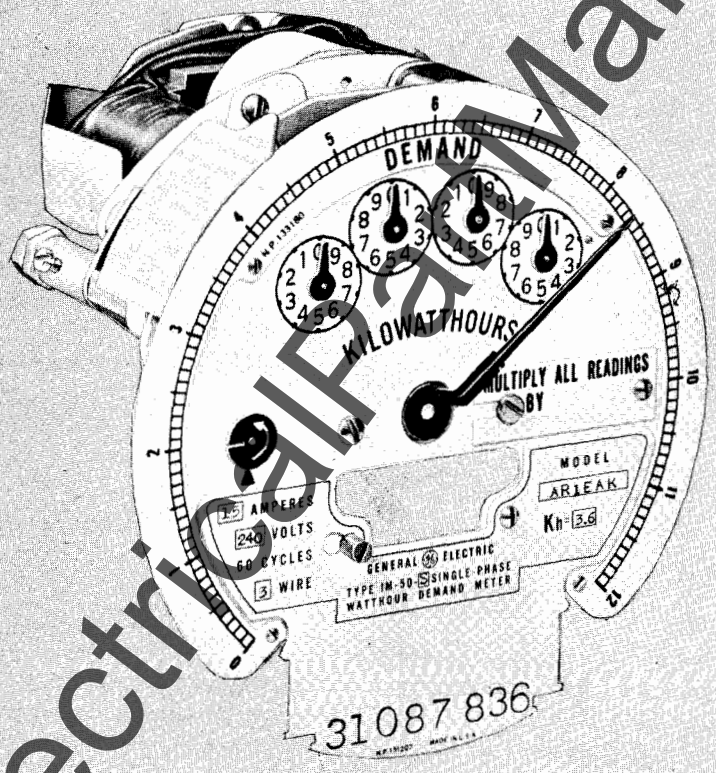
INSTRUCTIONS

GEH-1529D
Supersedes GEH-1529C

TYPE M-30
DEMAND REGISTERS



GENERAL ELECTRIC

TABLE OF CONTENTS

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

TYPE M-30 DEMAND REGISTERS

for use with

WATTHOUR DEMAND METERS

TYPES DM-6, -7, -14, -15; TYPES DSM-19, -20, 34, -35, -38, -39, -40, -41, -43, -44; TYPES IM-16, -18, -20, -30, -50; TYPES ISM-8, -9, -10, -11, -12; AND TYPES VM-2, -3, -4, 5, -6, -7, -9, -10.

INTRODUCTION

When the register of a standard General Electric watthour meter is replaced by a demand register, the resulting combination is a "watthour demand meter". These instructions cover the operation, maintenance, adjustment, and testing of the Type M-30 demand register as well as its installation on watthour meters of the following (and related) types: Types D-6, -7, -14, -15; Types DS-19, -20, -34, -35, -38, -39, -40, -41, -43, -44; Types I-16, -18, -20, -30, -50; Types IS-8, -9, -10, -11, -12; and Types V-2, -3, -4, -5, -6, -7, -9, -10.

The "watthour demand meters" are identical to corresponding types of watthour meters except for the register, connection leads and cover, and the addition of the type letter "M" following the regular type letter. For example, the VM-3-A is exactly like the V-3-A except that a demand register is used in place of the ordinary register, and the cover is deeper than the standard watthour-meter cover and has a manual resetting device.

The register indicates kilowatthour consumption by means of dials and pointers, and maximum kilowatt demand, averaged over a definite time interval, by a long pointer over a graduated scale.

GENERAL DESCRIPTION

The M-30 demand register is of the block interval type in which a pointer pusher is geared directly to the watthour-meter shaft through a suitable gear reduction and arranged to carry the indicating pointer with it as it moves up scale. In this gear train is a clutch which will open and slip to permit the pointer pusher to be brought back to its zero position. The pointer, since it is not rigidly attached to the pointer pusher, remains at the highest point on the scale to which it has been pushed and is held there by friction.

During the time interval, the pointer pusher is driven up scale at a rate proportional to the load on the watthour meter. It carries with it the pointer mechanism, if the pointer has not previously been advanced through the range covered by the pointer pusher during the interval under consideration. At the end of each time interval the pointer pusher is returned to its zero position by the resetting mechanism.

A synchronous motor is used to drive the timing and resetting mechanism. The complete motor assembly can be lifted from the register by slightly loosening the two mounting screws, one on either side of the coils. The motor drives the timing train through an over-running clutch making it possible to advance the train manually without disturbing any adjustment.

The progress of the time interval may be noted on the small black disk on the front of the register. The disk moves intermittently at such a rate that one complete revolution is equal to the duration of the time interval, thereby giving at a glance the elapsed time in that particular interval.

OPERATING PRINCIPLE

The following is a description of the operating principle of the Type M-30 demand register. References are to Fig. 1 (30-minute time interval register shown).

The worm wheel (1), meshes with a worm on the watthour-meter shaft and through worm shaft (2) drives the kilowatthour and demand gear trains. The kilowatthour dials are driven by a simple gear train consisting of worm wheel (3), ratio shaft (20), and pointer gear shafts (4) behind the dial plate.

The demand gear train consists of the clutch-shaft assembly, the pointer-pusher assembly, and the demand-pointer assembly.

The clutch-shaft assembly is driven by worm wheel (5) which is fastened to shaft (6). Clutch disk (7) is also secured to this shaft. Gear (8) is free to turn on shaft (6) and is driven by it through friction pad (9). Spring (10) and adjusting nut (11) provides means of adjusting the pressure on the friction pad and thereby its friction torque. Gear (8) meshes with gear (12) on pointer-pusher pinion sleeve (13) which is free to turn on shaft (17).

The pointer-pusher assembly carries on its gear (12) a post (14) which engages with formed dog (16) on pointer-mechanism shaft (17). The contact between (14) and (16) is through pointer-pusher adjusting screw (15) which provides a fine adjust-

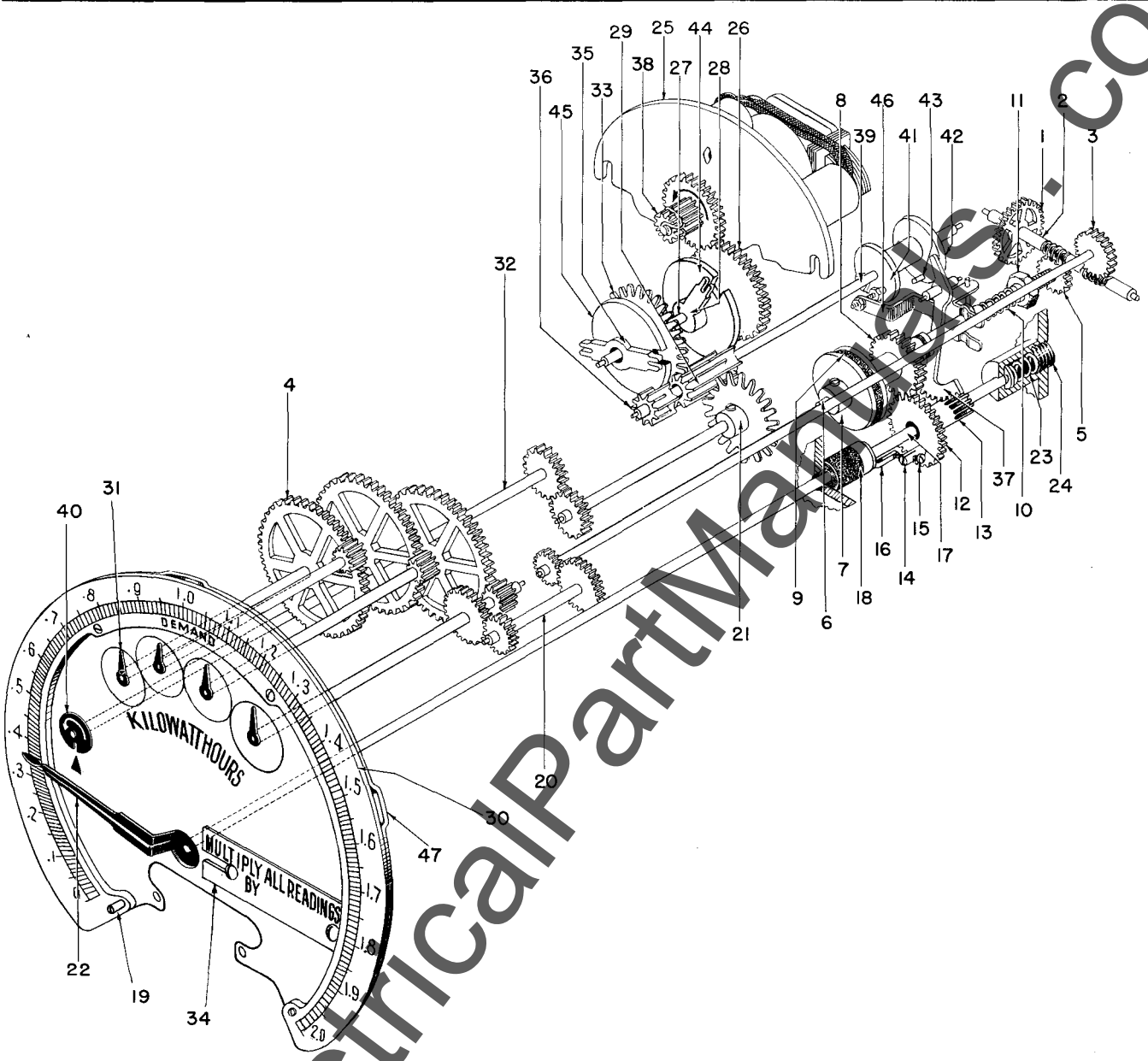


Fig 1. Type M-30 demand register, master schematic layout

ment to correlate the zeros of the pointer as determined by the manual pointer reset action and of the pointer-pusher as determined by the interval reset mechanism. Approximate setting for the pointer-pusher may be made by turning the pointer-mechanism dog (16) and shaft (17) with respect to pointer (22) and securing the pointer with two set screws.

The demand-pointer assembly (16, 17, and 22) is driven up scale by the pointer-pusher assembly through the engagement of pointer-pusher adjusting screw (15) and dog (16). During rotation of the pointer-pusher assembly, sector gear (37) is rotated by pinion (13) so that the pointer-pusher may be reset to zero at the end of the time interval by reset pin (43) on the plate (42). The pointer is held in the highest position to which it has been driven by the friction pad (18) and friction spring (23). The friction is adjustable by means of screw (24). The eccentric pin (19) serves as a zero stop for the pointer when the pointer is returned to zero manually.

The time interval is established by the operation of the synchronous motor (25) as it drives through the Geneva mechanism to a cam (41) and reset pin (43). The motor (25), operating at one rpm at rated frequency, continuously rotates gear (26) and shaft (27).

Transfer gear (28) together with locking ring (44), which holds the pinion stationary between engagements of the transfer gear, are fastened to shaft (27) and likewise rotate continuously.

Transfer pinion (29) is rotated intermittently on shaft (39) and intermittently drives gear (33) which, together with transfer gear (35) and locking ring (45) rotate freely on shaft (27). Transfer pinion (36) is thereby rotated intermittently one revolution each interval. Transfer pinion (36) is fastened to cam shaft (39) which, therefore, rotates reset cam and pin assembly one revolution each interval in four intermittent 90 degree steps. Each 90 degree movement of the cam assembly takes nine seconds.

The interval resetting is accomplished first by the action of cam (41) in lifting clutch-lever assembly (46), thereby disengaging the clutch, and second by the intercepting of pin (43) with the tail of sector gear (37) which rotates pointer pusher (15) through pinion sleeve (13) backward to its zero position away from the pointer-mechanism dog (16). The cam (41) has now closed clutch (9), thereby again allowing registration through shaft (6).

The duration of the time interval is determined by the number of sections or ends on the transfer gears (28) and (35). The combination of a single-ended transfer gear (28) and double-ended transfer gear (35), is for a 30-minute-interval register as shown in the figure. In a 15-minute register, both transfer gears are double ended.

The interval-indicator dial (40) is driven in intermittent steps through gear train (32), thereby indicating how much of the present interval has elapsed.

The overrunning clutch (38) on the motor (25) shaft drives gear (26). This permits the time train to be advanced or the pointer-pusher resetting operation to be performed manually by turning the gears with the finger. The pinion on the overrunning clutch (38) is for engagement with the self-checking adapter only, and is not part of the register-gear trains.

SCALES

All watthour demand meters are one of three classes, known as Class 1, 2, and 4. The following table sets forth the approximate overload values of the Type M-30 Class 2 demand registers when used on different types of watthour meters. When Class 1 registers are used, divide the values in the table below by two to obtain the approximate full-scale rating. When Class 4 registers are used, multiply the values in the table below by 1.5 to obtain the approximate full-scale rating (Class 4 registers are intended primarily for use only on Type IM-30, 15-ampere meters).

SCALE RATINGS OF REGISTERS

Type of Meter	Approximate Full-scale Rating in Per Cent of Meter Rating*	
	Self-contained	Used with C T
IM-16, -20, -50	330	165
IM-30 (except 15A)	330	165
ISM-8, -9, -10, -11, -12, same as IM-16		
IM-18	330	.....
DM-6, -7, 2-phase, 3- or 4-wire	165	165
DM-6, -7, 3-phase, 3-wire	190	190
DM-6, -7, 3-phase, 4-wire Y	180	180
DM-14, 2-phase, 3- or 4-wire	330	165
DM-14, 3-phase, 3-wire	380	190
DM-14, 3-phase, 4-wire Y	330	165
DM-14, 3-phase, 4-wire △	240	120
DM-15, 3-phase, 4-wire Y	330	165
DM-15, 3-phase, 4-wire △	370	185
DM-15, Totalizing 3-phase, 3-wire and 2- or 3-wire single phase	370	185
DSM-19, -34, -38, -40, -43, same as DM-14		
DSM-20, -35, -39, -41, -44, same as DM-15		
VM-2, 3-element, 3-wire	330	.....
VM-2, 3-phase, 3-wire	380	.....
VM-3, 2-phase, 3- or 4-wire	330	165
VM-3, 3-phase, 3-wire	380	190
VM-4, -5, 3-phase, 4-wire	330	165
VM-6, 3-phase, 4-wire △	240	120
VM-7, 3-phase, 4-wire △	370	185
VM-9, -10, same as DM-15 Totalizing		
IM-30, 15A, with class 4 register	415	.....

*The meter rating is based on 120 volts or multiples thereof and is determined as follows: single-phase: ExI; 2-phase: 2xExI; 3-wire, 3-phase: $\sqrt{3}$xExI; 4-wire Y, 3-phase: 3xExI; 4-wire △, 3-phase and totalizing meters: $(\sqrt{3}+1)$xExI. For 2.5-amp meters used with C T the meter rating is based on the secondary rating of the C T, i.e., I = 5 amp.

UNIVERSAL REGISTERS

The "Universal Register" is a standard Type M-30 demand register of a definite register ratio. This register ratio has been chosen as 166-2/3. It permits the use of register-dial multipliers which in practically all cases will be whole numbers and which are determined as follows:

$$\text{Dial Multiplier} = \frac{\text{Meter Constant*}}{0.6}$$

(* This is shown on the meter nameplate as "K_h" or "Test K". In the case of Transformer Rated meters

"Pri K_h" or "Pri Test K" is used which equals "K_h x CT ratio xPT ratio".)

An example of this calculation is shown below for an M-30 Universal Register, ratio 166-2/3, on a type VM-4-A meter, 4-wire, 3-phase having a 100 amp current transformer, 20:1 ratio, and a 4800 volt potential transformer, 40:1 ratio, with the appropriate meter test constant of 0.9:

$$\text{Dial Multiplier} = \frac{\text{Meter Constant}}{0.6} = \frac{K_h \times \text{CT ratio} \times \text{PT}}{0.6}$$

$$\frac{0.9 \times 20 \times 40}{0.6} = 1200$$

Note: This is not the simple product of the CT ratio and PT ratio as on the secondary reading registers.

A multiplier plate with the words "MULTIPLY ALL READINGS BY" is included with each "Universal Register". The dial multiplier, calculated as above, may be inserted on this plate and, since the plate is easily detachable, the multiplier may be changed any time.

Type M-30 registers are available with three different overload capacities identified by the class numbers 1, 2, and 4. The full-scale value of a Universal Register (ratio 166-2/3) Class 2 is 2 KW; of Class 1 is 1 KW; of Class 4 is 3 KW. (See chart on page 16.)

The "Universal Register" may be used with any rating of any watthour demand meter listed in these instructions, it being necessary only to apply the proper dial multiplier for the particular installation.

INSTALLATION

The registers are adjusted and checked for accuracy of registration at the factory and are ready for immediate installation.

They can be used only on General Electric meters of the types listed in these instructions. The demand register may be installed on watthour meters by mounting it in place of the kilowatthour register furnished on the watthour meters. For all front connected watthour meters, Types D-6, -7, -14, -15; Types I-16, -18, -20, -30, -50; Type IS-9; and Types V-2, -3, -4, -5, -6, -7, -9, -10, a complete new glass cover with resetting device is furnished. For the switchboard meters, Types DS-19, -20, -34, -35; and Type IS-8, new metal covers complete with glass windows and resetting devices are supplied. For drawout meters, Types DS-38, -39, -40, -41, -43, -44 and Types IS-10, -11, -12, only a new cover with a reset device is required.

To install an M-30 register on a watthour meter the following steps are necessary:

1. Remove the kilowatthour register from the meter.

2. Remove the two mounting studs from the packing bracket on which the Type M-30 register was received.

Note: If register is to be mounted on a meter which has detents, remove the shield covering the register motor.

3. Insert the mounting studs, which were used on the shipping bracket, in the tapped holes in the register-supporting posts of the watthour meter. For special instructions pertaining to the Type I-50 watthour meter see page 18. The mounting studs should be threaded in until the hexagon portion rests firmly on the top of the post. If the stud becomes tight, before it is seated, do not force it, but remove it and clean out any foreign matter which may have become lodged in the tapped hole. If this does not allow free insertion of the stud, retap the hole. Studs should be seated firmly, but do not force them to the point where they may be broken off.

4. An adjustment is provided to regulate the mesh of the register worm wheel with the worm on the watthour-meter disk shaft. Set the meter worm wheel on the register in its extreme position toward the front of the register. This is done by loosening the small clamping screw on the right end of the bearing bracket and turning the eccentric located just below the screw to throw the worm wheel to its extreme forward position toward the front of the register.

5. The register may now be mounted on the meter using the two mounting studs. Back out the set screws in the spacing studs on either side of the register and slip the register on over the mounting studs on the bosses on the meter frame. Be sure that the clamping nuts on either side of the register are in contact with the hexagon portion of the mounting studs, and then tighten the set screws on either side. This will hold the register rigidly in place.

After the register is securely mounted in place, bring the register worm wheel into mesh with the worm on the watthour-meter shaft, by using the adjustment described above.

6. Connect the motor extension leads to the watthour-meter terminals as shown in the appropriate connection diagram in this book. Also connect the screw connectors to the motor connector. It is important that they be connected exactly as shown with the red lead connected to the red end of the motor connector. For special instructions pertaining to the Type I-50 watthour meter see page 18. The leads may be passed through the hole in the meter base directly above the top bearing lug, except on the older Type D-6 watthour meter. (With the Type D-6 watthour meter it will be necessary to drill a hole in the web of the base;

the suggested location is shown in Fig. 2.)

To facilitate assembly of the leads through the frame it may sometimes be necessary, on later I-20 and on I-30 meters, to loosen the screws holding the element to the frame so that the clips on the leads will pass over the top of the element.

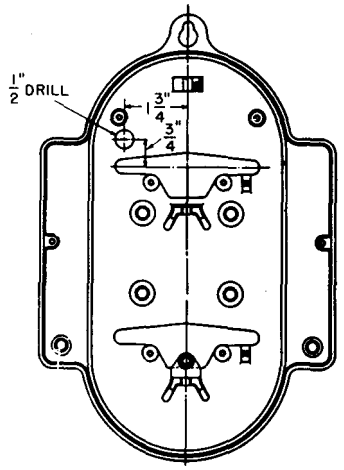


Fig. 2. Suggested location of opening in the base of Type D-6 watthour meter for connection leads from Types M-30 demand meter timing motors

The diagrams cover connections for 50 and 60 cycle meters (registers) up to and including 600 volts. For 25-cycle meters, the maximum voltage of the register is 280 volts. Above this voltage use must be made of a Type V-3 demand-meter transformer in connection with a 120-volt register. Separate diagrams will be furnished for such watthour demand meters or registers.

Some connection leads are equipped with "double" clips for connections to the meter terminals. These "double" clips are suitable for either No. 4 or No. 8 size screws. For those meters in which connections are made to the small-size screws use the clip as furnished by folding the outer part of the clip up against the inner part. Where connections are to be made to the larger-size screws, break off the outer part of the clip.

7. Recalibrate the meter at full load and light loads with the timing motor excited and the register meshed but with the demand pointer set at a position such that it will not be advanced by the pointer pusher at any time during the test.

It is possible that a few Type I-16 and I-20 meters will have insufficient light-load range to calibrate the meter correctly at light loads. The range of these meters can be increased by setting the light-load adjustment in its extreme fast position, loosening the hexagon-headed screw which clamps the left end of the light-load adjustment supporting plate and pushing this plate as far as possible to the right. If this does not increase the range by a sufficient amount, turn the adjusting screw to the extreme slow position until the hollow adjusting screw is released from the threaded stud in the meter base. Then lift the right-hand end of the light-load adjustment supporting bracket and thread the hollow adjusting screw in it by one or two turns before allowing this screw to thread onto the stud in the meter base. After making either of the changes described above, and correctly calibrating the meter, an inspection should be made to be sure that the light-load adjusting plate has not been carried up on the current laminations so as to interfere with the rotation of the meter disk.

8. Place the new cover, with the manual resetting device, on the meter, and turn the demand pointer to zero.

RESETTING OF DEMAND POINTER

When the reading of demand is taken, at the end of the reading period, it is necessary to return the demand pointer to the zero position. To do this the pointer resetting device provided on the front of the meter cover is unsealed and turned in the counterclockwise direction. The pointer will be caught by the spring arm on the resetting device and will be returned thereby, to the zero position. The pointer resetting device may then be turned back to its original position and resealed in the usual manner.

CARE AND MAINTENANCE

Under favorable operating conditions, the register, less motor, should not require maintenance any more frequently than the watthour meter with which it is associated. However, it must be remembered that adverse operating conditions such as exposure to dirt, moisture, industrial fumes, etc. will make servicing necessary at more frequent intervals, both for the register and for the watthour meters.

When the watthour meter is removed for periodic maintenance, the register should be inspected and overhauled and cleaned if necessary. Worn parts, likely to cause defective operation, should be replaced at that time. In order to clean the register effectively, it should be completely disassembled to permit the removal of gum products of wear from all pivots, bearing holes, gears, pinions, clutches, etc. The reassembled register will, of course, require readjustment and test before being placed back into service.

CLEANING REGISTER

Disassemble the register completely, as certain parts cannot be placed in a cleaning solution. Remove the gear assemblies and clean gears separately. Plates may be wiped with a cloth, but should not be put in a cleaning solution unless the adjustable bearing screws

are removed, as many solutions will corrode the bearings. If plates are immersed, wipe off carefully with a cloth. Keep all springs, fiber, and felt clutch parts out of solvents.

Clean gears and shafts by soaking in a high grade watchmaker's cleaner and by scrubbing with a bristle brush. Rinse parts thoroughly, preferably in chemically pure gasoline, commonly known as benzine. As a safety measure to reduce fire hazard, it may be desirable to add carbon tetrachloride* to the benzine.

Felt, or fiber parts which have become soaked with oil should be replaced with new parts.

The register dials can be cleaned by using a soft cloth slightly moistened in water (avoid getting water on other parts of the register or meter).

SYNCHRONOUS-MOTOR ROTORS

All parts of the G-E Type SG-1 motor which are subject to wear are contained in a sealed brass shell commonly called the "Rotor Unit", and are coated with a grease-type lubricant. When used in the Type M-30 register, experience indicates the expected life of the rotor unit to be ten years under favorable operating conditions.

The need to replace the rotor unit can be influenced considerably by adverse operating conditions, such as exposure to extremes of operating temperatures, excess moisture, etc. For example, in an outdoor installation, where the rotor is exposed to direct sunlight and the temperature extremes are great, the life expectancy of the rotor unit will be less than for an installation indoors where room temperature is approximately 70F and temperature variations are small. Therefore, consideration must be given to the actual operating conditions in estimating the useful life of a rotor unit.

The rotor unit will operate satisfactorily over a range of ambient temperatures from −30F to +150F. The minimum temperature is that at which motors in good condition will start and run synchronously after they have been de-energized for a few minutes. In most applications, the motor will continue to run at temperatures somewhat below the minimum temperature specified if there is no power interruption.

The maximum temperature specified is that at which the motor can operate continuously without resulting in breakdown of the lubricant. Motors will withstand for short periods of time, temperatures somewhat higher than the maximum rated temperature, but they should not be operated continuously above the maximum value, since oxidation of the lubricant will occur and result in a marked decrease in the life expectancy of the rotor.

If the rotor becomes inoperative, it should be replaced with a new rotor.

* Precautions should be taken against toxic vapors when using carbon tetrachloride.

For customer servicing of the older Type B-7 rotor, which is the reoilable type, see Instructions GEH-1156.

For ordering replacement rotors for Types B-14 (grease-lubricated), B-12 (oil-lubricated, non-reoilable), or B-7 (oil-lubricated, both reoilable and non-reoilable) see "G-E Service Plan for Rotor Units" (Meter and Instrument Handbook, Section 7805, page 5) or contact your nearest General Electric apparatus sales office.

DISASSEMBLY OF REGISTER

The M-30 demand register may be disassembled from the front or the back, as desired.

Disassembly from the Front

If it is necessary to remove only a demand pointer, scaleplate, front plate, pointer shaft assembly, etc., there is no need for complete disassembly of the register. It may be dismantled from the front. Steps 1 through 7 of the directions given below cover removal of parts down to the first intermediate plate.

Disassembly from the Back

If a worm wheel shaft assembly, clutch assembly, pointer-pusher shaft assembly, Geneva mechanism, etc. is to be removed, the register should be disassembled from the back following steps 8 through 12.

Complete Disassembly

When the register is to be disassembled completely it is recommended that the procedure given below, steps 1 through 12, be followed.

In the following suggested procedure for steps 1 through 7, the register, with its nameplate removed, should be resting on the packing bracket or a similar support to prevent damage to the worm wheel. The description below indicates the sequence for removal of the parts from the front of the register. Numbers referred to are found in Figure 1 and the several mounting plates are shown in Figure 5.

1. Demand pointer. Remove by releasing two set screws located on the pointer hub underneath the center of the dial face, and lifting pointer (22) through the dial opening.

2. Scale. Remove scale (30) by loosening four small screws.

3. Pointers and interval-indicating dial. Remove kilowatthour pointers (31) and indicator dial (40) from the end of the shafts. Use a piece or pad of paper or cloth under the pointer puller to prevent scratching of the dial. A pair of diagonal cutting pliers, with cutting edge ground off, makes a good pointer puller but care must be used not to scar the tapered end of the shaft.

4. Multiplier plate. Release one round head screw

and slide plate (34) from under eccentric pin (19).

5. Front plate. Remove three round head screws from the outside edge of front plate (47) and the two round head screws on either side of the demand pointer opening. Lift plate.

6. Gear assemblies. Remove pointer gear shaft assemblies (4) and interval indicating dial shaft (32) by lifting from the first intermediate plate.

Remove ratio gear shaft assembly (20) by lifting from the second intermediate plate. To remove the interval-indicator-idler-pinion shaft, loosen the set screw on gear and hub assembly (21), below the first intermediate plate. Lift out the idler pinion shaft and withdraw the gear and hub assembly from between the first and second intermediate plates.

7. Spacers. Lift off three spacers.

In the following steps, 8 through 12, the register should be rested with its back in an upward position. A simple wooden support made similarly to Figure 3 may be used either with the front of the register assembled or disassembled. If the front of the register has been disassembled, as in steps 1 through 7 above, the posts will drop into the holes provided, and the register will rest as indicated by the dotted line. If the front of the register has not been removed the slot provides clearance for the pointer and eccentric stop, and will rest as the phantom line indicates.

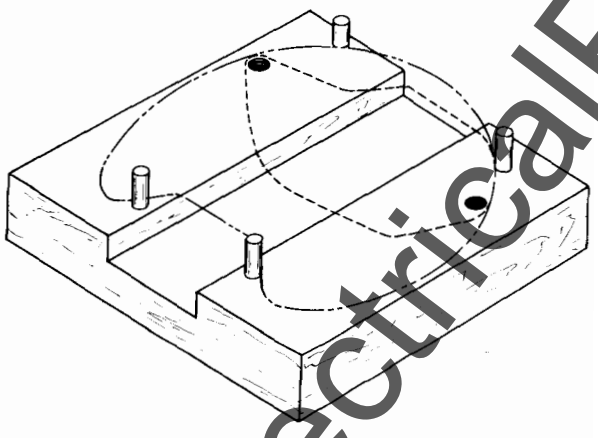


Fig. 3. Typical mounting block for supporting register

Disassembly will proceed as follows, with numbers again referring to Figure 1.

8. Motor Assembly. Remove motor (25) by releasing two mounting screws, one on either side of the motor coils.

9. Sub Plate. Remove three round head screws and lift off.

a. Back off the adjustable bearings and remove worm shaft (2) carefully so as not to damage the teeth and pivots.

b. Lift out clutch assembly (5, 6, 7, 8, 9, 10, 11). Disassemble by loosening the two screws holding clutch disk (7) to the shaft. Reassemble by replacing parts on the shaft and securing the clutch disk with the two set screws so that the hub is located .017 in. from the shaft shoulder as shown in Figure 6 reference (a).

Note: Whenever register is disassembled and cleaned all felt friction washers should not be cleaned. If there is any presence of oil on them, they should be replaced.

c. Lift out worm wheel shaft (3).

10. Back Plate. Remove three round head screws and lift off. This will include clutch lever assembly (46).

The clutch lever may be removed from the plate by loosening the set screw in the square pivot block to free the pivot shaft for withdrawal from the lever and block. The adjustable cam follower screw may be removed after removal of the locking nut. For reassmembly, replace an adjustable screw and nut loosely for later adjustment in assembly. Replace the lever by inserting the pivot shaft through the lever bearing holes and block and secure with the set screw.

a. Lift out sector gear (37).

b. Lift out the pointer-pusher-and-demand-pointer-shaft assembly (consisting of parts 12, 13, 14, 15, 16, 17, and 18, Fig. 1, and illustrated separately in Fig. 4). This assembly may be disassembled further by removing the retaining ring. This retaining ring must be removed carefully so as not to score, or bend, the shaft.

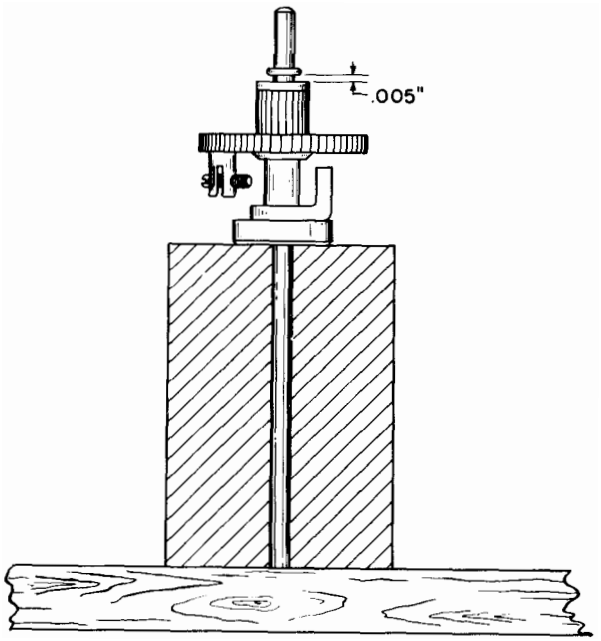


Fig. 4. Demand pointer shaft assembly with assembly gage block

Remove the retaining ring by holding the assembly by the pointer pusher (12) and pressing the rounded end of the pointer-pusher shaft against a wooden block. A uniform pressure (just sufficient to cause the retaining ring to move) should be applied to the flat end. DO NOT attempt to remove the pointer-dog assembly (16) as it is pressed on a knurled section of the pointer-pusher shaft.

To re-assemble, place the pointer pusher (12) and the small washer on the pointer-pusher shaft. Gently tap the split retaining washer (using a small driving bar with a clearance hole for the shaft) onto the end of the shaft squarely to avoid burring the shaft. Leave a clearance of 0.005-in. between the retaining ring and washer. This can be accomplished by driving the ring down against a 0.005-in. shim. Withdraw the shim after the retaining ring is in position. Remove the driving-bar and shaft assembly from the wooden block. Place the three small felt washers on the shaft against the flat end of the pointer dog

Note: Whenever register is disassembled and cleaned, all felt friction washers should not be cleaned. If there is any presence of oil on them, they should be replaced.

11. Second intermediate plate. Remove two screws and two register mounting posts and lift off the plate. If the front of the register has not been removed (steps 1 through 7), care should be taken when removing these posts not to turn the hexagonal posts below this plate and thus loosen them.

a. Remove two hexagonal spacers (if front disassembly has taken place).
b. Lift out the cam shaft (39).
c. Lift out the Geneva mechanism (26, 27, 28, 33, 35, 44, 45).

12. First intermediate plate. Disassembly of register has been completed. The first intermediate plate can be removed from the block if complete disassembly of the register, steps 1 through 12, has taken place, or the front portion of the register can be removed as a unit if only the back disassembly, steps 8 through 12, has been followed.

REASSEMBLY OF REGISTER

The M-30 demand register may be reassembled toward the back or the front as desired.

The dimensions and adjustments referred to below are for reassembly of registers in the field. They may not necessarily be exactly equivalent to the initial factory settings, as factory adjustments may be made with fixtures not adaptable to field work. However, the adjustments covered below will give equivalent satisfactory operation.

Reassembly toward the Back

If the register is being reassembled toward the back, steps 1 through 4 of the directions given below cover the reassembly of parts from the first intermediate plate.

Reassembly toward the Front

If the register is being reassembled toward the front, steps 5 through 7 below cover this procedure also starting with the first intermediate plate.

Complete Reassembly

When the register is being reassembled completely it is recommended that the procedure given below, steps 1 through 7, be followed. Again, reference numbers apply to Fig. 1 and the mounting plates are found in Fig. 5.

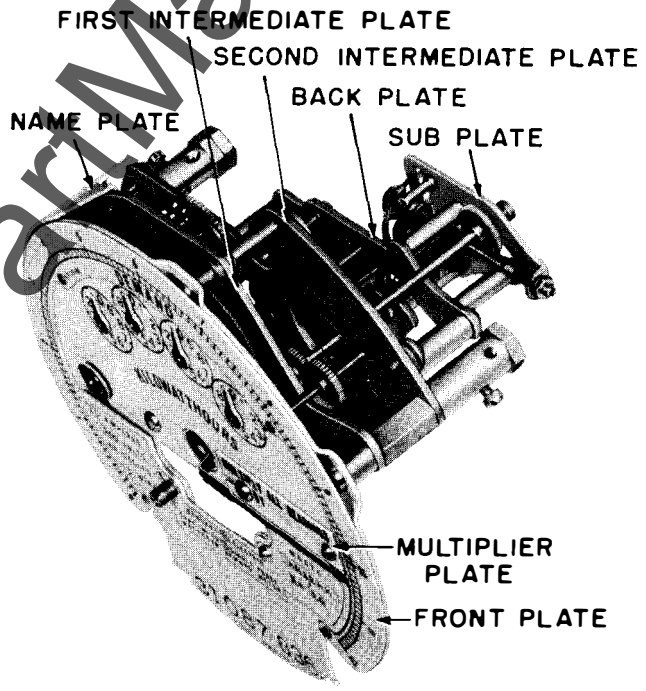


Fig. 5. View of Type M-30 demand register plates

1. First intermediate plate. Holding the interval indicator pinion shaft shoulder against the front of the plate, place the idler gear and hub assembly on the shaft at the back of the plate and set screw to the shaft leaving approximately .005 in. endshake clearance as shown in Fig. 6 reference (b). A temporary shim may be used to set this gap and be removed after the set screw has been tightened. Place the plate on the block as shown by the dotted line on Fig. 3.

Pick up the Geneva assembly and the cam-shaft assembly, meshing the pinions with the Geneva mechanism such that full length pinion teeth on both pinions are lined up with one another and engage

with the transfer gears (35) and (28). Place the Geneva assembly and cam-shaft assembly front pivots in the first intermediate plate.

Place two hexagonal spacers in the plate.

2. Second intermediate plate. Place the second intermediate plate over the studs and gears and fasten with two No. 4-48 screws.

Place and tighten two register mounting posts. Place the pointer shaft assembly as described under "Disassembly", paragraph 10 (b) together with three friction washers through the second and first intermediate plates. Place reset segment shaft (37) into the plate.

3. Back Plate. Place back plate and clutch lever assembly reassembled as described under "Disassembly", paragraph 10, and secure with two No. 4-48 and one No. 3-56 screws. Mesh the reset segment and the pointer-pusher gear as shown in Fig. 7, so that, with the tail of segment gear (37) resting on reset pin (43), the pointer-pusher post will be located approximately as shown.

Place the worm-wheel clutch assembly into the second intermediate plate with the reset lever behind the clutch collar as shown in Fig. 7. Place the worm-gear shaft assembly into the bushing of the first plate.

4. Sub Plate. Place the sub plate and the worm shaft assembly over the gears and posts and fasten with three No. 4-48 screws.

Adjust the endshake of the worm gear shaft assembly to approximately .003 in. as shown in Fig. 6 reference (d), the clutch assembly reassembled as described under "Disassembly", paragraph 9 (b), to approximately .003 in. as shown in reference (e), and the cam shaft assembly to approximately .003 in. as shown in reference (f).

Remove the register from the mounting block. Place it on the packing bracket or similar support for reassembly of the front portions.

5. Pointer gear assemblies. Place the fourth, second, first and third pointer shaft assemblies into the plate in the order mentioned. Place the ratio shaft assembly into the second intermediate plate and the interval dial shaft assembly into the first plate. Place two spacers over the hexagonal posts and set the third spacer in its hole at the top of the register.

6. Front Plate. Position the front plate over the shafts and fasten with the five dial screws. Set the clearance between the adjustable follower screw and the cam to approximately .007 in. with the register positioned face-up and the fork end of the adjusting

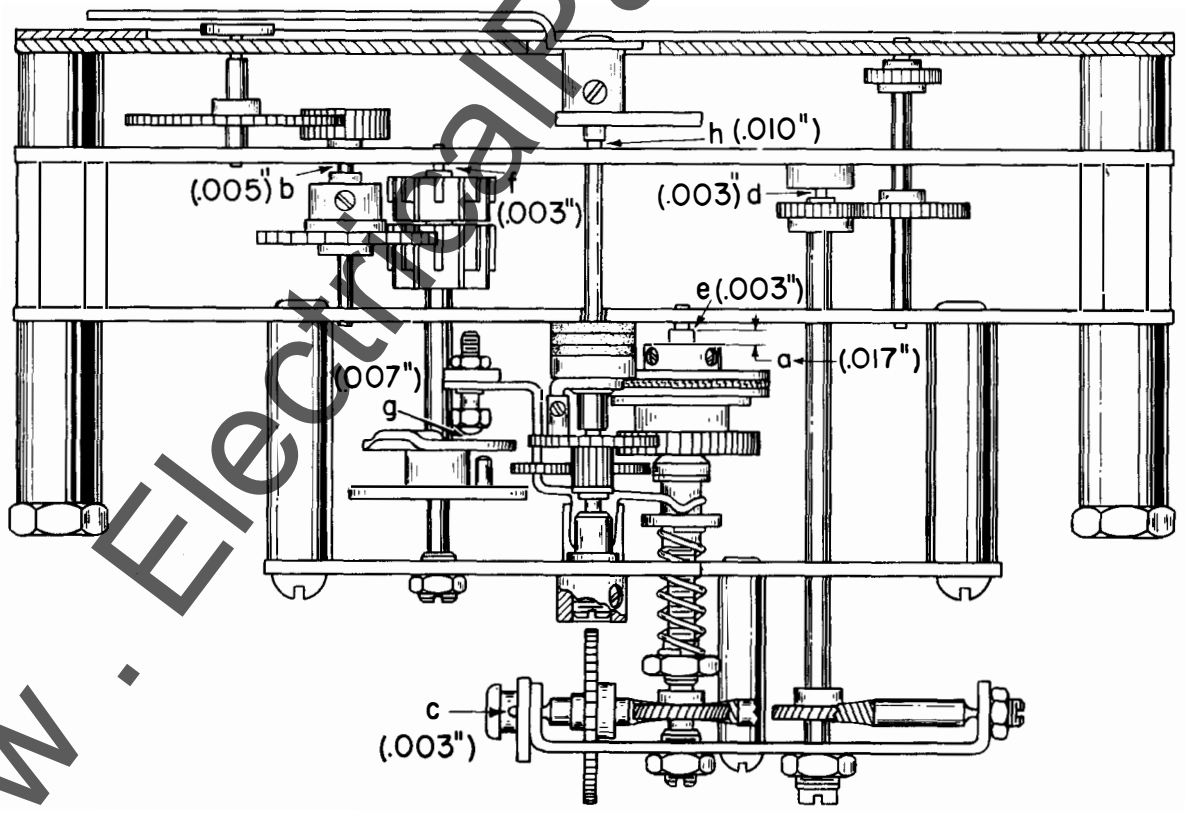


Fig. 6. Bottom schematic view of Type M-30 demand register

lever just in contact with the clutch collar as shown in Fig. 6 reference (g). This clearance may require further adjustment in order to insure that the clutch opens and closes properly in operation.

Press on the four kilowatthour pointers and the interval indicator dial. Slide the multiplier plate under the eccentric pointer stop and fasten to the front plate with a round head screw.

7. Scale. Fasten the scale to the front plate with four small scale plate screws. Insert the demand pointer-shaft assembly through the opening in the front plate and place it over the pointer shaft leaving a clearance of approximately .010 in. as shown in Fig. 6 reference (h). A shim may be used for setting this dimension. Secure the demand pointer lightly on the shaft with one set screw preparatory to final adjustment as covered later under "Adjustments".

Place the nameplate on the register and fasten to the first intermediate plate with a No. 2-64 screw.

Place the motor on the two mounting spacers and fasten by means of the two motor screws.

ADJUSTMENTS

For gear shafts with adjustable bearings, the endshake should be set in accordance with section 4 page 11 and as shown in Fig. 6.

For gear shafts with nonadjustable bearings, operation will be satisfactory if the end play is somewhat in excess of these limits as long as the shafts have sufficient clearance to rotate freely, yet, do not have excessive play so that the gears will not mesh properly. This endshake may range between .002 in. and .025 in.

It is important that the worm-gear and clutch-shaft end play should be held to the minimum, because, with excessive play, if the adjustment for mesh of the worm wheel with the disk shaft is set fully in, the worm gear or the clutch-shaft gear might become disengaged and strip or damage the worm. The worm gears are very delicate and if nicked will cause jerky improper indication. Great care should be used at all times to protect the worm shaft from damage.

There are only five adjustments on the register as follows:

1. The demand pointer should be over the zero mark of the scale when it is against pin (19). The pin is eccentric and can be turned until this condition is obtained.
2. To locate properly the pointer dog:
   a. The pointer-pusher adjusting screw (15) in Fig. 7 should be extending equally on either side of the post.
   b. Set the pointer-pusher assembly in its zero position.
   c. With the pointer loose on the shaft move the pointer dog so it just contacts the pusher screw.
   d. Rotate the pointer against the eccentric pin.
   e. Secure the pointer on the shaft maintaining clearance of .010 in. Fig. 6, reference (h).
   f. Recheck the zero position by moving the pusher and the demand pointer up scale and performing the interval reset, returning the pointer pusher to zero position.
   g. Return the demand pointer to its zero position and check to see that the dog just rests against the end of the pointer-pusher screw.
   h. If an appreciable clearance remains between the dog and the screw, or the pointer-pusher assembly had been moved by the dog, the demand pointer should be loosened on the shaft and the dog moved slightly to correct the condition.

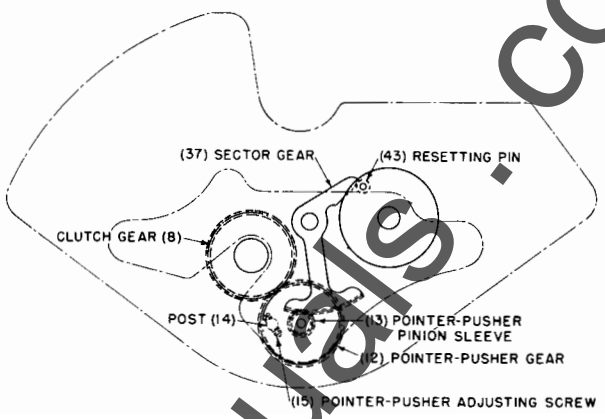


Fig. 7. Back view of position of gears in reset mechanism

It should be noted that the backlash between the gears (8) and (12), Fig. 7 and Fig. 1 is, when resetting, taken up in the opposite direction from what it is when the pointer is being advanced. If the zero of the pointer pusher is to be checked by bringing the pointer back in contact with it after an interval reset, the pointer must be brought back far enough to take up the backlash of these two gears. This can be done without danger of slipping the driving clutch if the pointer is held lightly, as the increase in pressure required to slip the clutch is quite noticeable.

3. A pointer-pusher screw (15) is provided to correlate the zero of the pointer-pusher assembly (12, 13, 14) (as established by the interval resetting operation) with the zero of the pointer mechanism (16, 17) as established by the manual pointer resetting action.

If the indication of the register is incorrect when checked as described under "Testing" it can be corrected by turning this screw. Backing this screw out will result in a lower indicated demand and screwing it in will result in a higher indication. (See later section on "Self-Checking Adapter" for further details.)

4. The friction of the pointer can be adjusted by turning the screw (24). (See later section on "Friction-Checking Device" for further action.)

5. The clutch friction is adjusted by means of the nut (11). (See later section in "Friction-Checking Device" for further action.)

TESTING WATTHOUR DEMAND METERS

The watthour demand meters should be tested periodically, using the same methods of test employed for the corresponding types of watthour meters. For detailed information regarding these methods of test, see the instructions furnished for the watthour meters.

Note that the testing and calibrating of watthour demand meters must be done with the timing motor excited with correct polarity, the register meshed and the demand pointer set at a position such that it will not be advanced by the pointer pusher at any time during the test.

TESTING DEMAND REGISTERS

Over-all check of the demand register can be made by holding a constant load on the watthour meter during one complete time interval. Assuming that the register is of the correct ratio for the meter on which it is mounted, the indicated demand on the register should then equal the constant load held.

A checking device is available for the Type M-30 register. See page 15 for instructions on this device.

If no special test devices are available, interval reset can be performed electrically by the motor or manually by turning the Geneva mechanism until reset occurs, then pushing the pointer back to some point below the check point and carefully turning the worm wheel a definite number of revolutions. The turning of the Geneva mechanism during the resetting operation shoud be done at the speed equivalent to the normal rotation of the motor. This is to insure the pointer pusher not overshooting its normal zero position.

The correct registration can be calculated by using the first general formula given under "Self-Checking Adapter" below. In using this method, great care must be used in holding the worm wheel to prevent backward rotation during resetting and in advancing the worm wheel an exact number of revolutions.

DIMENSIONS

Since the dimensions of watthour demand meters are identical with those of corresponding types of watthour meters, except the overall depth, this dimension only is given in Figure 31. For more detailed dimensions, see the Instructions covering the corresponding types of watthour meters.

SELF-CHECKING ADAPTER CAT. NO. 4151072G1

The Cat. No. 4151072G1 adapter used with the Type M-30 demand register is the same device as used with the Type M-31 cumulative demand register.

This adapter is designed for mounting on the register after the register has been moved forward on the meter by using two short adapter studs (1-1/8 in. long) except on meter types VM-4, -7, -9, and -10 and ISM -8, -9, -10, -11, and -12 and DSM-38, -39, -40, -41, -43, and -44 which use four-inch adapter studs. The procedure is to remove the register from the regular register mounting studs, place the adapter studs onto the regular studs, and remount the register on the adapter studs. The register so placed on the adapter studs is thereby moved sufficiently forward to permit placing the self-checking adapter on top of the register as shown in Fig. 8.

After the register is in place, a check could be obtained on its accuracy by allowing the timing motor to run at its normal speed through two or more time intervals. However, since all of the gear trains are now definitely tied together, if the time train is speeded up, the demand gear trains will be speeded up correspondingly. Since the indication of the register depends upon the relative speeds of the demand train and the

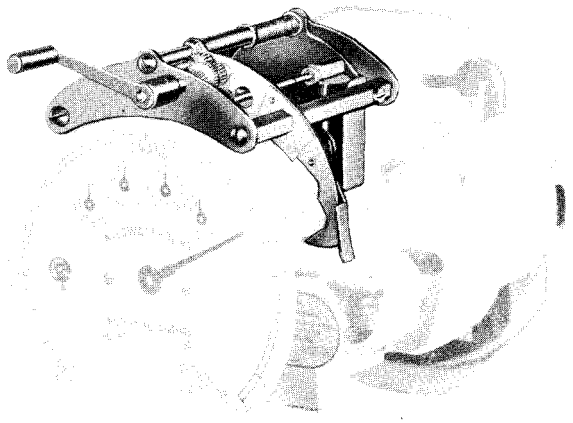


Fig. 8. Self-checking adapter Cat. No. 4151072G1 mounted on Type M-30 demand register using adapter studs

time train during the interval the same results will be obtained by advancing the trains manually as by allowing the motor to drive at its normal speed. Therefore, a quick test can be made on the register by advancing the gear trains manually. A handle is provided on the front of the check-device for this purpose. The complete check can be made manually if the mechanism is turned over slowly as the end of the interval is approached. However, to avoid possible errors due to too rapid manipulation of the device it is recommended that the test be made as follows:

1. Place the checking device on the register making certain that it meshes with the overrunning clutch (38) and worm wheel (1), Fig. 1.
2. Turn the handle of the adapter clockwise until the interval indicator shows that the register is about to reset. When the final intermittent advance is about to start, allow the motor to drive the mechanism, until resetting action is completed.
3. Move the demand pointer by hand back into some position below the point on the scale which is to be checked, but not to zero.
4. Again advance the mechanism manually until it is almost ready to trip and again allow the motor to complete the operation.
5. Note the reading of the pointer on the scale.

The self-checking adapter is equipped with a gear shift which provides two gear ratios. On class 2 and 4 registers with the manual operating handle pushed in (high check point), the ratio is such that between interval resets the worm wheel will be turned 5 revolutions with the 15-minute interval register and 10 revolutions with the 30-minute register. On Class 2 and 4 registers with the manual operating handle pulled out (low-check point) the worm wheel will be turned 2.5 and 5 revolutions respectively for 15- and 30-minute registers.

For checking Class 1 registers this device will check only the low scale point. This check is made by pulling out the operating handle and checking in the same manner as with the Class 2 low check point covered above whereby the worm wheel will be turned 2.5 revolutions in the 15-minute interval register and 5 revolutions in the 30-minute interval register.

In using these devices, the proper accumulated demand (neglecting the multiplier which may appear on the face of the register) is given by the following formula:

$$\text{Calculated demand} = \frac{10 \times \text{Rev. of Worm Wheel}}{\text{Time Int. (in Hr.)} \times \text{Reg. Ratio}}$$

Substituting the values given in the preceding paragraphs reduced this to the following simple formulas:

$$\text{Calculated demand} = \frac{200}{\text{Reg. Ratio}} \quad \text{(For the high reading)}$$

$$\text{Calculated demand} = \frac{100}{\text{Reg. Ratio}} \quad \text{(For the low reading)}$$

The calculated scale indications for both high and low points are given in the tabulation below for the various ratios and classes of overload capacity.

A complete check requires a check of the motor speed. This can be done with a stop watch by timing

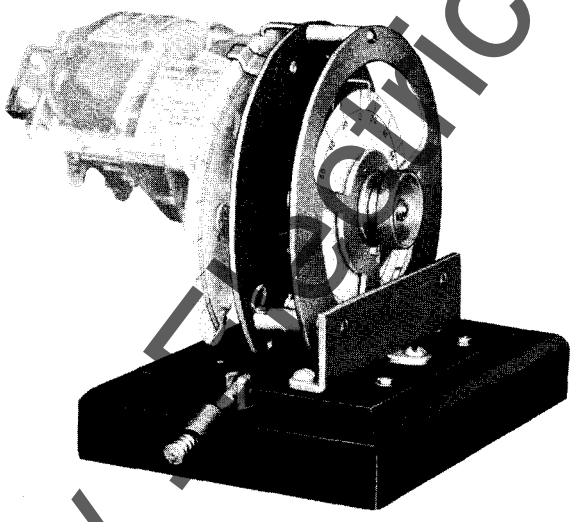


Fig. 9. Friction-checking device Cat. No. 4154935G1 with Type M-30 demand register mounted for testing

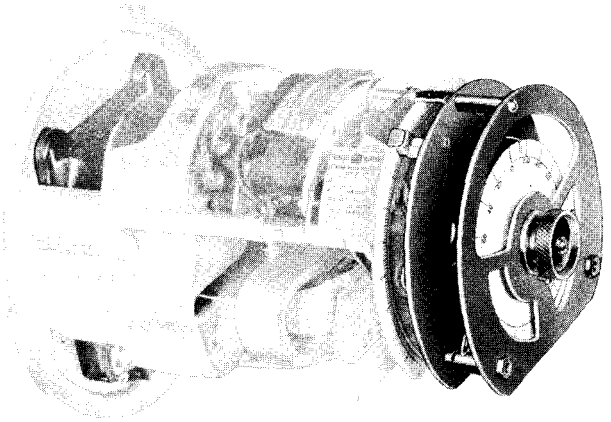


Fig. 10. Friction-checking device Cat. No. 4154935G1 with Type M-30 demand register mounted for testing register supported on watthour meter

one revolution of the motor output shaft. Reference marks are provided for this purpose on the gear of the overrunning clutch (38), Fig. 1, and the motor mounting plate just back of it. This gear makes one revolution per minute for all standard registers.

FRICTION CHECKING DEVICE

CAT. NO. 4154935G1

Successful operation of the Type M-30 register depends upon the values of the friction torques necessary to move the pointer mechanism and to slip the clutch. While these values are not at all critical, it is suggested that they be adjusted to the limits recommended on page 16.

To aid in checking these friction torques, a friction checking device is available. This device can be used whether the register is mounted on a meter or not. See Figures 9 and 10. It consists of suitable plates with provisions for mounting the register, a knob attached to a movable calibrated dial and a freely moving shaft carrying a calibration spring arm and pointer.

CALIBRATION OF CHECKING DEVICE

Although each friction-checking device is carefully calibrated and checked before leaving the factory, it is recognized that misuse or rough handling may change its calibration. Calibrating weights are therefore furnished to allow two points on the scale to be checked and corrected if necessary. The proper use of these weights is as follows:

Hang the smaller of the two weights in the groove near the end of the left-hand balance arm (front view) and turn the knob and dial clockwise until the balance arms are horizontal. The pointer should then point to 50 on the dial.

Remove the small weight and hang the larger weight in the groove near the end of the right-hand balance arm. Turn the knob and dial counterclockwise until the balance arms are again horizontal. The reading should then be 200 on the opposite side of zero from the point checked before.

Since extreme accuracy in the measurement of Type M-30 register friction values is not necessary, it is suggested that the position of the spring be changed only when the calibration readings are more than plus or minus five per cent from the values given on page 16.

USE AS LABORATORY DEVICE

When the device is to be used in the shop for checking registers not on meters, the following procedure may be used after having determined that the device pointer is free in its bearings and rests over zero on the dial. See Fig. 9.

Pointer Friction

a. Turn the device knob counterclockwise until the device pointer is at the bottom of the frame at its point of extreme counterclockwise travel.
b. Move the demand pointer on the register to full scale manually and return it to approximately scale zero.
c. Slip the register behind the two supporting tabs at the top of the friction-checking device and rest the register on the supporting plate against the covered stops at the bottom of the device.
d. On Type M-30 registers with serial numbers above 1177163, turn the checking device knob clockwise very slowly until the demand pointer moves and take the reading on the dial when the pointer again comes to rest. However, on registers with serial numbers 1177163 and below, turn the knob clockwise very slowly until the demand pointer moves, and take the reading on the dial just as the pointer starts to move.

   Repeat one of the above methods until the demand pointer has moved to the right end of the register scale. Four or five readings should be obtained during the travel of the pointer from one end of the scale to the other.
e. Pointer friction values should check between 15 and 50 mmg.
f. The friction on the pointer can be adjusted by means of screw (24) Fig. 1. This adjusting screw is locked in position by a set screw. Turning in the adjusting screw will increase the friction; backing it out will decrease the friction.

Clutch Friction

Two methods of checking clutch friction are covered below. The first Method A, is the more accurate and is used in the initial setting at the factory. Adjusting the clutch friction by either method will give equivalent final results in the clutch setting.

In Method A, the reading of the testing device equals the total clutch friction minus the pointer friction and minus the gear and bearing frictions; which is the reserve friction of the clutch.

In Method B, the reading of the testing device equals the total clutch friction plus the pointer friction and plus the gear and bearing friction; which is the total torque necessary to slip both the pointer and clutch and to overcome the associated gear and bearing frictions. Since, in this method, the testing device reading is greater than in Method A, the pointer gear

train is subjected to greater gear and bearing pressures than in Method A or in actual use; and, consequently, the gear and bearing friction is several times greater. Thus, method B is less accurate because of the abnormal influence of the higher gear and bearing friction.

Method A

The friction value measured by this method is the available reserve clutch driving torque over and above the pointer and clutch and other frictions in the gear train.

a. By turning the device knob, position the de-

TYPE M-30 DEMAND REGISTER DATA

SCALE NAMEPLATE NUMBERS AND CORRESPONDING CHECK POINTS

FOR REGISTER SELF-CHECKING DEVICE CAT. 4151072 G1

Register Ratio	Full Scale K. W. Class 1*	Class 2	Class 4**	Scale Nameplate Number Class 1	Class 2	Class 4	Check Points High †	Low
333 1/3	0.5	1.0	....	133184	133169	.....	0.600	0.300
166 2/3	1.0	2.0	3.0	133169	128985	133171	1.200	0.600
138 8/9	1.2	2.4	....	133185	133170	.....	1.440	0.720
111 1/9	1.5	3.0	....	133186	133171	.....	1.800	0.900
104 1/6	1.6	3.2	....	133187	133172	.....	1.920	0.960
92 16/27	1.8	3.6	....	133188	133173	.....	2.160	1.080
83 1/3	2.0	4.0	6.0	128985	133174	133177	2.400	1.200
69 4/9	2.4	4.8	....	133170	133175	.....	2.880	1.440
66 2/3	2.5	5.0	7.5	133189	133176	140410	3.000	1.500
55 5/9	3.0	6.0	....	133171	133177	.....	3.600	1.800
52 1/12	3.2	6.4	....	133172	.....	.....	3.840	1.920
46 8/27	3.6	7.2	....	133173	.....	.....	4.320	2.160
41 2/3	4.0	8.0	....	133174	133178	.....	4.800	2.400
34 13/18	4.8	9.6	....	133175	.....	.....	5.760	2.880
33 1/3	5.0	10.0	15.0	133176	133179	140406	6.000	3.000
27 7/9	6.0	12.0	....	133177	133180	.....	7.200	3.600
20 5/6	8.0	16.0	....	133178	133181	.....	9.600	4.800
18 14/27	9.0	18.0	....	133190	133182	.....	10.800	5.400
16 2/3	10.0	20.0	....	133179	133183	.....	12.000	6.000
13 8/9	12.0	24.0	....	133180	.....	.....	14.400	7.200
10 5/12	16.0	32.0	....	133181	.....	.....	19.200	9.600

*Class 1 registers have one-half the full scale values of Class 2 registers with the same register ratio. The demand scale for a Class 1 register of a given register ratio is, therefore, the demand scale which would be used on a Class 2 register with twice the Class 1 register ratio.

Example:
Class 1 register, register ratio 83-1/3)
Class 2 register, register ratio 166-2/3) NP-128985

**Class 4 registers have one and one-half the full scale values of Class 2 registers with the same register ratio. The demand scale for a Class 4 register of a given register ratio is, therefore, the demand scale that would be used on a Class 2 register with two-thirds the Class 4 register ratio.

Example:
Class 4 register, register ratio 166-2/3)
Class 2 register, register ratio 111-1/9) NP-133171

† For Class 1 registers the high check point is greater than the full scale value, therefore, it can not be checked with the self-checking device.

vice pointer to approximately the top of the checker.

b. Set the register pointer on approximately zero.

c. Mount the register on the checking device.

d. Turn the device knob counterclockwise until the device arm rests against the top edge of the pointer.

e. Rotate the register worm wheel clockwise, as viewed from the left side of the register, at a rate about 30 rpm until the demand pointer stops. Note the reading of the checking device. A series of about four or five points should be taken from one end of the scale to the other by slowly advancing the device knob clockwise in a series of steps waiting for the pointer to come to rest at each setting.

f. The average of the friction readings taken by this method should be between 35 and 95 mmg. Clutch friction may be adjusted by turning the split hexagon nut (11) in Fig. 1 on the clutch shaft of the register. Turning the nut in toward the front of the register increases the clutch friction, turning it toward the back of the register decreases the friction.

Method B

This method does not require continuous rotation of the register worm wheel but uses the same checking device as Method A. This method is similar to that described for pointer friction check. Friction value measured by this method is the combined pointer, clutch and gear train frictions.

a. Turn the device knob clockwise until the device pointer is at the bottom of the frame at its point of extreme clockwise travel.

b. With the demand pointer at approximately full scale mount the register on the checking device.

c. Turn the knob of the checking device slowly in the counterclockwise direction until the demand pointer begins to move, holding the register worm wheel while making checks. Note the checking device reading. If the demand pointer jumps forward, turn the knob slowly until it again starts to move and take another reading. A series of four or five readings should be taken from one end of the scale to the other.

d. The average of the combined clutch and pointer-friction readings taken should be between 100 and 260 mmg. Clutch friction may be adjusted by turning the split hexagonal nut (11), Fig. 1. Turning the nut toward the front of the register increases the friction.

USE AS PORTABLE DEVICE

When pointer and clutch frictions are to be checked on a register mounted on a meter the following procedure should be followed. See Fig. 10.

1. Demesh the register worm wheel from the meter disk shaft.

2. Remove the checking-device unit from its mounting stand by lifting the two springs and pulling the unit backward off the posts.

3. Hang the checking device to the front of the register by the two supporting tabs and let the covered stops rest against the scale plate.

4. Check the pointer friction and combined pointer and clutch friction in the same manner as described above for shop use under Method B.

GENERAL

Extreme temperature and humidity conditions are likely to affect the pointer and clutch frictions of the Type M-30 register to some extent. Therefore, it is recommended that, if the register has been stored or out of service for some time and the first check of friction shows values outside the recommended limits the pointer should be moved back and forth on the scale a few times by hand and the interval resetting operation performed manually a few times. Or, if preferred, the register may be operated for two or three complete intervals, using the self-checking device previously described and allowing the register motor to do the driving. If, after these operations, the frictions are still outside the desired limits, adjustments can then be made as required.

TYPE IM-50

Variations exist in the construction of the Type I-50 watthour meter which necessitate a change in the method of connecting the motor leads to the watthour meter terminals.

It will also be necessary to use the two special mounting studs (supplied in an envelope with each register) when mounting the demand register on to the watthour meter register supporting posts.

Except for the variations listed, the method of conversion remains the same for the Type I-50 watthour meter as for any other meter listed in the Introduction of this book.

The actual differences in the method of connecting the motor leads to the watthour-meter terminals are as follows:

(A) The motor leads are connected to the watthour-meter terminals, or at the point indicated in the figures, and soldered. Screw connections are not used.

I-50A, 2-wire: Remove the kilowatthour register from the meter, see Installation section.

Connect the two motor leads in parallel with the potential coil at the points illustrated in Fig. 11a.

Solder these connections.

I-50A, 3-wire: Remove the kilowatthour register from the meter, see Installation section.

Connect the motor leads in parallel with the potential coil at the "test link terminals", see Fig. 11b.

Solder these connections.

I-50S, 2-wire: Remove the kilowatthour register from the meter, see Installation section.

Connect the two motor leads to the meter current leads as shown in Fig. 11c.

Solder these connections.

I-50S, 3-wire: Remove the kilowatthour register from the meter, see Installation section.

Connect one motor lead to the top left current coil and by using a pair of notched diagonal cutters, break and remove the insulation from the right-hand potential lead and connect the other motor lead as shown in Fig. 11d.

Solder these connections.

Slide the insulating sleeve over the connection to the right-hand potential lead.

(B) On some Type I-50 watthour meters, it may be possible to increase the light-load range of adjustment by reversing the soldered connections at the points at which the motor leads were connected to the meter.

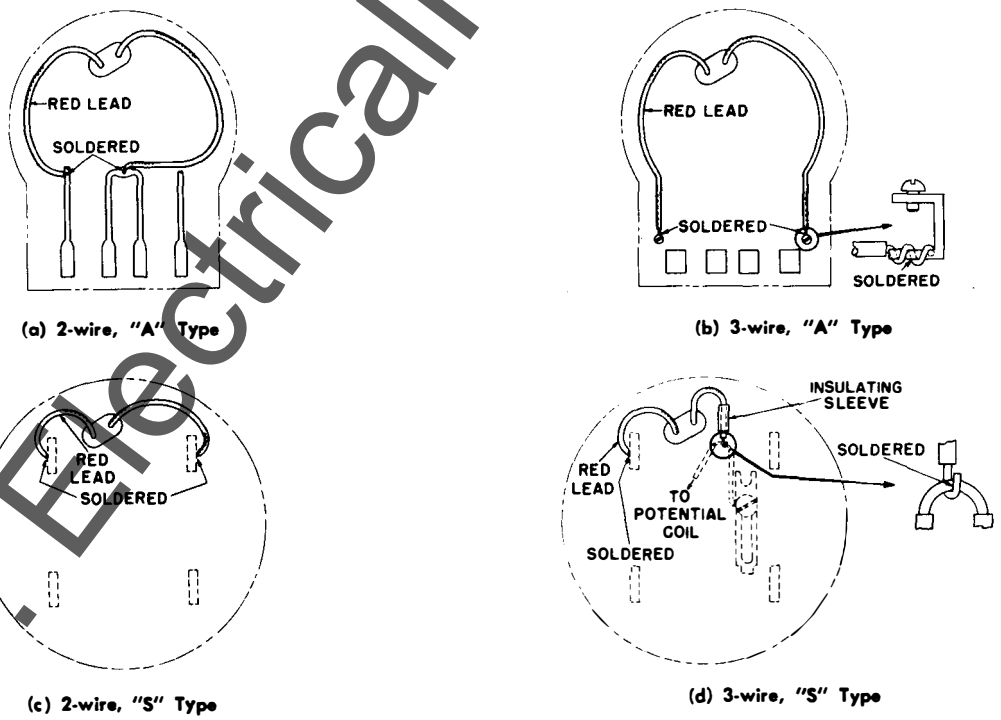


Fig. 11. Connection of register on Type IM-50 meters

CONNECTION DIAGRAMS

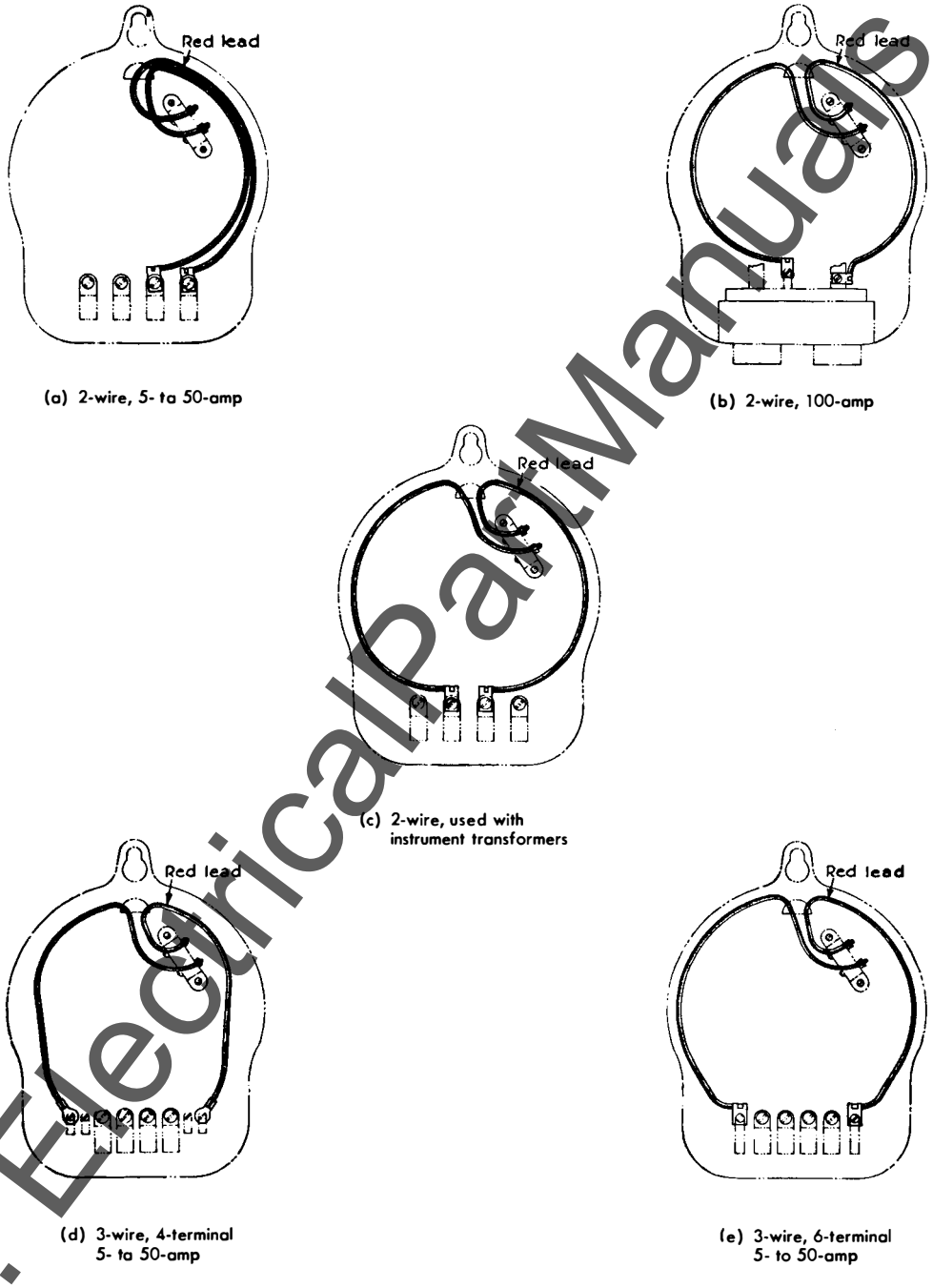
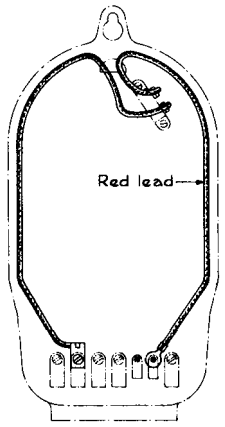
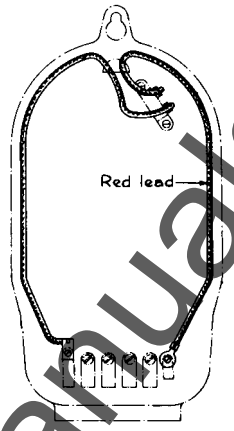


Fig. 12. Connections of register on Type IM-16 single-phase meters (back views)

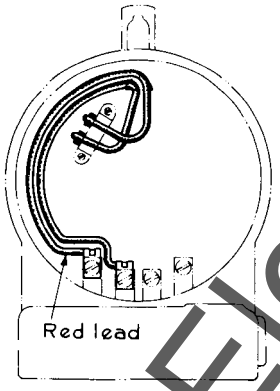


(a) 5- and 10-amp below Serial No. 15432974

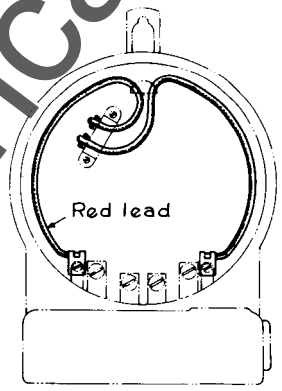


(b) 5- and 10-amp including and above Serial No. 15432974 Also 15-, 25- and 50-amp

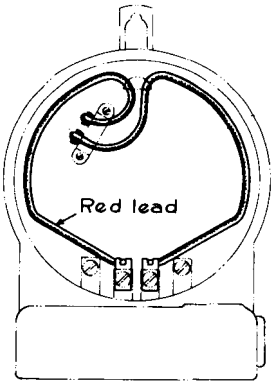
Fig. 13. Connections of register on Type IM-18 single-phase meters (back views)



(a) 2-wire, 5- to 50-amp

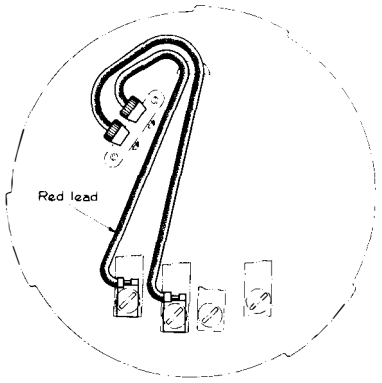


(b) 3-wire, 4-or 6-terminal

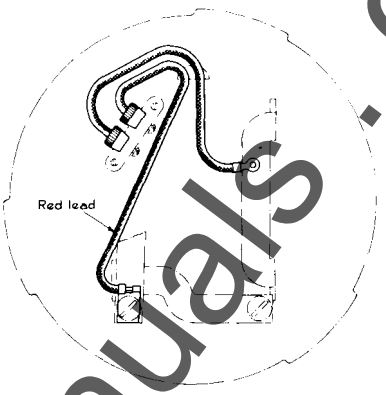


(c) 2-wire, used with instrument transformers

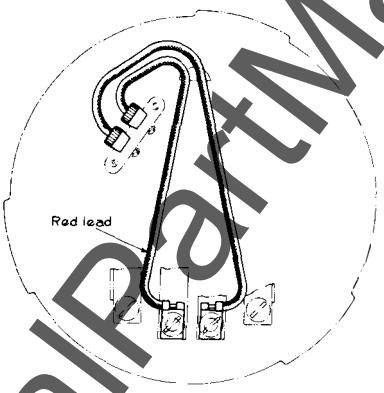
Fig. 14. Connections of register on Type IM-20-A, IM-20-B, IM-20-C, and IM-30-A single-phase meters (front views)



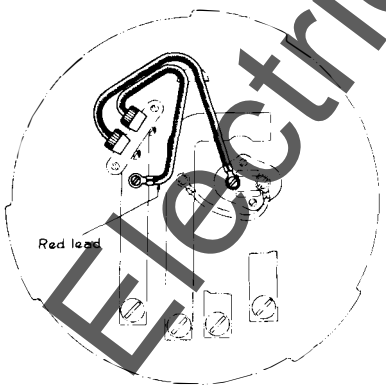
(a) 2-wire, 5- ta 50-amp
Models 8WIM20S-1 and -2



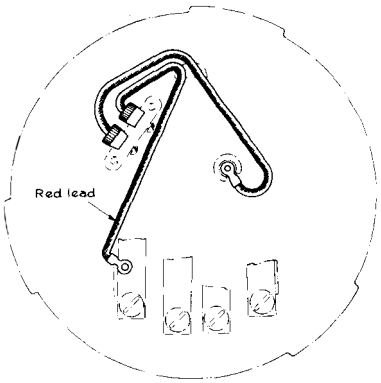
(b) 2-wire, 5- to 50-amp
Model 8WIM20S- 3



(c) 2-wire, used with
instrument transformers
Models 8WIM20S-1, -2, and -3



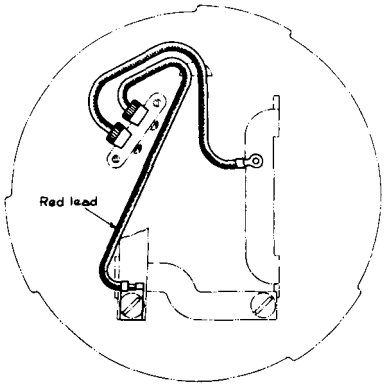
(d) 3-wire, 5- to 50-amp
Models 8WIM20S-1 and -2



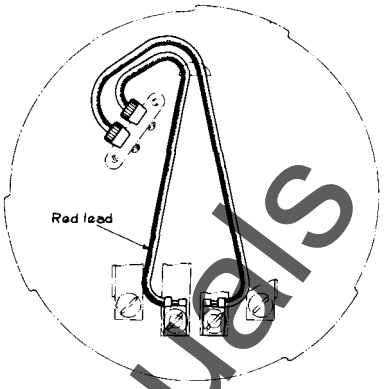
(e) 3-wire, 5- to 50-amp
Models 8WIM20S-3

Fig. 15. Connections of register on Type IM-20-S single-phase meters (front views)

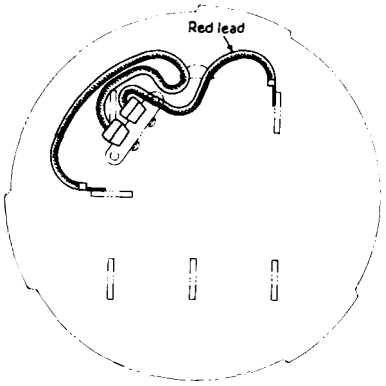
In later meters the "8WIM20S" is left out of the model number.



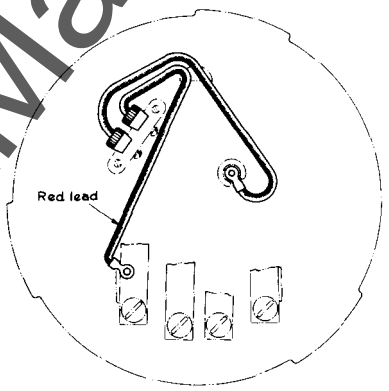
(a) 2-wire, 5- to 50-amp



(b) 2-wire, used with instrument transformers below Serial No. 20360858

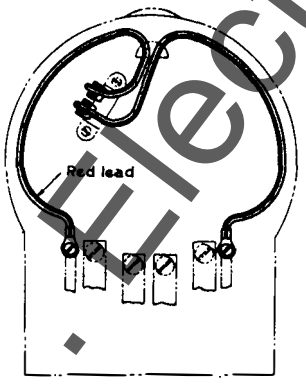


(c) 2-wire, used with instrument transformers Serial No. 20360858 and above

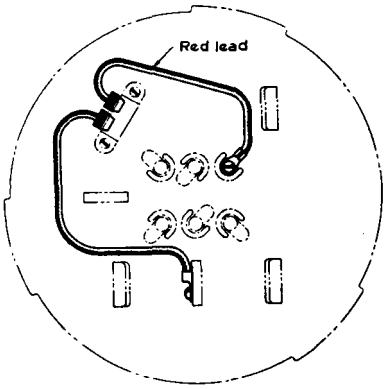


(d) 3-wire, 5- to 50-amp

Fig. 16. Connections of register on Type IM-30-S single-phase meters (front views)

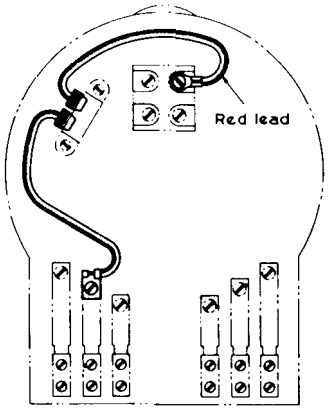


(a) Type VM-2-A 5- to 50-amp

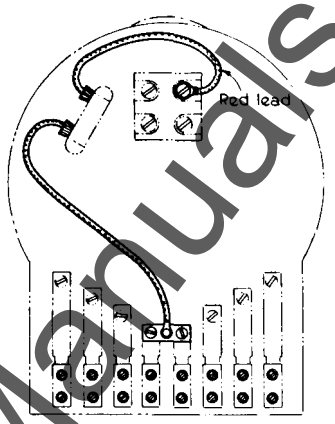


(b) Type VM-2-S 5- to 50-amp

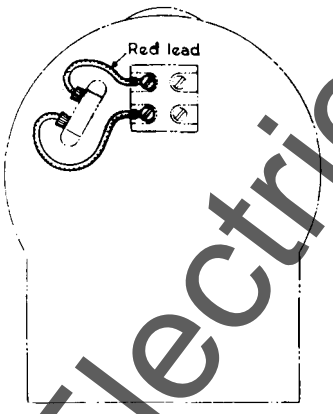
Fig. 17. Connections of register on Type VM-2 meters (front views)



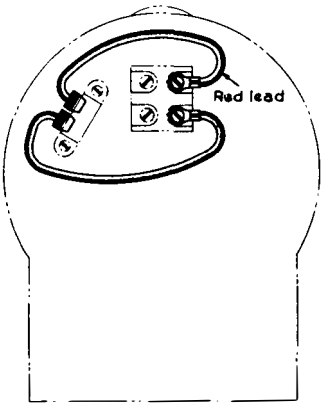
(a) Type VM-3-A meter, 3-wire, 2-or 3-phase; 5- to 50-amp



(b) Type VM-3-A meter, 4-wire, 2-phase; 5- to 50-amp
Types VM-3-A and VM 5-A meters, 4-wire Y, 3-phase; 5- to 50-amp

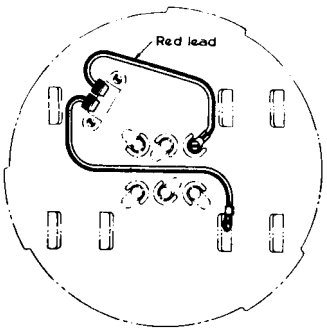


(c) Types VM-3-A and VM-6-A meters, 4-wire △, 3-phase; 5- to 50-amp
Types VM-3-A and VM-6-A meters, 4-wire △. 3-phase; used with instrument transformer

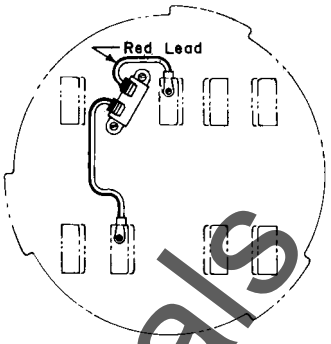


(d) Type VM-3-A meter 3-wire, 2- or 3-phase;
Type VM-3-A meter, 4-wire, 2-phase;
Types VM-3-A and VM-5-A meters, 4-wire Y, 3-phase; used with instrument transformers

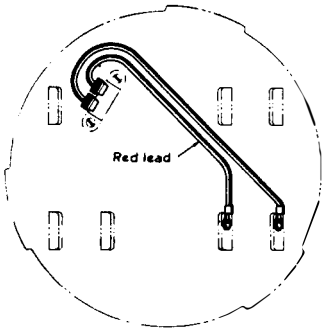
Fig. 18. Connections of register on Types VM-3-A, VM-5-A, and VM-6-A 2-element polyphase watthour demand meters (front views)



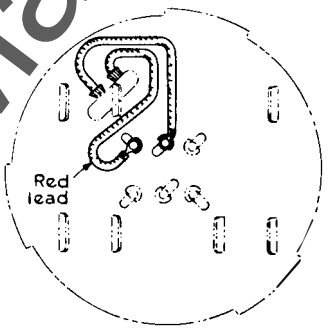
(a) Type VM-3-S meter, 3-wire, 2- or 3-phase and 4-wire, 2-phase below Serial No. 20103413
Type VM-5-S meter, 4-wire Y, 3-phase; 5- to 50-amp



(b) Type VM-3-S meter, 3-wire, 2- or 3-phase and 4-wire, 2-phase. For 5- to 50-amp meters Serial No. 20111350 and above. Also for all meters used with instrument transformers

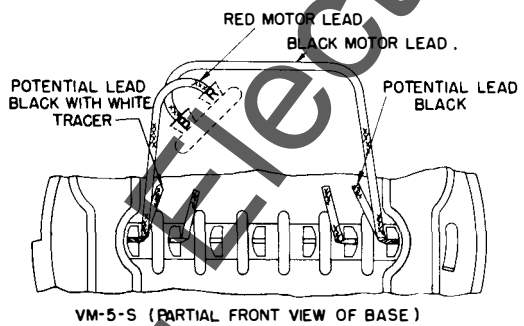


(c) Types VM-3-S and VM-5-S meters, 4-wire Y, 3-phase; used with instrument transformers



(d) Types VM-3-S and VM-6-S meters, 4-wire △, 3-phase; 5- to 50-amp

Fig. 19. Connections of register on Types VM-3-S, VM-5-S, and VM-6-S 2-element polyphase socket-type watthour-demand meters (front views)



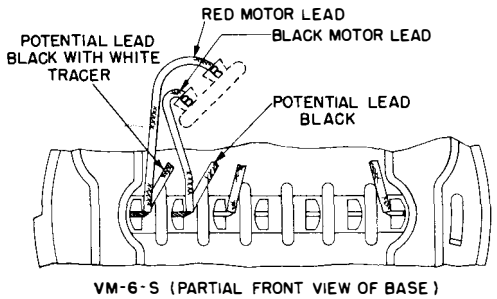
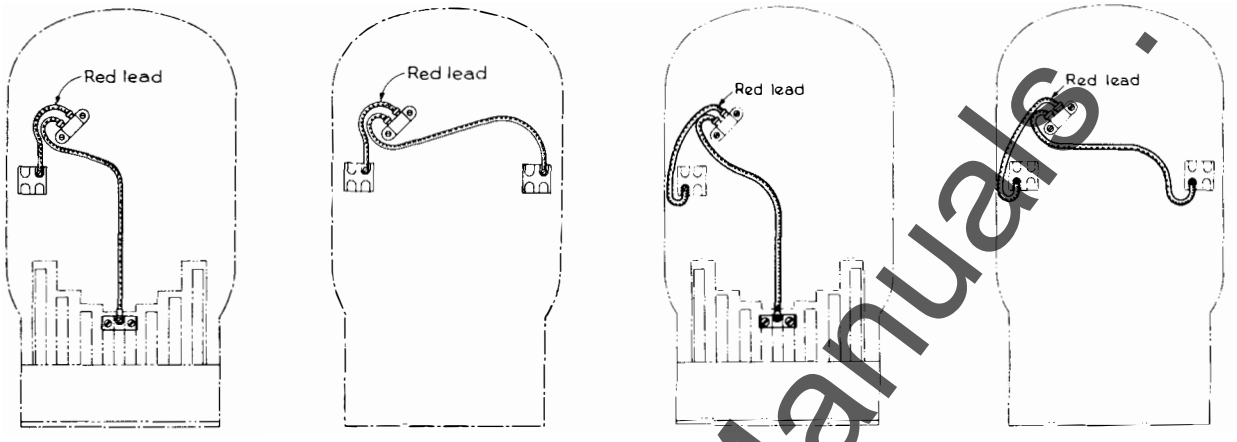


Fig. 20. Internal connections of motor leads for Types VM-5-S and VM-6-S Polyphase Watthour-Demand Meters with a 13-terminal base.

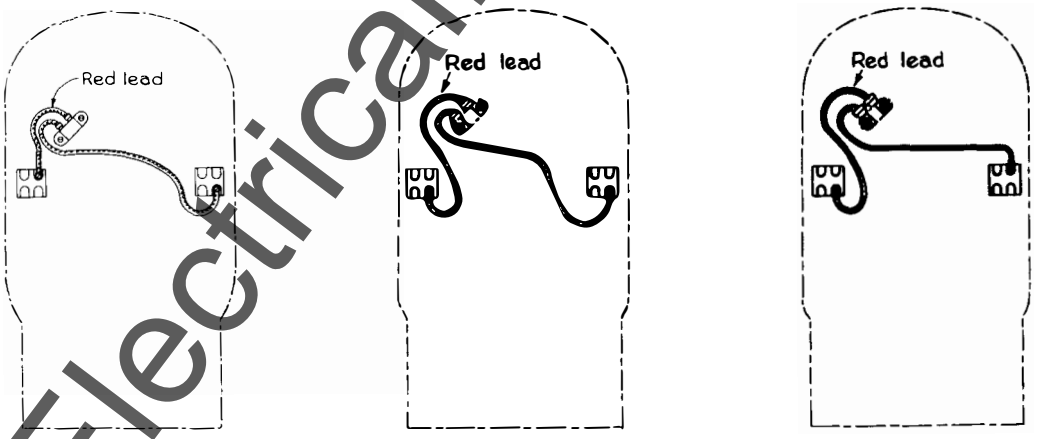


(a) Type VM-4-A meter, 4-wire Y, 3-phase; 5- to 50-amp

(b) Type VM-4-A meter, 4-wire Y, 3-phase; Types VM9-A and VM-10-A meters below Serial No. 21650733; used with instrument transfoimers

(c) Type VM-7-A meter, 4-wire △, 3-phase; 5- to 50-amp

(d) Type VM-7-A meter, 4-wire △, 3-phase; used with instrument transformers

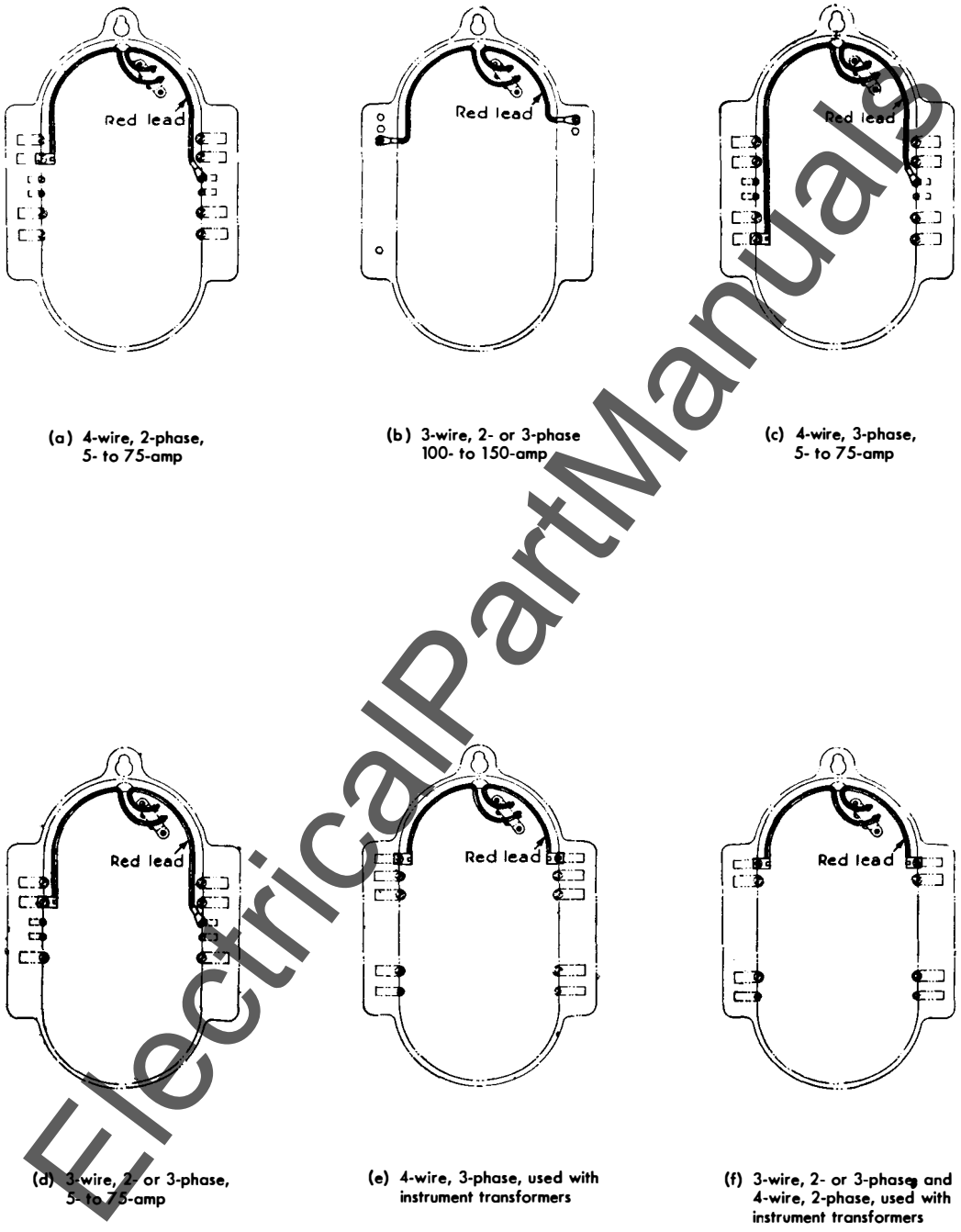


(e) Types VM-9-A and VM-10-A meters, 5- to 50-amp below Serial No. 21650733

(f) Types VM-9-A and VM-10-A meters, 5- to 50-amp Serial No. 21650733 and above

(g) Types VM-9-A and VM-10-A meters, Serial No. 21650733 and abave; used with instrument transformers

Fig. 21. Connections of register on Types VM-4-A, VM-7-A, VM-9-A, and VM-10-A 3-element polyphase watthour-demand meters (front views)



(a) 4-wire, 2-phase, 5- to 75-amp

(b) 3-wire, 2- or 3-phase 100- to 150-amp

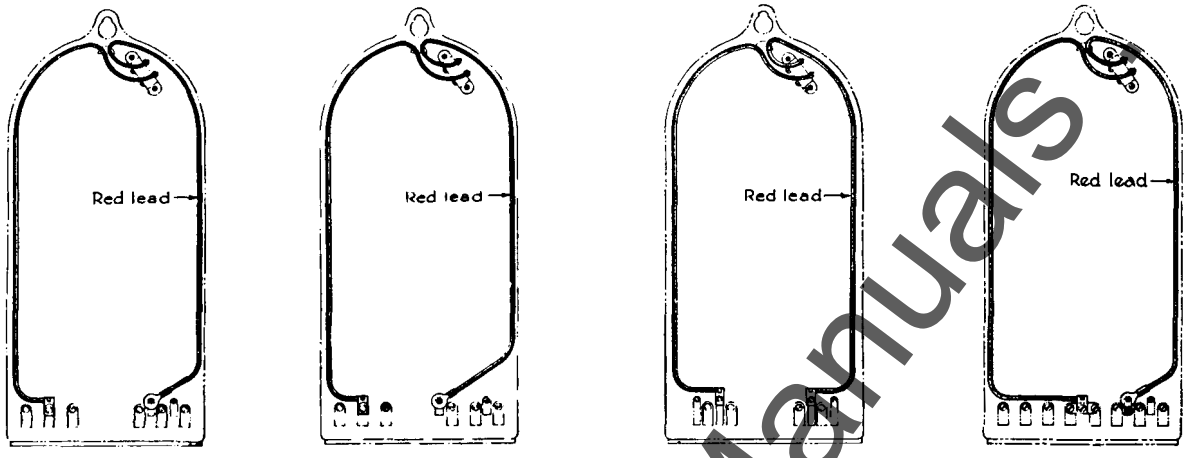
(c) 4-wire, 3-phase, 5- to 75-amp

(d) 3-wire, 2- or 3-phase, 5- to 75-amp

(e) 4-wire, 3-phase, used with instrument transformers

(f) 3-wire, 2- or 3-phase and 4-wire, 2-phase, used with instrument transformers

Fig. 22. Connections of register on Types DM-6 and DM-7 meters (back views)



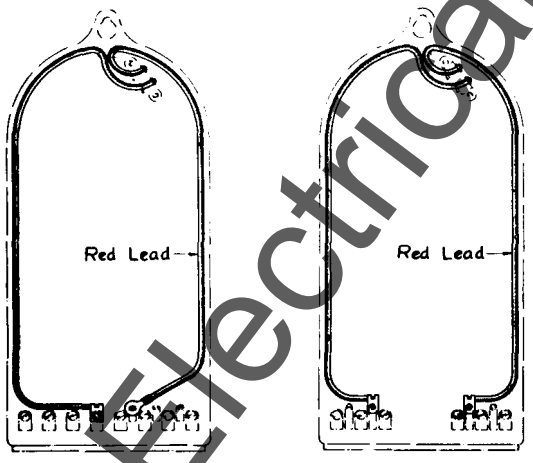
(a) 3-wire, 2- or 3-phase, 5- to 50-amp below Serial No. 16726889.

(b) 3-wire, 2- or 3-phase, 5-to 50-amp including and above Serial No. 16726889

(c) 3-wire, 2- or 3-phase, and 4-wire, 2-phase; used with instrument transformers

(d) 4-wire, 2-phase, 5- to 50-amp

Fig. 23. Connections of register on Type DM-14 meters, 3-wire, 2- or 3-phase and 4-wire, 2-phase (back views)



(a) 5- to 50-amp

(b) With transformers

Fig. 24. Connections of register on Type DM-14 meters, 4-wire △, 3-phase (back views)

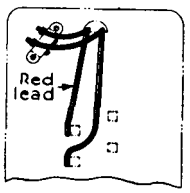
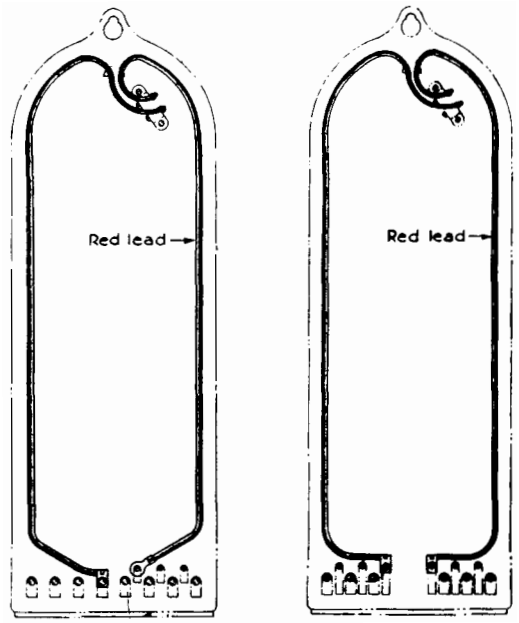


Fig. 25. Connections of register on Type ISM-8, -9 DSM-19, -20, -34, and -35 meters (front view)

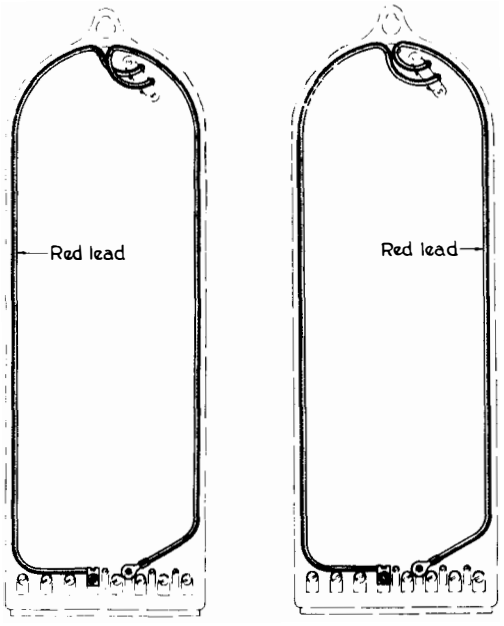


(a) 5- to 50-amp (b) With transformers

Note:—For 5- to 50-amp (self-contained) ratings the connections apply only to those meters in which the terminal arrangement is such that the 3-wire current coil on the bottom element is connected to the two outside left and two outside right current terminals, i.e., meters above Serial No. 16976134.

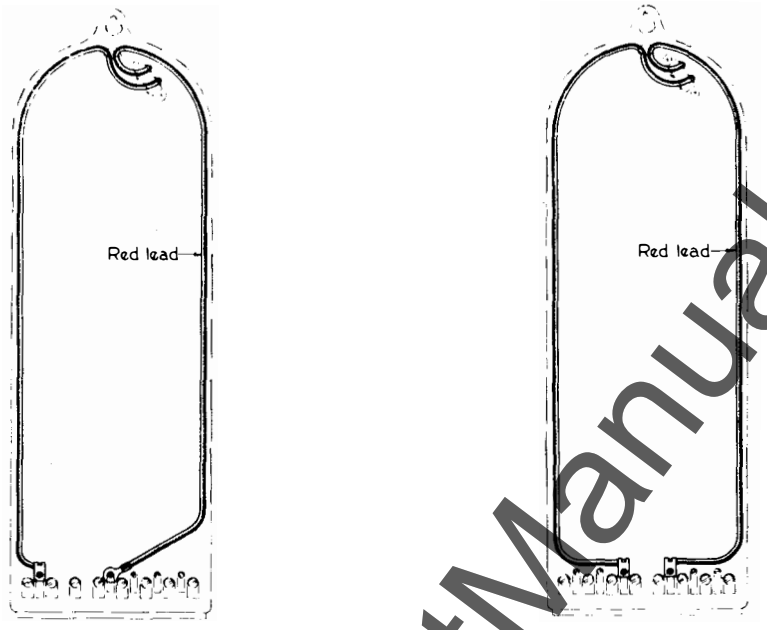
Fig. 26. Connections of register on Type DM-15 meters, 4-wire Y, 3-phase (back views)

Fig. 27. Connections of register on Type DM-15 meters, 4-wire △, 3-phase (back views)



(a) 5- to 25-amp, incl. (b) 50-amp

Note:—These connections apply only to those meters which have the 230-volt potential coil on the bottom element. Connections for these meters in ratings for use with transformers are the same as Type DM-15, 4-wire Y, 3-phase meters with transformers. See Fig. 24(b)



(a) 5- to 50-amp (b) With transformers

Fig. 28. Connections of register on Type DM-15 totalizing meters for one 3-wire, 3-phase circuit and one 3-wire, single-phase circuit (back views)

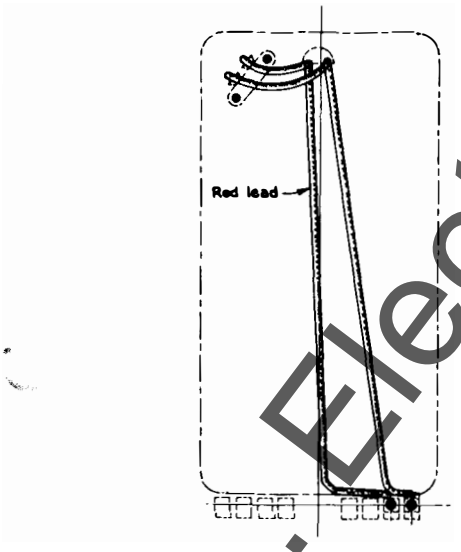


Fig. 29. Connection of register on Types DSM-38, -40, and -43, meters (front view)

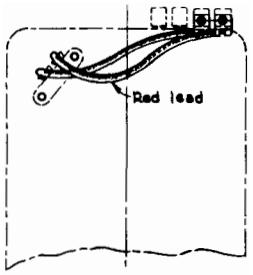


Fig. 30. Connection of register on Types DSM-39, -41, and -44, meters (front view)

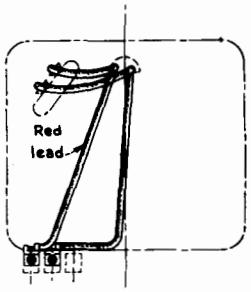
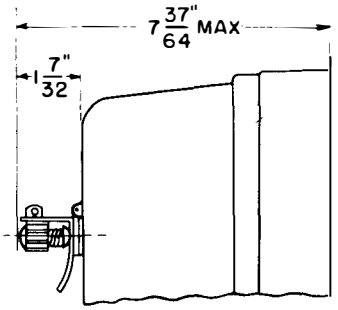
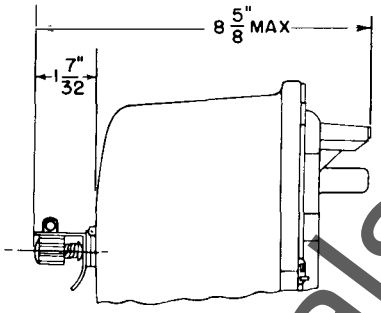


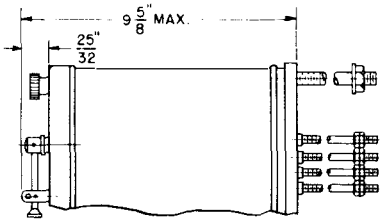
Fig. 31. Connection of register on Types ISM-10, -11, and -12, meters (front view)



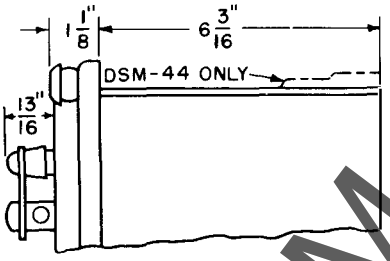
(a) Type IM-50-A



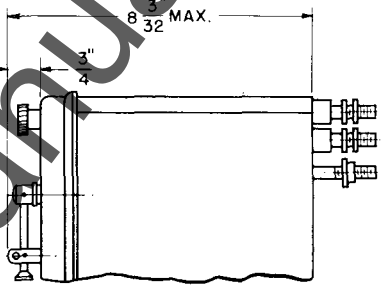
(b) Type IM-50-S



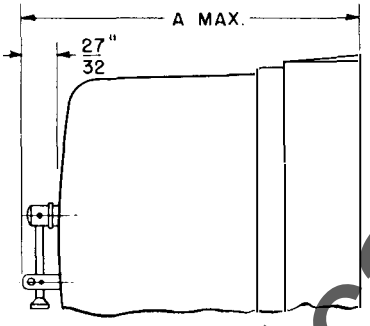
(c) Type ISM-8, -9, and -10, DSM-19 or DSM-20



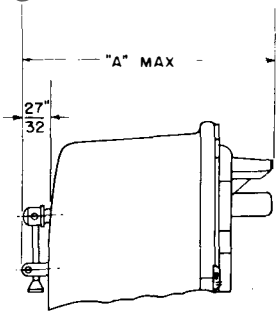
(d) Type ISM-12, DSM-38, -43 or DSM-44



(e) Type ISM-11, DSM-39 and -40 or DSM-41



(f) All other "A" Types



(g) All other "S" Types

TYPES	IM-16		IM-18		IM-20-A IM-20-B	IM-20-C*	IM-20-S	IM-30-A	IM-30-S
AMPS	5-10	15-50	5-10	15-25	2.5-50	2.5-50	2.5-50	2.5-50	5-50
MAX. "A" DIM. (INCHES)	7-1/32	7-7/16	7-3/8	7-17/32	7-11/16	9-1/4	10-1/4†	7-11/16	10-1/4†

TYPES	DSM-6 DSM-7		DM-14	DM-15	VM-2-A	VM-2-S	VM-3-A VM-5-A VM-6-A	VM-3-S VM-5-S VM-6-S	VM-4-A VM-7-A VM-9-A VM-10-A
AMPS	5-25	50-150	5-50	5-50	5-50	5-50	2.5-50	2.5-50	2.5-50
MAX. "A" DIM. (INCHES)	7-7/16	8-3/8	7-5/8	7-23/32	9-9/32	11-13/32†	9-3/8	13-7/16†	8-23/32

(For additional dimensions see Instructions for corresponding types of watthour meters.)

†This dimension is over-all and includes the meter socket. Note that the depth of the socket and the over-all dimension of meter and socket vary slightly with the rating of the socket.

*This dimension is over-all and includes the protector case.

Fig. 32. Dimensions of watthour demand meters

NOTES

WHEN YOU NEED SERVICE

IF YOU NEED TO REPAIR, recondition, or rebuild any electric apparatus, a G-E service shop near you is available day and night, seven days a week, for work in the shops or on your premises. Latest factory methods and genuine G-E renewal parts are used to maintain the original performance of your G-E equipment. For full information about these services, contact the nearest service shop or sales office listed below:

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Minneapolis 12, Minn. . . . . 2025 49th Ave., N.
New York 14, N. Y. . . . . 416 W. 13th St.
Philadelphia 23, Pa. . . . . 1040 E. Erie Ave.
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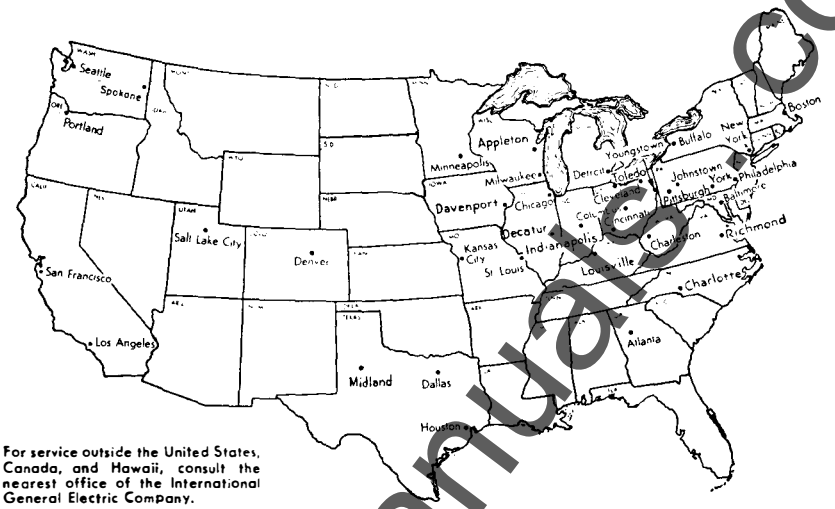

For service outside the United States, Canada, and Hawaii, consult the nearest office of the International General Electric Company.

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