C L A U D E L Y O N S L I M I T E D

A U T O M A T I C

V O L T A G E

S T A B I L I S E R T Y P E T S

(PATENTS APPLIED FOR)

TYPE TS- 35-448

SERIAL NO. [redacted] 477251

CLAUDE LYONS LIMITED · STABILISER DIVISION

VALLEY WORKS · HODDESDON · HERTS

Telephone: Hoddesdon (OWX 24) 4541-8 Telex: 22724

Cables & Telegrams: MINMETKEM HODDESDON TELEX

Regd. Office & Export Dept: 76, Old Hall Street · Liverpool 3

Telephone: (051) MARitime 1761

CLAUDE LYONS LIMITED

HIGH-SPEED AUTOMATIC VOLTAGE STABILISERS

TS SERIES WITH TRANSISTORISED SERVO AMPLIFIER.

SECTION 1.

1. GENERAL

1.1 The automatic voltage stabiliser is essentially comprised of four major units which are as follows:-

a) A transistorised servo amplifier.

b) A geared reversing motor.

c) A 'Variac' Continuously Adjustable Auto Transformer.

d) A fixed ratio auxiliary transformer.

1.2 The servo amplifier monitors the output voltage of the stabiliser and controls the supply of current to the armature of the geared reversing motor, which has a permanently excited shunt field. The motor shaft is mechanically coupled to the variable arm of the 'Variac' Transformer which is a toroidally wound continuously variable auto transformer. The fixed ratio auxiliary transformer has a primary winding connected across the variable output of the 'Variac' Transformer, and two low voltage high current secondary windings connected in series between the supply and the load.

1.3 All connections to the servo amplifier terminate at a multi-point connector. This enables the unit to be easily withdrawn for replacement if necessary.

2. INSTALLATION AND OPERATING INSTRUCTIONS

2.1 Inspection

2.1.1 The stabiliser should be examined carefully when received for physical damage sustained during transit. Particular attention should be paid to the 'Variac' brush assembly. The carriers must be informed of all transit damage.

2.1.2 Installation - Stabilisers Type TS-3, 4, 5, 6, 7.

2.1.3 Remove cover to expose terminals. If dirt has accumulated inside the stabiliser during storage, clean it out with compressed air or a soft bristle brush.

2.1.4 Connect the stabiliser to a suitably fused mains point (see paragraph 4.1), using cable of 25% higher rating than the desired output current.

2.1.5 Three-Phase Operation

2.1.6 Three TS stabilisers of the same size can be used on a 3-phase, 4-wire 'star' supply, one stabiliser controlling each phase-neutral voltage.

The neutral must be taken to the star point of the three stabilisers and preferably also to that of the load to ensure correct balance.

3. VENTILATION

3.1 When positioning the stabiliser, ensure that free air access is maintained through base and louvres of stabiliser.

4. OPERATION

4.1 This stabiliser has been set as follows:-

Output Voltage: 240V ± 0.5%
Input Voltage: 170-260V
Mains Frequency: 50~
Output Current: 17.5A
Maximum Input Current Fuse Rating:

4.1.1 The output voltage can be continuously varied from 200-254 volts (100-127 volts 'L' models). Under no circumstances must the output voltage be set to a higher voltage than 254 volts (127 volts).

4.1.2 Input voltage range can be changed by adjustment of tap on 'Variac' and the current rating of the stabiliser can be doubled or halved by connecting the transformer windings in series or in parallel, (for details see paragraph 7.1.9. The above facility however may not apply to stabilisers ordered with a non-standard rating.

6. GUARANTEE

6.1 This stabiliser has been exhaustively tested before despatch and should give years of trouble free service. In the event of a failure during one calendar year from the date of receipt by the customer, the stabiliser will be repaired free of charge provided that it has been used within its mechanical, electrical and environmental rating, and provided it is returned to our Works carriage paid. No responsbility can be accepted for any consequential damage.

SECTION 2.

7. CIRCUIT DESCRIPTION

7.1 Power Circuit

7.1.1 The operating principle of the stabiliser is that an in-phase or out-of-phase voltage of variable magnitude is applied to the primary winding of the buck-and-boost transformer T1, so as to control the voltage in the secondary winding, which is connected in series between the supply and the load (see paragraph 7.1.8).

7.1.2 The 'Variac' winding (T2) is connected across the controlled mains supply. The output from the 'Variac' is taken to the primary winding of the transformer T1 via a fixed and a variable tapping on the 'Variac' winding. The variable tapping is provided by brushes which traverse a specially prepared track on the winding. When the position of the brushes coincides with the position of the fixed tapping, the output voltage from the 'Variac' will be zero. The moveable arm or brushgear is rotated by the geared motor, and movement of the brushes in either direction from the zero position gives gradually increasing output voltage.

7.1.3 In Type TS-6 the variable transformer consists of a ganged parallel connected assembly of two 'Variac' units. In order to limit circulating currents, a balancing choke is inserted between the brushes. Type TS-7 employs a three gang parallel assembly incorporating two chokes.

7.1.4 When the mains supply voltage falls, the servo-amplifier supplies negative current with respect to earth to the motor armature. The motor then moves the brushgear of the 'Variac' in such a direction as to cause an in-phase voltage build-up in the secondary winding of the transformer T2. This voltage boosts the low mains and continues to build-up until the output voltage of the stabiliser is restored to normal. When the value of the output voltage has been restored to normal, the servo-amplifier cuts the supply of negative current to the motor and the movement of the 'Variac' brushgear is stopped.

7.1.5 Should the mains supply voltage rise, positive current is supplied to the motor, which drives the brushgear of the 'Variac' in the opposite direction, reducing the voltage supplied to the transformer T1. As the brushgear passes the position of the fixed tapping, the voltage in the transformer is reduced to zero and then begins to build up 180° out-of-phase to the supply voltage. The voltage in the secondary winding of the transformer now opposes the increased input voltage and continues to build up until the stabiliser output voltage is again restored to normal, when the servo-amplifier again stops the motor.

7.1.6 If the variations in the supply voltage are greater than the acceptance range of the stabiliser, the 'Variac' brushgear will be driven to one or other of its extremities without full correction being achieved. In order to prevent possible damage to the motor or to the 'Variac', limiting devices are fitted. Models TS-1 and TS-2 have a slip clutch which limits the torque transmitted to the 'Variac'. A slip clutch consists of a stainless steel shaft running in an oil lined bearing which is inserted in one half of the flexible coupling. The shaft has a circular groove with a dimple.

A spring loaded ball runs in the groove and engages in the dimple, the torque at which the clutch will slip is set to the 22 lbs/ins. Models TS-3, TS-4, TS-5, TS-6 and TS-7 have limit switches incorporated in the motor armature circuit which break the motor supply when the limit is reached. A rectifier is connected in series but in opposite polarity to each limit switch, and these two limit circuits are connected in parallel to the same motor brush. There are therefore separate paths for the supply of either positive or negative current to the motor. If the servo-amplifier is supplying the motor from a positive source (the stabiliser is correcting for a rise in the supply voltage) when a limit is reached, the limit switch which operates breaks the positive current path and stops the motor. Current of the opposite polarity is able to flow however so that the motor is able to reverse away from the limit when the supply voltage returns within the acceptance range of the stabiliser.

7.1.7 Series TS high-speed automatic voltage stabilisers have two important features which are not mentioned in the foregoing circuit description, these features are incorporated in all standard models in the TS range, but are not incorporated in models made to special order unless otherwise stated.

7.1.8 The secondary winding of the buck-and-boost transformer T1 although considered as a single winding for the purposes of explanation, actually comprises two separate windings which may be connected either in series or in parallel (see circuit diagram). A terminal panel on the transformer has four terminals marked 1 - input, 3, 2, 4 - output, which are provided with connecting links. When a stabiliser is series connected, terminals 3 and 2 are linked, whilst for parallel connection, terminals 1 and 3 and terminals 2 and 4 are linked. A series connected stabiliser has twice the speed of correction, twice the input voltage range and half the current rating of the parallel connected version (see table 7.1.11).

7.1.9 The 'Variac' transformer T2 has three alternative fixed output tappings (A, B, C in circuit diagram) which provides three alternative input voltage ranges for each model. For a series connected stabiliser which has a total input voltage range of 25% of the nominal operating voltage, this range can be proportioned as -17½% to +7½%, ±12½%, or -7½% to +17½%, by connecting the Taps A, B and C respectively (see table 7.1.12). With Types TS-6 and TS-7 which employ ganged 'Variac' Assemblies (see paragraph 7.1.3), it is most important that all 'Variac' units are connected for the same tapping as paralleling of 'Variacs' with different taps connected will cause destructive short circuit currents to flow.

7.1.10 All models are supplied set for series connection Tap A, 240 volts output, (input 198-258 volts) unless specifically ordered at other settings. Where models are supplied at other settings, suffixes to the type number indicate the setting chosen, and this information together with the output voltage setting, input voltage range and current rating are stamped on the stabiliser rating plate. Suffixes B and C indicate the respective alternative settings of the input voltage range, and suffix 'P' indicates parallel connection.

7.1.11 Table of Current Ratings and Speeds of Correction for Series TS

Model	Series Connection		Parallel Connection	
	Output Current (Amps.)	Approx. Speed of Correction	Output Current (Amps.)	Approx. Speed of Correction
TS-1	4	60 volts/sec	8	30 volts/sec
TS-2	12	60 volts/sec	24	30 volts/sec
TS-3	32	40 volts/sec	64	20 volts/sec
TS-4	62	20 volts/sec	124	10 volts/sec
TS-5	84	4 volts/sec	168	2 volts/sec
TS-6	168	2 volts/sec	336	1 volt/sec
TS-7	252	1 volt/sec	504	0·5 volts/sec

7.1.12 Table of Input Voltage Ranges for Parallel and Series Connection and at various Operating Voltages

Output Setting	Input Voltage Range - Series Connection			Input Voltage Range - Parallel Connection		
	Tap A	Tap B	Tap C	Tap A	Tap B	Tap C
200	165-215	175-225	185-235	183-207	188-212	193-217
210	173-226	184-236	194-247	192-218	197-223	202-228
220	182-236	193-247	204-258	201-228	206-234	212-239
230	190-247	202-259	213-270	210-239	216-244	221-250
240	198-258	210-270	222-282	219-249	225-255	231-261
250	206-269	219-281	231-294	228-259	234-266	241-272

7.2 SERVO-AMPLIFIER

7.2.1 Transformer T3 is fed from the output of the stabiliser by fuse F1 and has several functions. Referring to Drawing No. HAC 10276 at the rear of the handbook, secondary winding (a) and the silicon diodes D3 and D4, provide a negative bias supply isolated from earth for transistor Q1. Secondary winding (b) supplies diodes D7 and D8 which provide a high positive supply with respect to earth for transistor Q2. The main positive and negative supplies are taken from the tappings on this winding, D5 and D6 providing the main negative supply and D9 and D10 the main positive supply. The shunt field of the d.c. geared motor is directly connected across these supplies.

7.2.2 Secondary winding (c) of transformer T3 samples the stabiliser output voltage, and this proportional voltage is fed via potentiometer RV1 which permits adjustment of the stabilised voltage level to bridge rectifiers D11, D12, D13 and D14. The smoothed output across C2 is thus a d.c. voltage proportional to the a.c. output voltage of the stabiliser. This d.c. voltage is supplied to a Zener diode bridge R3, R4, D16, D5, the bridge output being proportional to the error between the measured voltage and the Zener diode reference voltage.

7.2.3 The bridge output is applied to the base of the current amplifier and transistor Q2, which is an emitter follower driving the base of Q3. The output at the collector of Q3 drives the base of Q1 and the bias on this latter transistor is such that when Q1 is fully conductive, Q3 is cut off and vice-versa, with a smooth variation between these states as the drive to Q3 (and thus the error voltage at the Zener diode bridge) varies.

7.2.4 Q1 and Q3 act as switches controlling the motor armature supply when Q1 is fully conductive the motor is supplied from the negative source D5 and D6, and when Q3 is fully conductive, the motor is supplied from the positive source D9 and D10. In this second condition diode D15 provides a direct power for the motor current which would otherwise have to pass through R1 and the bias supply. Under balance conditions, both transistors are partially conductive, the voltage drop across them being such that the emitter of Q1 is at earth potential so that no motor supply is available.

7.2.5 The sensitivity of the stabiliser is controlled by potentiometer RV2, which is in series with the smoothing condenser C2. As the resistance increases, the a.c. ripple of the voltage across the bridge increases, and therefore the ripple of the differential voltage applied between base and emitter of Q2 also increases. The voltage difference required between the point of Q2 being fully conductive and fully non-conductive is thus increased, which results in a decrease in sensitivity of the servo-loop.

7.3 ADJUSTING THE OUTPUT VOLTAGE

7.3.1 Adjustment of the stabilised output voltage (screwdriver adjustment available through panel labelled "output voltage") is affected by the potentiometer RV1, and normally an adjustment range of 200 to 254 volts ('L' models 100 to 127 volts) is available. The input range will alter in proportion to the change in the output voltage.

7.3.2 The output voltage must not be increased beyond 254 volts ('L' models 127 volts), unless the stabiliser has been designed for a high output voltage.

7.3.3 Certain special models may have a two or three position switch on the panel. This switch does not affect the output voltage selected, but ensures that the stabiliser will stabilise over the whole input voltage range at all selected output voltages.

7.4 SENSITIVITY ADJUSTMENT

7.4.1 The stabiliser is despatched set to the maximum sensitivity without appreciable overshoot. Where the highest degree of stabilisation is required and a little overshoot can be tolerated, the potentiometer can be set to a higher sensitivity (in a clockwise direction). Where less accurate operation is adequate, 'Variac' brush wear can be reduced by decreasing the sensitivity.

SECTION 3.

8. MAINTENANCE

8.1 General

8.1.1 The stabiliser must be kept free from dust and dirt, particularly the brush track on the 'Variac', which should be cleaned by means of a soft bristle brush or cloth. Never use an abrasive as this will damage the track plating.

8.2 'Variac' Brushgear

8.2.1 Brush wear on the 'Variac' should be checked once every six months, since excessive wear can cause damage to the brush track. The 'Variac' brushes should be replaced when worn down to within 1/16" of the metal clamp. The brush holder should also be examined to ensure free movement up and down.

8.2.2 When replacing the brush, it may be necessary to rotate the brushgear to a more convenient position. For stabilisers TS-1, TS-2 and TS-3, remove rubber bung and adjust gear box shaft with screwdriver. For stabilisers TS-4, TS-5 and TS-7, switch off the supplies to the stabiliser and the load. Disconnect the load at the stabiliser output terminals, and then switch on the supplies to the stabiliser. The position of the brush may now be adjusted by altering the setting of the potentiometer RV1, (see paragraph 7.3.1), and when a convenient position has been found, the stabiliser supply should be switched off. When the stabiliser is replaced in service, RV1 must be re-adjusted to give the correct value of stabilised output voltage.

8.3 Lubrication

8.3.1 The bearings of the motor are packed with grease before despatch, and will not normally require replenishment.

SECTION 4.

9. SERVICING

9.1 Simple Servicing Procedure

9.1.1 No Output Voltage: Check supply fuse - input and output connections.

9.1.2 Incorrect Output Voltage - No Movement of 'Variac' Brushgear or Motor: Check fuse F1 - turn the output voltage control from one end of its travel to the other - if there is no movement, replace servo-amplifier (see paragraph 9.4), or follow "Advanced Servicing Instructions". Where more than one TS stabiliser is in use, check servo-amplifier by substitution. To remove servo-amplifier, unscrew the four 2BA dome headed screws (the screws cannot be removed as they are held in case by means of circlips) and unplug the 9-pin plug. When replacing servo-amplifier, re-set output voltage.

9.1.3 Erratic Output Voltage Control: Check 'Variac' brushgear and track (see paragraph 8.2). The brush holders should move freely up and down and make good contact with the track. Check output control potentiometer by connecting a voltmeter between adjacent tags, and as the potentiometer is turned from one end of its travel to the other, the voltage should vary from 0 to 13 volts a.c. If the movement of the 'Variac' is jerky or oscillates, turn the sensitivity control (RV2), mounted on the face of the servo-amplifier, a little anti-clockwise (see paragraph 7.4).

9.2 Advanced Servicing Procedure:

(To be undertaken only by skilled personnel).

9.2.1 Uncouple motor from 'Variac' by loosening the grub screw securing the motor shaft to the motor. Move the 'Variac' brushgear with an insulated rod so that the output voltage is 240 volts. Set the sensitivity control (located on servo-amplifier heat sink) fully anti-clockwise. NOTE: Some tests are carried out with the output voltage control potentiometer fully anti-clockwise - this condition is indicated by "A"; other tests are made with the control set fully clockwise, indicated by "C".

9.2.2 Test No. 1: Potentiometer set to "A". Motor should run full speed (approximately 900 r.p.m. armature speed) in a clockwise direction (view from non-drive end of shaft). Voltage across field (blue and white leads) equals to 18 volts d.c. Voltage across armature (red and black leads) equals to 6·5 volts d.c.

9.2.3 Test No. 2: Potentiometer set to "C". Motor should run full speed in an anti-clockwise direction, field voltage as above, armature voltage 8 volts d.c. (reversed polarity to above).

9.3 Faults

9.3.1 If the motor does not turn but the motor voltages are correct, the motor is faulty.

9.3.2 If the motor functions as above but when coupled to the 'Variac', the brushgear does not move, check slip clutch (paragraph 9.3.6) and brush arm locking screw.

9.3.3 Stiffness of 'Variac': Strip down 'Variac' and examine shaft for high spots. Grease bearing with light grease and re-assemble.

9.3.4 'Variac' Transmission Loose: Tighten grub screw securing 'Variac' to shaft and 'Variac' shaft to brushgear.

9.3.5 Motor Turns in One Direction Only: (TS-3, TS-4, TS-5, TS-6 only). Check limit switches S1 and S2 and diodes D1 and D2 (situated near the motor).

9.3.6 Slipclutch: (TS-1 and TS-2 only). The slip clutch consists of a stainless steel shaft with a groove and dimple. The spring loaded ball runs in the groove and engages in the dimple. The torque at which the clutch will slip is set by means of a torque wrench to 22 lbs/ins. To increase the torque tighten the 2BA screw by ⅛ turn at a time. When adjustment is completed, tighten the locknut.

9.3.7 Motor turns 'Variac' Brushgear but voltage does not change, or changes Erratically: Check 'Variac' brush(es) to ensure good contact with track. Examine 'Variac' for broken turns or tapping - check brush to terminal connection for continuity (the connection is made either by a "slip ring" or "pigtail wire") - examine connections between 'Variac', buck and boost transformer and terminal panel - test buck and boost transformer.

9.4 Servo-Amplifier Servicing

9.4.1 To remove the servo-amplifier from the unit, unscrew the four 2BA dome headed screws (the screws are held captive by a circlip and need not be removed). To gain access to the components, unscrew the four 6BA screws retaining the black panel to the box. The panel can be swivelled upwards and laid on top of servo-amplifier box. To gain access underneath the printed circuit board, remove the two front 2BA dome headed screws by removing the circlip, unscrew the four 4BA screws retaining the cover to the transformer; the cover can now be removed. To lift printed circuit board, remove the four 6BA screws holding the board to the transformer. The board can then be swivelled upwards. Note that four insulated washers are placed between the board and the captive nuts.

9.4.2 Take voltage readings as listed. Where the voltage is measured on a diode, the top termination is negative and the body positive. The body of the diode may be painted but electrical contact can easily be made with a sharp prod.

9.5 NOTE: Further advice and assistance may be obtained from:-

CLAUDE LYONS LIMITED,
STABILISER SERVICE DEPARTMENT,
VALLEY WORKS,
HODDESDON, HERTS.

(Telephone: HODdesdon (OWX 24) 4541. Telex: 22724.
Telegrams and Cables: MINMETKEM HODDESDON TELEX).

9.5.1 Repairs and servicing and replacement of stabilisers and their components can only be undertaken by the Stabiliser Service Department at the above address. Equipment returned to us for these purposes should be sent carriage paid and preferably accompanied by a letter giving details of the fault condition or explaining the type of servicing required. Where it is necessary for servicing to be carried out at customer's premises, the engineer's time and expenses will be charged.

9.6

Test No.	Output Voltage Pot. RV1 Setting	Points at which voltage reading is taken.		Volts	If voltage is incorrect, suspect component indicated (or wiring to component).
		- (unless AC)	+		
3	C	PL1 Pin 1	PL1 Pin 2	240V AC	T1, PL1, SKT1 (PL2, SKT2, TS-3R only),
4	C	D10-	D9-	22V AC	T3,
5	C	C4-	C4+	18V DC	D5, 6, 9, 10,
6	C	D8-	D7-	31V AC	T3,
7	C	Q2:C	D8+	14V DC	D7, 8,
8	C	D3+	D4+	9V AC	T3,
9	C	R1-	R1+	3V DC	D3, 4 (voltage low) D15 (voltage high)
10	C	D11-	D12-	18V AC	T3, PL1, SKT1, RV1, (PL2, SKT2, TS-3R only),
11	A	D11-	D12-	31V AC	T3, PL1, SKT1, RV1, (PL2, SKT2, TS-3R only),
12	A	C2-	C2+	40V DC	D11, 12, 13, 14, C2, RV2,
13	C	R4-	R4+	1·3V DC	R4, R3, R8,
14	A	D16-	D16+	27V ±10%	D16, R5,
15	C	Q2:C	Q2:E	15V DC	Q2,
16	C	Q3:E	Q3:B	5V DC	R6,
17	C	Q3:C	Q3:E	18V DC	Q3,
18	C	Q1:C	Q1:E	Below ± ·5V DC	R1, Q1,
19	A	Q2:C	Q2:E	Below ·5V DC	Q2,
20	A	Q3:C	Q3:E	Below ·5V DC	Q3,
21	A	Q1:C	Q1:E	16V DC	Q1,

9.6.1 If all the above voltages are correct but the voltage at the terminals of the motor are incorrect, suspect PL1 and SKT1 or a broken wire.

9.6.2 C4 acts as a surge suppressor and a repeated failure of Q1 or Q3 may indicate C4 O/C.

9.6.3 On completion of servicing, re-set sensitivity potentiometer (see paragraph 7.4.1), and set output voltage.

SECTION 5.

10. PARTS LIST SUFFIX A.

10.1 Any component of equivalent or higher rating can be substituted for the make and type of component listed. If the component to be substituted is larger than the one removed, this can easily and neatly be done by suitably bending the leads before inserting the wires through the holes in the printed circuit board.

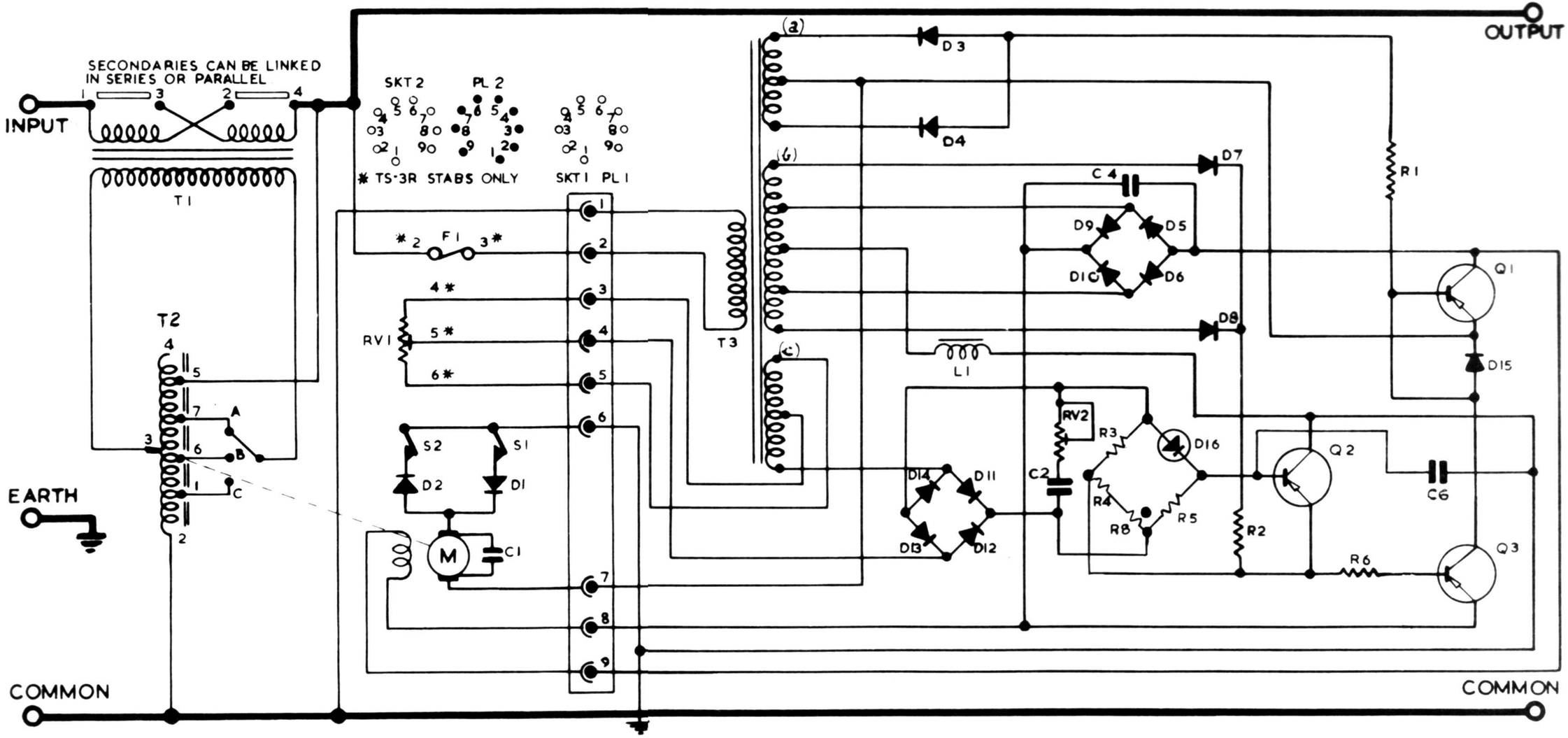
10.1.1 The values and reference numbers of parts listed are suitable replacements, but are not necessarily the parts fitted.

Circuit Ref.	Description	Manufacturer and Ref. No.	Ref. No. of Inter Services Equivalent.	Price £	s	d
R1	33Ω 1W ±10%	Morganite Type Y	5905-99-022-1048		1:	6:
R2, 5	270Ω 1W ±10% Grade 1	Welwyn Type F22A	5905-99-011-3241		1:	6:
R3	2·7K 1W 10% Grade 1	" " "	5905-99-011-3265		1:	6:
R4, 6	150Ω 1W ±10% Grade 1	" " "	5905-99-011-3235		1:	6:
R8	Thermistor	Mullard VA1034			2:	9:
RV1	100Ω 2W Pot.	Colvern CLR4001/15S	5905-99-027-1307		6:	9:
RV2	25Ω 1W Pot.	Colvern CLR1106/9S	5905-99-011-9843		6:	6:
D1 to 15	750mA at 55°C 200 PIV silicon diode	Bradley DD236	5960-99-037-2046 (CV7027)		7:	2:
D16	27V ±10% 1W Zener Diode	Bradley ZD527	CV7213	2:	5:	0:
C1	1mf 150V Cond.	Dubilier Type A77	5910-99-011-5322		6:	6:
C2	250mf 50V electrol	Hunts MEF45T	5910-99-014-5517		2:	3:
C4	16mf 450V	Hunts JFQ554AT	5910-99-014-5507		3:	0:
C6	0·1mf 150V	Hunts BD600	5910-99-940-1619		1:	2:
Q1, 2, 3	Germanium power transistor	Mullard OC28	5960-99-037-2160 (CV7085)	1:	8:	2:
S1, 2	Limit Switch (not used on TS-1 and 2)	Bulgin S509	5930-99-932-3139		10:	2:
T1	Buck & Boost Transformer	Claude Lyons Ltd. Quote Type & Serial No. of stabiliser		Price on Application		
T2	'Variac'	Claude Lyons Ltd. Quote Type & Serial No. of stabiliser		Price on Application		
T3	Sensor Transformer	Claude Lyons Ref. No. K.4585		4:	17:	6:

PARTS LIST (Cont.)

Circuit Ref.	Description	Manufacturer and Ref. No.	Ref. No. of Inter Services Equivalent	Price £ s d
M	Motor	TS-1, 2, 3 Parvalux Ref. W/O 077621. TS-4,5,6,7 Quote Serial No. of Stabiliser when ordering spares.		12: 18: 0:
	Slip Clutch	Claude Lyons Ref. No. TS-31		1: 12: 0:
Li	Motor Series Choke	Claude Lyons Ref. No. K.4808		13: 6:
Fl	Fuse	Bulgin L693/1	5920-99-059-0109	9:
	Servo-Amplifier, complete			30: 0: 0:
	Motor Brushes, (per set of 2)	Parvalux		9: 0:

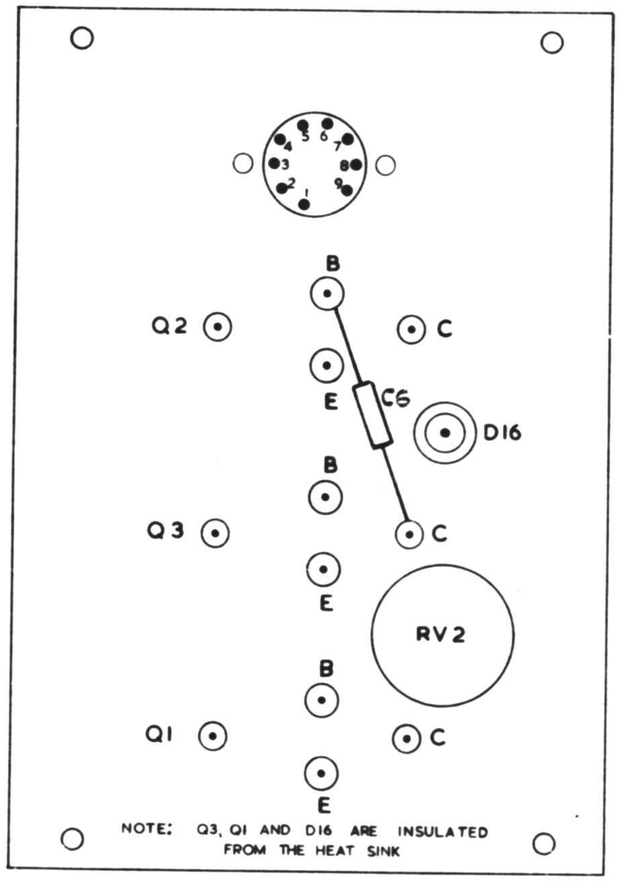
TITLE	DRAWN	ISSUE No	2	3	A		SCALE	DRAWING No.
SERIES TS A.C. STABILISER MARK IV	E.F.	1						HAC 10276
	CHECKED	DATE	7-11-62	20-3-63	26-7-63			
		16-7-62						



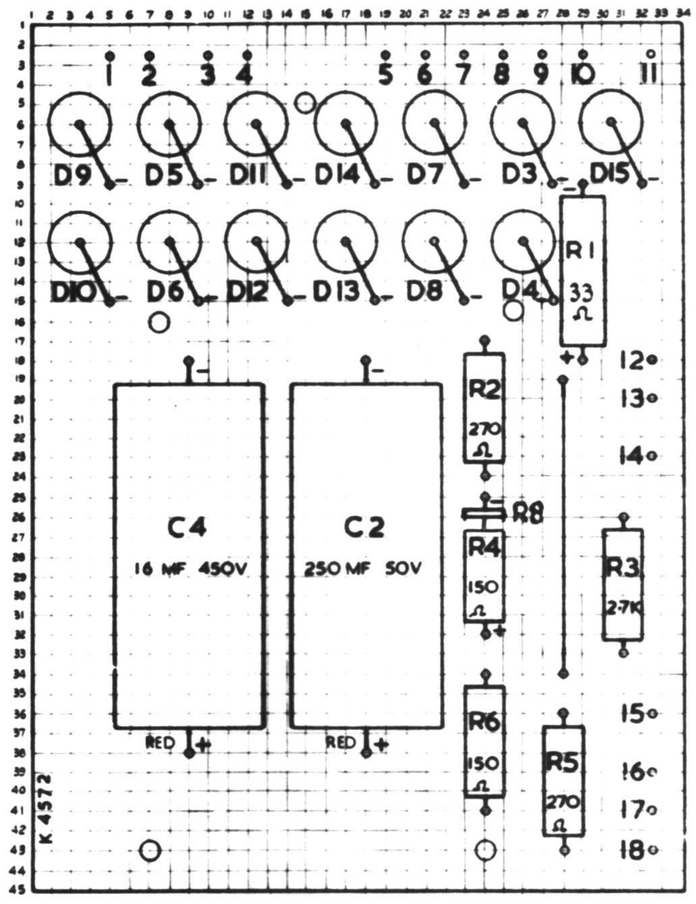
Claude Lyons Ltd. HODDESDON HERTS ENGLAND	MATERIAL	FINISH	TOLERANCES	CODE	No.	DESCRIPTION	STORES REF
DRAWING No. HAC 10276			FRACTIONAL DIMENSION ± 1/32" DECIMAL DIMENSIONS ± .005" OR AS OTHERWISE STATED				NUMBER OFF
							USED ON

TITLE	DRAWN	ISSUE No.						SCALE	DRAWING No.
SERVO - AMPLIFIER MARK IV	E.F	1	2		A				HAC 10276/1
	CHECKED	DATE							
		18-7-62	20-3	63	26-7-63				

THIRD ANGLE PROJECTION



SERVO - AMPLIFIER
TRANSISTOR MOUNTING PLATE

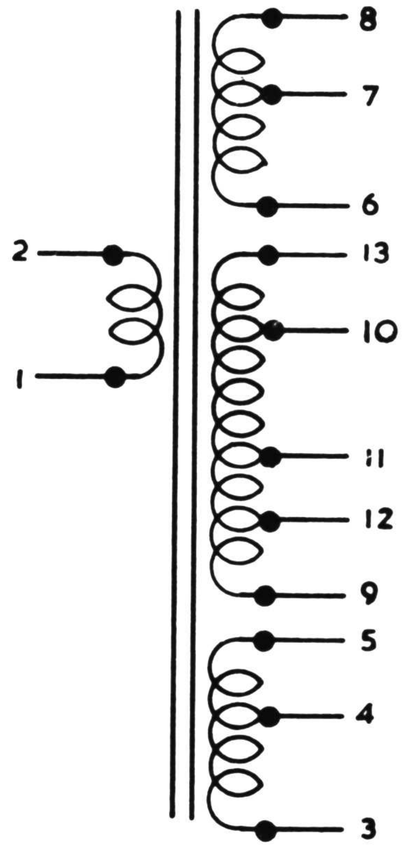


SERVO - AMPLIFIER COMPONENT BOARD

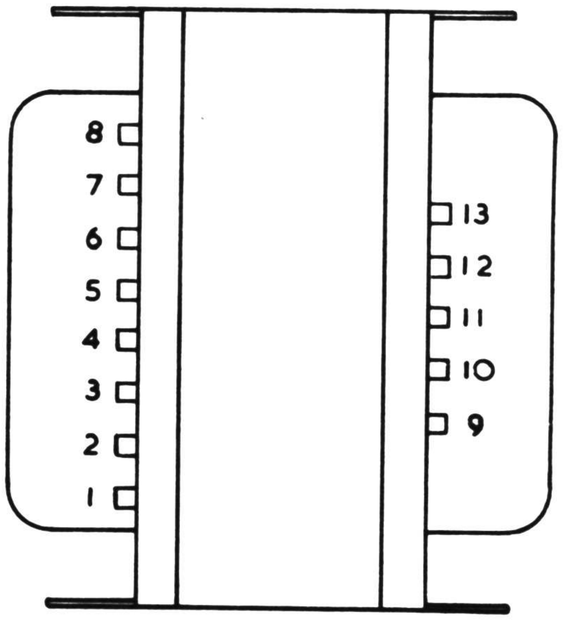
Claude Lyons Ltd. HODDESDON HERTS ENGLAND	MATERIAL	FINISH	TOLERANCES	CODE	No.	DESCRIPTION	STORES REF.
DRAWING No. HAC 10276/1			FRACTIONAL DIMENSION ± 1/32" DECIMAL DIMENSIONS ± .005" OR AS OTHERWISE STATED				NUMBER OFF
							USED ON

TITLE	DRAWN	ISSUE No					SCALE	DRAWING No
TRANSFORMER T 3	E.F.	1						HAC 10276/2
	CHECKED	DATE 16-7-62						

THIRD ANGLE PROJECTION



TRANSFORMER T3



TRANSFORMER T3

Claude Lyons Ltd. HODDESDON HERTS ENGLAND	MATERIAL	FIINISH	TOLERANCES	CODE	No.	DESCRIPTION	STORES REF.
DRAWING No. HAC 10276/2			FRACTIONAL DIMENSION ± 1/32" DECIMAL DIMENSIONS ± .005" OR AS OTHERWISE STATED				NUMBER OFF
							USED ON

BT 2.62.

TITLE	DRAWN	ISSUE No.					SCALE	DRAWING No.
SPECIFICATION FOR AUTOMATIC VOLTAGE STABILISER TYPE TS-3 S.448	M.O.	1	2					HAS 10228
	CHECKED	DATE 16.3.62	1.5.62					

THIRD ANGLE PROJECTION

SPECIFICATION

Stabilisers to be fitted with Light and Power Accessories Co. Ltd. fixed plug Type 33R, 3-pole, 25 Amp and fixed socket Type 33A, 3-pole, 25 Amp.

TS-3S448 Aotomatic Voltage Stabiliser.
Input Voltage: 170-260 volts.
Supply Frequency: 47-65 c/s.
Output Voltage: 240 volts, ± 0·5% zero to full load.
Output Current: 17·5 Amps.
Output kVA: 4·2.
Waveform Distortion: Nil.
Effect of Load Power Factor: Nil.
Speed of Correction: 40 volts per second.

Claude Lyons Ltd. HODDESDON HERTS ENGLAND	MATERIAL	FINISH	TOLERANCES	CODE	No.	DESCRIPTION	STORES REF.
DRAWING No. HAS 10228			FRACTIONAL DIMENSION ± 1/32" DECIMAL DIMENSIONS ± ·005" OR AS OTHERWISE STATED				NUMBER OFF
							USED ON PYE T.V.T.