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SAELVE WITH LUCAS AEROSPACE MATERIAL.

INDEX TO TECHNICAL LEAFLETS

Code Letters and Definitions	Code Letters and Definitions
A Linear Actuators (for Rotary Types see C)	B Generators (for Alternators see N)
C Starters, Motors, Rotary Actuators, Turbo starters	D Switchgear (see also F)
F Cutouts, Relays, Voltage Regulators, Chokes	H Lamps
J Batteries	K Ignition Harness, Pyrometer cables
L Booster Coils (see also N)	M Air Valves, Pumps, Compressors, De-icing Equipment
N Alternators, Ignition Equipment	P Transformers (Static)
U Control Panels and Transformer-Rectifier Units	T Windscreen Wiper Motors
S Convertors, Invertors	V Electric Horns
X Plugs and Sockets	Z Miscellaneous

TL. Numbers.	TL. Numbers.
A -	D continued
B	2703 , 13
1801 to 1806 , 3	2704 , 13
1809 to 1820 , 3	2708 , 67
	2709 , 13
	2710 , 87
	3502 , 33
C	3801 , 4
6703 , 75	3804 , 18
	4801 , 14
D	4902-1 , 31
0205 , 12	4903-2 , 31
0208 , 12	4904-1 , 31
0209 , 12	4905 to 4916 , 31
0210 , 12	5001/1A/2 to 5005/1A/2 , 7
0213 , 12	5009/1A/2 , 7
0419 , 44	5010/1A/2 , 7
0523 , 84	5101 to 5105 , 61
0701 , 66	5301 to 5306 , 48
0909 , 42	5901 , 38
2201 to 2209 , 10	6101 to 6104 , 17
2210 , 40	6200 , 22
2211 , 10	6301 , 29
2212 , 10	6302 , 29
2303/1 , 11	6303/1 , 29
2305/1 to 2307/1 , 11	6304 to 6306 , 29
2308/2 , 11	6401 , 19
2309/1 , 11	6402 , 19
2310/1 , 11	6501 to 6506 , 20
	6506A , 20
	6507 , 20
	6601 to 6626 , 21

continued over
page

INDEX OF TECHNICAL LEAFLETS CONT.

<u>T.L. Numbers.</u>	<u>T.L. Numbers.</u>
D cont.	F cont.
6701 , 23	3901/1 to 3905/1 , 64
6701/4 , 43	4907/1 , 70.
6702 to 6704 , 23	4908/1 , 70
6801 , 30	4910/1 , 70
6802 , 30	
7004 , 35	5002 , 63
7301 , 36	5102 , 46
7302 , 36	5601/1 , 85
7304 , 36	5602 , 85
7501 to 7503 , 28	5603/1 , 88
7501/1 to 7503/1 , 28	5902 , 74
7601 , 45	5903 , 74
8102,2,3,4,13-17,19,21 , 39	G
8402,4,13-15.20 , 39	3201 , 68
8513 , 91	3202 , 68
8704 to 8704 , 56	3801 , 68
8901 to 8904 , 77	
9001 to 9004 , 57	H
9101 to 9106 , 80	1701 to 1703 , 82
9201/1 , 73	1705 to 1707 , 82
to	1715 , 82
9248/1 , 73	1714 , 82
9301 to 9304 , 58	2001 to 2003 , 76
10001 to 10003 , 65	2006 , 76
10202/2 , 93	2007 , 76
10501 to 10507 , 71	2700 series , 54
10601 , 88	2800 " , 54
10602 , 88	2900 , 55
11801 , 92	4201 , 26,52
11901 , 92	4301,2,3,4,5 , 95
F.	4500 , 83
1401 , 9	4600 , 83
1501-1 to 1504-1 , 49	4700 , 83
1504/1A , 49	M
1601 , 8	010 1 , 15
1701 , 37	0106 , 62
1711 , 37	0902 , 69
2201 , 24	1101 , 15
2204/3 , 79	1502 , 6
2208/3 , 79	2601 , 5
2214/1 , 79	2603 , 53
2215/1 , 79	2201 , 60
2601 , 25	2701 , 59
3001 , 41	3001 , 16
3103 to 3106 , 50	N
3109 , 50	NB 13/2 , 1
3102 , 50	NB 14/2 , 1
3401/1 to 3404/1 , 34	NB 25/2 , 51
	NB 27 , 51

INDEX OF TECHNICAL LEAFLETS Cont.

<u>T.L. Numbers</u>	<u>T.L. Numbers</u>
N cont.	
NIKA , 2	
NIKB , 2	
N 111473 , 96	
P 2401/1 , 47	
P 2402/1 , 47	
U	
0801/1 , 27	
0802/1 , 27	
0803/1 , 27	
0804 , 27	
1901 , 32	
1902 , 32	
1902A , 32	
2001 to 2007 , 72	
2801/1 , 81	
V	
0214 , 78	
Z	
ZA 2601 to 2611 , 86	
ZA 2902 , 52	
ZA 3601 , 96	
ZA 7201 , 89	

SUBJECT: Low tension Booster Coils

TYPES: NB.13/2 and NB.14/2

DATA:

Nominal Voltage: NB.13/2 12 volts
NB.14/2 24 volts

Output Voltage: 200—300 volts

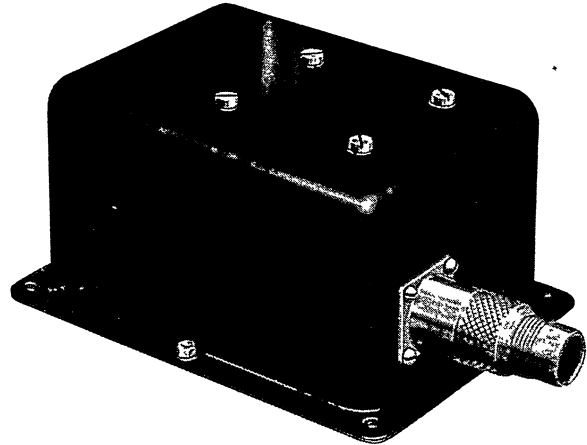
Time Rating (secs.): 45 on, 45 off

Weight: 2.8 lb.

Electrical Connections: Two 2-pin sockets
(A.M. Ref. 5X/6374)

Acceleration Grading: 1A

Mounting: Four 0.191 in. dia. holes, the
centres of which form a rect-
angle 4.687 ins. x 3.312 ins.



Description

The NB.13/2 and NB.14/2 booster coils are similarly constructed, the only difference being that the windings of the NB.13/2 are designed for 12-volt aircraft circuits and those of the NB.14/2 for 24-volt circuits.

The booster coil consists of a primary and secondary winding wound on a soft iron core, and enclosed in a bakelite moulding. On one end of the moulding is mounted a simple trembler system which interrupts the primary current, and also acts as a switch for closing the secondary circuit while the coil is in operation, but maintaining a permanent open circuit in the secondary when the coil is not used thus preventing the magneto coil from being short circuited through the booster coil windings. The trembler system consists of a single trembler upon which are mounted a primary and secondary contact insulated from one another. The trembler is actuated by a separate spring-mounted armature which also supports the other secondary contact. The second primary contact is integral with an adjusting screw held in a small plate rigidly mounted on the moulding.

Two condensers are mounted on the side of the moulding, one for the primary contacts (0.4 μ F) and the other for the secondary contacts (0.1 μ F). The whole unit is contained in a fully screened metal case fitted with two Breeze terminals for the primary and secondary external connections.

A typical wiring diagram is illustrated overleaf.

Electrical Operation

Basically, the L.T. booster coil is an induction coil which steps up the interrupted D.C. primary voltage to a voltage of approximately 200 to 300 volts. This output is fed to the magneto coil where it is again stepped up to the working voltage of a magneto and fed to the sparking plugs by the normal magneto distributor system.

When the primary circuit is energised the armature is attracted towards the core thus closing the secondary contacts. Further movement of the armature causes it to depress the trembler thereby breaking the primary circuit. The resultant collapse of the primary current induces a voltage in the secondary windings, and also allows the armature and trembler to move back to their static positions. This opens the secondary contacts and closes the primary contacts when the current again flows in the primary circuit and the cycle is repeated.

Servicing

If test equipment is not available, no attempt should be made to service the unit. It should be replaced by a new one and the faulty equipment returned to Rotax Limited, where it will be promptly dealt with by our repair organisation.

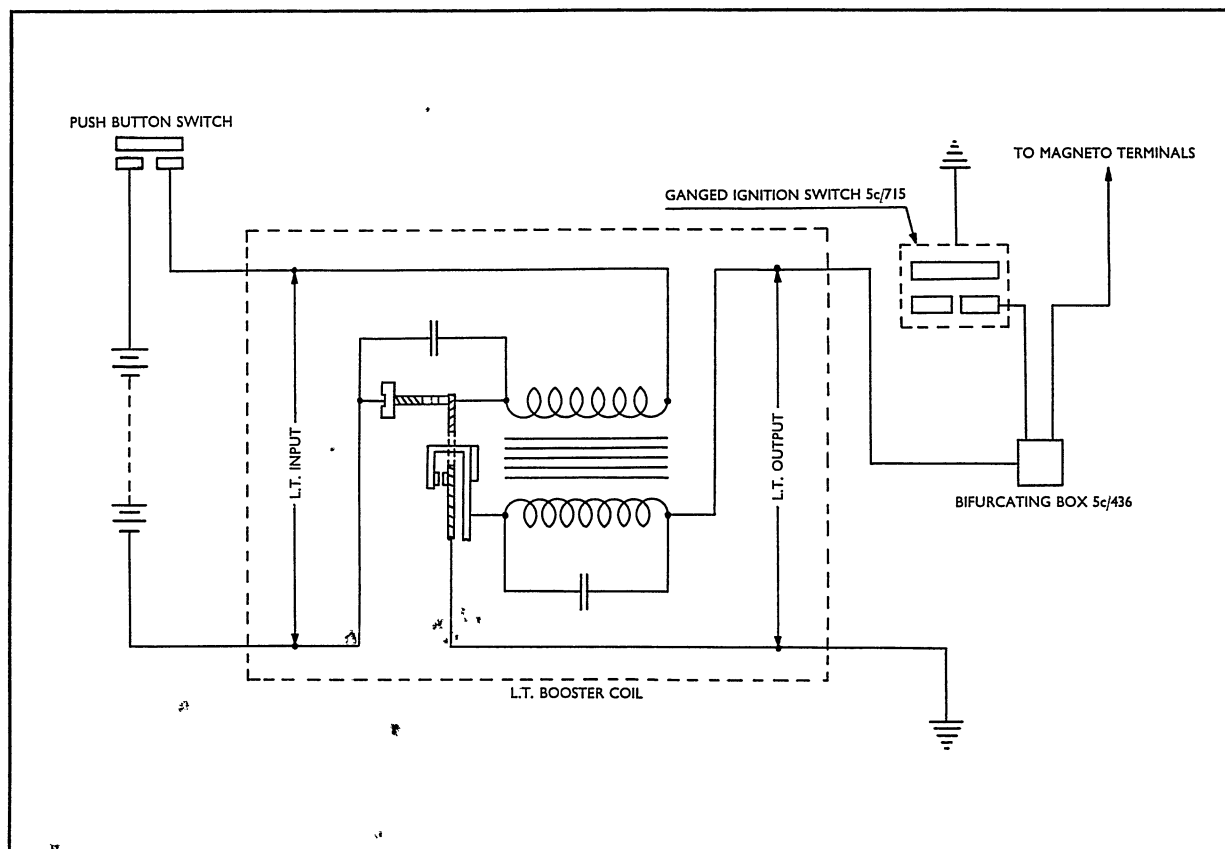
In cases where test equipment is available, apply for Rotax Service Leaflet No. S.L. 1 for full servicing details.

"This Leaflet is approved by the Air Registration Board. 10/1/58"
"Amendments to this publication invalidate the above approval unless issued
by the manufacturers with the concurrence of the Air Registration Board."

PRICE ONE SHILLING

REVISED JANUARY 1958

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10 • ENGLAND • TELEPHONE ELGAR 7777
LUCAS-ROTAX (AUSTRALIA) PTY. LTD • JOYNTON AVENUE • ZETLAND N.S.W. • TELEPHONE FF.2241
LUCAS-ROTAX LIMITED • TORONTO 13 • ONTARIO • CANADA • TELEPHONE PLYMOUTH 5-4171



For further information on the functioning, operation and maintenance
of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
JOYNTON AVENUE
ZETLAND
NEW SOUTH WALES

Telephone : SYDNEY FF.2241

ROTAX LIMITED
HEMEL HEMPSTEAD
HERTFORDSHIRE
ENGLAND

Telephone : BOXMOOR 4444

LUCAS-ROTAX LIMITED
5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA

Telephone : BY 6500-09

Technical enquiries should be addressed to :—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10 • ENGLAND

Telephone : ELGar 7777

SUBJECT: High Tension Booster Coils

TYPE: NIKA and NIKB

Description

The NIKA H.T. booster coil is wound for 12-volt aircraft circuits and the NIKB for 24-volt circuits, otherwise these two types are similar in every other respect.

The units consist of a primary and secondary winding wound on a soft iron core which is supported by a bakelite moulding. On one end of the moulding are mounted two contacts, which are connected in the primary circuit. One contact is attached to the end of an adjusting screw and the other is fixed to the end of a flat leaf spring. The contacts are operated by means of a trembler to which is attached a small circular soft iron armature.

One end of the secondary winding is brought out to a terminal in a moulded shroud in the top of the body moulding and the other end is earthed.

On one side of the moulding is mounted a condenser connected across the primary contacts. In earlier models of these booster coils the condenser was composed of alternate tin foil and mica plates enclosed in a "stabilite" moulding. The latest models, however, are fitted with tubular metal condensers containing two strips of tin foil and two strips of waxed paper, wound into a tight cylindrical roll. One tin foil strip is connected to a central electrode at the end of the condenser, and the other strip is connected to the metal case.

The whole unit is enclosed in a fully screened metal case to which the secondary windings are earthed. Suitable unions are supplied for the H.T. and L.T. external connections.

Electrical Operation

The electrical operation of these coils is similar to a simple induction coil. When the current is passed through the coil the iron core is energised and attracts the soft iron armature thereby actuating the trembler and opening the primary contacts. The current then collapses and the armature moves away from the coil core, the contacts close, the current builds up again and the cycle is repeated at a rate of

approximately 200-300 cycles per second. The result of building up and collapse of voltage in the primary windings induces a voltage in the secondary windings of the coil and this is wound with a sufficient ratio of turns to produce approximately 12 KV.

This voltage is fed to the hand starter electrode of the magneto and thence to the trailing electrode of the distributor rotor. It is then distributed to the various spark plugs as the distributor rotor rotates. The magneto trailing electrode is retarded approximately 30° to provide the correct starting conditions.

Installation

The booster coil is usually mounted on the forward side of the engine bulkhead, and as near as possible to the starboard magneto, to which it is connected. No booster coil is connected to the port magneto.

Screened L.T. and H.T. connections must be used if elimination of radio interference is desired.

The following are particulars of the installation of this booster coil in a Bristol Hercules Power Unit, and is typical of most installations. These, or similar cables to suit other installations, can be supplied by our Harness factory.

L.T. connections are made from the booster coil to the main junction box by means of Rotax cable N. 62167 which comprises two unisheathed 7 cables fitted with two pin type terminals at one end which are inserted in the booster coil L.T. sockets. The pins are secured by two screws which are accessible through a small swivel panel in the end of the coil casing. Union nuts are also fitted for complete screening. The other end of this cable is fitted with a plug type connector and union nut for connection to the main junction box.

It is sometimes desirable to incorporate an isolating spark gap between the magneto and booster coils and connection is made from this to the magneto and booster coil by means of Rotax H.T. cables N.62165 and N.62164 respectively. These are fitted with appropriate connections and unions and are fully screened.

FEBRUARY, 1949

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10

Servicing

If Booster Coil testing equipment is not available no attempt should be made to service or dismantle the booster coil. The unit should be replaced by a new one and the faulty equipment returned to Rotax Limited, where it will be promptly dealt with by our repair organisation.

In cases where test equipment is available apply for Rotax Service Leaflet No. SL.2 for full servicing details.

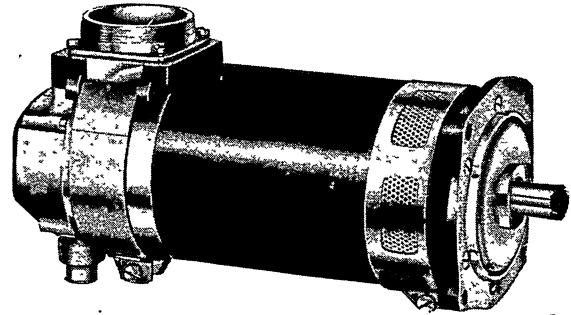
Address all enquiries to :—

TECHNICAL SALES
DEPARTMENT

ROTAX
LIMITED

WILLESDEN JUNCTION LONDON N.W.10
TELEPHONE ELGAR 7777

SUBJECT: Generators; 150 watt,
330 watt and 500 watt
output.



TYPE: B.1801 to B.1806 and B.1809 to B.1820 inclusive.

DATA: See overleaf.

Description

This leaflet supersedes the existing leaflet T.L.3, dated May 1950, and is extended to cover the present range of Type B.1800 generators. The following notes, except where otherwise stated, are applicable to all types, main differences being quoted overleaf.

Commutation is obtained by two brushes, diametrically opposite, the pigtails of which are connected to the G+ and G— terminal pillars. The brush boxes, terminals and brush springs are compactly arranged, the terminal posts being used as mountings for the brush springs.

Where a high output/weight ratio is required, blast cooling is employed.

The generators are completely screened to prevent interference with radio reception, all terminals being enclosed in the recess of the commutator end frame. Access to the terminals is obtained by removing the metal cover.

The generators are secured by four $\frac{1}{4}$ -in. diameter studs, equally spaced on a pitch circle diameter of 4 in.

Coupling to the engine is by means of the six splines on the end of the armature shaft.

The size of the shallow splines on the B.1801 to 06 and B.1809 to 12 inclusive, is 0.625" nominal diameter, to B.S. 46, Part 2, Table XIII U.Q. Fit. The size of the shallow splines on the B.1813 to B.1820 inclusive is 0.625 in. nominal diameter, to B.S. A.20, Table No. 4 close sliding fit.

Oil seals

Generators B.1813 to B.1820 inclusive are fitted with an oil seal at the drive-end which must be adequately lubricated.

Operation

Initial excitation of the field assembly is in the form of residual magnetism in the pole pieces. With the generator connected to its respective control box (See Data) its voltage will "build-up" to a figure dependent on the voltage regulator setting.

Used in conjunction with its control box, each generator will maintain the maximum output over its full range of speeds.

Carbon pile regulators may be fitted to these generators, but in all cases minimum full load speeds are thereby raised approximately 300 r.p.m. Before fitting carbon pile regulators reference should be made to the Service Department of Rotax Limited.

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A.6-2 of British Civil Airworthiness Requirements. 9/6/52."

REVISED FEBRUARY 1952

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W. 10 • ENGLAND • TELEPHONE ELGAR 7777
LUCAS-ROTAX (AUSTRALIA) PTY. LTD • BOUVIERIE STREET • MELBOURNE N. 3 • TELEPHONE F.J.4867
LUCAS-ROTAX LIMITED • TORONTO 13 • CANADA • TELEPHONE OXFORD 9368

DATA

		B.1801, B.1802, B.1813 & B.1814	B.1803, B.1804, B.1809, B.1810, B.1815 & B.1816	B.1805, B.1806, B.1811 B.1812, B.1817 & B.1818	B.1819 & B.1820
Voltage (regulated)		14 volts.	28 volts.	28 volts.	14 volts.
Maximum continuous output ..		23 amps.	17.5 amps.	5.5 amps.	10.5 amps.
Overload capacity for 5 mins. ..		40%	40%	40%	40%
Overload capacity for 10 mins. ..		30%	30%	30%	30%
Overload capacity for 30 mins. ..		20%	20%	20%	20%
Cooling		Blast cooled with a pressure drop across the generator equal to a 3.5" head of water	Blast cooled with a pressure drop across the generator equal to a 4.5" head of water	Fan	Fan
Electrical connection		Terminal	Terminal	Terminal	Terminal
Regulator and cut-out		F.0511	F.0406	F.0405	F.0407
Speed range		3,500—7,000 r.p.m.	4,300—7,000 r.p.m.	3,300—7,000 r.p.m.	3,000—7,000 r.p.m.
Weight		11 lb. 4 oz.	11 lb. 4 oz.	11 lb. 4 oz.	11 lb. 4 oz.
Mounting		Four .265" diameter holes on a pitch circle diameter of 4"			
Moment of armature inertia ..		.007 lb.ft. ²	.007 lb.ft. ²	.007 lb.ft. ²	.007 lb.ft. ²
Torque required to drive armature at full load at 5,000 r.p.m.		0.85 lb.ft.	1.15 lb.ft.	0.5 lb.ft.	0.5 lb.ft.
Clockwise rotation		B.1801, B.1803, B.1805, B.1809, B.1811, B.1813, B.1815, B.1817 and B.1819			
Anti-clockwise rotation		B.1802, B.1804, B.1806, B.1810, B.1812, B.1814, B.1816, B.1818 and B.1820			

Servicing

If generator testing equipment is not available no attempt should be made to overhaul the generators. In cases where test equipment is available apply for Rotax Service Leaflet No. S.L. 4.

Address all enquiries to :—

THE SERVICE DEPARTMENT

ROTAX LIMITED
WILLESDEN JUNCTION
LONDON, N.W. 10
ENGLAND

Telephone : ELGAR 7777

LUCAS-ROTAX (AUST.) PTY. LTD
BOUVERIE STREET
MELBOURNE, N. 3
AUSTRALIA

Telephone : F.J. 4867

LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA

Telephone : WALNUT 3435

SUBJECT : Solenoid Operated Locking Plunger

TYPE : D. 3801. 24v

Description

The D. 3801 Solenoid Operated Locking Plunger is designed in a simple and compact manner for operation from a 24-volt supply and can be adopted for many applications where locking devices for undercarriages, etc., are required.

The unit comprises two aluminium housings, one the body and the other the end cover. These are held together by three cheese-head screws, threaded into the coil yoke, equidistant apart around the solenoid circumference. Integral with the body casting is the mounting flange, through the base of which pass two grub screws to hold the coil assembly in position when the end cover is removed.

Electrical connection is made to the unit by a

two-way terminal block, mounted on the uppermost side of the body. The coil leads enter the unit, from the terminal block, through a rubber grommet in the housing.

The plunger, with the threaded (front) end projecting, through the end cover, is suspended between the two housings and the coil, with a light spring loading at the rear end.

Operation

When the coil is energised the magnetic pull created on the circular armature plate, decreases the air gap between the coil assembly and the armature plate by drawing the armature plate and plunger nearer to the coil assembly, thus moving any attachment fixed to the plunger.

Servicing

If test equipment is not available, no attempt should be made to service the unit, it should be replaced by a new one and the faulty equipment returned to Rotax Limited, where it will be promptly dealt with by our repair organisation.

In cases where test equipment is available, apply for Rotax Service Leaflet No. S.L. 6 for full servicing details.

Address all enquiries to :—

TECHNICAL SALES
DEPARTMENT
ROTAX
LIMITED

WILLESDEN JUNCTION LONDON N.W. 10
TELEPHONE ELGAR 7777

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10

SUBJECT : Hand Operated Pump.

TYPE : M. 2601.

Description

The pump is specially designed for lightness (8 ozs. less connecting pipes) and resistance to corrosion from the fluids in use.

With the addition of the Adaptor and accessories the pump is completely interchangeable with the B.S.1128 PUMP. A.M. REF. No. 27F/1870.

The Adaptor and accessories are comprised of the following parts :—

Nomenclature.	No.	Part Number
ADAPTOR	1	N.83286
FLANGE	1	N.83284
DISTANCE PIECES	3	N.83285
CSK. SCREWS	3	NK.4017-L
HEX. HD. SCREWS	3	NK.1717L
SPRING WASHERS	3	8921-6

Simple in construction the pump comprises the following main parts.

1. A tubular duralumin body, threaded at either end to receive an end nut at its base and an oil gland assembly housing at the other end. The oil gland housing also incorporates the mounting flange, and the outlet port.
2. A non-return ball valve assembly is threaded into the end nut to form the inlet pipe coupling.
3. A steel plunger which passes through the oil glands, into the tubular body, has upon the inner end a leather cup washer, clamped between two supporting washers, and at the other, the operating knob.
4. A stainless steel spring is situated internally, between the end nut and underside of the plunger assembly.

Provision is made for locking the pump in the fully primed position by bayonet slots in the knob, with corresponding pins in the oil gland assembly housing. All metal parts are made of duralumin (anodised) or stainless steel.

The pump can be installed in any position. It is, however, advisable to mount it below the supply tank and to have the outlet pipe as short as possible and rising above the pump. Positioning of the pump in such a relative position, eliminates any time lag in the delivery of fluid, which may be caused through a number of pump operations having to be made to prime the pipe lines.

The installation must ensure that the fluid is not allowed to run away from the top half of the pump, otherwise residue from drying fluid may cause the barrel to become sticky. The leather cup and gland sealing washers may also become dry and hard.

Mounting is facilitated by means of three .144" diameter holes, equally spaced on a pitch circle diameter of 1.5".

The coupling on the pump for the inlet pipe is a .125" B.S.P. external thread and for the outlet pipe, a .125" B.S.P. internal thread.

Operation

The principle of operation is that of the plunger type pump, with a non-return ball valve inlet and a free delivery.

If the pump is not primed, full delivery of the fluid from the pump can be completed very rapidly by two or three operations of the plunger, assuming the inlet pipe is already primed with fluid.

Movement of the plunger downwards against the spring tension, forces the ball of the inlet valve against its seating, thereby preventing escape of air, except past the leather cup washer into the top portion of the pump. When the plunger is released, the spring returns the plunger to the fully extended position. This

creates a suction on the ball of the inlet valve, and draws fluid into the pump. At the same time the air in the top of the pump is exhausted. Movement of the plunger downwards for the second time forces the fluid past the leather valve washer, therefore, the return of the plunger into its fully extended position will force the fluid from the outlet port.

S e r v i c i n g

If test equipment is not available, no attempt should be made to service the unit; it should be replaced by a new one and the faulty equipment returned to Rotax Limited, where it will be promptly dealt with by our repair organisation.

In cases where test equipment is available, apply for Rotax Service Leaflet No. S.L. 8 for full servicing details.

Address all enquiries to:—

TECHNICAL SALES
DEPARTMENT

R O T A X
L I M I T E D

WILLES DEN JUNCTION LONDON N.W.10

TELEPHONE ELGAR 7777

SUBJECT : Air Conditioning Control Valve Unit Electrically Operated.

TYPE : M. 1502.

The M. 1502 Air Conditioning Control Valve Unit is a 24 v. motor and gearbox assembly, which has been designed to operate the regulator valves for the cabin heating system on the "Viking" aircraft. The unit comprises two main housings of an aluminium alloy, one the motor housing and the other the gear housing. Both housings are held together by two draw bolts.

MOTOR

The motor is a 2 pole, split series type, one field coil being energised for clockwise rotation and the other for anti-clockwise rotation. The yoke and poleshoes are manufactured from one set of laminations so that the poles are integral with the yoke. Two brushes diametrically opposite are mounted in separate brush box assemblies and contact is maintained between the brushes and commutator by means of a phosphor-bronze spiral spring, which is part of each brush assembly. Each brush spring is compressed by a flat metal plate, secured to the motor housing above each brush box.

The armature is supported by two ballraces, one in the motor housing and the other in the gear housing.

Ballraces, gears and plain bearings are lubricated with EFHCO No. 2 Aero Grease, there being

sufficient to last the complete period between overhauls.

Electrical connection is made to the motor by a 3 pin Breeze plug and socket.

Armature resistance 15.8 ohms approximately.

Field resistance 16.7 ohms per coil approximately.

GEAR HOUSING

The gear housing contains a two stage worm drive gear assembly giving a ratio from armature to final drive spindle of 1,120 to 1.

note : A further worm drive gear between the unit and the regulator valve, but external to the unit, brings the final gear reduction between the armature and regulator valve to 36,000 to 1.

A worm drive, cut into the end of the armature shaft, forms the first drive, this engages with a worm wheel on the second drive shaft.

The second worm drive shaft is held between two thrust screws ; these thrust screws should not be interfered with in service as the alignment of the worm drives and worm wheels will be lost as well as altering the end play of the second drive shaft.

The second worm drive in turn engages with the worm wheel on the final cross-shaft drive.

Servicing

It should not be necessary to service this machine between major overhaul periods of the aircraft, but should any servicing be required, it is recommended that the machine be returned to ROTAX LTD., where all the necessary test equipment is available to facilitate complete and accurate overhaul within the shortest possible time.

Complete overhaul of the machine is necessary at every major overhaul of the aircraft.

Address all enquiries to :—

THE SERVICE
DEPARTMENT

ROTAX
LIMITED

WILLES DEN JUNCTION LONDON N.W.10
TELEPHONE ELGAR 7777

ROTAX LIMITED • WILLES DEN JUNCTION • LONDON N.W.10

SUBJECT: Thermal Trip Switches

TYPES: D.5001, /1A, /2— 5 amperes
D.5002, /1A, /2— 10 amperes
D.5003, /1A, /2— 15 amperes
D.5004, /1A, /2— 20 amperes
D.5005, /1A, /2— 25 amperes
D.5009, /1A, /2— 1 ampere
D.5010, /1A, /2— 2.5 amperes

DATA:

Weight : 3 oz.
Mounting : 2 holes tapped 4 B.A. spaced at 1.812" centres.
Electrical Connection : 19 ampere, S.B.A.C. type socket.

This leaflet incorporates information contained in Service Bulletins Nos. 105 and 227.

Description

This range of thermal trip switches has been designed to provide manual (push-button) "ON" — "OFF" control of aircraft electrical circuits with overload and short-circuit protection, except that types D.5009/etc. and D.5010/etc. do not provide short-circuit protection. In circuits where these are used a fuse must be included.

Variations between the basic types and later versions are as follows :—

Suffix /1 denotes that the switch incorporates a flush fitting trip button.

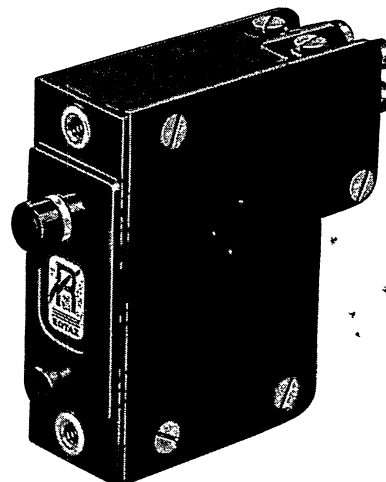
Suffix letter "A" i.e., D.5001/1A, identifies the /1 version as having a thimble sleeve fitted over the inner end of the trip button in order to limit its follow through. This modification has been incorporated on all /1 switches.

Suffix /2 denotes that the switch is provided with double socket assemblies for electrical connection.

Each switch is of the "thermally-operated" trip type, having inverse current time tripping characteristics (i.e., the length of time for which it will carry an overload becomes shorter as the overload becomes greater or vice versa).

The trip, however, can be over-ridden by pressing the operating button down and manually holding it in this position.

Calibration of the switch is made in an ambient temperature of 25°C., but will carry its normal rated



current up to 40°C., and will function satisfactorily at —30°C. The switch is not ambient compensated, but the protection is self compensating for tripping time at any ambient temperature, the tripping time under overload conditions becoming shorter for an increased ambient temperature and longer for a decreased ambient temperature; thus the maximum temperature to which the cables in the protected circuit will rise is approximately constant.

The calibration, namely, overload/trip time, is arranged to give adequate protection to the cable used with a specific switch in relation to its rating :—

D.5001/etc.	4 ampere cables
D.5002/etc.	7 ampere cables
D.5003/etc.	19 ampere cables
D.5004/etc.	19 ampere cables
D.5005/etc.	37 ampere cables
D.5009/etc.	4 ampere cables
D.5010/etc.	4 ampere cables

These are the minimum size recommended for use with the switch as the electrical connection is a 19 ampere, S.B.A.C. Type Socket.

The springs, levers, bi-metal strip and heater resistance are housed in a bakelite case, to the sides of which are fitted two cover plates. These plates are secured to the case by eight countersunk screws, four in each plate.

There are two external buttons on the switch, the large, coloured red, known as the operating button for closing the switch.

The other, coloured black, is the trip button for opening the contacts.

Mounting of the switch is achieved by means of two

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements. 27/5/55."

A.R.B. Authority Ref. Nos. D.5001/etc. E.660 D.5002/etc. E.661 D.5003/etc. E.662
D.5004/etc. E.663 D.5005 & /2 E.664 D.5005/1A E.993

PRICE ONE SHILLING

"Amendments to this leaflet invalidate the approval statement unless issued by the manufacturers with the concurrence of the Air Registration Board."

REVISED FEBRUARY 1955

ROTAX LIMITED *. WILLESDEN JUNCTION . LONDON N.W.10 . ENGLAND . TELEPHONE ELGAR 7777
LUCAS-ROTAX (AUSTRALIA) PTY. LTD . NEPEAN HIGHWAY . CHELTENHAM S. 22 . TELEPHONE XF 1381
LUCAS-ROTAX LIMITED . TORONTO 13 . CANADA . TELEPHONE PLYMOUTH 5-4171

4 B.A. screws which locate in holes spaced at 1.812" centres situated on the switch face.

Installation can be effected in any desired position without adverse affect to the switch operation.

Where however, it is desired to fit a number of switches in a bank, a minimum clearance of .032" must be allowed between each switch.

Operation

Depression of the operating button moves a bowed steel strip, pivoted at its ends and heavily spring loaded in the direction of its length, to a position against a strip just over the centre line of its pivots, thereby allowing a spring loaded movable contact arm (normally retained in the "off" position by the strip) to close its contact with a corresponding contact on a bi-metal strip.

Arrangement of the circuit inside the switch ensures that all the current flowing in the circuit passes through the bi-metal strip and a small heater resistance situated directly under the bi-metal strip. Increase in the temperature of the bi-metal strip causes it to deflect upwards, carrying the contact arm with it.

Should the current passing through the heater become excessive, the force exerted by the bi-metal strip against the movable contact arm, will lift the spring steel strip over its pivot centre line, when it is then rapidly returned to its initial "off" position by means of the spring providing the end load.

This causes the contact on the contact arm to be lifted from that on the bi-metal strip thus opening the circuit with a very sharp action.

Whenever it is required to put the switch in the "off" position, the trip button need only be pressed once. This action will trip the bowed leaf spring over its centre line and allow the movable contact arm to "break" the circuit.

Periodic Inspection

As the switch requires accurate setting in a constant temperature of 25°C., it is emphasised that no altera-

tion in service must be made to the adjusting grub screw which is sealed.

Examination of the switch for security of leads, possibility of damage to the case or incorrect operation of the operating and trip buttons are the only mechanical and visual checks which should be made.

Connection to the switch is made by ferrules and sockets of the S.B.A.C. type, thus creating an easy method of connecting and disconnecting the leads.

Electrically the operation can be checked by pressing the operating button to close the circuit and passing the following current through the switch :—

D.5001/etc.	10 amperes
D.5002/etc.	20 amperes
D.5003/etc.	30 amperes
D.5004/etc.	40 amperes
D.5005/etc.	50 amperes
D.5009/etc.	2 amperes
D.5010/etc.	5 amperes

In each case the current is 200 per cent of the rated current.

Check the time lag from the moment of closing the circuit up to the instant of automatic trip. This should be as follows :—

D.5001/etc.	45 to 75 seconds
D.5002/etc.	45 to 75 seconds
D.5003/etc.	45 to 75 seconds
D.5004/etc.	30 to 45 seconds
D.5005/etc.	30 to 45 seconds
D.5009/etc.	45 to 60 seconds
D.5010/etc.	40 to 50 seconds

Servicing

If test equipment is not available no attempt should be made to dismantle the switch. It should, however, be replaced by a new one and the faulty switch returned to our nearest Service Department where it will receive prompt attention by our Repair Organisation.

In cases where test equipment is available apply for Rotax Service Leaflet No. SL.3 for full servicing details.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
NEPEAN HIGHWAY
CHELTENHAM, S. 22
VICTORIA
Telephone : XF 1381

ROTAX LIMITED
HEMEL HEMPSTEAD
HERTFORDSHIRE
ENGLAND
Telephone : BOXMOOR 4444

LUCAS-ROTAX LIMITED
5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA
Telephone : BY 6500-09

Technical enquiries should be addressed to :—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10 • ENGLAND
ELGar 7777

SUBJECT: Current Flow Indicator Relay

TYPE: F. 1601

In certain heavy duty circuits, such as starter and feathering pump motor circuits, it has often been considered that a warning device should be incorporated to indicate to the operator that a heavy load is being imposed upon the battery.

Should the load remain upon the battery, unknown to the operator, it would be discharged to such an extent that essential circuits would not function when the generator was not generating.

The relay has been designed to utilise the magnetic field created around a current carrying conductor for the purpose of closing a pair of contacts.

A small soft iron loop is arranged to encircle the conductor, which is passed through the unit, and the field around that part of the conductor becomes concentrated across the ends of the

loop. Situated above the loop ends is a small armature, pivoted about its centre, and spring loaded at the end farthest away from the loop.

The aperture through which the cable passes is $\frac{3}{4}$ in. diameter and will receive quite easily "Unistart 1" cable. When a current of 40 to 50 amperes is flowing through the cable the contacts will close and remain closed until the current falls to 30 amperes.

The contacts are capable of carrying .1 ampere and are internally connected to two 6 B.A. terminals at the top of the unit, over which is placed a bakelite cover.

Each unit is assembled in a bakelite case, the overall dimensions of which are 2.4 in. high, 1.75 in. wide and 1.1 in. deep. A reinforced bakelite flange, 1.75 in. square, in which are positioned four 4 B.A. clearance holes is provided for mounting the unit.

Servicing

If testing equipment is not available no attempt should be made to service or dismantle the unit. It should, however, be replaced by a new one and the inoperative equipment returned to Rotax Limited, where it will be promptly dealt with by our repair organisation.

In cases where test equipment is available apply for Rotax Service Leaflet No. S.L. 10 for full servicing details.

Address all enquiries to:—

THE SERVICE
DEPARTMENT

ROTAX
LIMITED

WILLESDEN JUNCTION LONDON N.W. 10
TELEPHONE ELGAR 7777

SUBJECT: Steward Call Relay

TYPE: F. 1401

In modern passenger aircraft it is necessary that a simple method of calling the steward be within easy reach of the passenger. For this reason the Rotax Steward Call Relay, Type F.1401, has been designed.

Each passenger position has its own relay. However, these are approximately $2\frac{1}{2}$ in. long, $1\frac{1}{2}$ in. deep and 1 in. wide, and can therefore be installed in a junction box or behind a suitable panel in the stewards' position, on which can be mounted the call lights and re-set buttons.

The relay comprises two coils, a yoke, armature and contacts. The coils are mounted to the yoke, which is so shaped that the pole faces of the coils are presented at an angle of 8° to each other.

Pivoted between the coils is a copper-plated armature which is mounted on a thin bowed leaf toggle spring. This toggle spring is maintained in its bowed position by a further spring (the main spring) mounted directly above it.

At one side of the armature is mounted the moving contact.

Each unit is mounted by two screws or bolts and an arrangement of two $\frac{1}{4}$ -in. diameter holes,

2.812 in. apart (centres) in the bakelised linen base facilitates this.

The relay can be used in conjunction with two push button switches and a small wattage indicating lamp.

One push button is installed by the passenger and the other, with the call lamp, in the steward's quarters.

Operation of the push button in the passenger's position momentarily energises one coil in the relay and moves the armature, over the centre line of the bowed toggle spring, into a position which closes the contacts in the call light circuit.

Before complying with the passenger's request the steward can extinguish the call light by operating the re-set button. This button energises the second coil in the relay, returning the armature to its original position and breaking the call light circuit.

The relays operate from a 24-volt supply.

Although designed originally as the Steward Call Relay it can be used to operate any circuit through which the current does not exceed five amperes. The coil operating current does not exceed one ampere.

Servicing

If testing equipment is not available no attempt should be made to service or dismantle the unit. It should, however, be replaced by a new one and the inoperative equipment returned to Rotax Limited, where it will be promptly dealt with by our repair organisation.

In cases where test equipment is available apply for Rotax Service Leaflet No. S.L. 11 for full servicing details.

Address all enquiries to:—

THE SERVICE
DEPARTMENT

ROTAX
LIMITED

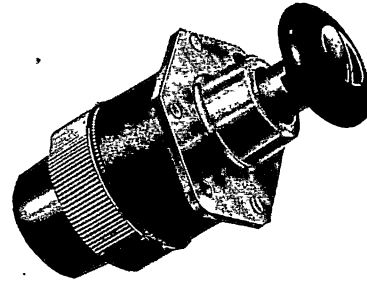
WILLESDEN JUNCTION LONDON N.W.10

TELEPHONE ELGAR 7777

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10

SUBJECT: Push-in Solenoid Switches

TYPES: D. 2201
D. 2202
D. 2203
D. 2204, A.M. Ref. 5C/2016
D. 2205
D. 2206
D. 2207
D. 2208, A.M. Ref. 5C/4018
D. 2209
D. 2211
D. 2212



DATA:

OPERATING VOLTAGE: 12 Volts, D.2201 & 3
24 Volts, D.2202, 4, 5, 6, 7, 8 & 9
28 Volts, D.2211 & 12
CURRENT RATING: 5 Amperes, Intermittent
(Type D.2206 Continuously rated)
WEIGHT: 10 oz.

Description

This range of push-in solenoid switches is designed primarily for controlling the feathering operation of the de Havilland Hydromatic Aircscrew, independently of the Constant Speed Unit, and also for initiating the starting sequence for the electric starters fitted to gas turbine engines. However, the switches may be included in suitable circuits, of not more than 90 seconds rating, where the action of a "No Voltage Trip" is required. The switches are mainly similar in general appearance and construction and differ only in the operating voltage, contact and terminal arrangement and mounting flange details.

The main housing is of aluminium with the mounting flange formed integrally. To the flange is secured a metal cover, from the boss of which protrudes a spring-loaded plunger. The end of the plunger is slotted to receive two locating keys machined on the end of the ebonite switch knob and a large, flush-fitting screw secures the knob to the plunger.

Internally, the housing carries a soft-iron coil bobbin assembly with the spring-loaded plunger passing through its centre. Resistance of the coil winding is 22-27 ohms and the minimum operating current .53 ampere for all types with the exception of the D.2201, 3, 11 and 12. Coil resistance of the types D.2201 and D.2203 is 4.7-5.75 ohms and the minimum

operating current 1.25 amperes. In the types D.2211 and D.2212, the winding has a resistance of 22-27 ohms, with a minimum operating current of .33 ampere.

At the end of the housing opposite the mounting flange, the plunger, with a spring-loaded copper contact plate attached to it, projects from the centre of the coil. At the same end, an ebonite combined terminal and contact block, having a locating key formed in one side of the moulding, is positioned in the housing so that the contacts are just clear of the contact plate. An insulated moulded cover fits over the top of the terminal block and both are secured to the housing by a large knurled nut which is, in turn, locked by a circlip.

Leads to the switch pass through a rubber grommet in the terminal cover and all terminals are clearly marked for connection purposes. Mounting arrangements differ throughout the range and these are dealt with separately below.

D.2201 & D.2202

4 holes .193" diameter, equally spaced in a circular mounting flange.

D.2203, 4 & 6

4 holes .193" diameter, equally spaced in a square mounting flange.

D.2205, 7, 8, 9, 11 & 12

2 holes .193" diameter, 2.187" apart, in a six-sided mounting flange.

Nominal operating voltages are as follows: 12v. for types D.2201 & D.2203; 24v. for types D.2202, 4 to 9; 28v. for types D.2211 and D.2212. The 5-ampere current rating is intermittent for all types with the exception of the D.2206, this unit being continuously rated. The overall length of each switch in the range is approximately 4" and the weight 10 oz.

"Information in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements. 19.6.53"

PRICE ONE SHILLING

REVISED APRIL, 1953.

ROTAX LIMITED · WILLESDEN JUNCTION · LONDON N.W.10 · ENGLAND · TELEPHONE ELGAR 7777
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LUCAS-ROTAX LIMITED · TORONTO 13 · CANADA · TELEPHONE OXFORD 9368

Operation

D.2201-8

As these switches are designed primarily for controlling the feathering operation of the de Havilland Hydromatic Airscrew, the action described here is as it applies to that feathering circuit. On depression of the plunger, the coil is energised as the contact plate shorts the contacts and maintains the plunger in the "on" position until its circuit is broken, either by pulling out the plunger manually or by breaking the coil circuit with another switch. (In the de Havilland system, this second switch is one of the Rotax Oil Pressure Switches in the D.2300 range, dealt with in T.L.11 and S.L. 13).

When the plunger is depressed, the circuit to the feathering pump motor relay is completed, which, in turn, energises the feathering pump motor. Oil pressure in the system builds up to a pre-determined value, at which the oil pressure switch opens, thus breaking the circuit to the push-in solenoid switch. The plunger of the solenoid switch returns to the "off" position under the action of its spring and breaks the circuit to the coil of the feathering pump motor relay, causing the motor to stop with the aircrew in the fully feathered position.

The plunger returns to the "off" position with a positive snap action whether pulled out manually or the coil circuit de-energised externally.

D.2209

The action of this solenoid switch is very similar to that of the D.2201-8 switches, but is used in conjunction with a selector switch which prevents the plunger being pushed in until the required circuit has been selected. Both the selector switch and the D.2209 switch are used to initiate the starting sequence for gas turbine engines.

D.2211 & D.2212

Since the solenoid coil of these switches is energised from its associated switchgear (terminals "C" and "CI" being isolated for this purpose), the action is slightly different to that of the other switches in the range, necessitating the manual depression of the plunger until the external source energises the solenoid coil. Both switches are designed primarily for use on starter panels, in conjunction with other switchgear. Depression of the plunger makes contact between terminals "+" and "SI" and initiates the first phase of the starting sequence, via a system of relays and switches. The plunger is held in manually until the coil circuit is completed through terminals "C" and "CI," thus maintaining the plunger in the "on" position and precluding the necessity for further manual depression of the plunger. The switch continues to stay in the "on" position until the starting cycle has been completed, when the circuit to solenoid coil is de-energised externally, allowing the plunger to return to the "off" position with a positive snap action.

Servicing

If test equipment is not available, no attempt should be made to service or dismantle the switch. It should, however, be replaced by a new or serviceable switch and the inoperative unit returned to our nearest Service Department, or to an authorised service station, where it will receive the prompt attention of our Repair Organisation. Where test equipment is available, apply for Rotax Service Leaflet No. S.L. 12 for full servicing details.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD.
BOUVERIE STREET
MELBOURNE, N. 3
AUSTRALIA
Telephone : F.J. 4687

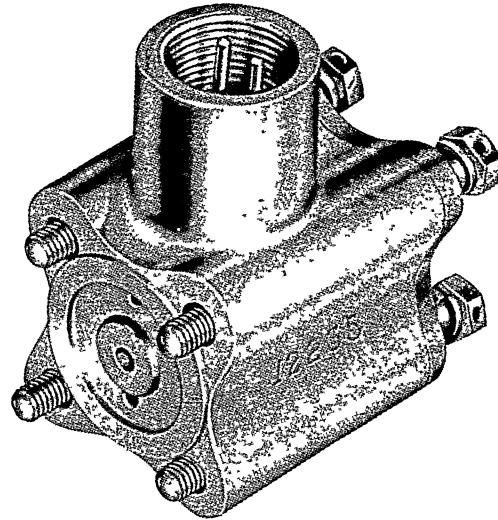
ROTAX LIMITED
WILLESDEN JUNCTION
LONDON, N.W. 10
ENGLAND
Telephone : ELGAR 7777

LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA
Telephone : WALNUT 3435

SUBJECT: Pressure Switch

TYPES:

D.2303/1 A.M. Stores Ref. 5C/2017
D.2305/1 A.M. Stores Ref. 5C/3153
D.2306/1 A.M. Stores Ref. 5C/4445
D.2307/1
D.2308/2
D.2309/1
D.2310/1 A.M. Stores Ref. 5C/4516



DATA:

MOUNTING: Four 2 B.A. bolts on a
1.312" P.C.D.
OPERATING VOLTAGE: 24 volts
WEIGHT: 6.5 ounces

Description

This group of pressure switches has been designed for single line operation or as a differential switch; they vary only in their operating pressure, this pressure being dependent upon adjustment and upon the spring fitted. The D.2304 switch is now superseded, and should be replaced by the D.2307/1 which is an improved modified version of the switch.

The settings for the various types of switches are as follows:

D.2303/1	425-450 lb. per square inch
D.2305/1	500-520 lb. per square inch
D.2306/1	190-210 lb. per square inch
D.2307/1	675-700 lb. per square inch
D.2308/2	250-275 lb. per square inch
D.2309/1	220-240 lb. per square inch
D.2310/1	350-370 lb. per square inch

The construction of these switches is essentially similar. The housing which is of light alloy, approximately cube shaped, into which is placed an insulating plate with two contact inserts. These inserts are connected electrically to the two pins of the plug. The plug shell is formed by a spout on the side of the housing.

Fitting over the contacts is the moveable contact plate which is held in the closed position by a spring. Variation of the switch setting is

obtained by varying the compression on the spring by adjusting the setting nut which is positioned under the top cover.

In the D.2303/1 the two oil pressures, which are being fed to the switch, are the engine and boosted oil pressures. Engine oil passes through a port, off-centre in the base, on to the top side of the contact plate, thus helping the normal spring pressure to retain the plate in the closed position. The boosted oil pressure is fed into a second port in the centre of the base where it forces a plunger upwards against the contact plate, spring and engine oil pressure. When the boosted oil pressure exceeds that of the engine oil pressure and spring compression combined by 450 lb. per square inch, the plunger will lift the contact plate and so break the switch circuit.

In other cases the engine oil supply is not available from the constant speed unit so that the switch operates solely by the boosted oil pressure against the spring compression. The port which, in the D.2303/1, was used for engine oil pressure acts as a drain, to prevent, in the event of oil passing the plunger, a counter-balancing pressure to the boosted oil pressure being formed.

The contacts are normally required to break a maximum current of 2 amperes at 24 volts. The overall height of the switch, including the head of the securing bolt, is 1.8" and its overall length including the spout which forms the plug shell is 2.7"; the width is 1.4". Weight of the unit is 6½ ounces.

Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements. 9.3.53

REVISED JANUARY, 1953

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LUCAS-ROTAX (AUSTRALIA) PTY. LTD. • BOUVIERIE STREET • MELBOURNE N.3 • TELEPHONE F.J. 4687
LUCAS-ROTAX LIMITED • TORONTO 13 • CANADA • TELEPHONE OXFORD 9368

Switch mounting is achieved by four 2 B.A. bolts which pass through the switch from top to bottom on a P.C.D. of 1.312". The mating surface and a gasket form an oil tight seal

between the switch and its associate equipment. Holes are drilled in the gasket to permit the oil pressure to be applied to the port in the switch.

Servicing

If test equipment is not available, no attempt should be made to service or dismantle the switch. It should, however, be replaced by a new or serviceable switch and the inoperative unit returned to our nearest Service Department, or to an authorised Service Station, where it will receive the prompt attention of our Repair Organisation.

In cases where test equipment is available, apply for Rotax Service Leaflet No. S.L.13 for full servicing details. For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to:—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD.
BOUVERIE STREET
MELBOURNE, N.3
AUSTRALIA
Telephone: F.J. 4687

ROTAX LIMITED
WILLESDEN JUNCTION
LONDON, N.W.10
ENGLAND
Telephone: ELGAR 7777

LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA
Telephone: WALNUT 3435

SUBJECT: Single Acting Solenoid Switch

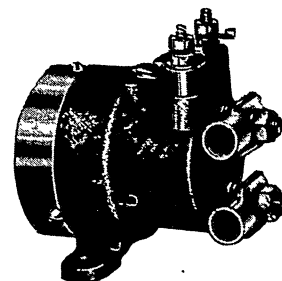
TYPE: D.0205 12v

D.0208 12v A.M. Stores Ref. 5C/858

D.0209 24v A.M. Stores Ref. 5C/860

D.0210 12v A.M. Stores Ref. 5C/1045

D.0213 24v A.M. Stores Ref. 5C/1572



This range of single acting solenoid switches is designed to cover the requirements of heavy duty, single pole switching, up to a maximum of 300 amperes for the short rated types and 150 amperes for the 15 minute rated types. The switches are neat and compact in design, enabling a position of mounting to be selected which reduces the heavy cable run to an absolute minimum. Wherever possible it is advisable to mount the switch with the main terminals uppermost. (For Double Acting Solenoid Switches see Technical Leaflet T.L.13.)

The main housing is machined from an aluminium alloy casting closed at one end. At this end are positioned the fixed contacts, the insulating plate and the helical return spring, whilst just inside the open end is the coil assembly with the armature and movable contact plate. A second spring, conical in form, is placed between the movable contact plate and the coil cup to allow the plate to have a semi-floating fit on the armature.

- Passing through a grommet in the top of the housing are the two leads from the coil, the end of which are secured to a two-way terminal block. A "flat" is machined above the closed end of the housing to facilitate the mounting of the terminal block.

A cover is placed over the open end of the housing and secured with three cheese-head screws. These screws pass through the housing into the metal coil case thus locating the coil assembly accurately.

All the switches are identical in appearance with the exception of the D.0205. In this case the mounting bracket, which is cast integral with the housing, is not flat but curved to a radius of 1.906" with the centres of the two .218" diameter mounting holes being 60° apart. For the other switches the two mounting holes are .234" diameter with centres 2.375" apart.

The overall length and height is approximately 3½" and the total weight 1 lb. 6 ozs.

Each switch coil has a special colour code for the leads which are listed below.

Code No.	Coil Leads	Ohmic Resistance	Time Rating
D.0205	2 yellow	1.1 ohms ± 10%	30 seconds
D.0208	2 yellow	1.1 ohms ± 10%	30 seconds
D.0210	1 black 1 yellow	3.0 ohms ± 10%	15 minutes
D.0209	2 black	13.3 ohms ± 10%	15 minutes
D.0213	1 yellow 1 red	5.2 ohms ± 5%	30 seconds

Electrical connection to the coil is made by two 3 B.A. terminals and for the heavy duty cable connections there are two ⅝" B.S.F. terminals. Cable lugs and rubber terminal covers are supplied separately.

Operation

When current passes through the solenoid the armature is drawn inwards causing the helical return spring to come under pressure and the contact plate to bridge the fixed contacts. Further movement of the armature compresses the conical spring behind the contact plate so that the contact plate lies evenly across, and in good contact with, the fixed contacts.

After the current through the solenoid is broken the armature returns to its position of rest. The first movement of the armature does not lift the contact plate from the contacts as the conical spring is at that moment returning to its normal position, thereby retaining the contact plate in the closed position. By the time the bevelled nut on the end of the armature reaches the contact plate the armature is travelling at such a speed that it strikes the contact plate from the contacts, making a very rapid break.

Servicing

If test equipment is not available, no attempt should be made to service or dismantle the unit. It should, however, be replaced by a new one and the inoperative equipment returned to Rotax Limited, where it will be promptly dealt with by our Repair Organisation.

In cases where test equipment is available apply for Rotax Service Leaflet No. S.L.14 for full servicing details.

Address all enquiries to:—

THE SERVICE
DEPARTMENT

ROTAX

L I M I T E D

WILLES DEN JUNCTION LONDON N.W.10

TELEPHONE ELGAR 7777

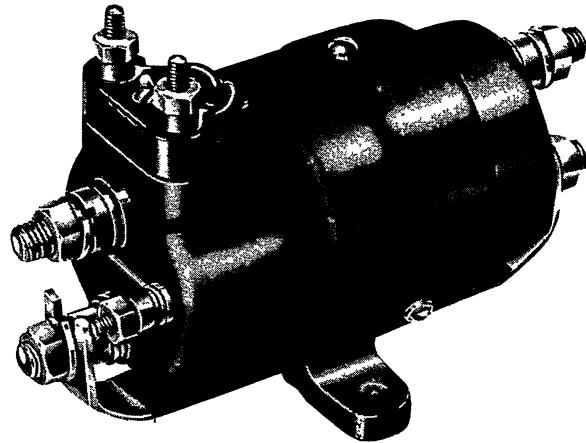
ROTAX LIMITED • WILLES DEN JUNCTION • LONDON N.W.10

SUBJECT: Double Acting Solenoid Switch

TYPES: D.2703, D.2704 and D.2709

DATA:

Nominal Voltage :	D.2703 24 volts
	D.2704 12 volts
	D.2709 24 volts
Current Rating :	300 amperes
Time Rating :	30 seconds
Maximum Altitude :	50,000 feet
Electrical Connections :	Coil, two 3 B.A. terminals
	Main, four $\frac{5}{16}$ " B.S.F. terminals.
A.M. Ref. :	D.2703 5CW/1712
	D.2704 5CW/2018



Description

These double acting solenoid switches are designed to cover the requirements of heavy duty single-pole switching, up to a maximum of 300 amperes.

The design of the switch is basically that of the well-known Rotax single acting solenoid switch. (See Technical Leaflet T.L.12). This simple and compact design enables any position of mounting to be selected which reduces the heavy duty cable runs to an absolute minimum. It is preferable, however, to mount the switch with the end, with the four contacts, uppermost.

In general appearances the switches are identical, the differences being their operating voltage, coil resistance and coil lead colour.

Code No.	Coil Leads	Ohmic Resistance	Time Rating
D.2703	2 red	4.5 to 5 ohms	30 seconds
D.2704	2 yellow	1.0 to 1.2 ohms	30 seconds
D.2709	2 red	4.5 to 5 ohms	30 seconds

An aluminium alloy casting, internally machined and closed at one end, forms the main housing. At the closed end there are four terminals (two heavy duty and two auxiliary), an insulating plate and helical return spring.

Just inside the open end is a coil assembly with an armature plate and spindle. This spindle passes through the centre of the armature plate, to which it is secured, and the coil assembly. The spindle receives over each end a conical spring and insulated contact

plate, the latter being held in a semi-floating position by the conical spring on one side and castellated nut and pin on each end of the shaft.

Fitted over the open end of the main housing is another housing with two heavy duty contacts and insulating plate mounted in its closed end. When placed together the housings are held by three cheese-head screws which also enter the coil cup thereby locating it in the main housing. Two grub screws in the main housing, under the mounting flange, give added security to the coil assembly.

A heavy copper strip, bound with varnish insulation and passing under the switch, connects two heavy duty terminals, one at either end of the switch.

Passing through a grommet in the top of the main housing are two leads from the coil, the ends of which are secured to a two-way terminal block. A "flat" is machined above the closed end of the housing to facilitate the mounting of the terminal blocks.

Operation

In the position of rest it is arranged for the two heavy duty contacts in the small housing to be short circuited, whilst the four contacts in the main housing are open circuited.

When current passes through the solenoid the armature is drawn inwards causing the helical return spring

"This Leaflet is approved by the Air Registration Board." 16/5/58

A.R.B. Authority Refs.: E1552 for D.2703 and E1553 for D.2704

"Amendments to this publication invalidate the above approval unless issued by the manufacturers with the concurrence of the Air Registration Board."

PRICE ONE SHILLING

REVISED MAY 1958

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to come under pressure and the contact plate in the main housing to bridge the two auxiliary contacts and then immediately afterwards the two main contacts. Further movement of the armature compresses the conical spring behind the contact plate so that the contact plate lies evenly across, and in good contact with, the contacts. It should be noted here that the contact faces of the auxiliary contacts are spring loaded.

At the opposite end of the switch the following occurs. The first movement of the armature does not lift the contact plate from the contacts as the conical spring is at that moment returning to its normal position, thereby retaining the contact plate in the closed position. By the time the castellated nut on the end of the armature reaches the contact plate the armature is travelling at a comparatively high speed and it strikes the contact plate from the contacts, making a very rapid break.

When the coil is de-energised the reverse action takes place. Both the contact plates cannot be in circuit with the contacts at the same time during the cycle of operation.

The mounting bracket which is cast integral with the main housing has two 0.234" diameter holes, with centres 2.375" apart to facilitate the mounting.

Each switch is approximately 5½" long and 3½" high with a total weight of 1 lb. 13 oz.

Electrical connections to the coil are made by two 3 B.A. terminals; for the heavy duty cable connections there are four ⅝" B.S.F. terminals (two at either end of the switch) and for the auxiliary connections, two 3 B.A. terminals. These latter terminals are connected together by a small insulated copper strip.

Servicing

If test equipment is not available, no attempt should be made to service or dismantle the unit. It should, however, be replaced by a new one and the inoperative equipment returned to Rotax Limited, where it will be promptly dealt with by our Repair Organisation.

In cases where test equipment is available apply for Rotax Service Leaflet No. S.L.15 for full servicing details.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to:—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
JOYNTON AVENUE
ZETLAND
NEW SOUTH WALES

Telephone : SYDNEY FF.2241

ROTAX LIMITED
HEMEL HEMPSTEAD
HERTFORDSHIRE
ENGLAND

Telephone : BOXMOOR 4444

LUCAS-ROTAX LIMITED
5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA

Telephone : BY 6500-09

Technical enquiries should be addressed to:—

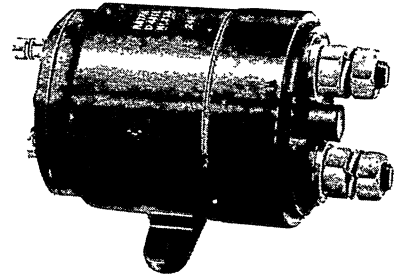
TECHNICAL SALES DEPARTMENT

ROTAX LIMITED . WILLESDEN JUNCTION . LONDON N.W.10 . ENGLAND

Telephone : ELGar 7777

SUBJECT: Solenoid Switch

TYPE: D.4801 24v A.M. Stores Ref. 5C/4080



Description

The D.4801 switch is a single pole, 24 volt switch with a normal rating of 1500 amperes for a period of 90 seconds. It is designed for use as a remotely operated starting switch for engine starters.

The body of the switch is a light alloy casting containing a liner held in place by a rubber grommet and in this liner is the solenoid cup assembly which should have an interference fit.

The moulded terminal assembly, which carries the fixed copper contacts, is secured to the body assembly by means of a large ring nut, the contacts being insulated from each other and from the body by the use of insulating washers.

At the other end of the switch, another moulded terminal assembly, secured by three cheese-head screws, carries the input leads to the solenoid. A spindle, on which is carried the moving contact plate and spring, plunger, and return spring, runs through the solenoid and is held by two bushes, one in the body assembly itself and the other in the terminal assembly holding the fixed contacts.

The moving contact plate is made of copper in a moulded bakelite centre. This assembly is held in the off position by the return spring on the end of the spindle, and is mounted in a manner designed to ensure perfect alignment of the fixed and moving contacts in the switch closed position.

Operation

When current is passed through the solenoid the plunger is drawn inwards towards the centre of the solenoid and causing the return spring to come under pressure. The contact spring between plunger and moving contact assembly will also be compressed when the plunger is drawn into the coil assembly. This contact spring ensures perfect alignment of the fixed and moving contacts when in the switch closed position.

After the current through the solenoid is broken, the plunger returns to its position of rest. The initial movement of the plunger does not lift the moving contact plate from the fixed contacts as the contact spring is returning to its normal position and is, in effect, still holding the contact plate in the "on position." By the time the contact spring has returned to normal, the conical nut on the spindle strikes the moving contact plate with considerable force, ensuring a rapid and positive break and return to the "off" position.

The two solenoid lead terminals are brass 3 B.A. threaded screws, while the heavy fixed contact terminals are made of copper and have a .375" B.S.F. thread.

Two holes .234" diameter and 2.375" between centres are drilled in a mounting bracket integral with the body casting. The switch may be mounted in any position but it is preferable to mount the switch with the heavy contacts uppermost so that the switch will open in the unlikely event of spring failure.

Servicing

If test equipment is not available, no attempt should be made to service or dismantle the unit. It should, however, be replaced by a new one and the inoperative equipment returned to Rotax Limited, where it will be promptly dealt with by our Repair Organisation. In cases where test equipment is available apply for Rotax Service Leaflet No. S.L.16 for full servicing details.

Address all enquiries to:—

THE SERVICE
DEPARTMENT
ROTAX
LIMITED

WILLESDEN JUNCTION LONDON N.W.10
TELEPHONE ELGAR 7777

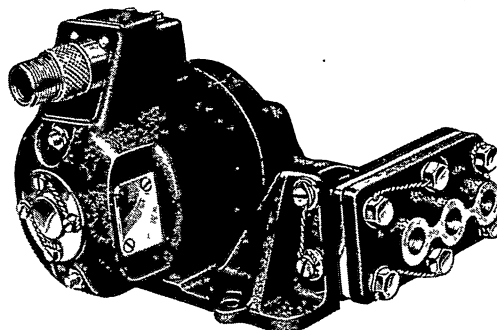
ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10

SUBJECT: 24 Volt Anti-Icer Pump

TYPE: M.1101

DATA:

OPERATING VOLTAGE :	24v. D.C.
CURRENT AT NORMAL DELIVERY :	1.75 amps.
DELIVERY AT SUCTION OF 2-5 ins. Hg :	190 c.c. each port per minute.
ELECTRICAL CONNECTION :	Plug & socket Type Z2/0/0/0.
FLUID CONNECTION :	Three $\frac{1}{8}$ " B.S.P. ports.
WEIGHT :	6 lb.
MOUNTING :	Three .261" diameter holes in base bracket.



Description

This 24 volt electrically-operated floating gear pump unit is designed to give a minimum fluid output of 380 c.cs., in two equal supplies of 190 c.cs. each, at a pressure of 15 to 20 lb./sq. in. with an inlet suction of from 2 to 5 in. Hg. at maximum current draw of 1.75 amperes.

The series wound, two-pole motor, which drives the pump through a worm and pinion gear, is contained in a cast aluminium-alloy housing which provides two access ports to the commutator brushes and carries an extension to which the connector plug, for the aircraft electrical system, is bolted.

The yoke and pole-pieces assembly is located in the housing by a grub screw, and the commutator end-frame, carrying the ballrace, is formed integrally with the housing. A cover plate, bolted to the end-frame, gives access to the armature shaft retaining nut.

The carbon brushes are carried in two separate brush mouldings, each brush being loaded against the commutator by a helical spring surrounding the brush pigtail and bearing directly on the head of the brush. The access apertures are enclosed by cover plates, each being retained by two screws.

The motor driving-end frame is an aluminium-alloy casting providing a housing for the driving end ballrace of the armature shaft and a mounting spigot for the worm drive casing, and carrying the threads for the two main assembly studs of the motor housing.

The aluminium-alloy worm-drive casing is spigoted and bolted to the driving end frame, and carries the intermediate drive shaft in two bronze bushes. The driven pinion is retained to one end of this shaft by a set screw impinging on a flat on the shaft, while a dog is formed integrally at the other, slotted to engage with a double muff and pin coupling transferring the drive to the pump drive shaft.

The body of the pump is assembled from three components, all of steel; the drive shaft housing, the gear plate housing the three pump gears and an end cover containing the single inlet and the two outlet ports for the fluid. These parts, and the pump gears, are lapped together to give the precision required to obtain full pump efficiency.

The pump driving gear is pinned to one end of the pump drive shaft and the muff and pin coupling engages in a slot in the other end. A Gits seal is carried in the drive shaft housing to prevent the egress of fluid from the pump through the shaft bearing.

The pump driving gear and the two floating gears run in apertures in the gear plate, in which they are a lapped fit, the gear plate being secured between the shaft housing and the end cover by means of six bolts.

The pump assembly is attached to the motor by a deep spigot between the pump drive housing and the worm-drive housing, and located by two bolts retaining it to a flange on the unit mounting bracket.

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A.6-2 of British Civil Airworthiness Requirements. 25/10/51."

NOVEMBER, 1952

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The cast aluminium bracket is bolted to a spigoted machined face on the motor housing, thus providing the positive means of assembly between the pump and the motor, and has three .261" diameter holes for the mounting of the pump unit to the aircraft.

The unit must be installed so that the fluid connecting pipes leave the pump in an upward direction, ensuring that the gears are constantly immersed in fluid. If this is not done, seizure of the pump due to drying-out may occur after long periods of disuse.

The fluid connections are made by means of $\frac{1}{8}$ " B.S.P. unions and the connection to the aircraft electrical system by a 2-pin plug and socket connection A.M. Type Z2/0/0/0.

If desired, the unit may be fitted with a filter N.60084 and N.60083 in the inlet to the pump. When this is supplied fitted to the pump, the unit is known as the M.1102.

Operation

When the pilot's switch is operated to allow current to flow to the motor, the pump drive shaft will rotate, producing a depression about the driving gear, consequently inducing fluid to enter the pump. The rotating gear forces the fluid to flow about the floating gears, and thus expel the fluid from the pump through the two outlet orifices.

Servicing

Full information regarding overhaul and testing of the M.1101 Anti-icer Pump is given in Service Leaflet No. S.L. 18. Any unit which cannot be readily serviced by following the instructions contained in S.L. 18 should be returned to our nearest Service Department, where it will receive prompt attention by our Repair Organisation. For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
BOUVERIE STREET
MELBOURNE, N. 3
AUSTRALIA
Telephone : F.J. 4687

ROTAX LIMITED
WILLESDEN JUNCTION
LONDON, N.W. 10
ENGLAND
Telephone : ELGAR 7777

LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA
Telephone : WALNUT 3435

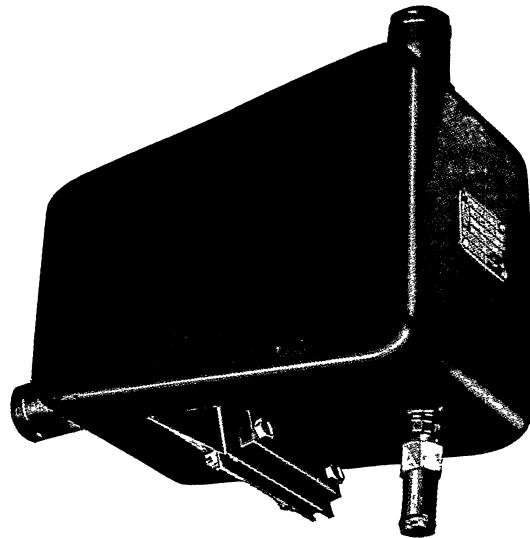
SUBJECT: Oil Separator

TYPE: M.3001

DATA:

MOUNTING : Two 2 B.A. holes. Shockproof mounting

WEIGHT : 1 lb. 5 oz.



Description

This unit, designed to cleanse the air from the pump, consists of a welded aluminium body having an inlet and outlet port, for connection of the unit in the air line from the pump, and an oil drain union to discharge oil which has been separated from the air. Within the unit a fine screen is positioned so that all incoming air must pass through the screen before reaching the outlet port.

The oil drain outlet consists of a union soldered to the body of the separator and a nipple for receiving the oil drain tubing. A sealing washer and filter disc are positioned between the union and the nipple.

A mounting bracket is welded to the body of the separator and a Neoprene mounting pad is positioned on each side of this bracket, these, together with a steel mounting plate, form a shock-proof mounting for the separator. Two holes passing through the mounting bracket, Neoprene pads and steel plate receive two brass sleeves through which two 2 B.A. screws are passed for securing the unit to the aircraft structure.

Operation

Air from the engine-driven air pump, entering the inlet port of the oil separator, is baffled against the fine screen within the separator body and the walls of the unit, thereby separating the oil from the air. The oil thus separated drains through the screen and away to discharge through the oil drain union. Clean air then passes out of the unit through the outlet port.

Installation

Installation of the oil separator should present no difficulty if the following points are borne in mind.

Mount the unit by means of the integral mounting bracket. Locate the separator, with the oil drain nipple downward, in the pressure line between the pressure relief valve and the air pump, and vertically to the aircraft flying position.

Connect the oil drain to the crankcase, exhaust, or overboard as specified on the installation drawings in the handbook prepared by the aircraft manufacturer. Take care to ensure that all connections at the separator are tight particularly the air inlet and outlet tubing connections.

Periodic Inspection

500-hour Inspection

The oil separator unit should be inspected at every 500 hours for signs of obvious damage to the body or connections.

Check that the air tubing connections are secure and do not allow air to escape.

Remove the oil drain nipple and inspect to see that the screen is not clogged. Wash in benzine if necessary.

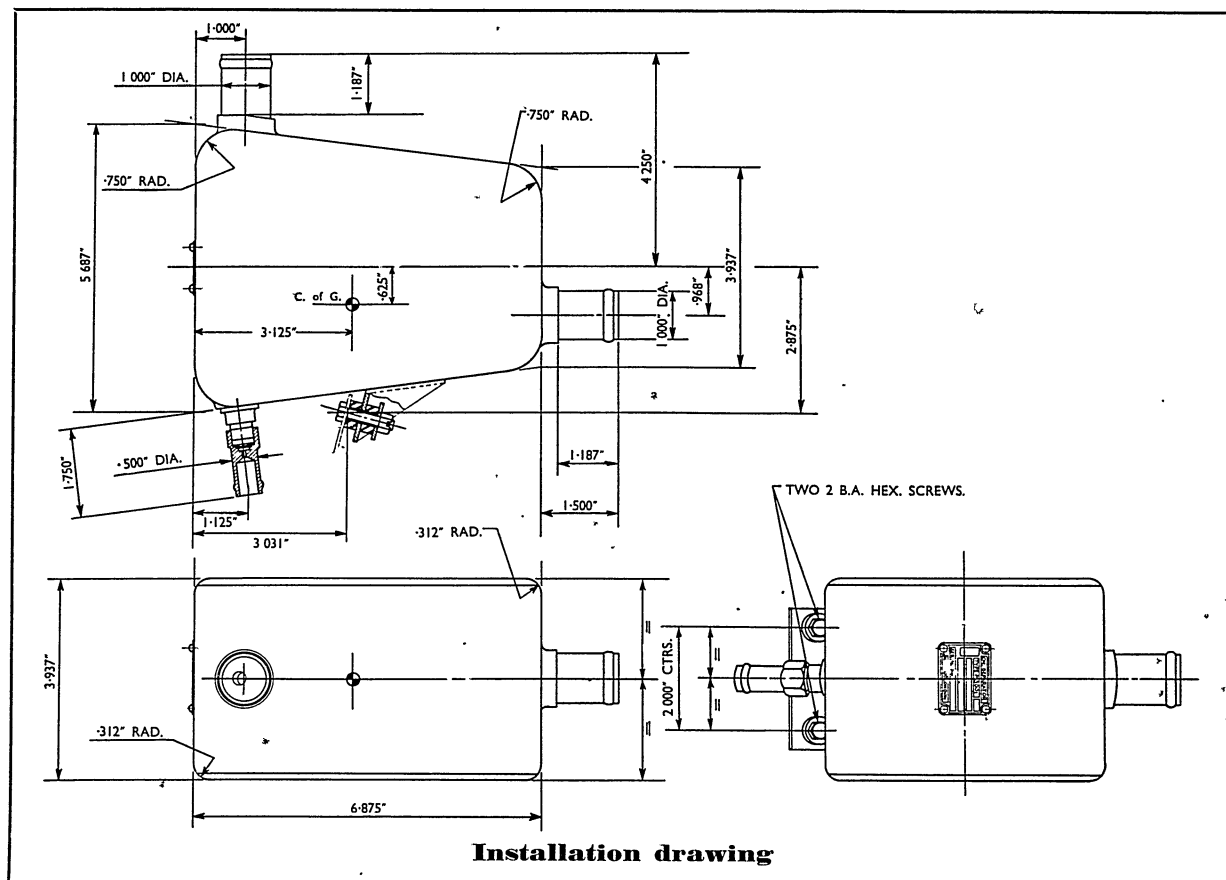
Check for security of mounting.

PRICE ONE SHILLING

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A 6-2 of British Civil Airworthiness Requirements. 9/6/53."

FEBRUARY 1953

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Servicing

If test equipment is not available, no attempt should be made to service or dismantle the unit. It should however be replaced by a new one and the inoperative

equipment returned to our nearest Service Department, where it will be promptly dealt with by our Repair Organisation.

In cases where the equipment is available apply for Rotax Service Leaflet No. S.L. 26
for full servicing details. Address all enquiries to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
BOUVIERIE STREET
MELBOURNE, N. 3
AUSTRALIA

Telephone : F.J. 4687

ROTAX LIMITED
WILLESDEN JUNCTION
LONDON, N.W. 10
ENGLAND

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LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA

Telephone : WALNUT 3435

Amendment—D.6108 Relay

The D.6108 relay differs only from the D.6103/2 relay inasmuch that the D.6108 is fitted with main terminals to suit 100 ampere Prenal cable lugs.

The information contained in Technical Leaflet No. 17 and Service Leaflet No. 20 is therefore applicable to the D.6108. A number of changes occur however in component part numbers and these are quoted on an amendment slip attached to the Service Leaflet.

D.6101—4 Technical Leaflet

November, 1955

D.6104

DATA:	MOUNTING :	2 holes .234" dia. 3.000" apart
	WEIGHT :	3 lb. D6101, D6103 3.25 lb. D6102, D6104
	RATING :	90 sec. D6101, D6103 Continuous D6102, D6104

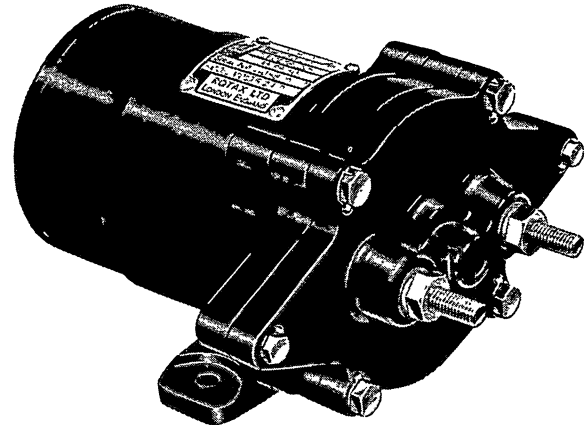
Description

In these units, the operating coil is energised from a 24-29 volt supply and has a rating of 90 seconds. The minimum pull-in voltage required is 16 volts and the minimum hold-in voltage is 4 volts. The contacts are designed to carry and break 50 amperes at 120 volts D.C. with minimum arcing. When used on 112 volt circuits it is necessary for these units to be electrically protected or insulated from the aircraft structure.

The unit, which weighs 3 lb., consists of a solenoid assembly housed in a light-alloy cylindrical body with an intervening liner maintained in position by a rubber seal and ring nut. A specially shaped intermediate moulding, contact mouldings, and terminal moulding are bolted to the main body. An additional refinement in the internal design of the intermediate mouldings is the provision of two arc shoots, formed in the vicinity of the contacts, which assist arc quenching by allowing the arc to lengthen and thereby cool.

Essential components comprising the unit are the solenoid coil, plunger, spindle assembly, fixed contact, and return spring. The spindle extends through the coil and has a circular contact, set in a moulded former, attached. A contact spring is sandwiched between a seating on the underside of the contact former and a seating pinned to the plunger end of the spindle. These components are so arranged that when the coil is energised, the plunger is drawn into the centre of the coil and imparts this movement to the spindle. Thus, the circular contact is moved towards a pair of

gnetic Relay.



contacts, positioned in the contact moulding, until positive connection is made. The necessary load to control this action is provided by the contact spring which, since it comes under compression when the spindle moves, assists in returning the spindle when the coil is de-energised. A return spring is positioned over the end of the spindle between a seating on the contact side of the moulded former and a seating on the contact moulding. When the coil is de-energised, the spindle comes under the action of both springs to effect a rapid and clean break between the contacting surfaces. The fixed contacts are anchored in the moulding by spring-washed nuts and are extended to provide terminal connections.

Type D.6102 is similar to D.6101 with the exception that it incorporates an economy switch operated by the movement of the spindle, while the D.6103 differs from the D.6101 in that it includes two special spring-loaded arcing contacts as protective devices. The D.6104 incorporates both the economy switch and the arcing contacts in its construction.

The solenoid coil is wound to form a closing coil and an economy coil; both coils being arranged in circuit with the switch so that, when the contacts are closed, only the closing coil is in circuit but, when the contacts are open, the economy coil is brought in so that both coils are in circuit.

The fixed contact of the switch is spring-loaded and can be adjusted by a nut which, in conjunction with a

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MARCH 1952

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bracket assembly, serves to maintain the body of the switch in position. An insulated contact ring, located on the spindle and secured by a barrel nut, comes against the spring-arm contact of the switch, when the plunger is drawn in, to thereby open the contacts.

Servicing

When adequate and efficient repair facilities exist, servicing should be effected in strict accordance with the instructions issued in Service Leaflet No. 20, which is obtainable on request from Rotax Limited.

If suitable servicing equipment is not available, the unit should be returned to our nearest Service Department where it will receive prompt attention from our Repair Organisation.

Address all enquiries to :—

THE SERVICE DEPARTMENT

ROTAX LIMITED
WILLESDEN JUNCTION
LONDON, N.W. 10
ENGLAND

Telephone : ELGAR 7777

LUCAS-ROTAX (AUST.) PTY. LTD
BOUVERIE STREET
MELBOURNE, N. 3
AUSTRALIA

Telephone : F.J. 4867

LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
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CANADA

Telephone : WALNUT 3435

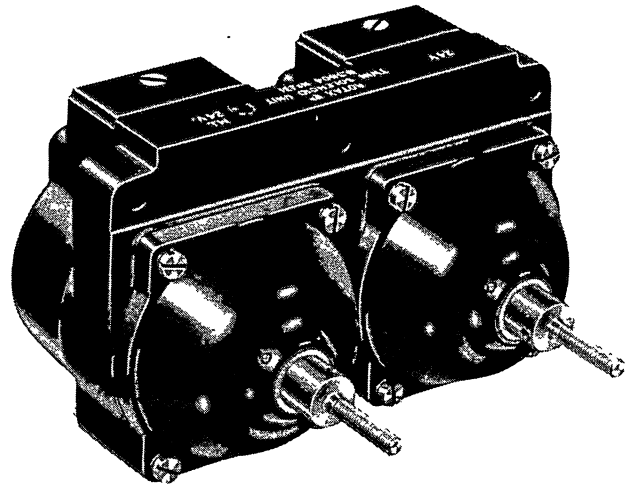
SUBJECT: Twin Solenoid Actuator**TYPE:** D.3804**Description**

The unit, which may be used for actuating a lock or similar device, consists of two solenoid assemblies mounted side by side on a common base having an overall length of 5.08 in., and a maximum width of 3.255 in. Individually, the solenoids give a minimum pull of 6 lb., at 24 volts, over a travel of 0.25 in. The unit weighs 3 lb. 12 oz.

The exposed end of each solenoid plunger is stepped down to provide a 2 BA threaded extremity for reception of the locking mechanism control rod. Excepting for the exposed end of the plunger, each solenoid assembly is wholly enclosed within a moulded housing solenoid support plate, and moulded end cap all bolted together. Access to the terminal connections is provided for in the shape of the housing and terminal cover fitting.

Routine Test and Inspection

The solenoids should be energised from a 24 volt



supply although the minimum voltage at which a complete pull-in can be effected is 16 volts. Conversely, the plunger should return to the fully extended position, under the action of the helical spring, before the energising supply drops below the minimum hold-in requirement of two volts.

It is important that the plunger should have free linear movement over its maximum travel distance of 0.25 in. Furthermore, the plunger should be free to rotate about its axis through any angle and on being released, after compression, it should return instantly to the fully extended position.

Servicing

Where adequate and efficient repair facilities exist, servicing should be effected in strict accordance with the instructions issued in Service Leaflet No. 21, which is obtainable from Rotax Limited on request.

If suitable servicing equipment is not available, the unit should be returned to Rotax Limited, where it will receive prompt attention from our Repair Organisation.

Address all enquiries to:—

THE SERVICE
DEPARTMENT

ROTAX

LIMITED

WILLESDEN JUNCTION LONDON N.W.10

TELEPHONE ELGAR 7777

DECEMBER 1950

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10

SUBJECT: Magnetically Held-in Circuit Breaker.

TYPE: D.6401

D.6402

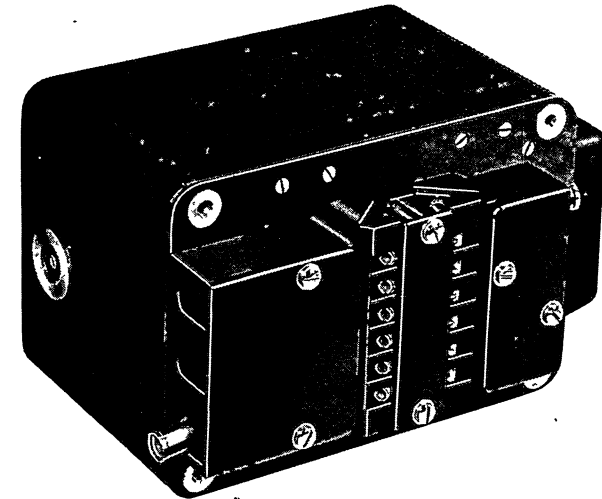
Description

The D.6401 is a single-pole, solenoid, multi-break switch, for use in 100 ampere, 120 volt D.C. circuits, incorporating thermal overload-protection and two auxiliary switches. The solenoid is energised by a minimum of 16 volts D.C.; the maximum permissible P.D. across the coil being 29 volts. The unit weighs 8.5 lb. The D.6402 is of similar construction but it does not include a thermal overload protection device.

When the plunger is pulled in, the main contacts are closed by the action of a toggle linkage; the design of the solenoid being such that the plunger will remain in the closed position until such time as the potential difference across the coil falls below five volts. The D.C. current supply energising the solenoid can be switched off manually or by the automatic operation of the thermal overload-protection device.

The solenoid coil is tapped to form a closing coil and economy coil. These coils are arranged in circuit with a switch operated by movement of the plunger. For starting, the economy switch is in the closed position so that only the closing coil is in circuit with the supply and consequently maximum current is available for starting. As the plunger moves in, the switch is opened and the economy coil comes into circuit to reduce the current flowing through the coil to a value sufficient to maintain the plunger in position.

Over-current protection is provided for by using a bimetal strip in conjunction with a relay so that, in the event of excessive current, the bimetal strip bends and closes the circuit to the relay which becomes energised and interrupts the D.C. supply to the solenoid coil. As the voltage across the coil collapses, the plunger drops out and the main contacts open. The relay remains energised until the D.C. supply is switched off manually, thus allowing the bimetal to cool without causing cyclic reclosure of the circuit breaker due to the persistence of the fault resulting in repeated overheating of the bimetal. After rectification of the fault, the circuit breaker can be



re-energised by a manual switch selection of the D.C. supply.

In addition to the main contacts, this unit incorporates two auxiliary switches operated by a movement of the solenoid plunger so that one is open and the other closed when the plunger is fully home. The maximum permissible current across the auxiliary contacts is 10 amperes.

The switch mechanism is totally enclosed in a flush-fitting metal case incorporating a flame trap. On the opposite side of the moulded base carrying the switch mechanism are two covered terminal panels each containing a main load connection. Between these two panels is an additional terminal bank comprising two sets of solenoid coil connections wired in parallel and four sets of auxiliary switch connections similarly wired.

A robust framework supports the solenoid assembly so that the plunger can operate the toggle mechanism controlling the three spring-loaded main contacts which are wired in series. The relay and bimetal strip are mounted contiguously on the base so that the bimetal strip can depress and close the contacts which bring the relay into circuit.

Four tapped bushes for the reception of fixing screws are fitted in the moulded base.

DECEMBER 1950

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Routine Test and Inspection

Visual inspection of the external connections should be made frequently and the contacts cleaned as necessary.

Periodic inspection should include those tests detailed hereafter, under their particular headings.

The internal wiring should be checked for continuity, in accordance with the wiring diagram, when a fractured coil is suspected.

The resistance of the "closing" and "economy" coils must be $2.56 \text{ ohms} \pm 7\%$ at 20°C. , and $65 \text{ ohms} \pm 10\%$ at 20°C. respectively. When measuring the resistance of these coils at room temperature, the readings obtained must be corrected to 20°C.

When the rated current of 100 amperes is passed through the main contacts, the voltage drop across them should not exceed 40 millivolts.

Similarly, when 10 amperes D.C. is passed through

the closed auxiliary contacts, the voltage drop across the mating contacts and contact strips should not exceed 80 millivolts.

The requirement for this test is as follows :—

- (a) that all parts having a P.D. of 120 volts D.C. shall withstand a high-potential test of 500 volts r.m.s. for a duration of one minute;
- (b) that all parts having a P.D. of 29 volts D.C. shall withstand a high-potential test of 250 volts r.m.s. for a duration of one minute.

Insulation resistance, between these parts at 120 volts and between the main terminals and frame, should be measured with a 500 volt Megger tester and must not be less than 20 megohms.

Insulation resistance, between those parts at 29 volts D.C. and between the auxiliary terminals and frame, should be measured with a 250 volt Megger tester and must not be less than 20 megohms.

All spindles and moving parts should be lubricated as necessary with Intava 669 grease (D.T.D.577).

Servicing

In view of the importance of carrying out adjustments under certain standard conditions, and the necessity for special testing equipment, it is recommended that, if a fault develops, the unit is returned to Rotax Limited where it will receive prompt attention by our Repair Organisation.

Where, however, adequate and efficient repair facilities have been arranged, maintenance should be effected in accordance with current servicing instructions.

Address all enquiries to :—

T H E S E R V I C E
D E P A R T M E N T

R O T A X

L I M I T E D

W I L L E S D E N J U N C T I O N L O N D O N N . W . 1 0
T E L E P H O N E E L G A R 7 7 7 7

SUBJECT: 28 volt, D.C., Magnetically Held-in Circuit Breaker

TYPES: D.6501, D.6502, D.6503, D.6504
D.6505, D.6506, D.6506A, D.6507

DATA:

D.6501—60 AMPERE, INCORPORATING THERMAL OVERLOAD PROTECTION PLUS AN AUXILIARY SWITCH NORMALLY CLOSED.

D.6502—AS D.6501 BUT 90 AMPERE AND WITH AUXILIARY SWITCH NORMALLY OPEN.

D.6503—120 AMPERE, WITHOUT THERMAL OVERLOAD PROTECTION, BUT INCORPORATING AN AUXILIARY SWITCH NORMALLY CLOSED.

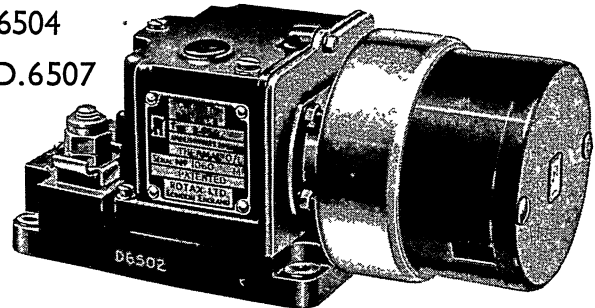
D.6504—AS D.6502 BUT 120 AMPERE AND WITH AUXILIARY SWITCH NORMALLY CLOSED.

D.6505—AS D.6504 BUT WITH AUXILIARY SWITCH NORMALLY OPEN.

D.6506—6A—AS D.6504 BUT WITH No. 1 TERMINAL REAR ENTRY (D.6506) AND No. 2 TERMINAL REAR ENTRY (D.6506A).

D.6507—AS D.6502 BUT 22 AMPERE.

WEIGHT : 3 LB. 5 OZ.



In all types the solenoid plunger is magnetically held in the closed position but will drop out before the voltage of the energising current reaches zero.

Opening of the main contacts can be effected by de-energising the solenoid coil, by manual operation of a spring-loaded trip button, and in all types except D.6503 automatically, under overload conditions, through a bimetal strip acting on the trip mechanism. As all units are trip-free, i.e., the main contacts can be opened with the plunger in the fully closed position, after operation of the trip mechanism the solenoid must be de-energised to reset the mechanism, before the main contacts can be again closed.

The bimetal strip in these units is positioned beneath an insulated screw on the trip lever so that when an excessive current is passed, the bimetal strip bends upwards against the screw to move the trip arm and release the toggle mechanism. This does not apply to D.6503.

Setting of the thermal trip-mechanism is effected, in an ambient temperature of 25° C., by careful adjustment of the insulated screw which is afterwards sealed with anti-sulphuric paint.

Maximum permissible D.C. voltage across the operating coil is 29 volts and the maximum continuous current which can be carried by the unit without tripping is 60 amperes on type D.6501 ; 90 amperes on type D.6502 ; 120 amperes on type D.6503, there being no overload protection ; 120 amperes on types D.6504, D.6505, D.6506, D.6506A ; 22 amperes on type D.6507.

In addition to the main contacts, the units have an auxiliary switch operated by the action of the plunger.

A difference between the D.6502, D.6505 and D.6507 and all other types is that the auxiliary switch in these units is normally open but on the others it is closed. The maximum permissible continuous D.C. current to be passed through these switches is five amperes.

Description

These units, for use in appropriate D.C. circuits as remotely operated circuit breakers or contactors, consist essentially of a solenoid assembly which, when energised, acts through a toggle linkage to close a pair of main contacts and operate an auxiliary switch. Each unit weighs 3 lb. 5 oz.

The solenoid operating coil is tapped to form a closing coil and economy coil. A low value of resistance in the closing coil provides for a maximum initial pull, while the higher-resistance economy coil serves to limit the current through the operating coil, to a value sufficiently high to maintain the plunger in position but low enough to prevent overheating and consequent damage. The two coils are arranged in circuit with a switch operated by the solenoid plunger. With the switch in the closed position, energising current flows through the closing coil to initiate plunger movement. As the plunger nears the stop, it causes an insulated pin, carried in the economy switch body moulding, to deflect the spring contact carrier of the switch. At the end of the plunger travel, the switch is fully opened and the economy coil is brought into circuit.

" Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A.6-2 of British Civil Airworthiness Requirements. 3/3/52."

FEBRUARY 1952

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LUCAS-ROTAX (AUSTRALIA) PTY. LTD • BOUVERIE STREET • MELBOURNE N.3 • TELEPHONE F.J.4867
LUCAS-ROTAX LIMITED • TORONTO 13 • CANADA • TELEPHONE OXFORD 9368



The D.6508/1 circuit breaker is similar to the D.6503 circuit breaker except that the auxiliary contacts are normally open and that it is fully flame proofed.

Type D.6548 is similar to type D.6508/1 but is fitted with de-ion grids and semi-elliptical silver-graphite contacts.

Type D.6552 is similar to type D.6548 but is fitted in addition to the de-ion grids and semi-elliptical contacts, with main terminals to suit 100 ampere Prenal cable lugs.

The information contained in Technical Leaflet No. 20 and Service Leaflet No. 23 is therefore applicable to these later types with the exception of a variation in component part numbers. These variations are quoted on an amendment slip attached to the Service Leaflet.

D.6501—7 Technical Leaflet

November, 1955

D.6502—AS D.6501 BUT 90 AMPERE AND WITH AUXILIARY SWITCH NORMALLY OPEN.

D.6503—120 AMPERE, WITHOUT THERMAL OVERLOAD PROTECTION, BUT INCORPORATING AN AUXILIARY SWITCH NORMALLY CLOSED.

D.6504—AS D.6502 BUT 120 AMPERE AND WITH AUXILIARY SWITCH NORMALLY CLOSED.

D.6505—AS D.6504 BUT WITH AUXILIARY SWITCH NORMALLY OPEN.

D.6506—6A—AS D.6504 BUT WITH No. 1 TERMINAL REAR ENTRY (D.6506) AND No. 2 TERMINAL REAR ENTRY (D.6506A).

D.6507—AS D.6502 BUT 22 AMPERE.

WEIGHT : 3 LB. 5 OZ.

Description

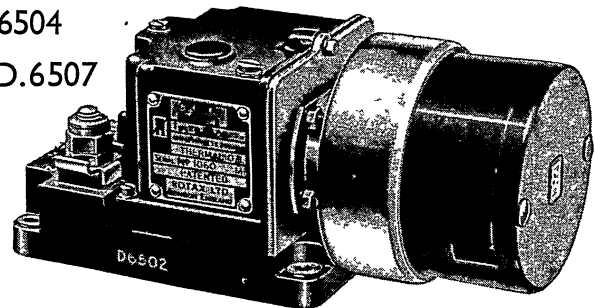
These units, for use in appropriate D.C. circuits as remotely operated circuit breakers or contactors, consist essentially of a solenoid assembly which, when energised, acts through a toggle linkage to close a pair of main contacts and operate an auxiliary switch. Each unit weighs 3 lb. 5 oz.

The solenoid operating coil is tapped to form a closing coil and economy coil. A low value of resistance in the closing coil provides for a maximum initial pull, while the higher-resistance economy coil serves to limit the current through the operating coil, to a value sufficiently high to maintain the plunger in position but low enough to prevent overheating and consequent damage. The two coils are arranged in circuit with a switch operated by the solenoid plunger. With the switch in the closed position, energising current flows through the closing coil to initiate plunger movement. As the plunger nears the stop, it causes an insulated pin, carried in the economy switch body moulding, to deflect the spring contact carrier of the switch. At the end of the plunger travel, the switch is fully opened and the economy coil is brought into circuit.

etically Held-in Circuit Breaker

503, D.6504

506A, D.6507



MAL
IARY

In all types the solenoid plunger is magnetically held in the closed position but will drop out before the voltage of the energising current reaches zero.

Opening of the main contacts can be effected by de-energising the solenoid coil, by manual operation of a spring-loaded trip button, and in all types except D.6503 automatically, under overload conditions, through a bimetal strip acting on the trip mechanism. As all units are trip-free, i.e., the main contacts can be opened with the plunger in the fully closed position, after operation of the trip mechanism the solenoid must be de-energised to reset the mechanism, before the main contacts can be again closed.

The bimetal strip in these units is positioned beneath an insulated screw on the trip lever so that when an excessive current is passed, the bimetal strip bends upwards against the screw to move the trip arm and release the toggle mechanism. This does not apply to D.6503.

Setting of the thermal trip-mechanism is effected, in an ambient temperature of 25° C., by careful adjustment of the insulated screw which is afterwards sealed with anti-sulphuric paint.

Maximum permissible D.C. voltage across the operating coil is 29 volts and the maximum continuous current which can be carried by the unit without tripping is 60 amperes on type D.6501 ; 90 amperes on type D.6502 ; 120 amperes on type D.6503, there being no overload protection ; 120 amperes on types D.6504, D.6505, D.6506, D.6506A ; 22 amperes on type D.6507.

In addition to the main contacts, the units have an auxiliary switch operated by the action of the plunger.

A difference between the D.6502, D.6505 and D.6507 and all other types is that the auxiliary switch in these units is normally open but on the others it is closed. The maximum permissible continuous D.C. current to be passed through these switches is five amperes.

" Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A.6-2 of British Civil Airworthiness Requirements. 3/3/52."

FEBRUARY 1952

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LUCAS-ROTAX LIMITED . TORONTO 13 . CANADA . TELEPHONE OXFORD 9368

In the general construction of the unit, the solenoid assembly is supported on a plate and enclosed in a metal case to which is attached a moulded body and cover containing the economy switch assembly. The main and auxiliary contact assemblies are accommodated in a moulded casing which also partly houses the solenoid plunger. Terminal connections are conveniently inserted into a robust mounting base plate, which also provides for ease of fitting in any position.

For installation purposes there are four .187" diameter holes in the base. The hole centres form a rectangle 3.687" by 2.500".

Routine Test and Inspection

The covers should be removed and the contacts examined at 250-hour intervals. If the contacts show signs of excessive burning the unit should be removed for servicing or replacement.

After 2,000 hours, or before if necessary, the unit should be removed for examination and test. No attempt should be made to overhaul the unit without complete servicing instructions. Testing should include those operations detailed hereafter.

The resistance of the coils should be measured at room temperature and then corrected to 20° C., when they must be within the following limits :—

- (1) Closing winding 2.9 ohms \pm 10%.
- (2) Economy winding 64 ohms \pm 10%.

Apply 18 volts D.C. to the closing coil to operate the switch and then pass the full rated current through the mating contacts. The voltage drop, measured across the contacts, should not exceed 40 millivolts.

Similarly, pass five amperes through the closed auxiliary contacts and check that the voltage drop does not exceed 100 millivolts.

Insulation tests, using a 250 volt Megger tester, should indicate not less than 20 megohms between the following points :—

- (1) All live parts and frame.
- (2) Main terminals and coil (both with the main contacts open and closed).

The resistance between the main terminals, whilst the main contacts are open, should not be less than 100 megohms.

Hinge pins should be lightly lubricated with Intava grease 669 (D.T.D.577).

Servicing

In view of the critical nature concerning the conditions under which these units must be adjusted, and the necessity for special testing equipment, it is strongly recommended that, if a fault develops, the unit should be returned to our nearest Service Department, where it will receive prompt attention by our Repair Organisation. For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT.

ROTAX LIMITED
WILLESDEN JUNCTION
LONDON, N.W. 10
ENGLAND
Telephone : ELGAR 7777

LUCAS-ROTAX AUST. PTY. LTD
BOUVERIE STREET
MELBOURNE, N. 3
AUSTRALIA
Telephone : F.J. 4867

LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA
Telephone : WALNUT 3435

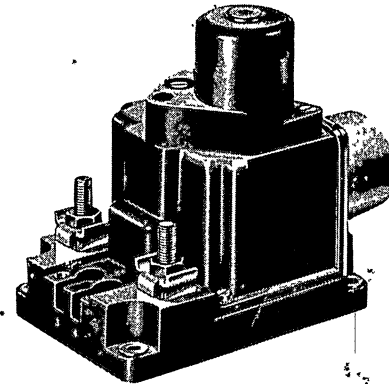
SUBJECT: Circuit Breakers

TYPES: D.6601 — D.6626

DATA:

Operating Coil Voltage : 28 volts D.C.
Magnetic Trip Coil Voltage : 28 volts D.C.
Current Rating : See table
Mounting : Four .187" dia. holes
whose centres form
a rectangular shape
3.687" x 2.500".

Electrical Connection
(Main terminals) : See table
(Operating and Trip Coil
terminals) : 4 B.A.
Weight : See table
Operative Temperature Range : —65°C. to +50°C.



Description

This range of magnetically-operated circuit breakers has been designed in a neat and compact manner for single-pole switching of heavy current D.C. circuits. The controlling solenoid(s) being operated from a 28 volt D.C. system.

In general appearance, with the addition to some units of the magnetic trip solenoid type D.6901, the units are similar, the main differences being in the rating, main terminal positioning and the method(s) of tripping, details of which are given in the following table:—

Type	Rating in amps.	Trip Actuation	Terminal Arrangement
D.6601	40	Manual and thermal	Front entry
D.6602	80	" "	"
D.6603	120	" "	"
D.6604	200	" "	"
D.6605	40	Manual, thermal and magnetic	"
D.6606	80	" "	"
D.6607	120	" "	"
D.6608	200	" "	"
D.6609	40	Manual and thermal	No. 2 terminal rear entry
D.6610	80	" "	" "
D.6611	120	" "	" "
D.6612	200	" "	" "
D.6613	40	Manual, thermal and magnetic	" "
D.6614	80	" "	" "
D.6615	120	" "	" "
D.6616	200	" "	" "
D.6617	160	Manual and thermal	Front entry
D.6618	160	" "	No. 2 terminal, rear entry

D.6619	60	Manual, thermal and magnetic	Front entry
D.6620	120	Manual and magnetic	"
D.6621	120	Manual only	"
D.6622	160	Manual and magnetic	"
D.6623	60	Manual and thermal	"
D.6624	50	Manual, thermal and magnetic	"
D.6625	80	" "	Front entry and to suit Prenal cable lugs
D.6626	80	Manual and thermal	" "

Each unit comprises a bakelite mounting plate assembly to which is fitted the switching mechanism and terminals. The former is completely shrouded with a bakelite cover secured to the mounting plate and support plate by three screws. This support plate forms part of the switch mechanism bracketry and carries the operating solenoid secured by four screws and nuts.

Where fitted, the D.6901 remote trip solenoid is mounted on top of the switch mechanism cover to which it is secured by two screws.

Mounting of these units is facilitated by four .187" dia. holes whose fixing centres form a rectangular shape 3.687" x 2.500", and installation may be effected in any desired position.

Electrical connection for the operating and magnetic solenoids is by way of 4 B.A. terminals and the following table gives the variations in main terminals:—

D.6601	1/4" B.S.F.	D.6602 to 4	5/16" B.S.F.
D.6605		D.6606 to 8	
D.6609		D.6610 to 12	
D.6613		D.6614 to 18	
D.6619	3/12" B.S.F.	D.6620 to 22	
D.6623			
D.6625	3/12" B.S.F.		
D.6626			

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements. 12.10.54."

PRICE ONE SHILLING

REVISED JUNE 1954

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LUCAS-ROTAX LIMITED • TORONTO 13 • CANADA • TELEPHONE OXFORD 9368

Total weight of the units are :—

D.6601 to 4	2 lb. 4 oz.	D.6605 to 8	2 lb. 10 oz.
D.6609 to 12		D.6613 to 16	
D.6617		D.6619	
D.6618		D.6620	
D.6621		D.6622	
D.6623			

Operation

Note : The following paragraphs describe the operation of a circuit breaker fitted with remote controlled magnetic and overload protection trips.

The main contacts are actuated by means of a solenoid operating through a toggle linkage which goes over centre to latch the contacts in the closed position against the action of the contact return spring.

Main contact closure is effected remotely by means of a push button or momentary operated type switch, wired in circuit with the 28 volt D.C. supply and terminal 4 to which the coil is connected. Protection of the operating coil is obtained by means of a safety switch, with normally closed contacts, which opens, and thereby interrupts the coil supply when the plunger is fully home. When the plunger drops out the spring mounted contacts of the safety switch re-close.

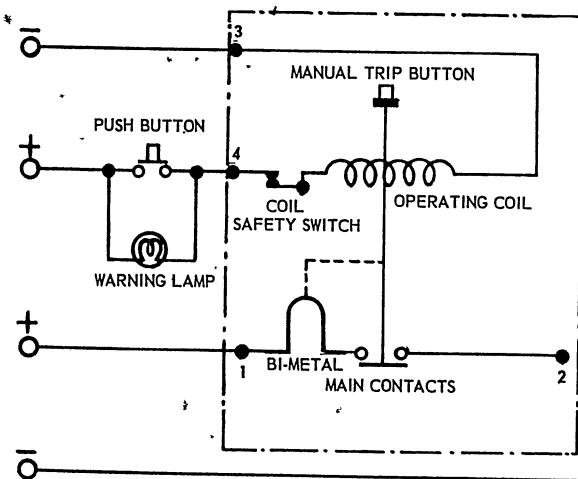


Fig. 1 Wiring Diagram for D.6601-4, 9-12, 17, 18, 21, 23 and 26

A trip mechanism, incorporating a latch-plate, lever, and spring-loaded trip rod, will open the main contacts when depressed. Remote operation of the trip

mechanism is effected by means of a trip coil assembly (D.6901) contained within a separate casing. This composite assembly is mounted to the unit so that its

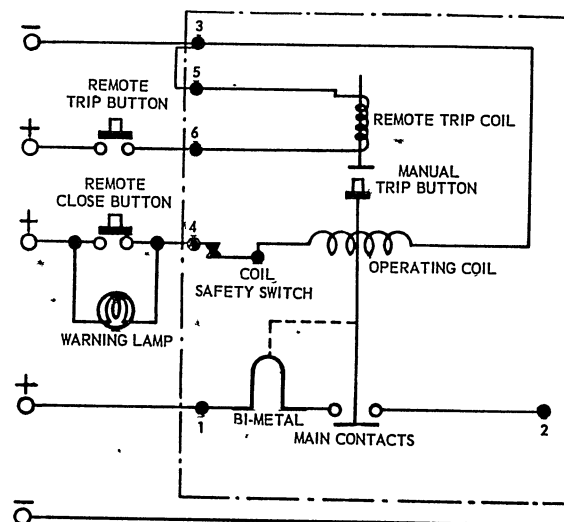


Fig. 2 Wiring Diagram for D.6605-8, 13-16, 19, 20, 22, 24 and 25

plunger is directly above and in contact with the press button on the end of the trip rod. Thus, on energising the coil, by the application of the remote switch connected between terminals 6 and the 28 volt D.C. supply, the plunger moves downwards to depress the trip rod and operate the trip mechanism. A push button, protruding from the centre of the trip coil casing, is provided for manual operation of the mechanism.

Overload protection is included in the load-line by the use of a bi-metal strip. The strip is positioned beneath an insulated adjustment screw attached to the trip mechanism so that in the event of currents above normal, the bi-metal will bend sufficiently after the appropriate time delay, to depress the screw and trip the mechanism.

Routine Test and Inspection

Visual inspection of the contacts for burns and burrs and the leads for loose and poor connections, should be made frequently and the contacts cleaned as necessary.

Periodic routine inspections should consist of those items detailed hereafter.

The resistance of the operating coil, measured between terminals 4 and 3, should be $4.15 \text{ ohms} \pm 10\%$ after correction to 20°C .

With the rated current passing through the contacts, the voltage drop across the contacts must not exceed 40 millivolts.

Insulation tests, using a 250 volt "Megger" between all live parts and frame, with the contacts open and closed, must not be less than 20 megohms.

With the main contacts open, the insulation resistance between the main terminals must not be less than 100 megohms.

Tests on the trip coil assembly should be affected as follows :—

The resistance of the trip coil, measured between

terminals 5 and 6, should be $33.3 \text{ ohms} \pm 10\%$ after being corrected to 20°C .

An insulation test, using a 250 volt "Megger" between the solenoid cup and terminals should not be less than 20 megohms.

Servicing

If test equipment is not available, no attempt should be made to service the unit. It should however, be replaced by a new one and the faulty equipment returned to our nearest Service Department, or authorised service station, where it will be promptly dealt with by our Repair Organisation.

In cases where test equipment is available, apply for Rotax Service Leaflet No. S.L.21 for full servicing details.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
NEPEAN HIGHWAY
CHELTENHAM, S. 22
VICTORIA

Telephone : XF 1381

ROTAX LIMITED
HEMEL HEMPSTEAD
HERTFORDSHIRE
ENGLAND

Telephone : BOXMOOR 4444

LUCAS-ROTAX LIMITED
5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA

Telephone : BY 6500-09

Technical enquiries should be addressed to :—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W. 10 • ENGLAND
ELGar 7777

SUBJECT: Thermal Units, 3-phase A.C. and single line D.C.

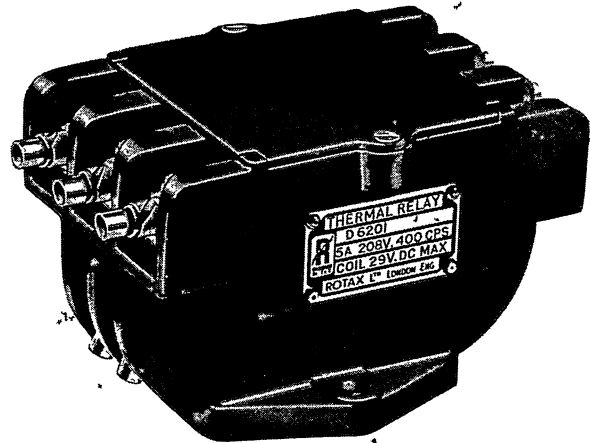
TYPES: D.6200 Series

DATA:

Rating : See table below.
Mounting : Base, two holes .203" diameter, spaced 1.625" apart.
Weight : 10 oz. (All types except D.6249-57)
8 oz. (D.6249-57)

Description

These units are produced in three main groups : 3-phase, 208 volt A.C. units, single line 120 volt D.C. units, and single line 120 volt D.C. units having no auxiliary relay. All the units in the series are basically similar and each one is used as a thermal protection device either in a 208 volt, 400 c.p.s. A.C. circuit or a 120 volt single line D.C. circuit. The following table shows the rating etc., of each type :—



Group A : 3-phase, 208 v. 400 c.p.s. A.C.
Group B : Single line, 120 v. D.C.
Group C : Single line, 120 v. D.C., less auxiliary relay.

3-Phase Units (see group A in table).

The three main load strip connection and bi-metal assemblies are positioned in a robust body moulding having ten terminal positions, six for the 3-phase and four for the relay contact and coil connections. The 3-phase terminals are marked A and L1, B and L2, C and L3 respectively, and the relay contact and coil terminals are marked, CT and ET at one end of the moulding and S and T at the opposite end. All socket assemblies and ferrules are standard S.B.A.C. types (see table for sizes).

Each bi-metal carries a grubscrew set directly above a moulded trip bar which rests in recesses in the body moulding. Between the trip bar and terminal S, which has a fixed contact on its connector, is a moving contact assembly. This contact assembly is screwed to the base and is connected by a lead assembly, via terminal T, to the relay coil, forming part of the armature and coil assembly, which is screwed to the base on the far side of the trip bar.

The fourth auxiliary terminal, marked CT, is connected to a contact and backing strip which is secured to a shelf inside the body moulding, the contact being positioned directly above a contact carried on top of the armature. A lead assembly connects the armature to terminal S (fixed contact terminal).

Secured by two 6 B.A. countersunk head screws, a protective cover is fitted flush with the top of the body moulding. For installation purposes the .281" thick base of the body moulding has two holes .203" diameter, spaced 1.625" apart. The unit weights 10 oz.

Group	Code	Nominal Rating	S.B.A.C. Terminal Connection	
			Socket	Ferrule
		amperes	amperes	amperes
A	D.6201	5	19	4
A	D.6202	10	19	7
A	D.6203	15	19	19
A	D.6204	20	19	19
A	D.6206	30	37	37
A	D.6207	40	37	37
A	D.6208	50	37	37-64
B	D.6209, 29	5	19	4
B	D.6210, 30	10	19	7
B	D.6211, 31	15	19	19
B	D.6211/1, 31/1	15	19	19
B	D.6212, 32	20	19	19
B	D.6214, 34	30	37	37
B	D.6215, 35	35	37	37
B	D.6216, 36	40	37	37
B	D.6217, 37	50	37	37-64
B	D.6219/1	20	19	19
B	D.6241/1	16	19	19
C	D.6249	5	19	4
C	D.6250	10	19	7
C	D.6251 & 51/1	15	19	19
C	D.6252	20	19	19
C	D.6254	30	37	37
C	D.6255	35	37	37
C	D.6256	40	37	37
C	D.6257	50	37	37-64
B	D.6264	30	37	37

Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A.6-2 of British Civil Airworthiness Requirements. 27/3/53.

REVISED FEBRUARY 1953

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Single line, 120 volt D.C. units (see group B in table). These are similar in construction to the 3-phase units but have only one central main load connection strip and bi-metal assembly.

This is connected between terminals B and L2. The auxiliary circuit is the same as that on the 3-phase group, but on types D.6229 to D.6237 the relay contact is isolated from terminal T.

Single line, 120 volt D.C. units less relay (see group C in table).

In this group the units are similar to those in group B except that the relay is omitted. Retaining strips are used to ensure stability of the trip bar and a stop plate is used in place of the yoke. Where auxiliary terminals (CT and ET) are not used, blanking strips are fitted in place of the connector assemblies. The unit weighs 8 oz.

Operation

When normal current values flow through the connection and bi-metal strips, the auxiliary circuit between CT and S is made through the armature contacts. Should current values above normal flow in any one of the main load connections, the bi-metal will heat up to such an extent that it will deflect downwards and apply pressure on the trip bar. This will pivot under the load and press against the moving contact assembly, closing the contacts and completing the coil circuit from S through to ET. The armature is attracted towards the energised coil and the movement breaks the circuit between CT and S. The maximum coil operating D.C. voltage is 29 and the current draw at this figure is 0.135 ampere, the nominal resistance of the coil being 219 ohms at 20°C. When cold, i.e., at 20°C, the coil will operate on a minimum of 16 volts D.C.

Single line D.C. units having no relay (group C in table) operate similarly but when the bi-metal deflects, the trip bar pivots and closes the contacts thus completing the circuit between S and T.

In all cases, when the current in the connection and bi-metal strips is switched off, the bi-metals will cool and resume their original positions.

Periodic Inspection

These units are correctly adjusted and tested before leaving the factory and should require little attention in service provided they are not maltreated. If a unit functions satisfactorily in its circuit, it can be considered suitable for further use.

A general visual inspection should be made periodically to ensure that there is no apparent physical damage. Any that is found will necessitate the complete overhaul of the unit and the renewal of the affected part. Ensure that the terminals are clean and free from any foreign matter.

Where possible an insulation test should be made on a unit provided that it is accessible and can be isolated from its circuit.

Using a 500 volt "Megger," the insulation resistance must be at least 20 megohms between the following points:—

- (a) Those parts at 208 volts A.C.
- (b) Those parts at 120 volts D.C.

Similarly, use a 250 volt "Megger" to check between all parts at 29 volts D.C. The insulation resistance should be at least 20 megohms.

Servicing

Any unit whose condition is at all doubtful should be replaced by a new one and the original returned to our nearest Service Department where it will receive prompt attention by our Repair Organisation.

No attempt should be made to service a unit unless adequate facilities are available. Where these have been arranged, full details of servicing and overhaul may be obtained on request of Rotax Service Leaflet No. S.L.22.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to:—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
BOUVERIE STREET
MELBOURNE, N. 3
AUSTRALIA
Telephone: F.J. 4687

ROTAX LIMITED
WILLESDEN JUNCTION
LONDON, N.W. 10
ENGLAND
Telephone: ELGAR 7777

LUCAS-ROTAX LIMITED
MONTRÉAL AIRPORT
DORVAL, P.Q.
CANADA
Telephone: WALNUT 3435

Amendment—D.6723 & 24 Contactors

SUBJECT

TYPES:

The D.6723 & 24 contactors differ only from the D.6703/2 and 04/2 contactors respectively inasmuch as they are fitted with main terminals to suit 50 ampere Prenal cable lugs. The information contained in Technical Leaflet No. 23 and Service Leaflet No. 43 is therefore applicable to these later types except for a variation in component part numbers. These variations are quoted on an amendment slip attached to the Service Leaflet.

D.6701—4 Technical Leaflet

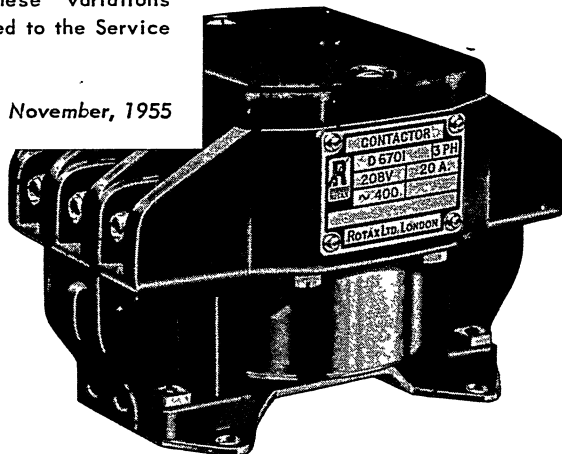
November, 1955

D.6703 †

D.6704*

*Auxiliary Switch
Normally Open

†Auxiliary Switch
Normally Closed



DATA:

MAIN CONTACT RATING
(D.6701 and 2) :

20 amperes A.C.
continuous

(D.6703 and 4) :

40 amperes A.C.
continuous

AUXILIARY CONTACT
RATING :

5 amperes D.C.
continuous

OPERATIVE TEMPERA-
TURE RANGE :

—70°C. to +50°C.

MOUNTING :

4 holes .189" dia. in
base plate

WEIGHT :

2 lb.

flowing through the solenoid is then reduced, by reason of the higher coil resistance, to maintain the plunger in position.

Maximum D.C. voltage across the operating coil is 29 volts and the maximum permissible continuous current through the main contacts is 20 amperes on types D.6701 and D.6702, and 40 amperes on types D.6703 and D.6704, at the design rating of 208 volts, 400 c.p.s.

An auxiliary switch is provided, in addition to the main contacts, and is designed to take a maximum continuous current of 5 amperes D.C.

The solenoid assembly is housed in a metal casing secured to a mounting base. Terminal connections and contacts are accommodated in a moulded casing formed in three sections to provide adequate insulation between the contacts and terminals of each phase line.

Description

These units are remote-controlled switches for use in 3-phase A.C. circuits, and each weighs 2 lb.

The unit contains a solenoid assembly arranged so that, when its coil is energised, the plunger will pull down three spring-loaded contact arms to make a positive connection in each phase line.

The solenoid coil is tapped to form a closing coil and economy coil. A switch is arranged in circuit with the two coils so that, when the solenoid is first energised, a comparatively heavy current passes through the closing coil, which has a low resistance value, to provide maximum pull. Then as the air-gap is overcome, the movement of the plunger opens the switch and brings the economy coil into circuit. The current

Routine Test and Inspection

The covers should be removed and the contacts examined at 250-hour intervals. If the contacts show signs of excessive burning, the unit should be removed for servicing or replacement.

After 1000 hours, or before if necessary, the unit should be removed for examination and test. No attempt should be made to overhaul the unit without complete servicing instructions. Testing should include those operations detailed hereafter.

PRICE ONE SHILLING

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A.6-2 of British Civil Airworthiness Requirements. 2/4/53."

REVISED FEBRUARY 1953

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The resistance of the coils should be measured at room temperature and then corrected to 20°C., when they must be within the following limits :—

- (1) Closing coil : 6.8 ohms $\pm 2\frac{1}{2}\%$
- (2) Economy coil (both windings in series) : 76 ohms $\pm 5\%$

Continuity of the operating coil can be checked across the terminals CT and ET with the economy switch in the open position.

Apply 16 volts D.C. across the contactor terminals CT and ET to close the contacts, then pass the rated current at 400 c.p.s. through the main contacts. The voltage drop across the contacts, in each phase, should not exceed 80 millivolts.

Similarly, pass 5 amperes D.C. through the closed auxiliary contacts and check that the voltage drop across the terminals IN.1 and IN.2 does not exceed 150 millivolts.

The insulation resistance, measured between all live parts and frame, should not be less than 20 megohms.

All parts at a P.D. of 208 volts A.C. must withstand a high potential test of 2,500 volts r.m.s. for one minute duration at an atmospheric pressure equivalent to sea level.

Also, all parts at a P.D. of 29 volts D.C. must withstand a high potential test of 250 volts r.m.s. under similar conditions.

During all flash tests, if the lamp glows, the insulation resistance is unsatisfactory.

Serviceing

In view of the critical nature concerning the conditions under which these units must be adjusted, and the necessity for special testing equipment, it is strongly recommended that, if a fault develops, the unit should be returned to Rotax Limited, where it will receive prompt attention by our Repair Organisation.

Where, however, adequate and efficient repair facilities have been arranged, apply for Rotax Service Leaflet No. S.L.43 for full servicing details.

For further information on the functioning, operation and maintenance of Rotax equipment, address all enquiries to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
BOUVERIE STREET
MELBOURNE, N. 3
AUSTRALIA
Telephone : F.J. 4687

ROTAX LIMITED
WILLESDEN JUNCTION
LONDON, N.W. 10
ENGLAND
Telephone: ELGAR 7777

LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA
Telephone: WALNUT 3435

SUBJECT: 200 Ampere Contactor and Differential Relay.

TYPE: F.2201

Description

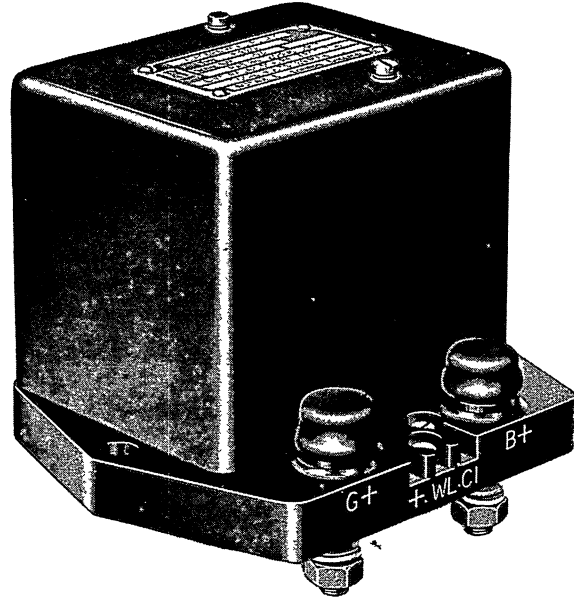
This unit is a battery-charging limiter and weighs 3 lb. It contains a contactor, normally in the closed position, which operates in conjunction with an external resistance, through the action of a differential relay, to limit the charging current to 50 amperes.

In effecting a limitation of the charging current, the main load is passed through a series coil controlling the differential relay. The action of the relay is such that when the current exceeds 50 amperes, its contacts close and current flows through them to energise the contactor coil. When this occurs, the contactor breaks circuit and the charging current has to flow through an external resistance positioned across the contactor terminals R and B+. The effect of the resistance is to limit the charging current to a maximum of 50 amperes.

To prevent the resistance affecting the discharge of current from the battery, the relay is designed so that a reverse, or discharge, current of six amperes will re-open its contacts to thereby break the contactor coil circuit and allow the spring-loaded contactor to close. In the closed position, the contactor shorts out the external resistance and an unrestricted discharge can take place from the battery through the mating contacts.

The contactor comprises a cup-shaped housing, secured to a support plate, which accommodates the stopped-solenoid assembly in such a manner that the spring-loaded plunger can move a contact arm to make and break the circuit to the battery. An air-gap of .002-.005 in. between the plunger end and stop, when the coil is energised, is obtained by means of shims placed between the stop and cup base. Similarly, the gap between the contacts is set to .093 + .010 in. by means of shims inserted under the support plate. The relay is arranged contiguously with the solenoid and comprises an armature assembled between the poles of a permanent magnet; the field being suitably modified to allow current to flow through a single series coil to effect armature movement.

A contact face on the armature makes with a fixed contact in circuit with the solenoid coil; the series coil being designed to close the relay when a forward current of 50 amperes is flowing and to open it when a reverse current of 6 amperes is obtaining.



The solenoid and relay assemblies are contained within a strong moulded casing offering easy access to the terminal connections marked G+, +, WL, CI, B+, and R.

Routine Test and Inspection

The covers should be removed and the contacts examined at 250 hour intervals. If the contacts show signs of excessive burning, the unit should be removed for servicing or replacement.

After 1000 hours, or before if necessary, the unit should be removed for examination and test. No attempt should be made to overhaul the unit without complete servicing instructions. Testing should include those operations detailed hereafter.

The contactor coil resistance measured between the terminal connections WL and CI, should be 75 ohms \pm 5%.

First apply 29 volts to the contactor coil terminals for a minimum period of ten minutes after which the contactor must close at a maximum of 18 volts and open at a minimum of 2 volts.

Secondly, operate the contactor twenty times whilst applying 18 volts to the contactor coil. The contactor should operate satisfactorily each time.

Check that the drop across the terminals G+ and B+ does not exceed 100 millivolts when a current of 200 amperes is flowing through them.

DECEMBER 1950

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Ensure that the differential relay contacts close when a current of 45 – 50 amperes is flowing from terminal G+ to B+ and conversely that the contacts open when a current of 3–5 amperes flows from B+ to G+.

Insulation tests, using a 500 volt Megger tester, must indicate not less than 20 megohms between the following points :—

- (1) G+ or B+ and frame.
- (2) G+ or B+ and terminals +, WL, or CI.
- (3) G+ and B+. This test must be made with 18 volts applied to the contactor coil.

Insulation tests, using 250 volt Megger tester, must indicate not less than 20 megohms between :—

- (1) Terminals +, WL, or CI and frame.
- (2) Terminals + and WL or CI. This test must

be effected with the differential relay contacts in the *open* position.

The insulation must withstand the application of 750 volts at 50 c.p.s. for a duration of one minute at the following points :—

- (1) G+ or B+ and frame.
- (2) G+ or B+ and terminals +, WL, or CI.
- (3) G+ and B+. This test must be effected with 18 volts applied to the contactor coil.

A flash test of 250 volts at 50 c.p.s., for a duration of one minute, should also be carried out between :—

- (1) Terminals +, WL, or CI and frame.
- (2) Terminals + and WL or CI. This test must be effected with the differential relay contacts in the open position.

Servicing

In view of the critical nature concerning the conditions under which the F.2201 Contactor and differential relay must be adjusted, and the necessity for special testing equipment, it is strongly recommended that, if a fault develops, the unit should be returned to Rotax Limited, where it will receive prompt attention by our Repair Organisation.

Where, however, adequate and efficient repair facilities have been arranged, detailed servicing instructions can be obtained on request.

Address all enquiries to :—

T H E S E R V I C E
D E P A R T M E N T

R O T A X

L I M I T E D

W I L L E S D E N J U N C T I O N L O N D O N N . W . 1 0
T E L E P H O N E E L G A R 7 7 7 7



SUBJECT: Frequency Sensitive Unit (240–280 c.p.s.)

TYPE: F.2601

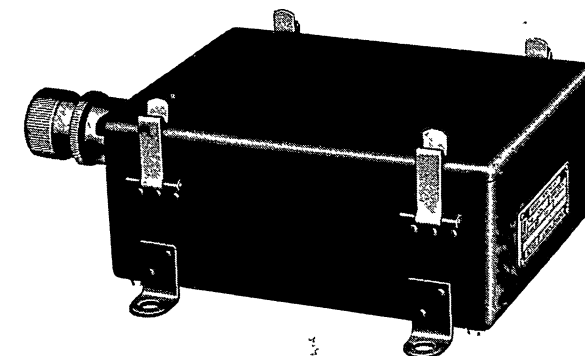
Description

This unit, which weighs 4 lb. 8 oz., functions to ensure that 3-phase 260 c.p.s. fan motors, fitted to the Hermes 4, operate only when an alternator frequency of 240–280 c.p.s. is obtained. In so doing it safeguards the motors from damage which might result from operating at higher or lower frequencies. The operating frequency band at which this unit is set corresponds to an engine speed range of 1263 r.p.m. to 1473 r.p.m. when using a 3.8 to 1 gear ratio for the engine drive to the N.0301 type alternator.

The unit is connected to the system by means of a 5X/6039, nine-pin socket, of which only eight pins are utilized. The plug pins are connected to a tag board carrying eight connections. Single phase current from the alternator is connected across the contacts 7 and 8 whence it is conducted, via the tag board, to the primary of a step-down transformer which reduces the supply voltage from 115 to 24 volts.

This 24-volt supply is applied to two full-wave, selenium, bridge rectifiers by way of two tuned circuits. These tuned circuits comprise first, a choke wired in series with a 0.1 mfd. condenser and secondly, a choke wired in parallel with a 4 mfd. condenser. Both chokes have an adjustable iron core set to a predetermined air gap, before leaving the factory. The resonant frequency of the circuits, by which the operating frequency band is determined, is dependent on the air gap setting of the chokes.

The resonant frequencies of the tuned circuits are matched so that the current generated in the series resonant circuit is greater than that in the parallel resonant circuit over the frequency range of 240–280 c.p.s. but at all other times the current in the parallel resonant circuit is the greater. The rectified current from these circuits is applied to two separate and opposed coils of a polarised relay so that the ampere-turns of these coils and consequently their



magnetomotive force changes in relation to the current in the resonant circuits.

The effect on the polarised relay of the predominance of one coil over the other is illustrated in Fig. 1, where the ampere-turns in the series fed coil is greater than that in the parallel fed coil and the resultant flux set up in the relay is such that the armature is pulled over on to contact 9.

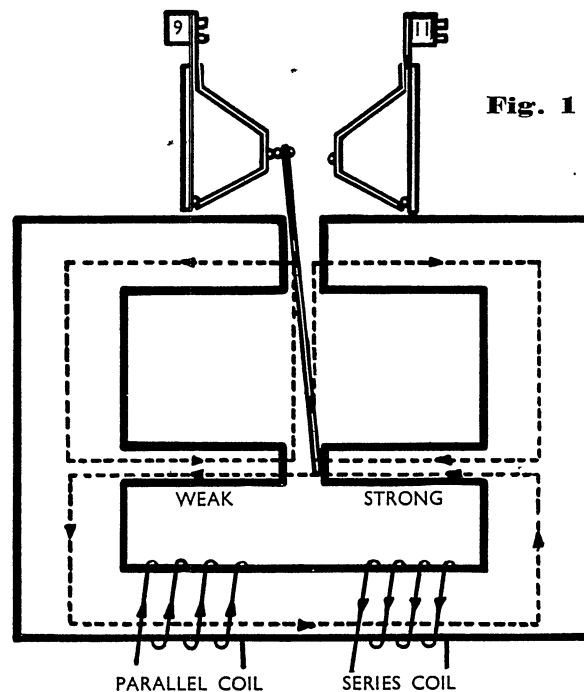


Fig. 1

Two contacts of the polarised relay are used to make or break the circuit to two F.1505 relays, which in

DECEMBER 1950

turn control the operation of the 3-phase contactors positioned in the motor circuits.

Control of the 260 c.p.s. motors over the alternator frequency range of 133 c.p.s.—600 c.p.s. can best be followed by reference to Fig. 2. As the frequency of the alternating supply increases progressively from 133 c.p.s. to 240 c.p.s. the current in the series circuit is increasing from a low to a higher value whilst that set up in the parallel circuit is correspondingly decreasing so that at 239 c.p.s. the current values are the same in both circuits and at 240 c.p.s. the current value in the series circuit becomes greater than that in the parallel circuit. Thus from 133 c.p.s. to 239 c.p.s., the parallel fed coil of the polarised relay is predominant and therefore the resulting field of flux causes the armature to be pulled over to contact 11 thereby breaking the circuit to the F.1505 relays.

At 240 c.p.s., however, the increased value of ampere turns in the series fed coil is such that the series coil becomes predominant and the consequent change in flux pulls the armature over to contact 9. This condition persists up to 280 c.p.s., when the current value in the two circuits again becomes the same. Thereafter up to 600 c.p.s., the current value in the parallel circuit is the greater and the resulting field of flux in the polarised relay is such that the armature is maintained on contact 11 and the circuit to the fan motors remains broken.

A 500 ohms potentiometer is interposed between the A.C. supply and the series-tuned circuit and another is similarly positioned between the A.C. supply and the parallel-tuned circuit. These potentiometers can assist in matching the circuits so as to effect the change-over action on the polarised relay at the correct frequencies. They are set under special test conditions and should not otherwise be touched. Smoothing is effected by having a 1 mfd. condenser connected across each of the two energising coils of the polarised relay.

Routine Test and Inspection

The cable plug and socket should be given frequent visual inspections and cleaned as necessary.

Note—The lid is retained by four spring clips and wired and sealed in position. It should not therefore, be removed except by an authorised service unit when the seal must be remade before the unit again goes into service.

Serviceing

In view of the importance of carrying out adjustments under special test conditions, and the necessity for having special test equipment, it is strongly recommended that, in the event of a fault developing, the unit be returned to Rotax Limited where it will receive prompt attention from our Repair Organisation.

Address all enquiries to :—

THE SERVICE
DEPARTMENT

ROTAX

L I M I T E D

WILLES DEN JUNCTION LONDON N.W.10
TELEPHONE ELGAR 7777

Periodic inspections should entail a check on the correct functioning of the unit and this should be effected in the following manner.

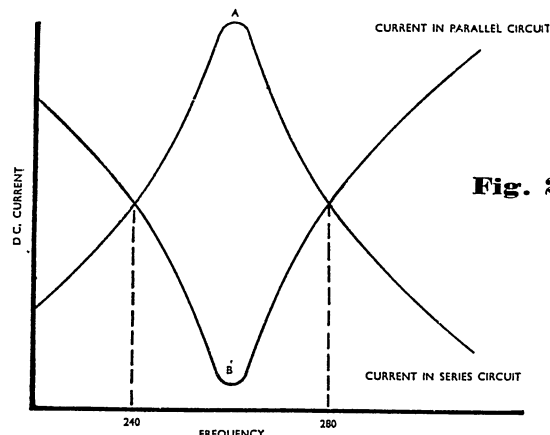


Fig. 2

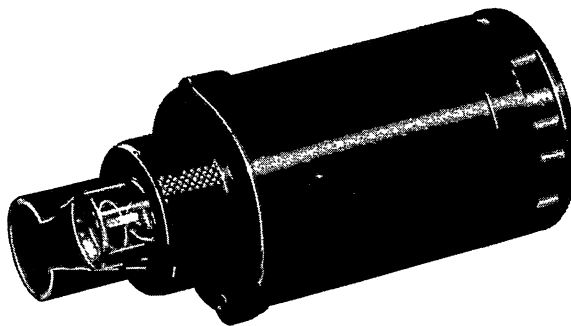
- (1) Connect the terminals 7 and 8 to a variable frequency 110 volt A.C. supply.
- (2) Connect the terminals 1, 2 and 5 to the positive of a 24 volt D.C. supply and terminal 4 to the negative of the same supply.
- (3) Connect the terminals 3 and 6 to indicator lamps.
- (4) Commencing at 133 c.p.s. check that the indicator lamps are not alight. Increase the frequency slowly whilst maintaining the input voltage at 110 volts. At 240 c.p.s. ± 2 c.p.s., the two indicator lamps must light and remain so until 280 c.p.s. ± 2 c.p.s. when they should be extinguished for the remainder of the frequency run up to 600 c.p.s. The same changeover sequence and limits apply for the decreasing frequency run from 600 c.p.s. to 133 c.p.s. The sequence must be repeated several times to ensure the correct functioning within the prescribed limits both for increasing and decreasing frequency runs. The action of the F.1505 relays must be rapid in response and definite in application.

Note—Any alteration in the width of the operating-frequency band should only be effected by an authorised service-unit and then only in strict accordance with the instructions issued by Rotax Limited in the appropriate service leaflet.

- (5) With all terminals bonded together the insulation resistance between the terminals and casing must not be less than 100 megohms when tested with a 500 volt Megger tester.

**SUBJECT:** Neon Indicator Lamp**TYPE:** H.4201

DATA: Max. Primary Current: 3 amperes D.C.
Weight : 4 oz.
Mounting : Two fixing holes, 1.250" apart, tapped 6 B.A. by .187" deep.
Neon Lamp : Rotax Ref. N.100979,
A.M. Ref. 5L/648.



Description

This unit has been designed as a warning lamp for use in circuits where a rapid change of current takes place to indicate to the operator that the circuit is functioning correctly. A typical application of this unit is when used as a panel indicator in conjunction with the Rotax Electronic Navigation Lamp Flasher, Type ZA.2903, to indicate the correct flashing sequence of an aircraft's navigation lights.

Each unit comprises a small Neon Lamp and terminal block, transformer and lampholder assembly housed within a cylindrical body moulding. To aid visual detection, the lamp is screened with a rubber hood which is clamped to the body moulding by means of an internally threaded knurled ring.

External electrical connection is by way of two 6 B.A. screw and washer terminals located in the base of the terminal block and to which the primary winding is also connected, the secondary winding being connected to the Neon lamp through its screw holder. A terminal cover is provided and this is secured to the block with a single, centrally located screw.

Provision is made for securing the unit to an instrument panel by two 6 B.A. tapped inserts integral with the face of the body moulding, spaced 1.250" apart.

Operation

The operation of these units is quite simple, use being made of the rapid change of flux occurring in the primary winding, caused by an interrupted primary current, inducing energy into the secondary winding to strike the Neon lamp. Flashing of the lamp therefore occurs at each "make" or "break" of the primary circuit.

Periodic Inspection

The construction of these indicator lamps is such that it renders periodic inspection of the components

unnecessary. A visual examination of the unit should be made however, and care taken to ascertain that cracks or signs of other physical damage are not in evidence. The terminal cover should be removed and connections checked to see that they are clean and secure and free from corrosion.

An operational check should be carried out on the equipment, in which this unit forms part of the system, to ensure that the indicator lamp is functioning correctly. If satisfactory it may be passed for further service.

Should it become necessary to replace component parts, the Neon lamp can be removed by first unscrewing the clamp ring, removing the rubber hood, and then unscrewing the lamp from its holder.

To remove the terminal block, transformer and lampholder assembly, first remove the cover and then unscrew the two 6 B.A. screws securing the assembly to the body moulding. The complete assembly can then be withdrawn from the body moulding.

Testing

After replacing any component part, or if the function of the unit is at all doubtful, it should be subjected to the following tests. A test circuit is illustrated in Fig. 1. *Note:* Although this is a transformer device, it is essential to observe the correct input polarity to ensure a sharp indication. This is due to the mechanical construction of the Neon lamp.

Coil Resistance: Check the ohmic resistance of both primary and secondary windings. These should be:—

Primary winding : 0.11 ohm maximum.

Secondary winding : 520—620 ohms.

Operational Test: Connect the indicator through a lamp load, comprising three 20 watt 24 volt lamps, as shown in Fig. 1, by closing switch S2.

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements. 28/3/55."

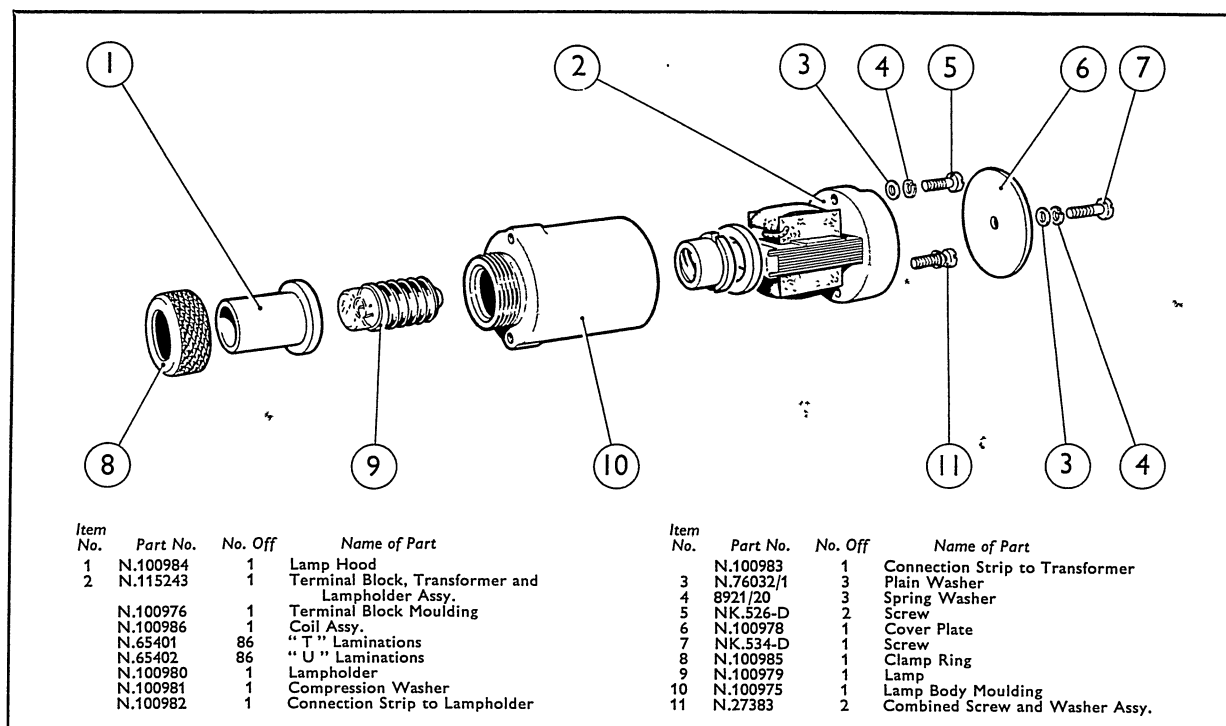
A.R.B. Authority Reference No. E.3077

"Amendments to this publication invalidate the approval statement unless issued by the manufacturers with the concurrence of the Air Registration Board."

PRICE ONE SHILLING

FEBRUARY 1955

ROTAX LIMITED . WILLESDEN JUNCTION . LONDON N.W. 10 . ENGLAND . TELEPHONE ELGAR 7777
LUCAS-ROTAX (AUSTRALIA) PTY. LTD . NEPEAN HIGHWAY . CHELTENHAM S. 22 . TELEPHONE XF 1381
LUCAS-ROTAX LIMITED . TORONTO 13 . CANADA . TELEPHONE PLYMOUTH 5-4171



Switch on the supply, and interrupt the primary circuit, either manually or automatically, approximately 40 times per minute with switch S1, and check that

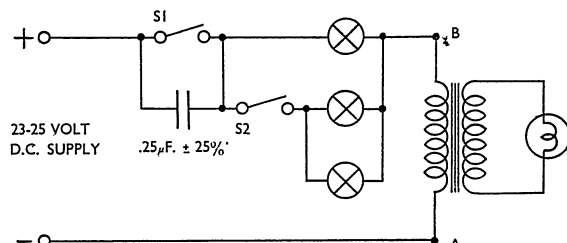


Fig. 1 Test Circuit

the indicator lamp flashes on each "make" or "break" of S1.

Open switch S2 and check that the indicator lamp functions correctly with a single lamp load.

Insulation Test: Using a 250 volt "Megger," check the insulation resistance between the primary and secondary windings. This should be not less than 20 megohms.

Spare Parts

When ordering replacement parts make reference to the Parts List above and quote complete information, including part name and number, the number of hours the part has been in operation and the serial number of the unit for which the parts are required. This will ensure correct identification and prompt service.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to:—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
NEPEAN HIGHWAY
CHELTENHAM, S. 22
VICTORIA

Telephone : XF 1381

ROTAX LIMITED
HEMEL HEMPSTEAD
HERTFORDSHIRE
ENGLAND

Telephone : BOXMOOR 4444

LUCAS-ROTAX LIMITED
5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA

Telephone : BY 6500-09

Technical enquiries should be addressed to:—

TECHNICAL SALES DEPARTMENT

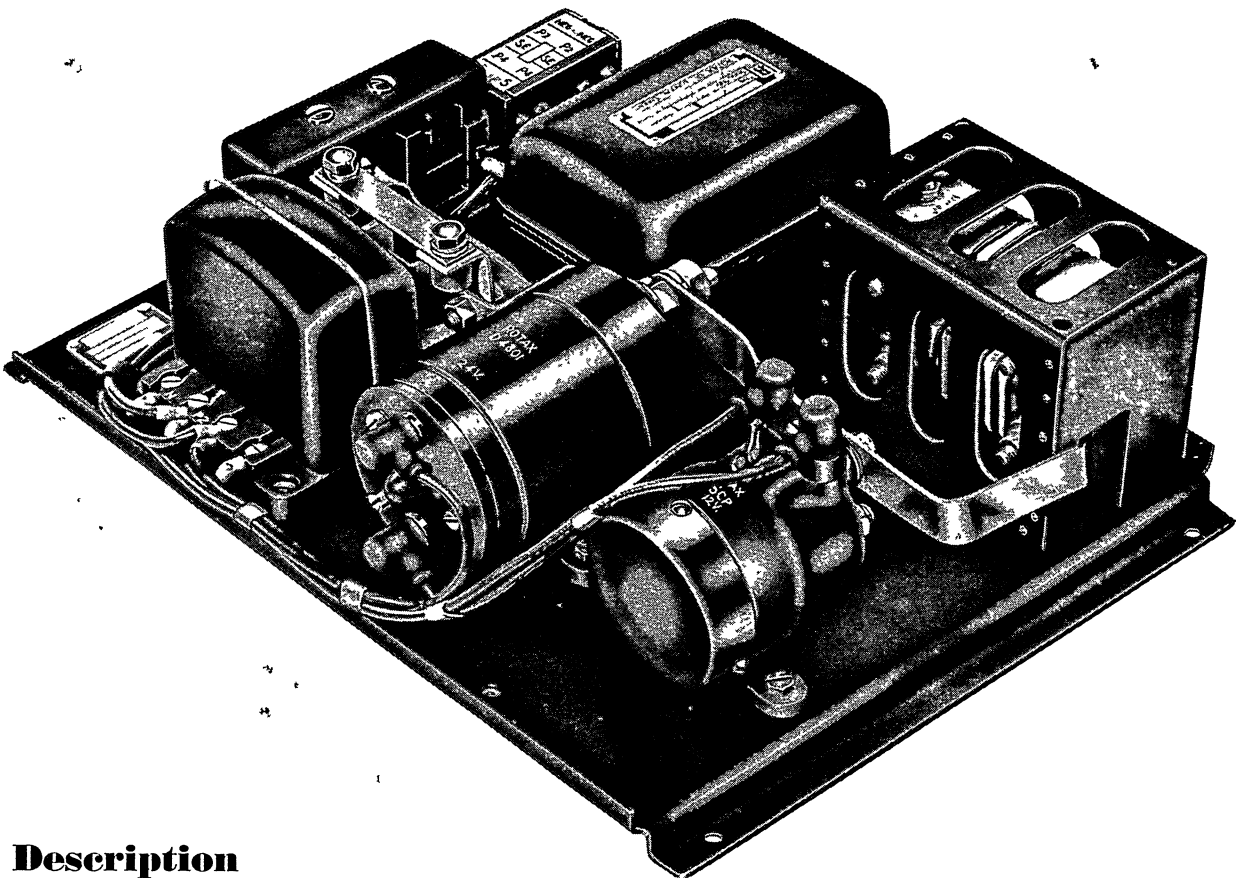
ROTAX LIMITED . WILLESDEN JUNCTION . LONDON N.W.10 . ENGLAND
ELGar 7777

SUBJECT: Starter Panels

TYPES: U.0801/I, U.0802/I
U.0803/I, U.0804

DATA:

SUPPLY VOLTAGE : 24 volts.
TIME SWITCH RUN : 36 seconds approximately.
MOUNTING : 4 holes 1/8" diameter in base panel
(U.0803/I has 6 holes).
WEIGHT : 11 lb. approximately.
ELECTRICAL CONNECTION : S.B.A.C. type terminal blocks
(U.0804 has Canadian type).



Description

This series of starter panels has been designed to control, by means of solenoid switches, the starting cycle of gas turbines. They conform to a general method of operation, the differences between each type being in layout, the changes being made to accommodate different installations.

Each panel comprises a D.8404 time switch, D.4801 magnetic relay, D.0213 relay (on U.0803/I this relay has extended leads in place of a terminal block and is coded D.0217), and an F.1703 overspeed relay (F.1704 on U.0801/I, i.e., similar to F.1703, but having no current diverter bar). A resistor, three-way heavy

terminal block and a five-way light terminal block are also included.

These panels are developments of the U.0615 series and are used in place of them, the U.0801/I being an alternative for the U.0618, the U.0802/I for the U.0615, and the U.0803/I for the U.0618. The U.0804 has Canadian type terminal blocks but is otherwise as U.0801/I and U.0802/I. U.0803 is equipped with a cover.

Reference to the diagrams contained in this leaflet will show dimensions of each panel.

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements. 10/8/53"
A.R.B. Authority Ref. No. E.2518

PRICE ONE SHILLING

APRIL 1953

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LUCAS-ROTAX (AUSTRALIA) PTY. LTD • BOUVERIE STREET • MELBOURNE N.3 • TELEPHONE F.J.4687
LUCAS-ROTAX LIMITED • TORONTO 13 • CANADA • TELEPHONE OXFORD 9368

Operation

To operate a starter panel when it is mounted in position, the external circuit must be prepared in the following manner :—

1. Close the master switch to make the supply circuit alive. Ensure that the throttle lever is in the closed position and check that both fuel cocks are open.

2. Close the safety switch to make the control circuits alive. The fuel pressure warning light will light up and continue to glow until such time as the fuel tank boost pump has built up sufficient pressure to commence the starting operation.

To initiate the starting cycle, the starter push-button should be pressed for one second and then released. This energises the time switch. The time switch winds up and commences its operation almost immediately.

Two to three seconds after the switch commences its operation a pair of contacts close in the time switch and allows the overspeed relay and the magnetic relay (D.0213) to be energised, thus completing the starter circuit through the engaging resistor, current being also fed to the booster coils. The starter engages with the turbine, takes up the slack in the drive, and slowly turns the turbine.

Approximately three seconds later another pair of contacts close in the time switch and the D.4801 relay is energised via the overspeed relay contacts. This relay operates and short circuits the engaging resistor, thus applying full voltage to the starter terminals, cranking the turbine at full power.

Approximately two seconds after the second pair close the first pair of contacts in the time switch open, releasing the engaging relay and the overspeed relay. However, the overspeed relay contacts remain closed by virtue of the heavy current flowing in the single turn series winding.

Cranking proceeds and the cycle is completed, either by the time switch completing its 36 second run, or by the starter attaining such a speed that the current passing through it and the single turn overspeed relay falls below its tripping current—150 amperes for U.0801/1 and 4, and 250 amperes for U.0802/1 and 3/1—and trips the relay and thus the whole circuit.

In the first case, where the time switch completes its run, the second-stage contacts open and release the magnetic relay D.4801. The heavy current supply to the series winding of the overspeed relay is cut off, causing the contacts to open.

If the cycle is completed by the starter motor reaching the trip speed, the contacts of the overspeed relay open, cutting off the supply to the magnetic relay D.4801, starter motor and booster coils.

In either case the time switch completes its run and the whole circuit is reset for a further cycle.

Installation

These panels are normally mounted in the vertical position in the aircraft and secured through holes in the base panel. Reference to the diagrams will give the exact position of these holes and will indicate the relative position of the terminal blocks for external electrical connections.

The battery characteristics for the starter motors employed with these panels is 1 volt drop per 70 amperes from 24 volts open circuit. Any loss in voltage at the motor terminals means a consequent loss in motor speed and slow acceleration with damaging effects. It is therefore recommended that Univin 138 cable should be used for connections made between the starter panels and the motor, and socket connector and starter panel.

For further information on the installation of these starter panels, reference should be made to the handbook issued by the manufacturers of the airframe to which they are fitted.

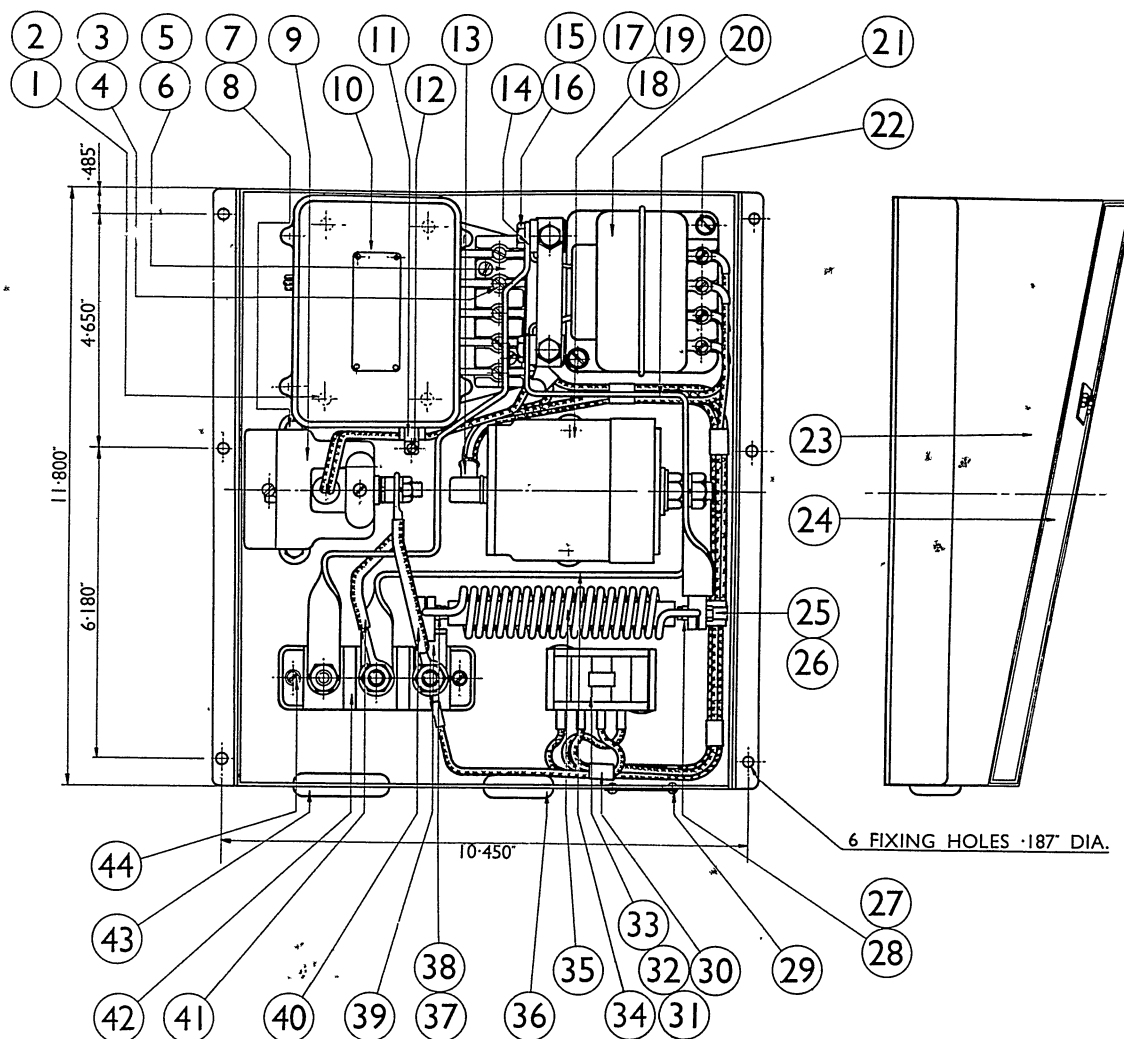
Periodic Inspection

Periodically a panel should be given a thorough visual inspection. All components should be clean and undamaged, and all terminals tight. The insulation of leads must be in good condition and there must be no local hot spots at joints or connections. Frayed and damaged leads will require renewal and where any hot spots are found they should be cleaned and reassembled. Using a 250 volt "Megger," check the insulation resistance between each main and auxiliary terminal and the panel base and between the resistor former fixing pins. The reading obtained with the panel cold must not be less than 20 megohms.

1000 Hour Overhaul

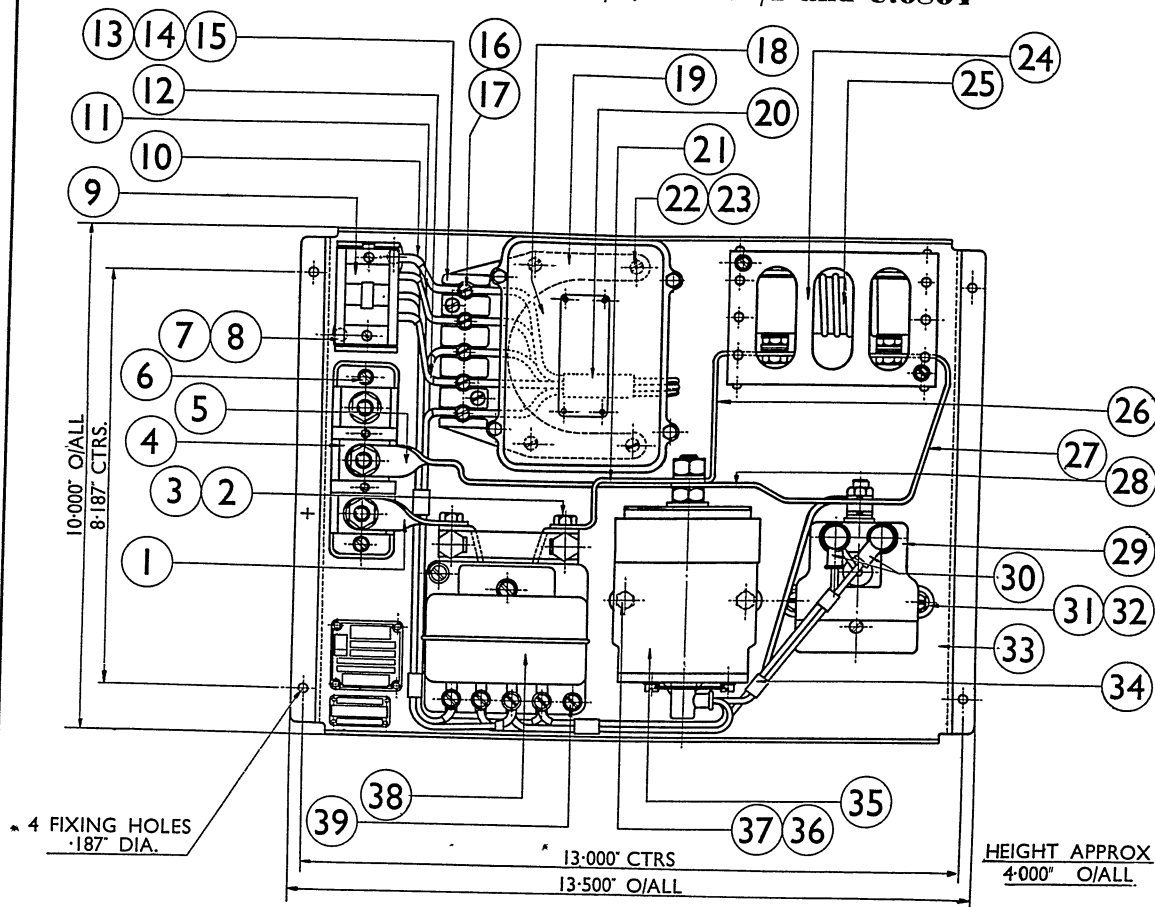
At every 1000 hours a panel should be removed from its installation, dismantled and inspected. Parts should be renewed where considered necessary, and the whole reassembled and tested before being put back into service.

Parts list for U.0803/1



Item No.	Part No.	Name of Part	No. per Unit	Item No.	Part No.	Name of Part	No. per Unit
1	NK.713L	Screw	4	23	N.105162	Box Assembly	1
2	8921/6	Washer	4	24	N.92037/1	Cover Assembly	1
3	12635/4S/3W	Terminal	5	25	N.97169	Cable Cleat	1
4	N.106041	Terminal Tag	5	26	NK.518F	Fixing Screw	1
5	N.64913	Terminal Block	1	27	N.97211	Bolt	1
6	NK.3831L	Fixing Screw	2	28	NK.10155F	Philidas Nut	1
7	N.94440	Fixing Bolt	2	29	NK.18205M	Rivet	2
8	N.1354	Washer	4	30	N.97166	Wiring Loom	1
9	D.0217	Magnetic Relay	1	31	N.67709	Terminal Block	1
10	D.8404	Time Switch	1	32	NK.723L	Screw	2
11	N.97168	Cable Cleat	1	33	N.1358	Washer	2
12	NK.518F	Fixing Screw	2	34	N.96748	Connector	1
13	16936	Terminal Cover	2	35	N.96752	Resistor	1
14	N.105161	Connector	1	36	N.92265	Grommet	1
15	NK.6822F	Screw	2	37	N.97211	Bolt	1
16	NK.10166F	Philidas Nut	2	38	NK.10155F	Philidas Nut	1
17	D.4801	Magnetic Relay	1	39	N.96750	Clamp	1
18	N.94440	Fixing Bolt	2	40	N.96754	Connector Assembly	1
19	N.1354	Washer	2	41	N.96756	Connector Assembly	1
20	F.1703	Overspeed Relay	1	42	N.27431/2	Terminal Block Assembly	1
21	N.96747	Connector Assembly	1	43	N.92266	Grommet	1
22	NK.929F	Fixing Screw	2	44	AGS.245/25	Fixing Screw	2

Parts list for U.0801/1, U.0802/1 and U.0804



U.0801/I & U.0802/I						U.0804		U.0801/I & U.0802/I						U.0804	
Item No.	Name of Part	Part No.	No. per Panel	Part No.	No. per Panel	Item No.	Name of Part	Part No.	No. per Panel	Part No.	No. per Panel	Item No.	Name of Part	Part No.	No. per Panel
1	Connector	N.95676	1	N.112063	1	21	Connector	N.96210	1	N.96210	1	21	Connector	N.96210	1
2	Philidas Nut	NK.10166F	2	NK.10166F	2	22	Screw	NK.729L	4	NK.729L	4	22	Screw	NK.729L	4
3	Screw	NK.6822F	2	NK.6822F	2	23	Washer	8921/6	4	8921/6	4	23	Washer	8921/6	4
4	Terminal Block Assy.	N.27431/I	1	AN.3436-10-2	1	24	Resistor Cover Assy.	N.92019	1	N.92019	1	24	Resistor Cover Assy.	N.92019	1
5	Connector	N.105326	1	N.112064	1	25	Resistor Assembly	N.92033	1	N.92033	1	25	Resistor Assembly	N.92033	1
6	Screw	AGS.245/25	2	AN.515-6R8	3	26	Connector	N.95675	1	N.95675	1	26	Connector	N.95675	1
7	Washer	N.1358	2	AN.961-6	4	27	Connector	N.96209	1	N.96209	1	27	Connector	N.96209	1
8	Screw	NK.723L	2	AN.515-4R7	4	28	Connector	N.96219	1	N.96219	1	28	Connector	N.96219	1
9	Terminal Block Assy.	N.67709	1	AN.3436-2-4	1	29	Solenoid Switch	D.0213	1	D.0213	1	29	Solenoid Switch	D.0213	1
10	Cable Assembly	N.96218/I	1	N.112065/I	1	30	Terminal Cover	I6936	4	I6936	4	30	Terminal Cover	I6936	4
11	Cable Assembly	N.96218/2	1	N.112065/2	1	31	Fixing Bolt	N.94440	4	N.94440	1	31	Fixing Bolt	N.94440	1
12	Cable Assembly	N.96218/3	1	N.112065/3	1	32	Washer	N.1354	4	N.1354	4	32	Washer	N.1354	4
13	Nut	AGS.2001/A/1	2	AGS.2001/A/1	2	33	Base Assembly	N.105324	1	N.112068	1	33	Base Assembly	N.105324	1
14	Screw	NK.3831/L	2	NK.3831/L	2	34	Wiring Loom	N.96225	1	N.112066	1	34	Wiring Loom	N.96225	1
15	Terminal Block	N.105711	1	N.64913	1	35	Magnetic Relay	D.4801	1	D.4801	1	35	Magnetic Relay	D.4801	1
16	Terminal Screw	I2635/4S/3W	5	I2635/4S/3W	5	36	Screw	N.94440	2	N.94440	2	36	Screw	N.94440	2
17	Terminal Tag	N.106041	5	N.106041	5	37	Washer	N.1354	2	N.1354	2	37	Washer	N.1354	2
18	Time Switch	D.8404	1	D.8404	1	38	Overspeed Relay	F.1704*	1	F.1703	1	38	Overspeed Relay	F.1704*	1
19	Plate Assembly	I05158	1	I05158	1	39	Screw	NK.929F	5	NK.929F	5	39	Screw	NK.929F	5
20	Sleeve	N.60791/7	1	N.60791/7	1										

* U.0802 has F.1703

As a panel is made up of several individual units which are easily detached, dismantling should present no difficulties whatsoever.

To dismantle the individual items on the panels reference should be made to the various Technical and Service Leaflets which cover these items.

These leaflets are :—

		T.L.	S.L.
D.4801	Solenoid Switch	14	16
D.0213	Solenoid Switch	12	14
D.8404	Time Switch	39	39
F.1703 and F.1704	Overspeed Relay	37	37

The above leaflets cover the inspections and tests required for the respective units and should be referred to.

Items not covered by these Technical and Service Leaflets require little more than a visual check to ensure good condition and serviceability. Cable ends, lugs and tags should be secure. All leads should be checked to see that they are in good condition, and any that are damaged or have low insulation resistance must be replaced.

Terminal blocks and any other moulded parts must not be cracked or chipped. If any are found to be like this they must be renewed.

After the components have been checked and tested satisfactorily they should be reassembled on to the panel and wired up as before. A final check should be made to ensure correct wiring and that all connections have been securely made.

Testing

The panel should be mounted in its normal operating position and connected to a 24 volt D.C. supply suitable for supplying a 400 ampere load, and a tapped 24 volt D.C. auxiliary supply having a common negative.

Connections

Connect the positive of the 400 ampere supply to the main positive terminal on the panel, using heavy duty cable.

Connect the ST terminal in series with a 500 ampere range ammeter and a suitable loading resistor to the negative supply. (If desired, a circuit link may be included to facilitate breaking the load circuit).

Connect terminal P4 via a 5 ampere switch to the supply positive.

Connect negative terminal to supply negative.

Connect a push switch between terminals P4 and P2.

Connect an 8 ohm resistor between terminal SE and the supply negative. (This resistor may comprise two 24 volt 36 watt lamps in parallel. If these are not used, an ammeter should be included to indicate current flow).

Tests

Operate the panel with a load of 350—450 amperes for 8 cycles with an interval of 45 seconds between cycles. The first two cycles should be made with 18 volts. Make the following checks during three cycles, including the final cycle :—

Check the time from pressing the push switch to the making of the engaging circuit. This should be 4 seconds maximum.

Check the time from the closing of the engaging relay (D.0213) to the closing of the main relay (D.4801). This should be between 1 and 3.5 seconds.

Check the total running period, i.e., from the closing of the engaging relay to switching off. This should be 30—35 seconds.

Check that the engaging current is approximately 100 amperes.

After approximately 15 seconds of operation slowly reduce the load on the panel to trip the overspeed relay (F.1704 on U.0801/1 and U.0803/1 ; F.1703 on U.0802/1 and U.0804). Tripping should occur at 140—160 amperes for F.1704 and 240—260 amperes for F.1703, with the cut-off clearly defined. This test should be made at least five times during the test cycles.

Check that the voltage drop across the main terminals of the magnetic relay with a load of 400 amperes does not exceed 0.2 volt.

Check for local hot spots at connections and joints. If any exist, the faulty joint should be cleaned and re-assembled and the panel re-tested.

Using a 250 volt "Megger," measure the insulation resistance between each main and auxiliary terminal and the panel base, and also between the resistor former fixing pins and the panel base. The reading obtained should not be less than 20 megohms when the panel is cold.

Rotax Servicing Facilities

Any panel or component on the panel which cannot be serviced satisfactorily by following the instructions contained in this leaflet should be replaced immediately and the original returned to our nearest Service Department or authorised service station, where it will receive prompt attention by our Repair Organisation.

When ordering replacement parts give complete information, including part name and number, the number of hours the part has been in operation and the serial number of the unit for which the part is required. This will facilitate prompt identification and efficient service.

For further information on the functioning, operation and maintenance of Rotax equipment, please address all enquiries to:—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
BOUVERIE STREET
MELBOURNE, N. 3
AUSTRALIA
Telephone : F.J. 4687

ROTAX LIMITED
WILLESDEN JUNCTION
LONDON, N.W. 10
ENGLAND
Telephone : ELGAR 7777

LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA
Telephone : WALNUT 3435

SUBJECT: Thermal Switches

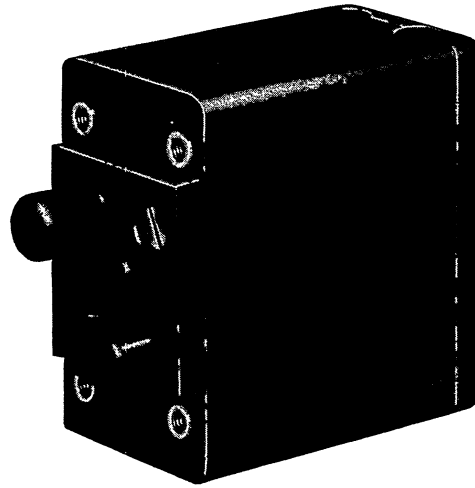
TYPES: D.7501, D.7501/1
D.7502, D.7502/1
D.7503, D.7503/1

DATA:

Current Rating (D.7501 and 01/1) : 40 amperes
(D.7502 and 02/1) : 45 amperes
(D.7503 and 03/1) : 50 amperes

Mounting : Four holes tapped 4 B.A. whose centres form a rectangular shape 1.580" x .860".

Weight : 7 oz.



Description

This range of thermal switches has been designed to provide a circuit breaker with manual push button, trip free, "ON"—"OFF" control and overload circuit protection for any aircraft electrical circuit rated at 40 amperes (D.7501 and 01/1), 45 amperes (D.7502 and 02/1), or 50 amperes (D.7503 and 03/1).

Each switch incorporates a trip mechanism which is thermally operated, having inverse current time tripping characteristics.

The switch is calibrated in an ambient temperature of 25°C. but it will carry its normal rated current in ambient temperatures up to 45°C. The tripping time under overload condition becomes shorter for an increased ambient temperature and longer for a decreased ambient temperature, as the temperature to which the protected circuit will operate is approximately constant. The protection compensates for the change of ambient temperature.

The switch mechanism is contained within a bakelite moulded case and is removable through the base of the moulding.

Two buttons are situated on the switch face, the large red one being the operating button and the small black one the manual trip.

To make electrical connection to the switch it is necessary to remove the terminal cover secured by

three 6 B.A. countersunk screws ; once removed, the two 4 B.A. terminals will be accessible.

Mounting of the switch is achieved by means of four 4 B.A. screws, which locate in holes whose centres form a rectangular shape 1.580" x 0.860". Total weight of the switch is 7 oz.

Operation

Contact is made when the operating button is depressed, bearing down, against spring pressure, on a hinge pin situated between the latchplate and toggle assembly and the intermediate linkage assembly. The latchplate carries the moving pivot of the two pivots on which the toggle assembly operates. These linkages are forced over the centre line of these two pivots and maintained in that position by the main toggle spring, causing the contacts to make with a snap action.

Should the current passing through the bi-metal strip become excessive, the bi-metal strip will deflect upwards, causing an insulated screw mounted upon it to press upwards against one arm of the centrally pivoted trip lever and thus release the latchplate. This frees one of the pivots of the toggle assembly and allows it to return, together with the contact assembly, to the open position.

The contacts can also be opened by depression of the trip button : this bears against spring pressure upon the trip lever and thus releases the latchplate in the same manner as before.

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements, 10-8-53"

PRICE ONE SHILLING

APRIL 1953

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W. 10 • ENGLAND • TELEPHONE ELGAR 7777
LUCAS-ROTAX (AUSTRALIA) PTY. LTD • BOUVIERIE STREET • MELBOURNE N.3 • TELEPHONE F.J.4687
LUCAS-ROTAX LIMITED • TORONTO 13 • CANADA • TELEPHONE OXFORD 9368

Periodic Inspection

These switches are accurately adjusted and tested before leaving the factory and should require but little attention between overhauls provided they are not maltreated. Provided a switch controls its associated circuit in the desired manner it may be considered satisfactory and passed for further use.

However, a general visual inspection should be made periodically to ensure that the switch has not sustained any physical damage and that the terminals are clean and secure ; the latter necessitating the removal of the terminal cover.

Also, the operating and trip buttons should be depressed and released to ensure that they do not foul the holes in the casing, and a check made on the load

required to close the switch operating button. This should be between 6 and $8\frac{1}{2}$ lb.

Where a switch fails to satisfy these checks it should be removed from the aircraft for servicing or replacement.

Servicing

If test equipment is not available no attempt should be made to dismantle the switch. It should, however, be replaced by a new one and the faulty switch returned to our nearest Service Department, where it will receive prompt attention by our Repair Organisation.

In cases where test equipment is available, apply for Rotax Service Leaflet No. S.L.28 for full servicing details.

For further information on the functioning, operation and maintenance of Rotax equipment, please address all enquiries to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
BOUVERIE STREET
MELBOURNE, N. 3
AUSTRALIA

Telephone : F.J. 4687

ROTAX LIMITED
WILLESDEN JUNCTION
LONDON, N.W. 10
ENGLAND

Telephone : ELGAR 7777

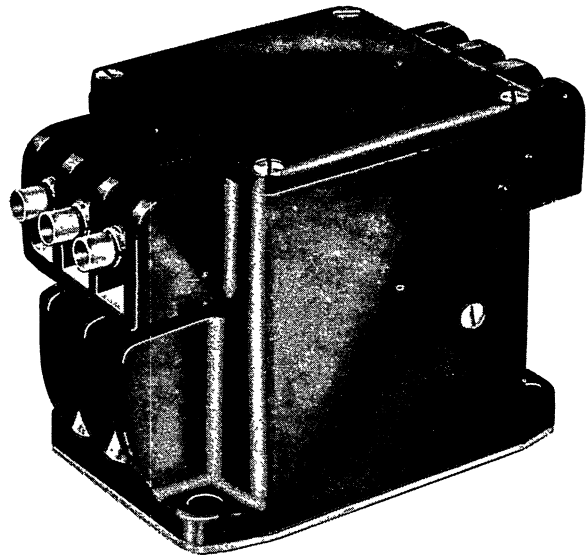
LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA

Telephone : WALNUT 3435

SUBJECT: Contactors

TYPES:

- D.6301 : 208 volt 3-phase 400 c.p.s. A.C.
- D.6302 : 28 volt D.C.
- *D.6303/1 : 2-pole load sharing contactor
- D.6304 : 2-pole rotor and load sharing contactor
- D.6305 : 208 volt single phase 400 c.p.s. A.C.
- D.6306 : 208 volt single phase 400 c.p.s. A.C.



DATA:

- Weight : 11 oz.
- Mounting : Four 2 B.A. holes whose centres form a rectangle 2.500" by 1.375" in the contactor base.

Description

All these contactors are of similar construction, differing only in their application and rating.

The main components consist of a moulded body in which is fitted a hinged armature and contact assembly. Provision is made for adjusting and locking the armature setting.

CURRENT RATINGS :

D.6301	} 10 amperes
*D.6303/1	
D.6304	} 10 amperes and 20 amperes
D.6302	
D.6305	
D.6306	

- * Designed for use on Transformer-Rectifier Unit U.0901 series

Continuously rated, the D.6301 contactor is for use in a 208 volt, 3-phase, 400 cycle A.C. circuit.

Essentially the same component the D.6305 and D.6306 differ from the D.6302 only in terminal connections. Rated at 30 amperes these single phase units are designed for use in a 29 volt D.C. system.

Similar in construction to the D.6304, but incorporating a special adjustment, the D.6303/1 is a 2-pole load sharing contactor rated at 10 amperes in a D.C. circuit.

Designed for a special application, the D.6304 comprises a 2-pole rotor and load sharing contactor.

Terminals B and C are connected in parallel with terminals L2 and L3 forming a 2-pole contactor rated at 20 amperes.

The contacts between terminals A and L1 are rated at 10 amperes.

Contact arrangement on the D.6301 comprises three pairs of nickel silver contacts, the fixed member being connected by means of rigid connecting strips to terminals L1, L2 and L3, and the moving contacts by means of flexible copper braid to terminals A.B.C.

Operation of the contactors is by means of a bi-polar magnet fitted to the steel base screwed to the body moulding.

Connections to the operating coils are brought out to terminals CT and ET mounted below the line terminals, all of which are standard S.B.A.C. 19 ampere type.

Line terminals are linked together on the D.6302, D.6305 and D.6306, so differentiating them from the D.6301 and D.6303/1 ; 29 volt coil supply being employed on all but the D.6303/1 which is continuously rated at 18 volts.

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements. 10/8/53."
A.R.B. Authority Ref. No. E.1745.

PRICE ONE SHILLING

APRIL 1953
REPRINTED AUGUST 1955

ROTAX LIMITED . WILLESDEN JUNCTION . LONDON N.W. 10 . ENGLAND . TELEPHONE ELGAR 7777
LUCAS-ROTAX (AUSTRALIA) PTY. LTD . NEPEAN HIGHWAY . CHELTENHAM S. 22 . TELEPHONE XF 1381
LUCAS-ROTAX LIMITED . TORONTO 13 . CANADA . TELEPHONE PLYMOUTH 5-4171

Periodic Inspection

Visual inspection of the contacts for signs of arcing and the leads for loose and poor connections should be made regularly at 500 hours.

Ensure that copper braiding shows no signs of fraying and that no foreign matter exists inside the contactor.

Check security of mounting and inspect the moulding for cracks ; evidence of same will necessitate the removal of the unit from service. Seal the four cover screws with shellac upon replacement.

Servicing

If test equipment is not available no attempt should be made to service the unit which should be removed from the aircraft. The faulty equipment should be returned to our nearest Service Department where it will be promptly dealt with by our Repair Organisation.

In cases where test equipment is available, apply for Rotax Service Leaflet No. S.L. 29, for full servicing details.

For further information on the functioning, operation and maintenance
of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
NEPEAN HIGHWAY
CHELTENHAM, S. 22
VICTORIA

Telephone : XF 1381

ROTAX LIMITED
HEMEL HEMPSTEAD
HERTFORDSHIRE
ENGLAND

Telephone : BOXMOOR 4444

LUCAS-ROTAX LIMITED
5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA

Telephone : BY 6500-09

Technical enquiries should be addressed to:—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10 • ENGLAND
ELGar 7777

Amendment—D.6803 Contactor

The D.6803 contactor differs only from the D.6801/1 contactor inasmuch that it is fitted with main terminals to suit 50 ampere Prenal cable lugs. The information contained in Technical and Service Leaflets Nos. 30 is therefore applicable to these later types except for a variation in component parts. These variations are quoted on an amendment slip attached to the Spare Parts List.

D.6801 & 2 Technical Leaflet

November, 1955

WEIGHT: 9 lb.

MOUNTING: Four 0.257" holes whose centres form a rectangle 6.157" by 4.187".

RATING: 30 kVA. 3-phase 208 volts 400 c.p.s.

COIL OPERATING VOLTAGE: 29 volt d.c.

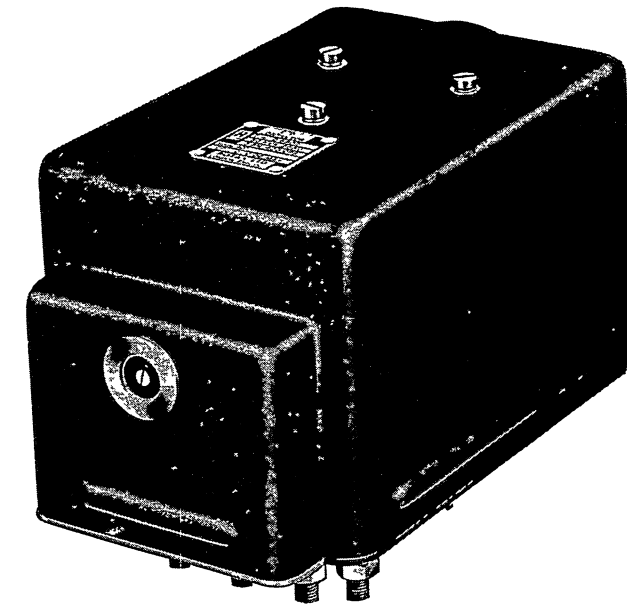
Description

Both these units are similarly constructed as 3-phase change-over contactors, continuously rated at 30 kVA, 3-phase, 208 volt A.C., the solenoid operating on a 29 volt D.C. supply. Each contactor is suitable for use on any 3-phase circuit within its rating.

The terminal arrangement in the D.6802 has been modified for installation in transformer-rectifier units similar to that designed by Rotax for the Handley Page Hermes aircraft and is used in conjunction with a tap change transformer, operated by a Frequency Sensitive Unit, dependent upon the speed of the alternator.

Built up on a moulded base, the contactor consists essentially of the contact assemblies, solenoid and plunger and linkage assemblies. The whole is contained in a light alloy cover which completely shrouds the switch and incorporates flame traps. The contacts are protected by moulded phase barriers screwed to the base, arcing contacts being fitted to the change-over contacts D, E, F, carrying the main line current.

Electrical connection to the D.6801 contactor is made by means of nine 64 ampere S.B.A.C. connectors for the line terminals and a moulded terminal block, centrally situated, carries twelve 7 ampere S.B.A.C.



connectors for the auxiliary contacts and the actuating solenoid connections.

As previously stated, terminal connections on the D.6802 have been modified to suit an individual requirement; two 4 B.A. terminals are provided for the solenoid connections (there being no auxiliary contacts) and nine 0.312" diameter terminals for the line connections.

Operation

When a supply is made to the solenoid the plunger is attracted, operating the toggle-mechanism which moves the contact carrier over to the change-over position and at the same time operating an economy switch which introduces the economy winding reducing the current consumption from 1.03 amps. to 0.213 amp.

Installation

Capable of being mounted with the centre line of the contactor in any plane, the units operate satisfactorily in air temperatures between +70°C. and -70°C. in altitudes up to 50,000 ft.

Four 0.257" mounting holes are provided in the moulded base, the centres forming a rectangle 6.157" by 4.187", the height of the contactor to the highest point of the cover is 4.890".

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements. 27/10/53"
A.R.B. Authority Ref. No. D.6801 : E.1745
D.6802 : E.638

PRICE ONE SHILLING

JULY 1953

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W. 10 • ENGLAND • TELEPHONE ELGAR 7777
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LUCAS-ROTAX LIMITED • TORONTO 13 • CANADA • TELEPHONE OXFORD 9368

Periodic Inspection in Service Servicing

The construction of the contactors is such that they require little or no attention between overhauls. However, the following visual inspection may be carried out with the periodic inspection of associated equipment.

Inspect the moulding for signs of distortion or cracks. Check that all terminals are secure and make good electrical contact. If the unit is operating satisfactorily it is safe to assume that it is serviceable for continued use.

If test equipment is not available no attempt should be made to service or dismantle the unit. It should, however, be replaced by a new one and the in-operative equipment returned to our nearest Service Department, where it will be promptly dealt with by our Repair Organisation.

In cases where test equipment is available, apply for Rotax Service Leaflet No. S.L.30 for full servicing details.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
BOUVERIE STREET
MELBOURNE, N. 3
AUSTRALIA

Telephone: F.J. 4687

ROTAX LIMITED
WILLESDEN JUNCTION
LONDON, N.W. 10
ENGLAND

Telephone: ELGAR 7777

LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA

Telephone: WALNUT 3435

SUBJECT: Time Switches

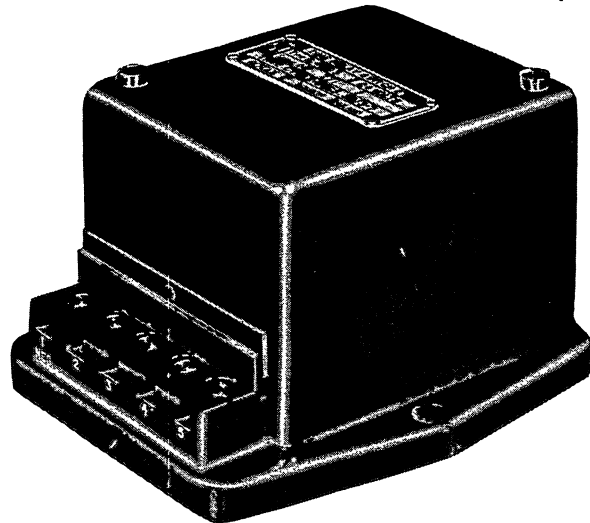
TYPES:	D.4902-1	D.4906
	D.4903-2	D.4907
	D.4904-1	D.4908
	D.4905	D.4909
	D.4910	D.4914
	D.4911	D.4915
	D.4912	D.4916
	D.4913	

DATA:

WEIGHT : 2 lb. 11 oz.

RATING : 8 amperes.

MOUNTING : 3 holes .191" dia. in base.



Description

Each of the series of time switches manufactured by Rotax has been designed to operate one or more circuits in a pre-determined sequence of time intervals.

The time switch contacts are mounted on blade assemblies on opposite sides of a gear and cam mechanism, and movement of the contacts is effected by small rollers on the blade assemblies which ride on the cams as they revolve. Although two cams are incorporated in every switch, on some models, according to the arrangement of the contact assemblies, only one cam is used.

Mounted above the gear and cam mechanism is a spring return rotary solenoid. This provides the drive for the gear train, a pawl on the armature lever engaging with the brass ratchet wheel on the main gear shaft to allow the free wheel action necessary to load the return spring.

Connecting leads from the switches are brought out to a terminal block which is screwed to the light alloy switchbase and the whole mechanism is protected from dirt and damage by a sealed cover which leaves only the terminals and the three fixing holes in the base exposed.

Variations in the arrangement of the contact assemblies of the switches are as follows:—

D.4902-1	One double and one single contact assembly.
D.4903-2	One double and one single contact assembly.
D.4904-1	Two double contact assemblies.
D.4905	One single contact assembly.
D.4906	One single and one double contact assembly.
D.4907	One single contact assembly.
D.4908	One single contact assembly.
D.4909	One single contact assembly.
D.4910	Two double contact assemblies.
D.4911	One double and one single contact assembly.
D.4912	Two double contact assemblies.
D.4913	Two single contact assemblies.
D.4914	One single and one double contact assembly.
D.4915	Two single contact assemblies.
D.4916	One single contact assembly.

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A.6-2 of British Civil Airworthiness Requirements. 3/3/52."

FEBRUARY 1952

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W. 10 • ENGLAND • TELEPHONE ELGAR 7777
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LUCAS-ROTAX LIMITED • TORONTO 13 • CANADA • TELEPHONE OXFORD 9368

Operation

On energising the solenoid from a 24 volt supply, the armature is rotated against a spring. At the end of the stroke, the pawl on the armature lever engages with the next tooth on the brass ratchet wheel. On de-energising the solenoid the time cycle commences and the spring begins to return the armature to its original position, thus setting the gear and cam mechanism in motion. An escapement mechanism controls the speed of return, 36 to 40 seconds, through the gear train. During this time the contacts are opened and closed according to the profile of the cams and arrangement of the contact assemblies thus making or breaking the circuits to be controlled.

Periodic Inspection

These time switches are correctly adjusted and tested before leaving the factory and should require little attention in service provided they are not maltreated. If a switch controls its associated equipment in the desired manner, then it can be passed for further use.

A general visual inspection should be made periodically to ensure that there is no apparent physical damage and that the terminals are clean and free from any foreign matter.

The insulation resistance when measured at 250 volts D.C. between each terminal and the frame, at room temperature, should not be less than 20 megohms.

Servicing

If test equipment is not available no attempt should be made to service or dismantle the unit. It should, however, be replaced by a new one and the inoperative equipment returned to our nearest Service Department, where it will be promptly dealt with by our Repair Organisation.

In cases where test equipment is available, apply for Rotax Service Leaflet No. S.L.31 for full servicing details.

For further information on the functioning, operation, and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

ROTAX LIMITED
WILLESDEN JUNCTION
LONDON, N.W. 10
ENGLAND

Telephone : ELGAR 7777

LUCAS-ROTAX (AUST.) PTY. LTD
BOUVIERIE STREET
MELBOURNE, N. 3
AUSTRALIA

Telephone : F.J. 4867

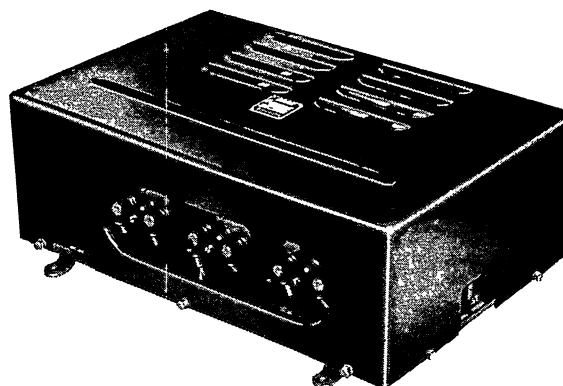
LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA

Telephone : WALNUT 3435

SUBJECT: Starter Panels
TYPES: U.1901, U.1902
U.1902A

DATA:

Supply voltage : 125 volts (U.1901)
112 volts (U.1902 and 2A)
Time switch run : 30 seconds approximately.
Mounting : 4 holes 0.257" diameter
Weight : 26 lb. approximately
Electrical connection: S.B.A.C. type terminal blocks



Description

These starter panels have been designed to control, by means of solenoid switches, the starting cycle of gas turbines. The panels provide a three-stage starting cycle with overspeed cut-out and comprise a D.8428 time switch, three D.6106 relays (D.6107 on U.1901) and one F.1711 overspeed relay (F.1711A on U.1902A). Two resistors, a three-way heavy terminal block and two five-way light terminal blocks are also included. Reference to the diagram contained in this leaflet will show dimensions of the panels.

Operation

Starting is effected in three stages to avoid the high peak currents which would otherwise occur, due to the heavy load put on the motor, by attempting to turn the turbine from rest to full speed in less than thirty seconds.

To initiate the starting cycle, an external hold-on push button is depressed thereby connecting a 28 volt positive supply (via terminal P.1) to one contact of the overspeed relay (F.1711) and, through the first pair of contacts in the time delay switch (D.8428), to the energising coil of the first stage relay (D.6106).

The latter operates, connecting a heavy current supply to the starter motor via the engaging resistor, the coils of the overspeed relay and the limiting resistor.

The overspeed relay is thus energised, closing the contacts and connecting the 28 volt supply (via terminal P.2) to the coil of the push switch, holding the latter in the closed position. At the same time, a positive is fed to the winding relay of the time delay switch and to the second and third pairs of contacts in the same unit. A nominal three seconds is allowed for this stage during which the starter engages with the turbine.

After three seconds interval, the mechanism of the time delay switch closes the second pair of contacts, thus energising the second stage relay (D.6106). The

contacts of this relay close, short circuiting the first stage relay, the engaging resistor and the light duty series winding of the overspeed relay. The latter remains closed, however, by means of the current flowing through the two heavy duty series turns of the relay. The motor now runs at increased speed.

Eight seconds later, i.e., eleven seconds from the commencement of the starting cycle, the mechanism closes the third pair of contacts in the time delay switch, thus energising the third stage relay (D.6106). The limiting resistor is short circuited and full current is applied, via the second stage relay, the two heavy duty series turns of the overspeed relay and the third stage relay, to the starter motor which will now run at full speed.

When the turbine reaches self-sustaining speed, the starter armature current decreases considerably and when it has fallen to approximately 85 amperes, the overspeed relay trips the whole circuit. The time switch mechanism comes to rest with the first pair of contacts closed and the circuit is then ready to commence a further cycle.

If the engine fails to start, however, the time switch mechanism will complete its run of approximately thirty seconds, the second pair of contacts will open, thus de-energising the second stage relay and breaking the supply to the starter motor.

Installation

These panels are mounted in the vertical position, with the resistance assembly uppermost, and secured through holes in steel strips riveted to the base panel. Reference to the parts list diagram will give the exact location of these holes and will indicate the relative positions of terminal blocks for external electrical connections.

For further information on the installation of these

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements. 11/11/55."

A.R.B. Authority Ref. for U.1902 : Proteus 705

"Amendments to this publication invalidate the approval statement unless issued by the manufacturers with the concurrence of the Air Registration Board."

PRICE ONE SHILLING

SEPTEMBER 1955

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10 • ENGLAND • TELEPHONE ELGAR 7777
LUCAS-ROTAX (AUSTRALIA) PTY. LTD • NEPEAN HIGHWAY • CHELTENHAM S. 22 • TELEPHONE XF 1381
LUCAS-ROTAX LIMITED • TORONTO 13 • CANADA • TELEPHONE PLYMOUTH 5-4171

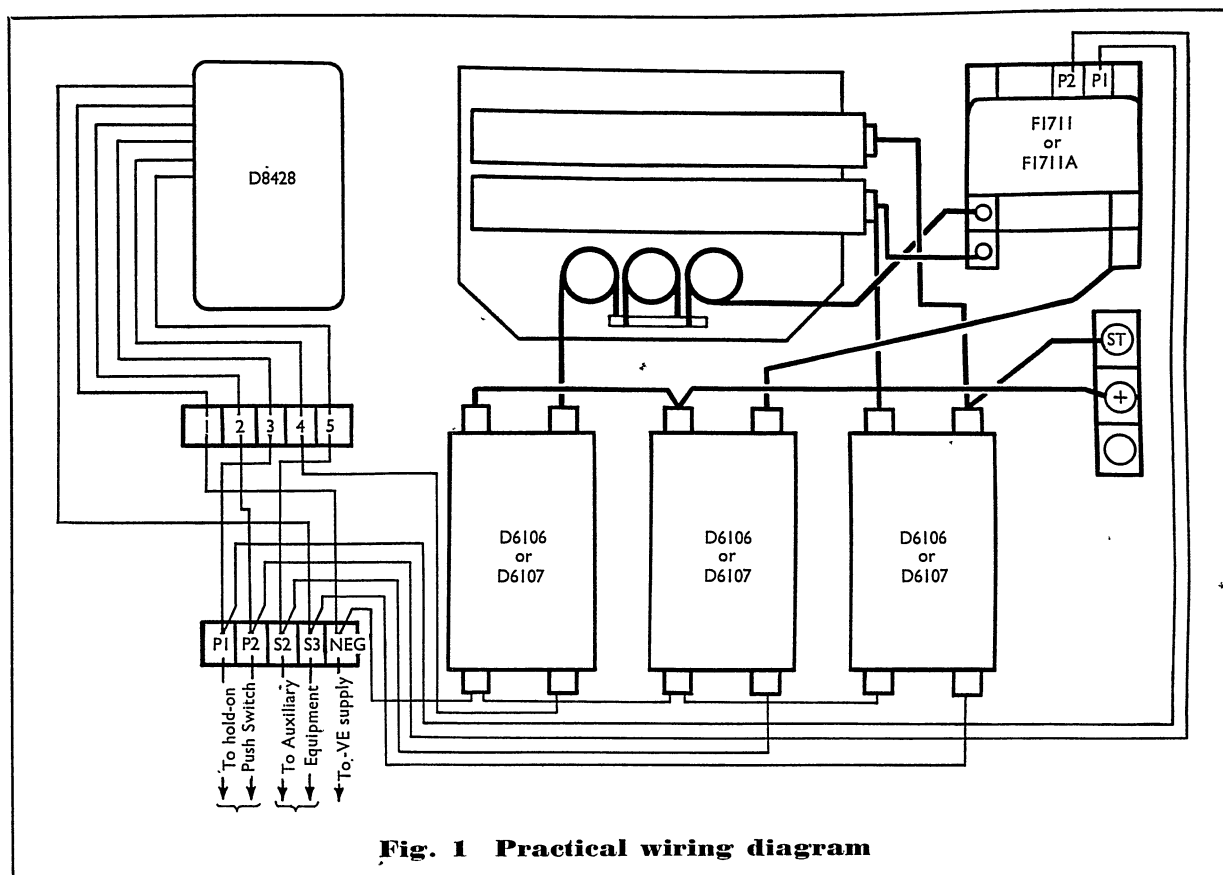


Fig. 1 Practical wiring diagram

starter panels, reference should be made to the handbook issued by the manufacturers of the airframe to which they are fitted.

Periodic Inspection

Periodically a panel should be given a thorough visual inspection. All components should be clean and undamaged, and all terminals tight. The insulation of leads must be in good condition and joints or connections must be free from local hot spots. Frayed and damaged leads will require renewal and where hot spots are found, they should be cleaned and re-assembled.

Using a 250 volt "Megger," check the insulation resistance between :—

Terminal "+" and terminals ST, N, and the frame
Terminal ST and terminal N, and the frame
Terminal N and the frame.

The reading obtained, with the panel cold, must not be less than 20 megohms.

1000 Hour Overhaul

At every 1000 hours a panel should be removed from its installation, dismantled and inspected. Parts should be renewed where considered necessary and the whole panel reassembled and tested before being put back into service.

A panel is made up of several individual units which can be easily removed so that dismantling should present no difficulties. To dismantle the individual items on the panel, reference should be made to the various Technical and Service Leaflets which describe them.

These leaflets are :—

		T.L.	S.L.
D.8428	Time Switch	39	39
D.6106 and D.6107	Solenoid Switch	17	20
F.1711 and F.1711A	Overspeed Relay	37	37

The above leaflets also describe the inspections and

tests required for the respective units. Items not covered by these Technical and Service Leaflets, require only a visual check to ensure good condition and serviceability.

Cable ends, lugs and tags should be secure. All leads should be checked to ensure good condition and any that are damaged or have low insulation resistance must be renewed. Terminal blocks and other moulded parts must also be renewed if they are cracked or chipped. After the components have been checked and tested satisfactorily, the panel should be re-assembled and wired up as before. A final check should be made to ensure correct wiring and that all connections have been securely made.

Testing

The panel should be mounted in the vertical position, with the resistance assembly uppermost, and connected to a 112 volt D.C. supply suitable for supplying a load of 400 amperes, and to a 28 volt D.C. supply for the operation of the solenoids.

Connections

Connect the positive of the 400 ampere supply to the main positive terminal on the panel, using heavy duty cable. Connect terminal ST in series with a 500 ampere range ammeter and a suitable loading resistor, to the negative heavy current supply. (A circuit link can be included to facilitate breaking the load circuit).

Using a D.2210, or similar hold-on push switch, connect the positive 28 volt supply to "+" on the switch.

Connect switch terminal C to terminal P2 on the panel.

Connect switch terminal S1 to terminal P1 on the panel.

Connect switch terminal C1 to terminal NEG on the panel.

Connect terminal NEG on the panel to the negative 28 volt supply.

Tests

Short circuit the two terminals P1 and P2.

Press the push switch and check the satisfactory operation of the auxiliaries. The heavy current circuit must remain open during this test.

Remove the short circuit. This test is to be repeated at 18 volts and 29 volts, measured at the input terminals to the panel.

With both supplies on, and the load resistor suitably set, gradually increase the current in the circuit until

the D.2210 switch holds on and the overspeed relay pulls in.

Repeat the cycle five times and check the following :—
The time from the beginning of the cycle to the end of the engaging period should be between 2.5 and 3.5 seconds.

The time from the beginning of the cycle to the end of the second stage should be between 10.5 and 11.5 seconds.

The time from the beginning of the cycle to the end of the third stage should be between 29 and 31 seconds.

The engaging current required to start the cycle should not exceed 25 amperes.

During the second and third stages, the current flowing in the circuit should be controlled by the load resistor to approximately 400 amperes. (To facilitate testing, a low voltage supply may be used).

Operate the panel on a load set to give approximately 400 amperes in the final stage.

Allow the cycle to enter the third stage, then gradually reduce the load until the overspeed relay trips. Cut-off should be clearly defined between 80 and 95 amperes. This should be repeated three times. (To facilitate testing, a low voltage supply may be used).

The voltage drop across the terminals of the magnetic relays, when a current of 200 amperes is flowing, must not exceed 0.15 volt.

The voltage drop across the main terminals during the final stage, with 200 amperes flowing, must not exceed 0.3 volt. With both supplies on and the load resistor suitably set, operate the panel. As the end of the cycle approaches, hold the push switch in manually and continue to do so until the time switch re-engages and the cycle is repeated. The current should fall to zero before re-engagement occurs. This should be repeated three times.

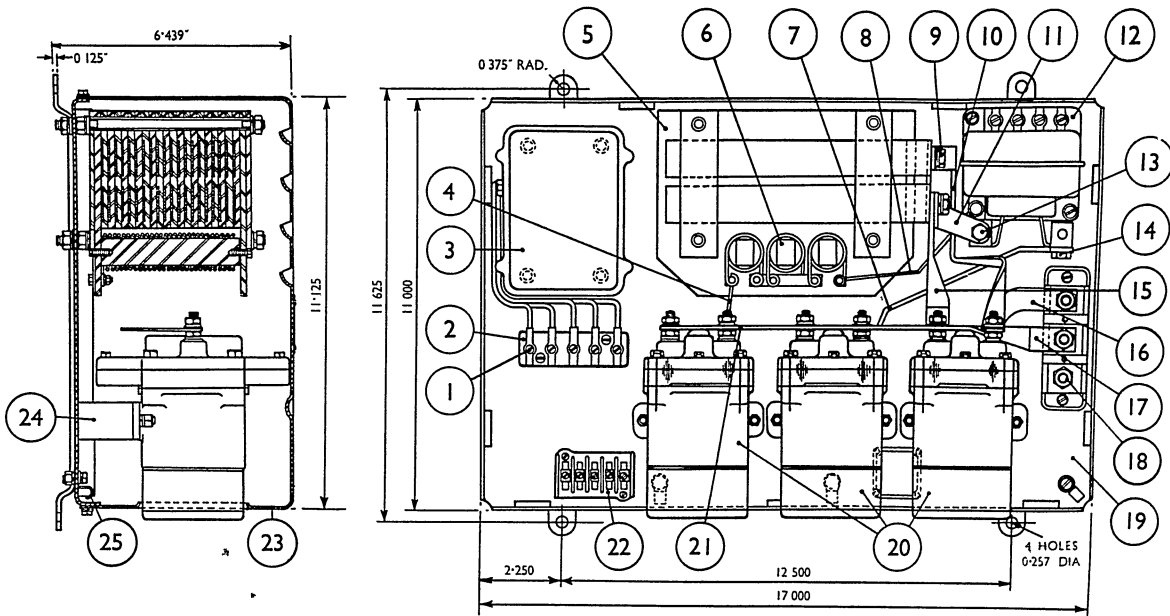
Check for local hot spots at connections and joints. If any exist, the connection or joint must be dismantled, cleaned and reassembled, and the panel retested.

Using a 250 volt "Megger," check the insulation resistance between :—

- Terminal "+" and terminals ST, N, and the frame.
- Terminal ST and terminal N, and the frame.
- Terminal N and the frame.

The reading obtained, with the panel cold, must not be less than 20 megohms.

Spare Parts List



Item No.	Part No.	No. Off	Name of Part	Item No.	Part No.	No. Off	Name of Part
1	12635/4S/3W	5	Combined Screw and Washer	16	NK.19308-L	16	Rivet
2	N.64913	1	Terminal Block	9	N.113811	9	Tapped Pad
	NK.3825L	2	Screw	18	NK.22710-M	18	Rivet
	N.1380	2	Spring Washer	20	D.6106	3	Relay (U.1902 & 2A only)
	N.1360	2	Washer		D.6107	3	Relay (U.1901 only)
	NK.10013-L	2	Nut		NK.961-L	6	Screw
3	D.8428	1	Time Switch		8921/1	6	Spring Washer
	NK.717-L	4	Screw		N.20925	6	Washer
	8921/6	4	Spring Washer		NK.10005-L	6	Nut
	N.1358	4	Washer	21	N.106497	1	Connector
4	N.112622	1	Connector	22	N.81401	1	Terminal Block
5	N.102302	1	Resistance Unit Assy. (including fixing nuts and washers)		NK.725-L	1	Screw
6	N.96897	3	Resistor Assy.		NK.733-L	1	Screw
7	N.106494	1	Connector		8921/6	2	Spring Washer
8	N.112621	1	Connector		N.1358	4	Washer
9	NK.6822-D	2	Screw	23	NK.10009-L	2	Nut
	8921/10	4	Spring Washer		N.113935	1	Cover
	N.1362	4	Washer		NK.2009-L	9	Screw
	NK.10064-D	2	Nut		8921/1	9	Spring Washer
10	N.106493	1	Connector		N.20925	9	Washer
11	N.106496	1	Connector	24	N.108750	3	Support Stirrup
12	F.1711	1	Overspeed Relay (U.1901 & 2 only)		NK.2053-L	6	Screw
	F.1711A	1	Overspeed Relay (U.1902A only)		8921/1	6	Spring Washer
	NK.927-L	2	Screw		N.20925	6	Washer
	8921/1	2	Spring Washer		NK.10005-L	6	Nut
	N.20925	4	Washer	25	N.101155	3	Clip
	NK.10005-L	2	Nut		NK.917-L	3	Screw
13	NK.2226-A	1	Screw		8921/1	6	Spring Washer
	8921/18	1	Spring Washer		N.20925	6	Washer
	AGS.1582-A	1	Washer		NK.10005-L	3	Nut
14	NK.6822-F	1	Screw				
	NK.10166-F	1	Nut		N.62874	20	As Req'd. Unipren 6 Blue Cable
15	N.106498	1	Connector		N.22213/2	8	Ferrule
16	N.106499	1	Connector		N.60791/78	6	Tag (4 B.A.)
17	N.106495	1	Connector		N.60791/125	1	Yellow Helsyn Sleeve
18	N.27431/4	1	Terminal Block Assy.		N.60791/126	1	Yellow Helsyn Sleeve (1)
	NK.753-L	2	Screw		N.60791/127	1	Yellow Helsyn Sleeve (2)
	8921/6	2	Spring Washer		N.60791/131	1	Yellow Helsyn Sleeve (3)
	N.64262	2	Washer		N.60791/259	2	Yellow Helsyn Sleeve (NEG)
	NK.10009-L	2	Nut		N.60791/424	2	Yellow Helsyn Sleeve (4)
19	N.102314	1	Panel Base Assy.		N.60791/425	3	Yellow Helsyn Sleeve (P1)
	N.102315	1	Panel Base		N.60791/426	2	Yellow Helsyn Sleeve (25)
	N.102316	1	Fixing Strap		N.60791/427	3	Yellow Helsyn Sleeve (35)
	N.102316/1	1	Fixing Strap		N.60791/428	1	Yellow Helsyn Sleeve (P2)
							Yellow Helsyn Sleeve (5)

Rotax Servicing Facilities

Any panel, or component on the panel, which cannot be serviced satisfactorily by following the instructions contained in this leaflet, should be renewed immediately and the original returned to our nearest Service Department or authorised service station, where it will receive prompt attention by our Repair Organisation.

When ordering replacement parts, give complete information, including part name and number, the number of hours the part has been in operation and the serial number of the unit for which the part is required. This will facilitate prompt identification and efficient service.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
NEPEAN HIGHWAY
CHELTENHAM, S. 22
VICTORIA

Telephone : XF 1381

ROTAX LIMITED
HEMEL HEMPSTEAD
HERTFORDSHIRE
ENGLAND

Telephone : BOXMOOR 4444

LUCAS-ROTAX LIMITED
5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA

Telephone : BY 6500-09

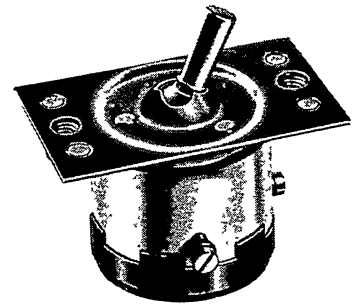
Technical enquiries should be addressed to :—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED · WILLESDEN JUNCTION · LONDON N.W.10 · ENGLAND
ELGar 7777

SUBJECT: Three-way Switch

TYPE: D.3502



Description

The D.3502 manually-operated switch has been designed as a centre "off" switch with three "on" positions. To select any one of these positions the switch lever should be moved into the appropriate recess on the front of the switch at the base of the lever.

The switch is of robust construction and consists of the switch casing and mounting plate assembly, a bakelite moulding which carries the three contacts and the contact plate locating insert, a contact plate assembly, a spring and plunger, and a terminal cover. The spring and plunger are contained in the switch lever and when in the upright or "off" position bears upon the centre of the contact plate. This contact plate is "Y" shaped carrying a silver contact at each of the three extremities in a position corresponding to the fixed contacts. It is shaped so that the contacts are held well clear of the fixed contacts on the bakelite moulding when the switch is in the "off" position. These fixed contacts are equally spaced on a P.C.D. of 2". An insert is fitted in the centre

of this moulding in which the contact plate is located. This insert serves the double purpose of ensuring correct alignment of fixed and moving contact while the bottom of each slot acts as a pivot when that particular section of the switch is operated.

Operation

Operation is simple and positive, when the lever is moved to any selected position, the plunger is moved along the selected arm of the contact plate, and, against spring pressure, the plunger is forced over the fulcrum of the arm, i.e., the bottom of the locating slot, causing the contacts to be made and maintained in that position. The switch is manually operated in all three positions there being no spring return.

To make connections to the switch, it is first necessary to remove the terminal cover plate to reveal the four terminals. The centre terminal is in contact with the contact plate itself, the other three with each of the contacts on the contact moulding. Mounting is achieved by two 2 B.A. fixing holes on the front plate 1.8" apart.

Servicing

If test equipment is not available, no attempt should be made to service the unit, it should be replaced by a new one and the faulty equipment returned to Rotax Limited, where it will be promptly dealt with by our repair organisation.

In cases where test equipment is available, apply for Rotax Service Leaflet No. S.L. 33 for full servicing details.

Amendment – D.3507 THREE-WAY SWITCH

The D.3507 switch is similar to the D.3502 switch, except that in one "on" position two pairs of contacts are made simultaneously, there being altogether four pairs. The base moulding has the extra contact set in it with an independent terminal screw, and one arm of the contact plate is forked at the end to carry two separate silver contacts. There are also variations in the tests and the list of component parts detailed in Service Leaflet No.33.

WILLES DEN

T E D.3502 & 03 Technical Leaflet

August, 1956

SUBJECT: Current Balance Relays

TYPES: F.3401/I, F.3402/I, F.3403/I, F.3404/I

DATA:

CURRENT RATING:

F.3401/I, F.3402/I : 35 amperes, 208 volt,
400 c.p.s. A.C.

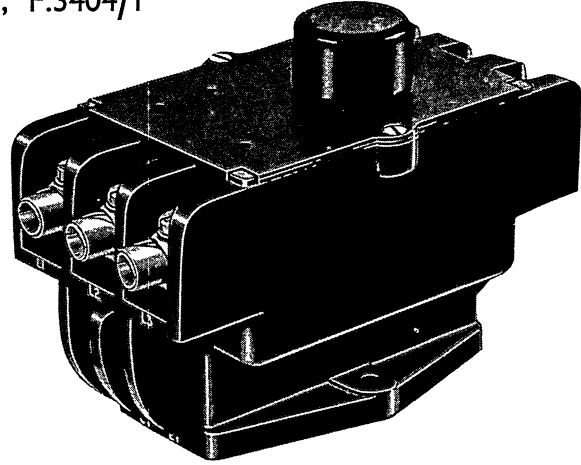
F.3403/I, F.3404/I : 20 amperes, 208 volt,
400 c.p.s. A.C.

WEIGHT:

F.3401/I, F.3402/I and F.3403/I : 14 oz.
F.3404/I : 14.5 oz.

MOUNTING:

Two 2 B.A. holes spaced 1.625" apart in the
base.



Description

Designed as an effective means of protection against an unbalanced three-phase load, the F.3400 relay consists of three bi-metal strips which carry the line current and support the moving trip contact which is in the form of a vertical rod. A d.c. trip relay which, when energised, breaks the supply to the main contactor, and a pair of hold-on contacts which electrically lock out the relay after it has tripped. The complete unit is contained in a moulded bakelite housing.

Connection to the three-phase supply is effected through standard S.B.A.C. socket connectors, sizes being governed by individual requirements. The d.c. connectors to the relay coil are mounted below the line terminals.

Operation

Under normal balanced load conditions, the three bi-metals deflect equally and the moving trip contact rises vertically in the centre of a fixed ring contact surrounding it. Should the line currents become unbalanced the bi-metals will no longer deflect equally and the moving contact carrier will tilt allowing the contact to "make" on to the fixed ring contact, thereby energising the trip relay which open-circuits the coil supply to the controlling contactor.

To prevent automatic resetting and consequent chattering when the bi-metals cool to equal temperature, the supply to the trip relay is maintained by the "hold-on" contacts and the relay is electrically locked out after tripping.

The unit can be reset by manual operation of the reset switch.

To cater for slight variations in circuit resistance, the F.3403/I and F.3404/I relays are set to carry an out of balance load of up to 15% without tripping.

Periodic Inspection in Service

Assuming that the relays have been correctly installed and operated, their construction is such that they require little or no attention in service. Foreign matter is excluded from the body of the relay by a flush fitting cover secured by two 6 B.A. screws.

Visually inspect the moulding for cracks and deformation, check all leads and terminals for cleanliness and security of connection. Utilising a supply of clean dry air, blow out any dust that may have accumulated in the interior of the relay during the service period. If any major defect is disclosed, the unit should be removed from the aircraft and completely overhauled.

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements. 10/8/53"
A.R.B. Authority Ref. No. E.2536

PRICE ONE SHILLING

JUNE 1953

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W. 10 • ENGLAND • TELEPHONE ELGAR 7777
LUCAS-ROTAX (AUSTRALIA) PTY. LTD • BOUVIERIE STREET • MELBOURNE N. 3 • TELEPHONE F.J.4687
LUCAS-ROTAX LIMITED • TORONTO 13 • CANADA • TELEPHONE OXFORD 9368

Rotax Servicing Facilities

No attempt should be made to dismantle the unit unless adequate facilities exist for overhauling and testing. The faulty unit should be returned to our nearest Service Department where it will be promptly dealt with by our Repair Organisation.

Where facilities exist for the overhaul and testing of the F.3400 relays, apply for Rotax Service Leaflet No. S.L.34 which contains comprehensive overhaul and testing instructions.

For further information on the functioning, operation and maintenance of Rotax equipment, address all enquiries to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
BOUVERIE STREET
MELBOURNE, N. 3
AUSTRALIA

Telephone : F.J. 4687

ROTAX LIMITED
WILLESDEN JUNCTION
LONDON, N.W. 10
ENGLAND

Telephone : **ELGAR 7777**

LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA

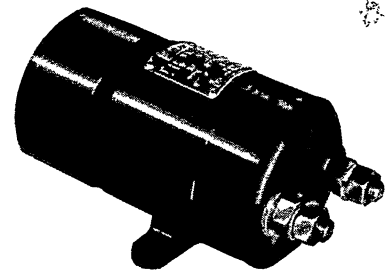
Telephone : WALNUT 3435



SUBJECT: Solenoid Switch

TYPE: D.7004-

DATA: WEIGHT : 3 lb.
MOUNTING : 2 holes .234" dia., 2.375" between centres
RATING : 150 amperes continuous



Description

Designed as a remotely operated switch for engine starters, the D.7001 solenoid switch is energised from a 24 volt supply and has a normal continuous rating of 150 amperes at 24 volts D.C.

A light alloy casting forms the body of the switch and this contains a liner, held in place by a rubber grommet; this in turn contains the solenoid cup assembly which has an interference fit.

The moulded terminal assembly which carries the fixed ~~copper~~ ^{silver} contacts, is secured to the body assembly by a large ring nut, the contacts being insulated from each other and from the body by means of insulating washers.

A moulding fitted to the opposite end of the switch contains the switch assembly which operates the economy coil, this moulding being secured by four 2 B.A. bolts to the main casting.

The solenoid coil is wound to form a closing coil and an economy coil, the coils being arranged so that when the economy contacts are closed, on a switch operated by the spindle, only the closing coil is in the circuit, but when the contacts are open, the economy coil is brought in so that both coils are in series; this occurs when the heavy duty contacts are made.

The fixed contact of the switch is spring-loaded and can be adjusted by a nut which, in conjunction with a bracket assembly, maintains the body of the switch in position.

An insulated contact ring, located on the spindle and secured by a barrel nut, bears against the spring arm contact of the switch when the plunger is drawn in, thereby opening the contacts.

The spindle, on which is carried the moving contact plate and spring, plunger, and return spring, runs

through the solenoid and is held by two bushes, one in the body assembly itself and the other in the terminal assembly holding the fixed contacts.

The moving contact plate is made of copper in a moulded bakelite centre. This assembly is held in the "off" position by the return spring on the end of the spindle, and is mounted so as to ensure alignment of the fixed and moving contacts in the switch closed position.

Operation

When current is passed through the solenoid the plunger is drawn inwards toward the centre of the solenoid, causing the return spring to come under pressure. The contact spring between plunger and moving contact assembly will also be compressed when the plunger is drawn into the coil assembly. This contact spring ensures alignment of the fixed and moving contacts when the switch is in the closed position. At the same time the economy switch contacts are opened and the economy coil is also introduced into the circuit.

When the current through the solenoid is broken, the plunger returns to its position of rest. The initial movement of the plunger does not lift the moving contact plate from the fixed contacts as the contact spring is returning to its normal position and is, in effect, still holding the contact plate in the "on" position. By the time the contact spring has returned to normal, the conical nut on the spindle strikes the moving contact plate with considerable force, ensuring a rapid and positive break and return to the "off" position.

Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements. 4.4.52

MARCH 1952

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The return of the spindle to its original position causes the economy switch to close, leaving only the closing coil in circuit.

Leads are introduced to the solenoid switch via two slots in the moulded economy switch housing and secured by 2 B.A. bolts.

Two holes 0.234" diameter and 2.375" between centres are drilled in a mounting bracket integral with the body casting.

Servicing

If test equipment is not available no attempt should be made to service or dismantle the unit. It should, however, be replaced by a new one and the inoperative equipment returned to our nearest Service Department, where it will be promptly dealt with by our Repair Organisation.

In cases where test equipment is available, apply for Rotax Service Leaflet No. S.L. 35 for full servicing details.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

ROTAX LIMITED
WILLESDEN JUNCTION
LONDON, N.W. 10
ENGLAND

Telephone : ELGAR 7777

LUCAS-ROTAX (AUST.) PTY. LTD
BOUVERIE STREET
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AUSTRALIA

Telephone : F.J. 4867

LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA

Telephone : WALNUT 3435

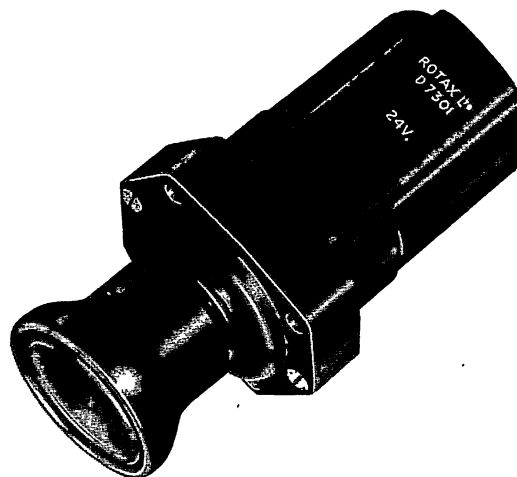


SUBJECT: Push-Pull Switch

TYPES: D.7301, D.7302, D.7304

DATA:

CONTACT RATING	5 amperes
HOLD-IN COIL	29 volts D.C. max.
VOLTAGE	12 volts D.C. min.
CURRENT	
CONSUMPTION	1.1 amperes
PUSH-BUTTON TRAVEL	.218"
MOUNTING	Four 2 B.A. tapped holes on $2.187 \pm .002$ " P.C.D.
WEIGHT	1 lb. 3 oz.



Description

This is a push-pull switch of in-line construction housed in a cylindrical moulding. At one end there is a detachable cover which incorporates a cable outlet for the electrical connections. At the other end a cover assembly provides the four 2 B.A. tapped holes for installation purposes.

Situated just inside the mounting flange is the double wound solenoid. The plunger is extended through a bearing in the mounting flange to the exterior, where a translucent red push-button is attached by means of an adaptor (for type D.7302 an iris diaphragm is fitted in place of the translucent button). Surrounding this button is a moulded shroud which is spring loaded to facilitate control of the switch.

Internally the hollow plunger carries a cylindrical moulded contact ring carrier. This in turn carries a lamp assembly designed so that a red glow is visible through the push button when the bulb lights up.

Five cam-shaped contacts, three double and two single, are assembled in slots around the terminal moulding. These contacts are held firmly in position by flat retaining springs which also serve as electrical connectors between the contacts and the terminals.

Terminals are 4 B.A. combined screw and washer type and the diagram Fig. 2 shows the terminal markings and positions. The leads are brought out through a grommet in the terminal cover for types D.7302 and D.7304, and for type D.7301, through a bonding connector riveted to the terminal cover.

Operation

With the switch wired up as shown in the wiring diagram Fig. 1 and a 24 volt supply connected across terminals "C+" and "C-", depression of the push button will close the circuit between terminals "+" and "R" and between "C+" and "S." The switch will hold in this position until the supply to the solenoid is broken. The plunger will then spring out to its neutral position.

By extending the outer shroud, the circuit between terminals "+" and "R" and between "C+" and "B" will be completed. The switch will be held in this position until the solenoid circuit is again broken externally. The plunger will then spring back to its neutral position.

Note—The lamp will glow irrespective of the position of the switch provided that a supply is connected across terminals L1 and L2.

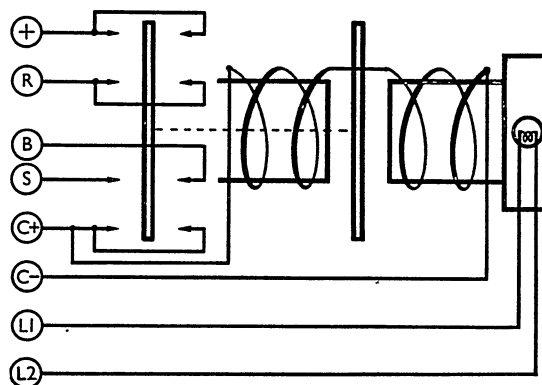


Fig. 1 Wiring Diagram

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements. 10.11.52"

JUNE 1952

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Periodic Inspection

In service these switches require little attention provided they are not maltreated. Periodically an inspection should be made as follows :—

1. Ensure that the switch is in good condition and is not damaged in any way.
2. The terminals and mouldings should be free from dirt, undamaged and in good condition.
3. Check the insulation resistance between each terminal and the metal portion of the case with a 250 volt "Megger." The reading obtained should not be less than 20 megohms.

If a switch satisfies the above conditions and controls its associated equipment satisfactorily then it can be passed for further use.

Testing

1. Operation check

Upon operation of the switch, by pressing the centre button or by pulling the outer knob with the coil energised, the switch must remain in its operated position when the coil volts are reduced to at least 12 volts. Drop out must occur at a minimum of 2 volts.

With the centre button depressed, circuits should be closed between "+" and "R" and between "S" and "C+." With the outer shroud extended, circuits should be closed between "+" and "R" and between "B" and "C+." The lamp should light in both positions provided a supply is connected across terminals L1 and L2.

Note—The coil should not be left in circuit longer than 90 seconds. The switch action must be quite free on depression of the operating button or shroud. When the coil is de-energised, the switch must return to the centre position.

2. Coil resistance

This should be between 24.3 and 29.7 ohms at 20°C.

3. Millivolt drop

The millivolt drop between "+" and "R," "B," "S" or "C+" when passing 5 amperes must not exceed 100 millivolts.

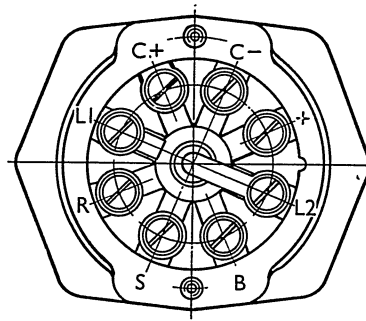


Fig. 2 View of Terminal markings, end cover removed.

4. Insulation resistance

The insulation resistance when measured with a 250 volt "Megger" between each terminal and the metal portion of the case should not be less than 20 megohms.

Servicing

If a switch does not satisfy the above inspections and tests, it should be dismantled sufficiently for a closer inspection to be made. The inoperative parts must be renewed and the switch reassembled and retested. For details please apply for Rotax Service Leaflet No. S.L. 36.

Where adequate servicing facilities are not available a switch should be replaced by a new one and the original returned to our nearest Service Department where it will receive prompt attention by our Repair Organisation.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
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WILLESDEN JUNCTION
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ENGLAND

Telephone: ELGAR 7777

LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA

Telephone: WALNUT 3435

SUBJECT: Overspeed Relays

TYPES: F.1701 - F.1711

DATA:

WEIGHT: 18 oz. approximately.

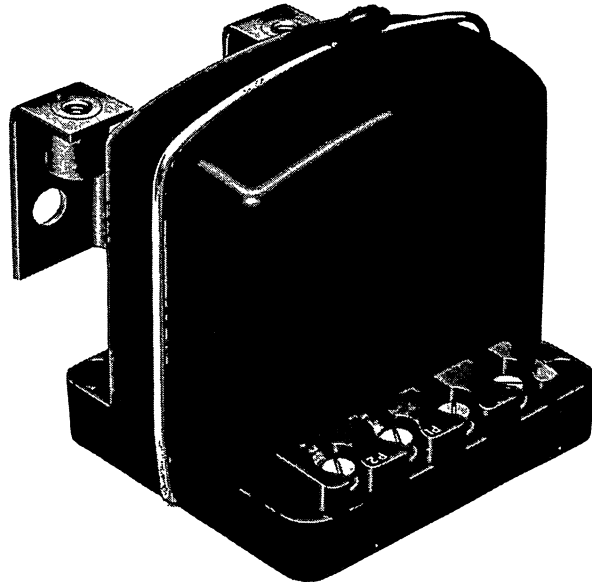
MOUNTING: Two 2 B.A. clear holes in base.

RATING: Intermittent.

F.1701 to 6, 8 and 10 1000 A. max.

F.1707, 9 and 11 500 A. max.

See overleaf for further data.



Description

In general, the application of a relay is to trip the circuit of a series or compound wound starter motor ; as the load is reduced and the armature speed increases the armature current falls. Thus a relay functions as a speed limiter.

Basically each relay in this series consists of an electro magnetic unit arranged to actuate an armature and thereby make or break an auxiliary circuit.

Mounted on a moulded base, a relay is protected by a moulded cover retained by a spring clip. The base provides four terminal positions along one of its sides and in some cases there is an additional terminal set in the corner of the base. On all units two heavy terminals protrude from between two moulded blocks screwed to the base on the side opposite the four small

The relay itself is of conventional design having a U-shaped yoke with a flat spring-loaded armature hinged on one leg, the armature carrying a contact plate which makes or breaks a pair of fixed contacts assembled on the opposite leg. The windings are arranged around a central core held in the yoke and a copper slug is fitted at the heel of the relay to stabilise it and prevent chatter.

When normally adjusted a relay operates with about 500 ampere turns excitation and holds down to 150 ampere turns.

All models in the series are basically similar but differ in their windings to suit particular applications. Some are actuated by a voltage coil and others by a series coil. In every case, however, release is by a falling current in a series winding, this current being the whole or part of the starter current.

Amendment-F.1714/1 OVERSPEED RELAY

This relay is generally similar to the F.1701-11 series. It is fitted with a single turn series coil without diverter bar and has no shunt or voltage coil. The operation current is 450-550 amperes and the release current 140-160 amperes; the contact terminals are designated P1 and P2.

et affecting safe operation and
proved by the Air Registration
r A.6-2 of British Civil Air-
3/3/52."

F.1701-F.1711 Technical Leaflet

August, 1956

FEBRUARY 1952

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Amendment - F.1718 Overspeed Relay

Add to table on rear page:-

Type	Operation	Release	Diverter Bar	Fixed Contacts Terminals
F.1718	25 A. MAX, SERIES WINDING	50-60 A SERIES WINDING	NOT FITTED	P1. P2

Add to DATA:

under sub-heading RATING:-

F.1718 450 A. max.

F.1701-11 Technical Leaflet

2-31-10-58

Voltage Coil terminals	Fixed Contacts Terminals
. 5	SE . P4
. 5	SE . P4
. N	S . 5
. N	S . 5
	N . P2
	N . P2
	N . P2
	PI . P2
	PI . P2
	PI . P2

F.1706	90-100 A. SERIES WINDING	145-155 A. SERIES WINDING	NOT FITTED		N . P2
F.1707	15-25 A. SERIES WINDING	45-55 A. SERIES WINDING	NOT FITTED		N . P2
F.1708	24 V. SHUNT WINDING	145-155 A. SERIES WINDING	NOT FITTED	3 . 5	SE . P4
F.1709	175-200 A. SERIES WINDING	80-90 A. SERIES WINDING	NOT FITTED		PI . P2
F.1710	650-750 A. SERIES WINDING	345-355 A. SERIES WINDING	FITTED		PI . P2
F.1711	15-25 A. SERIES WINDING	80-90 A. SERIES WINDING	NOT FITTED		PI . P2

Periodic Inspection in Service

These relays should require little attention in service provided they are not maltreated. Apart from a general visual inspection to ensure that there is no physical damage, a relay may be considered satisfactory if it controls its associated equipment in the desired manner.

Where possible, a "Megger" test should be made between the main terminals and the fixed contact terminals and the voltage coil terminals. The reading obtained should be at least 20 megohms when measured with a 250 volt "Megger."

Servicing

If test equipment is not available, no attempt should be made to service a unit. It should be replaced by a new one and the original returned to our nearest Service Department where it will receive prompt attention by our Repair Organisation.

Where, however, adequate and efficient testing facilities have been arranged, full details may be obtained on request of Rotax Service Leaflet No. S.L. 37.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :-

THE SERVICE DEPARTMENT

ROTAX LIMITED
WILLESDEN JUNCTION
LONDON, N.W. 10
ENGLAND

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LUCAS-ROTAX (AUST.) PTY. LTD
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Telephone : F.J. 4867

LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA

Telephone : WALNUT 3435

	Operation	Release	Diverter Bar	Voltage Coil Terminals	Fixed Contacts Terminals
F.1701	24 V. SHUNT WINDING	245-255 A. SERIES WINDING	FITTED	3 . 5	SE . P4
F.1702	24 V. SHUNT WINDING	145-155 A. SERIES WINDING	NOT FITTED	3 . 5	SE . P4
F.1703	24 V. SHUNT WINDING	245-255 A. SERIES WINDING	FITTED	3 . N	S . 5
F.1704	24 V. SHUNT WINDING	145-155 A. SERIES WINDING	NOT FITTED.	3 . N	S . 5
F.1705	90-100 A. SERIES WINDING	245-255 A. SERIES WINDING	FITTED		N . P2
F.1706	90-100 A. SERIES WINDING	145-155 A. SERIES WINDING	NOT FITTED		N . P2
F.1707	15-25 A. SERIES WINDING	45-55 A. SERIES WINDING	NOT FITTED		N . P2
F.1708	24 V. SHUNT WINDING	145-155 A. SERIES WINDING	NOT FITTED	3 . 5	SE . P4
F.1709	175-200 A. SERIES WINDING	80-90 A. SERIES WINDING	NOT FITTED		PI . P2
F.1710	650-750 A. SERIES WINDING	345-355 A. SERIES WINDING	FITTED		PI . P2
F.1711	15-25 A. SERIES WINDING	80-90 A. SERIES WINDING	NOT FITTED		PI . P2

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These relays should require little attention in service provided they are not maltreated. Apart from a general visual inspection to ensure that there is no physical damage, a relay may be considered satisfactory if it controls its associated equipment in the desired manner.

Where possible, a "Megger" test should be made between the main terminals and the fixed contact terminals and the voltage coil terminals. The reading obtained should be at least 20 megohms when measured with a 250 volt "Megger."

Servicing

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LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA

Telephone : WALNUT 3435



SUBJECT: Time Delay Relay

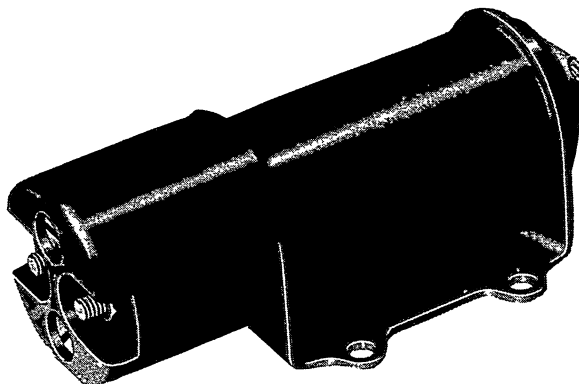
TYPE: D. 5901

DATA:

MOUNTING: 4 holes $\cdot 156$ " dia. in base, whose centres form a rectangle, $1 \cdot 156$ " \times $1 \cdot 437$ "

WEIGHT: 14 oz.

OVERHAUL LIFE: 4000 hours



Description

This relay has been designed for use in electric starter systems for gas turbines, where its function is to trip the energised time switch thus allowing it to unwind and control the starting cycle.

Each relay consists of a solenoid with a double winding and a copper slug around the iron core. This core is hollow and carries a push rod at either end, one rod bearing on the other through the medium of a helical spring.

Mounted at the coil end are two contact plates, one carrying a fixed contact and the other a moving contact. The design of these plates is such that upon movement of the push rods the contacts are either opened or closed.

The two studs locating the uvula shaped moving contact plate are used also for the attachment of the contact cover. This is a moulding which serves the dual purpose of contact protection and terminal block. One of the terminals is connected to one end of the series winding, the other end of which is connected both to the moving contact and through the second coil and fixed contact to the remaining terminal.

Operation

When connected in series with the 24 volt supply to the time switch solenoid the D.5901 relay operates as follows:—

1. When the supply is switched on the circuit is completed through the relay series winding and the closed contacts to the time switch rotary solenoid, which pulls round winding up the switch.

2. A fraction of a second later, the delay being effected by the magnetic field induced in the copper slug, the relay plunger pulls in and actuates the push rods. This opens the contacts and causes the circuit to be completed through both the series and the shunted windings. The combined resistance of these coils reduces the current sufficiently to enable the time switch to unwind and commence the starting cycle.

3. When the start is completed and the supply is cut off, the D.5901 plunger returns to its original position and the contacts close ready for the next operation.

Periodic Inspection

In service these relays require little attention provided they are not maltreated. Periodically an inspection should be made as follows:—

1. Ensure that the relay is in good condition and is not damaged in any way.
2. The contacts should be free from dirt, undamaged and in good condition.
3. Check the insulation resistance between terminals and frame with a 250 volt "Megger." The reading should not be less than 20 megohms.

If a relay satisfies the above conditions and controls its associated equipment satisfactorily then it can be passed for further use.

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A.6-2 of British Civil Airworthiness Requirements. 4/4/52."

FEBRUARY 1952

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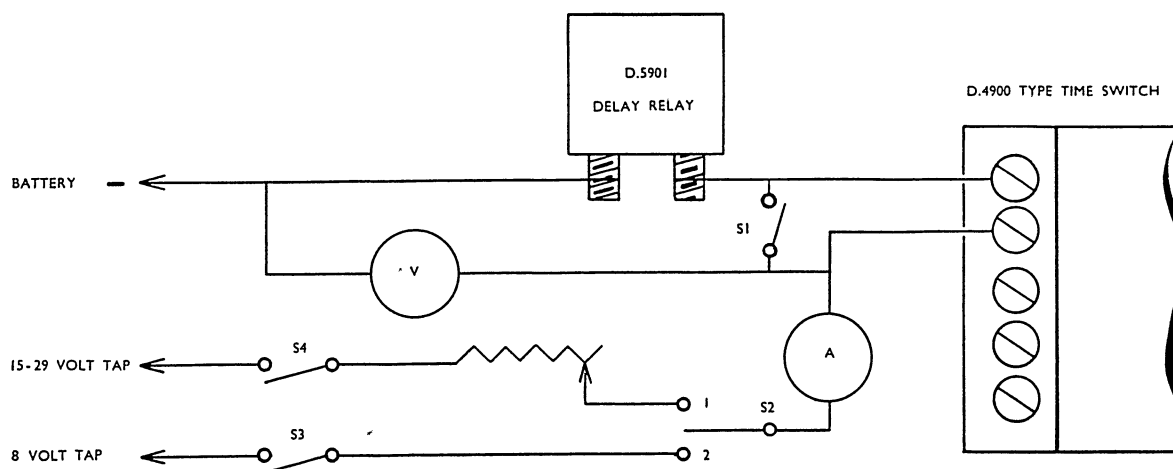


Diagram of Test Circuit

Testing

Preliminary Test with Cover removed

1. The contact gap (.045") and 13 oz. spring pressure should have been set and checked prior to the completion of the initial assembly.
2. Connect the relay in series with a suitable resistance on a D.C. supply as shown in the diagram. S1 should be closed, S2 should be in position 1 and S4 should be closed. Check the relay setting by slowly raising the current to 2.65 amperes at which point the relay should operate.

Final Test with Cover fitted

3. Recheck as in paragraph 2.
4. Connect the relay in the test circuit with S1 open, S2 in position 1, and S4 closed. The resistance should be all out. Check that the relay operates satisfactorily on a maximum of 29 volts and a minimum of 15 volts when tested in conjunction with a Rotax D.4900 type time switch. The switch must wind before being tripped by the relay. Check for fifty consecutive operations on both limits of voltage.

Note—A slave switch with a fast escapement may be used to reduce the unwind time to a few seconds.

5. The relay should operate at between 2.6 and 2.7 amps. when rechecked as in paragraph 2. If any further adjustment has to be made, the test specified in paragraph 4 must be repeated.

6. Connect the relay in the test circuit with S1 closed, S2 in position 2 and S3 closed. Check that eight volts will hold the contacts open continuously. The current should remain steady with low reading.

7. The insulation resistance between the terminals and frame should not be less than 20 megohms when tested with a 250 volt "Megger,"

OR

8. The terminals to frame must withstand a voltage of 500 volts, 50 c.p.s. A.C. for one minute.

Servicing

If a relay does not satisfy the above inspection and tests, it should be dismantled sufficiently so that a closer inspection can be made. The inoperative part must be renewed and the relay reassembled and retested. For details please apply for Rotax Service Leaflet No. S.L. 38.

Where adequate servicing facilities are not available a relay should be replaced by a new one and the original returned to our nearest Service Department where it will receive prompt attention by our Repair Organisation.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to:—

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LONDON, N.W. 10
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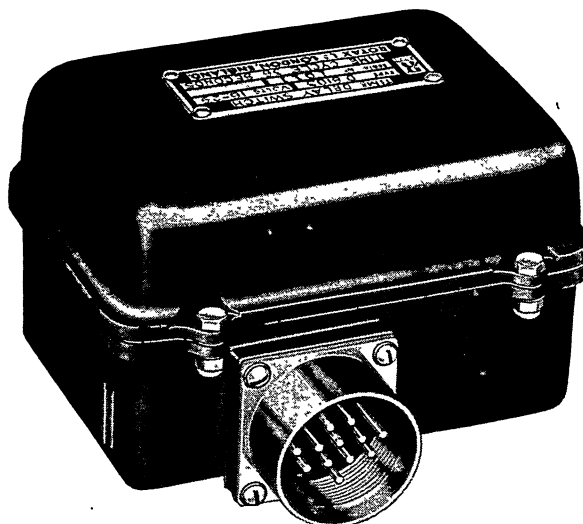
Telephone : WALNUT 3435

SUBJECT: Time Switches

TYPES: D.8102, 3, 4, 13-17, 19, 21
D.8402, 4, 13-15, 20

DATA

OPERATING VOLTAGE : 16—29 V.
WINDING CURRENT : .5 AMP. AVERAGE AT 24 V.
MAXIMUM CONTACT CURRENT : 8 AMPS.
TEMPERATURE RANGE : —40° C. TO +70° C.
WEIGHT APPROXIMATELY : 1 LB. 12 OZ.



Description

The D.8100 and D.8400 series of time switches have been designed primarily to replace the D.4900 series used in starter control circuits for gas turbines. However, a switch can be utilised in any 28 volt D.C. system where a master switch is required to operate other circuits in a pre-determined time sequence. Each switch weighs approximately 1 lb. 12 oz., which is 1 lb. less than a D.4900 type, and when used on a starter panel obviates the necessity of a trip relay, thus saving a further 14 oz. The nominal unwinding time of a switch is 36 seconds but this can be adjusted over a range of 28—44 seconds. These times represent one complete revolution of the camshaft but it is possible to arrange a switch to complete up to six operations within the one revolution. Thus, if the required time cycle is, say, 12 seconds, it is possible to initiate a fresh cycle immediately on completion of the first without waiting for the nominal unwinding time to elapse.

The switch mechanism is mounted in two light alloy castings which are bolted together to form a waterproof and flameproof housing. An auto-relay is arranged to wind, by ratchet mechanism, a preloaded clock type spring which provides the drive for the camshaft. To prevent overwinding of the spring, a protective device is incorporated in the winding mechanism, and to regulate the speed of unwinding an escapement mechanism is fitted.

Supported in two bearings, the camshaft projects through the baseplate where up to six cams can be keyed in position. The key is offset, making incorrect assembly of a cam an impossibility. Around the camshaft, the contacts are assembled in banks, movement of the switch blades being effected by the cam followers riding on the cam profiles.

CODE	ELECTRICAL CONNECTION	NO. OF CAMS FITTED	REPLACES
D.8102	12-PIN STANDARD BREEZE PLUG 5X/6086	2	D.4902
D.8103	" " " "	2	D.4903
D.8104	" " " "	2	D.4904
D.8113	" " " "	2	D.4913
D.8114	" " " "	3	D.4914
D.8115	" " " "	2	D.4915
D.8116	" " " "	1	D.4916
D.8117	" " " "	4	
D.8119	" " " "	5	
D.8121	" " " "	2	
D.8402	LEADS THROUGH GROMMET	2	D.4902
D.8404	" " " "	2	D.4904
D.8413	" " " "	2	D.4913
D.8414	" " " "	3	D.4914
D.8415	" " " "	2	D.4915
D.8420	" " " "	3	

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FEBRUARY 1952

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For installation purposes there are four brass bushes cast in the protective box. These are tapped 4 B.A. by .250" deep, their centres forming a rectangle 2.000" by 3.500". For the electrical connections a 12-pin plug is fitted on the D.8100 types, while on the D.8400 types the leads are brought out through a waterproof grommet to a separate terminal block, this being the only difference between the two types.

Operation

The switch will operate over a temperature range of -40°C. to 70°C. and operates on 16—29 volts with a current draw of an average 0.5 ampere during the winding period.

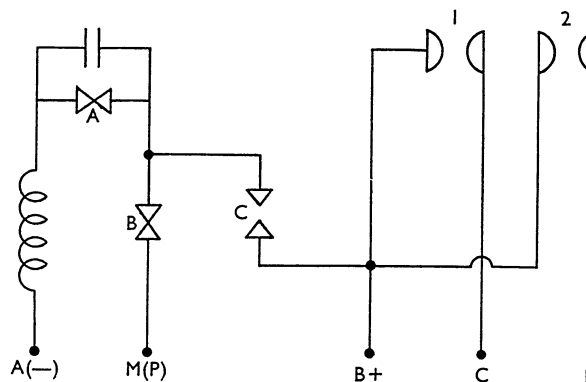
The following paragraphs detail the operation of a switch and refer to the wiring diagram of the D.8102 which is illustrated on this leaflet.

Contacts A, B, C are concerned solely with the winding of the spring. Upon depressing the starter push button in the pilot's or engineer's position, a nominal 24 volt supply is placed across the winding solenoid via contacts A and B. This energises the coil and by attracting the armature to its core, breaks the circuit to the coil by operating contacts A. The spring loading on the armature returns it to a position of rest allowing contacts A to close. Thus a simple bell action is created.

Attached to the armature is a steel hook which engages with the ratchet wheel, so that each movement of the vibrating armature turns the wheel one tooth, and thus winds up the spring. This takes approximately three seconds.

After six vibrations, the cams which operate contacts B and C will have rotated so as to close the circuit at C and break the circuit at B. Thus further depression of the starter push button is unnecessary as the coil is now energised direct from the battery through contacts C.

At the end of the winding period, the cam operating contacts C will allow them to open and as contacts B are already open, further energising of the coil is impossible during this unwinding period.



D.8102 Wiring diagram

Unwinding normally takes approximately 36 seconds, but due to the relatively short time cycle of type D.8116, the time taken is approximately 12 seconds, and for the D.8119/1, 18 seconds. During this time the camshaft is revolved and the contacts are opened or closed according to the cam profiles.

At the end of this time the cam operating contacts B will allow them to close, enabling a further winding operation to be made.

Periodic Inspection

Periodically a switch should be inspected to ensure that there is no apparent physical damage.

The components should be in good condition and the contacts should be clean and show no signs of excessive pitting or burning.

A check should be made on the insulation resistance between all live parts and the frame using a 250 volt "Megger." The reading obtained must not be less than 20 megohms.

Any switch whose condition is at all doubtful should be replaced immediately by a new one and the original returned to our nearest Service Department where it will receive prompt attention by our Repair Organisation.

Servicing

No attempt should be made to service a unit unless adequate and efficient testing facilities are available. Where, however, these have been arranged, full details of testing may be obtained on request of Rotax Service Leaflet No. S.L. 39.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to:—

THE SERVICE DEPARTMENT

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ENGLAND

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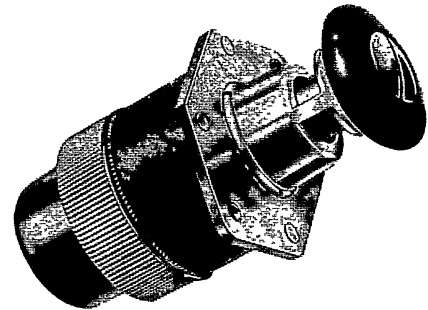
LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA

Telephone : WALNUT 3435

SUBJECT: Push-in Solenoid Switch

TYPE: D.2210

DATA: WEIGHT: 10 OUNCES
MOUNTING: TWO .193" DIA. HOLES
2.187" APART
RATING: 5 AMPERES INTERMITTENT



Description

This switch is similar to the D.2208 switch in that it is designed for manual "make" operation. However, as the hold-in solenoid is energised from an independent source, the plunger must be maintained in the "on" position until such time as the solenoid is energised, the "break" being automatic upon the de-energising of the solenoid which is assembled around the plunger.

Its present function is to initiate the starting sequence of electric starters fitted to gas turbine engines.

The plunger of the switch carries an interlocking device which locks the switch, during its operation, in the selected circuit until completion of the starting cycle. The switches are operated from a 28 volt supply, the contacts being capable of carrying 5 amperes to the external circuit.

The normal coil-operating current is 1 ampere, yet a current of approximately .53 ampere will retain the plunger in the "on" position. When the current is reduced to approximately .32 ampere the switch will "trip" automatically.

The coil resistance is 22 to 27 ohms.

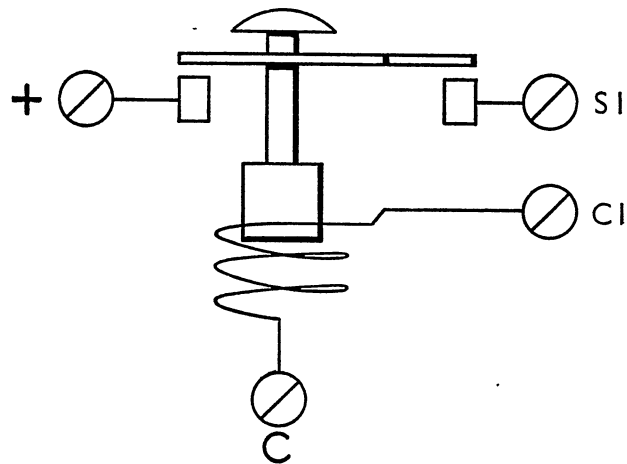
The main housing is aluminium with the mounting flange being machined integral with it. Inside the housing is a soft iron coil bobbin assembly, with a spring-loaded plunger passing through the centre of the coil.

At the end of the main housing opposite the flange, the plunger, with a spring-loaded contact plate secured to it, projects through the coil. Butting against the end of the housing is a combined terminal and contact block, which, when in position, allows for a clearance of approximately .200" between the contacts and contact plate.

A terminal cover butts against the terminal block, both being held to the main housing by a large circular knurled nut, which in turn is locked by a circlip.

There are four terminals for connection purposes which are marked quite clearly. A simple diagram of the contacts, terminals and coil is shown. The leads to the switch pass through a grommet in the terminal cover.

A dummy contact ensures that on depression of the plunger the contact plate bridges only the "+" and "SI" contacts.



Mounting of the switch is effected by two .193" diameter holes, 2.187" apart in the .125" thick mounting flange. The overall length is 4.111" and the plunger movement is approximately 0.200". Weight, 10 oz.

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A.6-2 of British Civil Airworthiness Requirements. 3/3/52."

FEBRUARY 1952

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Operation

Operation of the switch is simple and positive; depression of the plunger makes contact between "+" and "SI" and initiates the first phase of the starting operation via a system of relays and switches. This in its turn closes a circuit to the solenoid between contacts "C" and "CI" thus maintaining the switch in

the "on" position precluding the necessity for further manual holding. The switch continues to stay in the "on" position until the starting cycle has been completed when the circuit to the solenoid is broken by external means, and allows the plunger to return to the "off" position with a snap action.

Servicing

If test equipment is not available no attempt should be made to service or dismantle the unit. It should, however, be replaced by a new one and the inoperative equipment returned to our nearest Service Department, where it will be promptly dealt with by our Repair Organisation.

In cases where test equipment is available, apply for Rotax Service Leaflet No. S.L. 40 for full servicing details.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to:—

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AUSTRALIA

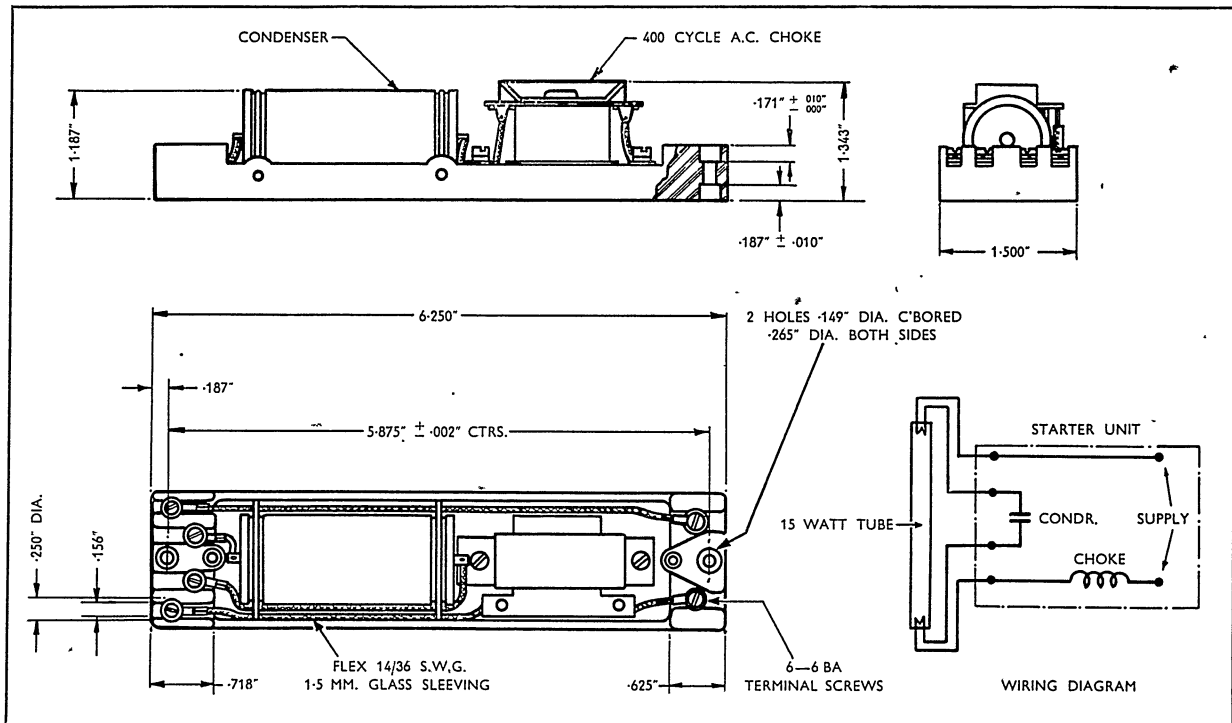
Telephone : F.J. 4867

LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA

Telephone : WALNUT 3435

SUBJECT: Starter for 15 Watt Tube

TYPE: F. 3001



General

These starter units are designed for use with a 15 watt fluorescent lighting tube. Each unit consists of a base on which is mounted a condenser and choke assembly. The nature of these components is such that they are not normally repairable and should they cease to function efficiently the complete unit should be replaced. The only checks necessary, at major overhaul periods of the aircraft, are to ensure that all soldered connections are secure and that the unit is firmly secured in position.

Address all enquiries to:—

Specification

Condenser :
400 Cycle A.C.
Choke :

Dimensions :

Weight :

Mounting :

1.5 mfd. 250 volts A.C. working.
With a current of 0.39 ampere at a voltage of 110 ($400 \pm 2\%$ c.p.s.) the inductance is 0.1 Henry.
Overall length : 6.250 in.
Overall width : 1.500 in.
Overall height : 1.343 in.
7.5 oz.
2 holes .149" dia. (c'bored .265" dia. both sides).

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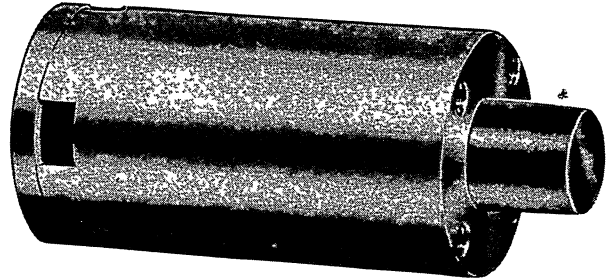
DECEMBER 1951

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SUBJECT: Plunger Switch

TYPE: D.0909

DATA: WEIGHT : 4 OZ.
RATING : 10 AMPERES
TERMINALS 4 B.A.



Description

This is a simple plunger switch designed to operate one circuit on depression of the plunger and another in its normal release position.

The switch body is a light alloy barrel and fixed to one end by two 4 B.A. screws is a terminal moulding. Positioned centrally in this moulding is a brass guide ferrule in which the end of the switch plunger slides. The plunger passes through a spring-loaded contact carrier, the two springs, one helical and the other conical, being assembled around the plunger spindle. Both bear on a thrust washer mounted on the spindle next to the moving contact carrier so that the carrier is pressed against the shoulder of the plunger button. Two contact plates are attached to the carrier. When the switch is in its normal position one plate bridges two fixed spring contacts which are connected to the terminals marked "1" and in the depressed position the second plate bridges another pair of fixed spring contacts which are connected to the terminals marked "2".

For installation purposes there are four holes tapped 4 B.A. by .500" deep in the end face of the metal switch barrel. These holes are equi-spaced on a 1.125" p.c.d. The diameter of the plunger button is .623" and when operated its travel is from .281" to .375".

Periodic Inspection and Testing

At each inspection and overhaul period of associated equipment, a switch should be inspected and tested.

Carefully examine the switch and ensure that there is no physical damage. Distorted, cracked, or chipped mouldings or components will necessitate the renewal of the complete switch.

The contacts should be examined to ensure that they are not pitted or burned. To do this remove the terminal cover and by unscrewing the two 4 B.A. cheesehead screws in the terminal moulding it will be possible to separate the moulding together with the spring contacts, springs and moving contact carrier from the switch barrel and plunger. If it is found that the condition of the switch interior is at all doubtful then the complete switch will have to be renewed.

After satisfactory inspection a switch should be re-assembled and tested in the following manner :—

1. Pass a current of 10 amperes through each pair of contacts for a period of one minute.
 2. Operate the switch six times to ensure correct functioning. The contacts which close when the plunger is depressed must not re-open even if the plunger is operated to maximum depression or vice versa.
 3. With 10 amperes flowing, the voltage drop across each pair of contacts must not exceed 40 millivolts.
 4. The insulation resistance between terminals with the switch open, and between terminals and the body with the switch closed, should be at least 20 megohms when tested with a 250 volt "Megger."
- OR
5. The insulation between terminals with the switch open, and between terminals and the body with the switch closed must withstand a pressure of 230 volts, 50 cycles A.C. for one minute.

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A.6-2 of British Civil Airworthiness Requirements. 3/3/52."

FEBRUARY 1952

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Servicing

If a switch does not satisfy the above inspection and tests, it should be dismantled sufficiently so that a closer inspection can be made. The inoperative part must be renewed and the switch reassembled and retested. For details please apply for Rotax Service Leaflet No. S.L.42.

Where adequate servicing facilities are not available a switch should be replaced by a new one and the original returned to our nearest Service Department where it will receive prompt attention by our Repair Organisation.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

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BOUVERIE STREET
MELBOURNE, N. 3
AUSTRALIA

Telephone : F.J. 4867

LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA

Telephone : WALNUT 3435

Amendment—D.6723 & 24 Contactors

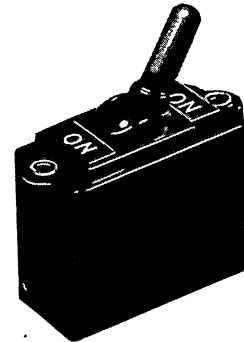
The D.6723 & 24 contactors are similar to types D.6703/2 and 04/2 respectively except for the following variations in component parts:—

SUBJECT

TYPES:

DATA:

Item No.	Part No.	No. per Unit	Name of Part
13	N.63932	1	Grub Screw (D.6724)
	N.63932/1	1	Grub Screw (D.6724)
	N.63932/1	2	Grub Screw (D.6723)
* 19	NK.920—F	6	Screw
	N.77668/22	6	Spring Washer
	N.77656	6	Washer
	N.129053	6	Cable Lug
22	N.129052	6	Connecting arm
23	N.129051	6	Square Nut
36	N.129513	1	Main Body
+ 38	N.63962	1	Solenoid Cup & coil assy.
	N.63949	1	Anvil



General

Note: * Items supplied as alternatives to those quoted in the Spare Parts List at customer's request.

+ These items common to all types.

These compact moulded bakelit Maximum current is 20 amperes at 250V AC.

D.6701/4 Service Leaflet

December, 1955

is made to these switches via 4 B.A. combined screws and washers at the base of the switch.

The action of the switch is simple and positive; the bottom of the switch lever contains two spring-loaded balls, one of which rests in the centre of a pivoted cam which is in turn attached to the moving contact or contacts. Movement of the switch lever forces the spring-loaded ball over the centre of the camface causing the moving contact to bear down on the fixed contacts and be maintained in this position. If, however, the switch is of a spring return type, the cam is so shaped that as soon as the switch lever is released the spring-loaded ball returns to the middle position of the cam providing a sharp break between fixed and moving contacts.

Variations in type of the D.5400 series of switches are stated below.

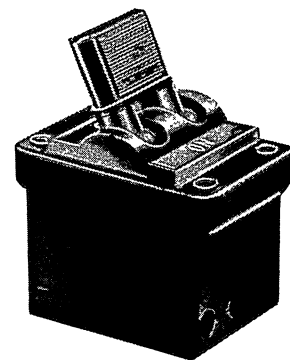
- D.5401 Changeover Centre Off.
- D.5402 Changeover Centre Off Spring Return from one position.
- D.5403 Changeover Centre Off Spring Return from both positions.
- D.5404 On-Off Switch Centre Off.
- D.5405 On-Off Switch Spring Return to Centre Off.
- D.5406 Changeover Switch.
- D.5407 Changeover Switch Spring Return to Centre On.

The design of these switches is such that they may easily be mounted in banks thus saving space. A minimum of .031" must be allowed between each switch when so mounted. The weight of this type of switch is two ounces.

is the double pole version of these be considered as two D.5400 series in the one case, the two switch operated together; the operation reverses before and the various types of

switch are as follows:—

- D.5501 Changeover Switch Centre Off.
- D.5502 Changeover Switch Centre Off Spring Return from one position.
- D.5503 Changeover Switch Centre Off Spring Return from both positions.
- D.5504 On-Off Switch Centre Off.
- D.5505 On-Off Switch Spring Return to Centre Off.
- D.5506 Changeover Switch.
- D.5507 Changeover Switch Spring Return to Centre On.



The weight of this type of switch is 3.75 ounces. Once again when the switches are mounted in banks a minimum of .031" between each must be allowed.

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A.6-2 of British Civil Airworthiness Requirements. 3/3/52."

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Periodic Inspection in Service

It is not recommended that these switches should be dismantled as they have been sealed after manufacture and test. They should, however, be subjected to the following visual examination and test, after which, if it passes successfully, the switch may be considered as acceptable for continued service. Failure of the switch on test will necessitate its replacement.

Check the moulded body, ensure that it is not cracked, strained, or otherwise damaged.

Remove the terminal cover, check that connections are secure and leads are in good condition.

Note: Types D.5402, 3, 5, and 7 must operate with $1\frac{1}{2}$ to 2 lb. in. and D.5401, 4 and 6 must operate with $2\frac{1}{2}$ to $3\frac{1}{2}$ lb. in. applied to each toggle arm. If an extension is used on toggle arm the weight of extension may be ignored if of light construction.

With 20 amperes flowing through the contacts, the millivolt drop across the terminals must not exceed 80 millivolts.

Insulation resistance between all terminals with the operating lever in all positions must not be less than 20 megohms when measured with a 250 volt "Megger."

The D.5500 series of switch should be subjected to the same tests, the types D.5501, 4 and 6 must operate with $2\frac{1}{2}$ to $3\frac{1}{2}$ lb. in. on the toggle arm; D.5502, 3, 5, and 7 must operate with $1\frac{1}{2}$ to 2 lb. in. on the toggle arm. All other figures quoted for the D.5400 also pertain to the D.5500 series.

It is recommended that any switch which does not satisfy the above inspections and tests should be replaced by a new one and the original returned to our nearest Service Department where it will receive prompt attention by our Repair Organisation.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

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WILLESDEN JUNCTION
LONDON, N.W. 10
ENGLAND

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BOUVERIE STREET
MELBOURNE, N. 3
AUSTRALIA

Telephone : F.J. 4867

LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA

Telephone : WALNUT 3435

SUBJECT: Barrel Type, contact switch

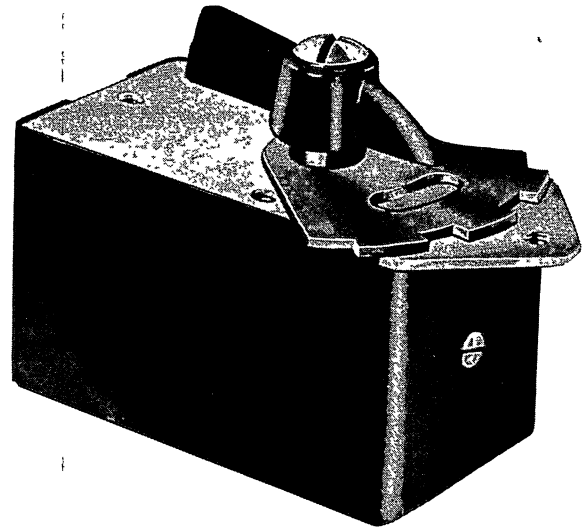
TYPE: D. 0419

DATA:

WEIGHT: 11 oz.

RATING: 5 amperes.

MOUNTING: 3 holes tapped 4 B.A.



Description

The D.0419 is a four position, barrel type, snap action switch designed as an engine selector switch on 24 volt electric starter systems for gas turbines.

Each switch consists of a barrel carrying a segmented brass contact ring. Mounted on a bracket about the barrel assembly is a moulded terminal block where five of the six terminal positions are utilised. A copper contact spring from each of the terminals rides on the barrel, the segments of the contact ring being designed so that certain terminals are bridged at each of the four switch positions.

To lock the switch in position during any one starting cycle, the D.0419 is fitted with a notched plate which mates with the tongue of the locking device on the starter push switch, thus ensuring that the selector switch knob cannot be turned to another position until the start is completed, when the starter push springs out and releases the interlock.

Operation

The switch knob has four positions, designated on the switch mounting panel in a clockwise direction as 1:2:3:4. The following table shows the switch action in each position:—

Switch Position	Terminals connected	Terminals isolated
1	SI to 1 on same terminal moulding	All other terminals
2	SI to 2 " "	" "
3	SI to 3 " "	" "
4	SI to 4 " "	" "

A brass cover protects the switch and the leads are brought out through a grommet in the end of this cover. The switch mounting flange provides three holes tapped 4 B.A. for installation purposes.

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A.6-2 of British Civil Airworthiness Requirements. 3/3/52."

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Periodic Inspection

In service these switches should require little attention provided they are not maltreated. Periodically a general visual inspection should be made to ensure that there is no damage and that the switch is free from any dirt or foreign matter. The snap action of the switch should always be positive, and movement

between positions must be smooth. An insulation resistance check should be made with a 250 volt Megger between all terminals and segments and the switch frame. The reading obtained should not be less than 20 megohms.

Servicing

If a switch does not satisfy the above inspection and tests, it should be dismantled sufficiently so that a closer inspection can be made. The inoperative part must be renewed and the switch reassembled and retested. For details please apply for Rotax Service Leaflet No. S.L. 44.

Where adequate servicing facilities are not available a switch should be replaced by a new one and the original returned to our nearest Service Department where it will receive prompt attention by our Repair Organisation.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

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AUSTRALIA

Telephone : F.J. 4867

LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA

Telephone : WALNUT 3435

SUBJECT: Electrically operated, mechanically latched contactor

TYPE: D.7601

DATA:

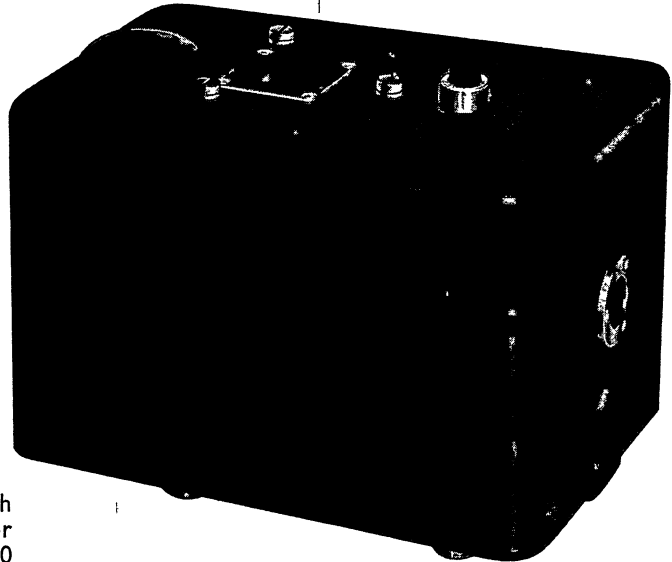
Weight: 6 lb. 15 oz.

Rating: Main contacts 200 amperes
continuous.

Auxiliary contacts 5 amperes
continuous.

Mounting: Four holes .257" diameter.

Operating
Voltage: 28 volts.



Description

This unit is a single pole latched-in contactor with manual and remote trip, and has been designed for operation on 28 volts; it is continuously rated at 200 amperes across the main contacts, and 5 amperes across the auxiliary contacts. A feature of the contactor is that there are two main pairs of contacts in parallel between the main terminals LI and A.

The contactor is built up on a moulded base and consists essentially of an actuating toggle mechanism, closing and tripping solenoids. The main contacts are of a rolling butt type with silver nickel faces and are employed with arcing contact extensions enclosed in a moulded arc chute; connection to the auxiliary contact is made via a moulded terminal block mounted on the base of the contactor.

The nominal operating voltage of the contactor is 28 volts, the maximum is 29 volts, while the minimum operating voltage for the closing coil is 18.5 volts and for the tripping coil 16 volts, both readings at 20°C.

External connections to the main contacts are made via two internal busbars each having a .386" fixing hole. Access to these is gained through .718" diameter holes in the moulded base.

Auxiliary and coil connections are made via 6 B.A. screw and washer terminations in the 8-way terminal block.

Operation

The main contacts are actuated by means of the 28 volt closing solenoid which, when energised, pulls a toggle linkage over centre to latch in the closed position against the action of the main contact return spring.

This same movement of the toggle linkage opens the switch contacts on the coil cut-out and thus de-energises the closing solenoid as the plunger completes its stroke; at the same time it also closes a pair of auxiliary contacts in the trip coil circuit. This closing operation is effected remotely by means of a push button or similar type of switch wired in circuit with the D.C. energising current supply and the terminal to which the closing solenoid is connected.

The trip mechanism may be operated manually, by pressing the push button which protrudes through the casing of the contactor, or electrically by means of the tripping solenoid which collapses the toggle mechanism and allows it to return to its original position under spring pressure.

Installation

This contactor may be mounted in any position except with the main contacts pointing downwards. It will give satisfactory operation in air temperatures between + 70°C. and - 70°C. and at altitudes up to 50,000 ft.

The mounting base dimensions are 7.343" by 5.187" while the height of the unit from the mounting surface to the top of the trip button is 5.187".

The four steel bushed fixing holes are .257" diameter and the fixing centres form a rectangle 6.156" by 4.187".

This contactor weighs 6 lb. 15 oz.

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements. 2/4/53."

PRICE ONE SHILLING

JANUARY 1953

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Servicing

If test equipment is not available no attempt should be made to service or dismantle the unit. It should, however, be replaced by a new one and the in-operative equipment returned to our nearest Service Department, where it will be promptly dealt with by our Repair Organisation.

In cases where test equipment is available, apply for Rotax Service Leaflet No. S.L. 45 for full servicing details.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
BOUVERIE STREET
MELBOURNE, N. 3
AUSTRALIA

Telephone : F.J. 4687

ROTAX LIMITED
WILLESDEN JUNCTION
LONDON, N.W. 10
ENGLAND

Telephone : **ELGAR 7777**

LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA

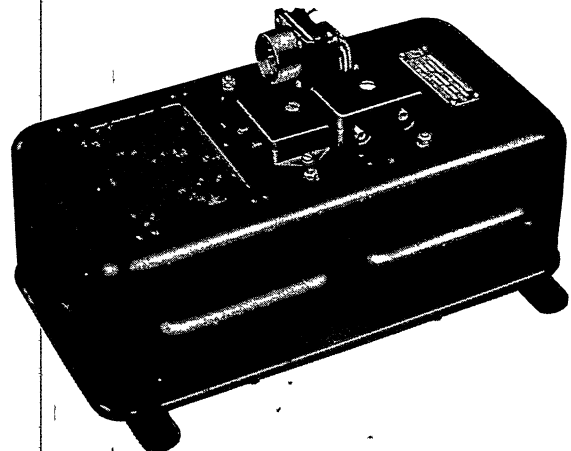
Telephone : WALNUT 3435

SUBJECT: Multiple Protection Unit

TYPE: F.5102

DATA:

Mounting : 4 holes 0.266" diameter.
Weight : 7 lb. 13 oz.
Electrical Connections : 9-pin Plug.
2-way Terminal block
0.250" diameter B.S.F.
studs.
4-way Terminal block
4 B.A. screws.



Description

The multiple protection unit operates in an aircraft generating system supplying a 112 volt D.C. supply, a 28 volt D.C. supply and a 200 volt three-phase A.C. supply. The complete generating scheme comprises four alternators each feeding separate transformer rectifier units, the D.C. outputs of which are connected to common low voltage and medium voltage busbars. A multiple protection unit operates with each transformer rectifier unit and has been designed to protect the system against a number of fault conditions which may arise during operation.

The multiple protection unit comprises a D.6708/2 Contactor, a D.6214/1 Thermal Relay, an F.5902 Overvoltage unit, a load sharing relay, and two 0.5µF. capacitors. These items are mounted compactly on a base panel and enclosed in a metal case. A 9-pin plug and two terminal blocks, mounted on top of the unit, provide external connections. A detailed description of each of the three main units is to be found in the following publications :—

D.6708/2 Rotax Technical Leaflet No. T.L. 23.
D.6214/1 Rotax Technical Leaflet No. T.L. 22.
F.5902 Rotax Technical Leaflet No. T.L. 74.

Overall dimensions of the unit will be found in the diagrams contained in this leaflet.

Operation

For a complete description of the operation of the generating scheme for which the multiple protection unit was designed, reference should be made to the Rotax Technical Manual for the generating scheme of the Bristol Britannia Mark 100. The following operational description of the unit applies when it is incorporated in this scheme :—

D.6708/2 Contactor

The field winding of the alternator is supplied, partly from a compounding transformer, the primary windings of which are connected in series with the stator windings of the alternator, and partly from the 28 volt D.C. busbar of the system. The feed from the busbar to the field is broken through the D.6708/2 contactor. Under normal operating conditions, the coil of the contactor is energized and the field circuit is completed through a pair of contacts in the contactor. If the supply to the contactor coil is interrupted, the feed to the field circuit is cut off and the alternator is switched off from the system. The hold-in supply to the contactor is made via a pair of normally closed contacts in the D.6214/1 thermal relay.

D.6214/1 Thermal Relay

The coil of the D.6214/1 relay is not energized under normal operating conditions. A fault signal applied to the relay coil (terminal T) will operate the relay and cause the normally closed contacts to open and the hold-in supply to the D.6708/2 contactor will be cut off. The feed from the busbar to the field circuit which is controlled by the D.6708/2 Contactor also passes through the thermal element of the relay. If the field current increases beyond certain limits due to a fault in the alternator set, the thermal trip operates to open the normally closed contacts and again the hold-in current to the D.6708/2 is cut off.

F.5902 Overvoltage Unit

This unit comprises two independently operated relays each with a single pole double break set of normally open contacts, the contact sets being connected in parallel. When either of the relays operate to close one set of contacts a supply is fed to the coil of the thermal relay which operates to cut off the hold-in current to the D.6708/2 contactor.

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements. 11/11/55"
A.R.B. Authority Ref. No. E.3452

"Amendments to this publication invalidate the approval statement unless issued by the manufacturers with the concurrence of the Air Registration Board."

PRICE ONE SHILLING

DECEMBER 1955

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W. 10 • ENGLAND • TELEPHONE ELGAR 7777
LUCAS-ROTAX (AUSTRALIA) PTY. LTD • NEPEAN HIGHWAY • CHELTENHAM S. 22 • TELEPHONE XF 1381
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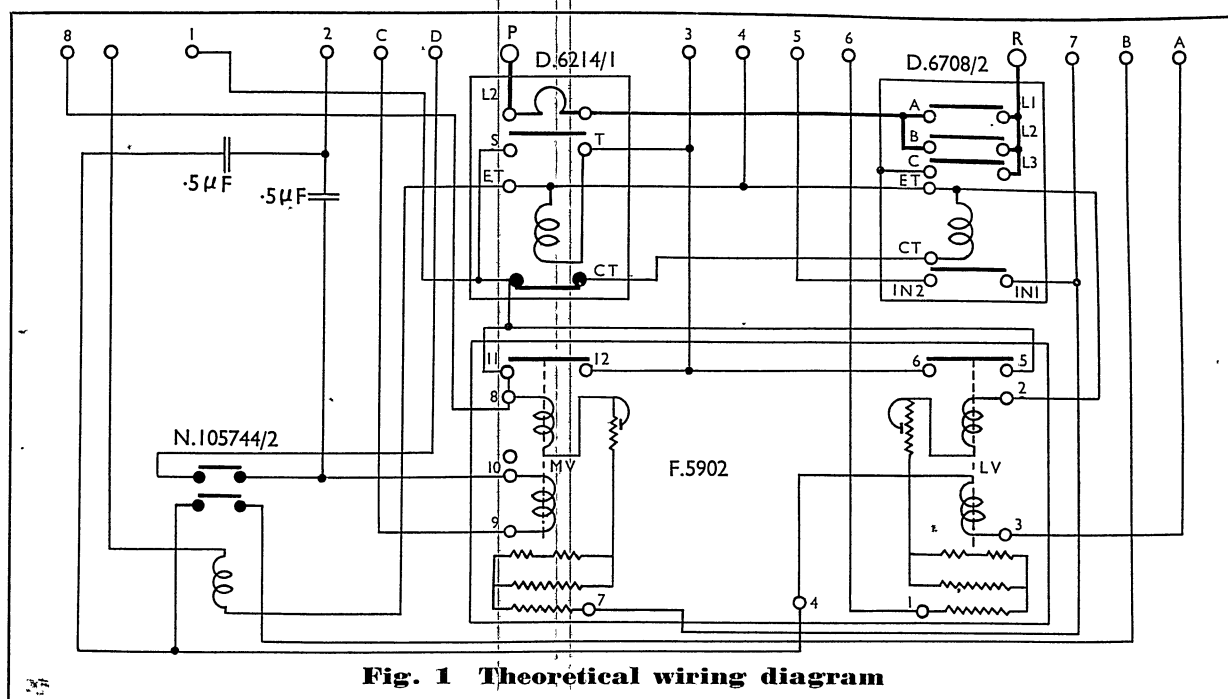


Fig. 1 Theoretical wiring diagram

The operation of each overvoltage relay in the unit is the same, one being connected in the 28 volt circuit and the other connected in the 112 volt circuit of the system. Each relay has a shunt and a series coil fitted and the following operational description applies to both relays :—

The shunt coil is connected between the respective positive busbar and negative and the setting of the relay is such that a given percentage overvoltage on the busbar will cause the relay to operate with resultant interruption of the hold-in current to the D.6708/2 contactor.

The series coil is connected in the load sharing line which equalises the load taken by the alternator sets. The polarity of the coil is such that, when an overvoltage occurs, the resultant load sharing current assists the tripping of the overvoltage relay associated with the faulted alternator set. At the same time this current opposes the tripping of the overvoltage relays associated with the unfaulted alternators.

N.105744/2 Load Sharing Relay

The low voltage and medium voltage load sharing circuits are broken through two pairs of contacts in the load sharing relay. Under normal working conditions, the coil of this relay is energized and both pairs of contacts are closed. If the hold-in current to the relay coil is switched off, load sharing between

alternators will cease and the alternators will operate as independent units.

Installation

The unit is mounted on a horizontal plane and anti-vibration mountings are used. Two mounting straps, each with two fixing holes 0.266" in diameter the centres of which form a rectangle 6.500" x 9.000", secure the unit in position.

Periodic Inspection

Periodically the unit should be given a thorough inspection. All components should be clean and undamaged, and all terminals secure. The insulation of leads must be in good condition and frayed or damaged leads will require to be renewed. After inspection the following insulation tests must be carried out provided the unit can be isolated from its associated circuits. Using a 250 volt "Megger", check the insulation resistance between the following points :—

- Terminal 1 and terminals 2, 5, 7, A, C and P.
- Terminal 2 and terminals 5, 7 and P.
- Terminal 5 and terminals 7, A, C and P.
- Terminal 7 and terminals A, C and P.
- Terminal A and terminal P.
- Terminal C and terminal P.

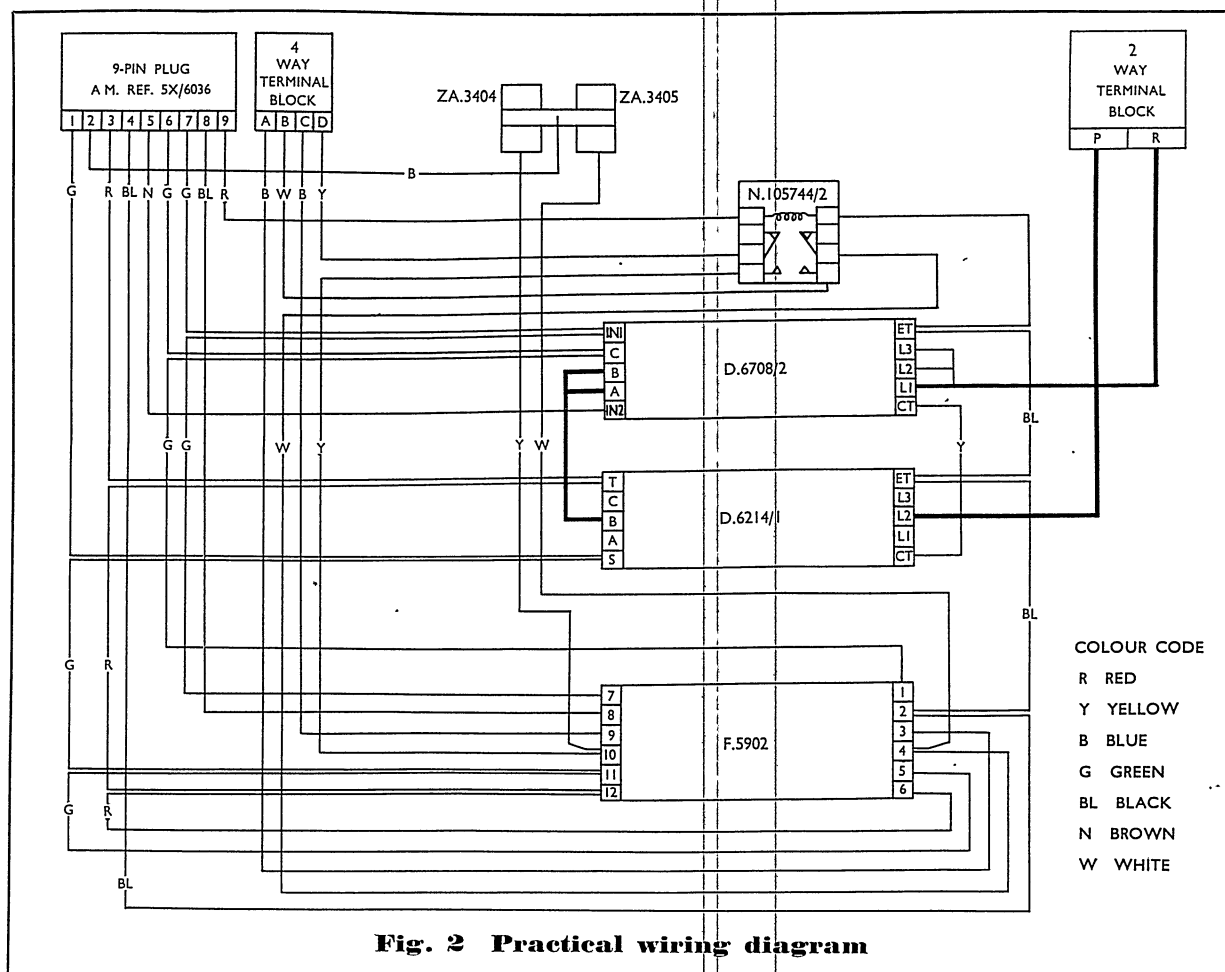


Fig. 2 Practical wiring diagram

The frame of the unit and terminals 1, 2, 5, 7, A, C and P.

The insulation resistance between these points must not be less than 100 megohms.

Note : The insulation resistance of 100 megohms applies to units being tested under normal conditions, allowance should be made for climatic conditions, in particular humid climates. Under such conditions, resistance readings may be lower and discretion should be exercised before rejecting a unit.

1200-Hour Overhaul

After every 1200 hours in service, the unit is to be removed from its installation and completely overhauled. The D.6708/2 contactor, the D.6214/1 thermal relay and the F.5902 overvoltage unit must be removed from the base panel and overhauled in

accordance with the overhaul instructions contained in the following leaflets :—

D.6708/2	Rotax Service Leaflet No. S.L. 43.
D.6214/1	Rotax Service Leaflet No. S.L. 22.
F.5902	Rotax Service Leaflet No. S.L. 74.

Dismantling

To remove the three main units from the panel, disconnect the internal leads to each unit and remove the nuts and screws securing them to the base panel. The D.6214/1 thermal relay can be removed from the panel without dismantling the support plate of the terminal blocks and plug.

It is recommended that all internal leads be marked when removed from their terminals to ensure that they are reconnected to the correct terminals during reassembly.

The load sharing relay, the two 0.5 μ F. capacitors and the terminal blocks and plug need not be removed from the unit.

Inspection

With the main units removed examine the remaining components for signs of physical damage. The terminal blocks should be carefully examined for cracks or distortion. When the condition of any part is doubtful it should be renewed. All internal wiring should be examined and when the insulation of any lead is frayed or damaged in any way the damaged wiring must be renewed. Ensure that all parts are clean and free from any foreign matter. It is recommended that benzine or unleaded petrol be used as cleaning agents. Carbon tetrachloride must not be used.

Using a 250 volt "Megger", measure the insulation resistance of the two 0.5 μ F. capacitors. The insulation resistance of each capacitor must not be less than 100 megohms.

Reassembly

When the main units have been overhauled reassemble them to the base panel. After reassembly the internal wiring must be checked against the wiring diagrams in this leaflet.

Testing

In the following paragraphs, terminals 1 to 9 refer to the 9-pin plug; terminals A to D, to the 4-way terminal block, and terminals P and R to the 2-way terminal block.

All resistances must be corrected to an ambient temperature of 20°C. using a Wheatstone Bridge resistance instrument.

N.105744/2 Load Sharing Relay

Connect a 24 volt D.C. supply via a switch to terminals 9 and 4. With the switch closed, measure the resistance between terminals A and B and between terminals C and D. This must be 5.2 ohms \pm 10% in each case.

Spare Parts List

Item No.	Part No.	No. Off	Name of Part
1	D.6708/2	1	Contactors
2	NK.2017-L	4	Screw
	8921/1	4	Spring Washer
	NK.10005-L	4	Nut
3	D.6214/1	1	Thermal Relay
4	NK.2031-L	2	Screw
	N.1354	2	Plain Washer
	8921/1	2	Spring Washer
	NK.10005-L	2	Nut
5	N.114635	4	Pillar
6	N.23539/21	4	Locking Tab
7	N.64262	8	Plain Washer
	8921/6	8	Spring Washer
	NK.10009-L	8	Nut
8	NK.719-D	2	Screw (Short)
	NK.721-D	2	Screw (Long)
	N.64262	8	Plain Washer
	8921/6	4	Spring Washer
	NK.10009	4	Nut
9	F.5902	1	Overvoltage Unit
10	N.129498	1	Panel Assy.
11	NK.733-L	8	Screw
	N.64262	8	Plain Washer
	8921/6	8	Spring Washer
12	N.129384	1	Cover Assy.
13	NK.726-F	2	Screw
	N.1358	2	Plain Washer
	N.1378	2	Spring Washer
	NK.10010-F	2	Nut
14	NK.726-F	1	Screw
	N.24126	2	Plain Washer
	N.1378	1	Spring Washer
	NK.10010-F	1	Nut
	N.43215/1	1	Terminal Tag
15	N.123043/1	1	Terminal Plate Assy.

Item No.	Part No.	No. Off	Name of Part
16	ZA.3404	1	Condenser Assy.
17	N.123016	1	Insulating Bar
18	ZA.3407	1	Condenser Assy.
19	NK.525-L	2	Screw
	N.1360	2	Plain Washer
	AGS.2001/A/1	2	Stiffnut
20	N.69968	1	Terminal Cover Assy.
21	N.114331	1	Cover Assy.
22	N.105744/2	1	Relay
23	N.1360	2	Plain Washer
	8921/20	2	Spring Washer
	NK.10013-L	2	Nut
24	AGS.1696/9	1	Grommet
25	AGS.1696/5	2	Grommet
26	N.114329	1	Terminal Block
27	N.104600/10	2	Cable Lug
28	NK.731-L	2	Screw
	N.1358	2	Plain Washer
	AGS.2002/B/1	2	Stiffnut
29	N.94139/1	1	9 Pin Plug
30	N.114149	1	Cable Lug
31	NK.10064-F	2	Nut
	8921/10	2	Spring Washer
32	N.114148	1	Cable Lug Assy.
33	12635/7S/3W	4	Combined Screw and Washer
34	N.116964/1	1	Cable Lug
35	N.127459	1	Terminal Block Assy.
36	N.116962	1	Cable Lug Assy.
37	N.116964/2	1	Cable Lug
38	N.104600/2	1	Cable Lug
	As Req'd.		*Unipren 6 Cable
	As Req'd.		*Unipren 24 Cable
	N.60791/740	2	*Helsyn Sleeve
			* Items not illustrated

With the switch opened, an open circuit must be indicated between terminals A and B and between terminals C and D.

Remove the supply connected to the unit.

D.6708/2 Contactor

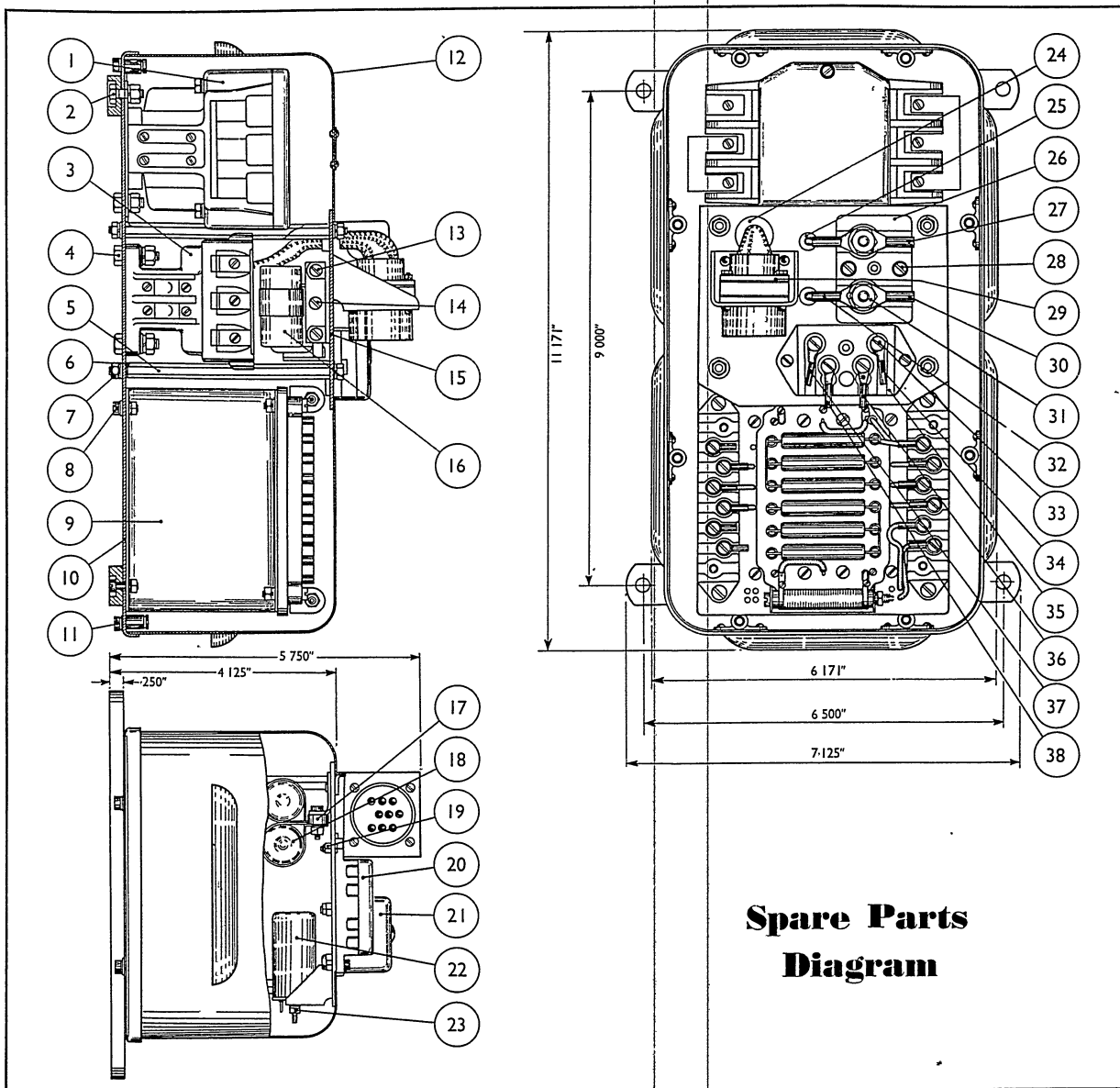
Connect a 24 volt D.C. supply via a switch to terminal 1 positive and terminal 4 negative, the switch being connected in the positive line. With the switch opened, an open circuit should be indicated between terminals P and R, and between terminals 5 and 7.

With the switch closed, a closed circuit should be indicated between terminals P and R, and between terminals 5 and 7.

D.6214/1 Thermal Relay

With the 24 volt D.C. supply still connected up to terminals 1 and 4, connect terminal 3 via a second switch to the positive terminal of the same 24 volt supply.

With both switches closed an open circuit should be indicated between terminals R and P.



With the switch in the lead to terminal 1 opened and the second switch in the lead to terminal 3 closed, an open circuit should be indicated between terminals R and P. Disconnect the supply to the unit.

F.5902 Overvoltage Unit

The resistance between terminals 7 and 8 is to be measured and should be between 1000 ohms and 1250 ohms.

The resistance between terminals 4 and 6 is to be measured and should be between 65 ohms and 80 ohms.

Connect up a serviceable U.0905/3 transformer rectifier unit to the protection unit, leaving the connections to the 4-way terminal block disconnected. Connect up a variable D.C. supply, via a suitable ammeter to terminals A positive and terminal B negative. With the transformer rectifier unit operating, increase the current to terminals A and B. The transformer rectifier unit should trip out when the current is between 145 milliamperes and 190 milliamperes. With the polarity of the current reversed, i.e., terminal A negative and terminal B positive, check that the transformer rectifier unit continues to operate with a current of 190 milliamperes flowing in the test circuit.

Insulation Tests

Note : When carrying out the following high potential tests, the potential must be gradually increased to the specified value, maintained for one minute and then gradually reduced to zero.

Apply a high potential test of 500 volts r.m.s., 50 c.p.s. for one minute between the following points :

Terminal 1 and terminals 2, 5, 7, A, C and P.

Terminal 2 and terminals 5, 7 and P.

Terminal 5 and terminals 7, A, C and P.

Terminal 7 and terminals A, C and P.

Terminal A and terminal P.

Terminal C and terminal P.

The frame of the unit and terminals 1, 2, 5, 7, A, C and P.

When the high potential tests have been completed, measure the insulation resistance between the points listed above using a 250 volt "Megger." The insulation resistance must not be less than 100 megohms.

When the unit has satisfied the above tests replace the cover. The unit can now be considered serviceable for continued use.

Rotax Servicing Facilities

Any unit which cannot be serviced satisfactorily by following the instructions contained in this leaflet should be renewed and the original returned to our nearest Service Department or authorised Service Station, where it will receive prompt attention by our Repair Organisation.

When ordering spare parts make reference to the spare parts list and quote part number and name, together with the serial number of the unit for which the parts are required. This will ensure correct identification and prompt attention.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
NEPEAN HIGHWAY
CHELTENHAM, S. 22
VICTORIA

Telephone : XF 1381

ROTAX LIMITED
HEMEL HEMPSTEAD
HERTFORDSHIRE
ENGLAND

Telephone : BOXMOOR 4444

LUCAS-ROTAX LIMITED
5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA

Telephone : BY 6500-09

Technical enquiries should be addressed to :—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10 • ENGLAND

ELGar 7777

SUBJECT: 3-phase 400 c.p.s. Auto-transformer Units

TYPES: P.2401/1
P.2402/1

DATA:

Input (P.2401/1): 200 V. 3-phase 6.65 kVA. max.
(P.2402/1): 200 V. 3-phase 16.3 kVA. max.

Frequency Range
(P.2401/1): 370—500 c.p.s.
(P.2402/1): 370—520 c.p.s.

Cooling: Natural

Rating (P.2401/1): Continuous at 200 V. with
6.65 kVA. .95 p.f. load

(P.2402/1): Continuous at 200 V. with
16.3 kVA. .95 p.f. load

Operating Temperature
Range: — 65°C. to +20°C. at full load
+20°C. to +45°C. at one-
third full load

Electrical Connection: 2 B.A. terminals

Weight (P.2401/1): 15.2 lb.
(P.2402/1): 17.6 lb.

Description

These transformers have been designed for use in air-
craft where a 200 volt, 3-phase, 400 c.p.s. power supply
is available and for many and varied applications, i.e.,
windscreen heating, tail de-icing, etc.

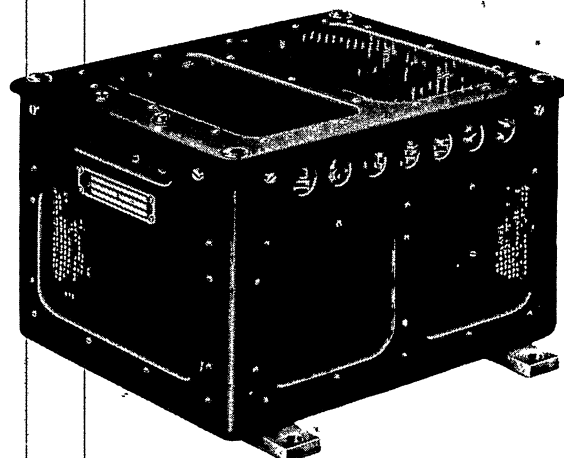
Both types are continuously rated at 200 volts input
with loads as follows:—

P.2401/1: 317 volt line, 12.2 amperes, 6.65 kVA.
at .95 p.f. or, 254 volts or 170 volts with
the same impedance load.

P.2402/1: 240 volts line, 39.2 amperes, 16.3 kVA.
at .95 p.f. or, 220 volts, 180 volts or 160
volts with the same impedance load.

Continuous operation can be maintained over a tem-
perature range of — 65°C. to +20°C. on full load or
between +20°C. and +45°C. at one-third full load,
and at altitudes of up to 50,000 ft.

Each unit comprises an aluminium box assembly con-
taining a core type auto-transformer with steel frame,
three-limb "Crystalloy" laminated yoke and cylin-
drical coils, and a terminal board assembly mounted



on a raised tier and secured by four screws. A rubber
cable clamp is fitted at the entry to the box assembly
and all components are screened and protected with a
cover which is secured in position with four Dzus
fasteners. The 3-phase windings are auto-star-con-
nected and tapped to facilitate a variation in output
voltages. Electrical connection is by way of 2 B.A.
studs which are brazed to the winding termination
and located in the terminal board and identified as
follows:—

P.2401/1:	Input	—	200
	Outputs	—	170, 254 and 317
	Star point	—	S
P.2402/1:	Input	—	200
	Outputs	—	160, 180, 220 and 240
	Star point	—	S

Cooling is by natural convection; the flow of air so
produced passes through the ventilating holes and
gauze-covered apertures in the box and cover
assemblies and across the heating surfaces. Two
7.250" x 7.500" x .250" mild steel bars form the mount-
ing feet. These are secured to, and serve also as
fixing clamps to, the transformer assembly by four
countersunk screws. The ends of each bar protrude
5.000" beyond the width of the box assembly and are
drilled with a .281" dia. hole, thus providing a four-
point fixing, the centres of which form a rectangular
shape 6.750" x 5.500".

Installation

The installation of these transformer units may be
effected in any desired position, but it should be borne

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by
the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements. 20/12/55"
A.R.B. Authority Ref. No.: P.2401/1 E.3443; P.2402/1 E.3444
"Amendments to this publication invalidate the approval statement unless issued
by the manufacturers with the concurrence of the Air Registration Board."

PRICE ONE SHILLING

NOVEMBER 1955

ROTA X LIMITED • WILLESDEN JUNCTION • LONDON N.W.10 • ENGLAND • TELEPHONE ELGAR 7777
LUCAS-ROTA X (AUSTRALIA) PTY. LTD • NEPEAN HIGHWAY • CHELTENHAM S. 22 • TELEPHONE XF 1381
LUCAS-ROTA X LIMITED • TORONTO 13 • CANADA • TELEPHONE PLYMOUTH 5-4171

in mind that, as the unit has been designed for natural cooling it should not be mounted nearer than 1" from any blanking surface. Due consideration should also be given to cover removal for inspection or connection purposes, i.e., sufficient clearance should be arranged to allow for cover removal over and above the unit height.

The height of each unit is :—

P.2401/1 : 5.222"

P.2402/1 : 5.597"

Periodic Inspection in Service

With the transformer unit "in situ" a general visual examination should be made to ensure that it has not sustained any physical damage and that all electrical connections are clean and secure.

Check the unit also for security of mounting.

An operational check, in conjunction with the equipment with which it is associated, is to be made and provided that this check is satisfactory, the transformer may be passed for continued use.

Overhaul Period

Due to the unit type construction and lack of moving parts, these transformers do not require a fixed period at which they should be overhauled, but a nominal figure of 4000 flying hours may be taken as a guide as to when it may be necessary to bench test a unit. Under normal conditions, provided a transformer satisfies a functional test at periodic intervals, it may be passed for further service.

However, a unit may sustain damage, or the transformer assembly become suspect, in which case the unit should be removed from the aircraft for testing and/or repair.

Testing

Note : In the following tests, figures quoted in parentheses refer to type P.2402/1.

Open-circuit Test

With the output terminals open-circuit, connect the 200 volt input terminals to a 3-phase, 400 c.p.s. variable voltage supply with the circuit suitably metered to measure the input voltage, current and power.

Adjust the input voltage to give a constant average line value of 200 volts and check the average primary line currents. These should not exceed 0.11 (0.13) ampere or the difference between individual line currents be greater than 0.04 (0.045) ampere.

Check also that the total input power does not exceed

30 (40) watts, and that the open-circuit voltage of each output is as follows :—

P.2401/1

Output No. 1 : Between 174 and 178 volts
Output No. 2 : Between 260 and 267 volts
Output No. 3 : Between 325 and 332 volts

P.2402/1

Output No. 1 : Between 162 and 166 volts
Output No. 2 : Between 181 and 186 volts
Output No. 3 : Between 221 and 226 volts
Output No. 4 : Between 243 and 247 volts

Short-circuit Test

With the transformer remaining connected as for the previous test, short-circuit the output terminals marked 317 (240) together, via a set of three current measuring instruments.

Increase the input voltage until the mean values of the output currents are 19.5 (39.5) amperes and check the average primary line currents. These should be between 32 and 34 (48.5 and 50) amperes.

Check also that, when cold, the input power does not exceed 235 (116) watts.

Maintain this short-circuit condition for at least 5 minutes, after which, i.e., when hot, recheck the total input power. This should have not increased by more than 35 (12) watts above the "cold" condition.

Insulation Test

Note : When carrying out the "Flash Test" the applied voltage must be gradually increased to its specific value and decreased slowly to zero before switching off.

Immediately after the short-circuit test, and whilst the transformer is still warm, carry out a "Flash Test" by applying a 750 volt r.m.s., 50 c.p.s. supply between terminal "S" and the frame for a 1 minute period.

Follow this by measuring the insulation resistance between the same two points using a 250 volt "Megger." The reading obtained should be not less than 100 megohms.

Faulty Operation

Should a transformer fail to satisfy the preceding tests it is recommended that the complete unit be replaced by a new one and the faulty unit returned to our nearest Service Department, or authorised service station, where it will be dealt with by our Repair Organisation.

In cases where transformer assemblies satisfy the tests but upon inspection other components are found to be in any way damaged, these may be renewed. Replacement items are listed in the following section.

Spare Parts

The following components are the only recommended spares for these units.

Name of Part	Part No.	No. per Unit	Name of Part	Part No.	No. per Unit
Box Assy. (P.2401/1)	N.111493	1	Stiff Nut for NK.925-L	AGS.2002/C/1	4
Box Assy. (P.2402/1)	N.111522	1	Cable Guide (P.2401/1)	N.111459	5
Dzus Fastener Spring	N.110165	4	Cable Guide (P.2402/1)	N.111459	6
Screw for N.110165	NK.517-L	8	Screw for N.111459 (P.2401/1)	NK.515-A	10
Washer for NK.517-L	N.1360	8	Screw for N.111459 (P.2402/1)	NK.515-A	12
Stiff Nut for NK.517-L	AGS.2002/A/1	8	Washer for NK.515-A (P.2401/1)	N.1360	10
Mounting Foot	N.111505	2	Washer for NK.515-A (P.2402/1)	N.1360	12
Screw for N.111505	NK.4233-L	4	Spring Washer for NK.515-A (P.2401/1)	N.1380	10
Cover Assy.	N.111524	1	Spring Washer for NK.515-A (P.2402/1)	N.1380	12
Upper Cable Clamp	N.111460/1	1	Locknut for Terminals (P.2401/1)	NK.10036-D	26
Lower Cable Clamp	N.111460/2	1	Locknut for Terminals (P.2402/1)	NK.10036-D	32
Screw for N.111460/1	NK.721-L	2	Terminal Nuts (P.2401/1)	NK.10006-D	13
Screw for N.111460/2	NK.729-L	2	Terminal Nuts (P.2402/1)	NK.10006-D	16
Washer for NK.721-L and 729-L	N.1358	4	Washer for Terminals (P.2401/1)	N.1354	26
Spring Washer for NK.721-L and 729-L	N.1378	4	Washer for Terminals (P.2402/1)	N.1354	32
Packing Piece for N.111406/1	N.113682	As reqd.	Spring Washer for Terminals (P.2401/1)	8921/1	13
Terminal Board Assy. (P.2401/1)	N.111506	1	Spring Washer for Terminals (P.2402/1)	8921/1	16
Terminal Board Assy. (P.2402/1)	N.111506/1	1	Terminal Tag for terminal " S "	N.55342/1	1
Screw for N.111506 or /1	NK.925-L	4	Terminal Tag	11354/1	6
Washer for NK.925-L	N.1354	4			

When ordering replacement parts give complete information, including part numbers, part name, and the model and serial numbers, which can be found on the nameplate of the unit for which the parts are required. This will ensure positive identification and prompt service.

For further information on the functioning, operation and maintenance
of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
NEPEAN HIGHWAY
CHELTENHAM, S. 22
VICTORIA

Telephone : XF 1381

ROTAX LIMITED
HEMEL HEMPSTEAD
HERTFORDSHIRE
ENGLAND

Telephone : BOXMOOR 4444

LUCAS-ROTAX LIMITED
5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA

Telephone : BY 6500-09

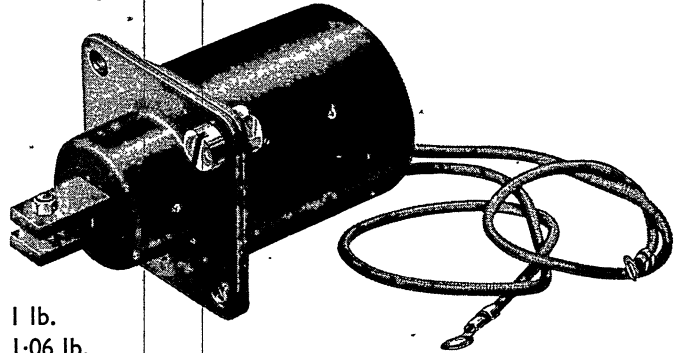
Technical enquiries should be addressed to :—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED · WILLESDEN JUNCTION · LONDON N.W.10 · ENGLAND
ELGar 7777

SUBJECT: Solenoid Operated Locking Units

TYPES: D.5301 A.M. Stores Ref. 5C/32|1
D.5302 A.M. Stores Ref. 5C/32|2
D.5303 A.M. Stores Ref. 5C/38|6
D.5305
D.5306



DATA: Weight (D.5301, 2, 5 and 6) : 1 lb.
(D.5303) : 1.06 lb.
Rating : 5 minutes.
Mounting : Flange ; four 0.1875" diameter holes.

Description

This range of Solenoid Operated Locking Units has been designed in a simple and compact manner for operation in either 12 or 24 volt circuits, and can be adopted for many applications where locking devices are required, i.e., undercarriages, etc.

In general appearance the units are similar, the main differences being in the operating voltage, electrical connections and plunger assemblies, details of which are given in the following table :—

Code	Operating Voltage		Plunger		Electrical connection
	Min.	Max.	Type	Travel	
D.5301	16	29	Bevelled lock	0.210"	9" leads and tags
D.5302	8	14.5	Fork-ended	0.210"	9" leads and tags
D.5303	16	29	Bevelled lock	0.210"	Terminal block
D.5305	16	29	Fork-ended	0.210"	9" leads and tags
D.5306	16	29	Fork-ended	0.375"	9" leads and tags

A mild steel combined end-plate and cylindrical case, enclosing the solenoid, core and coil tube assembly, forms the main body of the unit.

Secured to the end-plate by two 2 B.A. screws and nuts is an aluminium end-cover which, together with the end-plate, forms the unit mounting flange and also retains the plunger in position.

The plunger, with its lock or forked-end projecting through the end-cover, fits and slides in the tube of

the solenoid coil and is spring loaded at its front end to maintain it in a fully "locked" position when the solenoid is de-energised.

Electrical connection is made to the unit by either two leads, fitted with tags, or by a 2-way terminal block, fitted with 4 B.A. terminals, mounted on a bracket integral with the body. The coil leads enter the rear of the unit via a small slot.

Operation

When the solenoid is energised the magnetic pull created on the plunger causes it, against the pressure of the return spring, to be drawn in towards the core, thus moving any component attached to the plunger fork, or releasing the component "locked" in position in the case of a bevelled plunger.

When the current through the solenoid is broken the plunger, under pressure from the spring, returns to its normal "locked" position.

Servicing

If test equipment is not available, no attempt should be made to service the unit. It should however, be replaced by a new one and the faulty equipment returned to our nearest Service Department, or authorised service station, where it will be promptly dealt with by our Repair Organisation.

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A.6-2 of British Civil Airworthiness Requirements."

SEPTEMBER 1952

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LUCAS-ROTAX (AUSTRALIA) PTY. LTD • BOUVIERIE STREET • MELBOURNE N. 3. • TELEPHONE F.J.4687
LUCAS-ROTAX LIMITED • TORONTO 13 • CANADA • TELEPHONE OXFORD 9368

In cases where test equipment is available, apply for Rotax Service Leaflet No. S.L. 48 for full servicing details.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
BOUVERIE STREET
MELBOURNE, N. 3
AUSTRALIA

Telephone : F.J. 4687

ROTAX LIMITED
WILLESDEN JUNCTION
LONDON, N.W. 10
ENGLAND

Telephone : ELGAR 7777

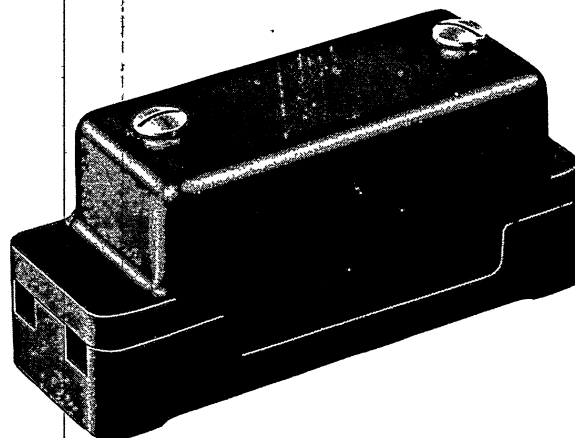
LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA

Telephone : WALNUT 3435

SUBJECT: Electro-magnetic Relays

TYPES:

F.1501-I A.M. Stores Ref. 5C/3643
F.1502-I
F.1503-I A.M. Stores Ref. 5C/3181
F.1504-I A.M. Stores Ref. 5C/1722
F.1504-IA



DATA:

Current Rating : 20 amperes continuous.
Operating Coil Voltage : 12 or 24 volts D.C.
(see table)
Mounting : Two .156" dia. holes in base,
counter-bored each side,
and spaced at 3.562" centres.
Operating Temperature
Range : +50°C. to -70°C.
Weight : 7.25 oz.

Description

This range of single-pole electro-magnetic relays has been designed in a simple and compact manner for operation in either 12 or 24 volt circuits where remote or auxiliary control is required of circuits carrying currents up to 20 amperes continuously.

In general appearance the relays are similar, the main differences being in the contact arrangement and the coil operating voltages, details of which are given in the following table.

Type	Volt- age	Contact operation	Coil resistance	Cut-in volts	Drop-out volts
F.1501-I	12	Normally closed	Ohms 54 — 68	7.5—8.0	1.5—3.0
F.1502-I	12	Normally open	54 — 68	7.5—8.0	6.0 max.
F.1503-I	24	Normally closed	220.5—269.5	15.0—16.0	3.0—6.0 max.
F.1504-I	24	Normally open	220.5—269.5	14.0—16.0	10.0 max.
F.1504-IA	24	Normally open	220.5—269.5	14.0—16.0	9.0—10.0

" Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A.6-2 of British Civil Airworthiness Requirements. 2/1/53."

NOVEMBER 1952

The relay comprises a solenoid, core and magnet frame fixed to a moulded bakelite base assembly by a nut which screws on to a threaded extension at the lower end of the core. An armature assembly, which carries the moving contact, is secured to the magnet frame by two screws, the necessary armature movement being achieved by hinging it by means of a thin flexible plate.

Riveted directly to and forming an integral part of the base assembly is the fixed contact carrier and main terminal connector strip, the latter being sandwiched between the contact carrier and base assemblies and " solder-bonded " to the carrier to ensure good conductivity.

All electrical connections are made via 4 B.A. combined screw and washer terminals, and the complete relay, including the terminals, is enclosed and protected by a moulded bakelite cover.

Total weight of the unit is 7.25 oz.

Operation

When an energising voltage is applied to the solenoid the magnetic pull created on the armature will cause it, against the pressure of the return spring, to be drawn in towards the core, thereby opening or closing the contacts depending upon the type of relay. This action will, in turn, make or break the external circuit.

On de-energising the solenoid, the armature, under pressure from the return spring, will return to its normal position, causing the contacts to be closed or re-opened, again depending upon the type of relay, thereby breaking or remaking the external circuit.

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LUCAS-ROTAX LIMITED • TORONTO 13 • CANADA • TELEPHONE OXFORD 9368

Periodic Inspection

These relays are accurately adjusted and tested before leaving the Factory and should require but little attention between overhauls provided they are not maltreated. Providing a relay controls its associated circuitry in the desired manner it may be considered satisfactory and passed for further use.

However, a general visual inspection should be made periodically to ensure that the relay has not sustained any apparent physical damage and that all terminal connections are clean and secure.

The cover should be removed and the contacts examined for signs of excessive pitting or burning. If

found, the unit should be removed from the aircraft for servicing or replacement.

Servicing

If test equipment is not available no attempt should be made to service or dismantle the unit. It should, however, be replaced by a new one and the inoperative equipment returned to our nearest Service Department, where it will be promptly dealt with by our Repair Organisation.

In cases where test equipment is available, apply for Rotax Service Leaflet No. S.L. 49 for full servicing details.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
BOUVIERIE STREET
MELBOURNE, N. 3
AUSTRALIA
Telephone : F.J. 4687

ROTAX LIMITED
WILLESDEN JUNCTION
LONDON, N.W. 10
ENGLAND
Telephone : ELGAR 7777

LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA
Telephone : WALNUT 3435

SUBJECT: Electro-magnetic Relays

TYPES:

F.3103 A.M. Stores Ref. 5C/4376
F.3104 A.M. Stores Ref. 5C/4379
F.3105 A.M. Stores Ref. 5C/4601
F.3106
F.3109 A.M. Stores Ref. 5C/4377
F.3112 A.M. Stores Ref. 5C/4380

DATA:

Current Rating (all contacts) : 5 amperes

Operating Coil Voltage

(all types except F.3104) : 28 volts D.C.
(F.3104) : 112 volts D.C.

Mounting :

Two 0.193" dia. counter-bored holes positioned in diagonally opposite corners of the base, whose centres form a rectangular shape 2.178" x 2.500"

Operative Temperature Range :

+50°C. to -70°C.

Weight (F.3103, F.3104,

F.3106, F.3112) :

16 oz.

(F.3109) :

15 oz.

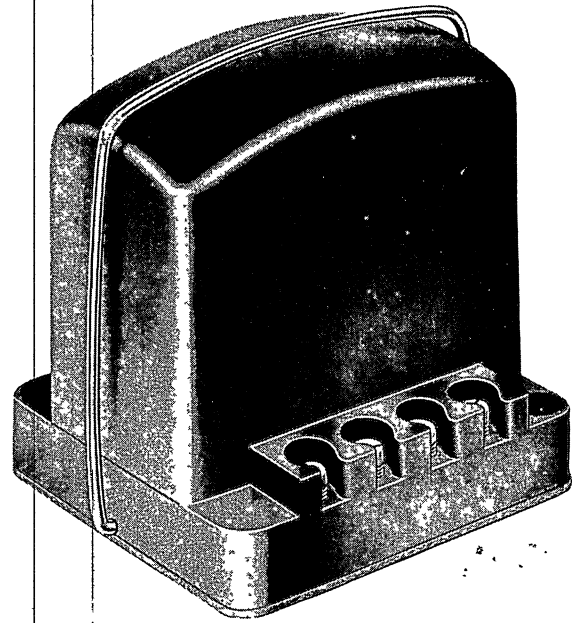
(F.3105) :

14.5 oz.

Description

Structurally the electro-magnetic relays in this range are similar, the different type number being allocated according to the internal wiring and contact arrangements and the operating voltage.

The unit is mounted on a bakelite baseplate with four terminals on each side. The main magnet assembly, which has the solenoid coil and core assembly secured to it by a single nut, is fixed to the baseplate by two screws. The armature is pivoted on one side of the magnet assembly, and when the coil is energised the core attracts the armature, on which are mounted the moving contacts, thus bringing these into contact with the adjustable fixed contacts mounted on the opposite side of the magnet assembly. When the coil is de-energised the armature is returned to its normal position by a helical tension spring, one end of which is



attached to an adjustable stud secured to the armature by two nuts, the other end being hooked to a bracket riveted to the magnet frame.

Where economy resistors are fitted they are mounted on the magnet assembly in a vertical position and held secure by means of clips utilising the armature back-stop fixing screws. In cases where swamping or discharge resistors are used they are mounted on the underside of the baseplate and held in position by clips secured to the baseplate with screws and nuts.

All external electrical connections are made via the 4 B.A. combined screw and washer terminals and the complete relay, except the terminals, is enclosed and protected by a moulded bakelite cover secured in position by a spring clip. The base wiring and resistors are protected by an insulated base-board fixed by two countersunk screws.

Installation of a relay may be made in any desired position except with the baseplate uppermost.

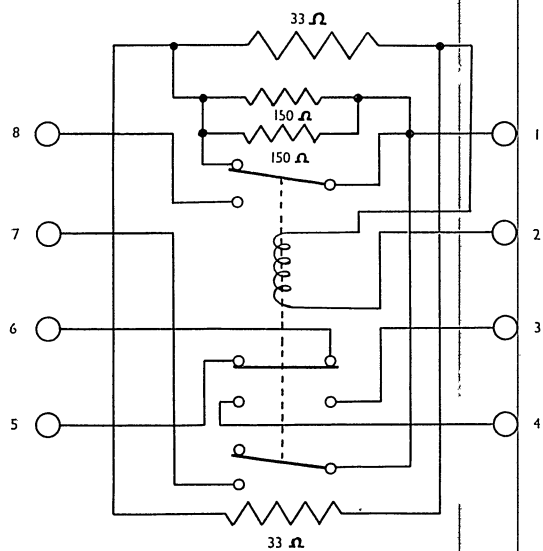
Type F.3103

This is a 28 volt voltage pick-up relay wired internally as shown in Fig. 1(a). The solenoid coil is connected in series with two 33 ohm swamping resistors in parallel and is kept energised, after the initial operation of the relay, by switching the coil circuit through two 150 ohm economy resistors in parallel. The coil resistance is 5.5 ohms and both the on/off and main change-over contacts are rated at 5 amperes.

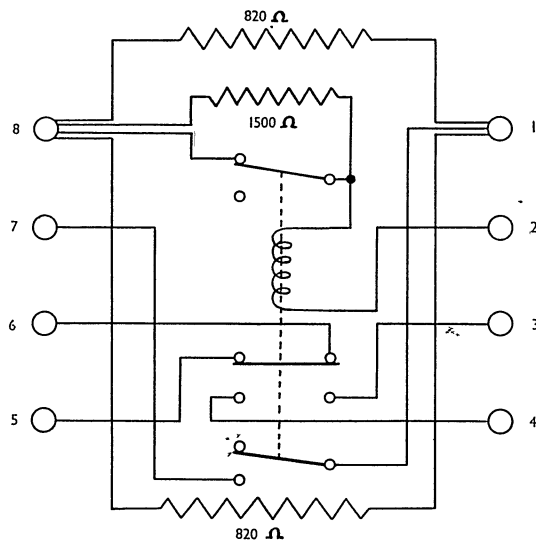
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2/1/53."

NOVEMBER 1952

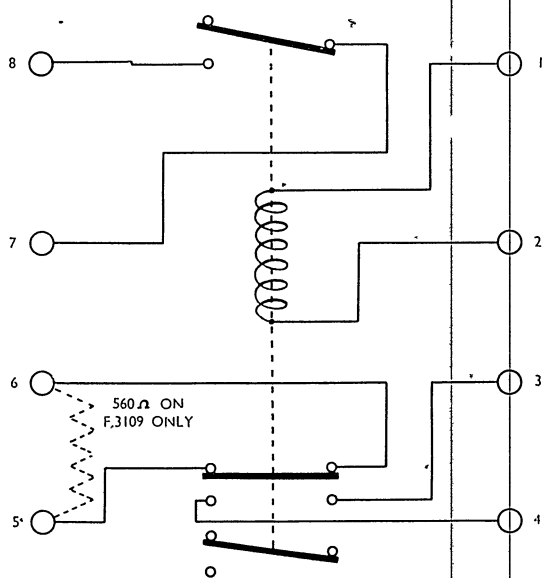
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LUCAS-ROTAX LIMITED • TORONTO 13 • CANADA • TELEPHONE OXFORD 9368



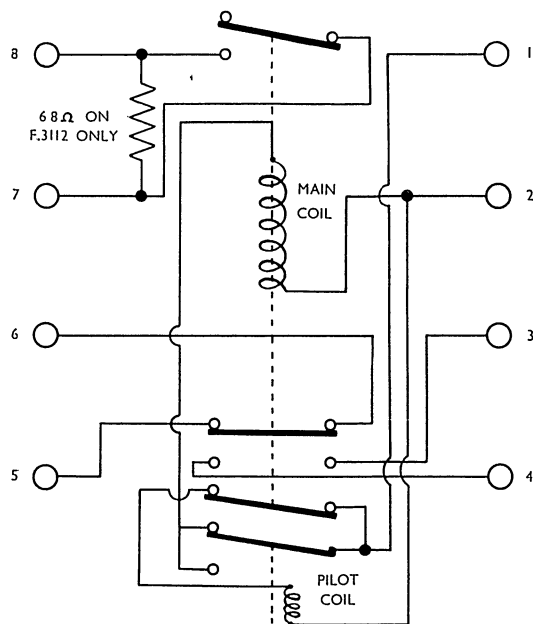
(a) F.3103



(b) F.3104



(c) F.3105 & F.3109



(d) F.3106 & F.3112

Fig. 1 Wiring diagrams

Type F.3104

This unit has the same function as the F.3103 relay and is in all respects similar, except that it has been designed for operation in 112 volt systems. The internal wiring in this case is as illustrated in Fig. 1(b), which shows a single and different value economy resistor and different value swamping resistors. Also, terminal 8 is utilised solely for the purpose of making internal connections and is sealed off externally. The coil resistance is 175 ohms.

Types F.3105 and F.3109

These units are wired internally in accordance with Fig. 1(c). In all respects they are similar except that the F.3105 is used as a simple relay for 28 volt operation, whilst the F.3109 is used as a field relay in 112 volt circuits, with a 28 volt operating coil, and has a 560 ohm surge damping resistor connected across the normally closed main change-over contacts, i.e., terminals 5 and 6.

There are no swamping or economy resistors fitted, the economy resistor coil contacts being used as the auxiliary contacts. The on/off contacts, as used on the F.3103 and F.3104, are not connected up and the coil resistance in this case is 179 ohms. All contacts are rated at 5 amperes.

Types F.3106 and F.3112

These units are similar to the F.3105 and F.3109 relays except that operation is delayed by means of a slugged coil and a time delay relay. With respect to each other the relays are similar except that the F.3112 has the addition of a 6.8 ohm resistor connected across the auxiliary contacts, i.e., terminals 7 and 8. All

internal wiring is made in accordance with Fig. 1(d), and the coil resistance is 179 ohms $\pm 7\%$.

The time delay relay is secured direct to the unit baseplate by a single screw and is so arranged that the coil and the contacts lie above and below the baseplate respectively.

Operation of the delay relay is such that, upon the application of a 28 volt supply to its operating coil, a delay in time of between 55 and 75 milliseconds is introduced before the supply voltage is switched through, via the delay relay contacts, to energise the main relay coil. The delay relay circuit is broken at the moment when the main relay coil circuit is completed.

Periodic Inspection

These relays are accurately adjusted and tested before leaving the Factory and should require but little attention between overhauls provided they are not maltreated. Providing a relay controls its associated circuitry in the desired manner it may be considered satisfactory and passed for further use.

However, a general visual inspection should be made periodically to ensure that the relay has not sustained any apparent physical damage and that all terminal connections are clean and secure.

The cover should be removed and the contacts examined for signs of excessive pitting or burning. If found, the unit should be removed from the aircraft for servicing or replacement.

Servicing

If test equipment is not available no attempt should be made to service or dismantle the unit. It should, however, be replaced by a new one and the inoperative equipment returned to our nearest Service Department, where it will be promptly dealt with by our Repair Organisation.

In cases where test equipment is available, apply for Rotax Service Leaflet No. S.L. 50 for full servicing details.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
BOUVERIE STREET
MELBOURNE, N.3
AUSTRALIA

Telephone : F.J. 4687

ROTAX LIMITED
WILLESDEN JUNCTION
LONDON, N.W. 10
ENGLAND

Telephone : ELGAR 7777

LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA

Telephone : WALNUT 3435

SUBJECT: High Energy Ignition Units

TYPES: NB.25/2 and NB.27

DATA:

Operating voltage range :	14 to 28 volts.
Sparks :	60 per minute at 21 volts applied.
Stored energy per spark :	12 joules.
Operative temperature range:	- 50°C. to +100°C.
Altitude :	55,000 ft. (NB.27) 60,000 ft. (NB.25/2)
Weight :	4.25 lb.

Description

These High Energy Ignition units have been developed to ensure ignition of the atomised fuel in the combustion chambers of gas turbine engines under all conditions of altitude up to 60,000 feet, and air mass flows likely to be encountered in service. It is, therefore, suitable for use with either electric or turbo-starters.

A most difficult condition under which a turbine has to be lit is undoubtedly that of relight in the air and the greater the altitude and speed the more difficult the problem becomes.

In order to obtain relight at really high altitudes and high air mass flows, it has been found that a large amount of energy must be released at the ignition plug in a short time. Ordinary booster coil methods, such as have been in general use, are quite inadequate at anything above 25,000 ft., not necessarily because the total energy is too small but because the form in which the energy is finally dissipated at the plug is far from being correct. However, a six microfarad capacitor charged to 2,000 volts and discharged across a surface discharge type of plug, in a period of about 100 micro-seconds, has proved quite satisfactory.

With such a system the efficiency cannot be very high due to the high currents and voltages creating large losses in the circuit. For example, with twelve joules stored in the capacitor, the energy dissipated in the spark may not be more than 50%, therefore these units have been designed to reduce all losses to a minimum and develop the maximum amount of energy at the plug.

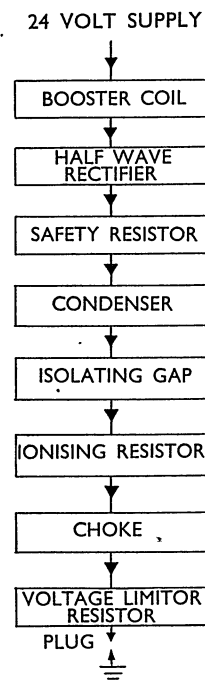
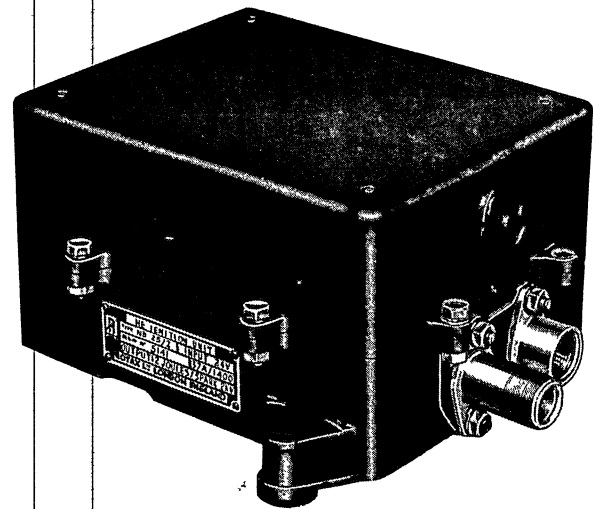


Fig. 1

Whatever system is adopted it must, of course, be suitable for all conditions of ground starting, including cartridge and liquid fuel starting as well as starting in the air. For cartridge or liquid fuel starting the periodicity of the sparks is to be considered: in such

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements. 17.3.55."

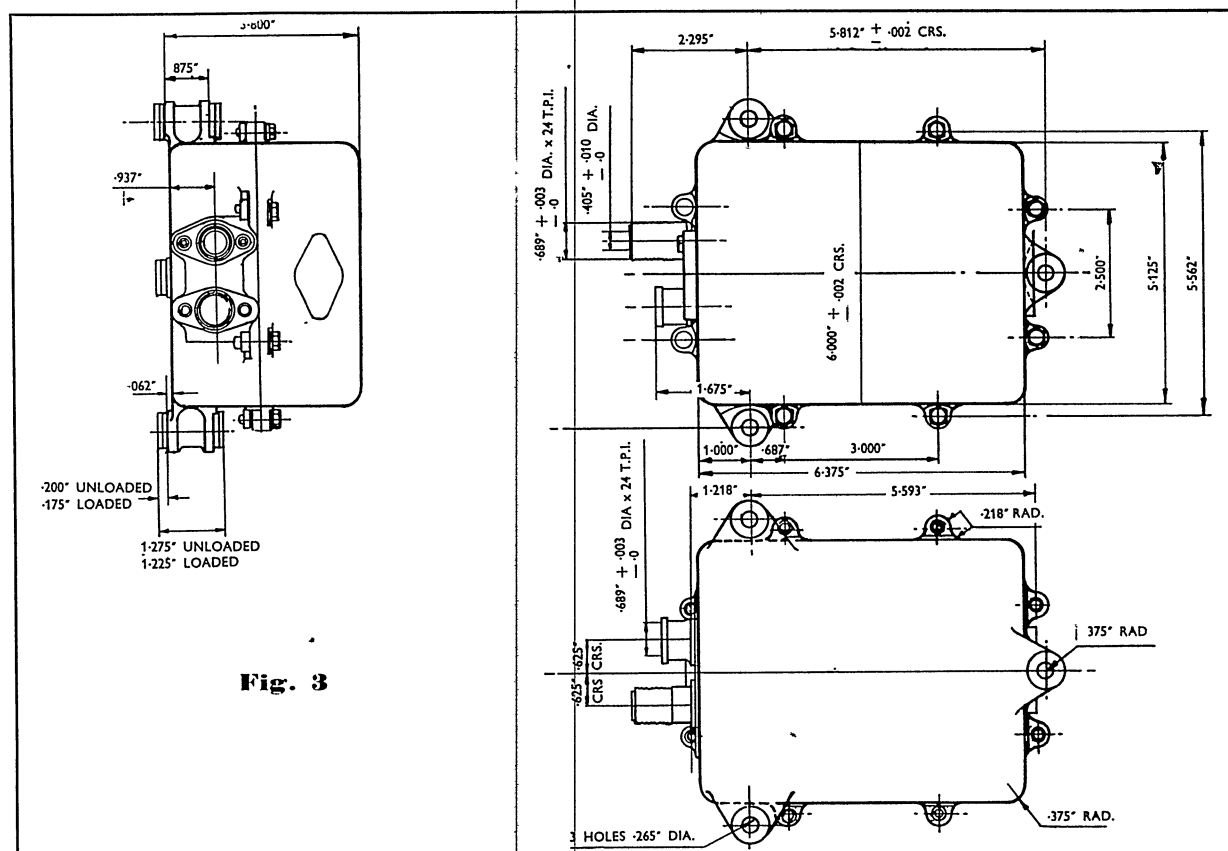
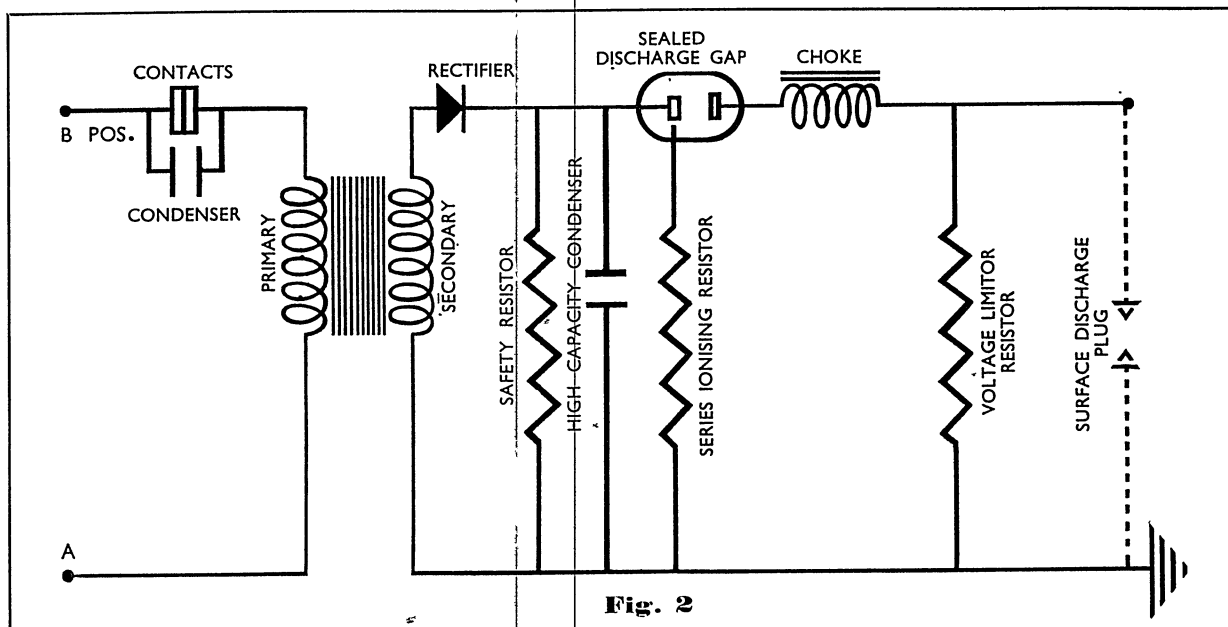
A.R.B. Authority Reference No. for NB.25/2 EQR.5.

"Amendments to this publication invalidate the approval statement unless issued by the manufacturers with the concurrence of the Air Registration Board."

PRICE ONE SHILLING

REVISED FEBRUARY 1955

ROTAX LIMITED	WILLESDEN JUNCTION	LONDON N.W. 10	ENGLAND	TELEPHONE ELGAR 7777
LUCAS-ROTAX (AUSTRALIA) PTY. LTD	NEPEAN HIGHWAY	CHELTENHAM S. 22	TELEPHONE XF 1381	
LUCAS-ROTAX LIMITED	TORONTO 13	CANADA	TELEPHONE PLYMOUTH 5-4171	



starts the total run-up time is quite short, of the order of two to five seconds, but ignition will only be satisfactory providing it occurs within a very narrow band of time during the run-up, therefore, the more frequently the sparks occur the better chance there is of obtaining at least one during this optimum period of time. It is with these considerations in view that these ignition units have been designed. To meet the last requirements at least 60 sparks per minute at 20 volts D.C. are being obtained in both these units. This is more than adequate for all forms of starting.

All components are fitted into a light magnesium alloy casting of which the lid and the base are so arranged to completely seal the unit and prevent it interfering with radio-equipment. The choke and voltage limit resistor is fitted into one of two compartments of the insulating base moulding and the discharge tube is fitted into the other compartment. The discharge tube is held in position between two soft rubber mounting blocks. Full details of outside dimensions and mounting feet can be seen in Fig. 3.

Operation

The NB.25/2 and the NB.27 units are operated from a 24 volt D.C. supply. The units are similar in construction with variations in the H.T. and L.T. plug assemblies. The units are shown in block schematic diagram form in Fig. 1 and the circuit diagram is shown in Fig. 2. In this arrangement the conventional type of booster coil is used to charge, via half-wave selenium rectifiers, a six microfarad capacitor to 2,000 volts. Booster coils, although of well-established design, have a modified secondary winding in order to obtain maximum efficiency; all rectifiers are very much under-rated in order to ensure reliability when operating under high ambient temperature conditions. Each capacitor employs a new

impregnant which ensures a large margin of safety over a wide range of temperatures, as well as reliability, in such an extremely small and light unit.

A rising voltage across the capacitor will bridge a sealed discharge gap at 2,000 volts. This gap by virtue of its ionising electrode maintains its accuracy over long periods. A high resistance is placed between this ionising electrode and earth. In order to extend the spark duration to about 100 micro-seconds, which has been found to give optimum conditions for ignition, a small inductance is connected in series with the discharge tube.

The complete unit is so designed that no excessive voltages will be experienced in the event of a plug becoming open-circuited.

Servicing

In view of the critical nature concerning the conditions under which the high energy ignition unit operates, and the necessity for special testing equipment, it is strongly recommended that if a fault develops, the unit should be returned to the nearest Service Department, or authorised service station, where it will receive prompt attention by our Repair Organisation.

Where, however, adequate and efficient repair facilities have been arranged, detailed servicing instructions are contained in Rotax Servicing Leaflet No. S.L.51, which can be obtained on request.

When these units are being serviced it is important to note that the 6 μ F. capacitor holds a dangerous charge. This capacitor **MUST** be discharged by "short circuiting" it to the case of the unit. A convenient method of discharging the capacitor is to "short" the discharge gap terminal opposite the choke to the case with a length of wire.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to:—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
NEPEAN HIGHWAY
CHELTENHAM, S. 22
VICTORIA

Telephone : XF 1381

ROTAX LIMITED
HEMEL HEMPSTEAD
HERTFORDSHIRE
ENGLAND

Telephone : BOXMOOR 4444

LUCAS-ROTAX LIMITED
5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA

Telephone : BY 6500-09

Technical enquiries should be addressed to:—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10 • ENGLAND

ELGar 7777



SUBJECT: Electronic Navigation
Lamp Flasher and
Indicator Lamp

TYPE: ZA.2902 (Flasher)
H.4201 (Indicator Lamp)

Data:

ZA.2902

Current consumption : .25 ampere at 24 volts.
Working voltage : 22 to 28 volts.
Maximum flashing load : 60 watts (two banks of
three 20 watt lamps)
Minimum flashing
frequency : 40 cycles per minute.
Maximum flashing
frequency : 60 cycles per minute.
Weight : 2 lb. 3 oz.
Mounting : Four anti-vibration
mountings with
.166" dia. hole, se-
cured to baseplate.
Electrical connection : 4-pin plug R.A.F. Ref.
5X/6006, Rotax Ref.
N.90030/1 (mating
socket R.A.F. Ref.
5X/6009, Rotax Ref.
N.95560).

H.4201

Weight : 4 oz.
Mounting : Two fixing holes,
1.250" apart,
threaded 6 B.A.
Neon bulb : A.M. Ref. 5L/648,
Rotax Ref. N.100979

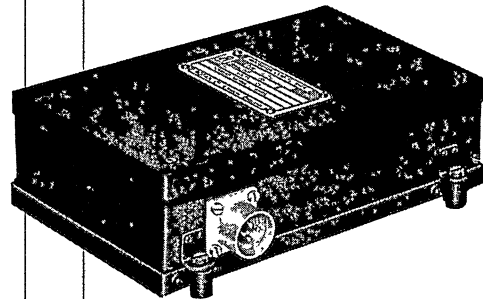
ZA.2902

General Description

These Electronic Navigation Lamp Flashers are de-
signed to meet the British Civil Airworthiness Re-
quirements for navigation lamp flashing. The re-
quirements are detailed in the following paragraphs.

Port Signal

A cycle of the signal emitted within dihedral angle L
shall consist of a steady red light and a flashing white



light, the length of the white flash being approximately
one-half the time of one cycle and the intensity of the
white light being greater than that of the red light in
any direction. See fig. 2.

Starboard signal

A cycle of the signal emitted within dihedral angle R
shall be the same as the port signal with the obvious
exception that the steady light shall be green.

Astern signal

A cycle of the signal emitted within dihedral angle A
shall consist of two successive flashes of white light
approximately equal in duration.

Synchronisation of signals

The cycles of the starboard, port and astern signals
shall be of equal duration. The white portions of the
port and starboard signals shall be synchronised with
one of the white flashes of the astern signal.

Frequency

The frequency shall not be less than 40 and not more
than 60 cycles per minute.

Failure of flashing

It shall be possible for the crew to determine whether
the system is functioning satisfactorily. In the event
of failure of the flashing unit, it shall be possible to
leave the port and starboard coloured lights and the
white astern light on and the other navigation lights
off.

The various components which make up the unit are
enclosed within an aluminium casing, the electrical
connections passing through a 4-pin plug R.A.F. Ref.
5X/6006, Rotax Ref. N.90030/1 (mating socket R.A.F.
Ref. 5X/6009, Rotax Ref. N.95560).

JANUARY 1952

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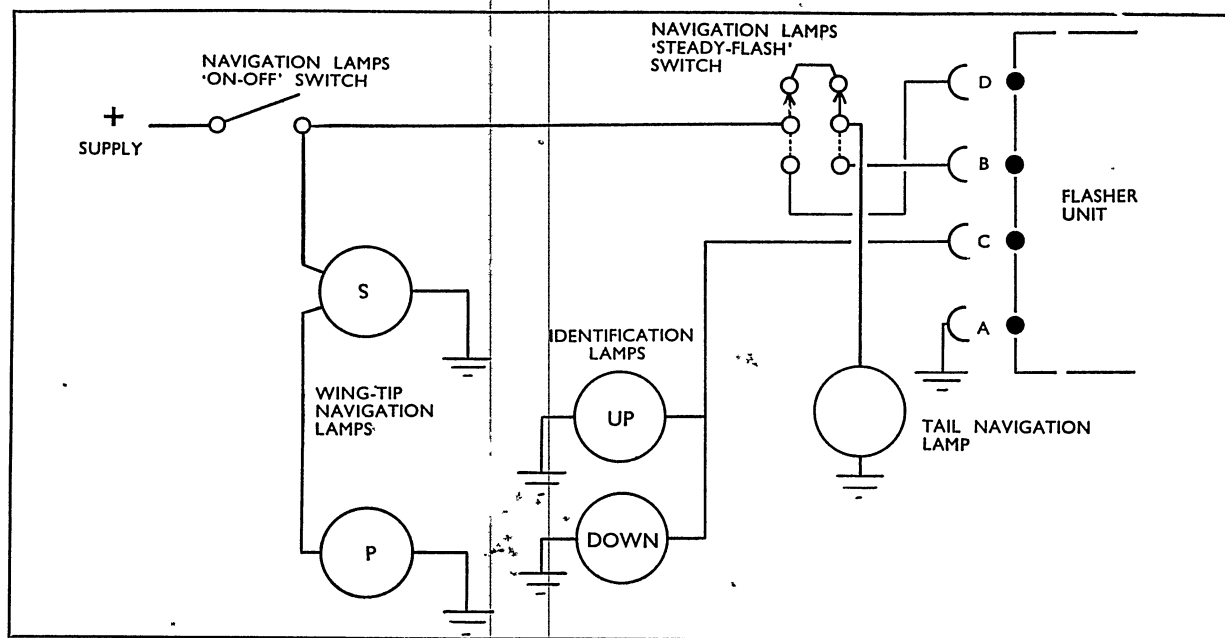


Fig. 1 Typical wiring diagram

The Carpenter relay, rheostats, valve, the change over relay, etc., are constructed as a unit and are secured within the casing by three screws.

A compartment within the unit contains a suppressor assembly to prevent interference with radio and also a 1 amp. fuse, Rotax Ref. N.102882.

A clip, located in the mounting panel, provides stowage for a spare fuse.

The complete assembly can be removed from the aircraft without disturbing the mounting plate which incorporates four anti-vibration mountings.

Operation

The circuit contains a double-triode valve, type 13D1, arranged so that each anode is capacity coupled to the opposite grid. A 28-volt supply is used to operate the valve through appropriate anode load and grid resistors. Note: A complete circuit diagram is included in S.L.52.

For descriptive purposes the double triode is considered as two separate valves.

On switching on, any random positive or negative voltage in the grid circuit of either valve will be amplified and fed to the grid of the next valve whilst undergoing a 180 degree phase reversal.

The amplified signal is then returned to the grid of the first valve to be further amplified.

The second stage of amplification reverts the signal to its original phase angle and thereby sustains oscillation.

Repetitive amplification of the signal is however limited in that the negative signal applied to the grid of one valve becomes more negative than cut-off and results in the cessation of D.C. current from that valve.

Conversely, the positive signal applied to the grid of the other valve produces maximum conduction.

As this action is almost instantaneous, it is apparent, at any one time, that one valve conducts whilst the other is cut off. The duration between successive cut-offs is determined by the alternate charging and discharging of the coupling capacitors. Thus, when one valve is cut off, its coupling capacitor commences to discharge and thereby decreases the negative signal on the grid of the valve until the cut off value is

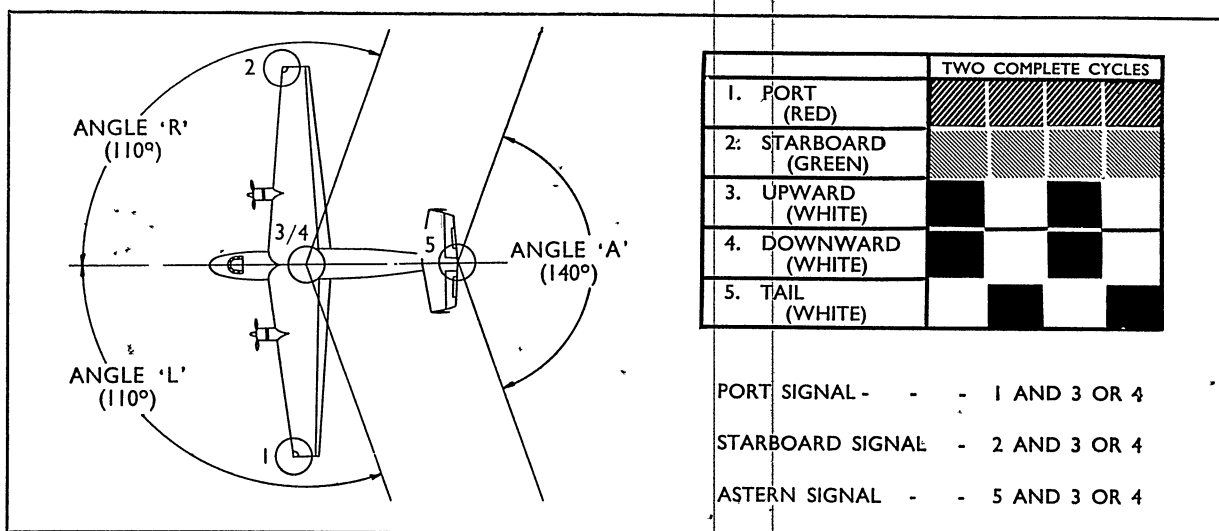


Fig. 2

reached and the valve recommences conduction. The capacitors are then recharged during the period of transition.

The duration over which the capacitors discharge is dependent on the values of both capacitor and grid resistance in circuit.

A spark suppressor circuit, comprising C4 and R4, is included across the contacts of the Carpenter relay, type 5C9. Similarly C5 and C6 are connected across the S.T.C. miniature relay contacts.

In view of the possibility of spurious oscillations being set up by interaction between the relay coil inductance and the timing capacitors C1 and C2, damping circuits, consisting of R5 and C3 and R6 and C7, have been incorporated in the grid circuits of VIA and VIB. These damping circuits also prevent triggering.

Multivibrator Timing Circuit

The duration of each flash period is determined by the duration over which VIA and VIB are successively conductive.

Conduction time of VIA is determined by C1, R8 and RV2. The conductive time of VIB is dependent on C2, R7 and RV1.

Adjustment to the timing circuits is made possible by varying the two potentiometers RV1 and RV2. Alteration of RV1 and RV2 varies the time constant of each circuit and therefore the period of conduction of each valve.

Installation

The unit should be mounted with the valve upright ; connection being made to the unit, using quadramet 4 cable, as shown in the wiring diagram, Fig. 1.

Electrical connection to the unit is by plug and socket, 4-pin, plug R.A.F. Ref. 5X/6006, Rotax Ref. N.90030/1 (mating socket R.A.F. Ref. 5X/6009, Rotax Ref. N.95560).

It is important that a double-pole double throw switch be used to control the circuit so that when the switch is in the STEADY position, i.e., with the unit switched off, pins B and D are both isolated from the positive supply, otherwise "buzzing" will occur within the unit.

Operational check

With the unit installed and connected as shown in Fig. 1, the following operational check should be carried out.

Place the double-pole switch in the "FLASH" position, allow 20 seconds for the valve to warm up, and see that the fuselage and tail lamps flash alternately and that the two flash periods are of equal duration.

II.4201 General

These units consist of a small Neon indicator lamp and transformer assembly, designed so that when connected in a circuit the indicator lamp will flash every

time the supply is interrupted, e.g., when connected in circuit with the Rotax Navigation Lamp Flasher the lamp will flash with each operation of the tail and fuselage lamps, thereby indicating to the pilot that the flasher circuit is functioning correctly. Connection is made from the primary winding of the transformer to terminals located in the base of the unit, the secondary winding being connected to the Neon indicator lamp through its screw holder.

The unit should be connected in the main positive lead to the flasher unit, between the "STEADY"/"FLASH" switch and socket pin "B."

The transformer is totally enclosed and provision is made for securing the unit to an instrument panel by two 6 B.A. screws. A terminal cover is provided.

Servicing

If test equipment is not available, no attempt should be made to service or dismantle a unit. It should, however, be replaced by a new one, the unserviceable equipment being returned to our nearest Service Department, where it will be promptly dealt with by our Repair Organisation. In cases where test equipment is available apply for Rotax Service Leaflet No. S.L.52 for servicing details.

Address all enquiries to :—

THE SERVICE DEPARTMENT

ROTAX LIMITED
WILLESDEN JUNCTION
LONDON, N.W. 10
ENGLAND

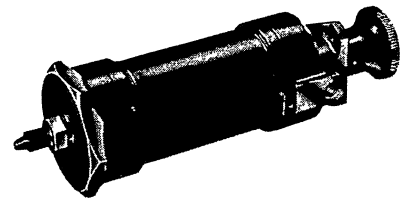
Telephone : ELGAR 7777

LUCAS-ROTAX (AUST.) PTY. LTD.
BOUVIERIE STREET
MELBOURNE, N. 3
AUSTRALIA

Telephone : F.J. 4867

LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA

Telephone : WALNUT 3435



SUBJECT: Hand Operated De-icer Pump

TYPE: M.2603

DATA: MOUNTING : 3 equi-spaced holes .144" dia.
on a 1.500" P.C.D.
WEIGHT : 1 lb.
CAPACITY PER STROKE: 87 c.c.

Description

Of robust construction, the M.2603 has been designed for lightness and resistance to corrosion from the fluids that are used with it.

This hand pump comprises a tubular duralumin body threaded at either end; at the base an end nut assembly is fitted which contains an oil seal, while at the other end is fitted the oil gland assembly which also incorporates the mounting flange and outlet port.

The end cap assembly contains the pipe coupling assembly which itself contains the non-return ball valve, the ball being retained in the coupling by means of a pin. Two gland washers are contained within this coupling assembly and, secured by a retaining nut, these washers form an oil seal on the extended spindle when in the stowed position. This extended spindle is part of the plunger spindle assembly which also carries the leather cup assembly supported by a washer on either side and secured by a castle nut; the main spring is held between the larger of the support washers and the end cap.

Provision is made for the stowing of the pump in the fully primed position by bayonet slots in the knob, with corresponding pins in the oil gland assembly housing. All parts are made of anodised duralumin or stainless steel.

The pump may be installed in any position. It is however, advisable to mount it below the supply tank and to have the outlet pipe as short as possible and rising above the pump. Positioning of the pump in such a position, eliminates any time lag in the delivery of fluid which may be caused at the commencement of priming.

The method of installation must ensure that the fluid is not allowed to escape from the top half of the pump otherwise residue from the drying fluid may cause the barrel to become sticky and the leather cup and gland sealing washers become dry and hard.

Mounting is facilitated by means of three .144" diameter holes, equally spaced on a pitch circle diameter of 1.500".

The coupling on the pump for the inlet pipe is a .125" B.S.P. external thread and for the outlet pipe a .125" B.S.P. internal thread.

Operation

The principle of operation is that of the plunger type pump, with a non-return ball valve inlet and a free delivery.

If the pump is not primed, full delivery of the fluid from the pump can be completed very rapidly by two or three operations of the plunger, assuming the inlet pipe is already primed with fluid.

Movement of the plunger downwards against the spring tension, forces the ball of the inlet valve against its seating, thereby preventing escape of air except past the leather cup washer into the top portion of the pump.

When the plunger is released, the spring returns the plunger to the fully extended position. This creates a suction on the ball of the inlet valve and draws fluid into the pump. At the same time the air in the top of the pump is exhausted. Movement of the plunger downwards for the second time forces the fluid past the leather valve washer, therefore, the return of the plunger into its fully extended position will force the fluid from the outlet port.

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A.6-2 of British Civil Airworthiness Requirements. 27/5/52."

MAY 1952

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Servicing

If test equipment is not available, no attempt should be made to service the unit. It should be replaced by a new one and the faulty equipment returned to our nearest Service Department where it will be promptly dealt with by our Repair Organisation.

In cases where test equipment is available, apply for Service Leaflet number S.L. 53 for full servicing details.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

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ENGLAND
Telephone : ELGAR 7777

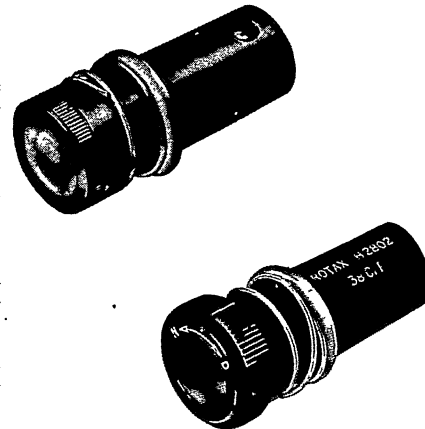
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BOUVERIE STREET
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LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA
Telephone : WALNUT 3435

SUBJECT: Cockpit Warning Lamp

TYPES: H.2700 Series
H.2800 Series

DATA: WEIGHT : .75 ounce H.2700 Series
1.00 ounce H.2800 Series
VOLTAGE : 6, 12 or 24 volts



Description

These switches have been designed for use as cockpit warning lamps. They are light and robust, being of a moulded bakelite construction, and each type is available with a number of glass colours, the coding being as follows :—

Clear Glass	H.2701	H.2801
Red Glass	H.2702	H.2802
Green Glass	H.2703	H.2803
Blue Glass	H.2704	H.2804
Amber Glass	H.2705	H.2805

The difference between these two types of lamps is that the H.2800 has been designed with an iris "stop" behind the glass. By turning the knurled bezel the amount of light can be controlled and the correct light brilliance selected under all conditions of day or night flying.

Connections are made to these switches by means of two 6 B.A. screws, the leads being introduced to the lamps through the side of the housing ; the terminal screws are revealed once the end cap has been removed.

The lamps must be mounted on a panel that is not thicker than .156 inches. A cut-out of .781" diameter must be made, with a keyway cut .431" from its base to the centre of the cut-out and .141" wide. When

mounted, the front of the lamp projects .546" from the front of the panel. There must be a minimum distance between cut-out centres of 1.062" in the case of the H.2800 series, and 1.000" in the case of the H.2700 series.

Mounting of these switches is achieved by clamping the panel or mounting plate between the head of the lamp and a "U" shaped clip that locates in the lamp body, a spring being interposed between the clip and the mounting plate to maintain a rigid fit. A locating key positioned at 90° to the two cable inlets prevents rotation of the switch when mounted.

These lamps should be subjected to a visual examination and if they pass successfully they may be considered as acceptable for continued service.

Check the moulded body to ensure that it is not cracked, strained or otherwise damaged.

Remove the end cap, check that all connections are secure and leads are in good condition.

Check that the lamp mounting is secure. It is recommended that any lamp which does not satisfy the above inspection should be replaced by a new one.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

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MAY 1952

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SUBJECT: Taxying Lamp

TYPE: H.2901 A.M. Ref. 5C/3863

DATA: WEIGHT : 8 oz.
VOLTAGE : 12 or 24 volts



Description

Of robust construction, this lamp has been designed to illuminate the region around the aircraft wingtips thereby indicating the presence of obstructions when taxiing into, or about, parking areas.

The glass is fluted and gives a fan-shaped beam, divergence being about 40° in the horizontal plane and about 10° in the vertical plane. With such a horizontal divergence, the setting of the beam in this plane is not critical. However, in the vertical plane a more accurate setting is required, thus ground adjustment is possible, when mounted on the aircraft, over a range of 20° by means of a slot calibrated at 5° intervals. The peak intensity of light is approximately 4000 candles and the beam divergence down to 10% of maximum is about $40^\circ \times 10^\circ$.

The lamp can be mounted in any position, but it is, however, advisable to mount it in the leading edge and near to the tip of the wing.

Vertical Plane Setting

The axis of the lamp should point downward at an angle B when the aircraft is at rest on the ground. B is about $D/4^\circ$, where D is the height of the lamp above the ground in feet.

Horizontal Plane Setting

In the case of single engined aircraft, the axis of the lamp should be turned outboard at an angle from the centre line of the aircraft. This is usually 12° , but may be smaller if the lamp is more than half-way out towards the wingtip.

When the lamp is mounted on multi-engined aircraft, the axis of the lamp should be pointed dead ahead unless the lamp is mounted more than half-way out towards the wingtip, in which case it may be turned inboard at some angle up to about 5° depending on the closeness of the lamp to the wingtip.

Provision is made for 12 or 24 volt, 35 or 60 watt filament lamps and the bulb is held in lamp holder S.B.C. type "B" A.M. reference 5C/2680. The lamp has a dimension of 4.120" from the glass front to rear of the lamp holder and measures 4.420" across its face.

Mounting is achieved by means of a fixing hole suitable for $\frac{1}{4}$ " diameter bolts, while a radial slot is cut on a .800" radius from the fixing hole; this slot is calibrated at 5° and permits a 20° variation in position of the lamp.

Periodic Inspection

Periodically these lamps should be subjected to a visual and electrical check as follows.

Visual Check

Check the moulded body to ensure that it is not cracked, strained or otherwise damaged, and by removing the end cap ensure that all connections are secure and leads are in good condition. A check should also be made on the lampholder plunger pins and the bulb connections for signs of possible corrosion which, if found, should be cleaned off to ensure continuity.

The lamp glass must not be damaged in any way and any discolouration of the bulb is sufficient cause to reject it. The metal reflector may occasionally require cleaning. A recommended method being that it should be washed with soap and water and then polished lightly with a soft cloth. Under no circumstances should any form of metal polish be used. N.B.—When replacing the glass front ensure that the flutes are in the vertical position.

Check also that the lamp mounting is secure.

Electrical Check

Operate the lamp from the cockpit switch, and if the lamp fails to light check the fuse, filament, switch and wiring to ascertain the cause and rectify same.

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PRICE ONE SHILLING

JANUARY 1953

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For further information on the functioning, operation and maintenance
of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

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AUSTRALIA

Telephone : F.J. 4687

ROTAX LIMITED
WILLESDEN JUNCTION
LONDON, N.W. 10
ENGLAND

Telephone : **ELGAR 7777**

LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA

Telephone : WALNUT 3435

SUBJECT: Reversing Contactors

TYPES: D.8701 A.M. Ref. 5C/4382
D.8702
D.8703
D.8704

DATA:

Rating (main contacts): 112 volts D.C. 5-15 amperes
(shunt field contacts): 112 volts D.C. 2.5 amperes
(auxiliary contacts): 29 volts D.C. 2.5 amperes

Operating Coil Voltage : 29 volts D.C. maximum

Mounting : Two slots for 2 B.A. fixing bolts in mounting plate spaced at 4.200" centres

Operating Temperature Range : +40° to -70°C.

Weight : 2 lb.

Description

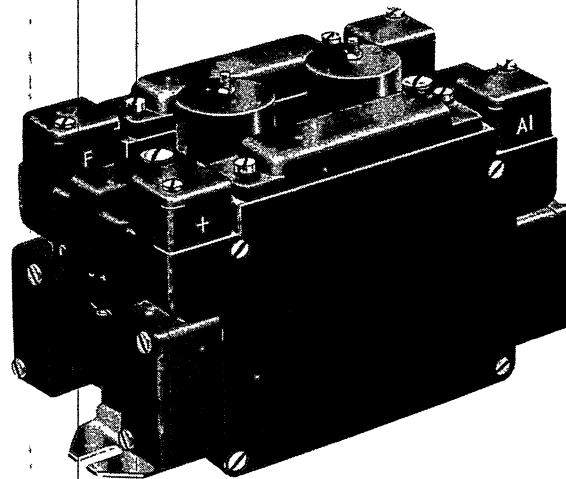
This range of double-pole reversing contactors has been designed for use in 112 volt D.C. electrical systems where it is necessary to provide a current flow in either direction as required, e.g., to reverse the direction of an actuator motor.

Separate pairs of contacts are employed for each direction of rotation with an interlocking mechanism provided to prevent the simultaneous closing of both sets of contacts at any one time. The main contacts are short-rated at 15 amperes and the shunt field contacts at 2.5 amperes. Two pairs of 29 volt auxiliary contacts, rated at 2.5 amperes, are opened and closed with their respective main contacts. Variations on the auxiliary contact arrangement is given in the following table :—

TYPE	CONTACTS	
	1 2	3 4
D.8701	Normally open	Normally open
D.8702	Normally closed	Normally closed
D.8703	Normally open	Normally closed
D.8704	Normally closed	Normally open

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A.6-2 of British Civil Airworthiness Requirements. 5/12/52."

SEPTEMBER 1952



Each unit comprises a light alloy main casting which houses the actuating and interlocking mechanism. Two operating solenoids with their associated terminal blocks are mounted on its top face and two moulded bakelite switch housings, containing the main and auxiliary or shunt field contacts, are fitted to its opposite side faces.

Mounted externally on each of the switch housings are the main and auxiliary or shunt field terminal blocks.

Easily removable covers are fitted over the main contacts and to the switch housings to facilitate access for inspection and servicing purposes.

A mounting plate with two slots spaced at 4.200" centres to take 2 B.A. fixing bolts is fitted to the bottom of the main casting. Installation of the unit may be effected in any desired position except with the mounting plate uppermost.

Electrical connections are made via the externally mounted terminal blocks fitted with 4 B.A. combined screw and washer terminals.

Total weight of the unit is 2 lb.

Operation

When either of the solenoids is energised the magnetic pull created on its plunger will cause it, against the pressure of the return springs, to be drawn in towards the core. This movement is transmitted via the actuating levers and main contact carrier driving shafts to operate the respective main and associated shunt field and auxiliary contacts.

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When the energising current through the solenoid is broken the plunger, under pressure from the springs, is returned to its rest position causing at the same time, via the actuating mechanism, the contacts to return to their normal positions.

Operation of the interlocking mechanism is such that, besides preventing the simultaneous closing of both sets of contacts if both coils are inadvertently operated together, also ensures that should one pair of contacts weld on making, the circuit is interrupted by the other pair of contacts when the operating solenoid is de-energised and cannot subsequently be closed until the interlock mechanism is manually unlatched.

The connections of the shunt field contacts are so arranged that the polarity of the associated motor shunt winding remains the same with either solenoid operated, i.e., remains constant irrespective of the direction of armature current. See wiring diagram of unit in Service Leaflet No. 54.

Periodic Inspection

These reversing contactors are accurately adjusted and tested before leaving the Factory and should require but little attention between overhauls provided they are

not maltreated. Providing a contactor controls its associated motor in the desired manner it may be considered satisfactory and passed for further use.

However, a general visual inspection should be made periodically to ensure that the contactor has not sustained any apparent physical damage and that all terminal connections are clean and secure.

The covers should be removed and all contacts examined for signs of excessive pitting or burning. If found, the unit should be removed from the aircraft for servicing or replacement.

Servicing

If test equipment is not available no attempt should be made to service or dismantle the unit. It should, however, be replaced by a new one and the inoperative equipment returned to our nearest Service Department, where it will be promptly dealt with by our Repair Organisation.

In cases where test equipment is available, apply for Rotax Service Leaflet No. S.L. 54 for full servicing details.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
BOUVERIE STREET
MELBOURNE, N. 3
AUSTRALIA
Telephone : F.J. 4687

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WILLESDEN JUNCTION
LONDON, N.W. 10
ENGLAND
Telephone : ELGAR 7777

LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA
Telephone : WALNUT 3435

SUBJECT: Reversing Contactors

TYPES: D.9001 A.M. Ref. 5C/4383
D.9002
D.9003
D.9004

DATA:

Rating (main contacts): 112 volts D.C. 20-60 amperes
(shunt field contacts): 112 volts D.C. 2.5 amperes
(auxiliary contacts): 29 volts D.C. 5 amperes
Operating Coil Voltage: 29 volts D.C. maximum
Mounting : Two slots for .250" dia. fixing bolts in fixing plate spaced at 6.000" centres
Operating Temperature Range : +40°C. to -70°C.
Weight : 4 lb. 4 oz.

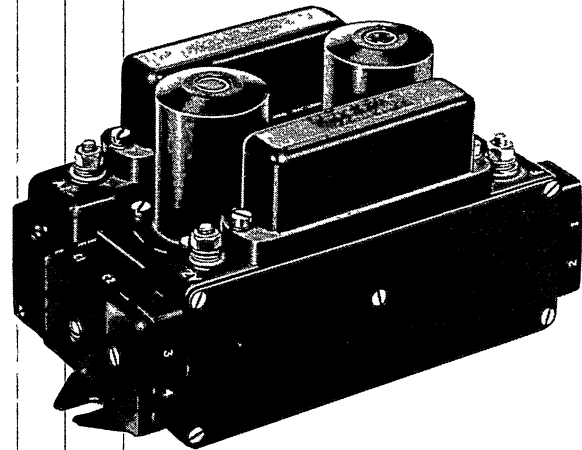
Description

This range of double-pole reversing contactors has been designed for use in 112 volt D.C. electrical systems where it is necessary to provide a current flow in either direction as required, e.g., to reverse the direction of an actuator motor.

Separate pairs of contacts are employed for each direction of rotation with an interlocking mechanism provided to prevent the simultaneous closing of both sets of contacts at any one time. The main contacts are short-rated at 60 amperes and the shunt field contacts at 2.5 amperes. Two pairs of 29 volt auxiliary contacts, rated at 5 amperes, are opened and closed with their respective main contacts. Variations on the auxiliary contact arrangement are given in the following table :—

Type	Contacts			
	1	2	3	4
D.9001	Normally open		Normally open	
D.9002	Normally closed		Normally closed	
D.9003	Normally open		Normally closed	
D.9004	Normally closed		Normally open	

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Each unit comprises a light alloy casting which houses the actuating and interlocking mechanism. Two operating solenoids with their associated terminal blocks are mounted on its top and end faces respectively, and two moulded bakelite switch housings, containing the main and auxiliary or shunt field contacts, are fitted to its opposite side faces.

Fitted directly to and mounted externally on each of the switch housings are the main terminal post assemblies and the auxiliary or shunt field terminal blocks.

Easily removable covers are fitted over the main contacts and to the switch housings to facilitate access for inspection and servicing purposes.

A mounting plate, with two slots spaced at 6.000" centres to take .250" dia. fixing bolts, is fitted to the bottom of the main casting. Installation of the unit may be effected in any desired position except with the mounting plate uppermost.

Electrical connections are made via the directly fitted 2 B.A. terminal posts and the externally mounted terminal blocks fitted with 4 B.A. combined screw and washer terminals.

Total weight of the unit is 4 lb. 4 oz.

Operation

When either of the solenoids is energised the magnetic pull created on its plunger will cause it, against the pressure of the return springs, to be drawn in towards the core. This movement is transmitted via the actuating levers and main contact carrier driving shafts to operate the respective main and associated shunt field and auxiliary contacts.

OCTOBER 1952

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When the energising current through the solenoid is broken the plunger, under pressure from the return springs, is returned to its rest position causing at the same time, via the actuating mechanism, the contacts to return to their normal positions.

Operation of the interlocking mechanism is such that, besides preventing the simultaneous closing of both sets of contacts if both coils are inadvertently operated together, also ensures that should one pair of contacts weld on making, the circuit is interrupted by the other pair of contacts when the operating solenoid is de-energised and cannot subsequently be closed until the interlock mechanism is manually unlatched.

The connections of the shunt field contacts are so arranged that the polarity of the associated motor shunt winding remains the same with either solenoid operated, i.e., remains constant irrespective of the direction of armature current. See wiring diagram of unit in Service Leaflet No. 55.

Periodic Inspection

These reversing contactors are accurately adjusted and tested before leaving the Factory and should require but little attention between overhauls provided they

are not maltreated. Providing a contactor controls its associated motor in the desired manner it may be considered satisfactory and passed for further use.

However, a general visual inspection should be made periodically to ensure that the contactor has not sustained any apparent physical damage and that all terminal connections are clean and secure.

The covers should be removed and all contacts examined for signs of excessive pitting or burning. If found, the unit should be removed from the aircraft for servicing or replacement.

Servicing

If test equipment is not available no attempt should be made to service or dismantle the unit. It should, however, be replaced by a new one and the inoperative equipment returned to our nearest Service Department, where it will be promptly dealt with by our Repair Organisation.

In cases where test equipment is available, apply for Rotax Service Leaflet No. S.L. 55 for full servicing details.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
BOUVERIE STREET
MELBOURNE, N. 3
AUSTRALIA

Telephone : F.J. 4687

ROTAX LIMITED
WILLESDEN JUNCTION
LONDON, N.W. 10
ENGLAND

Telephone : ELGAR 7777

LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA

Telephone : WALNUT 3435

SUBJECT: Reversing Contactors

TYPES: D.9301 A.M. Ref. 5C/4384
D.9302
D.9303
D.9304

DATA:

Rating (main contacts): 112 volts D.C. 150 amperes
(shunt field contacts): 112 volts D.C. 2.5 amperes
(auxiliary contacts): 29 volts D.C. 5 amperes

Operating Coil Voltage: 29 volts D.C. maximum

Mounting : Two slots for .250" B.S.F. fixing bolts in mounting brackets spaced at 7.000" centres

Operating Temperature Range : +40°C. to -70°C.

Weight : 7 lb. 9 oz.

Description

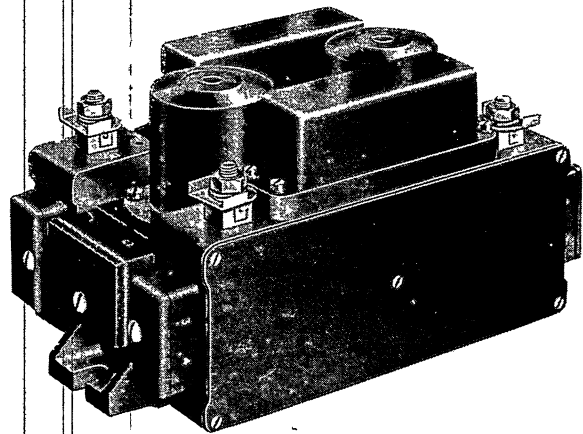
This range of double-pole reversing contactors has been designed for use in 112 volt D.C. electrical systems where it is necessary to provide a current flow in either direction as required, e.g., to reverse the direction of an actuator motor.

Separate pairs of contacts are employed for each direction of rotation with an interlocking mechanism provided to prevent the simultaneous closing of both sets of contacts at any one time. The main contacts are short-rated at 150 amperes and the shunt field contacts at 2.5 amperes. Two pairs of 29 volt auxiliary contacts, rated at 5 amperes, are opened and closed with their respective main contacts. Variations on the auxiliary contact arrangement are given in the following table :—

Type	Contacts			
	1	2	3	4
D.9301	Normally open		Normally open	
D.9302	Normally closed		Normally closed	
D.9303	Normally open		Normally closed	
D.9304	Normally closed		Normally open	

" Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements. 5/12/52."

OCTOBER 1952



Each unit comprises a light alloy casting which houses the actuating and interlocking mechanism. Two operating solenoids with their associated terminal blocks are mounted on its top and end faces respectively and two moulded bakelite switch housings, containing the main and auxiliary or shunt field contacts, are fitted to its side faces.

Forming an integral part of the main housing are two mounting brackets, each with a slot to take a .250" dia. bolt and spaced at 7.000" centres, which facilitate unit fixing. Installation of the unit may be effected in any desired position except with the mounting brackets uppermost.

Fitted directly to and mounted externally on each of the switch housings are the main terminal post assemblies and the auxiliary or shunt field terminal blocks.

Removable covers are fitted over the main contacts and to the switch housings providing easy access for inspection and servicing purposes.

Electrical connections are made via the directly fitted .250" B.S.F. terminal posts and the externally mounted terminal blocks fitted with 4 B.A. combined screw and washer terminals.

Total weight of the unit is 7 lb. 9 oz.

Operation

When either of the solenoids is energised the magnetic pull created on its plunger will cause it, against the pressure of the return springs, to be drawn in towards the core. This movement is transmitted via the actuating levers and main contact carrier driving shafts to operate the respective main and associated shunt field and auxiliary contacts.

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When the energising current through the solenoid is broken the plunger, under pressure from the return springs, is returned to its rest position, causing at the same time, via the actuating mechanism, the contacts to return to their normal positions.

Operation of the interlocking mechanism is such that, besides preventing the simultaneous closing of both sets of contacts if both coils are inadvertently operated together, also ensures that should one pair of contacts weld on making, the circuit is interrupted by the other pair of contacts when the operating solenoid is de-energised and cannot subsequently be closed until the interlock mechanism is manually unlatched.

The connections of the shunt field contacts are so arranged that the polarity of the associated motor shunt winding remains the same with either solenoid operated, i.e., remains constant irrespective of the direction of armature current. See wiring diagram of unit in Service Leaflet No. 56.

Periodic Inspection

These reversing contactors are accurately adjusted and tested before leaving the Factory and should require but little attention between overhauls provided

they are not maltreated. Providing a contactor controls its associated motor in the desired manner it may be considered satisfactory and passed for further use.

However, a general visual inspection should be made periodically to ensure that the contactor has not sustained any apparent physical damage and that all terminal connections are clean and secure.

The covers should be removed and all contacts examined for signs of excessive pitting or burning. If found, the unit should be removed from the aircraft for servicing or replacement.

Servicing

If test equipment is not available no attempt should be made to service or dismantle the unit. It should, however, be replaced by a new one and the inoperative equipment returned to our nearest Service Department, where it will be promptly dealt with by our Repair Organisation.

In cases where test equipment is available, apply for Rotax Service Leaflet No. S.L. 56 for full servicing details.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
BOUVIERIE STREET
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WILLESDEN JUNCTION
LONDON, N.W. 10
ENGLAND

Telephone : ELGAR 7777

LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA

Telephone : WALNUT 3435

SUBJECT: Suction Relief Valve

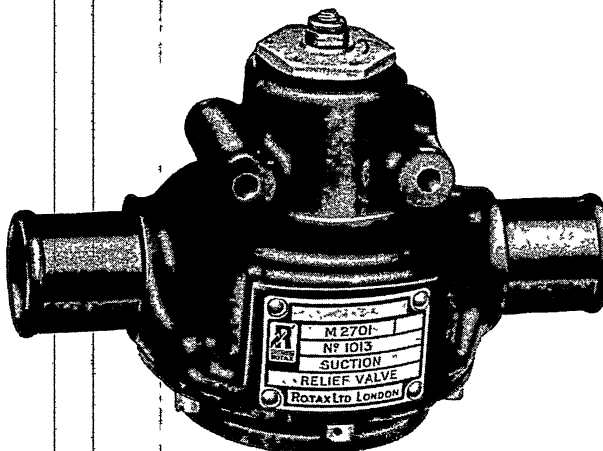
TYPE: M.2701

DATA:

Operating Range: 4" to 7.5" Hg.

Mounting: Two holes 0.203" diameter drilled 1.50" apart in housing.

Weight: 0.63 lb.



Description

The M.2701 suction relief valve has an adjustment range of 4 to 7.5" Hg and is normally set at 5" Hg to maintain approximately 4" Hg at the pilot's suction gauge.

The relief valve housing, which supports all of the removable parts of the complete valve, has two ports and forms a valve chamber. The valve seating which incorporates a screen, is secured to the base of the valve housing by six screws, the screen being held in position in the seating by means of a locking ring. The valve is held against its seating by a coil spring, the pressure of the spring being adjustable by the provision of an adjusting screw. The adjusting screw has an integral key and is threaded to one dimension at the middle and to a lesser dimension at each end. The key is inserted from the interior through a sealing washer, and a hole drilled in the upper end of the housing. A slotted adjusting nut is fitted over the key when the latter is in position. A spring retainer is assembled on the lower end of the adjusting screw, adjusting screw movement being limited at the upper end by a shoulder on the key and at the lower end by a spring retainer washer and stop nut. The square interior of the valve housing guides the valve spring retainer and prevents it from turning on the adjusting screw. The valve spring is compressed between the valve spring retainer and the inner face of the hollow valve, thereby holding the valve against its seating.

Operation

The suction relief valve is connected into the suction line which leads into the air pump suction port.

When the air pump is not in operation, the preload force of the valve spring seats the hollow valve against the valve seat and closes the relief valve against atmospheric pressure.

When the engine is started, the pump immediately draws air through the suction line and the relief valve into the pump intake port.

When the suction increases above the preset value of the suction relief valve, the reduction of internal air pressure allows atmospheric pressure exerted on the closed end of the hollow valve to compress the valve spring and unseat the valve. This action admits a flow of air into the suction line and relieves the excess suction.

When suction decreases to a value below the preset value of the relief valve, the preload force of the valve spring reseats the hollow valve on the valve seat and stops the air flow from atmosphere until suction again becomes greater than the preset value of the relief valve.

Throughout normal operation of the pneumatic system, the hollow valve thus continues to open and close, maintaining suction at an approximately constant value.

Operation of the suction relief valve is completely automatic. However, for satisfactory operation of the pneumatic system, the engine-driven pump speed must be within the rated speed range given in the handbook prepared by the pump manufacturer.

Installation

Follow the general instructions outlined in this section when units are being installed. For further information reference should be made to the installation drawings in the handbook prepared by the aircraft manufacturer.

Any units that have been left in storage for a period exceeding one year should be returned to the works

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JULY 1952

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for cleaning, re-lubrication and test, otherwise failure of the unit or shortened service life may result.

Units which have been in storage for less than one year may be placed in immediate service. In any event carry out the following check before installation.

Make certain that the housing is free from cracks and corrosion.

Remove the seal plugs from the ports and mount the valve by means of bolts inserted through the two mounting holes. It is recommended that suitable shock-mounting spacers and washers be used on the mounting bolts.

Locate the valve, screen downward, in the suction line as close as practicable to the air pump.

For overall dimensions refer to the installation drawing.

After installation of the entire pneumatic system has been completed, check for satisfactory performance of the suction relief valve in the following manner.

Start and accelerate the engines until the pumps are operating at the speed specified for adjustment of the valve. (Refer to the handbook and specification prepared by the aircraft manufacturer). Adjust the valve until the pneumatic system suction gauge indicates the suction in inches Hg specified for the particular installation.

Normally, the suction relief valves are set at cruising speed to provide 4" Hg suction.

Adjustment of the valves may be carried out in the following manner.

1. Using a spanner to prevent the adjusting nut from turning, loosen the upper stop nut about one quarter turn.

2. Turn the adjusting nut counter-clockwise to increase suction or clockwise to decrease suction, until the suction gauge indicates the specified reading.

Caution

Tighten the upper stop nut with each partial turn of the adjusting nut to prevent air leakage past the sealing washer and a consequent false reading.

Periodic Inspection

The inspection and maintenance procedure outlined in this section requires the use of a suitable spanner for adjustment of the valve.

Note—To save time in completing the inspection operations it is recommended that the entire pneumatic system—instrument suction, air pumps, De-lucer operation and accessories—be checked at the same time. Refer to the handbooks covering the various pieces of equipment used in the pneumatic system for complete details of the checks to be performed on the respective units.

500 Hour Inspection

1. Check for security of mounting bolts.
2. See that both tubing connections to the ports of the valve are secure.
3. See that the adjusting nut and the upper stop nut are tight.
4. See that the screen of the valve is undamaged and not clogged with dust and oil. Renew damaged screens, clean clogged filters with benzine.

Servicing

If test equipment is not available no attempt should be made to service the unit, it should be replaced by a new one and the faulty equipment returned to our nearest Service Department, where it will be promptly dealt with by our Repair Organisation.

In cases where test equipment is available, apply for Rotax Service Leaflet S.L. 57. Address all enquiries to:—

THE SERVICE DEPARTMENT

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BOUVIERIE STREET
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MONTREAL AIRPORT
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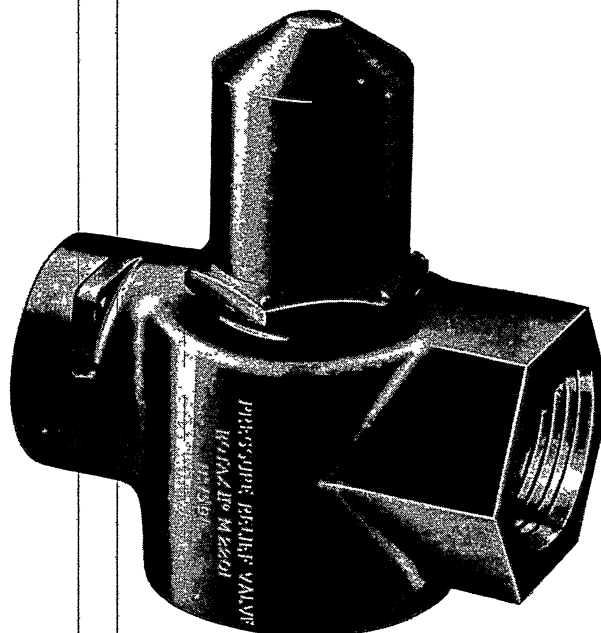
SUBJECT: Pressure Relief Valve

TYPE: M.2201

DATA:

Operating Range: 10" to 21" Hg.

Mounting: 1" British Standard Pipe
Connection to system.



Description

This pressure relief valve consists of a magnesium alloy, or, alternatively, an aluminium alloy casting, housing a spring loaded valve. Each end of the casting, i.e., the inlet and outlet port, has a 1" B.S.P. female thread for connection to the pressure line of the system. The top of the casting is formed to receive a phosphor bronze bush, positioned at right angles to the air flow, which supports the valve stem. A further circular protrusion from the casting is formed outside the bush housing leaving a space to receive the valve spring. This outer protrusion is threaded to receive a housing cap, which, while protecting the valve spring and providing access to the adjusting nut, also ensures air tightness of the valve unit should air leak past the valve stem.

The valve spring is covered by a steel cup washer. The end of the valve stem is threaded and passes through a hole in the steel cup. An adjusting nut and a stop nut on the stem compress the spring, thereby holding the valve head against its seat. The top of the stem is slotted so that the stem can be held with a screwdriver when turning the adjusting or lock nut.

A hole in the base of the housing forms the valve seat; the base of the casting protrudes around the seat supporting a screen which is firmly held in position by the provision of a circlip.

Operation

The operation of the pressure relief valve is quite simple and is described in the following paragraphs. Assuming the valve to be connected in an air pressure line, air will flow through the unit and the valve will remain closed due to atmospheric pressure combined with the preload force of the valve spring. If air pressure within the valve increases beyond the combined force of the valve spring and atmospheric pressure, the valve will be forced off its seat and the excess pressure will escape to atmosphere.

The valve will remain unseated until the internal pressure again falls sufficiently to allow the valve to close. The pressure required to open the valve is, of course, directly dependent on the pressure exerted by the valve spring due to the position of the adjusting nut.

Installation

The pressure relief valve should be installed screen downwards thereby preventing the ingress of foreign matter due to settlement on the screen. The relief valve should be installed in the pressure line as near to the outlet port of the oil separator as practicable, avoiding sharp bends in the tubing. For information relating to installation details reference should be made to the installation diagrams and notes contained in the handbook of the aircraft manufacturer.

PRICE ONE SHILLING

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JULY 1952

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Routine Inspection

Periodically inspect the valve for signs of obvious damage, i.e., cracked housing or loose pipe connections. Inspect the screen for damage, and if clogged or dirty wash thoroughly in clean benzine.

Servicing

If test equipment is not available, no attempt should be made to service the unit, it should be replaced by a new one and the faulty equipment returned to our nearest Service Department, where it will be promptly dealt with by our Repair Organisation.

In cases where test equipment is available, apply for Rotax Service Leaflet No. S.L. 58 for full servicing details. Address all enquiries to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
BOUVERIE STREET
MELBOURNE, N. 3
AUSTRALIA

Telephone : F.J. 4687

ROTAX LIMITED
WILLESDEN JUNCTION
LONDON, N.W. 10
ENGLAND

Telephone : **ELGAR 7777**

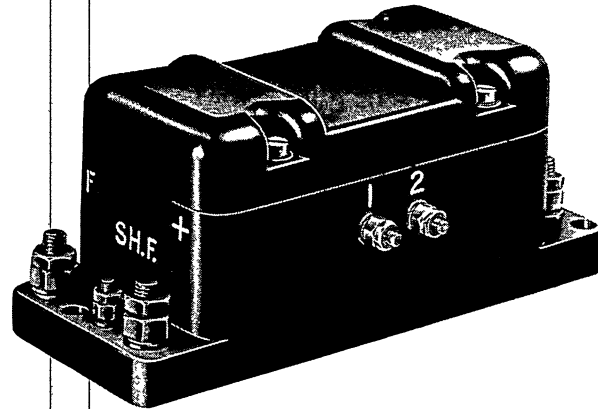
LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA

Telephone : WALNUT 3435

SUBJECT: Reversing Switch

TYPES: D.5101 (A.M. Ref. 5C/4448)
D.5102
D.5103
D.5104
D.5105

DATA: OPERATING VOLTAGE: 24—29 volts D.C.
MAXIMUM CURRENT: 200 Amperes
WEIGHT: $3\frac{1}{2}$ lb.
MOUNTING: 3 holes $\frac{1}{8}$ " dia. in base



Description

This is a double-pole change-over relay, used to reverse the direction of flow of the current in the armature windings of an electric motor, so reversing the direction of its rotation.

Variations of this switch to accommodate certain other requirements in circuit arrangement are available under Type Nos. D.5102-3-4 and 5.

D.5101 consists of a rectangular moulded bakelite box, inside and on the base of which are mounted two solenoids, axes vertical. Between and above them, on extensions of their yokes rising from the base as brackets, is pivoted a shallow "V" rocker, forming a combined armature for the solenoids, and which carries a set of insulated, spring-loaded, self-aligning contacts at each extremity. The rocker is held on its pivots in equilibrium by an adjustable screw and a roller at its centre, against the compression of a return-spring, a square nut mating with the screw and riding between the yoke brackets.

A set of fixed contacts inside each end of the box are arranged directly below the moving contacts. Connections to the contacts and solenoid coils are brought out via connecting strips and leads to terminals at the ends and sides of the box, and a loose recessed lid is provided, to be secured by four captive screws.

These switches will operate satisfactorily in any position. Provision is made for them to be secured by three fixing-bolts through holes in the end extensions of the base. All connecting terminals are outside the box, and differ with the type number of the switch. A table is appended, showing details.

D.5102 is essentially as D.5101 but incorporates a resistor, connected in the field circuit, connections to the ends of which are brought out to two external connectors, R and RI. (See diagram).

D.5103 differs from D.5101 only in the size of its terminals. (See table).

D.5104 has leads connecting two moving contacts to two additional terminals 5 and 6. (See diagram).

D.5105 has the solenoid coils' connections arranged with one common terminal, and one fixed contact connected to No. 2 terminal. (See diagram).

TERMINAL SIZES (DIA.)					
Term.	D.5101	D.5102	D.5103	D.5104	D.5105
A	$\frac{5}{16}$ "	$\frac{5}{16}$ "	$\frac{1}{4}$ "	$\frac{1}{4}$ "	2 B.A.
Al	$\frac{5}{16}$ "	$\frac{5}{16}$ "	$\frac{1}{4}$ "	$\frac{1}{4}$ "	2 B.A.
F	$\frac{5}{16}$ "	$\frac{5}{16}$ "	$\frac{5}{16}$ "	$\frac{5}{16}$ "	2 B.A.
+	$\frac{5}{16}$ "	$\frac{5}{16}$ "	$\frac{5}{16}$ "	$\frac{5}{16}$ "	2 B.A.
SH.F	2 B.A.	2 B.A.	2 B.A.	2 B.A.	2 B.A.
1	2 B.A.	2 B.A.	2 B.A.	2 B.A.	2 B.A.
2	2 B.A.	2 B.A.	2 B.A.	2 B.A.	2 B.A.
3	2 B.A.	2 B.A.	$\frac{1}{4}$ "	$\frac{1}{4}$ "	2 B.A.
4	2 B.A.	2 B.A.	$\frac{1}{4}$ "	$\frac{1}{4}$ "	2 B.A.
5				2 B.A.	
6				2 B.A.	
R		$\frac{5}{16}$ "			
RI		$\frac{5}{16}$ "			

Operation

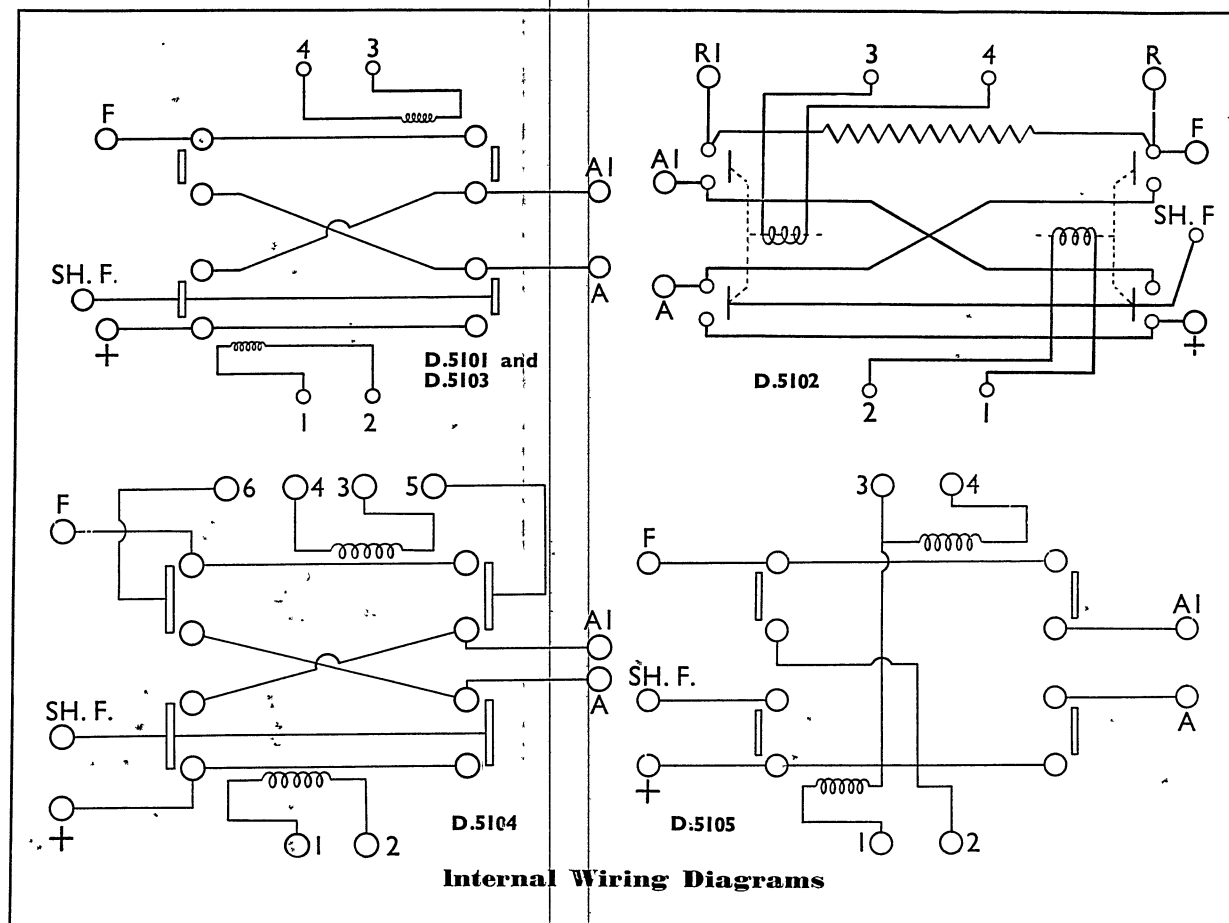
The energising of a selected solenoid by means of remote push-button or other selecting device results in the closing of one or other of two armature circuits and the field circuit(s) through the contacts of the switch, and a consequent particular direction of rotation of the motor armature. The screw at the centre of the rocker provides adjustment of the return-spring compression and so determines the operating voltage of the switch.

Periodic Inspection

The contacts should be cleaned periodically with benzine, and if pitted may be lightly stoned and finished to a smooth surface—flat in the case of the fixed contacts and rounded in the case of the moving contacts. Ensure security of all connecting terminals.

PRICE ONE SHILLING "Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements. 27.10.53." JUNE 1953

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Servicing

In view of the critical nature of the conditions under which these units must be adjusted and the necessity for special testing equipment it is strongly recommended that, if a fault develops, the unit should be returned to Rotax Limited, where it will receive prompt attention by our Repair Organisation.

However, where adequate repair facilities exist, detailed servicing instructions can be obtained on requesting Service Leaflet No. 59 from :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
BOUVIERIE STREET
MELBOURNE, N. 3
AUSTRALIA
Telephone : F.J. 4687

ROTAX LIMITED
WILLESDEN JUNCTION
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LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
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Telephone : WALNUT 3435

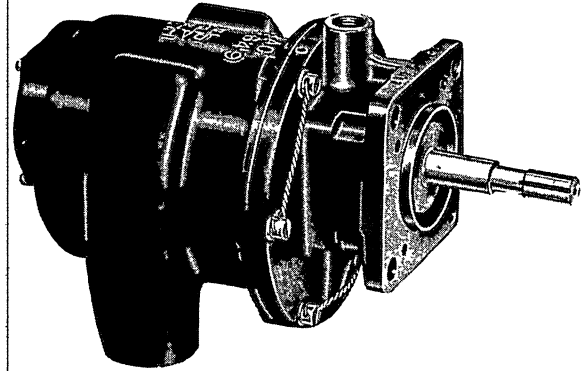
SUBJECT: Vacuum Instrument Pump

TYPE: M.0106

DATA:

MOUNTING : Flange mounting; four $\frac{9}{32}$ " dia. holes whose centres form a 1.875" square.

WEIGHT : 4 lb.



Description

The type M.0106 pumps are of the rotary sliding vane, reversible type designed for mounting on standard engine vacuum pump drives. The design of the pump is such that a clearance is maintained between the rotor and the pump body, thereby eliminating the possibility of trapping oil in the pump interior.

Moulded composition vanes, centrifugally actuated and lapped to fit the rotor slots, maintain a seal between the pump body and vanes. With this type of construction the interior of the pump body may be re-ground, in the event of scoring, without any loss in pump efficiency.

The pump body is of nickel cast-iron and incorporates $\frac{3}{8}$ " British Standard parallel pipe threaded intake and exhaust ports for connection to $\frac{1}{2}$ " O.D. tubing. One end of the ball bearing mounted steel rotor is supported in the pump body, the other end being supported by the heat-treated aluminium alloy mounting head in which is incorporated a nickel cast-iron liner.

A laminated shim is provided in the pump body behind the ball bearing to maintain the proper end clearance between the rotor and housing. A $\frac{1}{8}$ " pipe threaded connection is provided on the mounting head for the attachment of a $\frac{1}{8}$ " external oil line. Oil is supplied to the pump body under a pressure of from at least 40 to 60 lb./sq. in. either by means of the external oil connection or through an oil hole provided in the pump mounting flange, in which case the external oil line may be eliminated. A $\frac{1}{8}$ " air vent connection located opposite the external oil connection is adjacent to and integral with the pump mounting flange. The air vent should be connected

to a "Tee" in the pressure side of the pump in order to equalize pressure in the pump coupling chamber, thereby counteracting engine suction or pressure, which would ordinarily tend to suck or force oil into or out of the pump.

A drive coupling of the splined type, six deep splines $\frac{1}{2}$ " nominal diameter in accordance with B.S. Spec. A.20, Table 3, incorporating a laminated bar spring transmits torque from the driving member of the engine to the pump rotor and at the same time absorbs any torsional vibration. The coupling is designed to withstand a shear loading of 45 to 60 lb.ft.

An oil metering device consisting of a bronze oil ring, is pinned to the rotor shaft and permitted to float axially. Four coil springs inserted in the oil ring are equally spaced and bear against the pump rotor, thus providing a constant pressure on the oil ring, which is lapped to ensure a perfect contact with the liner in the mounting head.

Operation

The Type M.0106 engine-driven vacuum instrument pump, when operated over a speed range of from 1,500 to 4,000 r.p.m. will provide sufficient suction, when used in conjunction with a suction regulating valve, for the operation of a complete set of commonly used gyroscopic navigating instruments consisting of a Turn and Bank Indicator, Directional Gyro and Artificial Horizon. Maximum permissible pump speed for "Take-off" is 4,000 r.p.m.

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PRICE ONE SHILLING

JANUARY 1953

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SUBJECT: Overvoltage Relay

TYPE: F.5002

DATA:

Overvoltage Setting :	27 \pm .5 volts (Field)
Drop-out Voltage Setting :	6.0 volts max.
Resistance of Operating Coil Circuit :	228 ohms \pm 10%
Resistance of Impulse Coil Circuit :	36 ohms \pm 5%
Weight :	16.5 oz.
Mounting :	Two .193" dia. holes counterbored .377" dia. x .218" deep, positioned in diametrically opposite corners, whose centres form a rectangular shape 2.718" x 2.500".
Electrical Connection :	4 B.A. terminals.
Operative Temperature Range :	-70°C. to +50°C.

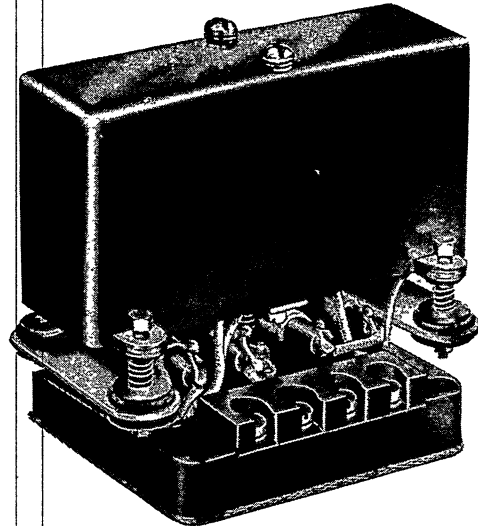
Description

This unit has been designed as a protective relay for use in 28 volt D.C. generating systems to disconnect a generator from the bus-bar in the event of an over-voltage. In order to obtain discrimination where two or more generators are being run in parallel, use is made of the excessive field voltage of the overvolting generator.

The unit comprises an impulse relay, operating relay and contact arrangement carried on a paper bakelite mounting plate which is attached to a rectangular moulded bakelite base by a flexible anti-vibration mounting and anchored to this base by means of a centre spring.

*Swamp and field resistors are mounted on top of the base moulding and two miniature festoon type bulbs are fitted, by means of spring clip bracket assemblies, in the recessed underside of the base moulding and are protected by an insulated baseplate.

The relays and contact assemblies are enclosed and protected by a light metal cover which is secured by two captive screws. Interconnection between the relays etc., and the terminals in the base are made by flexible leads routed via holes in both the paper bakelite plate and moulded base.



Electrical connection is by way of 4 B.A. terminals, and provision is made for mounting the unit by two .193" dia. holes situated in diametrically opposite corners of the moulded base whose centres form a rectangular shape 2.718" x 2.500". The unit may be installed in any position except with its base uppermost.

Total weight of the relay is 16.5 oz.

Operation

When the field voltage, applied to terminals 8 and 3, rises above 27.5 volts the impulse relay closes, connecting the bus-bar positive from terminal 4 to the coil of the operating relay which, on operation, opens the contacts between terminals 6 and 8 and inserts a resistor of 440 ohms in series with the generator field. The contacts between terminals 1 and 2 also open, disconnecting the positive supply from the voltage pick-up relay, thus opening the main contactor and isolating the generator from the bus-bar. A third pair of "normally open" contacts on the operating relay maintains the positive supply to its coil, retaining the unit in the "tripped" condition after the impulse relay has dropped out when the field voltage drops to below 6 volts.

To avoid the loss of a generator due to transient over-voltages, the impulse relay is given a short delay by shunting the coil with two 6 volt 3 watt lamp filaments in series. Sustained overvoltage will cause the shunt

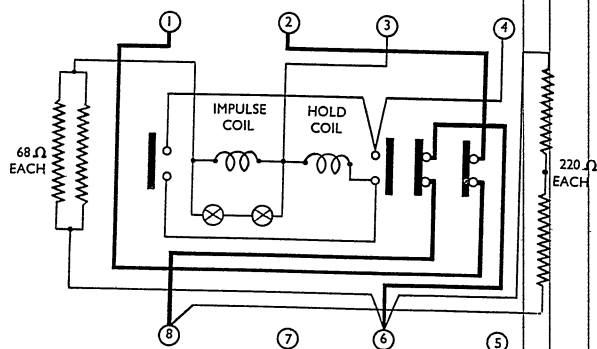
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DECEMBER 1953

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resistance to increase and permit the necessary value of operating current to flow in the relay coil.



Internal wiring diagram

Resetting

The positive supply to terminal 4 is connected via a normally closed reset switch. If an overvoltage has automatically disconnected a generator from the busbar, an attempt may be made to reconnect the generator by moving the reset switch to the "open" position and then returning it to normal. This attempt will only succeed if the cause of the overvoltage has been cleared.

Periodic Inspection

These relays are correctly adjusted and tested before leaving the factory and should require but little attention between overhauls provided they are not maltreated. Providing a relay controls its associated equipment in the desired manner it can be passed for further use.

However, a general visual inspection should be made periodically to ensure that the relay has not sustained any apparent physical damage and that all terminal connections are clean and secure.

The cover should be removed and all contacts examined for signs of pitting or burning, which, if found to be excessive, will necessitate the removal of the relay from the aircraft for servicing or replacement.

Servicing

Where test equipment is not available no attempt should be made to service or dismantle a relay. It should however, be replaced by a new one and the operative unit returned to our nearest Service Department where it will receive prompt attention by our Repair Organisation.

In cases where test equipment is available, apply for Rotax Service Leaflet No. S.L.61 for full servicing instructions.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to:—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
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MELBOURNE, N. 3
AUSTRALIA

Telephone : F.J. 4687

ROTAX LIMITED
HEMEL HEMPSTEAD
HERTFORDSHIRE
ENGLAND

Telephone : BOXMOOR 4444

LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA

Telephone : WALNUT 3435

Technical enquiries should be addressed to:—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10 • ENGLAND
ELGar 7777

SUBJECT: Differential Relays

TYPES: F.3901/I, F.3902/I,
F.3903/I, F.3904/I,
& F.3905/I

DATA:

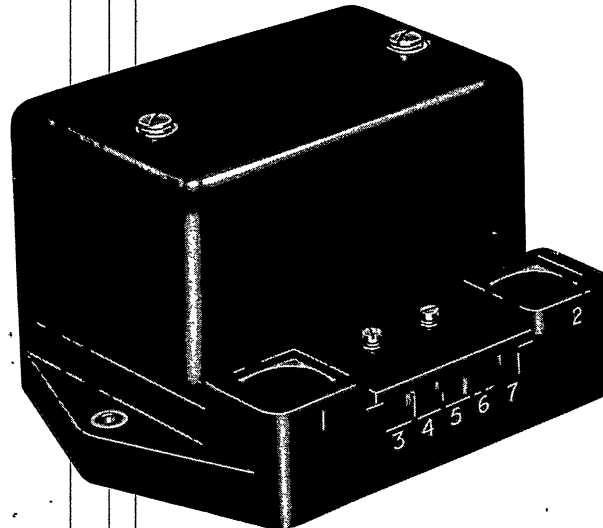
Rating:

F.3901/I :	28 volt	200 amperes
F.3902/I :	112 volt	200 amperes
F.3903/I :	28 volt	400 amperes
F.3904/I :	112 volt	400 amperes

Dimensions:

Height :	0.3 to 0.6 volt
Width :	3.5 to 4.0 volt

B.A. fixing holes at 4.812" centres



The primary purpose of operating an undervolt relay, which connects the aircraft to the busbar when a predetermined voltage has been reached between the generator and the busbar.

Mounted on a moulded base, the polarised relay comprises an armature, held stable in a permanent magnet field and is encircled at opposite ends by a voltage coil and a series current coil which consists of a single turn of heavy gauge copper strip. The voltage coil is normally connected between the generator and the busbar via an external undervolt relay.

A light alloy cover, retained by two 2 B.A. studs, completely shrouds the relay. Electrical connections are brought out to a terminal block in the base, and consist of two 3/16" B.S.F. terminals for connection to the main generating circuit, and five 4 B.A. terminals recessed into the base.

Total weight of the relay is 2 lb. and it can be operated, mounted in any position, in temperatures between plus and minus 70°C. at altitudes up to 50,000 ft.

Operation

When the generator voltage reaches a predetermined value, the externally fitted undervolt relay connects the generator supply to the voltage coil via terminals 3 and 4, terminals 1 and 3 being internally linked. When the generator voltage rises to a value higher than that of the busbar by a predetermined amount the voltage across terminals 4 and 5 is at the same value and causes a movement of the armature to close the contacts between terminals 6 and 7. This energises the operating coil of the external contactor via an external supply, the contactor thus connects the generator, via terminals 1 and 2 to the busbar. The current coil thereby carries the load current and assists the magnetic system to hold the armature closed.

A reverse current through the coil produces a reversal of flux in the armature, causing it to pivot to the "contact open" position, thereby tripping out the external contactor.

Installation

Capable of being mounted in any position, the units

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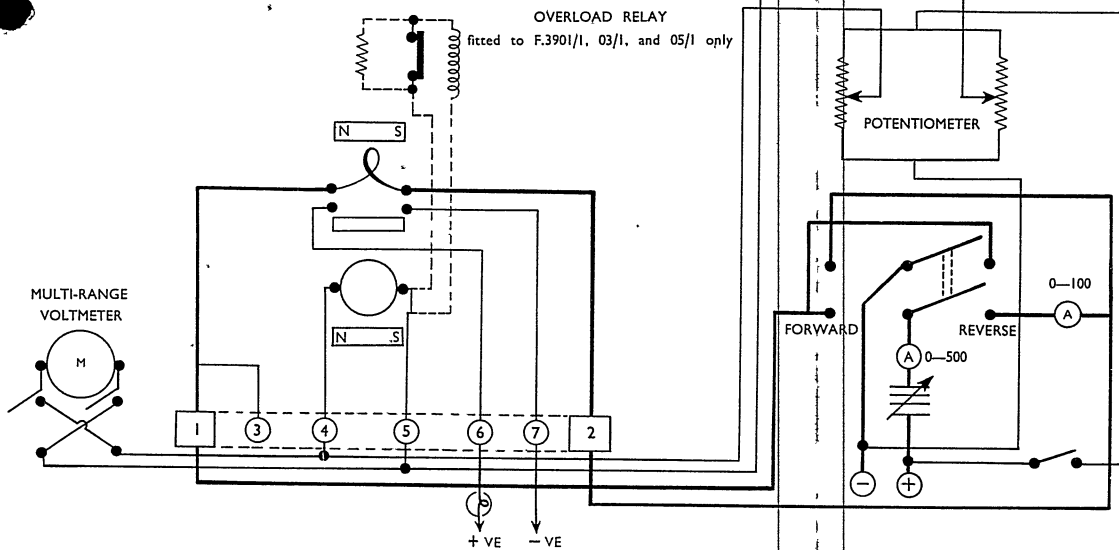
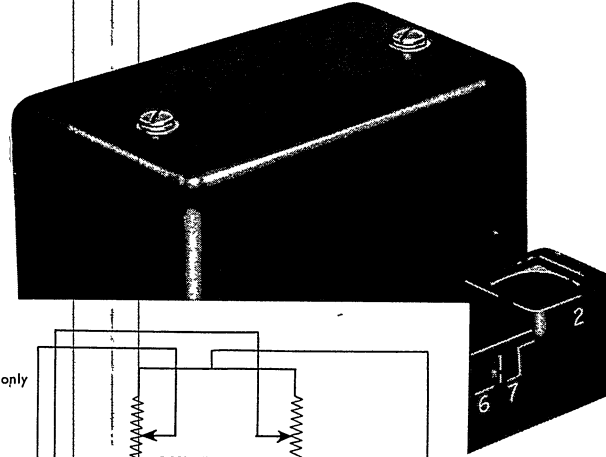
SUBJECT: Differential Relays

TYPES: F.3901/I, F.3902/I,
F.3903/I, F.3904/I,
& F.3905/I

DATA:

Rating:

F.3901/I :	28 volt	200 amperes
F.3902/I :	112 volt	200 amperes
F.3903/I, 05/I :	28 volt	400 amperes
F.3904/I :	112 volt	400 amperes



voltage coil and a series current coil which consists of a single turn of heavy gauge copper strip. The voltage coil is normally connected between the generator and the busbar via an external undervolt relay.

A light alloy cover, retained by two 2 B.A. studs, completely shrouds the relay. Electrical connections are brought out to a terminal block in the base, and consist of two .375" B.S.F. terminals for connection to the main generating circuit, and five 4 B.A. terminals recessed into the base.

Total weight of the relay is 2 lb. and it can be operated, mounted in any position, in temperatures between plus and minus 70°C. at altitudes up to 50,000 ft.

the operating coil of the external contactor via an external supply, the contactor thus connects the generator, via terminals 1 and 2 to the busbar. The current coil thereby carries the load current and assists the magnetic system to hold the armature closed.

A reverse current through the coil produces a reversal of flux in the armature, causing it to pivot to the "contact open" position, thereby tripping out the external contactor.

Installation

Capable of being mounted in any position, the units

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operate satisfactorily in air temperatures between plus or minus 70°C.

Two 2 B.A. mounting holes at centres of 4.812" are provided in the moulded base which measures 5.5" by 4". The total height of the unit is 3.125".

Full details of the installation can be found in the aircraft manufacturer's handbook concerning the aircraft in which the unit is used.

Periodic Inspection

Assuming that the relays have been correctly installed and operated, their construction is such that they require little or no attention in service. The almost total absence of moving parts makes it unnecessary to remove the cover if the unit is functioning satisfactorily.

Inspect the cover and moulding for signs of visual damage and ensure that the terminals and retaining screws are secure.

Note : It is not advisable to interfere unnecessarily with the relay. This has been originally set to operate correctly within the limits of differential voltage quoted on the nameplate.

If it becomes necessary to readjust the relay setting, refer to Rotax Service Leaflet No. S.L. 64, where the procedure is fully explained.

Servicing

If test equipment is not available, no attempt should be made to service or dismantle the unit. It should, however, be replaced by a new one and the inoperative equipment returned to our nearest Service Department, where it will be promptly dealt with by our Repair Organisation.

In cases where test equipment is available, apply for Rotax Service Leaflet No. S.L.64 for full servicing details.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

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Telephone : F.J. 4687

ROTAX LIMITED
HEMEL HEMPSTEAD
HERTFORDSHIRE
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Telephone : BOXMOOR 4444

LUCAS-ROTAX LIMITED
MONTREAL AIRPORT
DORVAL, P.Q.
CANADA

Telephone : WALNUT 3435

Technical enquiries should be addressed to :

TECHNICAL SALES DEPARTMENT

ROTAX LTD • WILLESDEN JUNCTION • LONDON N.W.10 • ENGLAND

ELGar 7777

SUBJECT: Single Pole, 3-way Changeover Switches

TYPES: D.10001 A.M. Ref. 5CW/4612
D.10002 A.M. Ref. 5CW/4861
D.10003 A.M. Ref. 5CW/4768

DATA:

RATING : 20 amperes continuous.

MOUNTING : Four holes tapped 4 B.A. x .187" deep, whose centres form a rectangular shape 1.580" x .860".

WEIGHT : D.10001 and 02: 3.75 oz.
D.10003: 4.00 oz.

OPERATIVE TEMPERATURE RANGE : - 65°C. to +70°C.

Description

This range of cam operated switches has been designed in a simple and compact manner for 3-way changeover operation in 28 volt circuits carrying currents of up to 20 amperes continuously.

In general appearance the switches are similar, the only difference being in their action. The variations are as follows :—

- D.10001 : 3-way single-pole changeover, no off position. Common terminal No. 4 made to terminal No. 2 in centre position.
- D.10002 : As D.10001 but with spring return from both sides.
- D.10003 : As D.10002 but with dolly locking device on centre position.

Each switch comprises a moulded bakelite casing, reinforced for added strength, which houses the cam mechanism, moving contacts and moulded base assembly containing the fixed contacts and terminal inserts.

The arrangement of the moving contacts is such, that the two contact carriers are positioned side by side and pivoted centrally, both carriers having a contact surface at each end. Corresponding to each of these moving contacts is a fixed contact fitted to the moulded base.

Each contact carrier is operated by a cam mechanism, via an actuating dolly, both dollies being operated simultaneously by virtue of a moulded external link.

The internal connections are so arranged that, with the switch dolly in the central position, one contact of each carrier mates with its respective fixed contact, thus connecting the common terminal 4 through to

terminal 2. Movement of the dolly towards terminals 1 or 3 connects terminal 4 to terminals 1 and 3 respectively. In the case of the type D.10003 switch, the dolly is locked when in the central position; thus necessitating its release, by pulling out slightly, before a circuit changeover can be effected.

Electrical connections are made at the rear of the switch via 4 B.A. combined screw and washer terminals, which are capable of accommodating cables of up to 19 amperes rating. These are totally enclosed and protected by a moulded cover secured by two screws.

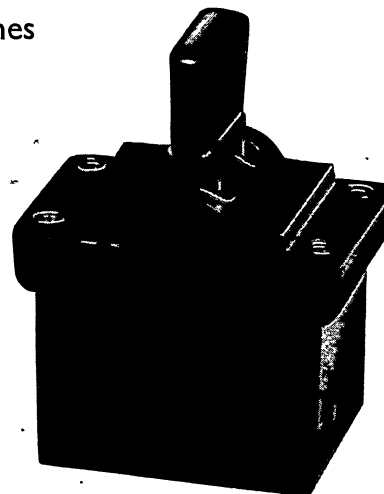
The design of these switches is such, that they may easily be panel mounted singly or in banks, the latter method thus saving space. Provision for mounting is facilitated by four 4 B.A. tapped holes .187" deep whose fixing centres form a rectangular shape 1.580" \pm .002" x .860" \pm .002". When fitted in banks a minimum clearance of .032" must be allowed between each switch. Maximum panel thickness must not exceed .930".

Total weight of these switches is D.10001 and 02 3.75 oz., D.10003, 4 oz.

Operation

The switch action is simple and positive. The internal bore of each dolly contains two spring-loaded balls, the lower one of which rests in the centre of a pivoted cam which is in turn attached to the contact carriers.

Movement of the switch dolly forces the lower spring-loaded ball over the centre of the cam face causing the moving contacts to make or break with their respective



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fixed contact and for the type D.10001 switch be maintained in this position.

In the case of the D.10002 and 03 switches, which are of the spring return type, the cam is so shaped that as soon as the switch dolly is released the spring-loaded ball returns to the mid-position of the cam, thus giving a sharp make or break between the contacts.

Periodic Inspection

It is not recommended that these switches be dismantled, as they have been sealed after manufacture and test. They should, however, be subjected to the following visual examination and test, after which, if it passes successfully, the switch can be considered as acceptable for continued service.

Remove the terminal cover and check that connections are secure and leads and grommets are in good condition.

Check the moulded body and terminal cover to ensure that they are not chipped, cracked, strained or otherwise damaged.

Operate the switch dolly in each direction to ensure

that it is free from binding and that the switch controls its associated circuits in the desired manner.

With 20 amperes flowing through the contacts, the millivolt drop across the terminals must not exceed:—

	Across Terminals		
	1 & 4	2 & 4	3 & 4
D.10001 :	40mV.	80mV.	80mV.
D.10002 & 03 :	80mV.	80mV.	80mV.

With the external connections released, and using a 250 volt "Megger," the insulation resistance between all terminals should be as follows :—

Dolly Position	Between Terminals		
	1 & 4	2 & 4	3 & 4
Towards terms. 1 & 2	Better than 50 MΩ	Better than 50 MΩ	Zero
Central	Better than 50 MΩ	Zero	Better than 50 MΩ
Towards term. 3	Zero	Better than 50 MΩ	Better than 50 MΩ

It is recommended that any switch which fails to satisfy the preceding inspections and tests should be replaced by a new one and the faulty one returned to our nearest Service Department where it will receive prompt attention by our Repair Organisation.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
BOUVERIE STREET
MELBOURNE, N. 3
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Telephone : F.J. 4687

ROTAX LIMITED
HEMEL HEMPSTEAD
HERTFORDSHIRE
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Telephone : BOXMOOR 4444

LUCAS-ROTAX LIMITED
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Technical enquiries should be addressed to :—

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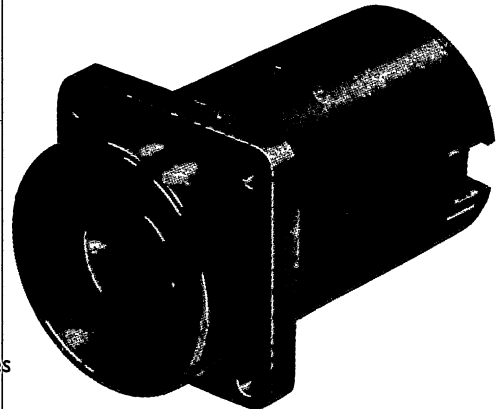
ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10 • ENGLAND

Telephone : ELGar 7777

SUBJECT: 7 ampere, Double Pole,
Push-button Switch

TYPE: D.0701 A.M. Ref. 5C/540

DATA: Weight : 1.5 oz.
Rating : 7 amperes.
Mounting : Four .120" holes whose centres
form a .960" square.



Description

Used extensively in a wide variety of applications where the maximum contact current does not exceed seven amperes, these light yet robust switches have been constructed to give long, reliable service with the absolute minimum of attention.

Contained in a cylindrical moulding, the switch comprises four leaf contacts which are connected by means of a spring-loaded, finger operated plunger, housed in a moulded shroud.

Electrical connection to the switch is made via four 4 B.A. combined screws and washers which are contained in a recessed terminal block at the base of the switch moulding. Polarity identification is engraved in the terminal block and the whole is protected by a moulded cover, retained in position by a 4 B.A. countersunk screw.

Periodic Inspection

The construction of the switch renders periodic inspection of the components unnecessary. A visual inspection of the switch should be made, and care taken to ascertain that cracks or signs of other physical damage are not in evidence. Ensure that the connections are clean and secure and show no signs of corrosion. Replace the switch by a new unit if damaged beyond economic repair.

Should it be necessary to dismantle the switch, unscrew the shroud, this allows the spring and plunger

to be removed. All contact surfaces are then easily accessible for examination and cleaning.

The component parts of the switch will, under normal circumstances, remain serviceable throughout the life of the switch. If necessary the spring can be ordered under Part Number N.56048. The plunger, Part Number N.56046, need only be changed if it is considered inadvisable to dress the contact surfaces.

Testing

1. Operate the switch six times to ensure correct functioning of the return spring, there should be no tendency for the switch to stick, the action must be positive and smooth.
2. Measure the length of stroke required to make contact, this should not be in excess of one-eighth of an inch. Apply a side load to the push-button whilst the contact is made and ensure that the circuit is not broken.
3. With seven amperes flowing through each pole, the voltage drop across each pair of contacts should not exceed 100 millivolts.
4. With a 250 volt "Megger" check the insulation resistance between all terminals with the switch open and between each circuit with the switch closed. The reading obtained should be a minimum of 20 megohms.

Discard any switch which fails to pass any of the foregoing tests and replace by a new unit.

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MARCH 1954

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of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
BOUVERIE STREET
MELBOURNE, N. 3
AUSTRALIA

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ENGLAND

Telephone: BOXMOOR 4444

LUCAS-ROTAX LIMITED
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DORVAL, P.Q.
CANADA

Telephone : WALNUT 3435

Technical enquiries should be addressed to:—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W. 10 • ENGLAND
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SUBJECT: Single Acting Solenoid Switch

TYPE: D.2708

DATA:

Rating :	170 amperes for 15 minutes.
Operating Coil Voltage :	29 volts D.C. max.
Operating Coil Resistance :	26 ohms \pm 5%
Mounting :	Foot, with two .234" dia. holes spaced at 2.375" between centres.
Weight :	2.25 lb.
Electrical Connections :	$\frac{5}{16}$ " B.S.F. main terminals. 3 B.A. operating coil terminals.

Description

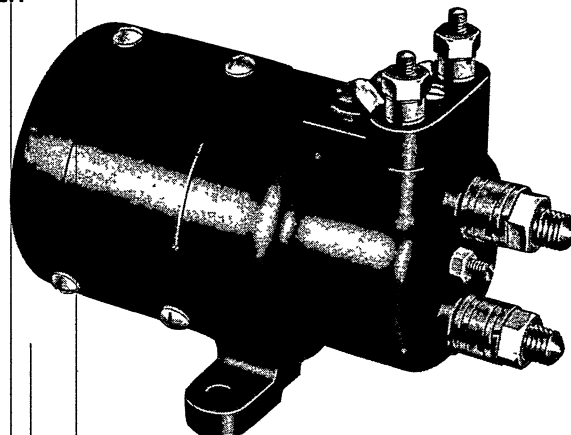
This single acting solenoid switch has been designed to cover the requirements of heavy duty, single-pole switching in D.C. circuits where the current flow does not exceed 170 amperes. The rating under this condition being 15 minutes.

Its design is neat and compact, the overall dimensions being 4.718" long and 3.000" wide by 3.343" deep, thus enabling a mounting position to be selected which will reduce the heavy duty cable run to an absolute minimum.

The main body of the switch is machined from a duralumin casting, of which the mounting feet form an integral part, and which is closed at one end. At this end are positioned the fixed contacts, insulating plate, helical return spring and its adjusting screw, and mounted externally on a machined flat is a 2-way terminal block for the operating coil connections. Just inside the open end is part of the coil assembly, pole-piece and coil cup, the latter abutting a shoulder machined on the inside of the body casting, with the spindle and armature assembly and movable moulded contact. A second spring, conical in shape, is positioned between the movable contact and the pole-piece to allow the movable contact to have a semi-floating fit on the spindle and armature assembly.

A circular hole in the top of the body casting, in which is fitted a rubber grommet, provides an exit for the coil leads to the terminal block.

Forming an extension to the main body to facilitate the remainder of the coil assembly, pole-piece and



coil cup is a cylindrical shaped housing. This is spigotted to the main body for accurate alignment and is secured by three screws.

A cover is fitted to the open end of this housing and secured by three screws. These screws, together with the three housing securing screws, pass through the housing and body castings into the coil cup thus locating the coil assembly accurately.

Mounting of the switch is achieved by the two integrally cast feet in which are drilled two .234" dia. holes spaced at 2.375" centres. It is recommended that, wherever possible, the switch should be installed with the main terminals uppermost.

Electrical connection to the coil is via two 3 B.A. terminals and for the heavy duty cable connections there are two $\frac{5}{16}$ " B.S.F. terminals. Cable lugs and rubber terminal covers are supplied separately.

Total weight of the unit is 2.25 lb.

Operation

When current passes through the solenoid, the spindle and armature assembly is drawn inwards causing the helical return spring to come under pressure and the moulded contact plate to bridge the fixed contacts. Further movement of the spindle and armature assembly compresses the conical spring behind the contact plate so that the contact plate lies evenly across, and in good contact with, the fixed contacts.

After the current through the solenoid is broken the spindle and armature assembly returns to its position of rest. The first movement of the armature does not

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lift the contact plate immediately from the fixed contacts as the conical spring is, at the moment, returning to its normal position, thereby retaining the contact plate in the closed position. By the time the bevelled nut, on the end of the spindle and armature assembly reaches the contact plate, the spindle and armature assembly is travelling at such a speed that it strikes the contact plate away from the fixed contacts, thus making a very rapid break.

Periodic Inspection

The construction of this switch is such, that it requires little or no attention between overhauls, and provided it controls its associated circuit or equipment in the desired manner it may be considered as satisfactory and passed for further use.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX. (AUST.) PTY. LTD
NEPEAN HIGHWAY
CHELTENHAM, S. 22
VICTORIA

Telephone : XF 1381

ROTAX LIMITED
HEMEL HEMPSTEAD
HERTFORDSHIRE
ENGLAND

Telephone : BOXMOOR 4444

LUCAS-ROTAX LIMITED
5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA

Telephone : BY 6500-09

Technical enquiries should be addressed to :—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED · WILLESDEN JUNCTION · LONDON N.W. 10 · ENGLAND
ELGar 7777

However, a general visual examination should be made periodically to ensure that the switch has not sustained any physical damage and that the leads to the terminals are clean and secure.

Servicing

If test equipment is not available no attempt should be made to dismantle the switch. It should, however, be replaced by a new one and the faulty switch returned to our nearest Service Department, where it will receive prompt attention by our Repair Organisation.

In cases where test equipment is available, apply for Rotax Service Leaflet No. S.L.65 for full servicing details.

SUBJECT: Avro Connector and Terminal Blocks

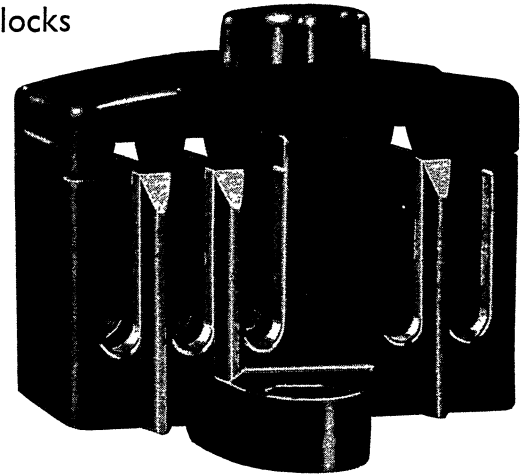
TYPES: G.3801, G.3201, and G.3202
(For A.M. Ref. Nos. see Installation Drawings)

**Type G.3801 12 Ampere
Lightweight Connector Block**

General Description

With the advent of higher voltages on modern aircraft, smaller currents can now be used to obtain the power necessary to operate the various electrical services, thus permitting lighter cables and connector blocks to be installed.

Utilising the advantages to be gained by this increase in supply voltages, the Avro Lightweight Connector Block, manufactured by Rotax, has been introduced for the junction of aircraft cables carrying up to twelve amperes, the main feature of the design being the small size of block. A connector block,



complete with cover, sockets and ferrules for ten cables, weighs approximately 1.25 oz., and a similar assembly for fifteen cables weighs 1.30 oz.

As a comparison with existing types of connector blocks, a panel made with thirty-five Avro Lightweight Connector Blocks, see Fig. 1, weighs 44% less

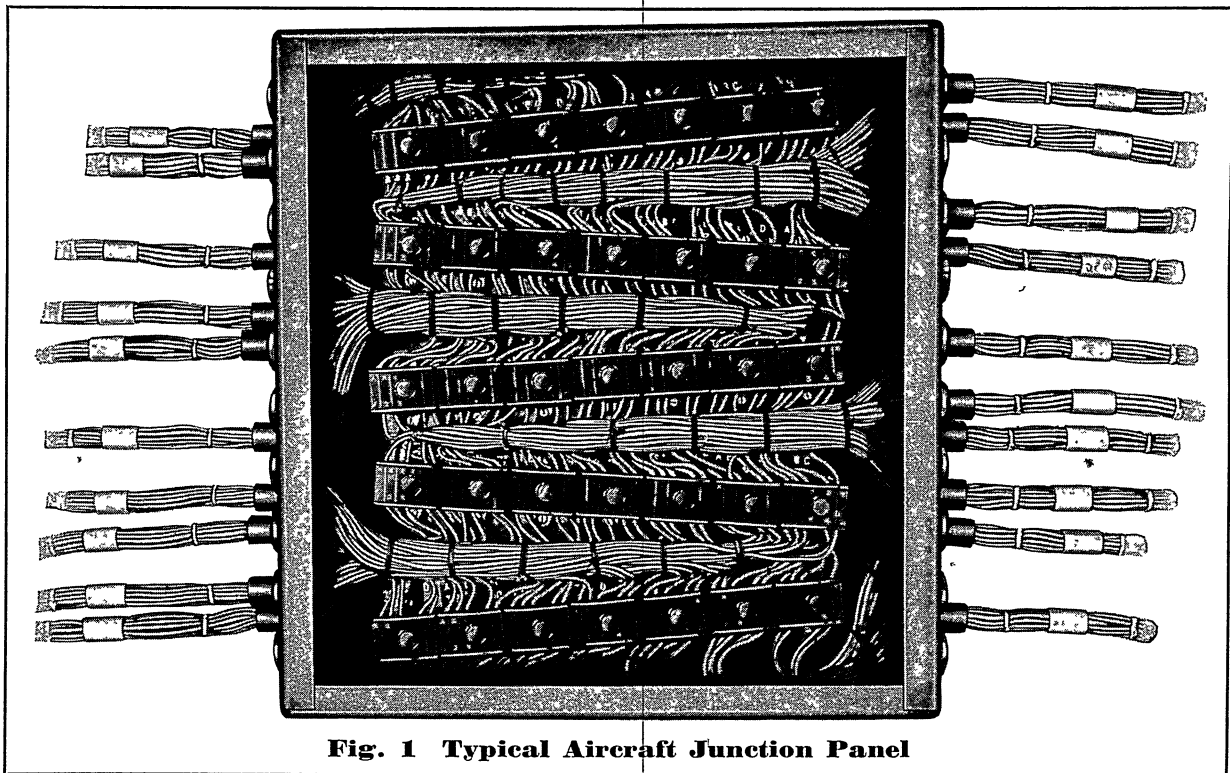


Fig. 1 Typical Aircraft Junction Panel

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REVISED AUGUST 1956

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LUCAS-ROTAX (AUSTRALIA) PTY. LTD	•	NEPEAN HIGHWAY	•	CHELTEMHAM S. 22	•	TELEPHONE XF 1381		
LUCAS-ROTAX LIMITED	•	TORONTO 13	•	CANADA	•	TELEPHONE PLYMOUTH 5-4171		

and occupies 30% less space in plan form area, than a panel fitted with the same number of standard connector blocks of a type now in use. These figures include panels and covers. For those engaged in the design of aircraft, this saving of weight and space needs no further emphasis when considering that several hundred terminal blocks are required on aircraft such as the "Britannia" and "Vulcan".

Incorporated in the design, however, are several additional improvements over other terminal blocks. Briefly, the lightweight connector block consists of a bakelite moulding, having five slots or "ways" in which cable sockets are fitted, and is provided with a cover having a captive thumbscrew fixing. Cylindrical ferrules are crimped to the ends of cables, and the method of housing and locking the cables in position is by inserting cable ends in single or double sockets. These sockets are then fitted in the slots of the connector block. Cables may enter or leave from either or both sides of the block, a provision of great assistance to those responsible for the planning of aircraft wiring layouts.

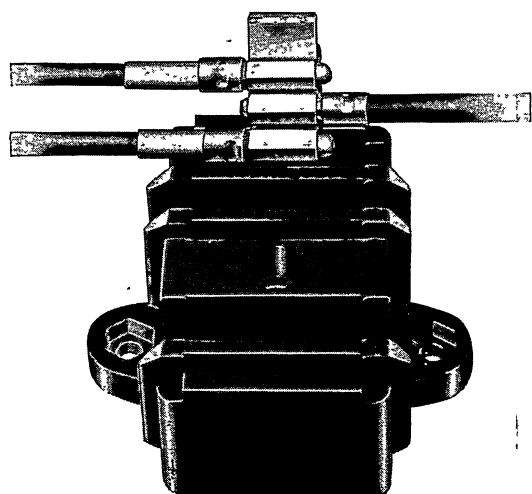


Fig. 2 Ferrules and socket correctly "mated"

If ferrules are not fully inserted in the sockets, the overall length of ferrules and sockets will exceed the distance between the shoulders of the slots, so preventing the socket being inserted in the "way". Consequently, before the cover can be secured to the block, all ferrules must be fitted correctly and maximum electrical contact is thereby obtained between cable ferrules and sockets. With the cover fitted, live parts of cables are completely shrouded, thus avoiding the possibility of short-circuits.

Page Two

The cables are locked in position in the block by the ends of the ferrules butting against the shoulders of the slots. By this arrangement, the ferrules take any mechanical stresses imposed on the cables, so preventing them from being withdrawn accidentally from the cable sockets.

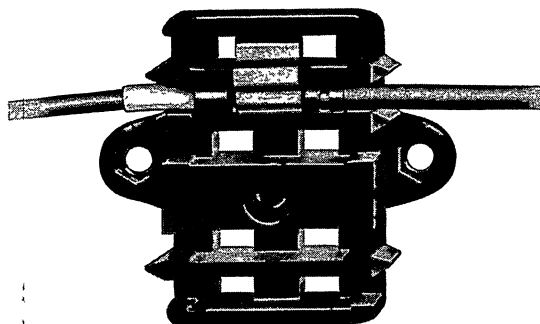


Fig. 3 Correct location of contact set

Another advantage of this block is the absence of screws and springs, so dispensing with the need for tools, and this feature, in conjunction with the captive thumbscrew fixing of the cover, permits cover and cables to be removed and replaced under service conditions by flying personnel wearing gloves.

The single cable socket accommodates three cables and occupies one slot of the connector block, whilst the double socket provides for six cables in two slots. The double socket is particularly useful as an earthing junction, and also for providing a common supply for a number of circuits in parallel. As there are five slots or "ways" the connector block can take up to fifteen cables, with a current carrying capacity of twelve amperes in each "way." With an aircraft supply voltage of 112 volts, sufficient power to operate motors up to $1\frac{1}{4}$ h.p., having an efficiency of 70%, can therefore be carried by cables in each of the five "ways" of this lightweight connector block.

Connector Block and Cover Assembly

Made from moulding powder to Specification X20H.D. or X761/5, the block and cover assembly is designed to allow maximum ventilation and drainage of moisture by means of large holes in the base of the block, and by the $\frac{1}{8}$ " gap between the base and its mounting location. This gap, obtained by bosses forming the

mounting feet, prevents any lodgement of water beneath the block.

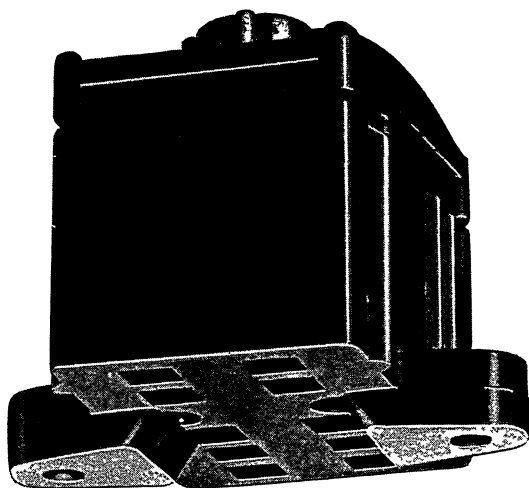


Fig. 4 View showing air-gap and drainage holes

The centralised mounting feet of the connector block are designed so that in the event of fracture of one or both flanges due to excessive strain, the block will remain in position, held by the 6 B.A. fixing bolts and the broken portions of the feet attached to the block; when similar damage occurs to a connector block having offset mounting holes, the block tends to swivel out of position.

As may be seen from Fig. 6, the provision of external mounting feet ensures that short-circuits cannot occur between the connector block fixing bolts and the live parts of cables. Also, that exceptionally long electrical leakage paths exist between the "ways" and between "ways" and earth, the maximum distance between cable sockets of adjacent "ways" being obtained by the length of slots and the central positioning of sockets. To avoid the possibility of sockets riding up the slots tongues forming part of the cover retain them in position.

The cover, which is lettered and numbered for identification purposes, is secured to the block by a captive thumbscrew which, when tightened, is locked by a spring washer fitted between the thumbscrew and cover. The cover fixing is not central, but is "handed" so that it can be replaced in one position only. This ensures that the cover markings, which comply with S.B.A.C. requirements, correspond with the correct cables and the markings on an

identification plate fitted underneath the block when installed. It will be noted that the only surface contact between cover and block is in line with the thumb-screw fixing, with the result that a gap between cover and block exists at each end. The purpose of this feature is that the cover cannot fracture due to uneven stresses when being tightened, a condition liable to occur with two or more contact areas.

When fitting a block to an aircraft or terminal block panel, the 6 B.A. fixing screws can be inserted from either side. If screws are inserted from the underside, hexagon recesses in the block mounting feet prevent locknuts from turning, so dispensing with the use of a spanner. The connector block fixing holes are on a centre line 1.360" between centres, and when assembling a bank of blocks the centre-to-centre dimension is only $1.500^{+0.010}_{-0}$, resulting in a very compact panel.

Contact Components

Two types of cable sockets can be used in conjunction with the connector block. Fig. 5 (a) shows the single socket N.113015 (A.M. Ref. 5X/6623) in which three cables can be fitted; this socket occupies one "way" of the block.

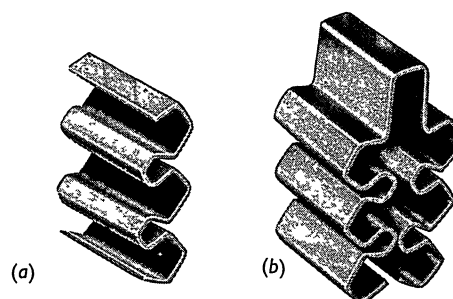


Fig. 5

The double socket N.113014 (A.M. Ref. 5X/6622) shown in Fig. 5 (b) occupies two adjacent "ways" and accommodates up to six cables. This socket is made from a single strip and bridges the separating partition. By dispensing with the need for an external "jumper" or connecting link, all metal parts remain completely shrouded when the connector block cover is in position, so obviating any possibility of short-circuits.

Both types of sockets are made to close limits from beryllium copper strip .012" thick and $\frac{1}{8}$ " wide. After forming, the sockets are heat treated which doubles the tensile strength, and silver plated to D.T.D. 919A, improving conductivity by 20%.

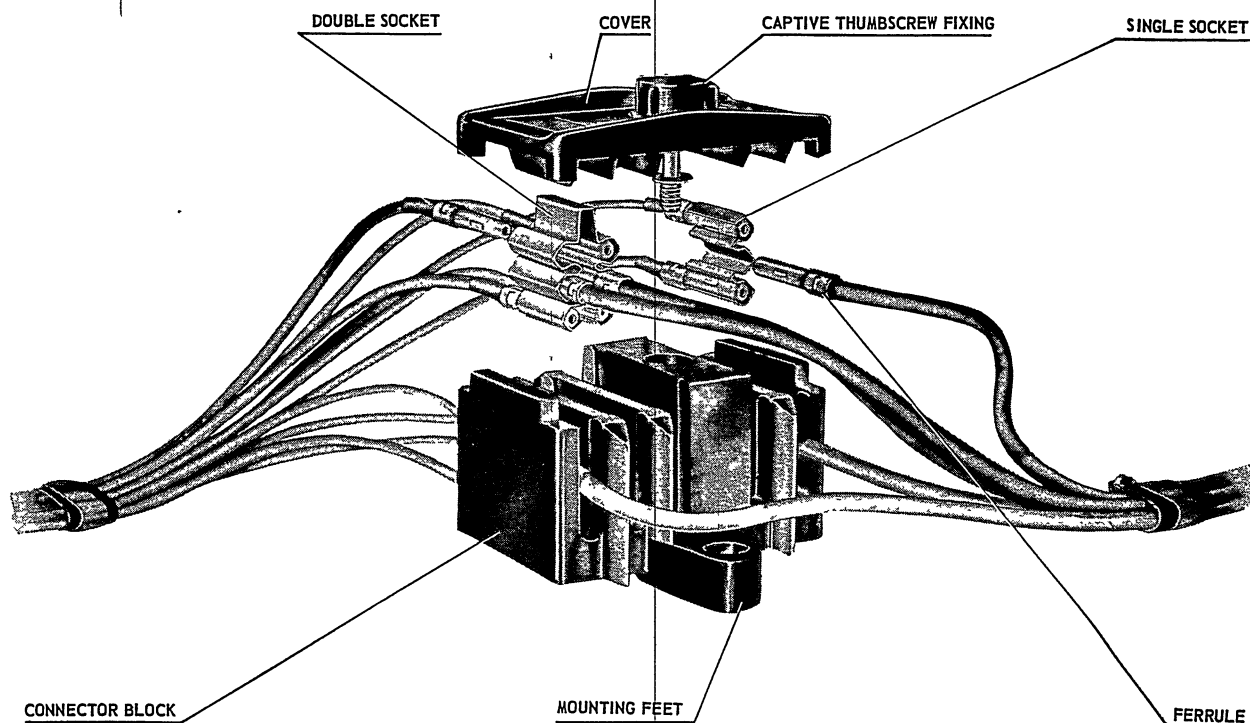


Fig. 6 Exploded View of G.3801 terminal block and connections

The shape of the socket with its self cleaning line-contact under intensified pressure, provides an ideal

see Fig. 8 (a). Both types are made of brass and silver plated to D.T.D. 919A.

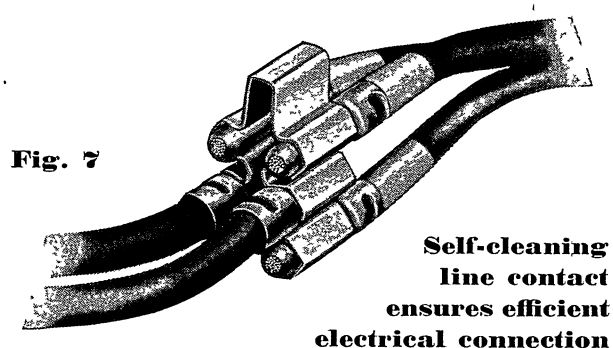


Fig. 7

electrical joint. Cable ferrules are of two types, having the same external diameters of .100" core barrel and .150" cable insulation bucket. One type, N.113013 (A.M. Ref. 5X/6620), used for 9 ampere and 12 ampere PREN cables, has a larger bore and can be recognised by its sharp external shoulder, see Fig. 8(b). The other type, N.113012 (A.M. Ref. 5X/6621), is used for 4 ampere and 6 ampere PREN cables, and has a smaller bore and a chamfered external shoulder.



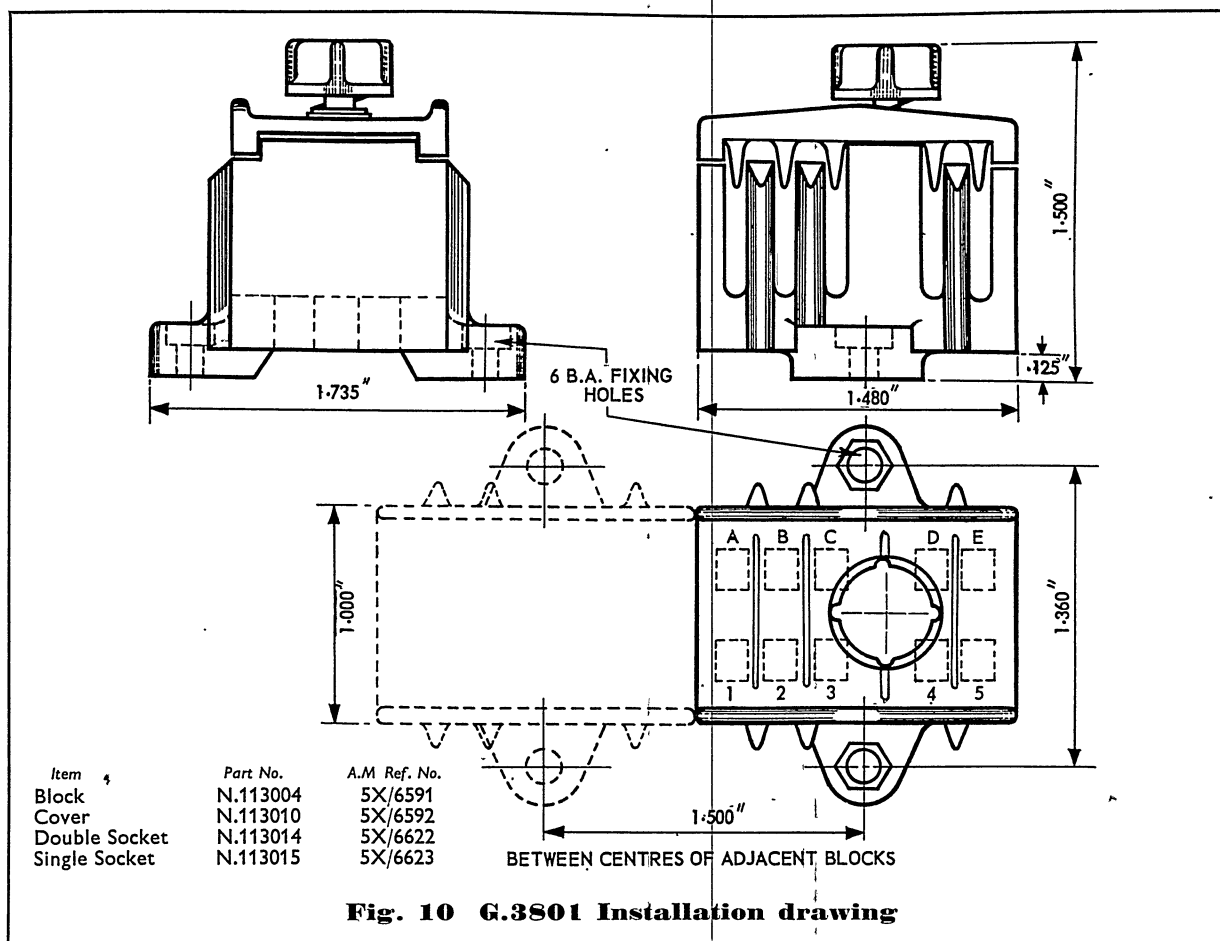
Fig. 8 Ferrules

Standard dimple crimping is used when fitting ferrules to cable ends, and to ensure a good grip on the cable both types are rifled. The ferrule for the larger cable is tapped 9 B.A., and the other ferrule tapped 12 B.A. the crests of the threads being removed in both cases by tapping drills larger than would normally be used, so producing a rifled finish.



Fig. 9 Correctly terminated cable

In preparation for crimping, the core of all cables should be bared $\frac{3}{8}$ ". Ferrules are designed to grip the insulation in addition to the cable. Internal diameter of the insulation buckets are 0.113" and 0.128" for the 4 and 6 ampere and 9 and 12 ampere ferrules respectively.



Type G.3201 Medium-duty Two-way Terminal Block

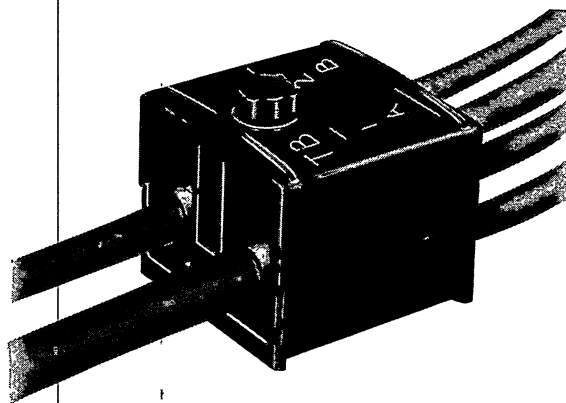
General Description

The Avro Medium-duty Two-way Terminal Block, manufactured by Rotax, has been introduced for the junction of cables fitted with the new Hexagonal. Crimping lugs having palms drilled to fit $\frac{1}{4}$ " diameter studs.

The types of cable lugs which can be accommodated in the block are as follows :—

(a) PREN CABLE LUGS

Cable Rating	Rotax Part No.	A.M. Ref. No.
24 ampere	N.104600/60	5X/6676
35 "	N.104600/14	5X/6514
50 "	N.104600/17	5X/6517
70 "	N.104600/20	5X/6520
100 "	N.104600/23	5X/6523



Page Five

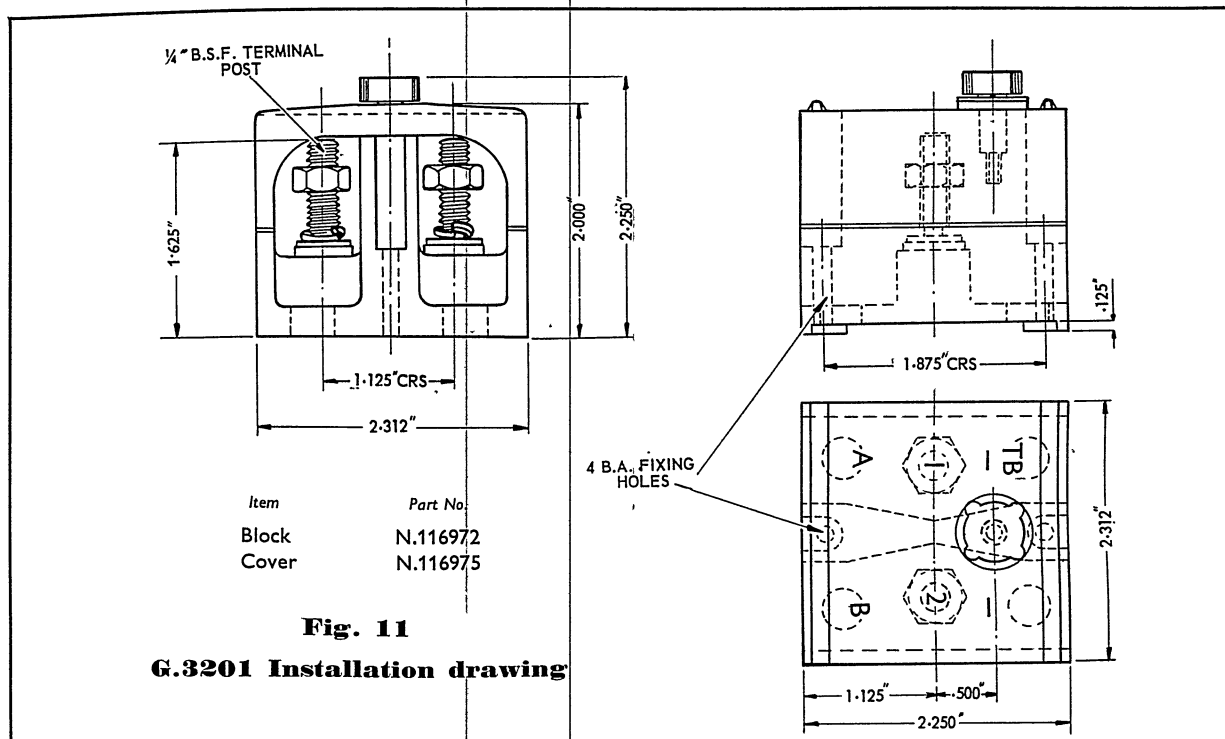


Fig. 11
G.3201 Installation drawing

(b) PRENAL CABLE LUGS

Cable Rating	Rotax Part No.	A.M. Ref. No.
35 ampere	N.104601/3	5X/6547
50 ampere	N.104601/6	5X/6550
70 ampere	N.104601/9	5X/6553
100 ampere	N.104601/12	5X/6556

The block is made of bakelite from moulding powder to specification X20H.D. or B.T.H. 107D, and consists of a base having two 4 B.A. fixing holes on a centre line 1.875" between centres and a cover secured by a captive thumbscrew. The design allows for maximum ventilation and protruding feet maintain a gap of $\frac{1}{8}$ " between the base and its mounting location so preventing accumulation of moisture. Fixing screws on the block centre line are well shrouded from live parts of cables thereby avoiding the possibility of short-circuits.

Two $\frac{1}{4}$ " B.S.F. terminal posts 1.125" between centres are mounted on steps, one on each side of the centre partition, thus forming recesses for the accommodation of cable lugs, which are fitted as shown in Fig. 12. Up to four lugs can be fitted to each post, and the outer walls of the block are low enough to allow an open-ended spanner to be used on cable lug securing nuts, should a box spanner not be available. By incorporating a thumbscrew in the design, the only

tool required when removing and replacing cover and cables is a spanner for cable locknuts.

For identification purposes, the cover is lettered and numbered, and with the captive thumbscrew being

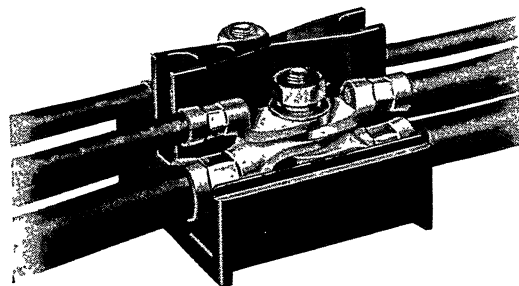


Fig. 12 G.3201 Terminal arrangement

located off-centre, the cover can be fitted in one position only, which ensures that cables correspond with the correct identification markings. The only surface contact between the cover and block is in line with the centre partition which prevents fracture of the cover due to uneven stresses when the thumbscrew is tightened.

The overall height of the block is 2.250" and plan form 2.250" x 2.312", the centre-to-centre dimension between adjacent blocks being 2.375". As a result

of a simple but effective design, this medium-duty terminal block weighs only 4.4 oz.

Type G.3202 Heavy-duty Single-way Terminal Block

General Description

The Avro Heavy-duty Single-way Terminal Block, manufactured by Rotax, has been designed for the junction of aircraft cables fitted with the new Hexagon Crimping lugs having palms drilled to fit $\frac{5}{16}$ " diameter studs.

The types of cable lugs which can be accommodated in the block are as follows:

(a) PREN CABLE LUGS

Cable Rating	Rotax Part No.	A.M. Ref. No.
24 ampere	N.104600/61	5X/6677
35 "	N.104600/15	5X/6515
50 "	N.104600/18	5X/6518
70 "	N.104600/21	5X/6521
100 "	N.104600/24	5X/6524
135 "	N.104600/27	5X/6527
150 "	N.104600/30	5X/6530
170 "	N.104600/33	5X/6533
200 "	N.104600/36	5X/6536
230 "	N.104600/39	5X/6539

(b) PRENAL CABLE LUGS

Cable Rating	Rotax Part No.	A.M. Ref. No.
35 ampere	N.104601/4	5X/6548
50 "	N.104601/7	5X/6551
70 "	N.104601/10	5X/6554
100 "	N.104601/13	5X/6557
135 "	N.104601/16	5X/6560
150 "	N.104601/19	5X/6563
170 "	N.104601/23	5X/6567
200 "	N.104601/27	5X/6571

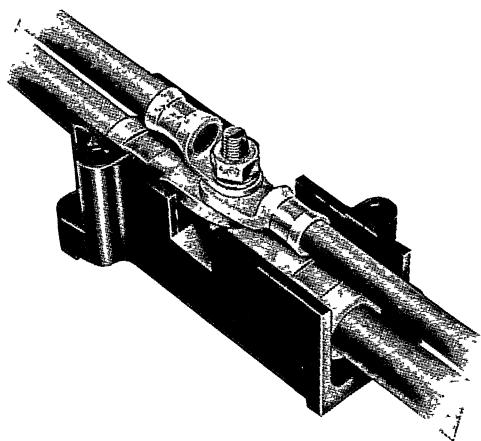
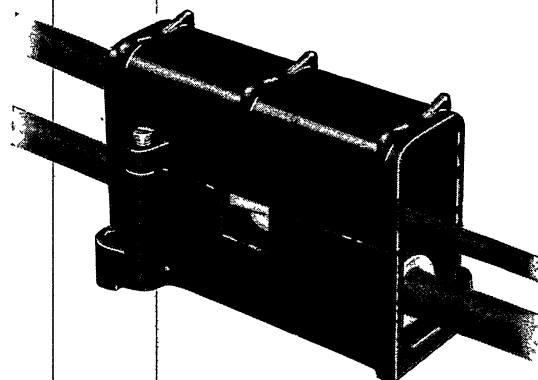


Fig. 13 G.3202 Terminal arrangement



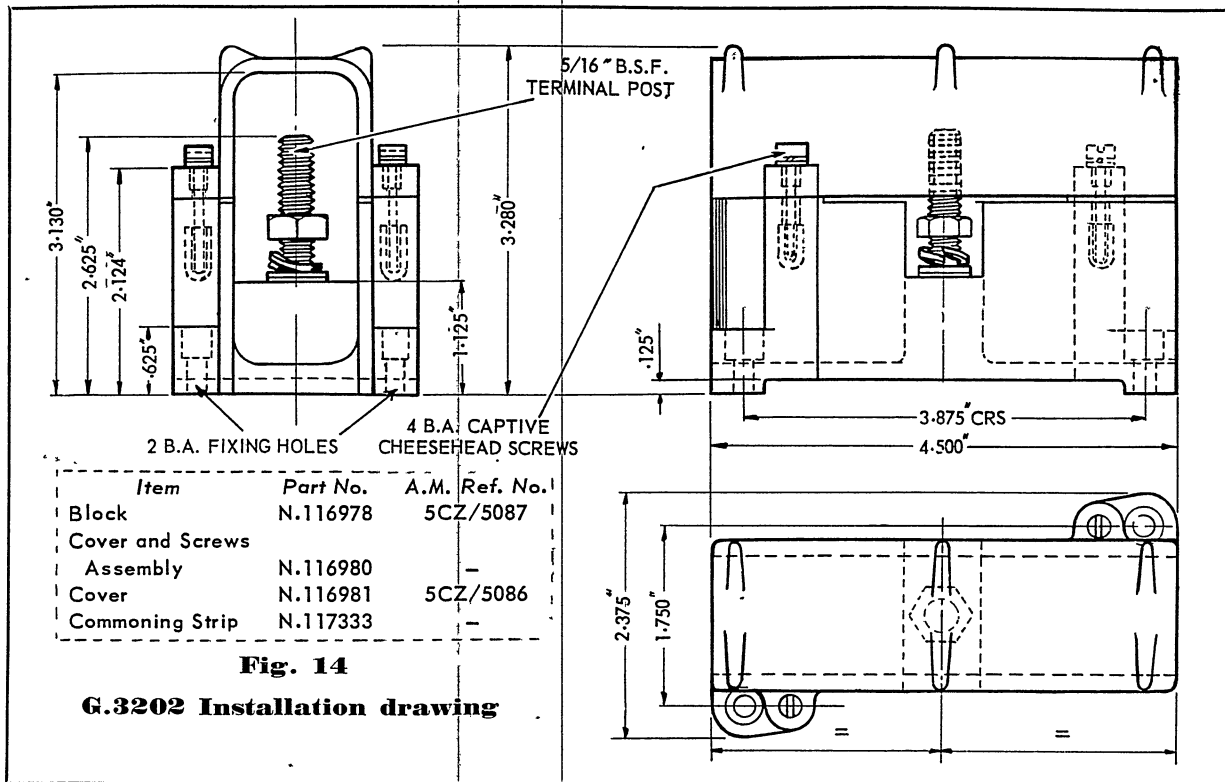
The assembly is made of bakelite moulding powder to specification X20 H.D. or B.T.H. 107D, and consists of a base having a single $\frac{5}{16}$ " B.S.F. terminal post 1.500" long, and a cover moulded with reinforcing projections. The design ensures maximum ventilation and drainage of moisture, protruding feet maintaining a gap of $\frac{1}{8}$ " underneath the base of the block.

By mounting the terminal post on a step, recesses are formed to accommodate cable lugs which are assembled as shown in Fig. 13, the capacity of the block being up to four lugs, depending on the size to be fitted. Gaps in the side walls of the base are provided for commoning strips which can be fitted between adjacent blocks so producing a useful busbar assembly.

The cover is secured to the base by two 4 B.A. cheesehead captive fixing screws, locked by spring washers. With the cover fitted, live parts of cables are completely shrouded, preventing any possibility of short-circuits.

Two 2 B.A. fixing holes, 3.875" between centres and staggered 1.750" apart, are used for mounting the terminal block. The height of the block is 3.280 and overall plan form 4.500" x 2.375", the centre-to-centre dimension between adjacent blocks being 2.000".

Despite its strong construction, incorporating all the features necessary for the junction of the largest size of aircraft cables, this heavy-duty terminal block weighs only 7.2 oz.



For further information regarding replacement parts, ferrules and crimping tools,
enquiries should be addressed to:—

TECHNICAL SALES DEPARTMENT

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SUBJECT: Oil Separator

TYPE: M.0902

DATA:

WEIGHT: 2.5 lb.

MOUNTING : Two 0.265 in. dia. holes, spaced 4.250 in. at centres, in lugs cast integral with main body of separator.

Description

This unit is designed to clean the air coming from the pump in de-icer systems and to keep the air pressure at a pre-determined value by means of a built-in pressure relief valve.

It is cast in aluminium alloy with ports, tapped $\frac{3}{4}$ " British Standard pipe thread, for the connection of inlet, outlet, and at the bottom, exhaust pipes. In the neck of the exhaust port is the adjustable spring-loaded relief valve.

The body of the separator contains a $\frac{1}{8}$ " B.S.P. pipe thread tapped hole, normally plugged, to allow the attachment of a pressure gauge when the unit is tested. Inside the body is a separate casing containing the fine copper mesh filter and two screens.

Operation

The unit is designed so that the air enters at a tangent and is first cleaned by the centrifugal action thus produced and then by the filter mentioned above. Any oil separated collects in a sump in the neck of the oil drain pipe until the pressure relief valve opens, when the oil is expelled with the excess air.

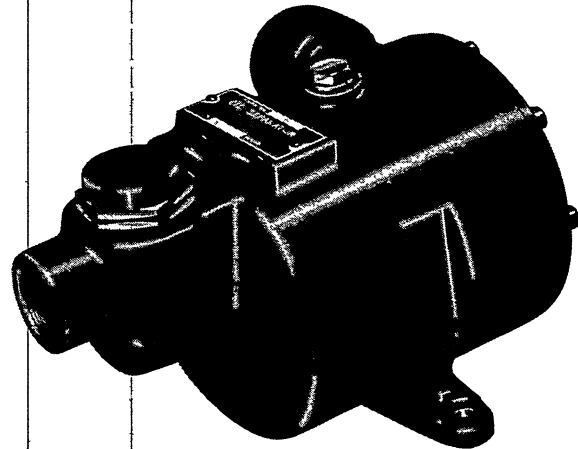
Installation

Installation of the separator should present no difficulty if the following points are borne in mind.

The unit should be mounted with the axis of the housing vertical to the horizontal of the aircraft in level flight, and with the pressure relief valve and exhaust port at the bottom.

It should be placed in the aircraft in the position specified by the aircraft manufacturer.

Where it is used in conjunction with distributor valves of the M.0600 series, the inlet pipe to the separator should come from the outlet port of the



control, or "dump" valve incorporated with the switch in the distributor.

The oil drain should be connected as specified for the particular aircraft, while the air outlet should normally lead to the distributor valve. Great care should be taken to ensure that all pipe connections are tight.

Periodic Inspection in Service

Every 250 hours

Without removing the separator from the aircraft a 0—15 lb. per sq. in. pressure gauge should be attached to the $\frac{1}{8}$ " B.S.P. pipe thread hole in the casing and enough pressure applied to the system to lift the release valve. The pressure at which this lifts should come within the tolerances specified for the system.

Apart from this no servicing or maintenance should be necessary between 1500 hour overhauls.

Servicing

If the correct test equipment is not available no attempt should be made to service or dismantle the unit. It should be replaced by a new one and the faulty equipment returned to our nearest Service Department, where it will be promptly dealt with by our Repair Organisation.

In cases where test equipment is available, apply for Service Leaflet No. 69, for full servicing details.

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements. 13/1/55."
A.R.B. Authority Ref. No. E.3093
"Amendments to this publication invalidate the approval statement unless issued by the manufacturers with the concurrence of the Air Registration Board."

PRICE ONE SHILLING

OCTOBER 1954

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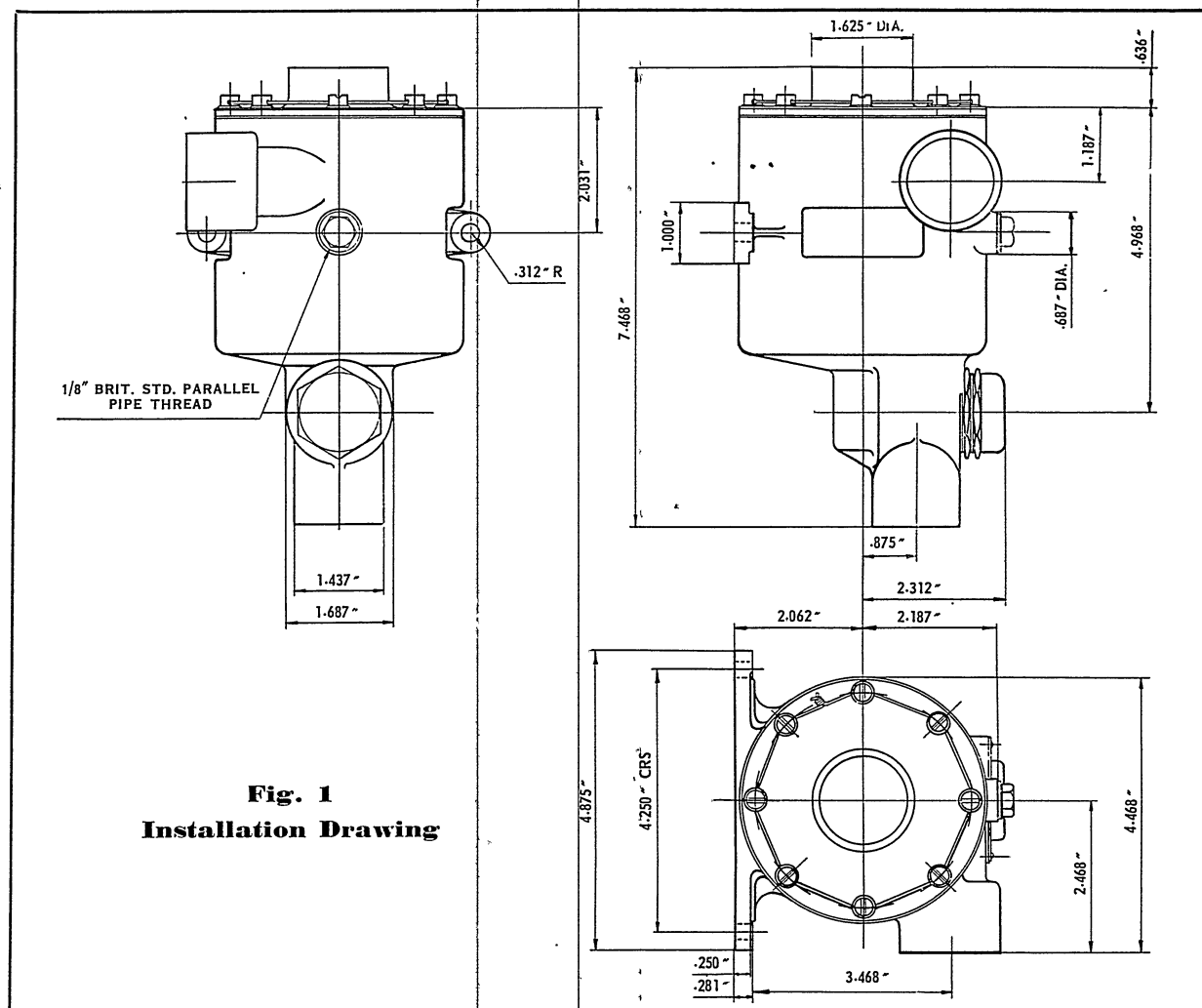


Fig. 1
Installation Drawing

For further information on the functioning, operation and maintenance
of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
NEPEAN HIGHWAY
CHELTENHAM S. 22
VICTORIA

Telephone : XF 1381

ROTAX LIMITED
HEMEL HEMPSTEAD
HERTFORDSHIRE
ENGLAND

Telephone : BOXMOOR 4444

LUCAS-ROTAX LIMITED
5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA

Telephone : BY 6500-09

Technical enquiries should be addressed to :—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10 • ENGLAND

ELGar 7777

SUBJECT: Current Balance Relays

TYPES: F.4907/1, F.4908/1, F.4910/1

DATA:

Rating : F.4907/1 : 13,000 volt/amperes, 208 volts,
400 c.p.s.
F.4908/1 : 3,200 volt/amperes, 208 volts,
400 c.p.s.
F.4910/1 : 6,000 volt/amperes, 208 volts,
400 c.p.s.

Weight : 2 lb. 3 oz.

Mounting : Brackets attached to base of unit with two
holes .203" in diameter.

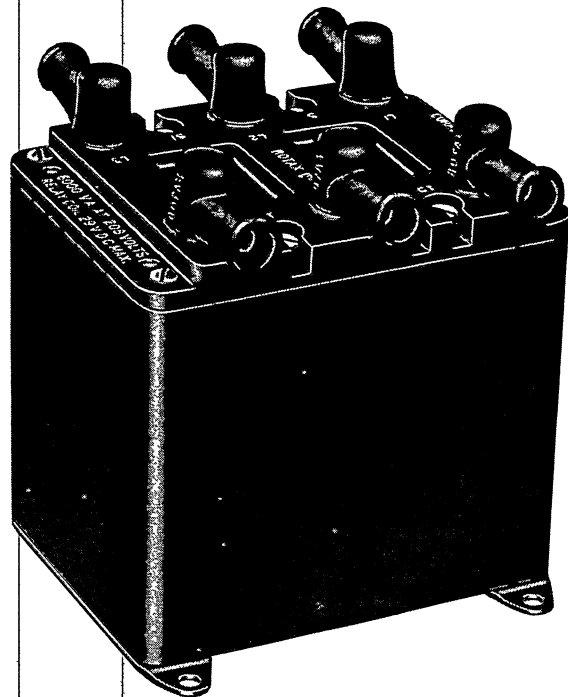
Description

This relay is designed as an effective means of protection against an unbalanced three-phase load. The relay consists of a transformer with three primary and three secondary windings and a sensing unit assembly. The output from each of the secondary windings of the transformer is rectified and connected to the sensing unit. The sensing unit operates instantaneously when an open circuit occurs on any one of the three A.C. lines, or when the line currents are approximately 80% out of balance. Connections of the three-phase supply are effected through six standard terminal lugs on the top side of the unit and the D.C. terminals are positioned between the A.C. terminal lugs.

Operation

The sensing unit consists of two relays each of which has two coils. Under normal current conditions the magnetic forces of the two coils are balanced against each other. The three primary windings of the transformer are connected, one in series with each of the A.C. lines. The outputs of the secondary windings of the transformer are each connected to a bridge rectifier.

The D.C. output from one of the rectifiers is connected to a coil of one of the relays of the sensing unit. The output from the second rectifier is connected to a coil of the second relay. The output from the third rectifier is connected to the remaining two coils which are in series one in each of the relays of the sensing unit. Should the supply to any one of the two coils in either of the relays fail or become approximately 80% out of balance one or both relays will close. When either of the relays of the sensing unit closes the trip relay in the unit is energised, the D.C. supply to the main contactor broken and the three A.C. lines open-circuited.



Periodic Inspection

Assuming that the relay has been correctly installed and operated, its construction is such that it requires little or no attention in service. Foreign matter is excluded from the body of the relay by a flush fitting cover.

Visually inspect the mouldings for cracks and deformation, check all leads and terminals for cleanliness and security of connection. Using a supply of clean dry air, blow out any dust that may be accumulated in the interior of the relay during the period of service. After every 2,000 hours service, or when any major defect is disclosed, the unit should be removed from the aircraft and completely overhauled.

Servicing

If test equipment is not available no attempt should be made to service or dismantle the unit. It should, however, be replaced by a new one and the inoperative equipment returned to our nearest Service Department, or authorised service station, where it will be promptly dealt with by our Repair Organisation. In cases where test equipment is available, apply for Rotax Service Leaflet No. S.L. 70, for full servicing details.

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements. 10/2/55."
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FEBRUARY 1955

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LUCAS-ROTAX LIMITED
5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA

Telephone : BY 6500-09

Technical enquiries should be addressed to:—/

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W. 10 • ENGLAND
ELGar 777

SUBJECT: Contactors

TYPES: D.10501
D.10502
D.10503
D.10504 A.M. Ref. 5CW/5705
D.10505
D.10506
D.10507

DATA:

Supply voltage : 28 volts D.C.
Current rating :
Main contacts : 150 amperes continuous.
Auxiliary contacts—
D.10504, 5 & 7 only: 5 amperes continuous.
Coil voltage (D.10501,
2, 4, 6 & 7) : 28 volts D.C.
(D.10503 & 5) : 7.5 volts D.C.
Electrical : Two main terminals ; $\frac{1}{4}$ "
Connections : B.S.F. studs.
Two coil terminals ; 4 B.A.
screws.
Four auxiliary terminals
(D.10504, 5 & 7) ; 4 B.A.
screws.
Mounting : Three point fixing each tapped
2 B.A. (except types D.10501
& 7). D.10501 has three
0.196" diameter holes in con-
tact cover plate. D.10507
has a four point fixing. Four
holes 3.687" x 1.875" centres,
tapped 4 B.A.
Compass Safe Distance :
(D.10501, 2, 4, 6 & 7) 25.5" for 1° deflection
(D.1053 & 5) 50" for 1° deflection
Weight : 2 lb.

Description

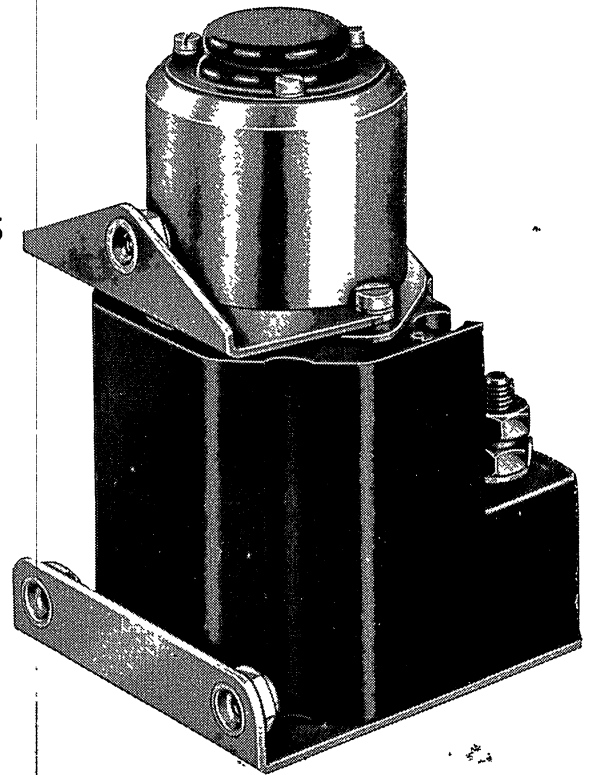
This type of balanced contactor is designed for use in aircraft circuits where the unit may be subjected to a severe force of acceleration in any direction. Under such conditions the balanced plungers maintain a substantially stable pull-in voltage and prevent inadvertent operation of the contacts. Continuous operation can be maintained over a temperature range of -70°C. to $+70^{\circ}\text{C.}$ and at altitudes of up to 60,000 ft.

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements. 11/11/55"

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OCTOBER 1955



The unit comprises a black bakelite body moulding, a solenoid, the main contact mechanism, two main terminals, two coil terminals and on D.10504, D.10505 and D.10507, four auxiliary switch terminals. Other differences in the series are the fixing arrangements all of which are similar with the exception of D.10501 and D.10507, and the solenoid coils of D.10503 and D.10505 which are wound for a lower voltage.

The fixing arrangements of D.10501 and D.10507 are specialised for the units to be fitted to particular starter units. D.10501 has three plain holes in the cover plate and D.10507 has two fabricated 16 s.w.g. aluminium brackets offering four holes tapped 4 B.A. for fixing the unit.

The core, which consists of two moving plungers as distinct from the more conventional moving plunger and fixed anvil arrangement, constitutes one riveted assembly. This assembly fits into the open bore of the coil which is in turn contained in a soft iron cylinder assembled in two halves and externally secured to the bakelite moulding by two cheese-head screws. The rear bracket is also secured by these two screws (except D.10501 which does not have a rear bracket). The moving contact plate is attached, by two spring loaded screws, to an insulated contact moulding. These are

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fastened directly to, and thus operated by, the solenoid core assembly and are pivoted as shown in the illustration. The pivot pin is supported by two duralumin pillars mounted on a flat plate which is held by four screws to the end of the soft iron cylinder enclosing the coil.

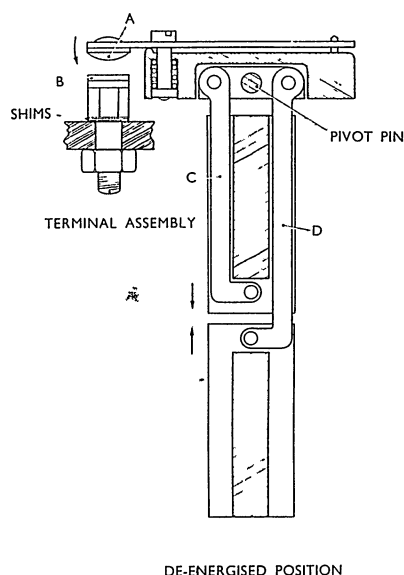


Fig. 1 Diagram showing operating mechanism

The auxiliary contacts on D.10504, D.10505 and D.10507 are mounted on the cover plate and operated by a dolly spindle screwed into the moving contact plate through a hole in the cover plate. The contacts are arranged with one pair normally open and one pair normally closed, both pairs being returned to these positions after operation, by light torsion springs.

The main fixed contacts form part of the main terminal assemblies and can be adjusted in height by means of shims.

Operation

When the coil is energized, the two plungers forming the core move towards each other as indicated in the illustration. This movement is imparted to the contacts A through the duralumin links C and D and the moving contact plate and moulding which pivots on the pin shown. The two coil springs (one only shown) allow the contact moulding to overtravel after the contacts are made and thus provide pressure on the contacts. This pressure can be varied by the extent of overtravel and by fitting shims behind the springs

as detailed in the service leaflet. The mechanism for D.10504, D.10505 and D.10507 differs from that illustrated only in that the dolly spindle is screwed into the moving contact plate for operating the auxiliary switches.

The two coiled torsion springs on the pivot pin (not shown) serve to return the mechanism to the de-energised position.

Periodic Inspection

As a 1000-hour check, the following tests should be made without removing the unit from its installation.

1. The resistance of the operating coil at a temperature of 20°C. or corrected to this temperature and measured across terminals 3 and 4, should be between:

D.10501	$\left\{ \begin{array}{l} 76.5 \text{ and} \\ 93.5 \text{ ohms} \end{array} \right.$	D.10503	$\left\{ \begin{array}{l} 5.49 \text{ and} \\ 6.71 \text{ ohms.} \end{array} \right.$
D.10502		D.10505	
D.10504			
D.10506			
D.10507			

2. The minimum pull-in current to completely close the contactor should be between :—

D.10501	$\left\{ \begin{array}{l} 0.16 \text{ and} \\ 0.17 \text{ ampere.} \end{array} \right.$	D.10503	$\left\{ \begin{array}{l} 0.595 \text{ and} \\ 0.632 \text{ ampere.} \end{array} \right.$
D.10502		D.10505	
D.10504			
D.10506			
D.10507			

3. The insulation resistance between terminal 3 and the frame should, under ideal conditions, be 20 megohms but a reading considerably lower than this may be experienced in humid or exceptional climatic conditions and due allowance should be made in such circumstances.

4. The drop-out voltage should be :—

D.10501	$\left\{ \begin{array}{l} 2 \text{ to } 5 \text{ volts} \end{array} \right.$	D.10503	$\left\{ \begin{array}{l} 0.54 \text{ to } 0.135 \\ \text{volt.} \end{array} \right.$
D.10502		D.10505	
D.10504			
D.10506			
D.10507			

5. The total millivolt drop across the main terminals 1 and 2 while carrying 150 amperes, must not exceed 80 millivolts.

In tests 2 and 4, a circuit detector should be connected across the main terminals 1 and 2.

If any of the readings taken are not within these limits then the unit requires to be fully overhauled in accordance with Service Leaflet No. S.L.71.

Servicing

If test equipment is not available no attempt should be made to service or dismantle the unit. It should, however, be replaced by a new one and the faulty one returned to our nearest Service Department, or authorised service station, where it will receive

prompt attention by our Repair Organisation. In cases where test equipment is available apply for Rotax Service Leaflet No. S.L.71 for full servicing details.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to:—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
NEPEAN HIGHWAY
CHELTENHAM, S. 22
VICTORIA
Telephone : XF 1381

ROTAX LIMITED
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5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA
Telephone : BY 6500-09

Technical enquiries should be addressed to:—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED · WILLESDEN JUNCTION · LONDON N.W.10 · ENGLAND
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SUBJECT : Starter Units

TYPES : U.2001 A.M. Ref. 5CW/4396
U.2002 „ „ 5CW/4401
U.2003 „ „ 5CW/4399
U.2004 „ „ 5CW/5036
U.2005 „ „ 5CW/5016
U.2007

DATA :

Supply Voltage :
(U.2001 to 4 & 7) : 112 volts D.C.
(U.2005) : 28 volts D.C.
Mounting : Four 0.203" dia. holes.
See Spare Parts illustration for details.
Electrical Connection : $\frac{1}{4}$ " B.S.F. and 2 B.A. terminals.
Weight : 4 lb. 8 oz.

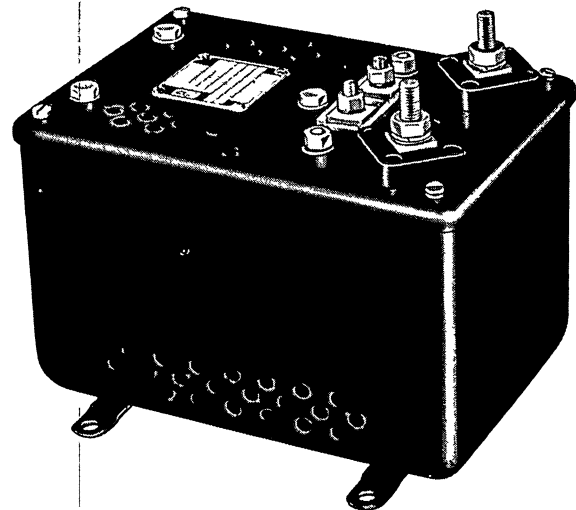
Description

These types of single stage starter units are designed for use with various Rotax 112 volt and 28 volt (U.2005 only) D.C. motors. They are similar in construction and the illustration may be regarded as being typical.

The mounting plate and cover of each unit is of 16 s.w.g. aluminium finished with black enamel outside and varnished inside. Each unit comprises a relay, relay ballast resistor and starting resistor. The starting resistor is cooled by providing an adequate number of ventilation holes in the case.

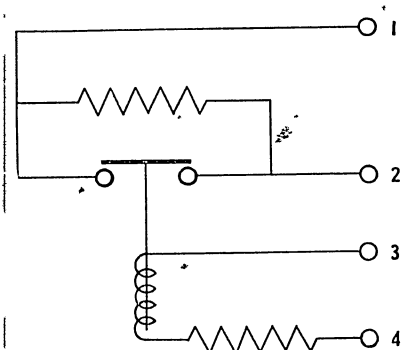
The internal differences between these six types are due to varying starting resistance values, causing U.2004 to be fitted with a vertically mounted card type resistor in place of the normal coil type, and a slightly different relay, number D.10503, is fitted to U.2005. All other types are fitted with relay number D.10502.

A detailed description of relays D.10502 & 3 is given in Technical Leaflet No. T.L.71.



Operation

When the supply is switched on, current flows through the starting resistor until the voltage across the armature terminals, 3 and 4 in diagram, reaches a value



Internal wiring diagram

predetermined by the ballast resistor. At this voltage the relay operates, shorting out the starting resistor and thus allowing the full supply voltage to be applied to the motor.

Installation

These units may be installed in any position and fixing dimensions are given on the parts list drawing.

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements. 14/9/55".

"Amendments to this publication invalidate the approval statement unless issued by the manufacturers with the concurrence of the Air Registration Board".

PRICE ONE SHILLING

JUNE 1955

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The main $\frac{1}{4}$ " B.S.F. terminals are numbers 1 and 2 in the diagram and the 2 B.A. coil terminals are numbers 3 and 4. These numbers are also engraved on the unit cover.

Periodic Inspection

A careful visual inspection should be made at intervals between the 1000 hour overhauls. All terminals and unit fixing nuts should be tight and lead insulation should be in good condition.

Signs of local burning or hot spots require further investigation and any defective part should be renewed. The insulation resistance between all terminals and the case and between terminals 1 and 3 should be checked with a 500 volt "Megger" (250 volt for U.2005). The reading obtained after a complete overhaul and under ideal conditions should be better than 20 megohms; however this figure may be considerably less when the unit is in damp or humid conditions and due allowance should be made for this during a periodic test.

1000 Hour Overhaul

The unit should be removed from its installation, dismantled and each part examined thoroughly and renewed if worn or damaged.

The relay D.10502 or D.10503 should be serviced in accordance with Rotax Service Leaflet No. S.L. 71.

When the relay has been serviced and other parts renewed or reconditioned, including defective cables, then the unit should be reassembled, revarnished where necessary and subjected to the following tests.

Testing

The resistance of the relay coil will have been measured whilst following the instructions contained in Service Leaflet No. S.L. 71.

The value of the starting resistor measured at terminals 1 and 2 should be :—

U.2001	—	0.550 ohm	± 10%
U.2002	—	0.460 ohm	± 10%
U.2003	—	0.300 ohm	± 10%
U.2004	—	1.016 ohms	± 10%
U.2005	—	0.065 ohm	± 10%
U.2007	—	0.400 ohm	± 10%

All resistance values given are correct at a temperature of 20°C.

The relay pull-in voltage which can be varied by altering the value of the ballast resistor, should be as follows:—

U.2001	—	80	+	1	—	2	volts
U.2002	—	60	+	1	—	2	volts
U.2003	—	65	+	1	—	2	volts
U.2004	—	75	+	1	—	2	volts
U.2005	—	18	+	25	—	5	volts
U.2007	—	65	+	1	—	2	volts

To obtain this reading the ballast resistor should be adjusted approximately and then with the relay plungers in the horizontal position, 116 volts (with the exception of unit U.2005) should be applied across terminals 3 and 4 and the pull-in voltage then measured.

In the case of unit U.2005, 29 volts should be applied across terminals 3 and 4.

If the reading is not within the limits specified then the ballast resistor should be readjusted and the procedure repeated.

The operation of the relay can be checked by proving continuity through contacts, using a low reading ohmmeter. This should be carried out with type U.2005 at 29 volts and all other types at 116 volts D.C. as a maximum, and as a minimum with the unit at its appropriate pull-in voltage.

With the relay energised and a current of 150 amperes flowing through the contacts, the voltage drop across terminals 1 and 2 must not be more than 180 millivolts.

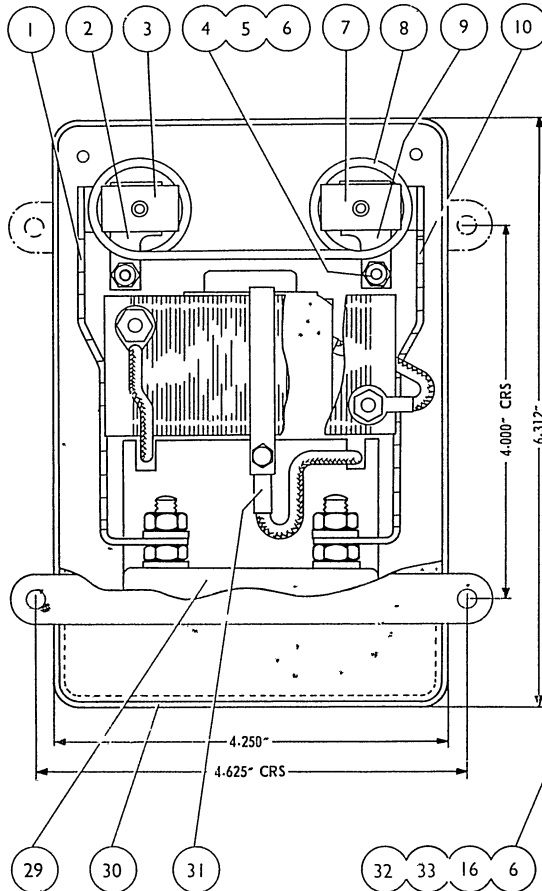
Insulation Tests

The insulation should withstand a high potential test of 1000 volts r.m.s. (500 volts for U.2005) 50 c.p.s. A.C. applied for one minute between the points used for the "Megger" test below.

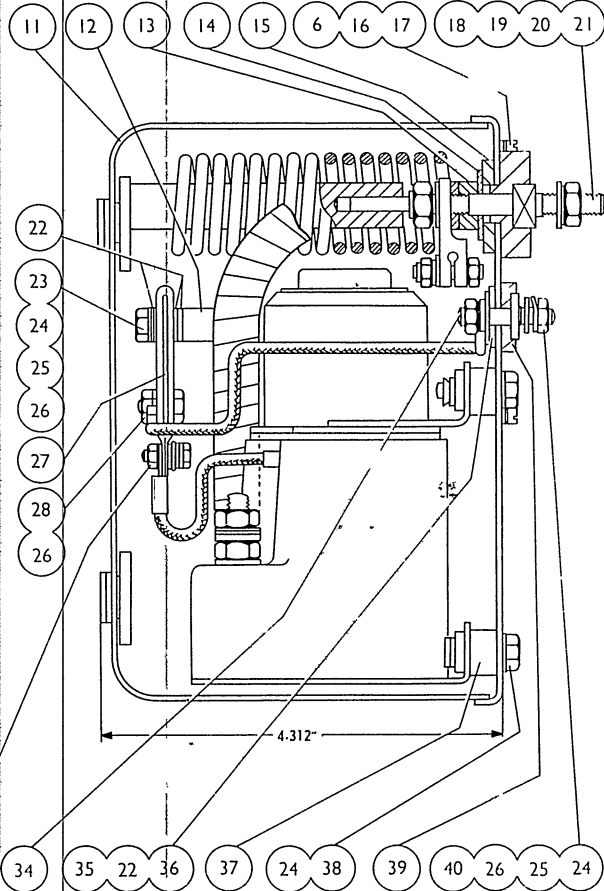
The insulation resistance between all terminals and the case and between terminals 1 and 3, measured with a 500 volt "Megger" (250 volt for U.2005), must not be less than 20 megohms.

A final visual check should be made to ensure the correct fitting of the relay cover and the even spacing of the starting resistor coils.

Spare Parts List



Item No.	Part No.	No. per Unit	Name of Part
1	N.115208	1	Connector Assy.
2	N.103114	1	Clamp (U.2001 and 2)
	N.103114/1	1	Clamp (U.2003)
	N.103114/2	1	Clamp (U.2005)
	N.103114/3	1	Clamp (U.2007)
3	N.113016	1	Core and Pin Assy. (U.2001 and 2)
	N.113017	1	Core and Pin Assy. (U.2003 and 7)
4	N.100292	2	Stud (All types except U.2004)
5	NK.10009-L	4	Nut (All types except U.2004)
6	N.1378	11	Washer
7	N.113016/1	1	Core and Pin Assy. (U.2001 and 2)
	N.113017/1	1	Core and Pin Assy. (U.2003 and 7)
8	N.100706	1	Starting Resistor (U.2001)
	N.102399	1	Starting Resistor (U.2002)
	N.100289	1	Starting Resistor (U.2003)
	N.111122	1	Starting Resistor (U.2004)
	N.110894	1	Starting Resistor (U.2005)
	N.123823	1	Starting Resistor (U.2007)
9	N.103113	1	Clamp (U.2001 and 2)
	N.103113/1	1	Clamp (U.2003)
	N.103113/2	1	Clamp (U.2005)
	N.103113/3	1	Clamp (U.2007)
10	N.115207	1	Connector Assy.
11	N.106276	1	Case Assy.
12	N.100279/1	2	Pillar
13	N.106492	2	Spacer (All types except U.2005)
14	N.66909/1	2	Washer
15	N.100284/1	2	Washer



Item No.	Part No.	No. per Unit	Name of Part
16	N.1358	7	Washer
17	NK.709-L	6	Screw
18	N.41173	4	Washer
19	N.1382	4	Washer
20	NK.10064-D	4	Nut
21	N.106553	2	Terminal Stud (All types except U.2004 and 5)
22	N.100277	8	Washer
23	NK.2022-A	2	Screw
24	N.1354	11	Washer
25	N.1374	10	Washer
26	NK.1006-D	7	Nut
27	N.100280/4	1	Ballast Resistor (U.2001 and 4)
	N.100280/5	1	Ballast Resistor (U.2002, 3 and 7)
	N.100280	1	Ballast Resistor (U.2005)
28	NK.2014-D	1	Screw
29	D.10502	1	Relay (All types except U.2005)
	D.10503	1	Relay (U.2005)
30	N.106278	1	Cover Assy.
31	N.9848/1	3	Terminal Tag
32	NK.722-D	1	Screw
33	NK.10010-D	1	Nut
34	N.100276	2	Terminal Stud
35	N.97960/1	2	Washer
36	N.100277/1	2	Washer
37	N.106280	3	Spacer
38	NK.2035-L	3	Screw
39	N.100278	1	Insulating Board
40	N.9538-A	3	Terminal Tag

Rotax Servicing Facilities

Any unit which cannot be serviced satisfactorily by following the instructions contained in this leaflet, should be replaced by a new one and the original returned to our nearest Service Department, or nearest authorised service station, where it will receive prompt

attention by our Repair Organisation.

When ordering replacement parts, please give full information by referring to the parts list and the engraved type and serial numbers on the unit. This will facilitate prompt identification and efficient service.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
NEPEAN HIGHWAY
CHELTENHAM, S. 22
VICTORIA

Telephone : XF 1381

ROTAX LIMITED
HEMEL HEMPSTEAD
HERTFORDSHIRE
ENGLAND

Telephone : BOXMOOR 4444

LUCAS-ROTAX LIMITED
5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA

Telephone : BY 6500-09

Technical enquiries should be addressed to :—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W. 10 • ENGLAND
ELGar 7777

SUBJECT: Circuit Breakers

TYPES: D.9201/1 A.M. Ref. 5CW/4393
D.9204/1
D.9205/1 A.M. Ref. 5CW/4818

Amendment—D.9249 Circuit Breaker

The D.9249 contactor differs only from the D.9238/1 contactor inasmuch that it is fitted with main terminals to suit 35 ampere Prenal cable lugs. The information contained in Technical and Service Leaflets Nos. 73 is therefore applicable to this later type, except for a variation in component parts. These variations are quoted in the Spare Parts List.

D.9200 series Technical Leaflet

November, 1955

D.9244/1
D.9245/1
D.9248/1

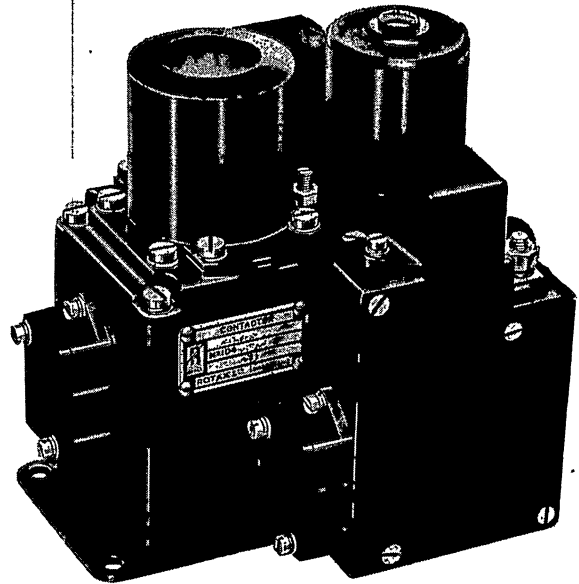
DATA:

Operating Coil Voltage : See Special Features.
Trip Coil Voltage : See Special Features.
Rating : See table.
Mounting : 4 holes .196" dia., the centres of which form a rectangle 4.250" x 1.750".

Electrical Connections :
(Main Terminals) : 2 B.A. terminal posts with nuts and washers fitted.
(Auxiliary and Coil terminals) : 4 B.A. combined screw and washer terminations.
Weight : See Special Features.
Temperature Range : -65°C. to +50°C.

Description

This range of mechanically latched in circuit breakers has been designed for use on aircraft electrical systems as single-pole switches in 112 volt circuits. The switches in the series D.9241/1 to D.9248/1 are operated by means of a 75 volt D.C. control circuit, all other switches in the range being operated by means of a 28 volt supply. All the switches are of similar construction and will give satisfactory service at all altitudes up to 50,000 ft. A bi-metal element is fitted in most of the switches which, in the event of an overload, will trip out the switch and thus prevent damage which would result if the overload was sustained. For the purpose of description the units are divided



into four groups as listed in the table below and the special features of each group are detailed in the notes following the table.

Rating	Group A	Group B	Group C	Group D
40 Amp No Bi-metal	D.9201/1	D.9211/1	D.9231/1	D.9241/1
15 Amp. With Bi-metal	D.9204/1	D.9214/1	D.9234/1	D.9244/1
20 Amp. With Bi-metal	D.9205/1	D.9215/1	D.9235/1	D.9245/1
40 Amp. With Bi-metal	D.9208/1	D.9218/8	D.9238/1	D.9248/1

Special Features

Group A : The closing coils of the units in this group are impulse operated by means of an external push-button or similar type of switch. When the main contacts close a safety switch is opened in the closing coil circuit and the circuit broken.

The units can be tripped manually by depressing a trip button on the switch or remotely by means of a tripping coil incorporated in the switch and energized via an external switch. The closing and tripping coils are operated by means of a 28 volt D.C. supply. The weight of each unit in this group is 3 lb. 2 oz.

Group B : The closing coils of the units in this group are operated either by impulsed or continuously fed

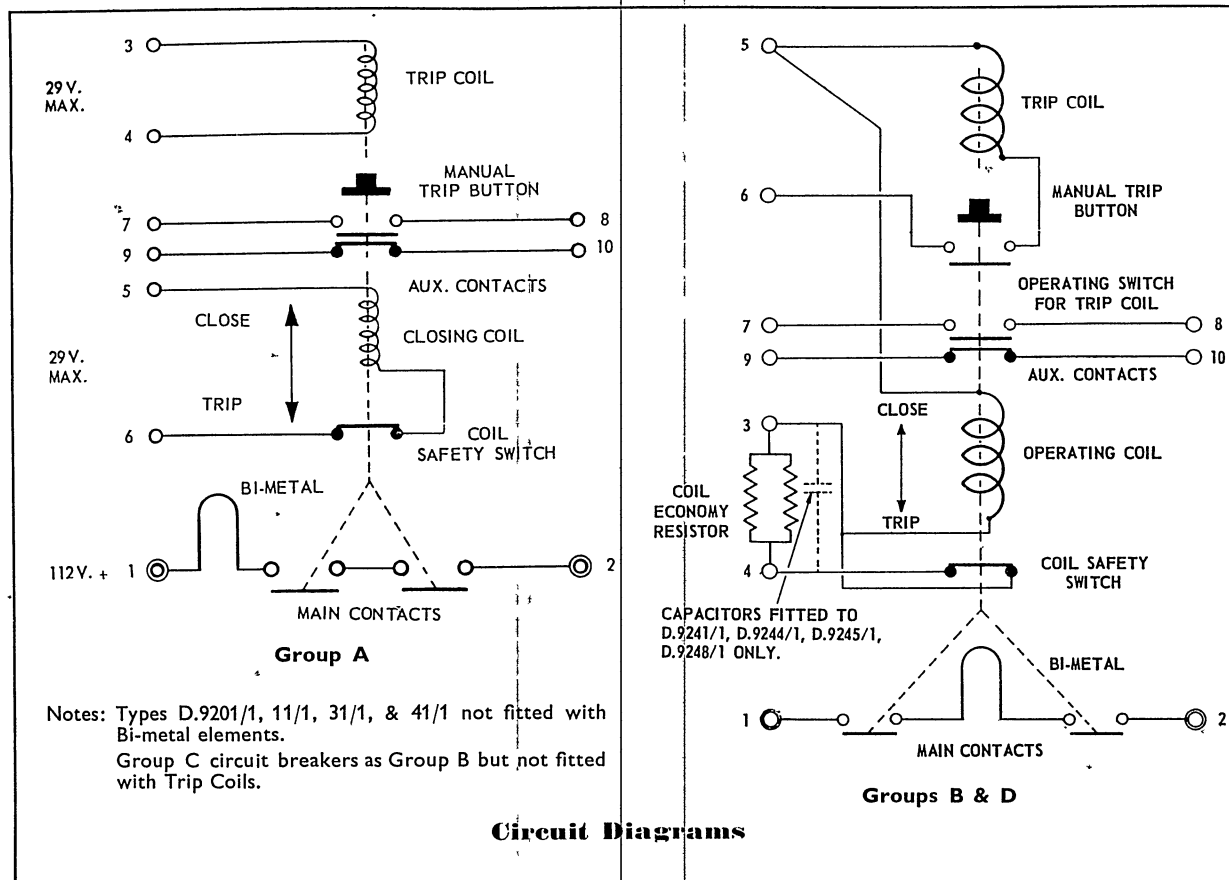
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" Amendments to this publication invalidate the approval statement unless issued by the manufacturers with the concurrence of the Air Registration Board."

PRICE ONE SHILLING

JULY 1955

ROTAX LIMITED . WILLESDEN JUNCTION . LONDON N.W. 10 . ENGLAND . TELEPHONE ELGAR 7777
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current. An economy resistor is fitted in parallel with the closing coil safety switch which, when the switches are operated on continuously fed current, reduces the current through the coil.

The units can be tripped manually by means of a push-button or remotely by means of a tripping coil incorporated in the switch.

The closing and tripping coils are operated by means of a 28 volt D.C. supply. The weight of each unit in this group is 3 lb. 2 oz.

Group C: The units in this group are similar to those of Group B, being operated either by impulsed or continuously fed current, but they are not fitted with a tripping coil. Tripping is effected manually by means of a push button on the switch.

The closing coil is operated by means of a 28 volt D.C. supply. The weight of each unit in this group is 3 lb.

Group D: The units in this group are similar to those of Group B, being operated either by impulsed or

continuously fed current and incorporating a trip coil but the closing coil is operated by a 75 volt D.C. supply. Arc suppression condensers are fitted in parallel with the economy resistor. The weight of each unit in this group is 3 lb. 7 oz.

General

The units comprise a main body casting containing the contact actuating, latching and tripping mechanism; a solenoid for closing the contacts which is mounted on the top face of the casting; and insulating cases containing the main and auxiliary contacts, mounted on opposite side faces of the main casting. Where a tripping solenoid is incorporated, it is fitted on the top face of the casting by the side of the closing solenoid.

The two main contacts are in series and the operation of each contact arm is effected by means of a driving shaft which projects through the side of the casting and is actuated by the closing coil via a toggle linkage and lever mechanism. The overcentring of the toggle mechanism effects the latching of the contacts when the closing coil is energised. The auxiliary

contacts are operated by a cam on the main contact assemblies.

The two main contacts are independently mounted and the mechanism incorporates a contact arm lock such that if one of the main contacts welds in the closed position the other contact opens and breaks the line circuit when the unit is tripped. At the same time, a leaf spring attached to the driving shaft of the contact which has failed to open, stops the operating pin of the lever and linkage mechanism from actuating the driving shafts, thus preventing the reclosure of the circuit until the weld has been cleared and the unit reset. To reset a unit which has interlocked remove the base cover and inspect the actuating arms to ascertain which one has locked. Gently deflect the leaf spring free from the actuating pin and allow the contact arm to return to the fully open position. Release the leaf spring so that it rests on the end of the actuating pin.

The tripping of the units is effected by a push-button or tripping coil which actuates a pivoted lever which, when the contacts are closed, retains the linkage and lever mechanism in the latched position against the force of a return spring. When the tripping lever is operated the toggle linkage mechanism collapses and the contacts are returned to the open position.

The main contacts are of the rolling butt type and are faced with silver nickel alloy. De-ion grids are fitted to the contact housing to assist in arc-quenching when the contacts are opening.

If test equipment is not available no attempt should be made to service or dismantle the unit. It should be replaced by a new one and the inoperative unit returned to our nearest Service Department, or auth-

Operation

With the control supply applied to the closing coil, the plunger of the solenoid is pulled inwards towards the solenoid anvil. The toggle pin connected to the plunger operates the toggle mechanism and closes the main contacts. When the toggle mechanism latches in the "over-centre" position, a safety switch in the closing coil circuit is opened and the current cut off or reduced where economy resistors are fitted. In the units which are continuously fed an economy resistor is fitted in parallel with the safety switch which allows sufficient current to pass through the closing coil to retain the plunger in the "in" position when the safety switch is opened. If the unit is manually or thermally tripped, the subsequent movement of the linkage and lever mechanism is such that the coil safety switch is retained in the open position and the main contacts are prevented from reclosing before the unit is reset, by interrupting the supply holding in the plunger.

Periodic Inspection

These units are correctly adjusted and tested before leaving the factory and should require little attention in service. If a unit functions satisfactorily in its circuit it can be considered suitable for continual use. A general visual inspection should be made periodically to ensure that there is no apparent physical damage and that the terminals are clean and free from any foreign matter.

Servicing

orised service station, where it will be promptly dealt with by our Repair Organisation. In cases where test equipment is available, apply for Rotax Service Leaflet No. S.L. 73 for full servicing details.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to:—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
NEPEAN HIGHWAY
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Technical enquiries should be addressed to:—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10 • ENGLAND
ELGar 7777

SUBJECT: Overvoltage Unit

TYPES: F.5902
F.5903

DATA:

Contact Rating : 2.5 amperes.
Mounting : Four holes 0.152" diameter.
Electrical : Two terminal blocks with
Connections : 4 B.A. terminals.
Weight : 2.5 lb.
Operational Temperature
Range : -40°C to $+50^{\circ}\text{C}$.

Description

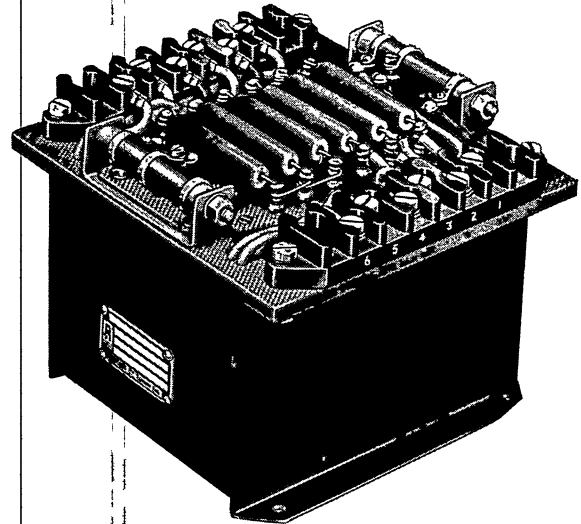
Units in this range have been designed to operate in aircraft rectified A.C. power systems employing wide speed range alternators. In the event of excessive voltages being generated due to any fault developing in voltage regulation, the unit and its associated circuits will switch out the over-volting transformer rectifier units from the system.

The unit comprises two independently operated relays each connected to a separate network of resistors. A thermistor is included in each network of resistors to provide temperature compensation. The relays and thermistors are mounted on one side of the base and are covered by a metal case. The resistors and terminal blocks are mounted on the opposite side of the base.

In the unit, one relay circuit has been designed to operate in a 28 volt system and the other relay designed to operate in a 112 volt system. The following description applies equally to the two relays in the unit :—

The operational characteristic of the relay is such that a time delay occurs between the application of an overvoltage signal and the closure of the relay contacts. This prevents the relay operating during transient overvoltage conditions such as obtain during normal load switching between T.R.U.s or when a T.R.U. is being switched on to a busbar.

The relay has a shunt and series coil and is, in effect, a solenoid and plunger type relay with an instantaneous "clapper" type relay coupled magnetically. The solenoid plungers are a close controlled fit in a tube and act as a dash pot and piston time delay. Under the influence of the magnetic flux, the two plungers move towards each other and in doing so the flux around the "clapper" relay circuit increases but remains insufficient to cause the "clapper" to operate



until the two plungers are almost in contact with each other. The time taken by the two plungers to travel from this normal position to a position that will cause the "clapper" to operate, provides the necessary time delay. This becomes shorter as the ampere turns of the coil increase thus giving to the relay a time characteristic which varies between a comparatively long time for small overvoltages to a short time delay for very high overvoltages.

The two plungers and their associated springs form a balanced assembly rendering the operational voltage independent of any accelerating forces to which the relay may be subjected. The "clapper" and contact assembly is also statically balanced for this purpose.

In order that the time delay will remain constant irrespective of altitude, the plungers and tube are hermetically sealed. The sealing also ensures that no extraneous matter can enter the tube. The thermistor incorporated in the relay circuit provides a method of reducing variations in operating voltage due to ambient temperature changes and coil heating.

Operation

The following operational description applies to the two relays in the unit :—

The shunt coil of the relay is connected between the busbar and negative. The relay setting is such that a given percentage overvoltage will cause the relay to operate and subsequent operation of the associated circuits will, in effect, switch out the T.R.U. from the system.

"This Leaflet is approved by the Air Registration Board. 12/3/58"
"Amendments to this publication invalidate the above approval unless issued by the manufacturers with the concurrence of the Air Registration Board."

PRICE ONE SHILLING

DECEMBER 1957

ROTAX LIMITED · WILLESDEN JUNCTION · LONDON N.W. 10 · ENGLAND · TELEPHONE ELGAR 7777
LUCAS-ROTAX (AUSTRALIA) PTY. LTD · JOYNTON AVENUE · ZETLAND N.S.W. · TELEPHONE FF.2241
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The overvoltage applied to the shunt coil, which would operate the relay, is between 120% and 125% of the normal system voltage. This percentage of overvoltage applies when there is no assisting current flowing in the series coil. Under overvoltage conditions however, current would flow in the series coil and normally a small increase in the busbar voltage would be sufficient to operate the relay.

The series coil is a low resistance coil connected in the load sharing line. The coil polarity is such that, when an overvoltage occurs, the resultant load sharing current assists in tripping the relay of the overvoltage generator. At the same time this current opposes the tripping of the relays associated with the generators which are operating under normal conditions.

For a description of the F.5903 overvoltage unit operating with associated units in a multiple protection unit, reference should be made to Rotax Technical Leaflet No. T.L.46.

Installation

The unit should be mounted in a horizontal plane and secured to the mounting by screws and nuts fitted in four .152" diameter holes in the mounting flanges at the base of the cover. The centres of the mounting

holes form a rectangle 3.281" x 3.625". The overall measurements of the unit are 4.250" x 4.50" x 3.531".

Periodic Inspection

These units are accurately adjusted and tested before leaving the factory and should require little attention between overhauls. Providing a unit controls its associated circuits in the correct manner, it can be considered satisfactory for continued use.

The unit is normally fitted to a panel with its associated units and need not be removed from the panel during inspection. If the unit satisfies the general inspection of the main unit to which it is fitted, it can be assumed to be satisfactory for continued service.

Servicing

Where test equipment is not available, no attempt should be made to service or dismantle a unit. During overhaul it should be replaced by a fully tested and serviceable unit and the inoperative unit returned to our nearest Service Department, or authorised service station, where it will be dealt with promptly by our Repair Organization.

Where test equipment is available, apply for Rotax Service Leaflet No. S.L.74, for full servicing instructions.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to:—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
JOYNTON AVENUE
ZETLAND
NEW SOUTH WALES

Telephone : SYDNEY FF.2241

ROTAX LIMITED
HEMEL HEMPSTEAD
HERTFORDSHIRE
ENGLAND

Telephone : BOXMOOR 4444

LUCAS-ROTAX LIMITED
5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA

Telephone : BY 6500-09

Technical enquiries should be addressed to:—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10 • ENGLAND

Telephone : ELGar 7777

SUBJECT: Reversible Motor with Brake

TYPE: C.6703

DATA:

Voltage :	24 D.C.
Current :	3 amperes
Speed :	8,000 r.p.m.
Torque :	4 oz.in.
Stall torque :	14 oz.in.
Weight :	19 oz.

Description

The type C.6703 reversible motor is suitable for general application in aircraft where a 24 volt D.C. supply is available, but particularly to serve as the prime mover for a Throttle Control Unit.

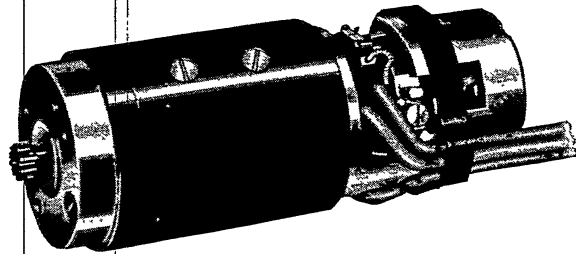
The machine comprises two end frames, two housings, armature, yoke and field coils, and brake assembly.

A housing, known as the motor housing, encloses the yoke and field coil assembly and is bolted between two end frames (drive and commutator). The mating surfaces of the motor housing and the end frames form two spigot joints. Extending beyond the commutator end frame, and secured to it by screws, is a housing which encloses an electro-magnetic brake assembly.

Each end frame houses a ball-bearing and the armature shaft is borne between them. At the drive end of the motor the shaft protrudes beyond the end plate and carries a driving pinion having ten teeth.

The C.6703 is a 2-pole motor with a split-series field; excitation of one field produces one direction of rotation and of the other, the reverse. (Field Coil No. 1, anti-clockwise; field coil No. 2, clockwise).

The brake consists of a coil wound on a bobbin interposed between a plunger and a steel plate. The latter, known as the brake anvil, encloses the end of the brake housing and is secured by a peened-over rim. A cavity in the anvil, and another in the plunger, houses each end of a brake spring which passes through the bore of the bobbin. The plunger is faced with a surface of "Langite" and, being free to move under the influence of the spring, exerts lateral pressure on a non-magnetic steel disc which is coupled to the armature shaft. With no current flowing in the brake coil, the plunger and disc are in contact under pressure and the shaft is locked.



Two apertures in the commutator end frame allow access to the brushes and springs, and provide an entry for the supply leads which are supported by a neoprene retaining ring surrounding the commutator end frame.

Connections

YELLOW lead to No. 1 field coil (AC/W).
WHITE lead to No. 2 field coil (C/W).
BLUE lead to brake coil.

Operation

The brake coil is connected in series with the armature so that excitation of either field energises the brake coil and draws the brake plunger away from contact with the brake disc. This retraction of the plunger is against the spring pressure, thus the brake will automatically be applied instantaneously with switching off current to the motor.

Installation

The type C.6703 motor may be mounted in any position. Four 4 B.A. tapped holes on a P.C.D. of $1\frac{1}{8}$ " are provided on the facing of the drive end frame, allowing for a thread engagement of $\frac{1}{4}$ ".

Periodic Inspection

250 Hours

The motor and brake should require no attention between overhauls other than the points indicated in the following paragraphs. These checks should be carried out regularly and do not necessitate the dismantling of the motor for their performance.

1. Blow out any carbon dust that may have accumulated round the brush boxes, with dry compressed air from a pipe line or bellows.
2. Inspect the brushes to ensure that they are a free fit in their boxes, care being taken not to damage the brushes and pigtails. Where binding brushes are encountered, the brush and brush box must be wiped clean, especially the corners, with a benzine-moistened cloth.

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements.
11/11/55."
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PRICE ONE SHILLING

SEPTEMBER 1955

ROTAX LIMITED . WILLESDEN JUNCTION . LONDON N.W. 10 . ENGLAND . TELEPHONE ELGAR 7777
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3. Measure the brush length, this must not be less than 0.200". It is necessary to always renew the brush before this minimum figure is reached to ensure correct functioning to the next inspection period.
4. Check the brush spring pressure, which should be 3 to 4 oz. The reading should be taken with a spring balance fitted with a suitable hook, from a point where the arm bears on the brush, taking care not to damage the spring by lifting the arm too high.
5. Examine the electrical connections for security and damage, and the wiring for frayed or damaged insulation.
6. Examine the neoprene cable retaining ring for signs of wear. If a new ring requires fitting it may be ordered under Part No. N.115348 and should

be secured in position using I.C.I. "Necol" Adhesive.

7. The motor is lubricated during manufacture and when completely overhauled (500 hours) and, normally, should not require lubrication during servicing periods.
8. Finally, check the insulation resistance of the unit with a 250 volt "Megger"; it should not be less than 10 megohms.

Note—This value applies to units being tested under normal workshop conditions. Due allowance should be made for the climatic conditions of the locality and those of the aircraft servicing area or dispersal point. In particularly damp or humid climates, the reading will be low enough to give apparently sufficient reason for rejection and in these instances discretion should be exercised.

Servicing

If test equipment is not available no attempt should be made to service or dismantle the unit. It should be replaced by a new one and the inoperative unit returned to our nearest Service Department, or authorised

service station, where it will be promptly dealt with by our Repair Organisation. In cases where test equipment is available, apply for Rotax Service Leaflet No. S.L.75 for full servicing details.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
NEPEAN HIGHWAY
CHELTENHAM S.22
VICTORIA

Telephone : XF 1381

ROTAX LIMITED
HEMEL HEMPSTEAD
HERTFORDSHIRE
ENGLAND

Telephone : Boxmoor 4444

LUCAS-ROTAX LIMITED
5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA

Telephone : BY 6500-09

Technical enquiries should be addressed to :—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED · WILLESDEN JUNCTION · LONDON N.W.10 · ENGLAND
ELGar 7777

SUBJECT: Navigation Lamps

TYPES: H.2001, H.2002, H.2003,
H.2006, H.2007

DATA:

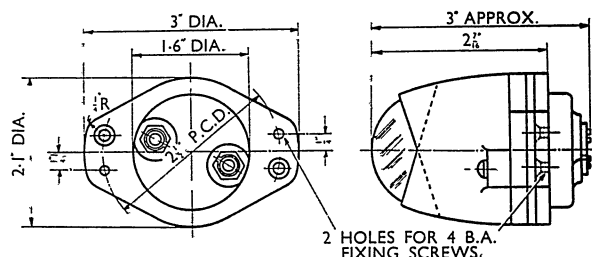
Voltage : See table below.
Power consumption : 10 watts.
Electrical connections : 6 B.A. screw and washer terminations.
Mounting : Two 4 B.A. screws 2.5" P.C.D.
Weight : 5 oz.

Description

These navigation lamps have been designed to comply with the Air Navigation Regulations. The main difference between the lamps in the series is in the shape of the aperture in the screen cap mounting, the two types of cap mounting producing respectively a light beam of 140° (for tail lamps) and 220° (for head lamps). The lamps are supplied with different voltage bulbs fitted, the power consumption of 10 watts being the same throughout the range. The difference between each lamp in the series is shown in the table below.

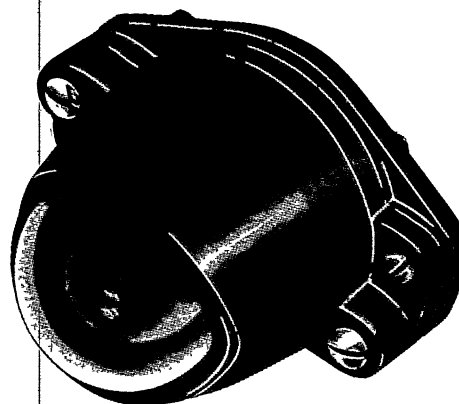
Code	Bulb Voltage	Aperture of Cap
H.2001 (tail)	12 to 14 volts	140°
H.2002 (tail)	24 volts	140°
H.2003 (tail)	12 volts	140°
H.2006 (head)	12 to 14 volts	220°
H.2007 (head)	12 volts	220°

The lamps are constructed in strong bakelite, the design being compact and allowing for easy dismantling or installation. The glass dome cover is protected by the screen cap mounting which is secured to



Installation diagram

the base of the lamp by two captive nuts. The base of the glass dome rests on a sponge rubber joint ring



which absorbs any vibration which the glass may be subjected to in service.

Bayonet type bulbs are used with the lamp and they fit into a socket which is part of the base moulding. The design of the lamp is such that the bulb is easily replaced, access to the bulb being obtained by unscrewing the two captive nuts on the screen cap mounting and removing the mounting and dome glass.

Installation

The overall dimensions of the lamp are shown in the diagram below. The lamps are mounted by means of two 4 B.A. countersunk screws spaced on a P.C.D. of 2.5". Electrical connection is made to the lamp via two 6 B.A. combined screw and washer terminations.

Periodic Inspection

From time to time the lamp should be inspected visually to ensure that there is no apparent physical damage. The mouldings should be examined carefully for signs of distortion or cracking and where this is discovered the lamp should be removed and the damaged part renewed. The terminals should be examined for signs of corrosion and the security of the lamp to its installation checked.

After this visual inspection the operation of the lamp should be checked by switching on and off.

When the lamp has satisfied this inspection it can be considered serviceable for continued use.

"Information contained in this leaflet affecting safe operation, maintenance and overhaul has been verified and approved by the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements. 29/8/56."

A.R.B. Approval Nos. H.2001 - E.3574, H.2002 - E.2453

PRICE ONE SHILLING

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JUNE 1956

ROTAX LIMITED · WILLESDEN JUNCTION · LONDON N.W. 10 · ENGLAND · TELEPHONE ELGAR 7777
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Spare Parts

When ordering replacement parts, reference should be made to the table below and the complete information including the part name and number and the

code and serial number of the unit for which the part is required, should be quoted. This will ensure correct identification and prompt service.

<i>Name of Part</i>	<i>No. Off</i>	<i>Part No.</i>
Screen Cap Mounting	1	13367 (H.2001, 2 & 3)
Screen Cap Mounting	1	13764 (H.2006 & 7)
Dome Glass	1	13370
Bulb	1	13354/A (H.2002)
Bulb	1	13354/B (H.2003 & 7)
Bulb	1	13354/C (H.2001 & 6)
Joint Ring	1	13368

<i>Name of Part</i>	<i>No. Off</i>	<i>Part No.</i>
Screw (for plug base assy.)	2	AGS 248/22
Base Moulding	1	13356
Inner Cover Moulding	1	13366
Screw (for inner cover moulding)	2	AGS 248/29
Plug Base Assy.	1	N 66039

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
NEPEAN HIGHWAY
CHELTENHAM, S. 22
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Telephone : XF 1381

ROTAX LIMITED
HEMEL HEMPSTEAD
HERTFORDSHIRE
ENGLAND

Telephone : BOXMOOR 4444

LUCAS-ROTAX LIMITED
5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA

Telephone : BY 6500-09

Technical enquiries should be addressed to :—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10 • ENGLAND

Telephone ELGar 7777

SUBJECT : Single Pole Contactors

TYPES : D.8901 A.M. Ref. 5CW/4386

D.8902

D.8903

D.8904

DATA :

Rating : Continuous.
Rating (main contacts) : 112 volts D.C., 5 to 15 amperes.
Rating (auxiliary contacts): 29 volts D.C., 2.5 amperes.
Operating Coil Voltage : 29 volts D.C., maximum.
Mounting : Two slots for 2 B.A. fixing bolts in mounting plate spaced at 2.750" (D.8901, D.8902) ; 3.109" (D.8903, D.8904).
Operating Temperature Range : + 50°C. to - 65°C.
Compass Safe Distance : 21" for 1° deflection.
Weight : 1 lb. 3 oz.

Description

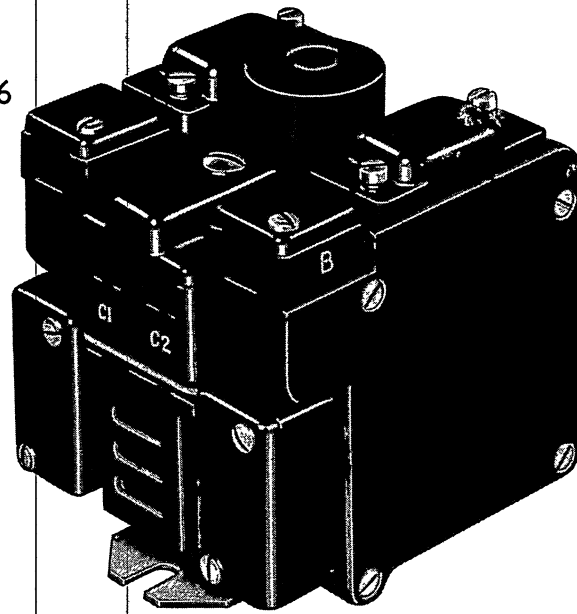
These single pole contactors have been designed for use in aircraft electrical systems where it is desired to break a 112 volt D.C. supply by means of a 28 volt D.C. switching circuit, for example, motor control.

One pair of 28 volt D.C. auxiliary contacts, rated at 2.5 amperes, is also provided.

Variations within the D.8900 series are either due to the auxiliary contact arrangement or the length of the mounting plate and they may be summarized thus :

Type	Auxiliary Contacts 1 & 2	Mounting Plate
D.8901	Normally open	3.250"
D.8902	Normally closed	3.250"
D.8903	Normally open	3.625"
D.8904	Normally closed	3.625"

The contactor comprises a main body casting of light alloy containing the contact actuating mechanism, a solenoid mounted on the top face of the casting, and insulated housings containing the main, auxiliary and



economy contacts, on opposite side faces of the casting. Each housing is fitted with an arc chute.

The two pairs of main contacts are in series, and operation of each contact arm is effected by means of a driving shaft which projects through the side of the casting and is actuated by the solenoid. The economy switch is opened towards the end of the plunger stroke, putting a resistance in series with the operating coil.

A return spring moves each main contact arm to the normally open position when the solenoid is de-energized.

The two contact arms are independently mounted and the mechanism incorporates a contact arm interlock which operates in such a manner that should one contact remain in the closed position when the coil is de-energized, the other contact arm will open to the extent of its travel, thus breaking the circuit. At the same time the interlock prevents the contact from re-closing should the solenoid be energized again.

Main Contacts

The main contacts are the sliding butt type and are faced with silver tungsten.

Auxiliary Contacts

These are operated by means of a cam attached to the main contact arm and are adjusted to give either a normally open or normally closed circuit.

"Information contained in this leaflet affecting safe operation and maintenance has been verified and approved by the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements. 11/11/55."

A.R.B. Authority Ref. No. for D.8901 & 2: E.3433

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PRICE ONE SHILLING

OCTOBER 1955

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Operating Coil

The maximum energizing voltage for the coil is 29 volts and the minimum is between 12 and 16 volts.

The initial resistance of the coil is 25 ohms \pm 5% and the final resistance, including two economy resistors in parallel, is 50 ohms \pm 5%.

Installation

These contactors may be mounted in any attitude except with the mounting base uppermost.

Overall dimensions :

Mounting base
(D.8901 and D.8902) : 3.250" by 2.600"

Mounting base
(D.8903 and D.8904) : 3.625" by 2.600"
Height (from base, all types) : 3.200"

Electrical Connections

All connections are made via externally mounted terminal blocks which contain 4 B.A. screw and washer terminations.

Periodic Inspection

These contactors are accurately adjusted and tested

before leaving the Factory and should require but little attention between overhauls provided they are not maltreated. Providing a contactor controls its associated equipment in the desired manner it may be considered satisfactory and passed for further use.

However, a general visual inspection should be made periodically to ensure that the contactor has not sustained any apparent physical damage and that all terminal connections are clean and secure.

The covers should be removed and all contacts examined for signs of excessive pitting or burning, and if found, the unit should be removed from the aircraft for servicing or replacement.

Servicing

If test equipment is not available, no attempt should be made to service or dismantle the unit. It should, however, be replaced by a new one and the inoperative equipment returned to our nearest Service Department, where it will be promptly dealt with by our Repair Organisation.

In instances where test equipment is available, it should be dealt with in accordance with the procedure detailed in Rotax Service Leaflet No. S.L.77.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to:—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
NEPEAN HIGHWAY
CHELTENHAM, S. 22
VICTORIA

Telephone : XF 1381

ROTAX LIMITED
HEMEL HEMPSTEAD
HERTFORDSHIRE
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LUCAS-ROTAX LIMITED
5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA

Telephone : BY 6500-09

Technical enquiries should be addressed to:—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10 • ENGLAND
ELGar 7777

SUBJECT: High Frequency Electric Horn

TYPE: V.0214

DATA:

Operating Voltage : 24—28 volts D.C.
Current Consumption : 1.5—2.0 amperes at 24 volts.
Mounting : Bracket ; two .266" dia. fixing holes spaced 1.250" between centres.
Electrical Connection : Terminal block ; two 4 B.A. terminals.
Weight : 2 lb. 6 oz.

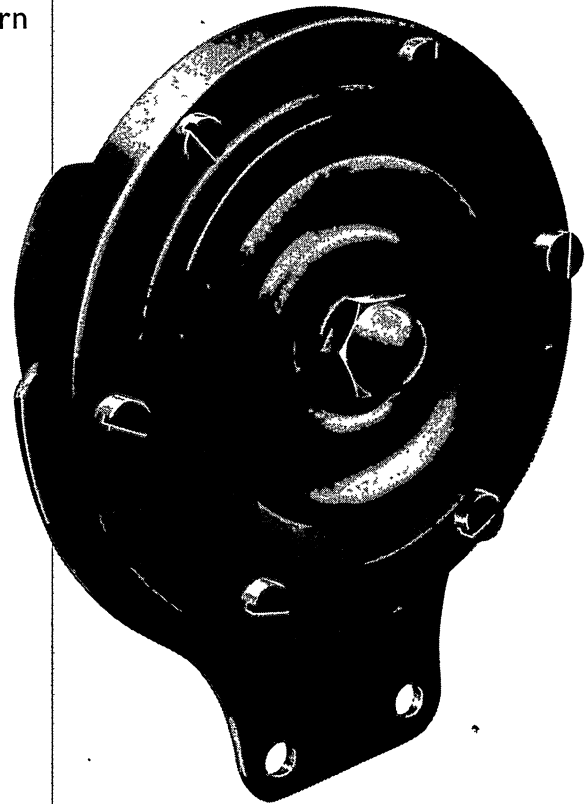
Description

This high frequency horn has been designed to give an extremely powerful, arresting and penetrating note which will be audible even under most adverse aircraft noise conditions. The main body, which houses, or has affixed to, all component parts, is of cast iron thus giving a construction which is very robust and ensures that adjustment will remain constant over a wide range of supply voltage variations, a particularly important characteristic.

The horn comprises two main assemblies, namely the Body, Winding, Terminal and Contact Breaker assembly and the Diaphragm and Armature assembly.

In the former case a cast-iron body houses the winding enclosed within two insulating washers and secured in position with an aluminium washer. Through the body and winding, and locked with a nut and washer, passes an adjustable mild steel centre core. Riveted to the inner face of the body is the contact breaker assembly, the bridge piece of which carries the threaded portion of a spring-loaded adjusting screw which enters the body from the outside. The countersunk head of this screw and the corresponding countersink in the body is serrated to facilitate "notch" adjustment. Attached to the outer face of the body is the terminal block assembly whose single fixing stud is tapped to receive the cover securing screw. A rubber sealing washer is interposed between the terminal block and body.

In the latter case the diaphragm and armature assembly, which includes an adjusting screw and locknut carried in the tapped centre bore of the cup, is interposed between two "Presspahn" packing washers



and clamped to the body assembly by a mild steel front cover secured with four 1 B.A. screws and two 1/4" B.S.F. screws, nuts and washers ; the latter items also secure the mild steel fixing bracket.

Additional to the main assemblies is the tone disc, and this is clamped to the diaphragm and armature assembly with a cover nut and washer.

Installation of this type of horn is preferred with the diaphragm in the vertical position, but where unavoidable, other positions may be adopted without having an adverse effect on its operation.

Mounting is achieved by means of two .266" dia. holes, spaced at 1.250" centres, located in the fixed bracket. Electrical connection is by way of two 4 B.A. terminals.

Total weight of the unit is 2 lb. 6 oz.

Operation

Operation of this horn is that of a simple bell type trembler action, inasmuch that with the winding de-energised the contacts, which are in series with the

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A.R.B. Approval No. : E.2454.

PRICE ONE SHILLING

"Amendments to this publication invalidate the approval statement unless issued by the manufacturers with the concurrence of the Air Registration Board."

MARCH 1956

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coil, are normally closed ; upon application of the supply voltage, the winding together with the mild steel centre core, forms an electro-magnet thus attracting the armature and diaphragm assembly towards it. This movement, by virtue of the pre-set adjustable armature screw, opens the contacts thus breaking the main circuit and allowing the armature and diaphragm assembly to return to its rest position.

With the supply still connected this cycle of operation continues until such time as the supply is switched off, thus giving rise to a sonic vibration which in turn is amplified by the resonance of the body cavity and tone disc to give an arresting audible note.

To minimise sparking at the contacts a suppression coil is connected in parallel with the contacts.

Periodic Inspection

Horns are accurately adjusted and tested before leaving the factory and will give long periods of service without any attention. However, a general visual examination should be made periodically to ensure that the horn has not sustained any physical damage. Also an operational check should be carried out to ensure that it is functioning correctly. If so it may be passed for further use.

Should the action of the horn become uncertain or fail to vibrate it does not follow that the horn is at fault. The trouble may be due to a power supply failure or a loose or broken connection in the wiring to the horn, in which case examine all cables, fuses, interconnecting plugs, etc., and renew any cables that are worn or chafed. Ensure that all connections are tight and that connecting nipples or eyelets are firmly soldered or crimped to the cables.

The performance of the horn may also be affected by a fixing bolt working loose or by the vibration of a component or aircraft part adjacent to the horn. To check this, remove the horn from its mounting, hold it firmly in the hand by its bracket and operate the control switch. If the note is still unsatisfactory, the horn may require adjustment, but this should only be necessary after a long period of service.

Method of Adjusting

Notes : (a) The adjustment of a horn does not alter the characteristics of the note but merely compensates for wear of vibrating parts.

(b) If the horn is used repeatedly when badly out of adjustment, due usually to unsuccessful attempts at

adjustment, the horn may become damaged due to the excessive current it will take. When testing do not continue to operate the control switch if the horn does not sound. Should, when the control switch be operated, the horn not take any current, indicated by the ammeter in circuit, it is possible that the horn has been adjusted so that its contact breaker is permanently open.

To carry out adjustment break the horn circuit at some convenient point and connect a 0—5 ammeter in series with the horn. Operate the control switch and note the current consumption. This should be, with 24 volts applied, between 1.5 and 2.0 amperes. If the current consumption lies outside of these limits the horn should be adjusted.

This is made by turning the serrated adjustment screw not more than 2 to 3 notches at a time, in a clockwise

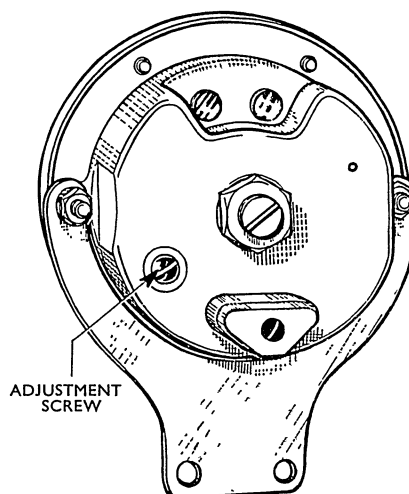


Fig. 1 Rear view of horn showing adjustment screw

direction to increase the current or anti-clockwise direction to decrease the current. Check the current consumption after each adjustment until the correct current value is obtained. *N.B.*—If the adjustment screw is turned too far in a clockwise direction a point will occur at which the armature and diaphragm assembly pulls in but does not separate the contacts.

Overhaul Period

Owing to its robust construction, accurate adjustment before leaving the factory and long serviceability factor this type of horn does not require a set period at which it should be overhauled. Provided it satisfies

a functional test at frequent intervals it may be passed for further use.

However, a horn may suffer physical damage, or the winding may go "short" or "open-circuit," due

usually to maladjustment, or the contact breaker assembly may wear to such a degree that corrective adjustment can no longer be made, in which case it is recommended that the horn be replaced by a serviceable one.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
NEPEAN HIGHWAY
CHELTENHAM, S. 22
VICTORIA

Telephone : XF 1381

ROTAX LIMITED
HEMEL HEMPSTEAD
HERTFORDSHIRE
ENGLAND

Telephone : BOXMOOR 4444

LUCAS-ROTAX LIMITED
5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA

Telephone : BY 6500-09

Technical enquiries should be addressed to :—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10 • ENGLAND

Telephone : ELGar 7777

SUBJECT: Reverse Current Relay

TYPES: F.2204/3, F.2208/3,
F.2214/1, F.2215

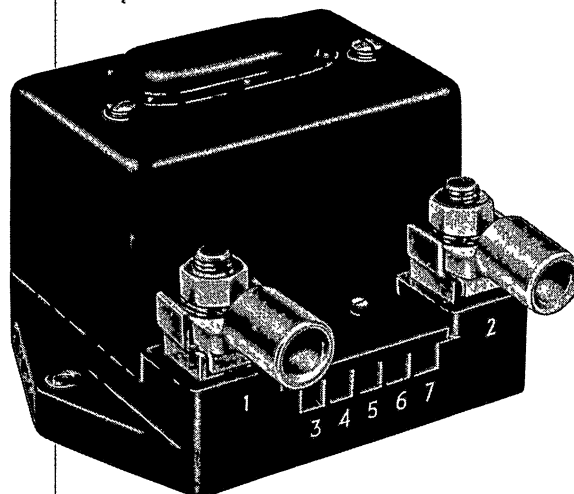
DATA:

Current Rating :	200 amperes.
Electrical Connections :	
Main Terminals :	$\frac{3}{8}$ " B.S.F. stud terminations.
28 Volt Terminals :	4 B.A. screw and washer terminations.
Earth Terminal (F.2215) :	4 B.A. screw and washer termination.
Mounting :	Two 2 B.A. clearance holes at 4.812" centres.
Weight :	2 lb. 2 oz.
Operating Temperature Range :	-70°C to +50°C.

Description

This relay has been designed for use on aircraft generating systems operating at 28 or 112 volts D.C. and using 28 volt D.C. control circuits. The relay operates to isolate a generating system from the aircraft busbar should the generator voltage fall sufficiently below the busbar voltage to produce a pre-determined value of reverse current. A reset coil is incorporated which enables the armature to be returned to the normal position by an external switch.

The four units in the range are basically the same in construction. The only difference between the F.2204/3 and the F.2208/3 is that the F.2204/3 relay contacts open when reverse current flows in the series coil and the reset coil operates to close the relay contacts, whilst the F.2208/3 relay contacts are closed by the reverse current and opened by the reset coil. The F.2214/1 is the same as the F.2208/3 except that the main terminals have been changed to accommodate 135 ampere Prenal cable lugs. The F.2215 differs from the F.2214/1 only in having an extra pair of contacts which are opened by the reverse current and closed by the reset coil.



The relay comprises an armature which pivots on a bracket fitted between two sets of permanent magnets. The magnets are secured between two yokes which are mounted on the moulded base of the unit. The armature is encircled on one side of the bracket by two turns of heavy section copper which forms the series coil and encircled on the other side of the bracket by the reset coil, which is secured in position by the two yokes. The moving contact of the relay is fitted to the underside of the armature and mates with the fixed contact in the form of a screw with the contact mating surface at the tip. The second or auxiliary pair of contacts, for the F.2215, is mounted above the top yoke and is actuated by an insulated push rod from the armature. The movement of the armature is limited by two adjustable stop screws fitted to the yokes.

The relay terminals and reset coil leads pass through the underside of the base assembly to a row of terminals on the moulded base at the front. In the case of the F.2215 the negative lead of the reset coil passes through the base recess to an additional terminal projecting from the side of the moulded base. These terminals are 4 B.A. screw and washer terminations and the row of terminals are protected by a flat cover plate secured to the base by two screws. The connections from the series coil to the main terminals are in the form of two metal strips which pass through the base recess to the main terminals sited one each side on the front of the base moulding.

"This Leaflet is approved by the Air Registration Board. 29/11/57"
A.R.B. Authority Ref. No.: E.2293 for F.2215

"Amendments to this publication invalidate the above approval unless issued by the manufacturers with the concurrence of the Air Registration Board."

PRICE ONE SHILLING

NOVEMBER 1957

ROTAX LIMITED	• WILLESDEN JUNCTION	• LONDON N.W. 10	• ENGLAND	• TELEPHONE ELGAR 7777
LUCAS-ROTAX (AUSTRALIA) PTY. LTD	• NEPEAN HIGHWAY	• CHELTENHAM S. 22	• TELEPHONE XF 1381	
LUCAS-ROTAX LIMITED	• TORONTO 13	• CANADA	• TELEPHONE PLYMOUTH 5-4171	

A moulded cover fits over the relay mechanism and is secured to the moulded base by two captive screws. The upper contacts on the F.2215 are accommodated by a special extension to the top of the moulded cover. A flat cover is fitted over the base recess.

Operation

F.2204/3

This relay operates in conjunction with a magnetically held-in contactor. The contacts of the relay are connected in series with the operating coil of the contactor.

The series coil of the relay and the contacts of the contactor are connected in series in the feed from the generator system to the busbar. When the relay is impulsed to the "ON" position by the external resetting switch the contacts of the relay complete the coil circuit of the contactor. The forward current from the generator to the load assists the permanent magnet system to retain the armature in the closed position. Should a reverse current of between 50 and 60 amperes flow from the busbar to the generator, a reversal of flux is produced in the armature and it moves to the "contacts open" position. This breaks the supply to the contactor coil which opens the contactor and isolates the generator from the busbar.

F.2208/3 and F.2214/1

These relays operate with a contactor which is mechanically latched and has a trip coil. The permanent magnet system is arranged so that the effect of impulsing the relay reset coil is to open the relay contacts. The forward current in the series coil assists the magnets to retain the contact in the open position. Reverse current through the series coil closes the relay contacts and this completes the circuit to the trip coil of the contactor which opens to isolate the generator from the busbar. When the external reset switch is operated to open the relay contacts, the trip circuit of the contactor is broken; the contactor operating coil can then be energised and the contactor closed to connect the generator to its load.

F.2215

The operation of this unit when used in a representative generating system is as follows:—

The auxiliary contacts are connected in series with a magnetically held-in contactor which connects the generating system to the busbar. The armature contacts are connected in series with the trip coil of a mechanically latched-in contactor which completes the alternator field circuit.

The series coil of the relay is connected in series in the circuit from the generating system to the busbar. The forward current, flowing from terminal 1 to terminal 2, in the series coil assists the permanent magnets to retain the armature in the normal position. Reverse current, from terminal 2 to terminal 1, through the series coil repels the armature, thus closing the armature contacts and opening the auxiliary contacts. This action then breaks the generator to busbar circuit and breaks the alternator field circuit. When the external reset switch is operated, to return the armature to its original position, both pairs of contacts return to their former positions and generation is restored.

Periodic Inspection

After every 2000 hours in service the covers of the unit should be removed and the unit inspected for signs of physical damage. Both pairs of contacts must be examined and if they show signs of excess arcing the unit should be removed for overhaul.

Insulation Resistance F.2204/3, F.2208/3 and F.2214/1

The insulation resistance between the following points should be measured with a 500 volt "Megger" and should not be less than 100 megohms:—

Terminal 1 and terminal 5.

Terminal 1 and terminal 6 with the contacts open.

Terminal 1 and terminal 6 with the contacts closed.

Terminal 1 and the yoke of the relay.

The insulation resistance between the following points should be measured with a 250 volt "Megger" and should not be less than 50 megohms:—

Terminal 5 and terminal 6 with the contacts open.

Terminal 5 and terminal 6 with the contacts closed.

Terminal 6 and terminal 7 with the contacts open.

The insulation resistance between the following points should be measured with a 250 volt "Megger" and should not be less than 20 megohms.

Terminal 5 and the yoke of the relay.

Insulation Resistance F.2215

The insulation resistance between the following points should be measured, with the armature in both positions, with a 500 volt "Megger" and should not be less than 100 megohms:—

Terminal 1 and terminals 3, 4, 5, 6 and 7.

Terminal 1 and frame.

The insulation between the following points must be measured, in the condition indicated, with a 250 volt

"Megger" and should not be less than 50 megohms :—

Terminal 3 and terminal 5. Armature contacts open.

Terminal 6 and terminals 3, 5 and 7. Armature contacts open.

Terminal 3 and terminals 4, 5 and 6. Armature contacts closed.

Terminal 5 and terminal 6. Armature contacts closed.

Frame and terminals 3, 4 and 5. Armature contacts closed.

It is recommended that the following millivolt drop tests be carried out to ascertain the condition of the series coil and the contacts of the relay :—

With 200 amperes flowing through terminals 1 and 2 the millivolt drop across the terminals shall not exceed 100 millivolts. With the armature contacts closed and 1 ampere flowing through terminals 6 and 7 the millivolt drop across the terminals shall not exceed 40 millivolts. With 1 ampere flowing through terminals 3 and 4 the millivolt drop across the terminals shall not exceed 40 millivolts, for F.2215 only.

If the millivolt test is not practical with the unit *in situ*, the relay contacts and series coil should be carefully examined and if their condition is at all doubtful the unit should be removed from its installation and the millivolt test applied.

Servicing

If test equipment is not available no attempt should be made to service these units. A unit should be replaced by a serviceable unit and the unit requiring to be serviced should be returned to our nearest Service Department, or authorised service station, where it will receive the prompt attention of our repair organisation.

Where test equipment is available apply for Rotax Service Leaflet No. S.L. 79 for full overhaul and servicing instructions.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
JOYNTON AVENUE
ZETLAND
NEW SOUTH WALES

Telephone : SYDNEY FF.2241

ROTAX LIMITED
HEMEL HEMPSTEAD
HERTFORDSHIRE
ENGLAND

Telephone : BOXMOOR 4444

LUCAS-ROTAX LIMITED
5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA

Telephone : BY 6500-09

Technical enquiries should be addressed to :—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED · WILLESDEN JUNCTION · LONDON N.W.10 · ENGLAND

Telephone : ELGar 7777

SUBJECT: Contactors

TYPES: D.9101 A.M. Ref. 5 CW/4387
D.9102
D.9103
D.9104 A.M. Ref. 5 CW/4388
D.9105
D.9106

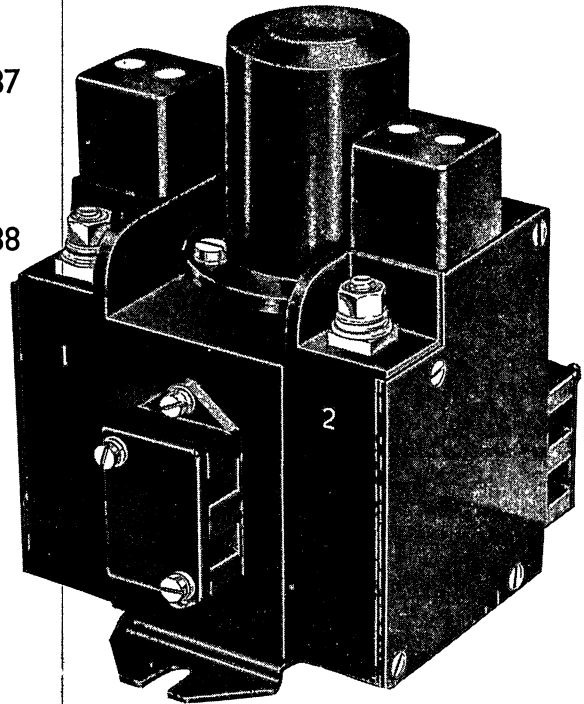
DATA:

Voltage :
Main contacts : 112 volts
Auxiliary contacts : 28 volts
Operating coil : 28 volts
Current Rating :
Main contacts
(D.9101, 2 and 3) : 60 amperes max. short-rated
(D.9104, 5 and 6) : 60 amperes max. continuous
Auxiliary contacts : 5 amperes
Mounting : 2 slots for 2 B.A. bolts 3.5" apart
Electrical Connections :
Main terminals : 2 B.A. studs
Auxiliary terminals : 4 B.A. terminations
Operating coil terminals : 4 B.A. terminations
Compass safe distance for 1° deflection : 38"
Weight :
(D.9101, 2 and 3) : 2 lb. 5 oz.
(D.9104, 5 and 6) : 2 lb. 6 oz.
Operating temperature range : - 65°C. +50°C.

This leaflet incorporates information contained in Service Bulletin No. 483.

Description

This range of magnetically-operated contactors has been designed for single pole switching in 112 volt D.C. circuits, the solenoid of the units being operated by a 28 volt D.C. supply. The units, D.9101, D.9102 and D.9103 incorporate, in addition to the main contacts, two pairs of auxiliary contacts and the only difference between these three units is in the normal position of the auxiliary contacts. The D.9104 and D.9105 contactors which are continuously rated, are basically the same as the other units in the range



except that they incorporate a coil safety switch and economy resistors which are not fitted to the other units and they have only one pair of auxiliary contacts. The D.9106 is identical to the D.9104 except that it is fitted with main terminals which will accommodate 35 ampere Prenal cable lugs.

The table below shows the normal position of the auxiliary contacts.

Unit	Contacts 3 and 4	Contacts 5 and 6
D.9101	Normally open	Normally open
D.9102	Normally closed	Normally closed
D.9103	Normally open	Normally closed
D.9104	Normally open	—
D.9105	Normally closed	—
D.9106	Normally open	—

The units comprise a main body casting containing the contact actuating levers, an operating solenoid which is mounted on the top face of the main casting and two insulated side cases which are mounted on opposite side faces of the main casting and house the main and auxiliary contacts. The main terminals are fitted on the top of the side cases and arc chutes containing de-ion grids are fitted to assist in arc quenching when the main contacts are operating. The terminal block of the operating coil leads is mounted at one end of the main casting and the terminal blocks for

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A.R.B. Authority Ref. No. for D.9104: E.3490

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PRICE ONE SHILLING

NOVEMBER 1955

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the auxiliary contacts are mounted on the end of the side cases.

In the D.9104, D.9105 and D.9106 the economy resistors are fitted on the end of the main casting opposite the coil terminal block and the coil safety switch is fitted in one of the side cases in the position occupied by the second pair of auxiliary contacts of the other units in the range.

The two main contacts are connected in series and the contact arm of each contact is mounted on a shaft which is rotated to close the contacts. The shafts are rotated by the pulling action on the actuating levers by a pin attached to the link of the solenoid plunger assembly. A mechanical interlocking device is incorporated to ensure that, should one of the moving contacts weld "ON" the other pair will open to interrupt the line circuit and that the open contacts cannot close again until the weld has been cleared and the mechanism reset.

The main contacts are of the rolling butt type and are faced with silver tungsten. The moving contacts are connected together, via copper braid connections and a conductor bar which passes through the main casting and is secured by nuts and screws to the base of each of the side cases.

Operation

With the control supply applied to the solenoid, the plunger is pulled upwards towards the solenoid anvil. The link of the plunger pulls on the actuating lever of each moving contact and closes the main contacts.

In the D.9104, D.9105 and D.9106 contactors, the closing action of the main contacts opens the coil safety switch and a reduced hold-in current is then supplied to the coil via the economy resistors.

The mechanical interlocking device which is fitted to all the units in the range operates as follows :—

The main contact arms are mounted on individual shafts and differential movement can be obtained. The two actuating levers are shaped with an arm extending in an arc at the bottom of the levers. When the solenoid is energized the two arm extensions move round parallel with one another. At the tip of one of these extensions, a locking pin is fitted and is held in position by a leaf spring attached to the outside of the lever which forces the pin against the inside of the opposite arm extension. The opposite extension is slotted and the locking pin is normally

positioned between this slot and the end of the extension. When both actuating levers move round to close the contacts the pin remains in position. Should one of the contacts fail to open when the solenoid is de-energized, the associated actuating lever remains in the closed position and the other lever returns to the open position. When this happens, the locking pin is forced by the pressure of the leaf spring, either into the slot or against the edge of the opposite extension depending on which contact has failed to open. In either position the pin prevents the open contact from reclosing until the mechanism is reset.

To reset the interlock, remove the cover from the base and ease back the locking pin until the actuating lever of the closed contact returns to the open position. The locking pin is then held in the normal operating position.

Periodic Inspection

These units are correctly adjusted and tested before leaving the factory and should require little attention in service. If a unit functions satisfactorily it can be considered serviceable for continued use. A general inspection should be made periodically to ensure that there is no apparent physical damage and that the terminals are clean.

It is recommended that the following millivolt test be carried out to ascertain the condition of the main contacts :—

With 60 amperes flowing, measure the millivolt drop across each of the main contacts. The millivolt drop should not exceed 50 millivolts. If this test is not practical with the unit in situ, the main contacts should be carefully examined and if their condition is at all doubtful the unit should be removed and the millivolt test applied.

Servicing

If test equipment is not available no attempt should be made to service or dismantle the unit. It should be replaced by a new unit and returned to our nearest Service Department, or authorised service station where it will be promptly dealt with by our repair organisation. In cases where test equipment is available, apply for Rotax Service Leaflet S.L. 80 for full servicing details.

For further information on the functioning, operation and maintenance
of Rotax equipment, enquiries should be addressed to:—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
NEPEAN HIGHWAY
CHELTENHAM, S. 22
VICTORIA

Telephone : XF 1381

ROTAX LIMITED
HEMEL HEMPSTEAD
HERTFORDSHIRE
ENGLAND

Telephone : BOXMOOR 4444

LUCAS-ROTAX LIMITED
5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA

Telephone : BY 6500-09

Technical enquiries should be addressed to:—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W. 10 • ENGLAND
ELGar 7777

SUBJECT: Starter Unit

TYPE: U.2801/1

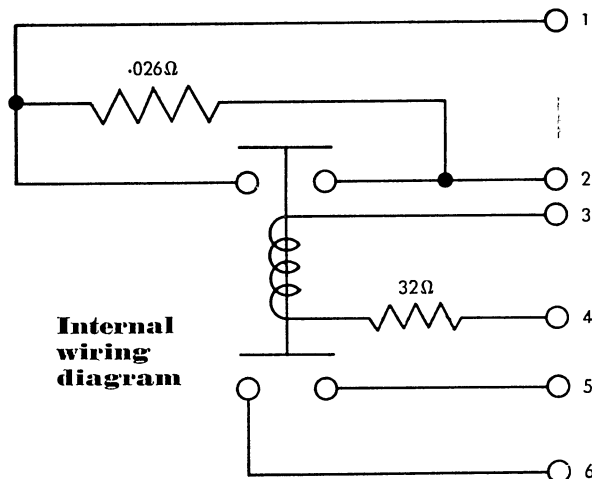
DATA:

Supply Voltage : 28 volts D.C.
Electrical Connections : 0.312" B.S.F. and 2 B.A. terminals
Ambient Temperature Range : -65°C. to $+70^{\circ}\text{C.}$
Altitude Ceiling : 60,000 ft.
Compass Safe Distance : 50" for 1° deflection.
Mounting : Four 0.281" dia. holes.
Weight : 5 lb.

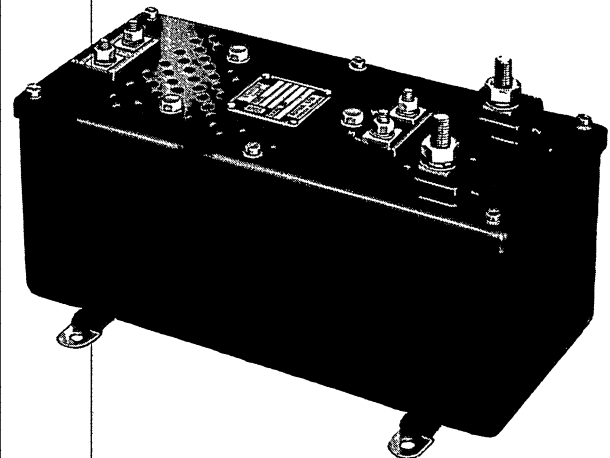
Description

This starter unit is a single stage unit designed for use with 28 volt D.C. motors. The unit comprises a D.10505 balanced contactor, a starting resistor and a ballast resistor, a case assembly which has two fixing brackets attached and a top cover assembly. The terminals of the unit are situated on the top cover assembly. For a detailed description of the D.10505 contactor, reference should be made to Rotax Technical Leaflet T.L. 71.

The contactor is fixed to the top cover assembly by means of three 2 B.A. bolts. The two main terminals



(1 and 2) are situated at one end of the top cover assembly and the starting resistor, which is in the form of a $2\frac{3}{4}$ turn coil of heavy section metal (8 s.w.g.), is connected directly to the base of the main terminals. Connections between the main terminals and the line



terminals of the contactor are in the form of solid copper strips.

The ballast resistor, which is fitted to the top cover assembly at the same end as the starting resistor, is a wire wound resistor with a mica former and has an adjustable slider fitted which can be set to give a pre-determined pull-in voltage for the contactor.

Operation

The usual method of operation is to connect the starting resistor (terminals 1 and 2) in series with the motor armature and then connect the coil terminals of the contactor (terminals 3 and 4) across the armature of the motor. When the supply is switched on, a current flows through the starting resistor until the voltage across the armature reaches the pre-determined value (17.5 to 18.23 volts) required to close the contactor contacts. With the contacts closed, the starting resistor is short circuited and the full supply voltage is applied to the armature. A pair of auxiliary contacts are provided in the contactor. These contacts can be used as part of an electric interlocking circuit which allows the motor to be switched directly into the reverse direction of rotation. The auxiliary contacts are so adjusted that they open after the main contactor contacts when the direction of rotation is being reversed and they can be so arranged as to ensure that the armature has stopped before the reverse direction voltage is applied.

Installation

These units may be installed in any attitude. The fixing measurements and overall dimensions are given in the spare parts diagram. The main terminals 1 and 2 are 0.312" B.S.F. terminals and the coil terminals

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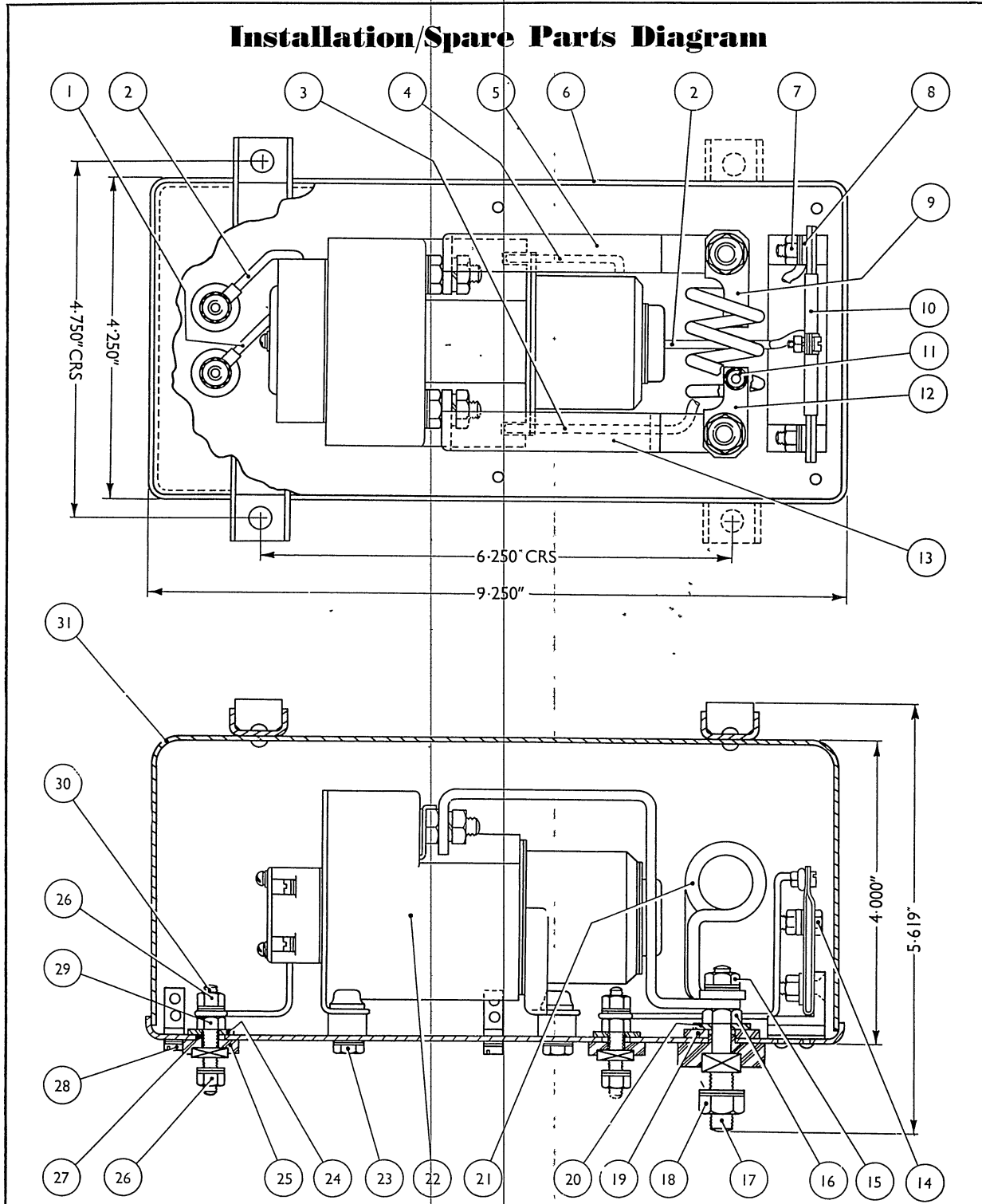
PRICE ONE SHILLING

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JUNE 1956

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Installation/Spare Parts Diagram



(3 and 4) and auxiliary terminals (5 and 6) are 2 B.A. stud terminals.

Periodic Inspection

A careful visual inspection should be made at intervals between overhauls. All terminals and the unit fixing nuts should be secure and the insulation of leads should be examined for signs of wear or damage.

If any signs of overheating are discovered they should be investigated and any damaged parts renewed. The insulation resistance between the following points should be measured, using a 250 volt "Megger" :—

Terminal 5 and terminals 6, 1 and 3.

Terminal 6 and terminals 1 and 3.

Terminal 1 and terminal 3.

All terminals and casing of the unit.

The insulation resistance between the points should not be less than 20 megohms.

2000 Hour Overhaul

After every 2000 hours in service, the starter unit should be removed from the aircraft and overhauled. The unit should be dismantled and each part thoroughly examined for signs of wear or damage and, where necessary, damaged or worn parts are to be renewed. Particular attention should be paid to leads.

When the D.10505 contactor has been removed from

the starter unit it should be overhauled in accordance with the instructions contained in Rotax Service Leaflet S.L. 71.

When the contactor has been overhauled and any other parts renewed where necessary, the unit should be reassembled and subjected to the following tests.

Testing

The starting resistor is to be measured between terminals 1 and 2 and should be $0.026 \text{ ohm} \pm 10\%$ corrected to a temperature of 20°C .

Pull-in Voltage

The contactor pull-in voltage is to be measured across terminals 3 and 4 and should be between 17.5 and 18.25 volts. If the pull-in voltage is outside these limits, adjust the slider of the ballast resistor until the correct voltage has been obtained. The main axis of the unit should be horizontal when setting the contactor pull-in voltage. The ballast resistor setting should be recorded after obtaining the correct pull-in voltage and the operation of the unit checked first at the pull-in voltage and then at 29 volts.

Auxiliary Contacts

Check that the auxiliary contacts open after the main contacts when the contactor coil circuit is switched off.

Millivolt Drop

With the contactor coil energized and a current of

Table of Spare Parts

Item No.	Part No.	No. Off	Name of Part	Item No.	Part No.	No. Off	Name of Part
1	N 130138	1	Lead Assy.	16	N 1382	2	Spring Washer
2	N 130137/1	2	Lead Assy.	17	NK 10064-F	2	Nut
	N 24062	2	Washer	17	N 119151	2	Terminal Stud
3	N 130137/2	1	Lead Assy.	18	NK 10068-F	2	Nut
	N 24062	1	Washer		N 77668/16	2	Spring Washer
4	N 130137	1	Lead Assy.		N 8521	2	Washer
	N 24062	1	Washer	19	N 121753	2	Washer
5	N 119152	1	Connecting Strip	20	N 66909/1	2	Washer
6	N 119148	1	Cover Assy.	21	N 123678	1	Starting Resistor
7	NK 4226-F	2	Screw	22	D 10505	1	Balance Contactor
	N 1354	2	Plain Washer	23	N 106280	3	Spacer
	N 1374	2	Spring Washer		NK 2035-E	3	Screw
	NK 10006-F	2	Nut		N 1354	3	Plain Washer
8	N 96889	2	Washer		N 1374	3	Spring Washer
9	N 103114/4	1	Clamp	24	N 121752	4	Washer
10	NK 100280	1	Ballast Resistor	25	N 100278	2	Insulating Board
11	NK 10009-L	4	Nut	26	NK 10006-F	8	Nut
	N 1378	4	Spring Washer		N 1354	8	Plain Washer
	N 100292	2	Stud		N 1374	8	Spring Washer
12	N 103113/4	1	Clamp	27	N 96889	4	Washer
13	N 119152/1	1	Connecting Strip	28	NK 709E	6	Screw
14	NK 2018-F	1	Screw		N 1358	6	Plain Washer
	N 1354	1	Plain Washer		N 1378	6	Spring Washer
	N 1374	1	Spring Washer	29	NK 10006-F	4	Nut
	NK 10006-F	1	Nut		N 1354	4	Plain Washer
15	NK 10064-F	2	Nut		N 100276/1	4	Terminal Stud
	N 41173	2	Plain Washer	31	N 119417	1	Case Assy.

150 amperes flowing through terminals 1 and 2, measure the millivolt drop across these contacts. This should not be greater than 180 millivolts.

With the contactor still energized and 5 amperes flowing through the auxiliary contacts, measure the millivolt drop across these contacts (terminals 5 and 6). This should not be greater than 100 millivolts.

Insulation Tests

The insulation tests set out in this leaflet for a periodic inspection should be carried out during overhaul of the starter unit. As an alternative to these tests, a high potential test of 250 volts r.m.s., 50 c.p.s. may be applied for one minute between each set of points enumerated in the insulation tests. After completion of the insulation or high potential tests, the unit should be given a visual check to ensure that there is

even spacing between the turns of the starting resistor and that the cover fits correctly.

When the unit has satisfied these tests it may be considered serviceable for continued use.

Rotax Servicing Facilities

Any unit which cannot be serviced satisfactorily by following the instructions contained in this leaflet, should be replaced by a new one and the original returned to our nearest Service Department, or nearest authorised service station, where it will receive prompt attention by our repair Organisation.

When ordering replacement parts, please give full information by referring to the parts list and the engraved type and serial numbers on the unit. This will facilitate prompt identification and efficient service.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
NEPEAN HIGHWAY
CHELTENHAM, S. 22
VICTORIA

Telephone : XF 1381

ROTAX LIMITED
HEMEL HEMPSTEAD
HERTFORDSHIRE
ENGLAND

Telephone : BOXMOOR 4444

LUCAS-ROTAX LIMITED
5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA

Telephone : BY 6500-09

Technical enquiries should be addressed to :—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10 • ENGLAND

Telephone : ELGar 7777

SUBJECT: Navigation Lamps

TYPES: H.1701, H.1702, H.1703,
H.1705, H.1706, H.1707,
H.1714, H.1715

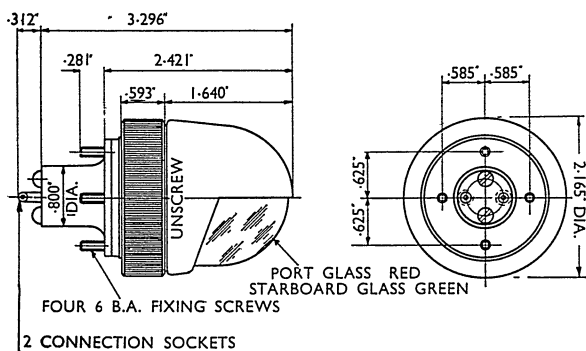
DATA:

Voltage :	See table below.
Power consumption :	20 watts.
Electrical connection :	Soldered leads to pins.
Mounting :	Four 6 B.A. screws.
Weight :	4 oz.

Description

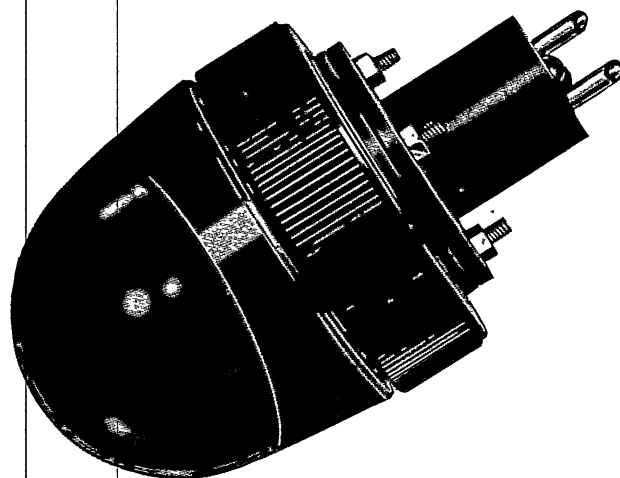
These port (red) and starboard (green) navigation lamps have been designed to comply with the Air Navigation Regulations. The lamps in the series, all of which have a power consumption of 20 watts, are identical in construction, the difference between each lamp in the series being shown in the table below.

Unit	Bulb Voltage	Colour of Glass
H.1701	12 to 14 V.	Red
H.1702	12 V.	Red
H.1703	24 V.	Red
H.1705	12 to 14 V.	Green
H.1706	12 V.	Green
H.1707	24 V.	Green
H.1714	As H.1703 but with aluminium screen cap and union ring.	
H.1715	As H.1707 but with aluminium screen cap and union ring.	



Installation diagram

The lamps are strongly constructed, the design being compact and allowing for easy dismantling or installation. The unit comprises a socket moulding for the



filament lamp, and a screen cap support moulding, the socket moulding having spring loaded plunger contacts, a screen cap and a union ring for securing the screen cap to the socket moulding, a dome-shaped glass and the filament lamp. The glass is held in position by the screen cap and a cork gasket is fitted at the base of the glass to ensure a good joint. The spring-loaded plungers which make contact with the filament lamp, pass through the socket and are hollow at the outer ends to receive the supply leads. The socket moulding and the screen cap support moulding are secured to each other by means of the four fixing screws. The screen cap is dome-shaped with a section cut-away between the vertical plane and a plane 110° from the vertical plane in the outboard direction. A small hole in the inboard side of the screen cap gives indication of the lamp being alight during flight.

The filament lamp is a bayonet cap type and the filament is so arranged as to give sharp cut-off at the edges of the screen cap aperture.

The lamps are small enough to be installed in the wing tip under a perspex cover thus preventing any drag which might be caused by external mounting. On smaller aircraft, however, where it may not be possible to install the lamps under a cover in the wing tip, the lamp may be installed externally.

Installation

The overall dimensions of the lamp are shown in the diagram above. The lamps are mounted by means of four 6 B.A. screws positioned in diametrically opposite pairs on P.C.D.s of 1.170" and 1.250" respectively. Electrical connection is made to the lamp via two soldered leads.

"Information contained in this leaflet affecting safe operation, maintenance and overhaul, has been verified and approved by the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements, 29/8/56."

A.R.B. Approval Nos. H.1703 - E.2451, H.1707 - E.2452.

"Amendments to this publication invalidate the approval statement unless issued by the manufacturers with the concurrence of the Air Registration Board."

PRICE ONE SHILLING

JUNE 1956

ROTAX LIMITED · WILLESDEN JUNCTION · LONDON N.W. 10 · ENGLAND · TELEPHONE ELGAR 7777
LUCAS-ROTAX (AUSTRALIA) PTY. LTD · NEPEAN HIGHWAY · CHELTENHAM S.22 · TELEPHONE XF 1381
LUCAS-ROTAX LIMITED · TORONTO 13 · CANADA · TELEPHONE PLYMOUTH 5-4171

Periodic Inspection

From time to time the lamp should be inspected to ensure that there is no apparent physical damage. The mouldings should be examined carefully for signs of distortion or cracking and where this is discovered the lamp should be removed and the damaged part replaced. The terminals should be examined for signs

of corrosion and the security of the lamp to its installation checked.

After this visual inspection, the operation of the lamp should be checked by switching on and off.

When the lamp has satisfied this inspection it can be considered serviceable for continued use.

Spare Parts

When ordering replacement parts, reference should be made to the table below and the complete information, including the part name and number and the

code number of the unit for which the part is required, should be quoted. This will ensure correct identification and prompt service.

Part Name	Part No.	No. Off	Part Name	Part No.	No. Off
Screen Cap Moulding (H.1701 to 07)	13374	1	Support Moulding	13373	1
Screen Cap Moulding (H.1714 & 15)	55958	1	Union Ring (H.1701 to 07)	13376	1
Glass (red) (H.1701, 02, 03 & 14)	13371/1	1	Union Ring (H.1714 & 15)	N 55957	1
Glass (green) (H.1705, 06, 07 & 15)	13371/2	1	Lampholder Moulding	13375	1
Filament Lamp (H.1701 & 05)	13353/C	1	Screw (fixing)	AGS 245/31	4
Filament Lamp (H.1702 & 06)	13353/B	1	Thackery Washer	AGS 1583/D	4
Filament Lamp (H.1703, 07, 14 & 15)	13353/A	1	Lampholder Plunger	13378	2
Cork Gasket Ring	13369	1	Plunger Spring	13380	2
			Lampholder Disc	13377	1
			Screw (for lampholder disc)	AGS 244/30	2

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LUCAS-ROTAX (AUST.) PTY LTD
NEPEAN HIGHWAY
CHELTENHAM, S. 22
VICTORIA

Telephone : XF 1381

ROTAX LIMITED
HEMEL HEMPSTEAD
HERTFORDSHIRE
ENGLAND

Telephone : BOXMOOR 4444

LUCAS-ROTAX LIMITED
5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA

Telephone : BY 6500-09

Technical enquiries should be addressed to :—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10 • ENGLAND
Telephone: ELGar 7777

SUBJECT: Lamp Bodies and Knob Assemblies

TYPES: H.4500 Series Lamp Bodies
H.4600 and H.4700 Series Knob Assemblies

DATA:

Voltage : 24 volts unless otherwise specified
Power Consumption : 2.4 watts
Weight : Body 1.5 oz. Knob Assemblies 0.18 oz.
Electrical Connections : 6 B.A. Combined Screw
and Washer Terminations

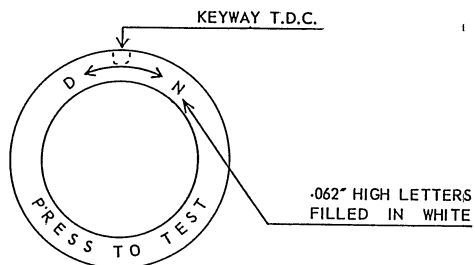
Description

These units have been designed for use as warning lamps in general applications, e.g., power indication, and are intended to replace the lamp assemblies formerly obtained under the code numbers H.3400 and H.3500 series. Each lamp comprises body and knob assembly, the H.4600 series of knob assemblies being matched to lamp bodies H.4501 or H.4503, and the H.4700 series of knob assemblies being matched to lamp bodies H.4502 or H.4504. Lamp knob assemblies may be obtained in various combinations of shapes and window colours (see illustration and table). The design is such that a lamp may be tested without being removed from its circuit simply by pressing the knob assembly.

Full dimensional details are given on the installation diagram.

Lamp Bodies H.4501 and H.4503

These lamp bodies are of similar construction and comprise the lamp, a terminal post assembly, two contact post assemblies and a socket assembly enclosed in a light robust case of moulded Bakelite. The case is fitted at one end with an adaptor for the bezel and at the other a removable base which serves as a cover for the terminals. The bezel is attached to the adaptor by means of a bayonet fitting and is engraved D—N as shown below.

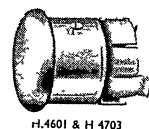


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PRICE ONE SHILLING

JANUARY 1958

ROTAX LIMITED WILLESDEN JUNCTION LONDON N.W. 10 ENGLAND TELEPHONE ELGAR 7777
LUCAS-ROTAX (AUSTRALIA) PTY. LTD JOYNTON AVENUE ZETLAND N.S.W. TELEPHONE 11 2241
LUCAS-ROTAX LIMITED TORONTO 13 ONTARIO CANADA TELEPHONE FLYMOUTH 5 4171



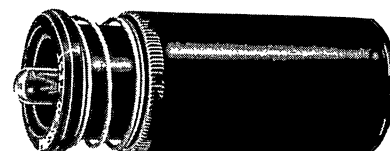
H.4601 & H.4703



H.4602 H.4603 & H.4701



H.4702



H.4501 & H.4502

When a body is fitted with its complementary knob assembly this engraving indicates the direction in which the bezel of the knob must be turned in order to adjust the iris dimmer from the Day to Night position.

The two bodies differ in that H.4503 is slotted at the base to allow side entry to the terminals for tags type A.M.P. 31878.

Lamp Bodies H.4502 and H.4504

With the exception that the bezel used on these bodies is not engraved they are identical to H.4501 and H.4503 respectively.

Knob Assemblies H.4600 series

This series of knob assemblies comprising types H.4601, H.4602 and H.4603, are each fitted with an iris dimmer and are for use in conjunction with body H.4501 or H.4503. Rotation of the knob bezel controls the opening and closing of the dimmer thus enabling the light to be adjusted to suit all conditions of day or night flying.

Type code numbers H.4601 and H.4602 indicate the shapes of knob assembly that are available ; each shape is shown in the illustration above.

Type H.4603 is identical in shape to the H.4602, the difference being confined to the finish of the iris dimmer, i.e., in the H.4603 the beryllium copper strips forming the iris are black oxidised to further reduce the amount of light required for specific flying conditions.

Each code number is suffixed by a stroke number to indicate the colour of the window fitted to the assembly.

Knob Assemblies H.4700 series

This series of knob assemblies, comprising types H.4701, H.4702 and H.4703, is similar to the H.4600 series but is not fitted with the iris dimmer. They are used in conjunction with body H.4502 or H.4504. Windows are available in various colours as for the H.4600 series.

The table overleaf summarises the possible combinations of the four lamp bodies and the two series of knob assemblies.

Installation

The lamps are mounted on a panel, being fixed in a cut-out 0.781" diameter with a keyway, cut 0.031" deep by 0.141" wide as shown in the installation diagram, to prevent the lamp from turning in the cut-out.

With the bezel removed insert the adaptor end of the body into the cut-out (against the pressure of the

adaptor spring) and secure it in this position by replacing the bezel.

When these units are mounted in banks, the minimum distance between centres of installation cut-outs is 1.000".

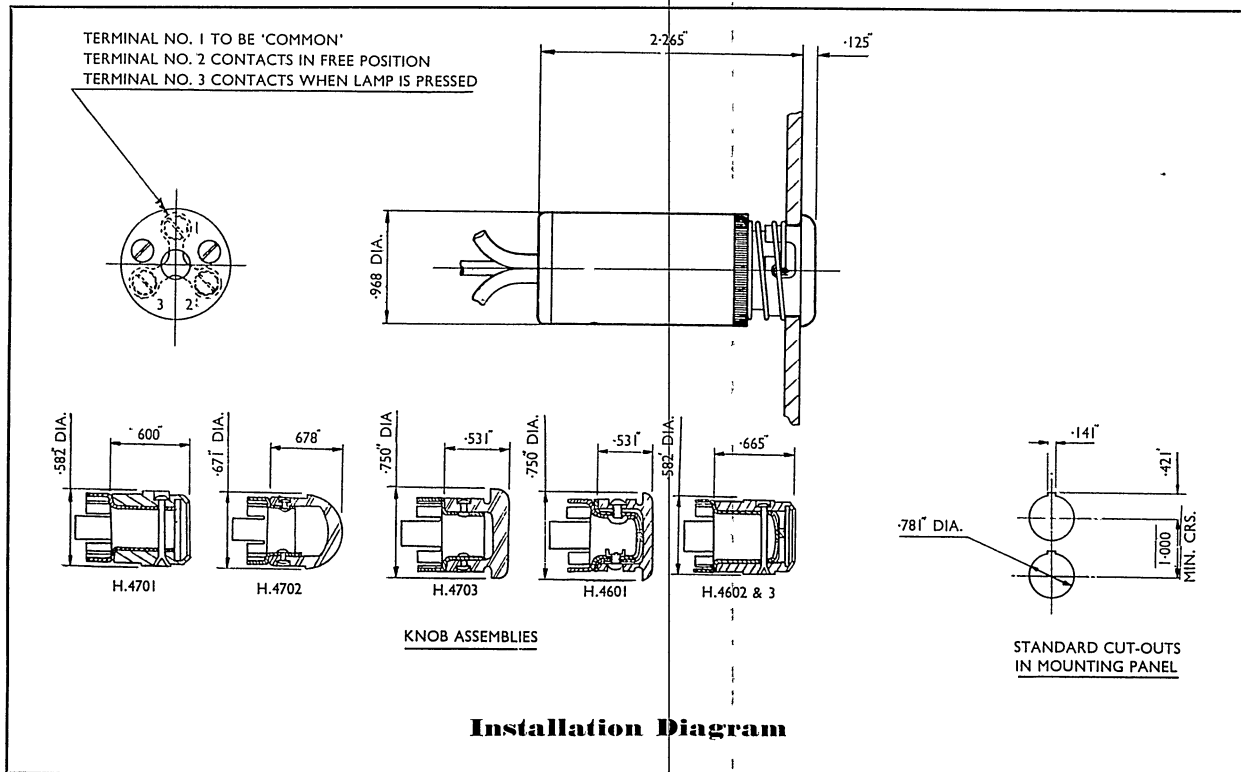
Periodic Inspection

These lamps should be subjected to a visual inspection and if they pass successfully they may be considered as acceptable for further service.

Examine the moulded body to ensure that it is not cracked, strained or otherwise damaged. Remove the end cap and ensure that all connections are secure and the leads in good condition.

Spare Parts

When ordering replacement parts, reference should be made to the spare parts list and complete information, including the part name and number and the code number of the unit for which the part is required, should be quoted.



<i>Body</i>	<i>Knob Assembly</i>	<i>Colour</i>	<i>Code No. of previous Lamp Assemblies</i>
H.4501 or 3	H.4601/1	Mist	H.3411/1
H.4501 or 3	H.4601/2	Ruby Red	H.3412/1
H.4501 or 3	H.4601/3	Green	H.3413/1
H.4501 or 3	H.4601/4	Blue	H.3414/1
H.4501 or 3	H.4601/5	Amber	H.3415/1
H.4501 or 3	H.4601/6	Purple	H.3416/1
H.4501 or 3	H.4602/1	Colourless	H.3401/1
H.4501 or 3	H.4602/2	Red	H.3402/1
H.4501 or 3	H.4602/3	Green	H.3403/1
H.4501 or 3	H.4602/4	Blue	H.3404/1
H.4501 or 3	H.4602/5	Amber	H.3405/1
H.4501 or 3	H.4602/6	Ultra-Violet	H.3406/1
H.4501 or 3	H.4603/1	Colourless	—
H.4501 or 3	H.4603/2	Red	—
H.4501 or 3	H.4603/3	Green	—
H.4501 or 3	H.4603/4	Blue	—
H.4501 or 3	H.4603/5	Amber	—
H.4501 or 3	H.4603/6	Ultra-Violet	—
H.4502 or 4	H.4701/1	Colourless	H.3501/1
H.4502 or 4	H.4701/2	Red	H.3502/1
H.4502 or 4	H.4701/3	Green	H.3503/1
H.4502 or 4	H.4701/4	Blue	H.3504/1
H.4502 or 4	H.4701/5	Amber	H.3505/1
H.4502 or 4	H.4701/6*	Red	—
H.4502 or 4	H.4701/7	Ultra-Violet	H.3506/1
H.4502 or 4	H.4702/1	Colourless	—
H.4502 or 4	H.4702/2	Red	—
H.4502 or 4	H.4702/3	Green	—
H.4502 or 4	H.4702/4	Blue	—
H.4502 or 4	H.4702/5	Amber	—
H.4502 or 4	H.4703/6	Mist	H.3511/1
H.4502 or 4	H.4703/2	Ruby Red	H.3512/1
H.4502 or 4	H.4703/3	Green	H.3513/1
H.4502 or 4	H.4703/4	Blue	H.3514/1
H.4502 or 4	H.4703/5	Amber	H.3515/1
H.4502 or 4	H.4703/6	Purple	H.3516/1

* Coloured window is marked with the letter " F "

Note : Lamp bodies types H.4503 and H.4504 have no previous equivalent.

For further information on the functioning, operation and maintenance
of Rotax equipment, enquiries should be addressed to :—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST). PTY. LTD
JOYNTON AVENUE
ZETLAND
NEW SOUTH WALES

Telephone : SYDNEY FF. 2241

ROTAX LIMITED
HEMEL HEMPSTEAD
HERTFORDSHIRE
ENGLAND

Telephone : BOXMOOR 4444

LUCAS-ROTAX LIMITED
5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA

Telephone : BY 6500-09

Technical enquiries should be addressed to :—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED · WILLESDEN JUNCTION · LONDON N.W.10 · ENGLAND
Telephone : ELGar 7777

SUBJECT: 5 ampere, Single Pole Push-button Switch

TYPE: D.0523 (A.M. Ref. 5CW/898)

DATA:

Rating : 5 amperes.

Weight : 1.4 oz.

Mounting : Four 0.120" dia. holes whose centres form a 0.960" square.

Description

Used extensively in a wide variety of applications where the maximum contact current does not exceed 5 amperes, these light yet robust switches have been constructed to give long, reliable service with the absolute minimum of attention.

Contained in a cylindrical moulding, the switch comprises two leaf contacts which are connected by means of a spring loaded, finger operated, plunger housed in a moulded shroud.

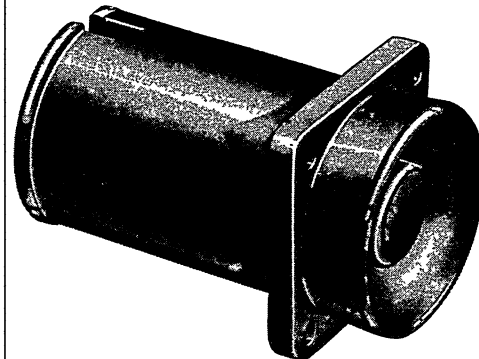
Electrical connection to the switch is made via two 4 B.A. combined screws and washers which are contained in a recessed terminal block at the base of the switch moulding. The terminal block is protected by a moulded cover retained in position by a 4 B.A. countersunk screw.

Installation

The mounting flange is drilled with four 0.120" dia. holes, the centres of the holes forming a 0.960" square. The switch is secured to a panel having a cut out 1.160" dia. by means of two diagonally opposite 6 B.A. screws or two No. 4 woodscrews. Full dimensional details are shown in the diagram overleaf.

Periodic Inspection

The construction of the switch renders periodic inspection of the components unnecessary. A visual inspection of the switch should be made, and care taken to ascertain that cracks or signs of other damage are not in evidence. Ensure that the connections are secure and clean and that they show no signs of corrosion. Operate the switch six times to make sure that the return spring is functioning correctly and that there is no tendency to stick. The action must be positive and smooth. Replace the switch by a new unit if damaged beyond economic repair. At periods consistent with the utilisation of the switch and having regard to the class of circuit in which it is installed, the following tests should be carried out.



1. With 5 amperes flowing the voltage drop across the contacts must not exceed 150 millivolts.

2. The insulation resistance between terminals shall not be less than 5 megohms when tested with a 250 volt "Megger."

Dismantling

Should it be necessary to dismantle the switch, unscrew the shroud, this allows the spring and plunger to be removed. All contact surfaces are then easily accessible for examination and cleaning.

The component parts of the switch will, under normal circumstances, remain serviceable throughout the life of the switch. If necessary the spring may be ordered under Part Number N.56804. The plunger, Part Number N.65296, need only be changed if it is considered inadvisable to dress the contact surfaces. If any component is renewed then the following tests must be carried out before the unit is put back into service.

Testing

1. Operate the switch six times to make sure that the return spring is functioning correctly and that there is no tendency to stick. The action must be positive and smooth.

2. With 5 amperes flowing the voltage drop across the contacts must not exceed 100 millivolts.

3. The insulation resistance between terminals shall not be less than 20 megohms when tested with a 250 volt "Megger."

Any switch which fails to pass any of the above tests should be discarded.

"This Leaflet is approved by the Air Registration Board. 10/1/58"
A.R.B. Authority Ref. No. for D.0523 : E.2388

"Amendments to this publication invalidate the above approval unless issued by the manufacturers with the concurrence of the Air Registration Board."

PRICE ONE SHILLING

JANUARY 1958

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10 • ENGLAND • TELEPHONE ELGAR 7777
LUCAS-ROTAX (AUSTRALIA) PTY. LTD • JOYNTON AVENUE • ZETLAND N.S.W. • TELEPHONE FF.2241
LUCAS-ROTAX LIMITED • TORONTO 13 • ONTARIO • CANADA • TELEPHONE PLYMOUTH 5-4171

SUBJECT: Current Indicator Relays

TYPES: F.5601/I
F.5602
F.5603/I

DATA:

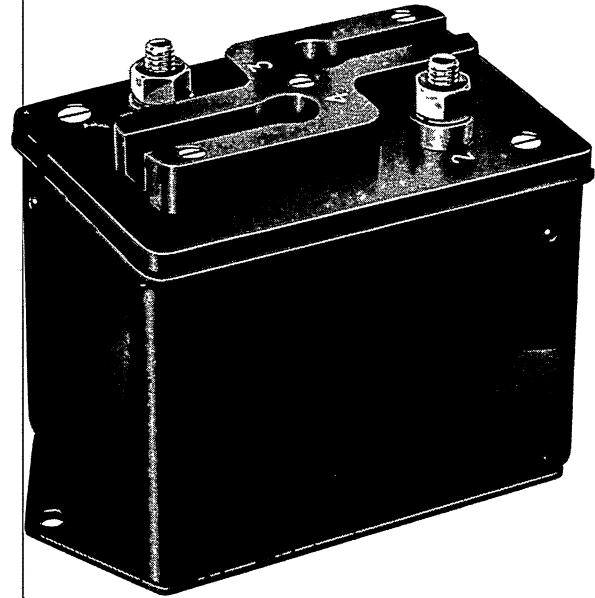
Rating :	
F.5601 :	30 amperes D.C. maximum. Indication at 15 amperes and below.
F.5602 :	6 amperes D.C. or A.C. (280-560 c.p.s.)
F.5603 :	25 amperes A.C. maximum. (frequency range 280 c.p.s. to 560 c.p.s.). Indication at 8 amperes and below.
Contact Rating :	0.25 ampere at 28 volt D.C.
Mounting :	Two 0.156" diameter holes on the main axis of the mounting plate; fixing centres 3.375" apart.
Operational Ceiling :	60,000 ft.
Operational Temperature Range :	- 65°C to + 70°C.
Compass Safe Distance :	23.5" for 1° deflection.
Weight :	0.5 lb.
Electrical Connections :	
Coil Terminals :	2 B.A. studs.
Contact Terminals :	6 B.A. screw and washer assemblies.

These units are flame-proof and fire resistant.

Description

The F.5601 relay is designed for inclusion in a 28 volt D.C. circuit while the F.5603 is designed for 208 (nominal) volt A.C. circuits (frequency range 280 c.p.s. to 560 c.p.s.) and each unit closes a 28 volt D.C. circuit to operate a warning signal when the current in the main circuit falls below a certain pre-determined value. The F.5602 may be used in 28 volt D.C. circuits or 208 volt A.C. circuits (280-560 c.p.s.) and the relay contacts open to break a 28 volt D.C. warning circuit when the current falls below 3.0 ± 0.5 amperes. The ratings of the units are listed above under "Data."

The units are similar except that the coil windings vary to give the required ratings. Each relay has a U-shaped laminated core, held parallel to the terminal board by three mounting pillars, which is energised by a coil mounted and wedged on one arm. A laminated armature is pivoted to a bracket, which supports it between the jaws of the core, and has a cam which



operates a moving contact assembly mounted horizontally across the jaws of the core. The armature bracket is secured to the core by one of the mounting pillars and a bolt, being positioned by spacers. The contacts are mounted on a transverse insulation piece fitted to the armature bracket; the fixed contact is in the form of a stud while the moving contact assembly consists of a leaf contact spring, a backing spring and an adjustment plate mounted on a duralumin block which in turn is screwed to the insulation piece.

The armature cam is loaded by a spring, anchored to the duralumin block, so that it is held clear of the moving contact spring. In this position, the armature is at approximately 45° to the core arms but when it is turned towards the 90° position the cam engages the moving contact spring and opens or closes the contacts.

The unit is enclosed by a sheet metal cover secured to the terminal board by two countersunk screws. A rectangular mounting plate, riveted to the cover, contains six 0.156" diameter fixing holes, three in line at each end of the unit. Of the three holes, the inner fall on the centre line of the relay, whilst the outer are displaced 0.780" on either side. The holes at each end are on centres 3.375" apart. The terminals are secured to the terminal board by internal nuts.

"This Leaflet is approved by the Air Registration Board." 14/3/58

A.R.B. Approval Ref. No. for series: E.3461

"Amendments to this publication invalidate the above approval unless issued by the manufacturers with the concurrence of the Air Registration Board."

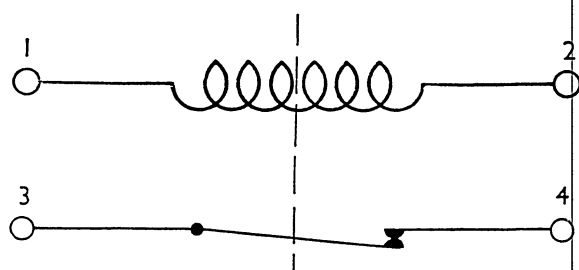
PRICE ONE SHILLING

DECEMBER 1957

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10 • ENGLAND • TELEPHONE ELGAR 7777
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Operation

The main circuit line is connected via terminals 1 and 2 and the 28 volt indicator leads are connected to terminals 3 and 4. The contacts are normally closed on the F.5601/1 and F.5603/1, and normally open on the F.5602. When the main circuit is switched on the core is energised and the armature swings toward the 90° position so that the cam opens and closes the contacts respectively. Since the restoring torque exercised by the cam spring is opposing the torque



**Internal wiring diagram
(F.5601/1 and F.5603/1)**

exercised by the magnetic attraction of the core, the armature will tend to return to its normal position if the current falls and if the current is reduced to its indicating value or below, the armature will swing sufficiently to allow the contacts to close or open respectively. Thus the indicator will operate if the main current falls below the predetermined value and cut out if the current rises above it.

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THE SERVICE DEPARTMENT

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ZETLAND
NEW SOUTH WALES

Telephone : SYDNEY FF.2241

ROTAX LIMITED
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HERTFORDSHIRE
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Telephone : BOXMOOR 4444

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5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA

Telephone : BY 6500-09

Technical enquiries should be addressed to :—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10 • ENGLAND

Telephone : ELGar 7777

Periodic Inspection

These units are correctly adjusted and thoroughly tested before leaving the factory and should require little attention in service. If a unit functions satisfactorily in its circuit it may be considered suitable for continued use. A general inspection should be made after every 2400 hours of operation to ensure that no physical damage has been sustained and that the connections and terminals are clean and secure.

Millivolt Drop Test

The following test should be carried out to ensure that the contacts and the coil are in good condition.

Allow a 0.25 ampere current to flow through the contacts and measure the potential drop between terminals 3 and 4. This must not exceed 60 millivolts. Pass the maximum rated current (D.C.) through the coil and measure the potential drop between terminals 1 and 2. This must not exceed the value given in the table below.

Unit	Maximum Rated Current	Potential Drop
F.5601	30 amperes	100 millivolts
F.5602	6 amperes	130 millivolts
F.5603	25 amperes	120 millivolts

Servicing

If test equipment is not available, no attempt should be made to dismantle or service the unit. It should be replaced by a new one and the unit requiring overhaul returned to our nearest Service Department, or authorised service station, where it will receive prompt attention by our Repair Organisation. Where test equipment is available, apply for Rotax Service Leaflet No. S.L. 85 for full servicing instructions.

SUBJECT: Trimmer Resistors

TYPES: ZA.2601 - ZA.2611

DATA:

Rating : 8 watts (at 20°C. ambient)
Resistance value : See table below
Mounting : 2 brass inserts tapped 6 B.A. and spaced 1" centres

Description

All resistors in the range are similar in construction the only difference between them being their resistance value. The value of each resistor in the range is shown in the table below.

Code No.	Resistance	Code No.	Resistance
ZA.2601	5 ohms	ZA.2607	350 ohms
ZA.2602	15 ohms	ZA.2608	100 ohms
ZA.2603	40 ohms	ZA.2609	7 ohms
ZA.2604	10 ohms	ZA.2610	270 ohms
ZA.2605	3 ohms	ZA.2611	200 ohms
ZA.2606	20 ohms		

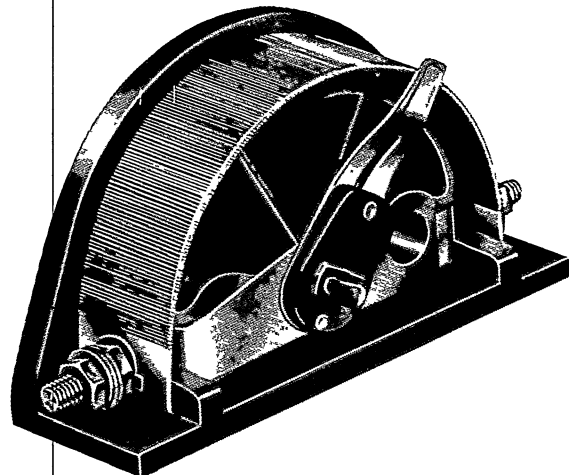
The unit comprises a moulded bakelite body, a semi-circular mica former wound with resistance wire which is secured to the body by means of the two 6 B.A. terminal assemblies, a moving contact arm which sweeps the edge of the wound former and a metal strip which forms the connection between one of the terminals and the moving contact arm.

The moulded body is shaped in the form of an arch with a rectangular base. The outside curve of the body is flat with a flange at one side and the former is fitted with one edge against the flange and the other overlapping the end of the body. The moving contact sweeps over the edge of the overlapping part of the wound former. The two fixed contacts are fitted opposite each other at each end of the former.

The overall dimensions of the resistor with details of terminals and fixing inserts are shown in the diagrams overleaf.

Periodic Inspection

Periodically the resistor should be inspected to ensure that there is no apparent physical damage. The body moulding should be examined carefully for signs



of cracking or distortion and the moving contacts and terminals should be clean and free from corrosion. It is unnecessary to remove the unit from its installation if it satisfies this visual check. If it functions satisfactorily in its associated circuit it can be considered serviceable for continued use.

Overhaul

When the associated unit, to which the trimmer resistor is connected, is removed for overhaul, the resistor should also be removed and inspected as described above. After inspection the following tests should be applied :—

With the moving contact arm set at the maximum position measure the resistance between the terminals. This should be within $\pm 15\%$ — 0% of the resistance value quoted in the table of resistance values.

With an ohmmeter connected to the terminals, turn the spindle from the maximum position to the minimum position and check that the fall in resistance value is even throughout the sweep of the moving contact arm.

Using a 500 volt "Megger," measure the insulation resistance between the moving arm and the spindle. This should not be less than 20 megohms.

Apply a flash test of 1000 volts r.m.s., 50 c.p.s. A.C. supply for one minute between each of the fixing inserts and its nearest terminal.

If the resistor satisfies these tests it can be considered serviceable for continued use.

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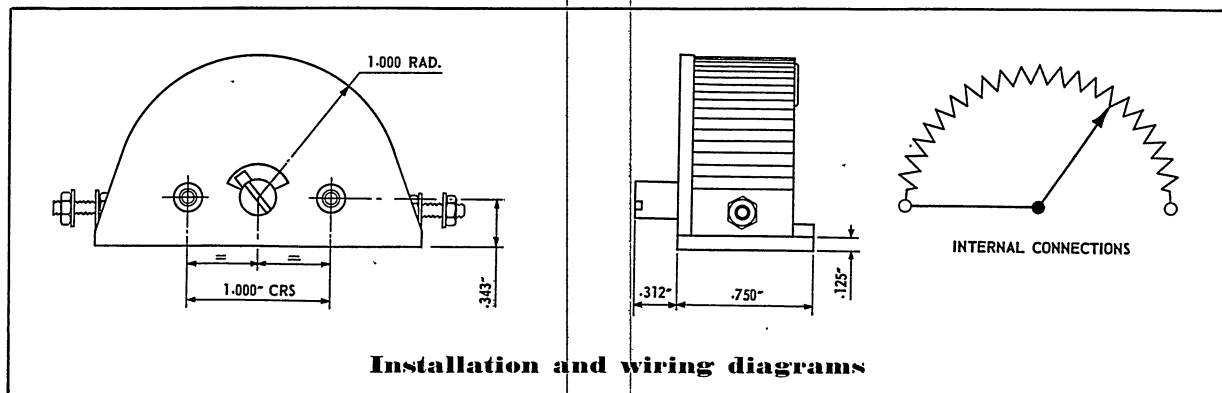
A.R.B. Authority Ref. No. for ZA.2606 and C8: E.3442.

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PRICE ONE SHILLING

JANUARY 1956

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For further information on the functioning, operation and maintenance
of Rotax equipment, enquiries should be addressed to:—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
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ROTAX LIMITED
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HERTFORDSHIRE
ENGLAND
Telephone : BOXMOOR 4444

LUCAS-ROTAX LIMITED
5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA
Telephone : BY 6500-09

Technical enquiries should be addressed to:—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED . WILLESDEN JUNCTION . LONDON N.W.10 . ENGLAND
ELGar 7777

SUBJECT: Double Action Solenoid Switch

TYPE: D.2710

DATA:

Voltages :

Contacts : 29 volts D.C. maximum
Coil : 29 volts D.C. maximum

Rating (contacts) : 150 amperes

Mounting : Four 0.234" diameter holes in pedestal, whose fixing centres form a rectangle 2.375" x 1.500".

Operational Ceiling : 60,000 ft.

Operational Temperature Range : -65° C. to +70° C.

Climatic Grading : Fully tropicalised

Acceleration Grading : 1A

Vibration Grading : 3 (Central regions)

Weight : 4.25 lb.

Electrical Connections :

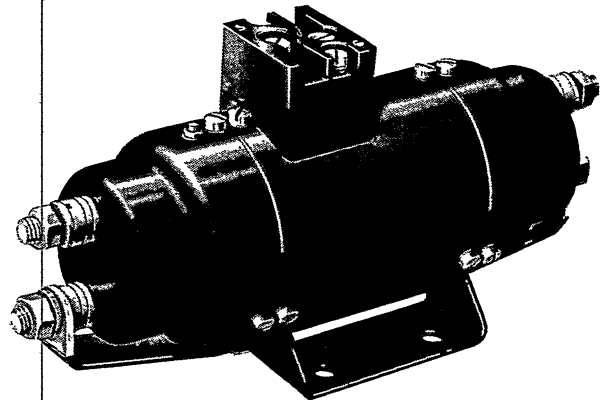
Contacts : Four $\frac{5}{16}$ " B.S.F. studs
Coil : Two 4 B.A. screw and washer terminations

This switch is fully flame-proof.

Description

This double-action solenoid switch is intended for use as a change-over contactor in a 28 volt D.C. circuit. A special preloaded ball catch is incorporated to render the switch free of disturbance under conditions of acceleration, so that it may be mounted in any position without loss of efficiency.

The solenoid consists of a coil wound on a bobbin tube, within which slides a plunger. The tube is partly filled by a soft iron core which provides an anvil stop for the plunger in its energised position. The coil is housed in a cylindrical body and retained by a throat plate through which the plunger projects. A moulded two-way terminal block is fitted to the body for the coil connections and has two 4 B.A. screw and washer terminations. Screwed into the open end of the plunger is a short spindle which carries a circular contact moulding into which a contact ring is set. This contact ring connects two fixed contacts, which are integral with terminals 3 and 4, when the solenoid is de-energised. The contact moulding is free to slide



on the spindle, being retained by a conical nut, and contact load is maintained by a conical spring between the moulding and the plunger. The correct load of 5—5.5 lb. is obtained with a follow-through of approximately 0.030". Both fixed and moving contact surfaces are of silver. The terminals are $\frac{5}{16}$ " B.S.F. studs set in, and insulated from, an end cap bolted to the solenoid body. A long rod butts against the anvil end of the plunger and passes through an axial hole in the core to operate contacts similar to those at the plunger end. These contacts are normally open but, when closed, have a contact load of 5—6 lb. with a follow-through of 0.030". The two $\frac{5}{16}$ " terminals (1 and 2) are mounted in a similar manner to those at the plunger end of the switch. A protected connection strip passes under the switch between the feet of the pedestal to common terminals 1 and 3.

A helical return spring bears on the end of the long rod to maintain the plunger in the normal position when the coil is de-energised. The "out-stop" is formed by a collar, integral with the long rod, which slides in the bore of a preload plate bolted to the core. The collar has a slight bevel around the circumference at the mid position. A bow spring loads two levers, pivoted on the preload plate, which in turn apply pressure through two short rods to two balls housed in the preload plate and riding on the periphery of the collar. They are spaced at 180° and are so placed that, when the plunger is in the de-energised position, the balls rest on the smaller circumference of the collar and against the bevel so that a force of at least 5 lb. is required to move the plunger towards its energised position. This ball catch is sufficient to eliminate any movement of the plunger, with consequent lessening of the load on the made pair of contacts, as a result of acceleration. When the coil is energised, the balls

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PRICE ONE SHILLING

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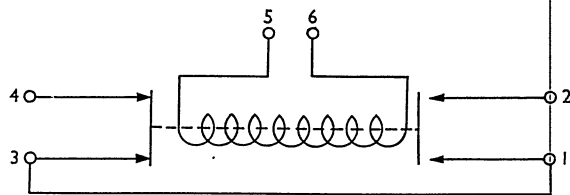
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ride up over the bevel. A screw is provided in the top of the cover which houses the bow spring to bear on the spring and provide a means of adjustment for the catch load.

Operation

When the coil is energised, the plunger moves into the coil, open circuiting terminals 3 and 4 and making



Wiring Diagram

contact between terminals 1 and 2. The slight movement of the contact rod which precedes the actuation of the closed contact moulding allows sufficient time for full acceleration of the plunger, ensuring that contact is broken sharply so that the possibility of welding is minimised. When the coil is de-energised the plunger immediately returns to its normal position under the action of the return spring. Terminals 3 and 4 close and terminals 1 and 2 open in a similar manner to 3 and 4.

Periodic Inspection

The units are correctly adjusted and thoroughly

tested before leaving the factory and should require little attention in service. If a unit functions satisfactorily in its circuit it may be considered suitable for continued use. A general inspection should be made to ensure that no physical damage has been sustained and that the terminals are clean.

Millivolt Drop Test

This test should be carried out to ensure that the contacts and conductor strip are in good condition. Allow 90 amperes to flow between the points enumerated below and measure the potential drop between them, which should not exceed the value indicated.

Between terminals 1 and 2 (coil energised)	50 millivolts
Between terminals 3 and 4 (coil de-energised)	50 millivolts
Between terminals 1 and 3	40 millivolts

Servicing

If test equipment is not available no attempt should be made to service or dismantle the unit. It should, however, be replaced by a new one and the inoperative equipment returned to our nearest Service Department, or authorised service station, where it will be promptly dealt with by our Repair Organisation. In cases where test equipment is available, apply for Rotax Service Leaflet No. S.L.87, for full servicing details.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :

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Technical enquiries should be addressed to :—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED · WILLESDEN JUNCTION · LONDON N.W.10 · ENGLAND
Telephone : ELGar 7777

SUBJECT: Push-Button Switches**TYPES:** D.10601 D.10602**DATA:**

Voltage : 28 volts.
 Current Rating (continuous) : 10 amperes.
 Electrical Connections : 4 B.A. combined screw and washer terminations.
 Ambient Temperature Range : - 65°C. to +70°C.
 Fixing : Two 4 B.A. screws.
 Weight : 1.75 oz.

Description

These switches are designed for general application in aircraft electrical systems where a single-pole, change-over push-button switch is required. Each switch is of robust construction and comprises a moulded base assembly, the switch mechanism and a moulded body. Two fixed contacts and the external terminals are fitted to the base moulding and the external connections are protected by a base cover which is secured to the base moulding by two 6 B.A. screws. A push button, which forms the operating plunger of the switch mechanism, protrudes through the top of the moulded body.

The switch mechanism is assembled on a bracket secured to the base moulding and consists of the spring loaded operating plunger, an operating arm, a roller carrier plate and roller and the moving contact assembly. The moving contact assembly is a copper strip, with a contact at each end, and the assembly pivots on a pin attached to the bracket of the switch mechanism. Both moving contacts are connected to the common terminal (terminal 2) and in the normal unoperated position terminals 2 and 3 are closed and terminals 1 and 2 open.

When the operating plunger is depressed the roller of the mechanism is moved across the top of the contact strip by the operating arm and when the roller over-centres the contact strip, terminals 2 and 3 are opened and terminals 1 and 2 closed. This position is maintained while pressure is exerted on the plunger. When the pressure is removed the moving contact returns to the normal position with terminals 2 and 3 closed and 1 and 2 open.

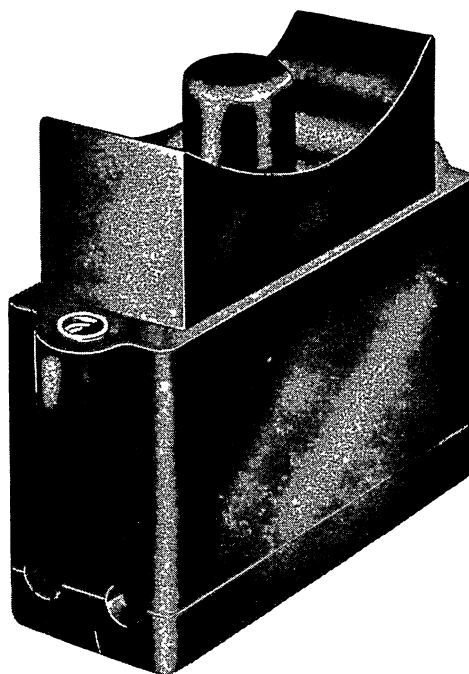
"Information contained in this leaflet affecting safe operation, maintenance and overhaul has been verified and approved by the Air Registration Board in accordance with Chapter A6-2 of British Civil Airworthiness Requirements. 29/8/56."

A.R.B. Approval No. E.3288

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PRICE ONE SHILLING

JUNE 1956



The only difference between the two switches in the range is that the body moulding of the D.10602 is formed with a push-button guard which prevents the inadvertent operation of the switch.

Installation

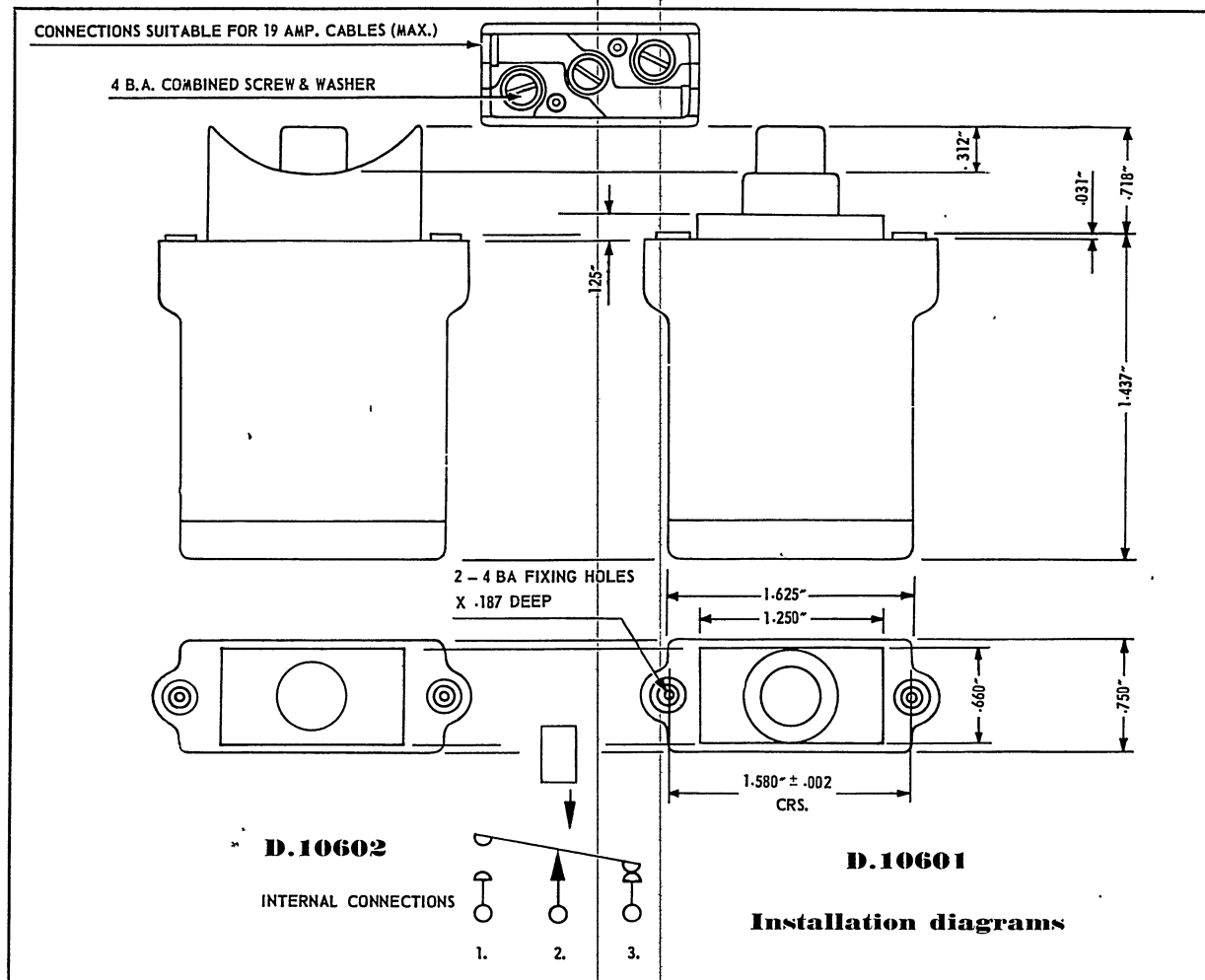
The unit may be mounted in any attitude and is secured to its mountings by two 4 B.A. screws which screw into two tapped bushes in the body moulding. The centres of the fixing holes are spaced 1.580" apart.

Dimensions of the switches are shown in the installation diagram overleaf.

Periodic Inspection

It is not recommended that these switches be dismantled as they have been sealed after manufacture and test. Periodically, however, they should be inspected to ensure that there is no apparent physical damage. The body moulding and base cover should be carefully examined for signs of cracking or distortion and the unit should be firmly secured to its mountings. Terminals should be examined, where it is possible to do so without removing the unit from its installation, and these should be clean and free from corrosion. If the unit satisfies this visual check and functions correctly in its associated circuit, it can be considered serviceable for continued use. Where a switch is found to be in any way defective it should be removed and a serviceable one fitted.

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ROTAX LIMITED
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HERTFORDSHIRE
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Telephone : BOXMOOR 4444

LUCAS-ROTAX LIMITED
5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA

Telephone : BY 6500-09

Technical enquiries should be addressed to :—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10 • ENGLAND
Telephone : ELGar 7777

SUBJECT: Phase Correction Unit

TYPE: ZA.7201

DATA:

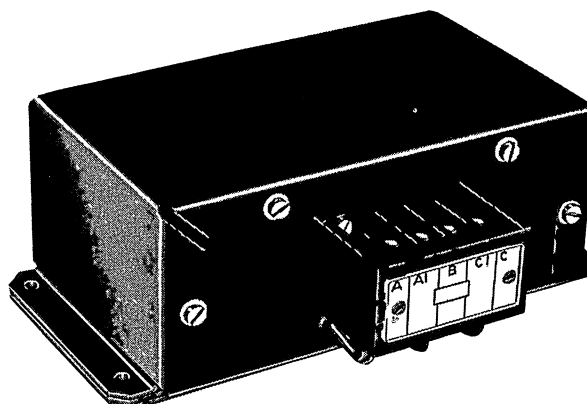
Input : 115 V., A.C., 3-phase, 400 c.p.s.
Output : 225 VA., 115 V., single phase, 0.866
lagging power factor.

Rating : Continuous.

Operating Temperature Range : -55°C. to $+50^{\circ}\text{C.}$

Electrical Connection : 5-way S.B.A.C. terminal block; cable ferrule AS 2672.

Weight : 2 lb. 12 oz.



Description

This unit has been specifically designed to enable the "Loran" (Long Range Navigational Equipment) single phase load to be taken from a 750 watt, 3-phase inverter without unbalancing the line voltages.

It comprises an aluminium box and cover assembly within which are mounted two chokes and a capacitor, the latter occupying a central position. Externally secured to one side of the box is a 5-way S.B.A.C. terminal block. Connections between the block and the internal components pass via three rubber grommets located in the wall of the box below the terminal block.

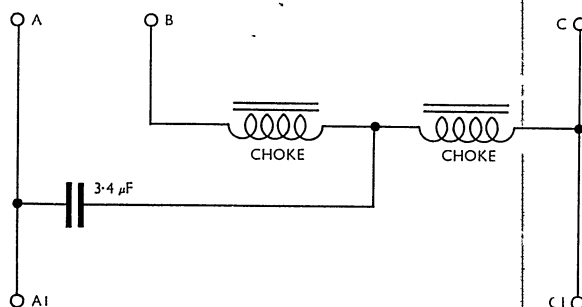


Fig. 1 Circuit diagram

The base of the unit extends beyond the box at each end to provide a means for mounting. The protrusions are of double thickness metal. These are further increased by the addition of the ends of the box which are turned out and shaped to coincide with the extended base.

The chokes are bolted to the base of the box, whilst the capacitor is held by a clamp arrangement which passes through the side of the box opposite to the terminal block. The wall of the box carrying the capacitor is strengthened by a channel section which is located externally and secured by the nuts forming part of the clamp arrangement.

Installation

This unit may be mounted in any attitude. When being installed, due consideration should be given to the space required to enable the cover to be removed, also that required for making the connections at the terminal block.

It is IMPORTANT that the connections at the terminals marked A, B and C be such that the phase rotation is A — B — C. Terminals A1 and C1 are connected to the single phase load. Four 0.160" diameter fixing holes, whose centres form a rectangle 6.625" by 2.500", are provided for mounting purposes.

Overall dimensions are :—

Length :	7.125"
Width :	3.687"
Width (at terminal block) :	5.342"
Height :	2.687"

Periodic Inspection

With the phase correction unit "in situ" a general visual examination should be made to ensure that it has not sustained any physical damage and that all electrical connections are free from corrosion and secure.

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PRICE ONE SHILLING

FEBRUARY 1957

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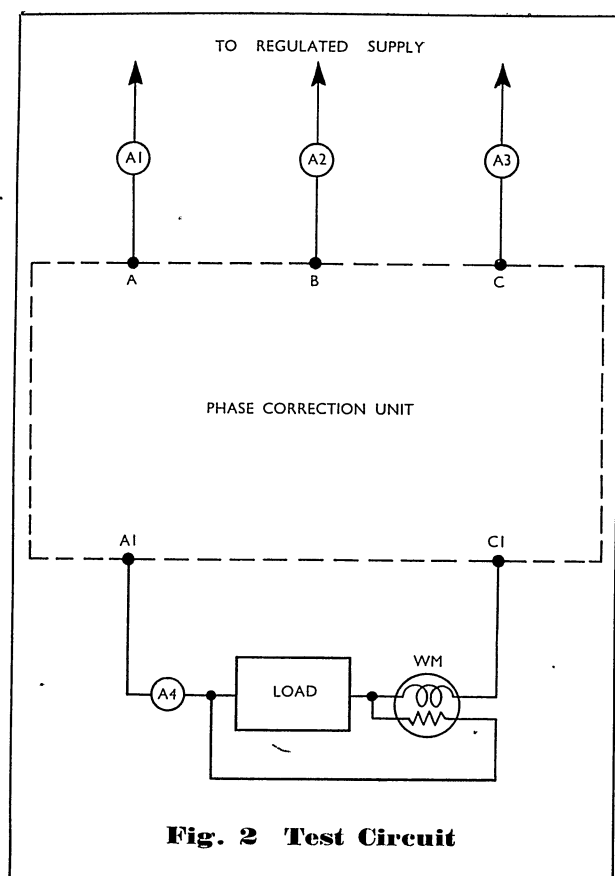


Fig. 2 Test Circuit

Check the unit, also, for security of mounting. An operational check, in conjunction with the equipment with which it is associated, is to be made and provided that this check is satisfactory, the phase correction unit may be passed for continued use.

Overhaul Period

The nature of this unit does not necessitate a set period at which it should be overhauled. Provided that it continues to satisfy a functional test at periodic intervals it may be passed for further service.

However, in the event of the unit suffering physical damage or in some way appearing suspect, it should be removed from the aircraft for testing and/or repair.

Testing

The unit should be connected in a circuit as shown in Fig. 2. A 115 volt, 3-phase, 400 c.p.s. regulated supply should be connected to terminals A, B and C in such a way that the phase sequence is clockwise (A — B — C).

Connect across terminals A1, C1 a load of 255 VA. at 115 volts and lagging power factor of 0.866.

Switch on the supply and measure the current in the three lines as indicated by A1, A2 and A3. For the unit to be functioning correctly the current in each line must be 1.13 amperes \pm 10%.

Spare Parts

The following components are the only recommended spares for these units :—

Name of Part	Part No.	No. per Unit	Name of Part	Part No.	No. per Unit
Base Assembly	N.136238	1	Spring Washer	NK.7305	2
Cover	N.136241	1	Choke	F.3601	2
Screw	NL.2113	10	Screw	NL.1102	4
Plain Washer	NK.7056	10	Stiffnut	AGS/2002/B/2	6
Capacitor (3.4 μ F.)	N.136242	1	Terminal Block Assy.	N.67709	1
Capacitor Clamp	N.136243	2	Ferrule	N.62874	3
Support Plate	N.136244	1	Grommet	NK.25202	3

When ordering replacement parts give complete information, including part numbers, part name and the model and serial numbers, which can be found on

the nameplate of the unit for which the parts are required. This will ensure positive identification and prompt service.

For further information on the functioning, operation and maintenance
of Rotax equipment, enquiries should be addressed to:—

THE SERVICE DEPARTMENT

LUCAS-ROTAX (AUST.) PTY. LTD
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Telephone : BY 6500-09

Technical enquiries should be addressed to:—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED . WILLESDEN JUNCTION . LONDON N.W.10 . ENGLAND

Telephone : ELGar 7777

SUBJECT: Contactor

TYPE: D.11901

DATA:

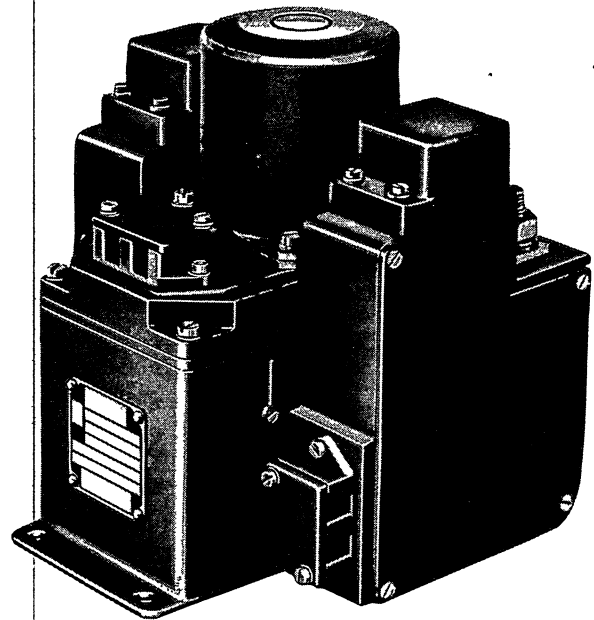
Voltage :	
Main contacts :	112 volts D.C.
Auxiliary contacts :	28 volts D.C.
Operating coil :	28 volts D.C.
Current Rating :	
Main contacts :	100 amperes
Auxiliary contacts :	5 amperes
Mounting :	Four holes 0.196" dia. in base on centres 2" x 4.75".
Electrical Connections :	
Main terminals :	0.312" B.S.F. studs
Auxiliary terminals :	4 B.A. terminations
Operating coil terminals :	4 B.A. terminations
Weight :	6 lb. 10 oz.
Operating Temperature Range :	-65°C to +70°C
Operating Altitude Range :	Up to 60,000 feet.

Description

This magnetically operated contactor is designed for single pole switching in 112 volt D.C. circuits, the operating solenoid working from a 28 volt D.C. supply. The unit incorporates two pairs of auxiliary contacts and a coil economy switch in addition to the main contacts. Both pairs of auxiliary contacts are normally open.

The actuating levers are contained within a main body casing together with the coil economy switch. The solenoid is mounted on the top of the main casing in a cylindrical housing. Two insulated side casings mounted either side of the main casing house the main contacts and auxiliary contacts. The main terminals are fitted on top of the side cases and arc chutes containing de-ion grids are fitted in extensions to the top of the side casing. The terminal block for the solenoid leads is mounted on top of the main case, and terminal blocks for the auxiliary contacts are fitted on the end of the side cases.

The two main contacts are connected in series and the contact arm of each contact is mounted on a shaft which is rotated to close the contacts. The shafts are rotated by the movement of the plunger in the solenoid by means of a mechanical linkage. An interlock is included in the linkage, which ensures that should one moving contact weld closed the other pair of contacts will open to interrupt the line circuit; the contacts



remain open until the weld has been cleared and the mechanism reset.

The main contacts are of the rolling butt type and are faced with silver graphite. The moving contacts are connected together via flexible copper braids and a conductor bar, which passes through the main casing and is secured by nuts and screws to the base of each side case.

Operation

When the control voltage is applied to the solenoid, the plunger is pulled upwards towards the solenoid anvil. The plunger pulls on the centre pin of the toggle mechanism to drive a pin against actuating levers on the shafts. This action rotates the shafts, on which the main contact arms are mounted.

This action also opens the coil economy switch which has been shorting out the hold-in coil and places it in series with the pull-in coil. The combined coils being of higher resistance give a reduction in current consumption for continuous rating.

"This leaflet is approved by the Air Registration Board."

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PRICE ONE SHILLING

OCTOBER 1957

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The main contact arms are mounted on individual shafts and differential movement can be obtained. In the event of a main contact becoming welded so that its return spring cannot open it when the switch trips, its actuating arm will remain in the closed position while the actuating pin moves away to the normal position. The spring strip attached to the actuating arm will no longer rest on the end of the actuating pin but will spring in and abut on its periphery, forming a distance lock between the arm and the pin. If the solenoid is again energised, the free contact will not be closed because the movement of the actuating pin is restricted by the spring strip.

Periodic Inspection

These units are correctly adjusted and tested before leaving the factory and should require little attention in service. If a unit functions satisfactorily it can be considered serviceable for continued use. A general inspection should be made periodically to ensure that there is no apparent physical damage and that the terminals are clean.

It is recommended that the following millivolt test be carried out to ascertain the condition of the main contacts :—

With the contacts in the closed position and rated current of 100 amperes flowing, measure the millivolt drop across each pair of main contacts. The millivolt drop should not exceed 50 millivolts. If this test is not practical with the unit in situ, the main contacts should be carefully examined and if their condition is at all doubtful the unit should be removed and the millivolt test applied.

Servicing

If test equipment is not available no attempt should be made to service or dismantle the unit. It should be replaced by a new unit and returned to our nearest Service Department, or authorised service station where it will be promptly dealt with by our repair organisation. In cases where test equipment is available, apply for Rotax Service Leaflet S.L. 90 for full servicing details.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

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5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA
Telephone : BY 6500-09

Technical enquiries should be addressed to :—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10 • ENGLAND
Telephone : ELGar 7777

SUBJECT : Thermal Unit

TYPE : D.8513 A.M. Ref. 5CW/4407

DATA :

Rating : 200 amperes.
Tripping time : 60 to 75 seconds (at 25°C).
Contact voltage : 28 volts D.C.
Weight : 1 lb. 8 oz.
Altitude Range : 0—60,000 ft.
Temperature Range : —65°C to + 50°C.
Acceleration Grading: 1A.
Vibration Grading : A (Central region).

Description

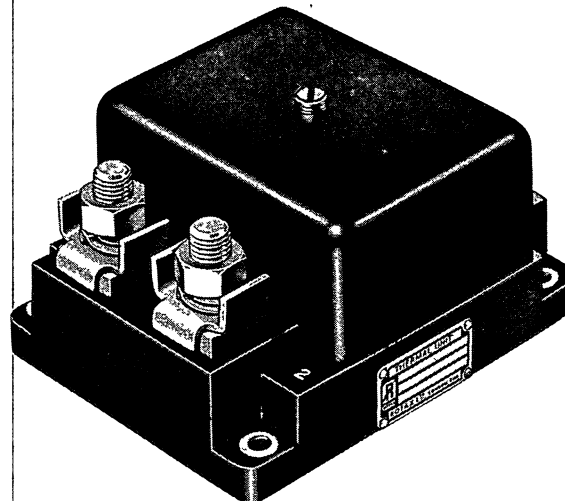
The thermal unit D.8513 has been designed for thermal overload protection in 112 volt aircraft electrical circuits.

The unit comprises a moulded base on which is mounted a bi-metal strip and shunt, a spring-loaded trip lever and a pair of contacts. These parts are covered by a metal protective casing.

The point at which the bi-metal strip actuates the trip lever to close the contacts can be varied by means of a ceramic dolly at one end, which is locked in the required position by a screw thread and nut.

Connections from the main terminal studs, on the top of the moulding outside the cover, to the bi-metal strip are made by silver plated, cast brass connecting strips mounted in the underneath cavity of the moulding. The connections between the contacts and contact terminals are made in the moulding recess underneath. An insulating board covers the base of the moulding.

The bi-metal strip, with a shunt, carries the main line current and actuates the trip lever so as to close the contacts in the event of the pre-determined overload occurring. Closing of the contacts provides a 28 volt supply to the associated protection device in the main supply.



Installation

The unit may be mounted in any position by means of four 2 B.A. clearance holes at centres 3.750 in. by 3.00 in.

Overall dimensions :

Length : 4.500"
Width : 3.500"
Height : 2.562"

Electrical Connections

The main supply line connections are made by two $\frac{3}{8}$ " B.S.F. terminal studs. The trip contact connections are made by two 4 B.A. screw and washer terminations.

Periodic Inspection

These thermal units are accurately adjusted and tested before leaving the Factory and should require but little attention between overhauls provided they are not maltreated. Providing a unit controls its associated equipment in the desired manner, it may be considered satisfactory and passed for further use. However, a general visual inspection should be made periodically to ensure that the thermal unit has not sustained any apparent physical damage and that all terminal connections are clean and secure.

"This Leaflet is approved by the Air Registration Board." 29/11/57
A.R.B. Authority Ref. No. : E.3528 for D.8513

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PRICE ONE SHILLING

NOVEMBER 1957

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The covers should be removed and all contacts examined for signs of excessive pitting or burning, and if found, the unit should be removed from the aircraft for servicing or replacement.

Servicing

If test equipment is not available, no attempt should

be made to service or dismantle the unit. It should, however, be replaced by a new one and the inoperative equipment returned to our nearest Service Department, or authorised Service Station, where it will be promptly dealt with by our Repair Organisation.

In instances where test equipment is available, it should be dealt with in accordance with the procedure detailed in Rotax Service Leaflet No. S.L. 91.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

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ROTAX LIMITED
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LUCAS-ROTAX LIMITED
5595 ROYALMOUNT AVENUE
TOWN OF MOUNT ROYAL, P.Q.
CANADA
Telephone : BY 6500-09

Technical enquiries should be addressed to :—

TECHNICAL SALES DEPARTMENT

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10 • ENGLAND

Telephone : ELGar 7777

SUBJECT: Magnetic Switch

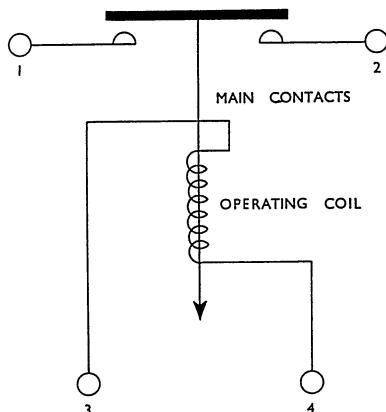
TYPE: D.11801 A.M. Ref. 5CW/5862

DATA:

Main Contacts :	
Operating voltage :	28 volt D.C.
Operating current :	400 amperes.
Operating Coil :	
Operating voltage (max.) :	29 volt D.C.
Operating voltage (min.) :	14 volt D.C. (at 20°C.)
Current (max.) :	0.67 ampere
Current (min.) :	0.265 ampere
Resistance :	48 ohms \pm 10% at 20°C.
Rating :	Continuous.
Temperature Range :	-65°C. to +50°C.
Acceleration Grading :	1A
Vibration Grading :	A (Central region)
Weight :	4 lb.

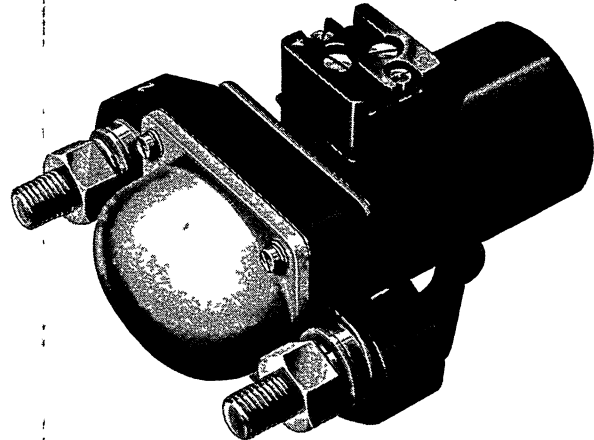
Description

This single pole magnetic relay has been designed for the remote switching of a 28 volt D.C. ground supply.



Internal wiring diagram

The main contacts can carry a continuous load of 400 amperes. The operating mechanism is very



simple, the operating solenoid closing the contacts against two springs. Current passing through the coil pulls the plunger into the solenoid against a return spring and a mechanical linkage pulls the moving contact bridge on to the two fixed contacts, compressing the moving contact spring.

When the coil is de-energised the loaded springs return the plunger and moving contacts rapidly to the normal "open" position.

Main Contacts

The main contacts are of the double break bridge type.

Operating Coil

The maximum operating voltage for the coil is 29 volts, and the minimum hold-in voltage lies between 5 and 1 volt. The resistance of the coil is 48 ohms \pm 10% at 20°C.

Installation

The switch may be mounted in any position by means of the mounting plate with two 0.281" clearance holes at 2.406" centres.

Overall dimensions :

Length :	5.375"
Width :	3.250"
Height :	5.562"

Electrical Connections

The main contact connections are made by two 0.5" dia. B.S.F. terminal posts with nuts and washers. The

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PRICE ONE SHILLING

SEPTEMBER 1957

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solenoid connections are made via a terminal block with two 4 B.A. screw and washer terminations.

Periodic Inspection

This switch is accurately adjusted and tested before leaving the Factory and will require little attention between overhauls providing that it is not maltreated. If the switch performs its function in the desired manner it may be considered satisfactory and passed for further use.

A general visual inspection should be made periodically however, to ensure that the switch has not sustained any apparent physical damage and that all terminal connections are clean and secure. The cover

should be removed and all contacts examined for signs of excessive pitting or burning, and if found, the unit should be removed from the aircraft for servicing or replacement.

Servicing

If test equipment is not available, no attempt should be made to service or dismantle the unit. It should, however, be replaced by a new one and the inoperative equipment returned to our nearest Service Department, or authorised service station, where it will be promptly dealt with by our Repair Organisation.

In instances where test equipment is available, it should be dealt with in accordance with the procedure detailed in Rotax Service Leaflet No. 92.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

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TECHNICAL SALES DEPARTMENT

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10 • ENGLAND

Telephone : ELGar 7777

SUBJECT: Change-over Contactor

TYPE: D.10202/1
A.M. Ref. 5CW/5029

DATA:

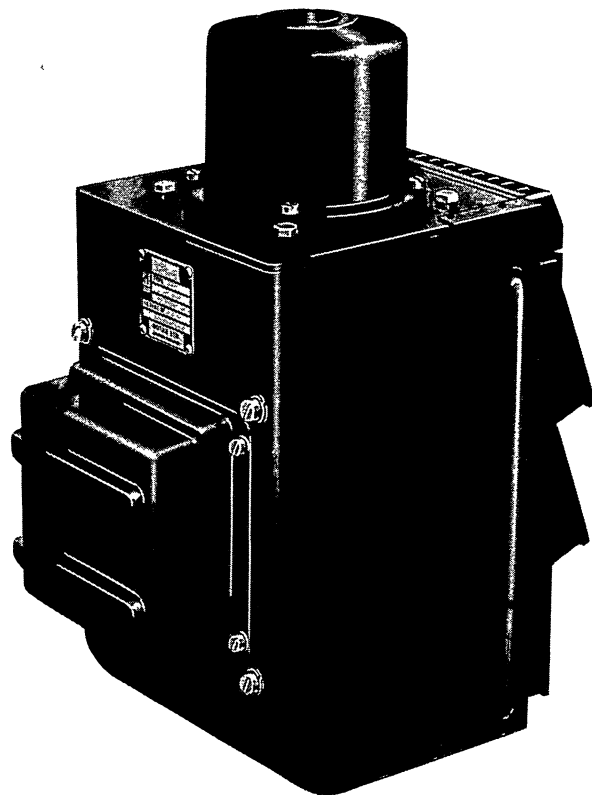
Voltage :	
Main Contacts :	112 volt D.C.
Auxiliary Contacts :	28 volt D.C.
Coils :	29 volt D.C. (maximum) 21 volt D.C. (minimum)
Current Rating :	
Main Contacts :	300 ampere (continuous) 500 ampere (3 min.) 1,000 ampere ($\frac{1}{2}$ min.)
Auxiliary Contacts :	5 ampere
Coil Resistance at 20°C.	
Pull-in Coil :	3.45 ohm \pm 5%
Hold-in Coil :	36.4 ohm \pm 5%
Temperature Range :	-70°C to +50°C.
Operational Ceiling :	50,000 feet
Vibration Grading :	3 (Central region)
Acceleration Grading :	1A
Weight :	15.75 lb.

Description

This double pole, magnetically operated, change-over contactor has been designed to transfer a load from one supply to another in 112 volt D.C. systems, particularly for changing from aircraft to ground supply.

The main contacts are able to carry 300 amperes continuously and 500 amperes for three minutes. When the solenoid is energised two pairs of main contacts are broken and the two other pairs are made. The action also breaks two pairs and makes two pairs of auxiliary contacts. De-energising the solenoid allows the spring-loaded contacts to return to the initial position.

When the solenoid is energised the final movement of the plunger operates an economy switch which brings the hold-in coil into series with the pull-in coil.



The contacts are contained in a rectangular moulded housing mounted between the mechanism side frames. Arcing contacts are fitted to the main contacts and extend above into an arc chute, containing de-ion grids, mounted on top of the housing. The operating solenoid is mounted on a rectangular plate fixed to the end of the side frames and at right angles to the base. The solenoid is enclosed in a cylindrical metal cover and the main body in a rectangular metal casing.

As the change-over contacts are mechanically connected on the same pivot there is no possibility of both circuits being made at the same time.

Main Contacts

The two pairs of main contacts are of the sliding butt type and are fitted with arcing extensions.

Auxiliary Contacts

These are operated by a spindle projecting from the moving contact carrier.

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PRICE ONE SHILLING

DECEMBER 1957

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Operating Solenoid

The solenoid coil consists of two windings, one of low resistance and the other of high resistance. The former is used alone to provide pull-in effect and both are used in series for continuous hold-in.

The maximum rated voltage for the solenoid is 29 volts D.C. The minimum voltage to operate the unit must lie between 13 and 15.2 volts. The drop-out voltage for the solenoid shall lie between 2 and 10 volts. The resistance of the pull-in winding is $3.45 \text{ ohms} \pm 5\%$, and the resistance of the hold-in winding is $36.4 \text{ ohms} \pm 5\%$.

Installation

This contactor may be mounted in any position except with the contacts pointing down.

Fixing by 4 holes 0.193" dia. at 7.375" and 4.437" centres.

Dimensions :

Base 8.5" x 5.07"

Overall 11.42" x 5.34" x 6.83"

Height required to remove arc chutes 7.8"

Height required to remove cover 10"

Electrical Connections

The main contact connections are made by shrouded cable lugs. Auxiliary contact and coil connections are made via 4 B.A. screw and washer terminations in a 10-way terminal block.

Periodic Inspection

These contactors are accurately adjusted and tested before leaving the Factory and should require but little attention between overhauls provided they are not maltreated. Providing a contactor controls its associated equipment in the desired manner it may be considered satisfactory and passed for further use.

However, a general visual inspection should be made after every 1000 hours of service to ensure that the contactor has not sustained any apparent physical damage and that all terminal connections are clean and secure.

The covers should be removed and all contacts examined for signs of excessive pitting or burning, and if found, the unit should be removed from the aircraft for servicing or replacement.

Servicing

If test equipment is not available, no attempt should be made to service or dismantle the unit. It should, however, be replaced by a new one and the inoperative equipment returned to our nearest Service Department, where it will be promptly dealt with by our Repair Organisation.

In instances where test equipment is available, it should be dealt with in accordance with the procedure detailed in Rotax Service Leaflet No. S.L. 93.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

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TECHNICAL SALES DEPARTMENT

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W.10 • ENGLAND

Telephone : ELGar 7777

B. Keaver
SAE (F)

SUBJECT: Warning Lamp with Integral Switch

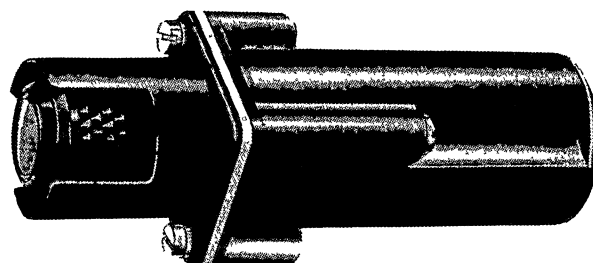
TYPES: H.4301, 2, 3, 4 & 5

DATA:

Bulb : 28 volt 3.5 watts.

Switch Contact Rating : 1.5 ampere 28 volt D.C.

Weight : 2.96 oz. (including bulb).



Description

These units combine the functions of a warning lamp and an operating switch and are intended for use in 28 volt D.C. circuits, i.e. fire warning and fire extinguisher circuits. The switch is operated by pushing in the knob which houses the bulb. The bulb may be tested by pulling out the knob, which returns automatically to the central position from both the "in" and "out" positions. The units in the series are similar in construction but have the following differences:—

- H.4301 : Fitted with red glass engraved with letter "F."
- H.4302 : As H.4301 but glass not engraved.
- H.4303 : As H.4302 but with amber glass.
- H.4304 : As H.4302 but with green glass.
- H.4305 : As H.4301 but with "Pull to Test" action omitted.

H.4301, 2, 3 and 4

Each unit consists of a cylindrical moulded body in which are fitted three silver-plated phosphor-bronze contacts connected to three terminals at the rear end. A bulb holder assembly is free to slide within the body but is normally held in the central position by two opposed coiled springs. The bulb holder and springs are retained in the body by a metal mounting plate which also provides a connection between the bulb holder and an earth terminal moulded into the mounting flange of the body. The bulb has a single-pole bayonet cap and is enclosed in the bulb holder by a metal screw-on cover which forms a knurled knob for operating the switch contacts and also contains the coloured glass. The knob is protected against inadvertent operation by a steel tubular guard having two finger slots set mutually at 180° to enable the knob to be pulled out.

Connection between the three contacts is made by a cylindrical contact and a contact ring fitted at the end of the bulb holder. The cylindrical contact is connected to the bulb contact plunger in the bulb holder. The three contacts are so positioned in the body that contact No. 2 makes with the cylindrical contact in the centre position, contact No. 1 makes with the cylindrical contact in the "out" position and contacts Nos. 1 and 3 are commoned by the contact ring in the "in" position. An important feature of the units is that, whether the knob is pushed in or pulled out, contact No. 2 breaks from the cylindrical contact before the other contacts make. The possibility of feeding back to contact No. 2 is thereby eliminated. The contact terminals are enclosed by a moulded cover.

H.4305

The construction of the H.4305 is similar to that of the other units in the series except that a stop plate in the body of the unit prevents the knob from being pulled out. This eliminates the "Pull to Test" action.

Installation

Each unit should be mounted behind its panel with the switch knob projecting in front and must be secured by two 6 B.A. fixing screws. The fixing screws are also used to secure the guard to the front of the panel.

The diameter of the cut-outs in the mounting panel should be 0.781" and the distance between the centres of the two 6 B.A. clearance holes for the fixing screws must be $1.093 \pm .005$ ". When the units are mounted in banks the minimum distance between cut-out centres is 1.093". The end cover must be removed

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PRICE ONE SHILLING

MARCH 1958

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to gain access to the three contact terminals which, as well as the earth terminal, are 6 B.A. combined screw and washer assemblies.

Periodic Inspection

The unit should be subjected to a visual inspection and functional test when the circuit in which it is connected undergoes a periodic inspection.

WARNING: In some applications, i.e., fire extinguisher circuits, serious consequences may arise if the knob is pushed in without first isolating the unit.

Examine the body for cracks and other damage and ensure that the glass is intact and secure. Ensure that the electrical connections are clean and secure and check that the bulb lights when the knob is pulled out. Check that terminals 1 and 3 are connected when the knob is pushed in. The knob must return smoothly to the central position from both the "in" and "out" positions.

If the unit fails to operate satisfactorily it must be removed from the aircraft and subjected to a complete overhaul and test as described in the following sections.

Dismantling and Inspection

Unscrew the knurled knob and remove the bulb. Unscrew the two 6 B.A. countersunk-head mounting plate fixing screws and remove the mounting plate. Remove the first coiled spring (and stop plate for H.4305) from inside the lamp body, withdraw the bulb holder and then the second coiled spring.

Examine the lamp body for cracks and other damage and ensure that the three contacts are clean, resilient and fastened securely to the body moulding.

Inspect the bulb holder for damage and ensure that the bulb contact plunger is clean, free to slide and, when pressed in, returns to its correct position under the influence of its spring. Check that the cylindrical contact and contact ring are clean and secure.

Examine the bulb for sagging filament and bulb discoloration and ensure that the coloured glass in the knob is intact, clean and secure. The length of each of the two springs should be approximately 0.586" and the load required to compress each spring to 0.156" is 5.25—6.25 lb.

Reassembly

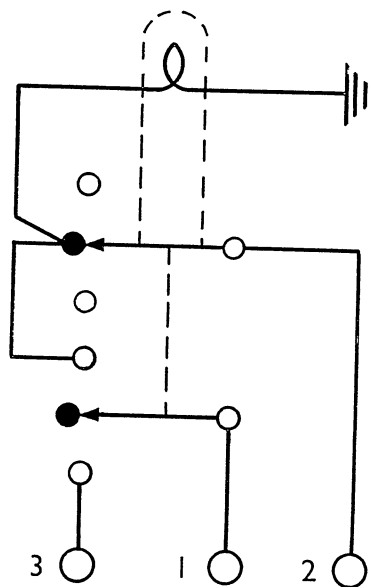
When the inspection has been completed and the parts are in a satisfactory condition, reassembly can be commenced. No difficulty should be experienced if the sequence of dismantling, described in the preceding section, is reversed.

Testing

H.4301, 2, 3 and 4

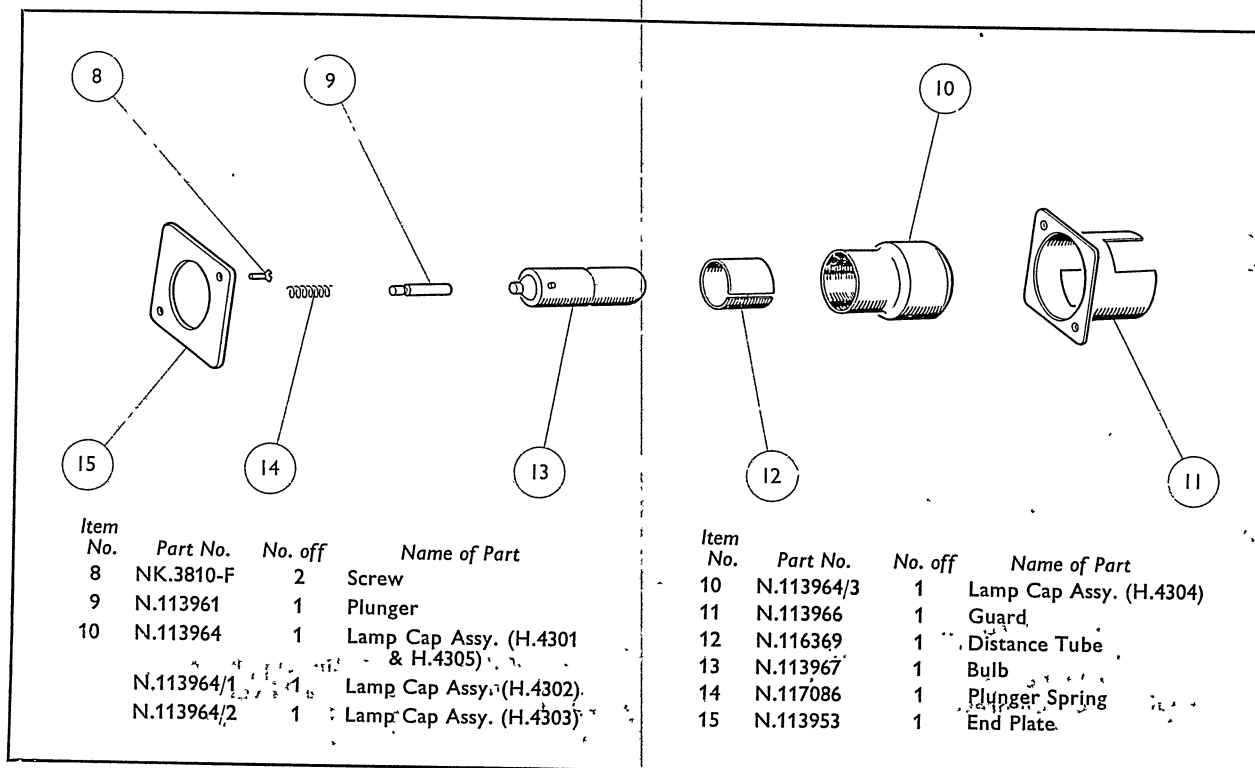
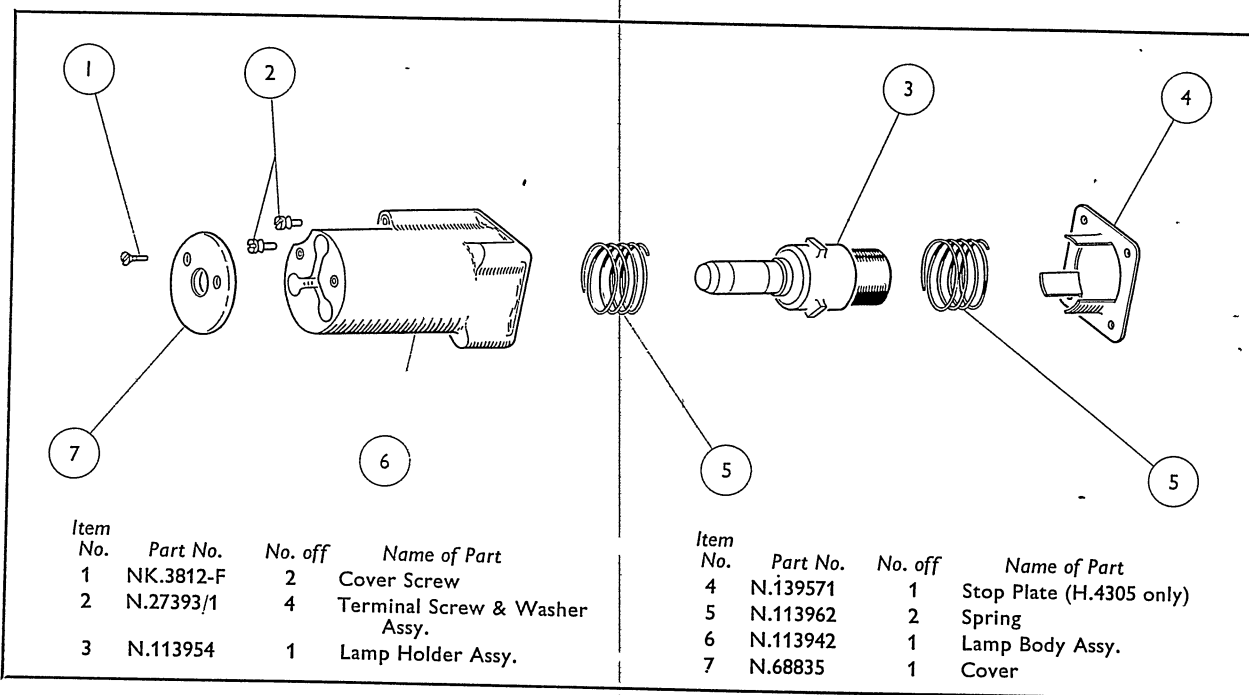
Functioning Test

- Connect a 24 volt D.C. supply across terminal 2 (positive) and the earthing terminal (negative). The bulb must light when this is done.
- Connect the positive side of the supply to terminal 1. The bulb must light when the knob is pulled out.
- Check that terminals 1 and 3 are connected when the knob is pushed in.
- Ensure that the knob returns smoothly to the central position from both the "in" and "out" positions.



Internal wiring diagram

- Connect the positive side of the supply to terminals 1 and 2. Connect one side of a 24 volt bulb to terminal 3 and the other side of the bulb, together with the supply negative, to the earthing terminal.



Measure the distance the knob moves from the central position before contact is made (indicated by bulb lighting) in both the "in" and "out" positions. This should not be less than $\frac{1}{8}$ " and $\frac{1}{16}$ " respectively.

Measure the follow-through of the knob in both the "in" and "out" positions. This should be greater than $\frac{1}{64}$ " and $\frac{1}{32}$ " respectively. The contacts must remain closed during the complete follow-through movement; no intermittent contact is permissible.

(f) Measure the force required to fully operate the knob in both "in" and "out" positions. This should be between $6\frac{1}{4}$ lb. and $8\frac{3}{4}$ lb. in both instances.

(g) With the unit connected as described in para. (e) ensure that the lamp in the unit under test indicates a break-before-make operation for both the "in" and "out" positions.

Millivolt Drop Test

Connect a 24 volt D.C. supply to terminals 3 (negative) and 1 (positive), with a suitable resistive load connected in the negative line. With the knob in the "in" position and 1.5 amperes flowing, measure the millivolt drop across terminals 1 and 3. The millivolt drop must not exceed 40 millivolts.

Insulation Resistance Test

Remove the bulb and measure the insulation resistance between the following points, using a 250 volt "Megger."

- (a) With knob in central position :—
 - (i) The earthing terminal and terminals 1 and 3.
 - (ii) Terminals 1 and 2, 1 and 3, 2 and 3.
- (b) With knob in "in" position :—
 - (i) The earthing terminal and terminals 1 and 2.
 - (ii) Terminals 1 and 2, 2 and 3.
- (c) With knob in "out" position :—
 - (i) The earthing terminal and terminals 2 and 3.
 - (ii) Terminals 1 and 2, 1 and 3, 2 and 3.

The value of insulation resistance in each instance must not be less than 500,000 ohms.

H.4305

The test procedure for H.4305 is as for H.4301, 2, 3 and 4 except that tests with the knob in the "out" position should be omitted.

Spare Parts

When ordering replacement parts make reference to the Parts List and quote complete information, including part name and number, the number of hours the part has been in operation and the serial number of the unit for which the parts are required. This will ensure correct identification and prompt service.

For further information on the functioning, operation and maintenance of Rotax equipment, enquiries should be addressed to :—

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Telephone: RI. 8-7737

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TECHNICAL SALES DEPARTMENT

ROTAX LIMITED • WILLESDEN JUNCTION • LONDON N.W. 10 • ENGLAND
Telephone : ELGAr 7777

SUBJECT : Resistor Units

TYPES : ZA.3601 A.M. Ref. : 5CZ/4761
N.111473

DATA :

Resistance : 0.12 ohm \pm 10%
Operating Temp. : 400°C Max.
Mounting : Four $\frac{1}{4}$ " B.S.F. studs on centres
3.0" by 3.25"

Description

These resistor units are suitable for heavy duty applications such as in circuit with a motor to reduce starting current. The units consist of two folded "Brightray B" strip elements supported side by side by two columns of insulated spacers. In the case of the N.111473 a double "Brightray B" strip element is used and also the effective length is double that of the ZA.3601. The spacers are secured by four long bolts extending the full length of the unit and projecting below the base to form the four securing studs. At one end the two elements are commoned together by a link and at the other end they are left free for external connection.

Both resistor units are of similar construction the only difference between them being their conductive mass.

Installation

The overall dimensions of the resistor and details of the terminals and fixing studs are shown in Fig. 2.

Periodic Inspection

This unit must be examined periodically for any signs of physical damage or distortion. Terminals should be clean and free from corrosion, and mounting studs

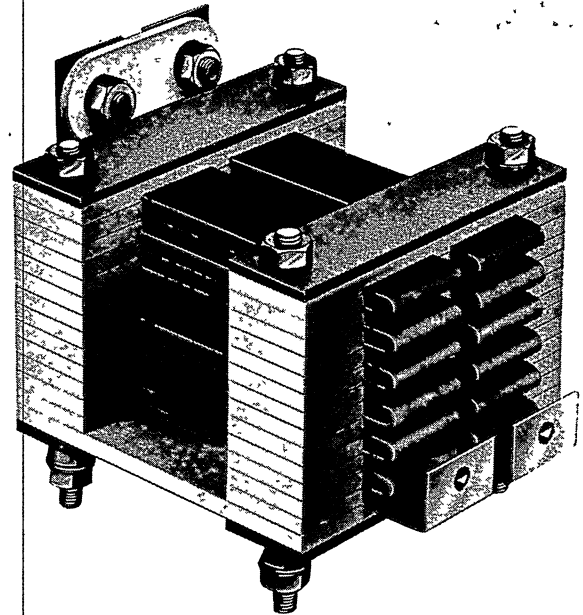


Fig. 1 General view ZA.3601

must be secure. It is not necessary to remove the unit from its installation if it satisfies this visual examination. The unit can be passed for continued service if it functions correctly in its particular circuit.

Overhaul

When the associated equipment, in which the resistor unit is fitted, is removed for overhaul, the resistor should also be removed and inspected as above. After inspection the following tests should be applied :—

The resistance must be measured between the free ends of the elements, using the voltmeter—ammeter method with 50 amperes flowing in the circuit. The resistance value should be 0.12 ohm \pm 10%.

Using a 500 volt "Megger" measure the insulation resistance between the elements and the securing studs. The resistance must not be less than 500,000 ohms.

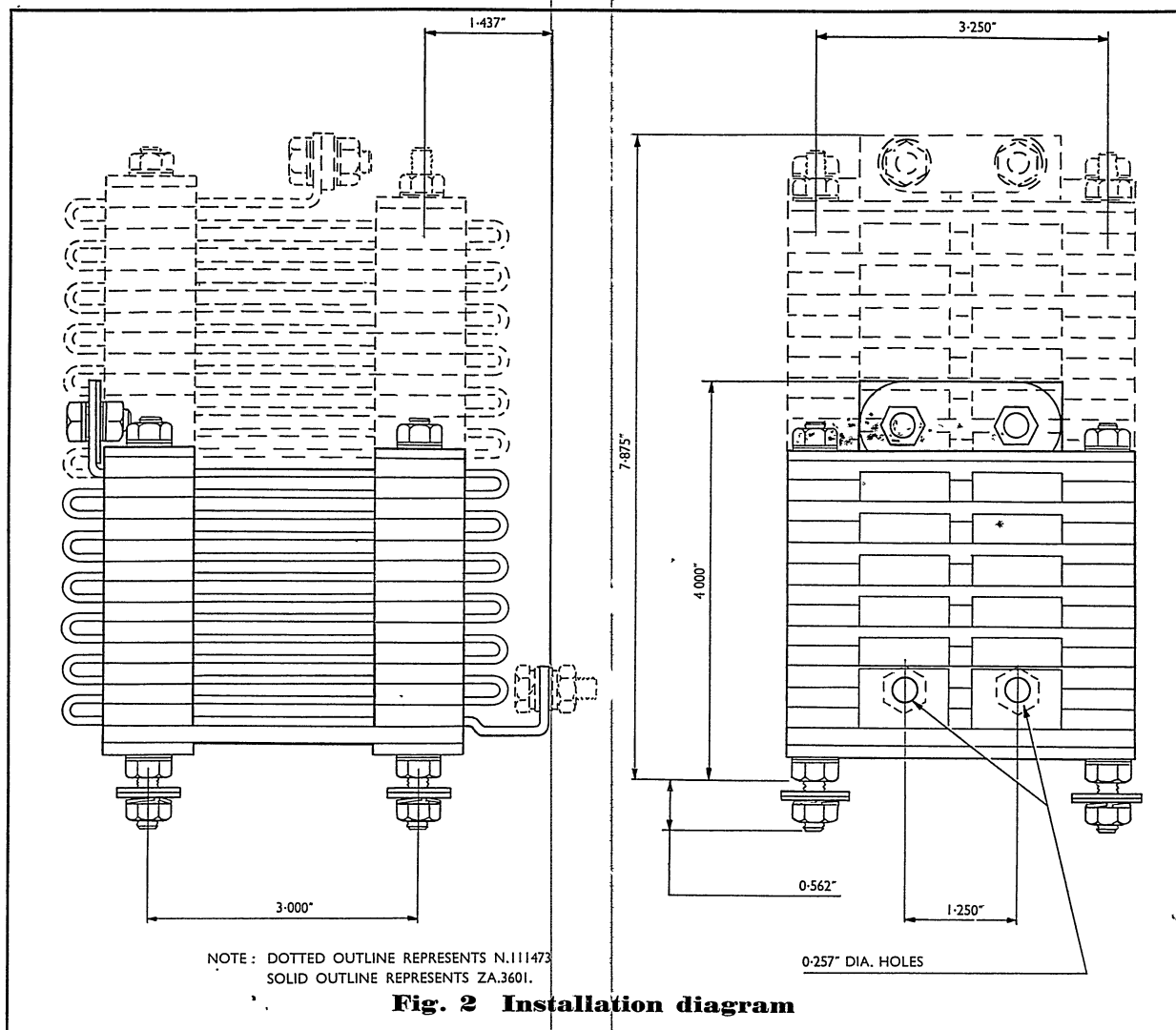
If a unit is tested in aircraft service it can be considered satisfactory if the resistance is at least 50,000 ohms when tested at the above potential.

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PRICE ONE SHILLING

FEBRUARY 1958

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