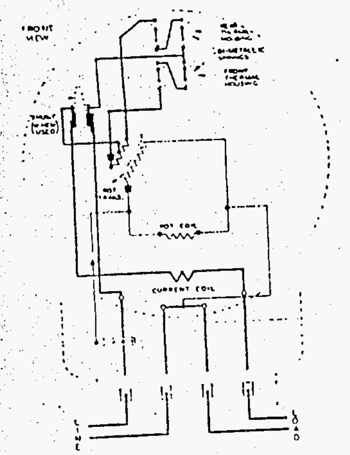
TYPE T-ST
THERMAL WATT DEMAND METER
2½ & 5 AMP. 3 WIRE
WITH TWO 2-WIRE CURRENT TRANSFORMERS



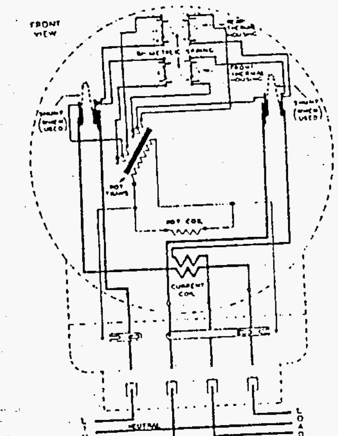
WHEN POTENTIAL TRANSFORMER IS TO BE USED, IT SHOULD BE CONNECTED AS SHOWN BELOW.



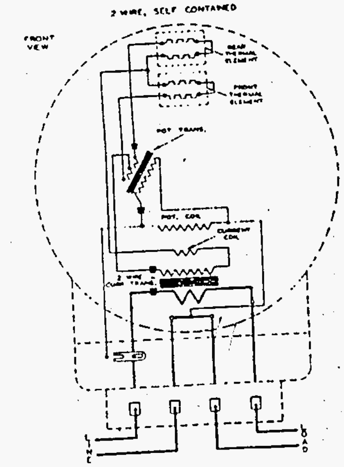
TYPE TF-A
SINGLEPHASE WATTHOUR & THERMAL WATT DEMAND METER
2½ TO 15 AMP. INCL.
2 WIRE, SELF CONTAINED



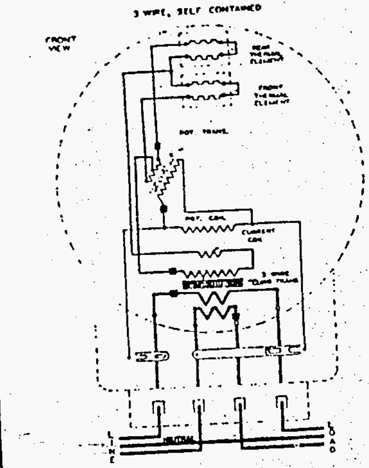
TYPE TF-A
SINGLEPHASE WATTHOUR & THERMAL WATT DEMAND METER
2½ TO 15 AMP. INCL.
3 WIRE, SELF CONTAINED



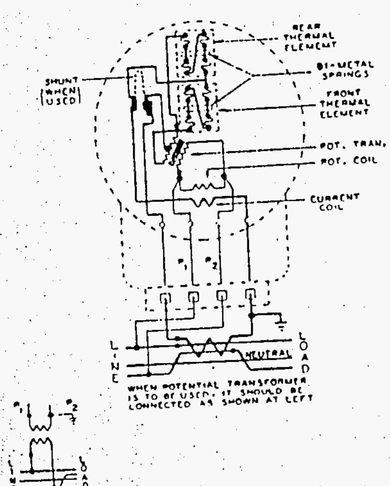
TYPE TF-A
SINGLEPHASE WATTHOUR & THERMAL WATT DEMAND METER
50 AMPERES
2 WIRE, SELF CONTAINED



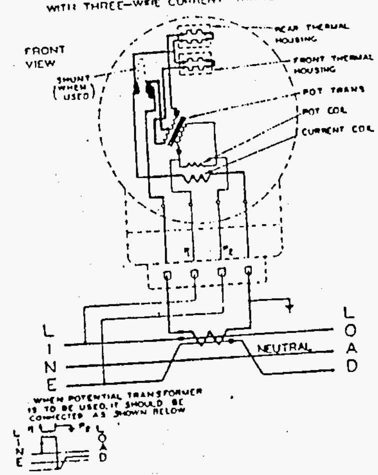
TYPE TF-A
SINGLEPHASE WATTHOUR & THERMAL WATT DEMAND METER
50 AMPERES
3 WIRE, SELF CONTAINED



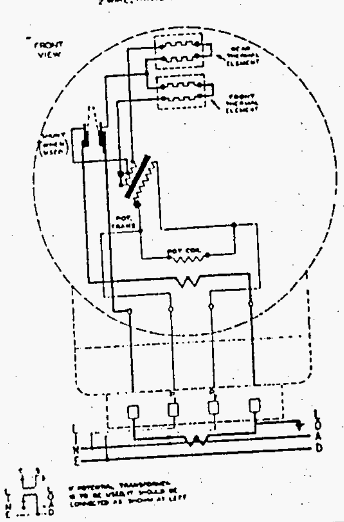
TYPE TF-AT SINGLEPHASE WATTHOUR
& THERMAL WATT DEMAND METER
5 AMP. 2 WIRE
WITH THREE-WIRE CURRENT TRANSFORMER



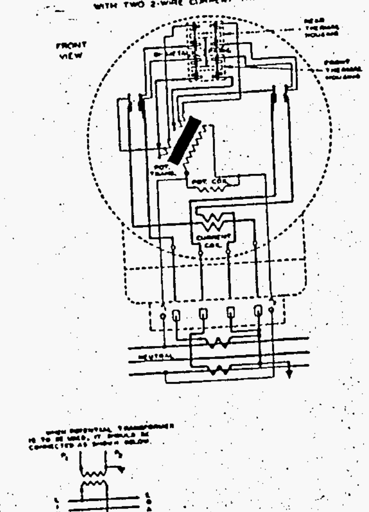
TYPE TF-AT SINGLEPHASE WATTHOUR
& THERMAL WATT DEMAND METER
2½ AMP 2 WIRE
WITH THREE-WIRE CURRENT TRANSFORMER



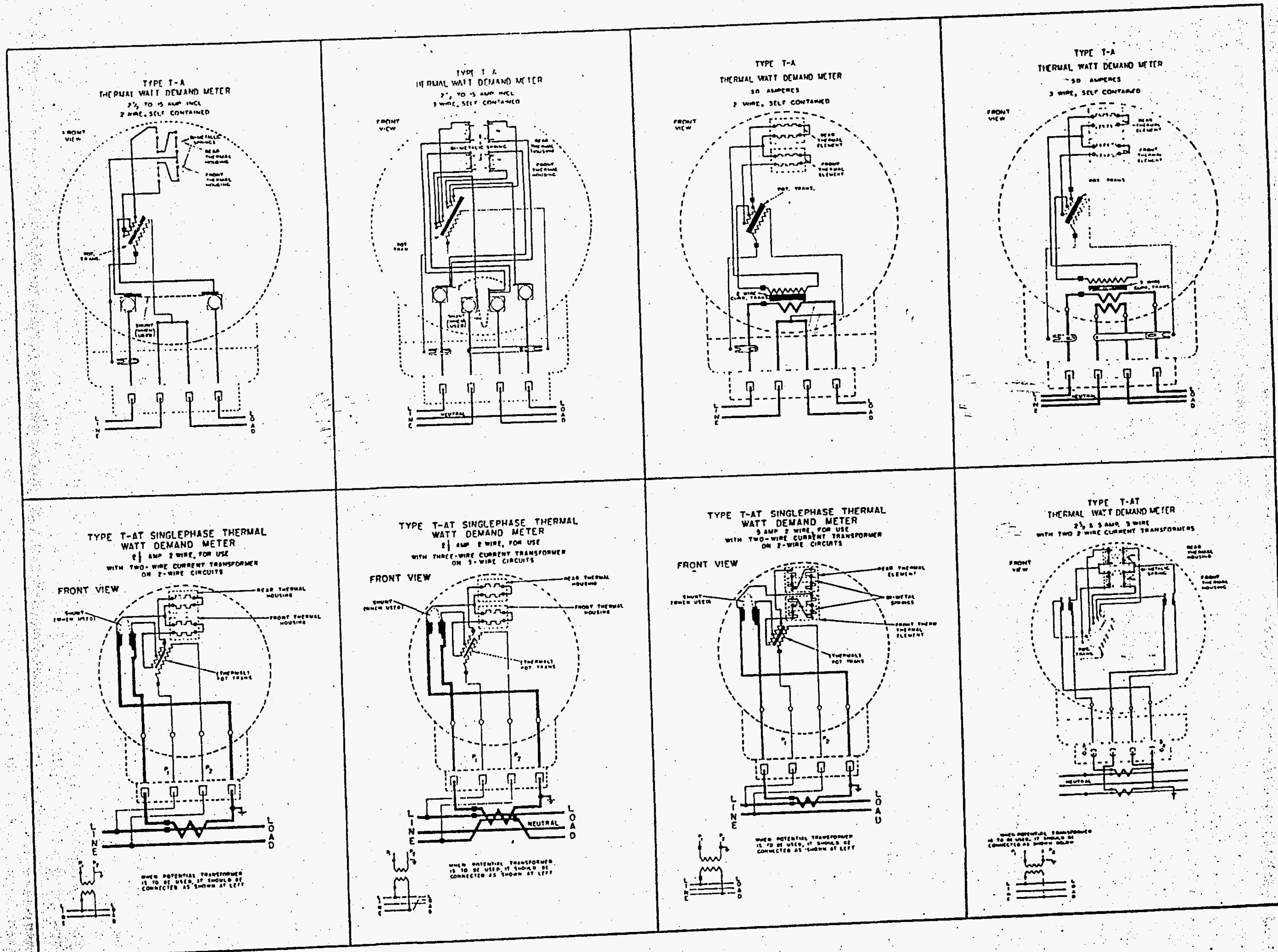
TYPE TF-AT
SINGLEPHASE WATTHOUR THERMAL WATT DEMAND METER
2½ AMP.
2 WIRE, TRANSFORMER RATED



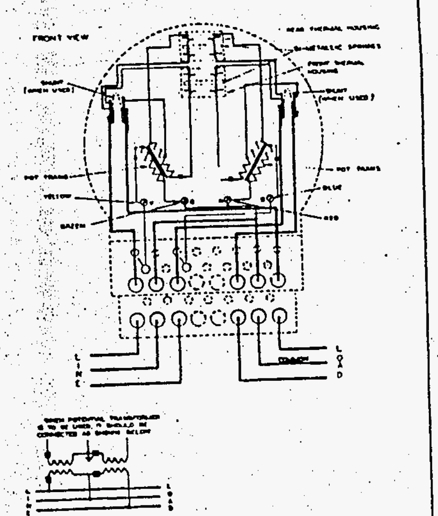
TYPE TF-AT
SINGLEPHASE WATTHOUR & THERMAL WATT DEMAND METER
2½ & 5 AMP. 3 WIRE
WITH TWO 2-WIRE CURRENT TRANSFORMERS



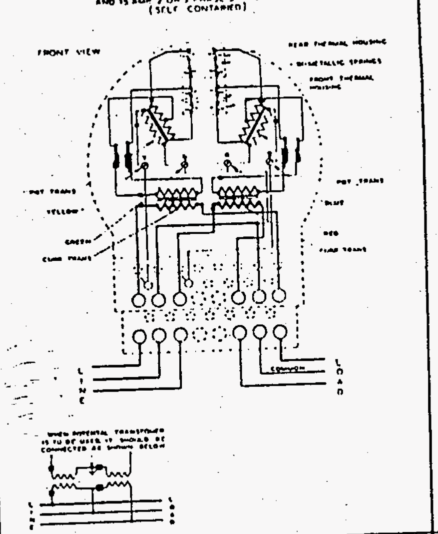
003997 TDM


TYPE T-A
THERMAL WATT DEMAND METER
2½ TO 15 AMP INCL
2 WIRE, SELF CONTAINED
FRONT VIEW
TYPE T-A
THERMAL WATT DEMAND METER
2½ TO 15 AMP INCL
3 WIRE, SELF CONTAINED
FRONT VIEW
TYPE T-A
THERMAL WATT DEMAND METER
50 AMPERES
2 WIRE, SELF CONTAINED
FRONT VIEW
TYPE T-A
THERMAL WATT DEMAND METER
50 AMPERES
3 WIRE, SELF CONTAINED
FRONT VIEW
TYPE T-AT SINGLEPHASE THERMAL
WATT DEMAND METER
2½ AMP 2 WIRE, FOR USE
WITH TWO-WIRE CURRENT TRANSFORMER
ON 2-WIRE CIRCUITS
FRONT VIEW
LINE
LOAD
WHEN POTENTIAL TRANSFORMER IS TO BE USED, IT SHOULD BE CONNECTED AS SHOWN AT LEFT
TYPE T-AT SINGLEPHASE THERMAL
WATT DEMAND METER
2½ AMP 2 WIRE, FOR USE
WITH THREE-WIRE CURRENT TRANSFORMER
ON 3-WIRE CIRCUITS
FRONT VIEW
LINE
NEUTRAL
LOAD
WHEN POTENTIAL TRANSFORMER IS TO BE USED, IT SHOULD BE CONNECTED AS SHOWN AT LEFT
TYPE T-AT SINGLEPHASE THERMAL
WATT DEMAND METER
5 AMP 2 WIRE, FOR USE
WITH TWO-WIRE CURRENT TRANSFORMER
ON 2-WIRE CIRCUITS
FRONT VIEW
LINE
LOAD
WHEN POTENTIAL TRANSFORMER IS TO BE USED, IT SHOULD BE CONNECTED AS SHOWN AT LEFT
TYPE T-AT
THERMAL WATT DEMAND METER
2½ & 5 AMP, 3 WIRE
WITH TWO 2 WIRE CURRENT TRANSFORMERS
FRONT VIEW
NEUTRAL

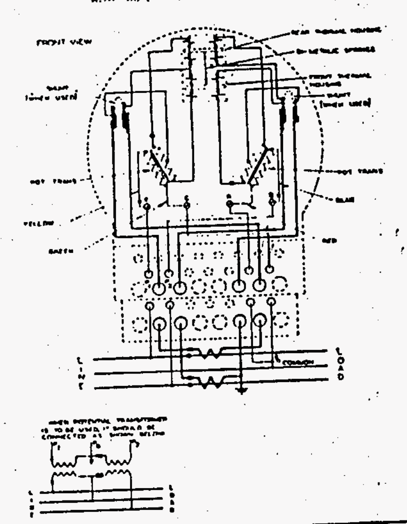
TYPE T-2P
TWO ELEMENT THERMAL DEMAND METER
15 AMP, 2 OR 3 PHASE, 3 WIRE
BELOW SER. NO. 7147410
(SELF CONTAINED)



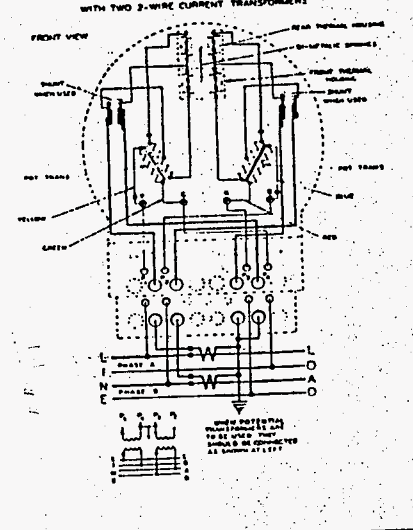
TYPE T-2P
TWO ELEMENT THERMAL DEMAND METER
50 AMP, 2 OR 3 PHASE, 3 WIRE
AND 15 AMP 2 OR 3 PHASE 3 WIRE ABOVE SER NO. 7147410
(SELF CONTAINED)



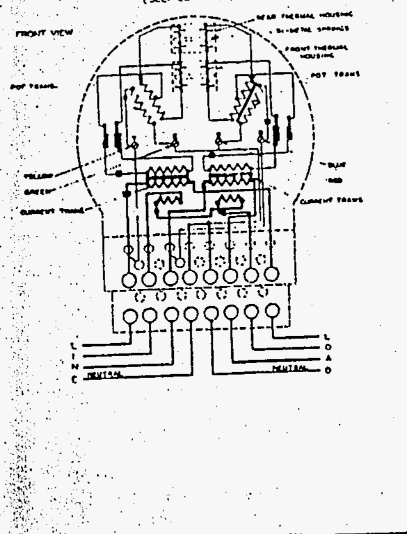
TYPE T-2PT
TWO ELEMENT THERMAL DEMAND METER
2½ & 5 AMP, 2 OR 3 PHASE, 3 WIRE
WITH TWO 2-WIRE CURRENT TRANSFORMERS



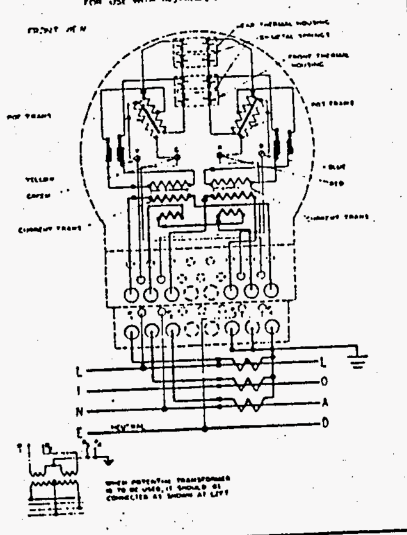
TYPE T-2PT
TWO ELEMENT THERMAL DEMAND METER
3 PHASE 3 WIRE METER WHEN USED ON 2 PHASE 4 WIRE LINE
WITH TWO 2-WIRE CURRENT TRANSFORMERS



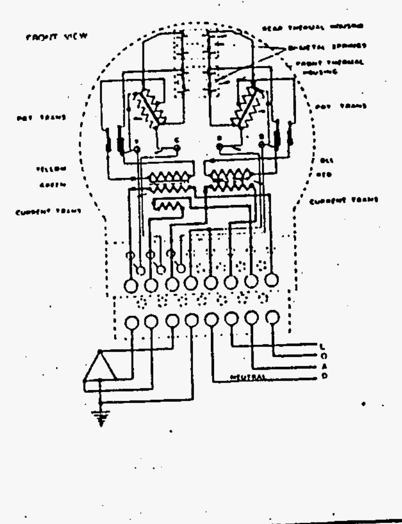
TYPE T-2½P
TWO ELEMENT THERMAL DEMAND METER
2½ TO 50 AMP, 3 PHASE, 4 WIRE, WYE
(SELF CONTAINED)



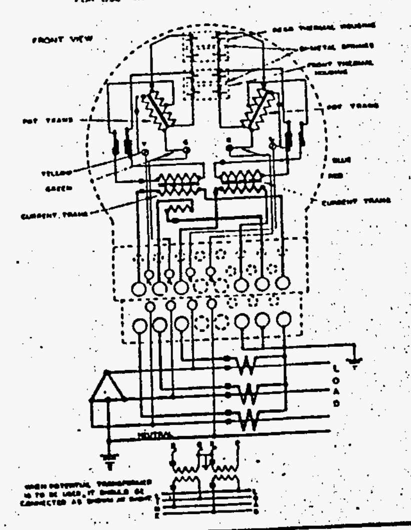
TYPE T-2½PT
TWO ELEMENT THERMAL DEMAND METER
2½ & 5 AMP, 3 PHASE, 4 WIRE, WYE
FOR USE WITH INSTRUMENT TRANSFORMERS

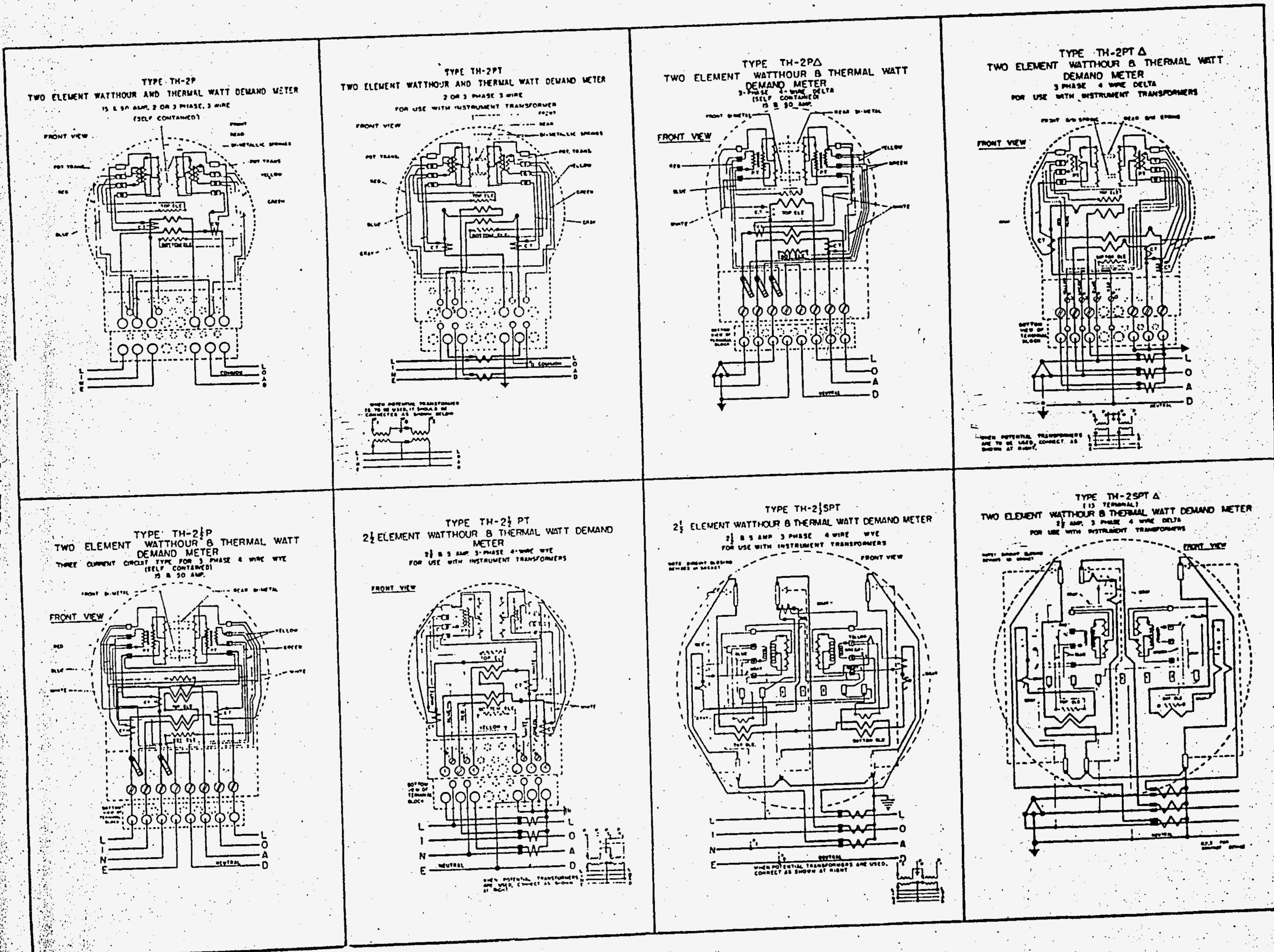


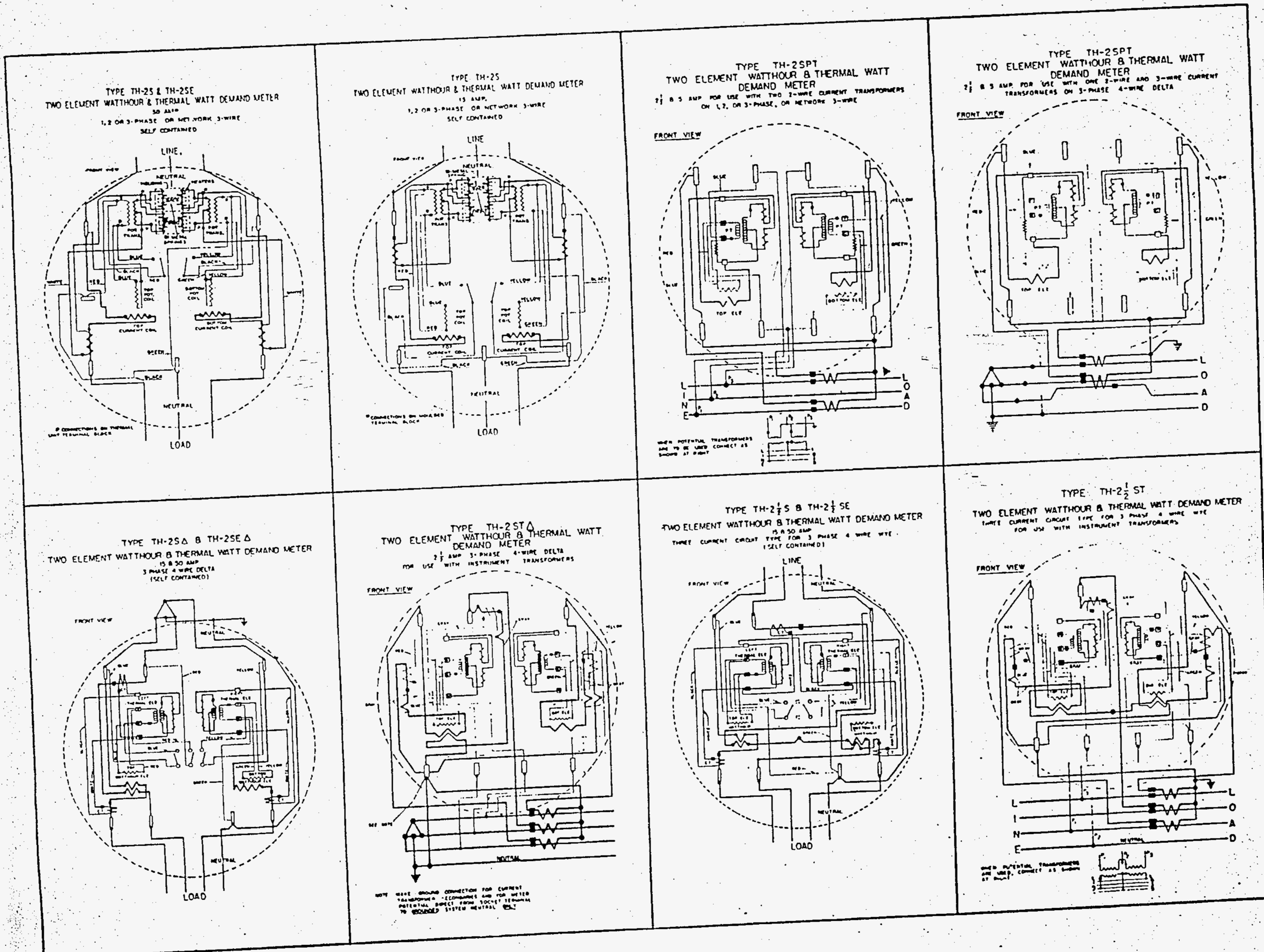
TYPE T-2PΔ
TWO ELEMENT THERMAL DEMAND METER
2½ TO 50 AMP, 3 PHASE, 4 WIRE, DELTA
(SELF CONTAINED)



TYPE T-2PTΔ
TWO ELEMENT THERMAL DEMAND METER
2½ & 5 AMP, 3 PHASE, 4 WIRE, DELTA
FOR USE WITH INSTRUMENT TRANSFORMERS




TYPE TH-2P
TWO ELEMENT WATTHOUR AND THERMAL WATT DEMAND METER
15 & 50 AMP, 2 OR 3 PHASE, 3 WIRE
(SELF CONTAINED)
FRONT VIEW
TYPE TH-2PT
TWO ELEMENT WATTHOUR AND THERMAL WATT DEMAND METER
2 OR 3 PHASE 3 WIRE
FOR USE WITH INSTRUMENT TRANSFORMER
FRONT VIEW
TYPE TH-2PΔ
TWO ELEMENT WATTHOUR & THERMAL WATT DEMAND METER
3-PHASE 4-WIRE DELTA
(SELF CONTAINED)
15 & 50 AMP.
FRONT VIEW
TYPE TH-2PT Δ
TWO ELEMENT WATTHOUR & THERMAL WATT DEMAND METER
3 PHASE 4 WIRE DELTA
FOR USE WITH INSTRUMENT TRANSFORMERS
FRONT VIEW
TYPE TH-2½P
TWO ELEMENT WATTHOUR & THERMAL WATT DEMAND METER
THREE CURRENT CIRCUIT TYPE FOR 3 PHASE 4 WIRE WYE
(SELF CONTAINED)
15 & 50 AMP.
FRONT VIEW
TYPE TH-2½ PT
2½ ELEMENT WATTHOUR & THERMAL WATT DEMAND METER
2½ & 5 AMP 3-PHASE 4-WIRE WYE
FOR USE WITH INSTRUMENT TRANSFORMERS
FRONT VIEW
TYPE TH-2½SPT
2½ ELEMENT WATTHOUR & THERMAL WATT DEMAND METER
2½ & 5 AMP 3 PHASE 4 WIRE WYE
FOR USE WITH INSTRUMENT TRANSFORMERS
FRONT VIEW
WHEN POTENTIAL TRANSFORMERS ARE USED, CONNECT AS SHOWN AT RIGHT
TYPE TH-2SPT Δ
TWO ELEMENT WATTHOUR & THERMAL WATT DEMAND METER
3 PHASE 4 WIRE DELTA
FOR USE WITH INSTRUMENT TRANSFORMERS
FRONT VIEW


TYPE TH-2S & TH-2SE
TWO ELEMENT WATTHOUR & THERMAL WATT DEMAND METER
30 AMP
1,2 OR 3-PHASE OR NETWORK 3-WIRE
SELF CONTAINED
LINE
NEUTRAL
LOAD
TYPE TH-2S
TWO ELEMENT WATTHOUR & THERMAL WATT DEMAND METER
15 AMP
1,2 OR 3-PHASE OR NETWORK 3-WIRE
SELF CONTAINED
LINE
NEUTRAL
LOAD
TYPE TH-2SPT
TWO ELEMENT WATTHOUR & THERMAL WATT DEMAND METER
2½ & 5 AMP FOR USE WITH TWO 2-WIRE CURRENT TRANSFORMERS ON 1,2, OR 3-PHASE, OR NETWORK 3-WIRE
FRONT VIEW
L I N E
L O A D
TYPE TH-2SPT
TWO ELEMENT WATTHOUR & THERMAL WATT DEMAND METER
2½ & 5 AMP FOR USE WITH ONE 2-WIRE AND 3-WIRE CURRENT TRANSFORMERS ON 3-PHASE 4-WIRE DELTA
FRONT VIEW
L O A D
TYPE TH-2SΔ & TH-2SEΔ
TWO ELEMENT WATTHOUR & THERMAL WATT DEMAND METER
15 & 30 AMP
3 PHASE 4 WIRE DELTA
(SELF CONTAINED)
FRONT VIEW
NEUTRAL
LOAD
TYPE TH-2STΔ
TWO ELEMENT WATTHOUR & THERMAL WATT DEMAND METER
2½ AMP 3-PHASE 4-WIRE DELTA
FOR USE WITH INSTRUMENT TRANSFORMERS
FRONT VIEW
NEUTRAL
TYPE TH-2½S & TH-2½SE
TWO ELEMENT WATTHOUR & THERMAL WATT DEMAND METER
15 & 30 AMP
THREE CURRENT CIRCUIT TYPE FOR 3 PHASE 4 WIRE WYE
(SELF CONTAINED)
LINE
FRONT VIEW
NEUTRAL
LOAD
TYPE TH-2½ ST
TWO ELEMENT WATTHOUR & THERMAL WATT DEMAND METER
THREE CURRENT CIRCUIT TYPE FOR 3 PHASE 4 WIRE WYE
FOR USE WITH INSTRUMENT TRANSFORMERS
FRONT VIEW
L I N E
L O A D
NEUTRAL

INTERPRETATION OF BAD TEST RESULTS

Condition Found	Possible Cause	Correction
A. Meter fails to respond when current and voltage are applied.	1. Potential Transformer primary open.	Check with ohmmeter.
	2. High resistance connection in either potential or current circuit	Check loose screw or bad soldered joints.
	3. For meters having more than one element or current circuit, they may be bucking each other	Check for proper connections.
	4. Shunts shorted	Check for correct location of shunt block insulation.
B. Large pointer movement (over 5% of F.S.) when potential only is applied.	1. One loose bi-metal.	Replace bi-metal assembly.
	2. High resistance heater connection.	Replace heater assembly.
	3. Bi-metals of unequal activity. See page 6.	Replace bi-metal assembly.
C. Unbalanced Elements.	1. One shunt shorted	Check for correct location of shunt block insulators.
	2. Incorrect shunt resistance.	Replace shunts or change resistance.
	3. One element fails to operate.	Correct the same as Condition A.
D. Zero recheck error after initial zero and load calibration.	1. Quadrant arm at rear of bi-metal shaft improperly adjusted.	Check adjustment. See page 16 and page 7, Bulletin 171.
	2. Bi-metals have not been properly stabilized and have become unpaired.	Replace bi-metal assembly.
E. Indicating pointer (red) has excessive friction (over 1½%). The pointer will go upscale by jerks.	1. Bent bi-metal shaft.	Replace bi-metal assembly.
	2. Shaft rubs side of grease cup hub.	Shift thermal element assembly.
F. Excessive error (more than 3%) at scale check points.	1. Faulty calibration.	Recalibrate.
	2. High resistant connection in thermal circuit.	Check all soldered joints and screw connections.
G. Zero calibration out of range for adjustment assembly.	1. Excessive "cold" to "hot" zero shift.	See Condition B.
	2. Zero adjusting gear improperly located at "cold" zero.	Readjust zero adjusting gear, indicating pointer, and quadrant arm. See page 12 and page 7, Bulletin 171.
H. Indicating Pointer drags maximum pointer down scale.	1. Foreign material on maximum pointer "flag"	Clean "flag".
	2. Maximum pointer contacts indicating pointer other than at "flag".	Adjust clearance between pointers by careful bending.
	3. Indicating pointer hub rubs maximum pointer hub.	Replace maximum pointer.
I. Excessive looseness or tightness of calibration adjustment screw.	1. Loose set screws.	Adjust proper friction and tighten set screws. See page 14 and 15.
	2. Crossed threads in set screws.	Replace calibration assembly.
	3. Dirt under friction washer causes galling.	Clean, cover friction washer with silicone grease, and adjust assembly. See page 14 and 15.

BULLETINS ON DUNCAN THERMAL DEMAND METERS

DUNCAN ELECTRIC COMPANY, INC. BOX 7180, LAFAYETTE, INDIANA 47903

TELEPHONE: 317+742-1001 A SUBSIDIARY OF LANDIS & GYR, N. A., INC. TELEX: 27-2120

004004 TDM

The following graphic representations AND TABLES are the results of testing TMT-6S DUNCAN meters. These meters are the same meter used by FPL in their 1U class of CT rated meters.

Another test that was done but has no graphic value was to start the meters cold without preheating. This is what we believe may happen with all of the shop tests and the annual sample test to the PSC.

The meters were set-up calibrated as closely as possible on the low-scale (1.5) to zero and full-scale accuracy. This is how we believe most meters were delivered to FPL from Duncan/Landis & Gyr.

The test load was maintained at ~2.6 amps. At the end of a one hour period each meters' accuracy was noted and adjusted AS NECESSARY to match the standard reading. The table below shows those results.

Cold start test	STANDARD	METER A	METER B	METER C
READING	1.25	1.23	1.23	1.24
ERROR	0	-1.333%	-1.333%	-.667%
ADJUSTMENTS		1.25	1.25	1.25
AFTER 15 MIN.	1.25	1.24 TWEEK +. 01	1.25	1.25

A second test was conducted with the face scale changed to high scale (3). The meters were allowed to cool to ~ room temperature (76-78 degrees).

The test load was maintained at ~2.5 amps. At the end of a one hour period each meters' accuracy was noted and adjusted AS NECESSARY to match the standard reading. The table below shows those results.

Cold start test	STANDARD	METER A	METER B	METER C
READING	1.21	1.21	1.21	1.2
ERROR	0	0	0	-.0667
ADJUSTMENTS				TWEEK +. 01
AFTER 15 MIN.	1.21	1.21	1.21	1.21

The next test is a standard test with 2-hour preheat and 5 amp load.

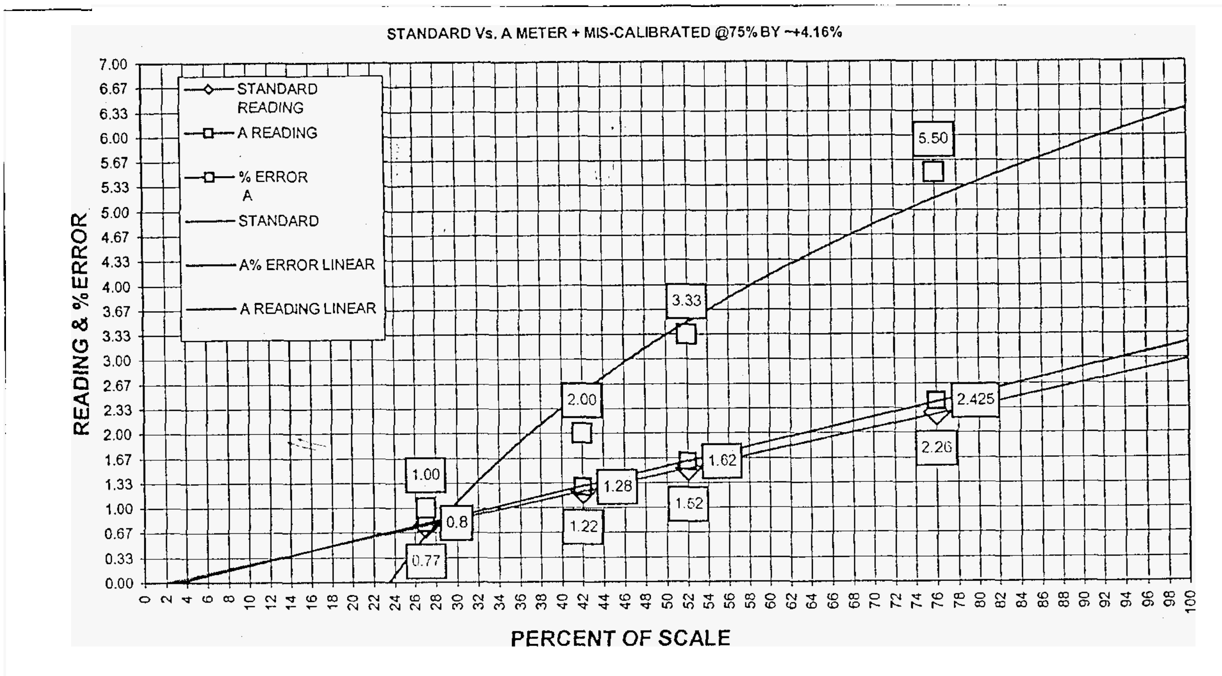
2-HOUR PREHEAT	STANDARD	METER A	METER B	METER C
READING				
ERROR				
ADJUSTMENTS				
AFTER 15 MIN.				

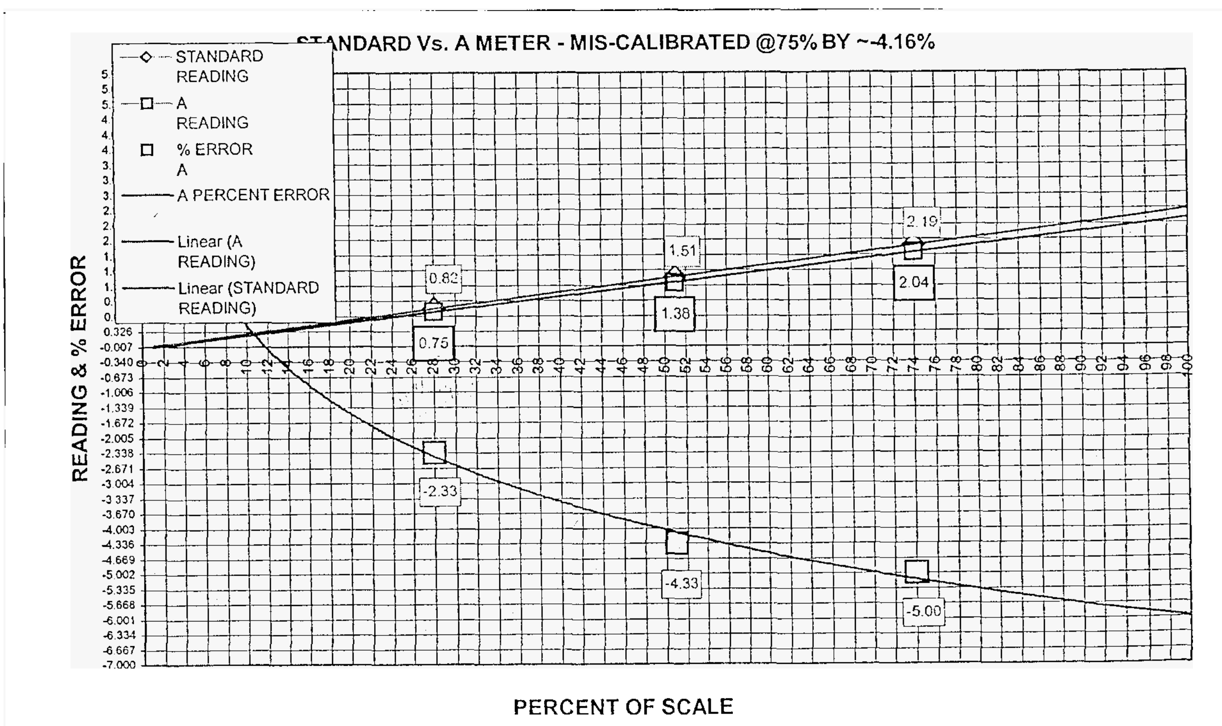
EXHIBIT
tabbies
GB-7

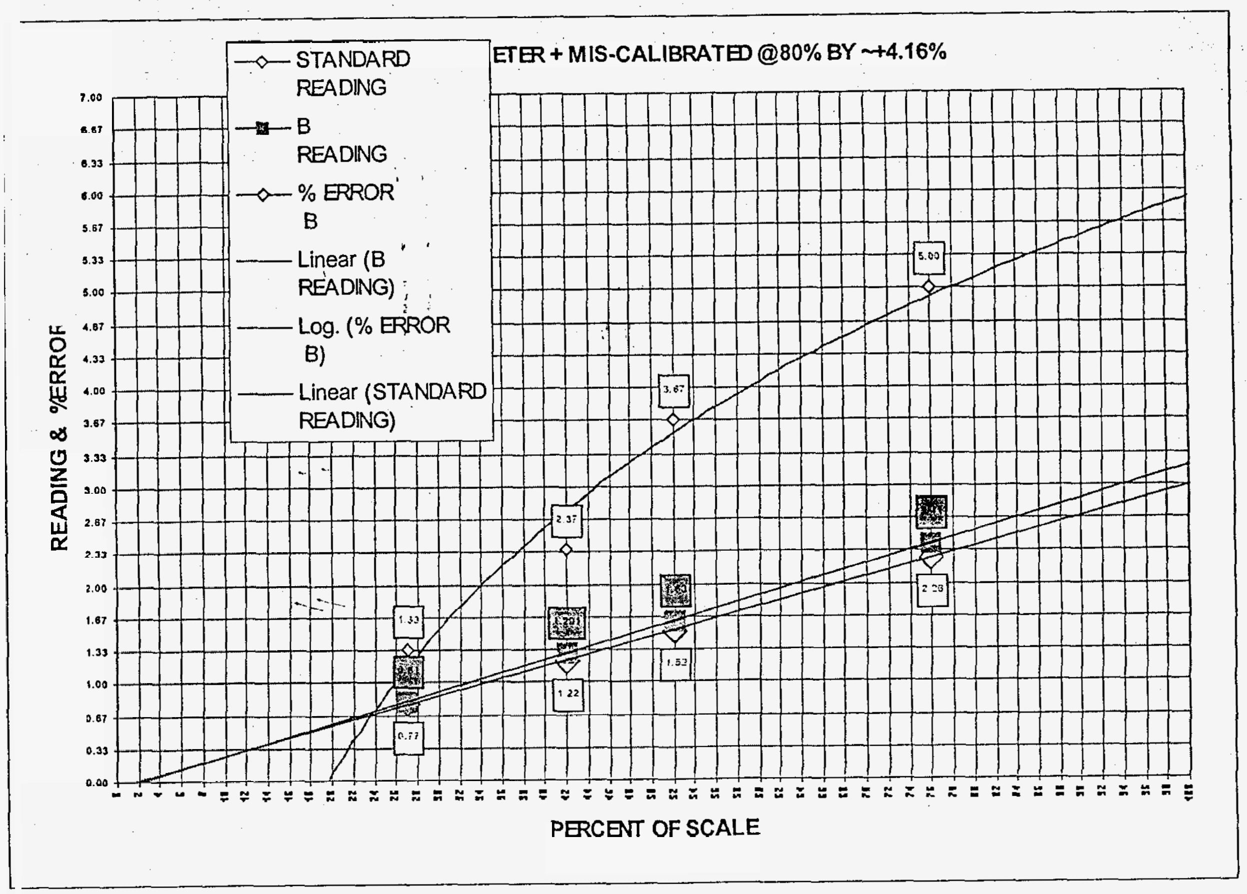
The plus testing was set-up with a miscalibration of what was believed to be +4%, however the testing results showed differently.

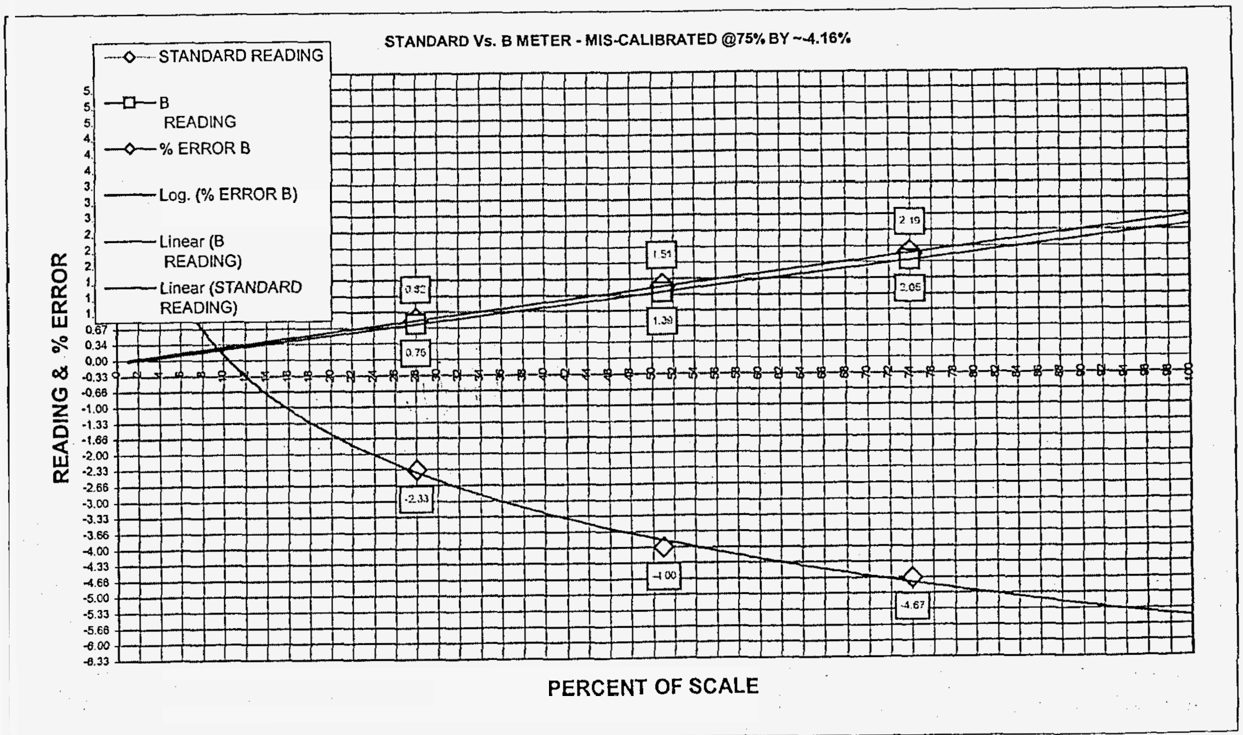
The minus testing, was set-up similarly with a mis-calibration of –4%, again the results were unexpected.

Neither showed an absolute linear reaction, the logarithmic trend line shows more of an arch or curve.

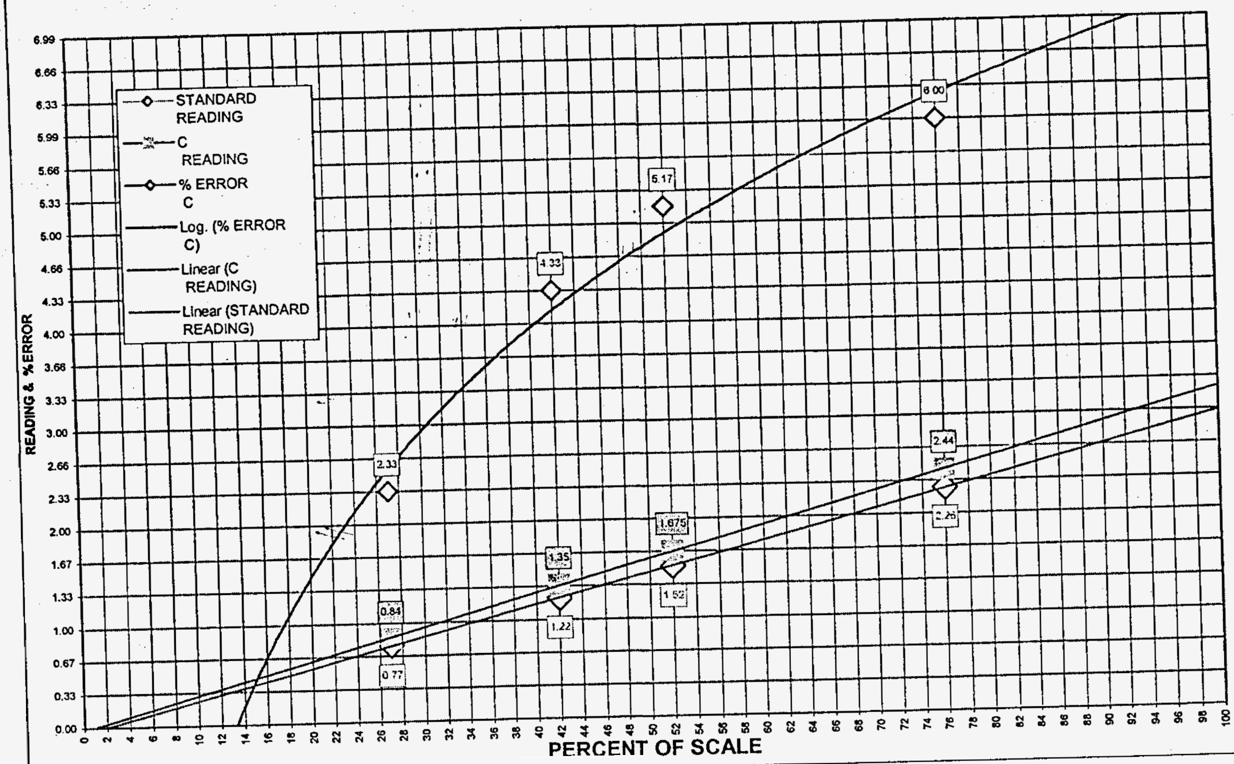





ETER + MIS-CALIBRATED @80% BY ~+4.16%
STANDARD READING
B READING
% ERROR B
Linear (B READING)
Log. (% ERROR B)
Linear (STANDARD READING)
READING & %ERROF
PERCENT OF SCALE
5.00
3.67
2.37
1.33
0.77
1.22
1.52
2.28


STANDARD Vs. B METER - MIS-CALIBRATED @75% BY ~-4.16%
STANDARD READING
B READING
% ERROR B
Log. (% ERROR B)
Linear (B READING)
Linear (STANDARD READING)
READING & % ERROR
PERCENT OF SCALE
0.82
0.76
1.51
1.39
2.19
2.05
-2.33
-4.00
-4.67

STANDARD Vs. C METER + MIS-CALIBRATED @80% BY ~+4.16%



STANDARD Vs. C METER - MIS-CALIBRATED @75% BY ~-4.16%