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Appendices marked thus ♦ apply to variations of the standard machine and are obtainable on request, they are not included in the standard manual.

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## APPENDIX A

## IMPERIAL/METRIC CONVERSION TABLE

INCHES	MILLIMETRES	INCHES	MILLIMETRES	INCHES	MILLIMETRES
0.001	0.025	0.034	0.864	0.067	1.70
0.002	0.051	0.035	0.889	0.068	1.73
0.003	0.076	0.036	0.914	0.069	1.75
0.004	0.102	0.037	0.940	0.070	1.78
0.005	0.127	0.038	0.965	0.071	1.80
0.006	0.152	0.039	0.991	0.072	1.83
0.007	0.178	0.040	1.02	0.073	1.85
0.008	0.203	0.041	1.04	0.074	1.88
0.009	0.229	0.042	1.07	0.075	1.90
0.010	0.254	0.043	1.09	0.076	1.93
0.011	0.279	0.044	1.12	0.077	1.95
0.012	0.305	0.045	1.14	0.078	1.98
0.013	0.330	0.046	1.17	0.079	2.00
0.014	0.356	0.047	1.19	0.080	2.03
0.015	0.381	0.048	1.22	0.081	2.06
0.016	0.406	0.049	1.24	0.082	2.08
0.017	0.432	0.050	1.27	0.083	2.11
0.018	0.457	0.051	1.30	0.084	2.13
0.019	0.483	0.052	1.32	0.085	2.16
0.020	0.508	0.053	1.35	0.086	2.18
0.021	0.533	0.054	1.37	0.087	2.21
0.022	0.559	0.055	1.40	0.088	2.23
0.023	0.584	0.056	1.42	0.089	2.26
0.024	0.610	0.057	1.45	0.090	2.29
0.025	0.635	0.058	1.47	0.091	2.31
0.026	0.660	0.059	1.50	0.092	2.34
0.027	0.686	0.060	1.52	0.093	2.36
0.028	0.711	0.061	1.55	0.094	2.39
0.029	0.737	0.062	1.58	0.095	2.41
0.030	0.762	0.063	1.60	0.096	2.44
0.031	0.787	0.064	1.63	0.097	2.46
0.032	0.813	0.065	1.65	0.098	2.49
0.033	0.838	0.066	1.68	0.099	2.51

## APPENDIX B

## LUBRICANTS

The following is a list of lubricants supplied by ITT Creed Limited for use on their range of equipment. The nearest commercial equivalents are also quoted together with a brief description of the lubricant qualities. Of these lubricants, those required for use on the Model 444 Teleprinter are detailed in the list of accessories featured in Appendix C.

CREED No.	PART No.	SUPPLIED IN	DESCRIPTION	EQUIVALENTS
1	TA1095	¼ Pint Container	Thin Oil	Shell Clavus Oil 17 Castrol Magna RS
2	TA1096	¼ Pint Container	Medium Oil	Shell Talpa Oil 30 Castrol XL
3	—	—	Not Allocated	—
4	TA1097	2oz Tin	Lithium Based Soft Grease	Shell Alvania RA
5	TA1098	2oz Tin	Semi-fluid Water-resistant Grease	Shell Mytilus A Castrol Impervia CL
6	TA1317	100 Grammes Tube	High Melting-point Molybdenum Disulphide Grease	Rocol MT-LM
7	TA1331	¼ Pint Container	Lithium Based Soft Grease	Shell Alvania R1
8	TA1330	¼ Pint Container	Medium Oil	Shell Tellus Oil 33
9	TA1333	¼ Pint Container	Thin Oil	Shell Tellus Oil 127
10	—	—	No Longer Stocked	
11	TA1358	¼ Pint Container	Thin Molybdenum Disulphide Oil	Rocol MO4
12	TA1562	¼ Pint Container	Thin Synthetic Oil	Esso Univis P38
13			Allocated for ITT Creed use only	
14	TA1572	2oz Tube	Non-drying Molybdenum enriched grease	Rocol MTS 1000

**APPENDIX C**  
**TOOLS AND ACCESSORIES**

**1. TOOLS**

Tools for the maintenance of the Model 444 Teleprinter are divided into two groups. The standard kit, part number TA1510—Group 1, is designed for customers who have not previously maintained this type of equipment and therefore require a set of standard tools. The special kit, part number TA1510—Group 2, contains the extra tools and gauges which are peculiar to the Model 444.

The contents of the kits are listed below. For identification purposes the less common tools and special gauges are shown in Figure C1.

**TA 1510 GROUP 1 – STANDARD TOOLS**

DESCRIPTION	QUANTITY	PART No.	REFERENCE FIGURE C1
Spring Hook – Pull	1	TA 1008	A
Spring Hook – Push	1	TA 1130	B
Tommy Pin – Medium	1	TA 1011	
Tommy Pin – Large	1	TA 1019	
Tommy Pin – Small	1	TA 1020	
Spanner 4BA – 6BA	2	TA 1022	
Spanner 8BA – 10BA	1	TA 1036	
Spanner 0BA – 2BA	1	TA 1039	
Spanner 1/4 x 5/16 in. Whit.	1	TA 1076	
Spanner 2BA – 4BA	1	TA 1178	
Spanner 6BA – 8BA	2	16766	
Spanner 2BA Box – with Handle	1	TA 1375	C
Screwdriver 4 x 1/10 in.	1	TA 1053	
Screwdriver 5 x 1/4 in.	1	TA 1148	
Screwdriver 6 x 5/16 in.	1	TA 1149	
Screwdriver 5 x 5/32 in.	1	TA 1187	
Pliers – Snipe Nose	1 pair	16767	
Pliers – Flat Nose	1 pair	16768	
Cutters	1 pair	16769	
Feeler Gauges	1 set	16818	
Anderton Clip Applicator No. 2	1	TA 1373	D
Anderton Clip Applicator No. 3	1	TA 1374	
Contact Blade Adjuster	1	TA 1402	E
India Stone 4 x 3/8 in. – Triangular	1	16816	
Hammer 3oz	1	16817	
Punch Block Cleaner (for Tape Punch Unit only)	1	TA 1034	F
Tweezers	1 pair	8199	
Oilcan	1	16771	
Brush 6 x 1/2 in.	1	16820	
Duster 18 x 18 in.	2	12693	
Wallet	1	16819	
Carrying Case – with Lock and Key	1	TA 1200	

## TA 1510 GROUP 2 – SPECIAL TOOLS

DESCRIPTION	QUANTITY	PART No.	REFERENCE FIGURE C1
Feeler Gauge 0-003 in.	1	TA 1344	
Feeler Gauge 0-004 in.	1	TA 1345	
Feeler Gauge 0-005 in.	1	TA 1346	
Feeler Gauge 0-006 in.	1	TA 1347	
Feeler Gauge 0-008 in.	1	TA 1348	
Feeler Gauge 0-010 in.	1	TA 1349	
Feeler Gauge 0-015 in.	1	TA 1350	
Feeler Gauge 0-020 in.	1	TA 1351	
Feeler Gauge 0-062 in.	1	TA 1352	
Feeler Gauge 0-004 in. (Special)	1	TA 1518	
Slip Gauge 0-036 / 0-046 in.	1	TA 1482A	G
Slip Gauge 0-238 / 0-242 in.	1	TA 1488	H
Gauge Block	1	TA 1498	J
Finger - Type Gauge	1	20367	K
Preset Gauge 0-200 gm.	1	20877	L
Preset Gauge 200-1300 gm.	1	TA 1493	
Autoplex Gauge 0-14 lbs.	1	1285/35	M
Carpo Gauge 20-100 gm.	1	TA 1567	N
Pin Gauge (Print Suppression)	1	TA 1551	O
Pin Gauge (Print Suppression)	1	TA 1552	
Function Bar Gauge	1	TA 1496A	P
Tape Pitch Gauge	1	TA 1385	Q
Pozidriv Screwdriver (Large)	1	50212	
Pozidriv Screwdriver (Small)	1	TA 1553	
Box Spanner (Mainshaft Turning)	1	TA 1559	R
Box Spanner (Camshaft)	1	TA 1561	
Special Spanner (Camshaft)	1	TA 1484	S
Spanner <sup>3</sup> / <sub>16</sub> in. Whit.	1	TA 1379	
Box Spanner 4BA x 6BA	1	TA 1113	
Support Bar	1	TA 1489	T
Circlip Pliers (Internal)	1	TA 1490	
Circlip Pliers (External)	1	TA 1568	
Type Bar Pivot Wire	1	4413/13	U
Bearing Extractor (Motor)	1	TA 1492	V
Spring Retainer	1	TA 1497A	W

In addition the following workshop items can be supplied if required.

DESCRIPTION	QUANTITY	PART No.	REFERENCE FIGURE C1
Typehead Sector Gauge	1	TA 1514	X
Setting Gauge (Workshop tool for use in Major overhaul)	1	TA 1487A	Y
Leather Wallet	1	20362	
Fork Stroboscope 125VPS (Governed Motors only)	1	TA 1117	Z

## ACCESSORIES

DESCRIPTION	QUANTITY	PART No.	
Lubricant No. 7	1 tin	TA 1331	
Lubricant No. 9	1 tin	TA 1333	
Loctite - Grade 'C'	1 tube	TA 1435	
Loctite - Grade 'Bearing Fit'	1 tube	29418	
Paper, code word 'ABABY'	1 roll	8682	
Paper Tape <sup>1</sup> / <sub>16</sub> in. wide, code word 'ABAST' (for Tape Punch Unit only)	1 reel	8184	
Ink Ribbon - Black or Red/Black, as required	1	BO 2633/1/2	
Equipment Manual EM444	1		

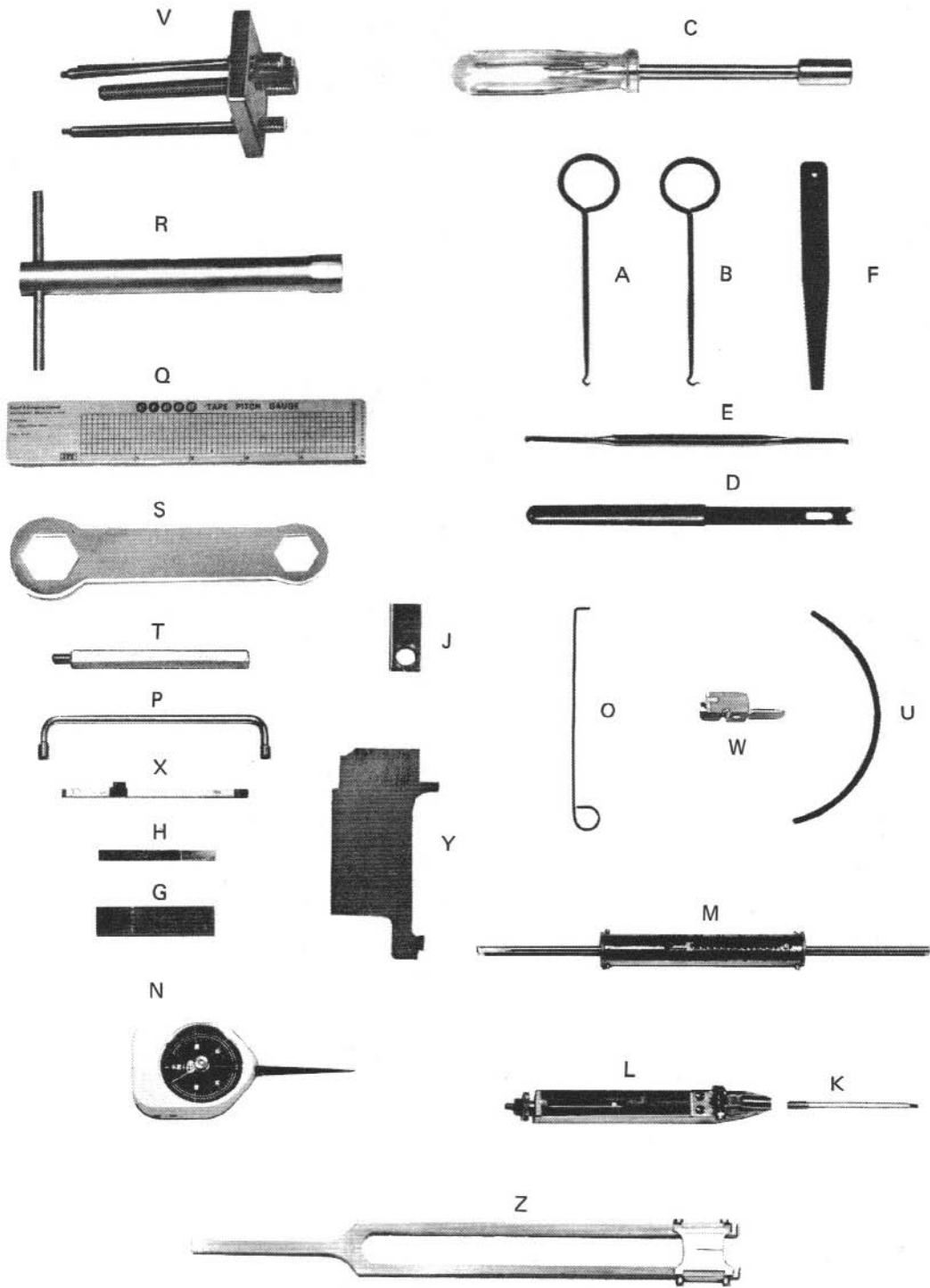


Figure C1

## APPENDIX J

## FAULT LOCATION

## 1 GENERAL

The efficient correction of faults depends upon a thorough knowledge of the principles of operation of the teleprinter and the type of circuit in which it is being used. Without this knowledge it may be possible to restore the machine temporarily to a working condition, but there will be no guarantee that it will continue to work satisfactory for any length of time. This is because a fault may sometimes be cleared temporarily by adding a compensating maladjustment to the machine, e.g. bias in the incoming signals may be compensated for by biasing the electromagnet, but such practises should be avoided because they have a cumulative effect on the remainder of the machine which may conflict with any slight change in the circuit conditions, general wear and tear or any further re-adjustment to the machine and thus lead to poor serviceability. A fault condition should therefore be systematically diagnosed, and if in the rectification a re-adjustment is necessary, this should be done according to the instructions in Part 4.

## 2. FAULT IDENTIFICATION PROCEDURE

- 2.1 When necessary, diagnose the fault condition by considering how the suspect machine compares with the qualifications listed in Table 1, Fault Location.
- 2.2 Connect the machine back-to-back with a serviceable machine or a suitable article of test equipment such as a Telegraph Distortion Measuring Set. If a spare machine or suitable test equipment is not available and the machine is fitted with a keyboard, the Local Record method of testing may be used whereby the transmitted signals are fed back into the receiver electromagnet of the same machine. Circuit diagrams showing this and back-to-back circuit connections are provided in Part 1.
- 2.3 Using a known test message check the operation of the receiver and/or transmitter. Note any faults that do occur and refer to Table 2, Fault Diagnosis and thence cross-refer to Table 3, Fault Analysis for the probable cause and method of rectification.

TABLE 1 FAULT LOCATION

HOME STATION		DISTANT STATION		PROBABLE LOCATION OF FAULT
RECEPTION	LOCAL RECORD	RECEPTION	LOCAL RECORD	
Correct	Faulty	Faulty	Correct	Home Keyboard Transmitter
Faulty	Correct	Correct	Faulty	Distant Keyboard Transmitter
Faulty	Faulty	Correct	Correct	Home Station Receiver
Correct	Correct	Faulty	Faulty	Distant Station Receiver

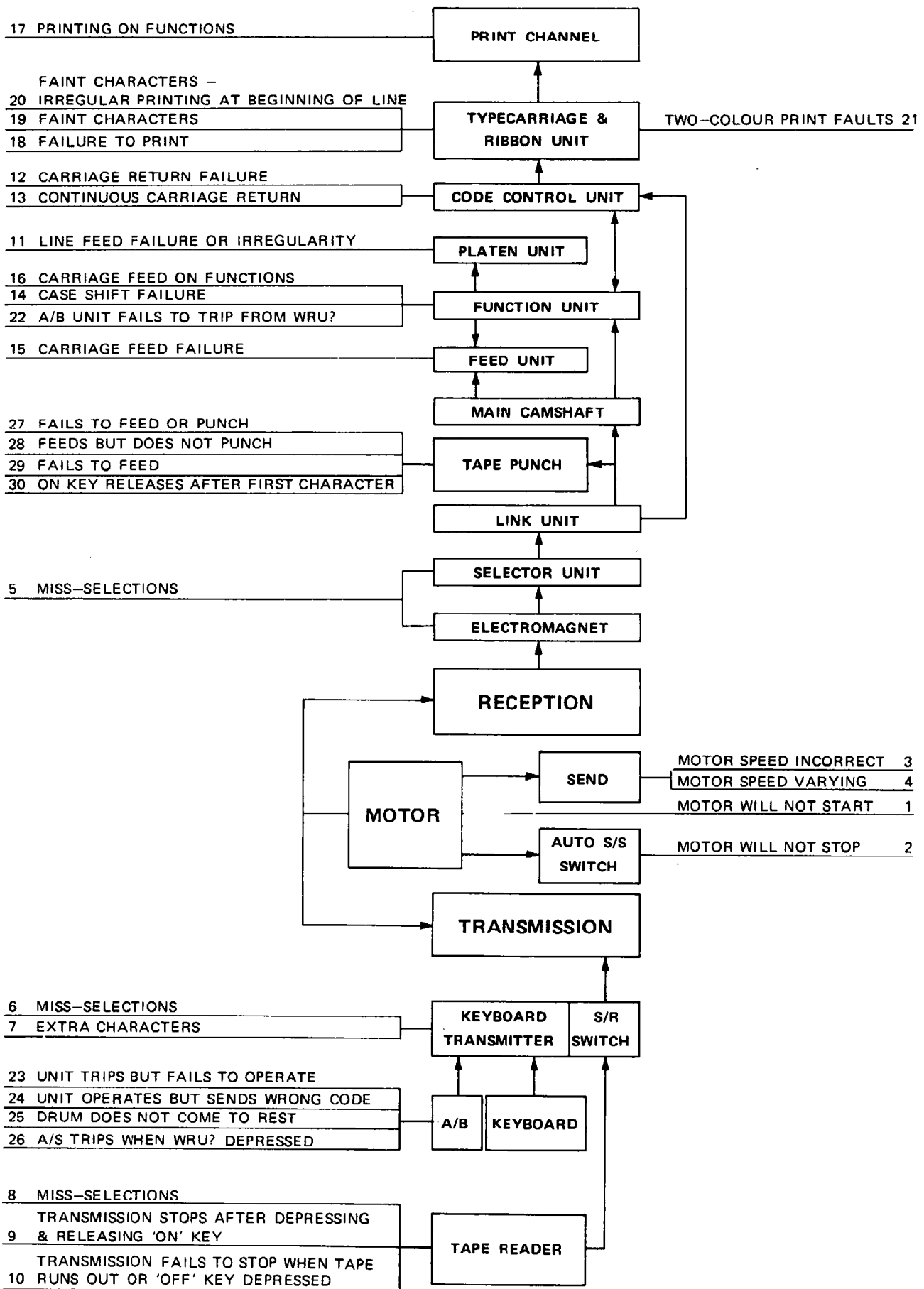




TABLE 3 FAULT ANALYSIS

REF.	FAULT	PROBABLE CAUSE	RECTIFICATION
	<b>MOTOR</b>		
1.	Motor will not start.	(a) Faulty or disconnected power plug/socket. (b) Fuse blown (external on synchronous motor). (c) Thermal overload operated. (d) Worn brushes and dirty commutator (governed motor). (e) Automatic motor switch maladjusted or sticky. (f) Start capacitor U/S (synchronous motor).	Check connections or re-connect.  Renew (after rectifying cause).  Remedy cause and re-set. Renew brushes, clean commutator.  Adjustment No. 80, check for freedom of lever and pawls - lubricate. Renew capacitor.
2	Motor will not stop.	(a) Retention pawls eccentric pivot maladjusted. (b) Switch-off link screw adjustment incorrect. (c) Ratchet release maladjusted.	Adjustment No. 78.  Adjustment No. 79.  Adjustment No. 80.
3.	Motor Speed incorrect (governed motors).	(a) Variation in mains voltage. (b) Governor contacts badly set or damaged. (c) Defective motor or governor components or wiring.	Adjustment No. 113. Renew and adjust.  Check wiring connections and renew components where necessary.
4.	Motor Speed varying (governed motors).	(a) As (b) above. (b) Worn brushes (c) Worn commutator. (d) Faulty connection in motor/governor circuit.	Renew. Skim and polish. Repair connection.
	<b>RECEPTION</b>		
5.	Mis-selections.	(a) Electromagnet biased. (b) Electromagnet armature unbalanced. (c) E/M armature height incorrect. (d) Read bail height incorrect. (e) Storage latch reset arm eccentric maladjusted. (f) Code transfer levers not aligned with link unit bar. (g) Incorrect gap between code transfer levers and link unit bar. (h) Orientation knob incorrectly set.	Adjustment No. 4. Adjustment No. 87.  Adjustment No. 86. Adjustment No. 88. Adjustment No. 83.  Adjustment No. 84.  Adjustment No. 85.  Carry out a margin check in accordance with the instructions in Part 2.

TABLE 3 FAULT ANALYSIS (Continued)

REF.	FAULT	PROBABLE CAUSE	RECTIFICATION
		<b>If machine is fitted with punch:</b>	
		Incorrect gaps between the lowest code transfer bar and the suppression levers.	Adjustment No. 127.
	<b>KEYBOARD TRANSMISSION</b>		
6.	Mis-selections.	(a) Carrier stop pin not centralised. (b) Jockey roller pressure incorrect. (c) Common frame blade maladjusted. (d) Striker height incorrect. (e) Striker sub-unit - contact block not centralized. (f) Send/Receive delay release lever not tripping. (g) Send/Receive contacts transit gap incorrect. (h) Send/Receive operating levers maladjusted.  Sequential lever spring pressure. M/S contact transit gap. Dirty contacts.	Adjustment No. 22. Adjustment No. 24. Adjustment No. 25. Adjustment No. 26. Adjustment No. 21. Adjustment No. 27. Adjustment No. 28. Adjustment No. 30.
7.	Extra characters.	(a) Clutch double-tripping.	Adjustment Nos. 19, and 114.
	<b>TAPE READER TRANSMISSION</b>		
8.	Mis-selections.	(a) Carrier stop pin not centralised. (b) Jockey roller pressure incorrect. (c) Sequential lever bail maladjusted. (d) Pecker frame pressure incorrect. (e) Feed wheel movement maladjusted. (f) Contacts transit gap incorrect. (g) Striker lever height incorrect. (h) Pecker leaf springs weak or mis-aligned. (j) Send/Receive link maladjusted. (k) Send/Receive trip lever maladjusted.  Centralising of feed wheel incorrect.	Adjustment No. 68. Adjustment No. 70. Adjustment No. 73. Adjustment No. 61. Adjustment No. 66. Adjustment No. 67. Adjustment No. 71. Re-align and set springs. Adjustment (24-32 grams) No. 60. Adjustment No. 115. Adjustment No. 115.  Adjustment by slackening locknut and turning shaft.
9.	Transmission stops after depressing and releasing 'ON' key.	(a) 'ON' key not latching in 'ON' position.	Adjustment No. 56.

TABLE 3 FAULT ANALYSIS (Continued)

REF.	FAULT	PROBABLE CAUSE	RECTIFICATION
10.	Transmission fails to stop when tape runs out, or 'OFF' key is depressed.	(b) Alarm trip lever maladjusted.	Adjustment No. 63.
		(c) Magnet read lever not latching.	Adjustment No. 62.
		(a) Alarm stop lever maladjusted.	Adjustment No. 54.
10.	Transmission fails to stop when tape runs out, or 'OFF' key is depressed.	(b) 'OFF' key latch mechanism maladjusted.	Adjustment No. 57.
		(c) Alarm trip lever maladjusted.	Adjustment No. 63.
		<b>FUNCTIONAL</b>	
11.	Line feed failure or irregularity.	(a) Feed pawl stop maladjusted.	Adjustment No. 14.
		(b) Pressure roller maladjusted.	Adjustment No. 15.
		(c) Line feed link disconnected.	Re-connect.
		(d) Link lever eccentric maladjusted.	Adjustment No. 111.
		(e) Power bail maladjusted.	Adjustment No. 96.
		(f) Function control lever spring disconnected or broken.	Replace or renew.
12.	Carriage return failure.	(a) Function control lever spring disconnected or broken.	Re-connect or renew.
		(b) Carriage return pull bar leaf spring weak or damaged.	Re-set or renew.
		(c) Carriage return spring disconnected.	Re-connect.
		(d) Link operating lever eccentric maladjusted.	Adjustment No. 107.
13.	Continuous carriage return.	(a) Function control lever incorrectly positioned below pull bar.	Re-position above pull bar.
		(b) Function reset bail setting incorrect.	Adjustment No. 97.
14.	Case shift failure.	(a) Power bail maladjusted.	Adjustment No. 96.
		(b) Shift beam height incorrect.	Adjustment No. 2.
		(c) Function control lever(s) spring(s) disconnected or broken.	Re-connect or renew.
		(d) Shift cam roller eccentric out of adjustment.	Adjustment No. 1.
15.	Carriage feed failure.	(a) Function reset bail maladjusted.	Adjustment No. 97.
		(b) Feed pawls not engaging correctly with feed rack.	Adjustment No. 6.
		(c) Carriage stop lever maladjusted.	Adjustment No. 101.
		(d) Feed unit trip latch maladjusted.	Adjustment No. 108.

TABLE 3 FAULT ANALYSIS (Continued)

REF.	FAULT	PROBABLE CAUSE	RECTIFICATION
16.	Carriage feed on functions.	(e) Feed pawl(s) spring(s) disconnected or broken.	Replace.
		(f) Feed pawls damaged or worn.	Renew.
		(e) Feed rack worn.	Renew.
		(a) Function reset bail maladjusted.	Adjustment No. 97.
		(b) Feed unit trip latch maladjusted.	Adjustment No. 108.
<b>PRINTING</b>			
17.	Printing on functions.	(a) Print suppression members maladjusted.	Add shim(s) (not in EM444).
18.	Failure to print.	(a) Print suppression members maladjusted.	Adjustment No. 93.
		(b) Selection of two type bars simultaneously.	Adjustment No. 98.
		(c) Print channel setting incorrect.	Adjustment No. 92.
		(d) Code seeker bar spring weak or broken.	Renew spring.
		(e) Notch on code seeker bar worn.	Renew bar.
		(f) Typebar link distorted or disconnected.	Renew link.
19.	Faint characters.	(a) Print spring pressure too weak.	Adjustment No. 122.
		(b) Excessive typecarriage/platen clearance.	
		(c) Ribbon feed failure.	Adjustment No. 105.
		(d) Ribbon changeover failure.	Adjustment No. 105.
20.	Irregular printing at beginning of line.	(a) Stop screw maladjusted.	Adjustment No. 99.
		(b) Incorrect carriage return damping.	Adjustment No. 104.
21.	Two-colour print faults.	(a) Red/Black merging.	Adjustment No. 102.
		(b) Failing to change colour with transmit and receive conditions.	Adjustment No. 103.
<b>ANSWER-BACK</b>			
22.	Unit fails to trip from WRU? signal.	(a) Function control lever spring disconnected or broken.	Re-connect or renew.
		(b) Power bail maladjusted.	Adjustment No. 96.
		(c) Shift slide incorrectly positioned.	Adjustment No. 95.
		(d) Answer-back release shaft mis-positioned.	Adjustment No. 77.

TABLE 3 FAULT ANALYSIS (Continued)

REF.	FAULT	PROBABLE CAUSE	RECTIFICATION
23.	Unit trips but fails to operate.	(a) Drum detent operating lever maladjusted. (b) Drum detent maladjusted. (c) Run-out push-rod maladjusted.	Adjustment No. 37. Adjustment No. 34. Adjustment No. 35.
24.	Unit operates but sends incorrect code.	(a) A/B drum incorrectly positioned. (b) Pawl eccentric stop maladjusted. (c) Wards not broken off clearly at root.	Adjustment No. 31. Adjustment No. 32. Remove residue with knife or file.
25.	Drum does not come to rest in normal position.	(a) 21st feed not operating.	Adjustment No. 36.
26.	A/B trips when WRU? key depressed.	(a) WRU? inhibiting lever eccentric maladjusted. (b) WRU? inhibiting lever spring too weak. (c) Main camshaft not 'homing'.	Adjustment No. 38. Set or renew spring. Adjustment No. 82.
<b>TAPE PUNCH</b>			
27.	Fails to feed or punch.	(a) Excessive clearance between drive arm rollers and cams. (b) Punch suppression frame tripping.	Adjustment No. 126. Adjustment No. 129.
28.	Feeds but does not punch.	(a) Suppression control knob in position '11'. (b) Punch block set too high.	Set knob to '1' to '111' as required. Adjustment No. 135.
29.	Fails to feed.	(a) Feed pawl maladjusted.	Adjustment No. 138.
30.	'ON' key releases after first character.	(a) Latch spring weak or disconnected. (b) Remote control latch maladjusted.	Replace. Adjustment No. 131.