AUTOTRANSFORMERS
CONTINUOUSLY TAPPED TYPE
MOTOR DRIVEN
REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers the KS-5552, KS-5621, KS-5702, KS-5775, KS-15581, KS-15583, KS-15585, KS-15680, KS-15682, KS-15683, KS-15684, KS-15685, KS-15779 continuously tapped-type, motor-driven autotransformers and the autotransformers of the KS-15508 and KS-15908 motor-driven, tapped autotransformer-type regulators.

1.02 This section is reissued to revise the lubrication requirements and procedures for the motor and gear case of the KS-15583 and KS-15684 autotransformers. Detailed reasons for reissue will be found at the end of the section.

1.03 Reference shall be made to Section 020-010-711 covering general requirements and definitions for additional information necessary for the proper application of the requirements listed herein.

1.04** ***Asterisk (*): Requirements are marked with an asterisk when to check for them would necessitate the dismantling or dismounting of apparatus or would affect the adjustment involved or other adjustments. No check need be made for these requirements unless the apparatus or part is made accessible for other reasons or its performance indicates that such a check is advisable.

φ1.05 ***Phi (φ):*** Requirements are marked with a phi when they are not required to be checked before turnover.

1.06 The KS-5552, KS-15585, KS-15680, and KS-15685 autotransformers are furnished without motors. The motor used with these autotransformers should meet requirements covered in the BSP section for the motor.

1.07 Two different makes of autotransformers are furnished with the designation KS-5552 which differ in construction to such an extent that in some cases the maintenance information is given separately. These are the transtat, furnished by the American Transformer Company, and the powerstat, furnished by the Superior Electric Company. KS-5621, KS-5702, KS-5775, KS-15581, KS-15583, KS-15585, KS-15680, KS-15682, KS-15683, KS-15684, KS-15685, and KS-15779 autotransformers are powerstats, furnished by the Superior Electric Company. The autotransformers of the KS-15508 and KS-15908 L2 regulators are furnished by the Superior Electric Company. The autotransformer of the KS-15908 L1 regulator is furnished by the Standard Electrical Products Company.

1.08 Prior to 1952, flat nickel-plated phosphor-bronze brush springs were furnished for powerstats. Subsequently, prebent cadmium-plated steel brush springs have been furnished. With flat brush springs, the brush unit pressure should be within the limits shown in requirement 2.06(a) and, with prebent brush springs, the unit pressure should be within the limits shown in requirement 2.06(b). The autotransformer of the KS-15908 regulator is furnished with a spring-loaded-type brush assembly and the brush pressure should meet requirement 2.06(c) or (d).

1.09 Before doing any work on an autotransformer, arrangements should be made for maintaining service and disconnecting the autotransformer from supply and load. In some cases, in order to check certain requirements and make adjustments, it is necessary to remove the guard plate or perforated screen, if provided, or to remove the autotransformer from its mounting.

1.10 ***Caution: Never permit the brushes to break contact with the commutator while the autotransformer is connected to the power supply, since a severe spark would be produced when the circuit is opened and damage would result.***

1.11 ***Caution: Never attempt to rotate the autotransformer shaft without disengaging the driving mechanism except where specifically permitted in the requirements and procedures.***

1.12 ***Caution: It is essential that all autotransformer requirements be met to prevent occurrence of fires.***

2. REQUIREMENTS

2.01 *Lubrication*

(a) *Motor Bearings*

(1) ***KS-5775, KS-15583, KS-15683, and KS-15684 Autotransformers:*** The motor bearings shall be cleaned and then repacked with fresh 260-300P grease every 3 years in service or when the autotransformer is put into service after 1 or more years of storage.

(2) ***KS-15581 and KS-15682 Autotransformers:*** The motor bearings shall be cleaned and then repacked with fresh 260-300P grease annually or when the autotransformer is put into service after 1 or more years of storage.

Note: The KS-15684 autotransformer may be furnished with a Holtzer-Cabot motor or Superior Electric Company Slo-Syn motor. The bearings of the Slo-Syn motor are double-shielded type ball bearings and require no lubrication.

(3) ***Autotransformer of KS-15908 L1 Regulator:*** The motor bearings shall be lubricated with a few drops of KS-16326 L1 oil applied to each motor bearing oil hole annually or when the autotransformer is put into service after 1 or more years of storage.

Note: KS-5621, KS-5702, KS-15779 Autotransformers and Autotransformers of KS-15508 and KS-15908 L2 Regulators: The motor bearings of these autotransformers are double-shielded-type ball bearings and normally require no lubrication.

(b) *Autotransformer Shaft Bearings*

(1) ***Bearings of KS-5552, KS-5621, and KS-5775 Autotransformers:*** Fig. 1(A), Fig. 2(A) — If the autotransformer squeaks during rotation, the bearings shall be lubricated sparingly with KS-6232 oil.

Note: The shaft bearings of all other autotransformers covered in this section are either oilless-type sleeve bearings or double-shielded-type ball bearings and normally require no lubrication.

(c) *Gear Case*

KS-5775, KS-15581, KS-15682, and KS-15683 Autotransformers (Fig. 2) and Vertically Mounted KS-15583 and KS-15684 Autotransformers (Fig. 3)

Note: KS-15583 and KS-15684 autotransformers are considered vertically mounted when the autotransformer shaft is in the vertical position.

(1) The drive shaft bearings and the bearings of the intermediate gears shall be lubricated with a few drops of KS-7470 oil.

(2) The teeth and accessible surfaces of all gears shall be cleaned and then lubricated with a small amount of 260-300P grease.

The bearings and gears shall be lubricated every 3 years in service or when the autotransformer is being put into service after 1 or more years of storage.

Note: If the Superior Electric Company Slo-Syn motor is furnished on the KS-15684 autotransformer, the associated gear reduction unit requires no lubrication.

Horizontally Mounted KS-15583 and KS-15684 Autotransformers [see note of (c)] Fig. 3

(3) The gear case shall be filled to the level of the overflow hole with KS-6232 oil when being put into service, and annually thereafter. [See note under (c)(2).]

(d) ***Exposed Gears, Sprockets, and Drive Chains***

(1) Exposed gears, sprockets, and drive chains shall be cleaned and then lubricated with a small amount of 260-300P grease when being put into service and annually thereafter.

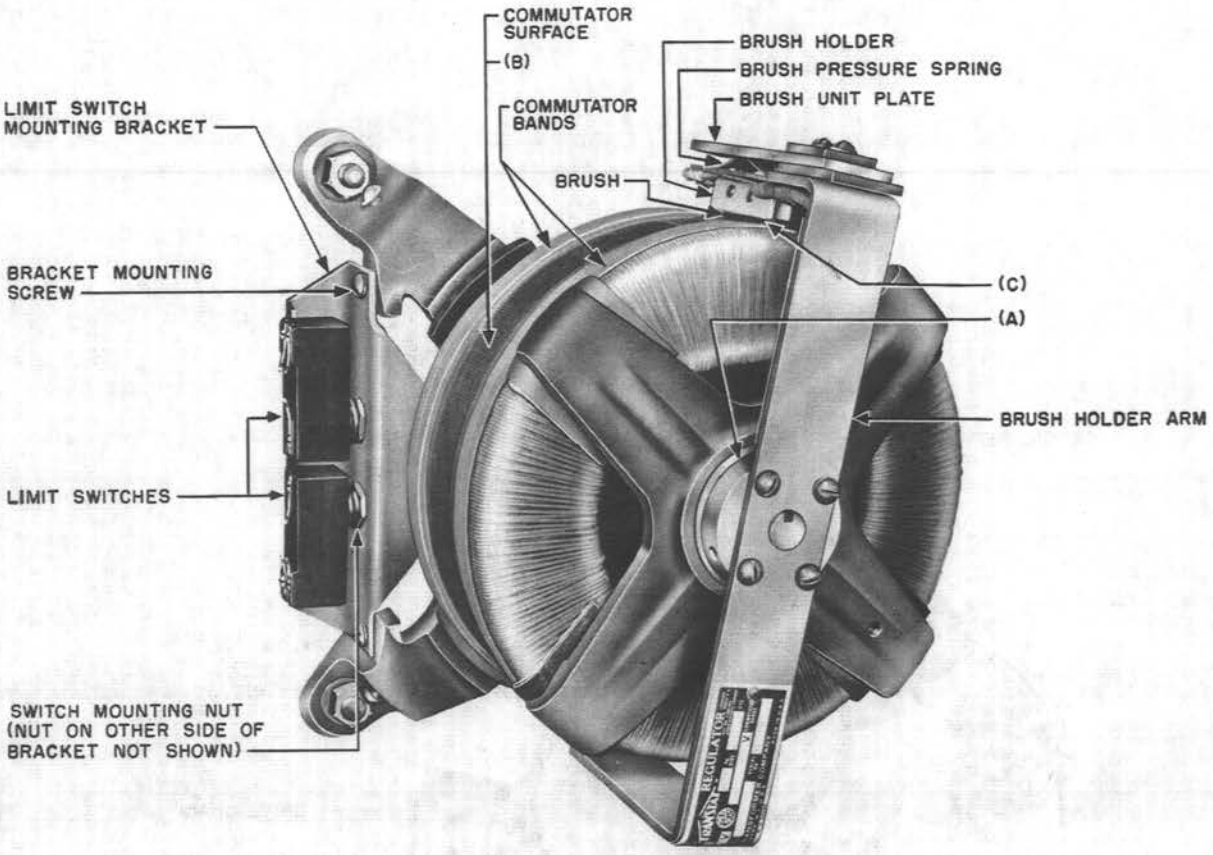


Fig. 1 – KS-5552 (transtat) Autotransformer

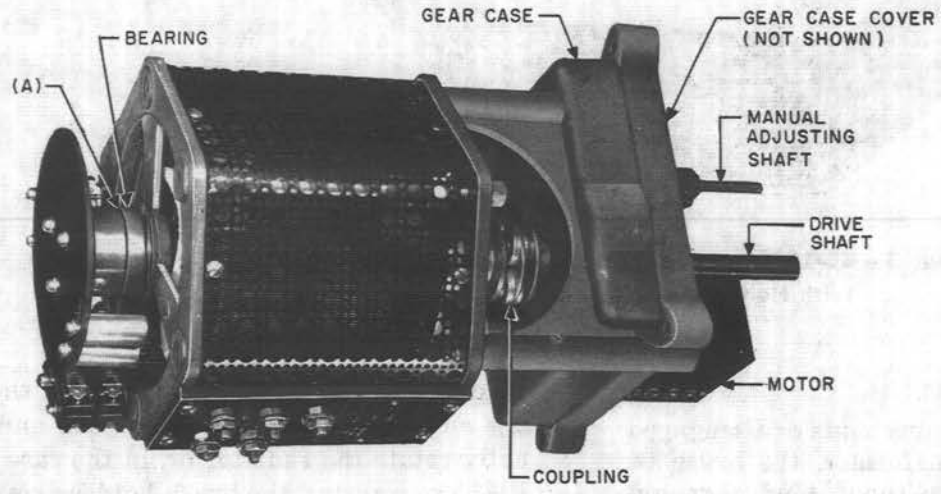


Fig. 2 – KS-5775 Autotransformer

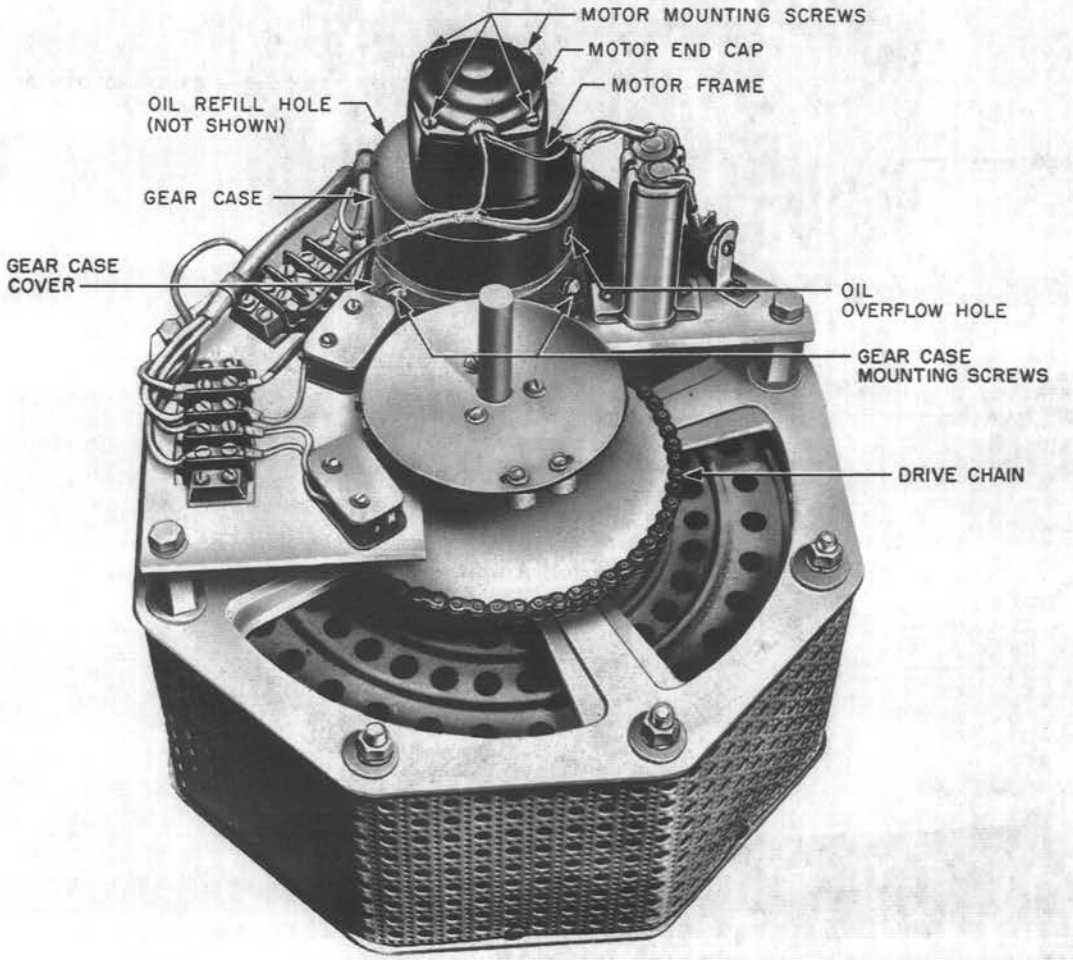


Fig. 3 – KS-15583 and KS-15684 Autotransformers Equipped With Holtzer-Cabot Motor and Gear Case

*φ2.02 ***Freedom of Rotation***

(a) With the driving mechanism disengaged from the autotransformer, the brush or brushes shall rotate without bind throughout their intended range of travel.

Gauge by feel.

To check this requirement, disengage the driving mechanism as covered in 3.003 and manually rotate the radiator or, in the case of the KS-5552 transtat, the brush holder arm. After the requirement is met, remount the parts as covered in 3.004.

(b) ***All Autotransformers Except KS-5621 and KS-5702 Autotransformers and Autotransformer of KS-15508 Regulators:*** For any position of the brush, the torque required to rotate the shaft with the driving mechanism disengaged shall be as follows.

AUTOTRANSFORMER	MAX TORQUE (oz-in.)	MAX TORQUE (gram-in.)
KS-5775, KS-15581, KS-15682, and KS-15683	50	1420
KS-15583 L1 and KS-15684 L1	150	4250
KS-15583 L2 and KS-15684 L2	300	8500
KS-5552, KS-15585, KS-15680, KS-15685, KS-15779, and Autotransformer of KS-15908 L1 Regulator	70	1985
Autotransformer of KS-15908 L2 Regulator	35	990

Use the R-2771 spring balance or 79F push-pull tension gauge. To check the torque, disengage the driving mechanism as covered in 3.003. Referring to Fig. 4 for powerstats, loop a cord around one of the limit switch actuators and engage the hook of the spring balance or push-pull gauge in the loop. For the transtat (Fig. 1), loop the cord around the brush holder arm adjacent to the outer end. Referring to Fig. 4, pull the gauge at right angles to the radius through the center of rotation and observe the gauge reading just as movement starts. Determine the torque by multiplying the gauge reading by the lever arm distance, in inches, shown in Fig. 4. After the requirement is met, remount parts as covered in 3.004.

(c) ***KS-5621 and KS-5702 Autotransformers and Autotransformer of KS-15508 Regulators:*** With the driving mechanism disengaged from the autotransformer, the shaft shall turn freely throughout its intended range of travel.

Gauge by feel.

To check the requirement, disengage the driving mechanism as covered in 3.003 and manually rotate the radiator. After the requirement is met, remount parts as covered in 3.004.

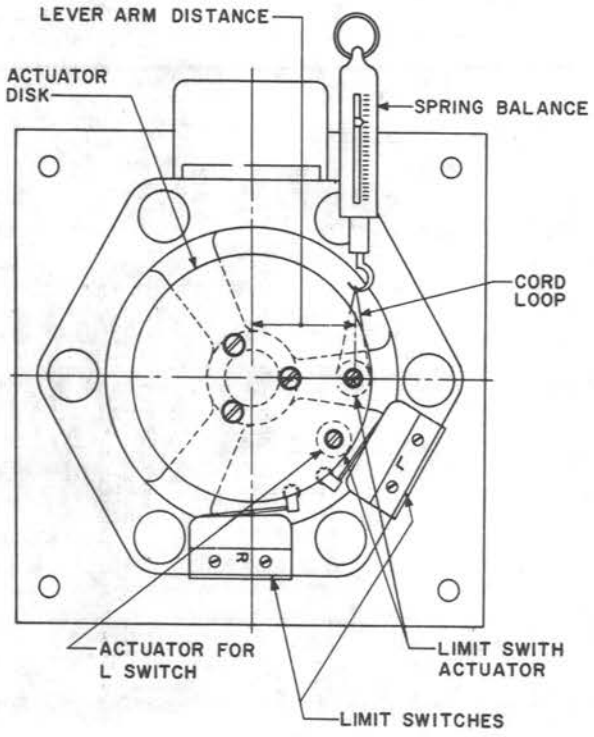


Fig. 4 – Typical Powerstat Showing Method of Measuring Torque

2.03 ***Condition of Slip Ring Surface:*** Fig. 5(A)

(a) The slip ring surface shall be clean and smooth.

Gauge by eye.

2.04 ***Condition of Commutator Surface:*** Fig. 1(B) and Fig. 5(B)

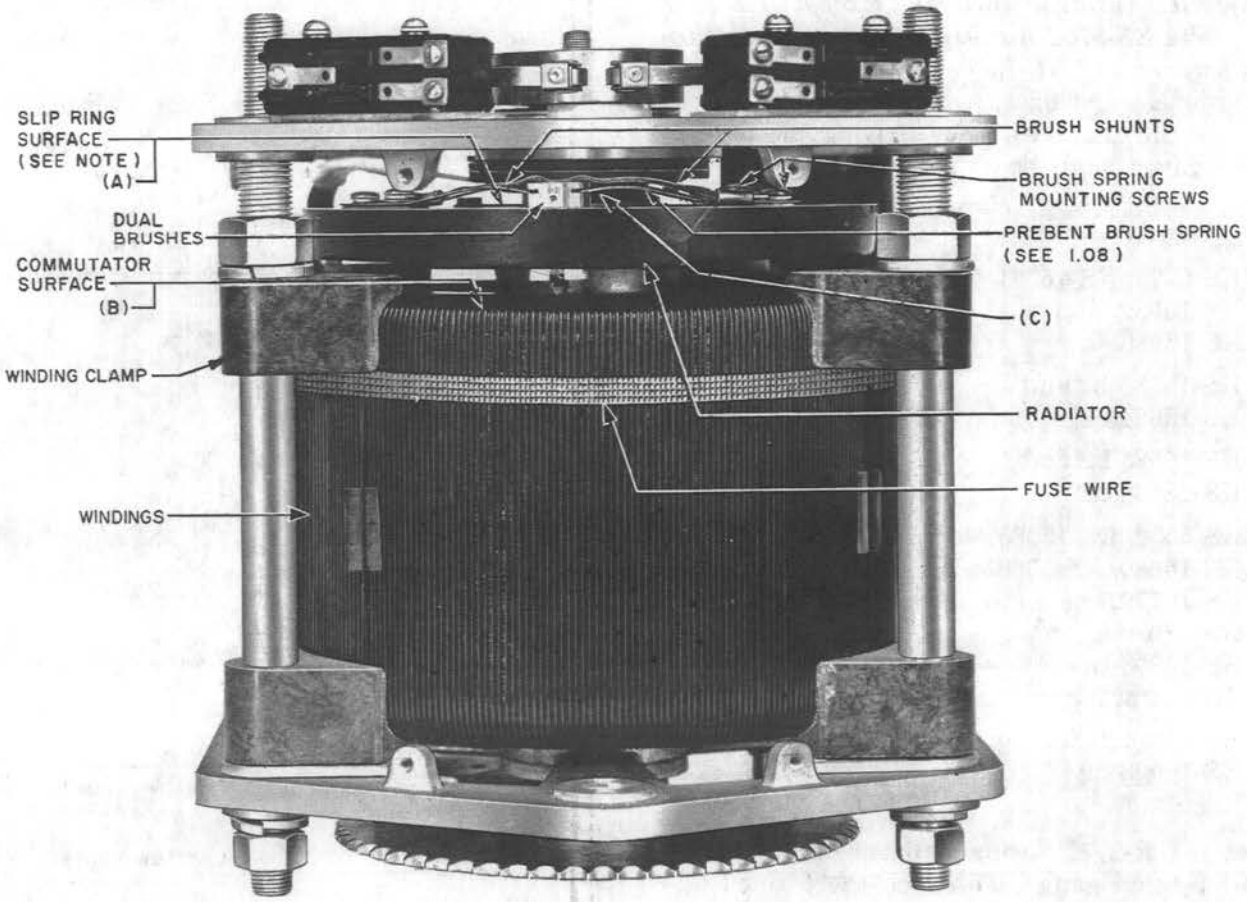
(a) The commutator surface shall be clean and smooth.

Gauge by eye or feel.

This requirement shall be checked annually. If at any time it is necessary to smooth the commutator surface, this requirement and requirements 2.05, 2.06, and 2.07, 2.08, or 2.09 shall be checked every 6 months thereafter.

2.05 ***Brush Contact With Commutator***

(a) ***All Autotransformers Except KS-5552 Transtat:*** Fig. 5



NOTE: FOR KS-15581 AUTOTRANSFORMERS THE SLIP RING SURFACE IS AT THE OUTER EDGE OF THE RADIATOR.

Fig. 5 – KS-15685 Autotransformer

(1) The brush shall make good contact successively with each conductor of the commutator as it moves from end to end of its travel.

Gauge by eye.

To check this requirement, disengage the driving mechanism from the autotransformer as covered in 3.003 and manually rotate the radiator. After the requirement is met, remount parts as covered in 3.004.

ϕ(2) The contact surface of the brush shall cover at least one but not more than two conductors of the commutator.

Gauge by eye.

(b) ***KS-5552 Transtat:*** Fig. 1

*ϕ(1) The contact surface of the brush shall fit the curvature of the commutator.

Gauge by eye.

(2) The brush shall be positioned to ride approximately in the center of the commutator.

Gauge by eye.

2.06 *Brush Pressure*

All Autotransformers Except KS-5552 Transtat and Autotransformer of KS-15908 Regulator: Fig. 5

(a) ***Brushes Associated With Flat Brush Springs*** (see 1.08): The pressure for each brush unit shall be as follows.

(1) ***KS-5552, KS-5621, KS-5775 Autotransformers and Autotransformers of KS-15508 L1, L2, L4, L6, L7, and L10 Regulators***

POUNDS				GRAMS	
MIN		MAX		MIN	MAX
lb	oz	lb	oz		
1	4	1	5	570	595

(2) ***KS-5702 Autotransformer and Autotransformers of KS-15508 L3, L5, L8, and L9 Regulators***

POUNDS				GRAMS	
MIN		MAX		MIN	MAX
lb	oz	lb	oz		
1	2	1	3	510	540

(3) ***KS-15581 and KS-15585 Autotransformers***

OUNCES		GRAMS	
MIN	MAX	MIN	MAX
10	12	280	335

(4) ***KS-15583 Autotransformer***

POUNDS				GRAMS	
MIN		MAX		MIN	MAX
lb	oz	lb	oz		
1	4	1	8	570	680

The requirement shall be checked annually as covered in (e). If at any time it is necessary to smooth the commutator surface to meet requirement 2.04, the requirement shall be checked every 6 months thereafter. Use the R-2771 spring balance or the 79F push-pull gauge.

(b) ***Brushes Associated With Prebent Brush Springs*** (see 1.08): The pressure for each brush unit shall be as follows.

(1) ***KS-5552, KS-5621, KS-5775, KS-15581, KS-15585, KS-15680, KS-15682, KS-15683, KS-15685, KS-15779 Autotransformers and Autotransformers of KS-15508 L1, L2, L4, L6, and L7 Regulators***

OUNCES		GRAMS	
MIN	MAX	MIN	MAX
11	15	310	425

(2) ***KS-5702, KS-15583, KS-15684 Autotransformers and Autotransformers of KS-15508 L3, L5, L8, L9, and L10 Regulators***

POUNDS				GRAMS	
MIN		MAX		MIN	MAX
lb	oz	lb	oz		
1	4	1	8	570	680

The requirement shall be checked annually as covered in (e). If at any time it is necessary to smooth the commutator to meet requirement 2.04, the requirement shall be checked every 6 months thereafter. Use the R-2771 spring balance or the 79F push-pull gauge.

KS-5552 Transtat and Autotransformer of KS-15908 L1 Regulator: Fig. 1 and 6

(c) The brush pressure shall be adequate for maintaining good contact with the commutator. The requirement shall be checked annually. If at any time it is necessary to smooth the commutator to meet requirement 2.04, the requirement shall be checked every 6 months thereafter.

Gauge by feel.

To check the brush pressure, carefully lift the brush unit away from the commutator with the fingers and make sure that the brush was held firmly against the commutator by the action of the spring.

Autotransformers of KS-15908 L2 Regulators: Fig. 6

(d) The pressure of the brush shall be

OUNCES	GRAMS
MIN	MIN
12	340

The requirement shall be checked annually as covered in (e). If at any time it is necessary to smooth the commutator to meet requirement 2.04, the requirement shall be checked every 6 months thereafter. Use the R-2771 spring balance or the 79F push-pull gauge.

(e) To check requirements (a), (b), and (d), if access to the brushes is obstructed by the limit switch actuator disc, first remove the disc as follows. Using a pencil, mark the disc and radiator to obtain the same relation between the two when remounting the disc. Using the 4-inch E screwdriver, remove the

disc mounting screws and remove the disc. If necessary, rotate the radiator to gain access to the brushes through one of the openings in the autotransformer frame as follows.

KS-5775, KS-15581, KS-15682, and KS-15683 Autotransformers: Push in and turn the manual control knob.

KS-15779 Autotransformer: Manually rotate the large gear on the autotransformer shaft.

All Other Autotransformers: Disengage the driving mechanism as covered in 3.003.

For the autotransformers of the KS-15908 L2 regulators, engage a brush holder lug or the inner end of the brush holder with the hook of the spring balance or push-pull gauge. For all other autotransformers, loop a cord under the spring at each side of the brush unit to be checked and engage the hook of the spring balance or push-pull gauge in the loop. Exert a pull on the gauge at right angles to the commutator and observe the gauge reading as the brush unit just begins to move. Similarly, check the other brush unit. Where brushes are inaccessible, for example, in a lower unit of a tandem assembled autotransformer, it is satisfactory to check the brush pressure by carefully lifting the brush unit away from the commutator with a KS-6320 orange stick. In this case make sure that the brush was held firmly against the commutator by the springs. If the limit switch actuator disc was removed, remount it and securely tighten the screws. Then, check requirement 2.10. After the requirements involved are met, if the driving mechanism was disengaged, remount parts as covered in 3.004.

ϕ2.07 ***Clearance Between Brush Springs and Radiator:*** Fig. 5(C)

(a) ***All Autotransformers Except KS-5552 Transtat and Autotransformer of KS-15908 Regulator***

(1) The clearance between the brush springs and radiator shall be

Min 0.071 inch

Use the 131A thickness gauge nest.

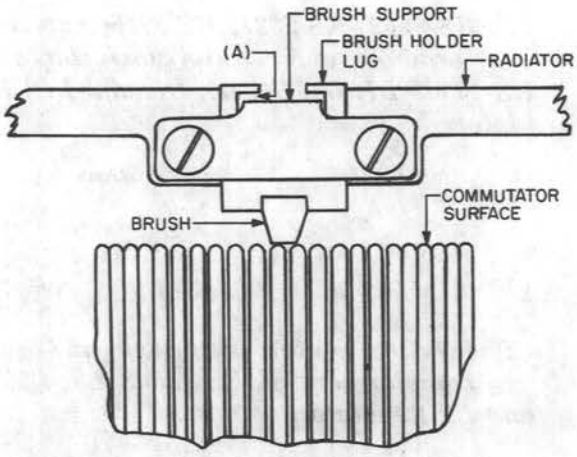


Fig. 6 – Partial View of Autotransformer of KS-15908 L2 Regulator Showing Spring-Loaded-Type Brush Assembly

ϕ2.08 ***Clearance Between Brush Holder and Commutator Bands:*** Fig. 1(C)

(a) ***KS-5552 Transtat***

(1) The clearance between the brush holder and commutator bands shall be

Min 1/16 inch

Gauge by eye.

2.09 ***Clearance Between Brush Holder Lugs and Brush Support:*** Fig. 6(A)

(a) ***Autotransformer of KS-15908 L2 Regulators***

(1) The clearance between the brush holder lugs and brush support shall be

Min 0.020 inch

Use the 131A thickness gauge nest

2.10** ***Limit Switches

(a) ***KS-5552, KS-5621, KS-5702, KS-15585, KS-15680, KS-15685, KS-15779 Autotransformers and Autotransformers of KS-15508 Regulators***

(1) Each limit switch shall operate when the leading edge of the brush reaches the fifth conductor from its respective end of the commutator.

Gauge by eye and ear.

Check the requirement as covered in (h).

(b) *KS-5775 Autotransformer*

(1) Limit switches R and L shall operate when the leading edge of the brush reaches the tenth conductor from the R switch end and the fourth conductor from the L switch end of the commutator, respectively.

Gauge by eye and ear.

Check the requirement as covered in (i).

(c) *KS-15581 and KS-15683 Autotransformers*

(1) Limit switches A and D shall operate when the leading edge of the brush is between the third and first conductor from their respective ends of the commutator.

Gauge by eye and ear.

Check the requirement as covered in (i).

(2) Limit switches B and C shall operate when the voltage between terminals 1 and 3 of the autotransformer is as follows.

LIMIT SWITCH	VOLTAGE (volts)
B	138 to 142
C	82 to 92

Use the 300-volt scale of the model 904 Weston Voltmeter and the two 4516 Weston Instrument Company leads.

To check the requirement, first connect a 230-volt ac supply to the 1 and 2 terminals of the autotransformer. Then, connect the voltmeter across the 1 and 3 terminals. Push in and turn the manual adjusting shaft knob of the autotransformer, observing the reading on the meter when the switch operates as indicated by a click.

(d) *KS-15583 and KS-15684 Autotransformers*

(1) Limit switches R and L shall operate when the leading edge of the brush is between the third and first conductor from their respective ends of the commutator.

Gauge by eye and ear.

Check the requirement as covered in (h).

(e) *KS-15682 Autotransformer*

(1) Each limit switch shall operate when the leading edge of the brush reaches the tenth conductor from its respective end of the commutator.

Gauge by eye and ear.

Check the requirement as covered in (i).

(f) *Autotransformer of KS-15908 L1 Regulators*

(1) Each limit switch shall operate when the leading edge of the brush is between the third and first conductor from the end of the commutator adjacent to the switch.

Gauge by eye and ear.

Check the requirement as covered in (h).

(g) *Autotransformer of KS-15908 L2 Regulator*

(1) Each limit switch shall operate when the leading edge of the brush is between the fourth and third conductor from the end of the commutator adjacent to the switch.

Gauge by eye and ear.

Check the requirement as covered in (h).

(h) To check requirements (a), (d), (f), and (g), except for the KS-15779 autotransformer, first disengage the driving mechanism as covered in 3.003. Then, manually rotate the radiator, observing the position of the brush when the switch operates as indicated by a click. After the requirement is met, remount parts as covered in 3.004.

(i) To check requirements (b), (c)(1), and (e), push in and turn the manual adjusting shaft knob and observe the position of the brush when the switch operates as indicated by a click.

2.11 *Fuse Wire:* Fig. 5

(a) The fuse wire, if provided, shall be held snugly around the periphery of the autotransformer windings adjacent to the winding clamps at the commutator end of the autotransformer.

Gauge by eye and feel.

*φ2.12 *Temperature*

(a) With the autotransformer connected to supply and load, the maximum temperature shall be as follows.

(1) ***KS-5552, KS-15585, KS-15680, KS-15685 Autotransformers and Autotransformers of KS-15508 Regulators***

Autotransformer Windings and Frame	95 C (203 F)

(2) ***KS-5621 Autotransformer***

Autotransformer Windings	90 C (194 F)
Motor Windings	95 C (203 F)

(3) ***KS-5702 Autotransformer***

Autotransformer Windings	80 C (176 F)
Motor Frame	80 C (176 F)

(4) ***KS-5775, KS-15581, KS-15682, KS-15683, and KS-15779 Autotransformers***

Autotransformer Windings	95 C (203 F)
Motor Windings	95 C (203 F)

(5) ***KS-15583 and KS-15684 Autotransformers***

Autotransformer Windings	95 C (203 F)
Motor Frame	90 C (194 F)

(6) ***Autotransformers of KS-15908 L1 and L2 Regulators***

Autotransformer Windings	66 C (151 F)
Motor Windings	95 C (203 F)

Use the R-1032 Thermometer.

To check the requirement, apply the bulb of the thermometer to various spots on the surface to be checked in order to find the hottest spot. Cover the side of the bulb not in contact with the surface with a small asbestos pad or suitable equivalent. Take care not to touch the windings, frame, or any other hot surface with the fingers.

3. ADJUSTING PROCEDURES

3.001 ***List of Tools, Gauges, Materials, and Test Apparatus*** (equivalents may be substituted)

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
141 (2 reqd)	Cord Tip
411A (2 reqd)	Tool (test pick)
485A	Smooth-Jaw Pliers
563A	Offset Screwdriver
KS-6320	Orange Stick
→KS-14642	Oiler
R-1051	File
R-1102	Spudger
R-1542	3/4-Inch Adjustable Wrench
R-2670	3/32-Inch Allen Socket Screw Wrench
R-2959	1/16-Inch Allen Socket Screw Wrench
R-2966	Brush
—	4-Inch B Screwdriver
—	4-Inch E Screwdriver
—	5-Inch E Screwdriver
—	10-Inch Hand Bellows
→—	P-Long-Nose Pliers
—	Pliers, Waldes-Truarc No. 2, 90° Bent Tip, Waldes-Kohinoor Inc
—	Oiler, No. 1706, Gem Div Plews Oiler Co
↱—	1/16-Inch Drive-Pin Punch, L.S. Starrett Co No. 565 or Equivalent
↳	
GAUGES	
79F	Push-Pull Tension Gauge
131A	Thickness Gauge Nest
R-1032	Thermometer
R-2771	Spring Balance

CODE OR SPEC NO.	DESCRIPTION
MATERIALS	
KS-2423	Cloth
KS-6232	Mineral Oil, Light
KS-7470	Mineral Oil, Medium ←
KS-7860	Petroleum Spirits
KS-14666	Cloth
KS-16326 L1	Oil
—	260-300P Grease
—	8/0 Pouncing Paper
TEST APPARATUS	
1W13B (2 reqd)	Test Cord
81A	Test Set
—	Voltmeter, Model 904, 300/150 Volt Scale, Weston Instrument Co
— (2 reqd)	Leads, No. 4516, Weston Instrument Co

3.002 Care should be exercised when using petroleum spirits in power rooms where there are dc machines, since commutation may be adversely affected by softening of commutator film by the fumes. To avoid the need for burnishing the commutators of dc machines after doing any cleaning called for in this section, provide adequate ventilation. Use the absolute minimum amount of petroleum spirits required for the cleaning operation and keep the container closed when not in use.

3.003 ***Disengaging Driving Mechanism:*** Checking certain requirements necessitates manual rotation of the autotransformer shaft. In most cases, the driving mechanism must be disengaged from the autotransformer as follows.

(1) ***KS-5552 and KS-15680 Autotransformers:*** Using the proper size Allen Wrench, loosen the setscrews in the half of the coupling on the autotransformer shaft and disengage the coupling. Turn the radiator as required.

(2) ***KS-5621, KS-5702, KS-15779 Autotransformers and Autotransformers of KS-15508 and KS-15908 Regulators:*** Tag and disconnect the motor leads from the terminal block using the 4-inch E screwdriver. Remove the motor mounting plate screws and washers, if washers are provided, and remove the plate with the motor. Turn the radiator as required.

(3) ***KS-5775, KS-15581, KS-15682, and KS-15683 Autotransformers:*** Using the R-1542 adjustable wrench, remove the nuts that secure the gear case to the autotransformer and remove the gear case, carefully disengaging the coupling on the shaft. Turn the radiator as required.

(4) ***KS-15583 and KS-15684 Autotransformers:*** Using a pencil, mark the autotransformer sprocket and drive chain to obtain the same relation between the two when remounting the chain. Using the 5-inch E screwdriver, remove the screws and lockwashers that secure the gear case and motor to the autotransformer. Disengage the drive chain from the autotransformer sprocket by tilting the gear case and motor. Turn the radiator as required.

(5) ***KS-15585 and KS-15685 Autotransformers:*** Using a pencil, mark the autotransformer sprocket and drive chain to obtain the same relation between the two when remounting the chain. Also mark the vertical position of the motor mounting bracket for remounting it in the same position. Using the 4-inch E screwdriver, loosen the bracket mounting screws and lower the bracket and motor as far as the screw slots in the bracket will allow. Then remove the drive chain. Turn the autotransformer sprocket to rotate the radiator.

3.004 ***Remounting Parts***

(1) ***KS-5552 and KS-15680 Autotransformers:*** Engage the two halves of the coupling so that there is a clearance of approximately 1/64 inch between the end of the projections on one half and the bottom of the grooves on the other half. Securely tighten the setscrews.

(2) ***KS-5621, KS-5702, KS-15779 Autotransformers and Autotransformers of KS-15508 and KS-15908 Regulators:*** Making sure that the motor shaft meshes freely with the gear on the autotransformer shaft, mount the plate with the motor and securely tighten the screws. Connect the motor leads to the proper terminals on the terminal block, securely tightening the screws.

(3) ***KS-5775, KS-15581, KS-15682, and KS-15683 Autotransformers:*** Carefully engage the half of the coupling on the gear case shaft with the half on the autotransformer shaft and mount the gear case. Securely tighten the nuts.

(4) ***KS-15583 and KS-15684 Autotransformers:*** Position the chain on the autotransformer sprocket so that the lines marked on the chain and sprocket in 3.003(4) are in line. Tilt the gear case and motor and position the chain on the gear case sprocket. Then, mount the gear case and motor, securely tightening the screws. Make sure that the chain properly engages both sprockets.

(5) ***KS-15585 and KS-15685 Autotransformers:*** Position the chain on the sprockets so that the lines marked on the chain and autotransformer sprocket in 3.003(5) will be in line when the motor mounting bracket is positioned as covered in 3.003(5). Position the bracket and securely tighten the mounting screws. Make sure that the chain properly engages both sprockets.

3.01 ***Lubrication*** (Reqt 2.01)

(1) ***Motor Bearings:*** To lubricate the motor bearings, proceed as follows.

KS-5575, KS-15581, KS-15682, and KS-15683 Autotransformers: Fig. 2

(a) Tag and disconnect the leads from the terminals on the motor using the 4-inch E screwdriver.

(b) Note the position of the motor for remounting it in its original position. Then, using the 4-inch B screwdriver, remove the motor mounting screws and remove the motor.

(c) Note the position of the gear with relation to the end of the motor shaft. Using the proper size Allen wrench, loosen the setscrew and remove the gear. Note the position of the end cap for remounting it in its original position. Then, using the 4-inch E screwdriver, remove the motor assembly screws from the end cap and remove the end cap. Withdraw the rotor and remove the endplay washers, if provided. Mark the washers for remounting them in the proper order.

(d) Remove as much grease as possible from the unsealed side of the bearings using the R-2966 brush moistened with KS-7860 petroleum spirits. Wipe the bearings with a clean, dry KS-14666 cloth. Then, apply the 260-300P grease around the balls, filling the space between the inner and outer race approximately two-thirds full of grease.

(e) Remove grease from the bearing housings, using the R-2966 brush moistened with KS-7860 petroleum spirits. Wipe the housings dry with a clean KS-14666 cloth. Using another KS-14666 cloth moistened with KS-6232 light mineral oil, again wipe the bearing housings.

(f) Remount the washers, rotor, and end shield in reverse order of removal and securely tighten the screws. Place the gear in its original position on the shaft with the setscrew in line with the flat on the shaft. Securely tighten the setscrew.

(g) Remount the motor, making sure that the gear on the motor shaft meshes freely with the gear in the gear case. Securely tighten the screws. Connect the leads to the proper terminals on the motor, securely tightening the screws.

KS-15583 and KS-15684 Autotransformers: Fig. 3

(h) Tag and disconnect the motor leads from the terminal block using the 4-inch E screwdriver.

(i) Note the position of the motor for remounting it in its original position. Using the 4-inch E screwdriver, remove the motor mounting screws and remove the motor. Carefully pull the rotor out of the motor housing and remove the endplay washers, marking them for remounting in their proper order. Then clean and lubricate the bearings as covered in (1)(d) and (e).

Note: One of the bearings may be a double-shielded-type ball bearing and will not require lubrication.

(j) After lubrication, place the endplay washers in their proper order in the bearing housing in the motor end shield. Then position the rotor in the motor housing

and, making sure that the gear on the motor shaft meshes freely with the gear in the gear case, mount the motor and securely tighten the screws.

(k) Connect the motor leads to their respective terminals and securely tighten the screws.

Autotransformer of KS-15908 L1 Regulator

(*l*) Using the Gem oiler, apply the KS-16326 L1 oil to the motor bearing oil holes at each end of the motor. Take care to avoid an excess of oil.

(2) ***Autotransformer Shaft Bearings:*** To lubricate the autotransformer shaft bearings, proceed as follows.

KS-5552 (transtat): Fig. 1(A), KS-5552 (powerstat), KS-5621, and KS-5775 Autotransformers: Fig. 2(A)

(a) For the KS-5552 and KS-5621 autotransformers, disengage the driving mechanism as covered in 3.003.

(b) Using the Gem oiler, apply the KS-6232 oil between the bearings and adjacent collar. Avoid an excess of oil. For the KS-5552 (powerstat) and KS-5621 autotransformers, manually rotate the radiator and, for the KS-5552 transtat, rotate the brush holder arm back and forth several times to work the oil into the bearings. For the KS-5775 autotransformer, rotate the shaft by pushing in and turning the manual adjusting shaft knob. Wipe off excess oil with a clean KS-14666 cloth.

(c) Remount parts as covered in 3.004.

(3) *Gear Case*

KS-5775, KS-15581, KS-15682, and KS-15683 Autotransformers: Fig. 2

(a) Tag and disconnect the leads from the motor using the 4-inch E screwdriver. Remove the motor mounting screws with the 4-inch B screwdriver and remove the motor.

(b) Using the Waldes-Truarc pliers, remove the snap ring on the drive shaft. Before removing the gear case cover screws, wipe the drive shaft with a clean KS-14666 cloth to remove any dirt or grease. If the shaft is scored, smooth it, using the R-1051 file, to prevent damage to the drive shaft bearing in the gear case cover when removing the cover. Remove the cover screws with the 4-inch B screwdriver and slide the cover off the drive shaft.

(c) ***Gears:*** Using the R-2966 brush and a clean KS-14666 cloth moistened with KS-7860 petroleum spirits, wipe off as much of the old grease as possible from the surfaces and teeth of the gears. If necessary, remove hardened grease with the KS-6320 orange stick. Then, wipe the parts dry with a clean KS-14666 cloth. Apply fresh 260-300P grease sparingly with the R-2966 brush.

(d) ***Intermediate Gear Bearings:*** Using the Gem oiler, lubricate the intermediate gear bearings by applying KS-7470 oil between the shaft and the bearing race and turn the gears to work the oil into the bearings. Wipe off excess oil with a clean, dry KS-14666 cloth.

(e) ***Drive Shaft Bearing:*** Using the R-2966 brush moistened with KS-7860 petroleum spirits, clean the drive shaft bearing in the gear case cover. Wipe the bearing dry using a corner of a KS-14666 cloth. Then, using a clean R-2966 brush, brush KS-7470 oil on the bearing. Wipe away excess oil with a clean KS-14666 cloth.

(f) Wipe the drive shaft using a clean KS-14666 cloth moistened with KS-7470 oil so that the drive shaft bearing will slide over it easily when remounting the gear case cover. Then remount the cover and securely tighten the screws. Wipe the oil off the exposed portion of the drive shaft with a clean KS-14666 cloth.

(g) Remount the snap ring on the drive shaft. Remount the motor and securely tighten the screws. Connect the leads to the proper terminals on the motor, securely tightening the screws.

Vertically Mounted KS-15583 and KS-15684 Autotransformers: Fig. 3

(h) Tag and disconnect the motor leads from the terminal block using the 4-inch E screwdriver. Disengage the drive chain in

accordance with 3.003 and remove the motor and gear case.

(i) If the sprocket is secured to the drive shaft with a setscrew, note the position of the sprocket with relation to the end of the drive shaft to obtain the same relation when remounting the sprocket. Then, using the proper size Allen wrench, loosen the setscrew in the hub of the sprocket and remove the sprocket. If the sprocket is secured with a Rollpin, gently tap one end of the pin, using the pin punch and 4-ounce riveting hammer, until the other end of the pin extends beyond the hub of the sprocket. Then remove the pin using the P-long-nose pliers and remove the sprocket.

(j) Mark the gear case and gear case cover to obtain the same relation between the two when remounting the cover. Using the 4-inch E screwdriver, remove the gear case cover mounting screws. Then, if necessary, pry the cover free of the gear case with the screwdriver and remove the cover, pulling it off the drive shaft.

(k) Remove the plate that retains the three intermediate gears by gradually prying it off the shafts. Extreme care should be exercised to avoid bending the plate when removing it.

(*l*) To lubricate the drive shaft bearing at the motor end of the gear case, it will be necessary to remove the drive shaft. This may be done without removing the outermost intermediate gears as follows. While supporting the two outermost gears, gradually withdraw the drive shaft, allowing the gears to move outward until the drive shaft is free of the bearing.

(m) Clean and lubricate the gears, intermediate gear bearings, the drive shaft and the drive shaft bearings in the gear case and gear case cover in accordance with (3)(e) and (f).

(n) After lubrication, move the two outermost intermediate gears outward on their shafts sufficiently to permit insertion of the end of the drive shaft into the drive shaft bearing in the gear case. Then mount the drive shaft and, making sure that all the gears mesh freely, move the intermediate gears inward as far as possible. Mount the retaining plate on the intermediate gear shafts and push the plate inward as close as possible to the gear hubs.

(o) Mount the gear case cover and securely tighten the screws. Place the sprocket in its original position on the drive shaft and securely tighten the setscrew if provided. If the Rollpin is provided, line up the Rollpin hole in the hub of the sprocket with the hole in the drive shaft. Start the Rollpin through the hole using the P-long-nose pliers. Then tap the pin into place using the hammer. Position the gear case and motor on the autotransformer and remount the unit in accordance with 3.004(4). Then connect the motor leads to their respective terminals and securely tighten the screws.

Horizontally Mounted KS-15583 and KS-15684 Autotransformers: Fig. 3

(p) Using the 4-inch E screwdriver, remove the screw from the oil filler hole in the side of the gear case. If a screw is mounted in the overflow hole (the lower hole) in the side of the gear case, also remove this screw. Using the KS-14642 oiler, fill the gear case to the level of the overflow hole with KS-6232 oil. Then, remount the screws in the holes. Wipe off oil drippings with a clean, dry KS-14666 cloth.

(4) ***Exposed Gears, Sprockets, and Drive Chains***

(a) Remove as much of the old grease as possible with the R-2966 brush and a clean KS-14666 cloth moistened with KS-7860 petroleum spirits. If necessary, remove hardened grease with the KS-6320 orange stick. Then, wipe the parts dry with a clean KS-14666 cloth. Apply fresh 260-300P grease sparingly with the R-2966 brush.

3.02 ***Freedom of Rotation*** (Reqt 2.02)

(1) If the requirement is not met, check whether anything is jamming the autotransformer. If so, remove the object. If not, check requirement 2.04. If the requirement cannot be met, refer the matter to the supervisor for considering replacement of the autotransformer.

3.03 ***Condition of Slip Ring Surface*** (Reqt 2.03)

(1) If the requirement is not met, clean the slip ring surface using a clean KS-14666 cloth wrapped around the KS-6320 orange stick. If necessary, moisten the cloth with KS-7860 petroleum spirits.

3.04 ***Condition of Commutator Surface*** (Reqt 2.04)

(1) Clean the commutator surface using a KS-14666 cloth. If necessary, moisten the cloth slightly with KS-7860 petroleum spirits and then wipe the surface with a dry cloth. Cleaning the commutator surface in some cases may be facilitated by wrapping the cloth around a KS-6320 orange stick.

(2) If the commutator surface is rough, proceed as covered in (3) for rhodium- and gold-plated surfaces and as covered in (4) and (5) for unplated surfaces. A rhodium-plated surface may be identified by its silver color.

(3) If the condition of a rhodium- or gold-plated commutator surface causes poor commutation, replace the autotransformer. Slight roughness is not objectionable provided commutation is satisfactory. Never attempt to smooth the surface of a rhodium- or gold-plated commutator.

(4) If an unplated commutator surface is slightly rough, smooth it as follows. Place a KS-14666 cloth around the surface to prevent particles from falling into adjacent portions of the windings. Wrap a piece of 8/0 pouncing paper around the flat end of the R-1102 spudger or a suitable flat stick and smooth the commutator surface taking care to maintain the surface as flat as possible. After smoothing, remove any particles of carbon or dirt which may have been deposited on the commutator and associated parts using the 10-inch hand bellows or a clean KS-14666 cloth. Then, replace the brush or brushes as covered in Section 028-706-801.

(5) If the unplated commutator surface causes poor commutation, is badly roughened, and cannot be smoothed as covered above, replace the autotransformer.

3.05 ***Brush Contact With Commutator*** (Reqt 2.05)

(1) ***All Autotransformers Except KS-5552 Transtat:*** Fig. 5

(a) If part (1) of requirement 2.05(a) is not met, check requirements 2.04 and 2.06. If the requirement is still not met, replace both brush assemblies as covered in Section 028-706-801.

(b) If part (2) of requirement 2.05(a) is not met, replace both brush assemblies as covered in Section 028-706-801.

(2) ***KS-5552 Transtat:*** Fig. 1

(a) If part (1) of requirement 2.05(b) is not met, check requirements 2.04 and 2.06. If the requirement is still not met, replace the brush, as recovered in Section 028-706-801.

(b) If part (2) of requirement 2.05(b) is not met, loosen the brush unit plate mounting screws using the 4-inch E screwdriver, and move the plate along the screw slots to center the brush on the commutator. Then, securely tighten the screws.

3.06 ***Brush Pressure*** (Reqt 2.06)

(1) ***All Autotransformers Except KS-5552 Transtat and Autotransformer of KS-15908 Regulator:*** Fig. 5

(a) If the requirement is not met, check requirement 2.07. If requirement 2.07 is met and this requirement is not, adjust the pressure of the brush springs as follows. Remove the brush spring mounting screws and lockwashers which secure the brush shunt terminals. Slightly loosen the other brush spring mounting screws and swing the springs outward to disengage them from the brush holders. Increase or decrease the tension in the spring legs associated with the brush unit by bending the legs with the 485A smooth-jaw pliers as required. Adjust both legs, since it is desirable to have the total tension distributed between the two legs. Take care, while bending, to maintain a gradual curve in the spring legs. Remount the brush springs in the reverse order of removal. Make sure that both brush shunts lie as close to the radiator as possible so

that they do not touch the frame when the radiator is rotated. Then, recheck the requirement.

(2) ***KS-5552 Transtat and Autotransformer of KS-15908 Regulator***

(a) If the requirement is not met, replace the brush as covered in Section 028-706-801.

3.07 ***Clearance Between Brush Springs and Radiator*** (Reqt 2.07)

(1) ***All Autotransformers Except KS-5552 Transtat and Autotransformer of KS-15908 Regulator***

(a) If the requirement is not met, replace both brush assemblies as covered in Section 028-706-801.

3.08 ***Clearance Between Brush Holder and Commutator Bands*** (Reqt 2.08)

(1) ***KS-5552 Transtat***

(a) If the requirement is not met, replace the brush as covered in Section 028-706-801.

3.09 ***Clearance Between Brush Holder Lugs and Brush Support*** (Reqt 2.09)

(1) ***Autotransformer of KS-15908 L2 Regulator***

(a) If the requirement is not met, replace the brush assembly as covered in Section 028-706-801.

3.10 ***Limit Switches*** (Reqt 2.10)

(1) ***All Autotransformers Except KS-5552 Transtat:*** Fig. 7

(a) Referring to Fig. 7, hold the actuator associated with the switch and slightly loosen the actuator mounting screw with the 4-inch E screwdriver. Move the actuator along the screw slot toward the switch for earlier operation of the switch and away from the switch for later operation. Then, securely tighten the screw. In cases where the actuator is not adjustable or where further adjustment than the screw slots will allow is necessary, adjust the operation of the limit switch by bending the switch lever with the 485A smooth-jaw pliers. Then, recheck the requirement. If the requirement cannot be met, replace the limit switch as covered in Section 028-706-801.

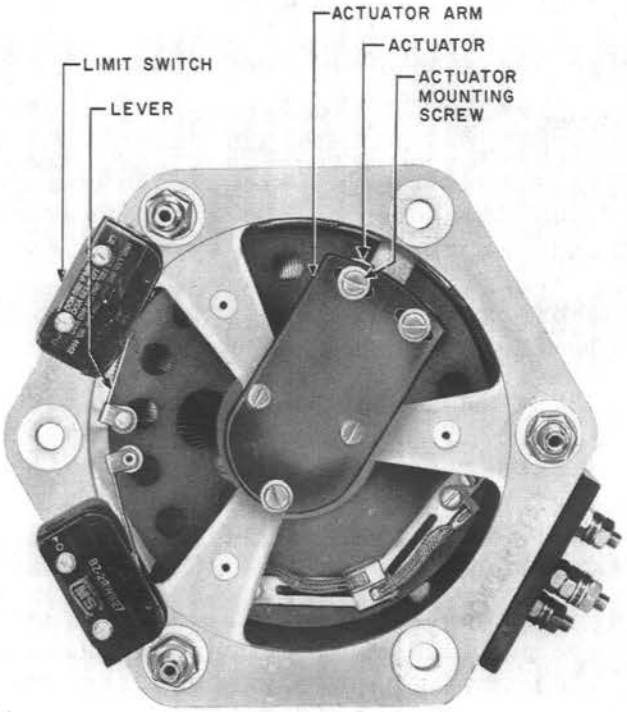


Fig. 7 – KS-15685 Autotransformer

(2) ***KS-5552 Transtat:*** Fig. 1

(a) Using the 4-inch E screwdriver, remove the limit switch bracket mounting screws and move the bracket away from the autotransformer. Then, using the R-1542 adjustable wrench, loosen the switch mounting nut on the plunger side of the bracket. Using the blade of the screwdriver, turn the nut on the switch side of the bracket, moving the switch towards the shaft for earlier operation of the switch and away from the shaft for later operation. Remount the switch, securely tightening the nut. Remount the bracket and securely tighten the screws. Recheck the requirement. If the requirement cannot be met, replace the limit switch as covered in Section 028-706-801.

3.11 ***Fuse Wire*** (Reqt 2.11)

(1) If the requirement is not met, press the fuse wire so that it rests smoothly against the autotransformer windings. If the V shaped insulator does not hold the fuse wire against the windings, the fuse wire may have stretched or the spring on the insulator may be defective. Replace the fuse wire or the spring as covered in Section 028-706-801.

3.12 ***Temperature*** (Reqt 2.12)

Autotransformer Windings

(1) If the requirement is not met, check requirements 2.03, 2.04, 2.05, and 2.06. If these requirements are met, check that all leads to the autotransformer are connected to their proper terminals and that the input voltage and output current stamped on the nameplate are not exceeded. If the excessive temperature persists, replace the autotransformer.

(2) On autotransformers provided with fuse wires, opening of the autotransformer circuit caused by melting of the fuse wire shows that the temperature was excessively high in the autotransformer windings. Open circuit in the fuse wire can be checked with the 81A test set with 1W13B cords, each equipped with a 141 cord tip on one end and a 411A tool (test pick) on the other. To check for an open fuse wire, first disconnect one of the fuse wire leads from the terminal board on the autotransformer using the R-1542 adjustable wrench, then apply the test picks to the terminals of the fuse wire. If the fuse wire is open, replace the autotransformer.

Caution: Make sure that the autotransformer is disconnected from supply and load before checking the fuse wire with the test set.

Motor Frame

(3) If the requirement is not met, check requirement 2.02. If requirement 2.02 is met and the excessive temperature persists, replace the motor as covered in Section 028-706-801.

REASONS FOR REISSUE

1. To add the motor bearing and gear case lubrication requirement notes for KS-15684 autotransformers equipped with Slo-Syn motors (2.01).
2. To revise the interval for lubricating the motor bearings of KS-15581 and KS-15682 autotransformers (2.01).
3. To add the lubrication requirement and procedure for the gear case of vertically mounted KS-15583 and KS-15684 autotransformers (2.01, 3.01).
4. To revise Fig. 2 and 3.
5. To add the 1/16-inch drive-pin punch, P-long-nose pliers, and the KS-7470 oil and to substitute the KS-14642 oiler for the KS-14796 oiler in the List of Tools, Gauges, Materials, and Test Apparatus and wherever else specified in the section (3.001).
6. To revise the procedures for lubricating the bearings in the motor of KS-15583 and KS-15684 autotransformers (3.01).