



BR 966

Revised Aug. 1981

Incorporating

Amendments Nos. 1 - 5

Specification for

MINIATURE TRACTIVE ARMATURE RELAYS

PLUG-IN TYPE

FOR

RAILWAY SIGNALLING PURPOSES

British Railways Board



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Amendments

Amd.No.	Date	Text Affected
1	SEPT.81	APPENDIX A1
2	NOV. 85	APPENDIX A1

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BRITISH RAILWAYS BOARD

SPECIFICATION NO. 966

FOR

MINIATURE TRACTIVE ARMATURE RELAYS,

(PLUG-IN TYPE) FOR

RAILWAY SIGNALLING PURPOSES

FOREWORD

This specification supersedes the issue dated May 1973.

This specification is issued by the Director of S & T Engineering, British Rail, Materials Management Group, Room 1103, Rail House, Gresty Road, Crewe, CW2 6EA; from whom further copies may be obtained.

Technical queries shall be referred to the above address. For telephone enquiries the numbers are:-

BT (STD) 0270-532494
BT (STD) 0270-532345 FAX
BR (ETD) 05-32494
BR (ETD) 05-32345 FAX

REFERENCES

Reference in this specification is made to:-

British Railways specification	831	Connectors for BR miniature relays.
	930	Minature tractive armature d.c neutral line relay.
British Standard	2757	Classification of insulating materials for electrical machinery and apparatus on the basis of thermal stability in service.

Where this specification requires reference to BR specifications and British Standards the latest issue shall apply, unless specially stated. Where reference is made to 'Common appendices', these are the 'Common appendices for miniature relay specifications', for specifications in the BR 930 series.

1. GENERAL

- 1.1 The relays covered by this specification are of identical physical dimensions to the BR 930 series of relays, but due to the particular properties required of the relays, do not conform to any of the BR 930 series of specifications.
- 1.2. These relays must not be used to break circuits in which the energy dissipated at the contact exceeds the limit given in clause 12.1. In general, this means that equipment such as lever locks must be spark quenched.

2. SCOPE

- 2.1. This specification relates to the design requirements of BR miniature relays; the mechanical requirements are given in the body of the specification, and the special characteristics of the particular relay are given in the relevant 'F' series appendix to this specification.

3. DEFINITIONS

- 3.1. For the purpose of this specification the following definitions shall apply:-

Operate	That condition of the relay when all front contacts are just made.
Full Operate	That condition of the relay when the armature has completed its maximum travel.
Release	That condition of the relay when all front contacts have opened.
Full Release	That condition which the relay assumes when de-energised.
Front Contact	A contact which is made when the relay is energised.
Back Contact	A contact which is made when the relay is de-energised.
Contact Element	The contact piece which is attached to a contact spring.
Contact Spring	The spring strip to the end of which the contact element is secured.
Operate Winding	A winding which when energised at the appropriate voltage will cause the armature to move to the full operate position.
Magnetic Latch	A permanent magnet so arranged in the magnetic circuit to hold the relay in the full operate position.
Release Winding	A winding which when energised at the appropriate voltage will neutralise the latching magnet and cause the armature to release.
'Cut-Off' Contact	A front contact permanently wired in series with the release coil such that this coil cannot be energised unless the relay armature is in the operate position.
Direct Current	Current from a battery or smoothed rectified a.c. with a ripple content not exceeding 1.25% r.m.s.

4. DESIGN

- 4.1. The complete assembly shall consist of two main parts, viz:-
- (a) A relay
 - (b) A plugboard into which a relay is plugged.
- 4.2. The relay shall be designed to have minimum bulk and weight consistent with the prime necessity for safety and reliability, and its construction shall be such as to minimise accidental damage sustained during transit or installation.
- 4.3. The relay shall include a rigid baseplate which shall form part of the plug-socket interconnection between the relay and its plugboard.
- 4.4. The relay shall be enclosed in a cover which shall be so constructed that the relay shall be clearly visible for inspection. A retaining device shall be provided for the cover such that the cover cannot be removed without breaking a seal.
- 4.5. There shall be a minimum clearance of 0.125 inch between the cover and any moving part of the relay. The material of the cover and construction of the relay shall be such that the application of a force of 30 lb at any point on the surface of the cover of the assembled relay, shall not result in its deflection to an extent sufficient to interfere with the operation of the relay. The material shall be of such resilience that after removal of this force it shall restore to its normal condition.
- The cover shall be free from detrimental warping which may reduce this clearance, either from temperature or moisture changes or long term ageing or release of locked up stresses.
- 4.6. The cover and baseplate of the relay when assembled shall be dustproof.
- 4.7. Surface leakage distances shall not be less than 0.125 inch internal and 0.25 inch external. Parts enclosed when the relay is attached to its plugboard may be regarded as internal.
- 4.8. There shall be a minimum of 0.015 inch clearance between any moving part and any other part which might interfere with its correct operation and the design must be such that this clearance is maintained throughout the rated life of the relay.
- 4.9. A retaining clip, as indicated in Common appendix 'B2' shall be provided to hold the relay securely in its plugboard without the possibility of the electrical connections becoming disconnected.
- 4.10 The male portion of each interconnection shall make a positive sliding contact with the female portion.

- 4.11. The permanent relay rack wiring to the plugboard shall be terminated either by soldering or crimping to a connector which shall allow up to a maximum of two wires to be connected to each termination. The maximum size of wire to be accommodated will be of overall diameter not greater than 3.4 mm with a conductor diameter of 1.12 mm. The connector shall be positively locked into the plugboard but shall be capable of being released and withdrawn to permit easy disconnection.

Such a connector is described in BR specification no. 831.

5. DIMENSIONS

- 5.1. The dimensions of the relay and plugboard shall be in accordance with Common appendices 'A1', 'A2' and 'B1'.
- 5.2. The retaining clip is to be in accordance with Common appendix 'B2'. The handle of the relay shall be such that with the relay in position on its plugboard the total force exerted by the clip on the handle shall be not less than 20 lb and shall not exceed 50 lb.
- 5.3. All relays with the same coding must be interchangeable.

6. MATERIALS

- 6.1. All materials used in the construction of the relay and plugboard shall comply with the appropriate British Standard unless otherwise stated.
- 6.2. No materials shall be used in the construction of the relay and plugboard which during storage life, would cause alteration in performance, except as provided for in clause 15.1. Neither shall any materials be used which are not capable of maintaining all their relevant electrical and mechanical properties during rated service life as specified.
- 6.3. All non-metallic materials used in the relay and plugboard shall be non-hygroscopic, self-extinguishing, free from detrimental warping, deformation, or embrittlement, and when transparent, permanently so, over the external temperature range -40°C to +60°C when the relay is continuously energised at 20% above rated voltage.
- 6.4. All insulating materials in contact with current carrying parts of the relay and plugboard shall comply with the following test:-
- Two $\frac{1}{4}$ inch diameter electrodes shall be placed $\frac{1}{8}$ inch apart on a sample of the material, which is at a temperature of not more than 20°C. The sample shall then be transferred to a test chamber having a temperature of 30°C and a humidity of 85%. The insulation resistance measured at a voltage of 500 V.d.c. between the electrodes shall not then fall below 1 M Ω while the sample remains in the test chamber for a period of not less than 15 seconds.

- 6.5. No materials shall be used in construction of the relay and plugboard which are capable of supporting growth of mould, or which are subject to deterioration by exposure to sunlight.
- 6.6. All parts both separately and in combination shall either be resistant to corrosion or be so treated as to resist corrosion. Dissimilar metals used in contact with each other shall be so chosen or protected as to minimise the effect of electro-chemical action.
- 6.7. All materials used in the construction of the relay and plugboard or for the impregnation of coils etc., shall be chemically and physically inert over the temperature range specified in clause 6.3.
- 6.8. All soldered joints in conductors shall be made with soft solder. Non-corrosive flux shall be used in making all soldered joints and after completion of the soldering operation, any excess flux shall be removed.
- 6.9. All screwed fastenings shall be securely locked to prevent movement in service. Mechanical means which do not abrade the surface and produce loose pieces of material shall be used to secure all pins, nuts, screws, etc against working loose.
- 6.10. Screw threads in parts fabricated of materials which do not lend themselves to successful tapping shall be formed in metal bushes.
- 6.11. Silver or silver plated components must not be used in combination with insulating materials susceptible to silver migration.

7. MOUNTING

- 7.1. The plugboard shall be so designed that when the connector is inserted all live metallic parts are shrouded against accidental contact even when the relay is removed.
- 7.2. The spring tags on the relay shall be so constructed that in the event of the relay being plugged into a plugboard having maximum tolerances, they shall afterwards make effective contact if the relay is later plugged into a plugboard having minimum tolerances.
- 7.3. A registration device shall be provided to prevent an incorrectly coded relay being plugged into a particular plugboard. That portion of the registration device carried on the relay shall be incapable of alteration without breaking a seal and shall be adequately protected against accidental breakage liable to permit the relay, to be plugged into the wrong plugboard.

The schedule of codes is shown in Common appendix 'D', which is an extract from BR specification no. 944.

- 7.4. The code pins on the relay must not extend beyond the joint face and may be up to $\frac{1}{16}$ inch short of this.
- 7.5. The electrode potential of the material forming that part of the plugboard connector which makes contact with the spring tags of the relay shall lie between the values of -0.55 V and +0.10 V as measured against a saturated calomel electrode in sea water at 25°C.

8. LIFE

- 8.1. The rated life of the relay shall be taken as 10^6 cycles unless stated otherwise in the relevant 'F' series appendix, under specified conditions of operations where one cycle consists of an operation followed by a release.

The rate of operation shall be taken as 250 cycles daily, unless stated otherwise in the relevant appendix.

- 8.2. The relay shall be considered as having a possible period of up to 3 years in reasonable storage conditions prior to being brought into use without verification or examination and without any adverse effect on its rated life.

9. MAGNETIC CIRCUIT

- 9.1. All parts forming the magnetic circuit of the relay, i.e. armature, yoke and core, and permanent magnet where provided shall be of suitable quality magnetic materials so as to ensure consistent performance.
- 9.2. A non-adjustable residual stop pin of non-magnetic material shall be provided which shall be so designed that the relay continues to operate within the specified values throughout its rated life.

10. ARMATURE SUPPORTS

- 10.1. The armature shall be positively located so as to prevent any displacement other than that required for the proper operation of the contacts.
- 10.2. The armature shall be held in place in a manner which permits free movement throughout the normal stroke. There shall be no displacement of the armature as a result of the tests carried out under clause 17.1.
- 10.3. In relays fitted with pivot bearings the armature pivots and bearings shall be of dissimilar materials possessing high resistance to corrosion under service conditions, shall fit rigidly in their supports, and be suitably secured and so constructed that they cannot restrict the desired motion of the armature.
- 10.4. In relays fitted with pivot bearings, the armature pivots and bearings shall be cylindrical, and the bearings shall be not less than 0.002 inch or more than 0.004 inch larger in diameter than the pivots. The end play of the armature shall not be less than 0.01 inch and not more than 0.02 inch.
- 10.5. The design must be such that the breaking of a pivot shall not allow any front contact to close irregularly.

11. COILS

- 11.1. Each coil winding shall be formed preferably from one continuous length of conductor. If joints are necessary between coil conductors, these shall be securely soldered and efficiently insulated.
- 11.2. No conductor of a smaller diameter than 0.1 mm shall be used for coil windings.
- 11.3. Coil impregnation is not mandatory, but if carried out, attention is drawn to clause 6.7.
- 11.4. The coil of a single wound relay is to be connected to terminals R1 and R2. The coil of the second winding, when provided, should be connected to terminals R3 and R4, the connections to be so made that the coils would assist with like polarities on terminals R1 and R3 unless stated otherwise in the relevant 'F' series appendix. The contact prongs in position R3 and R4 must always be provided.

Where more than two windings are included in one relay case the connections to the windings are given in the relevant appendix.

- 11.5. Each coil shall be so fixed as to prevent movement with respect to its core.

12. CONTACTS

- 12.1. Signalling contact ratings shall be as follows:-

All contacts shall be capable of carrying 3 A continuously, front contacts being considered with the relay in the full operate position, without injurious effect to the contact.

Over the rated life of the relay each contact shall be capable of making and breaking a load detailed in the relevant 'F' series appendix.

Over the rated life of the relay, each contact shall be capable of making and breaking the current in an unquenched circuit consisting of three parallel connected line relays of a type covered by BR specification no. 930.

- 12.2. Each contact pair shall consist of at least one domed element.
- 12.3. Front contacts shall be non-fusible unless stated otherwise in the relevant 'F' series appendix and back contacts may be metal/metal unless stated otherwise in the relevant appendix subject to the provisions of clause 13.7.
- 12.4. After a contact pair has been loaded to the requirements of clause 12.1 over the period of rated life of the relay, contact pressures shall not be less than 50% of those stipulated in clause 14.1 and there shall remain a minimum distance of 0.020 inch between the metal element of the contact and the metal support of the associated non-fusible element.

13. CONTACT ASSEMBLIES

- 13.1. Contact springs shall be formed in such a way that their main axes lie at not more than 45° from the direction of rolling of the strip and so that abrupt changes of dimensions giving rise to high localised stresses do not occur.
- 13.2. The design shall be such that springs shall not be subjected to any twist about their longitudinal axis.
- 13.3. Contact elements shall be firmly secured so that they will not become loose in service, and the material used for this purpose shall be such as not to cause corrosion. They shall not be out of centre with respect to each other by more than 0.02 inch.

*When the contact is fully closed the distance of the point of contact from the edge of either element shall not be less than half the distance from that point to the centre of that element.
- 13.4. When the last back contact is just broken all front contacts must be open by at least 0.015 inch, and vice versa.
- 13.5. All similar contacts, i.e. either front or back, shall function approximately simultaneously when the relay is operated or released.
- 13.6. If twin contact elements are employed, these shall be coplanar and shall make or break contact approximately simultaneously.
- 13.7. In the event of any back contact remaining closed as a result of fusion or locking, it shall not be possible for any front contact on the relay to close when the relay is energised at up to 35% in excess of nominal voltage. Alternatively back contacts must be non-fusible.
- 13.8. Where front contacts are not of a non-fusible type in the event of any front contact remaining closed as a result of fusion or locking, it shall not be possible for any back contact of the relay to close when the relay is de-energised.
- 13.9. The relay shall be designed so as to reduce contact chatter, bounce and hesitation to a minimum on closure of the contact elements concerned. When the relay is energised at rated voltage, or released, the contact elements shall establish steady contact conditions in more than 20 ms after the initial contact closure.
- 13.10. Contacts of the non-fusible type shall be so designed that they cannot become mechanically locked or fused to the metal element by abnormal flow of current, and the formation of metal elements shall be such that they will not undercut the non-fusible element by continual rubbing.
- 13.11. The contact tag of the spring shall be composed of unplated phosphor bronze.
- 13.12. Other details of the contact assemblies are given in the relevant 'F' series appendix.

7. TYPE TESTS

Front contacts : One ounce when in full operate position

The contact resistance shall be measured at the manufacturer's works immediately before acceptance or despatch.

6. TERMINAL MARKINGS

16.1. Terminal positions on the plugboard shall be marked as indicated in the relevant 'F' series appendix.

17.1. Type tests shall be applied in order to prove the following features:-

- (i) That the relay is able to withstand the life tests as specified in relevant appendix.
- (ii) That the relay is so designed to withstand shocks equivalent to a free drop of 1 inch on to solid concrete surface.

19. LABELLING AND MARKING

19.1. A nameplate giving the following information shall be attached to the relay in a conspicuous position:-

- (i) Manufacturer's name
- (ii) Reference number
- (iii) Serial number of the relay
- (iv) Rated voltage
- (v) Contact arrangement
- (vi) Specification quoting number of appendix and code number
- (vii) Date tested, (month and year is sufficient)

19.2. This nameplate shall be so situated that it is readily visible when the relay is in its installed position, and shall be securely fixed in such a manner that it does not obscure the moving parts and cannot interfere with the operation of the relay.

19.3. Each coil shall have attached to it, secured by the outside binding, a tag which shall be clearly and indelibly marked with the following particulars:-

- (i) Manufacturer's reference
- (ii) Resistance (nominal) at 20°C

BRITISH RAILWAYS BOARD



BR SPECIFICATION NO. 966

FOR

MINIATURE TRACTIVE ARMATURE RELAYS
PLUG-IN TYPE FOR RAILWAY SIGNALLING PURPOSES

AMENDMENT NO. 1

APPENDIX A1

Withdraw the existing Appendix A1 dated Jan. 1981 and substitute the attached.

Sept. 1981

BRITISH RAILWAYS BOARDB.R. SPECIFICATION FOR MINIATURE RELAYS
FOR RAILWAY SIGNALLING PURPOSESAMENDMENT NO. 2APPENDIX A1

Withdraw the existing Appendix A1 dated September, 1981 and substitute the attached.

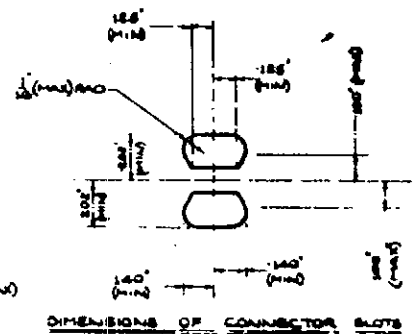
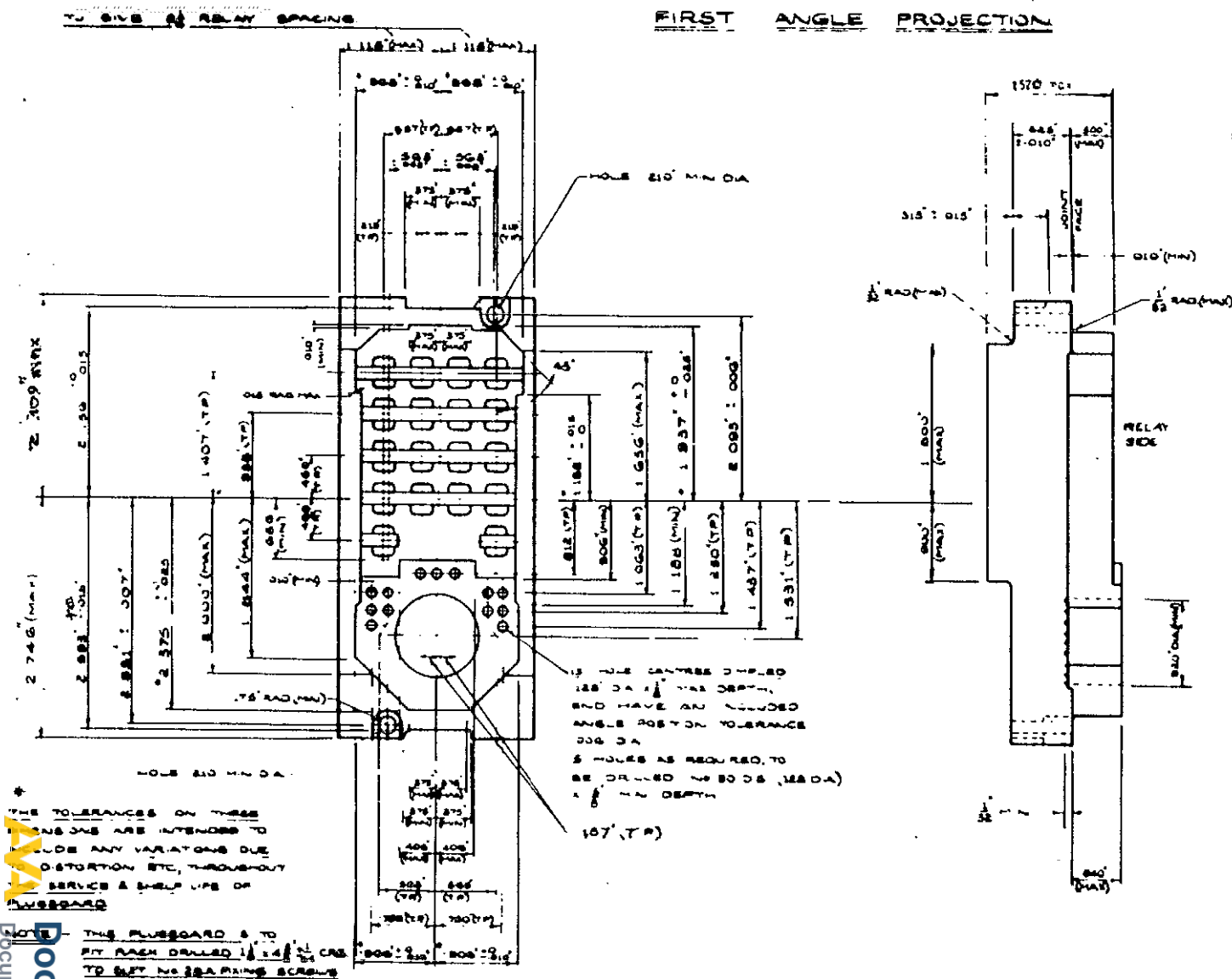
The maximum allowable overall (length) dimensions have been increased as follows:-

dimension 2.746" (Max.) was 2.708" (Max)

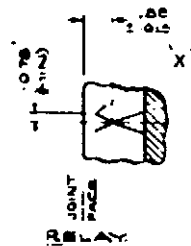
dimension 2.309" (Max.) was 2.271" (Max)

This Appendix applies to all the Specifications listed below:-

930A, 931A, 932A, 933A, 934A, 936A, 938A, 939A, 940A, 941A, 942, 943, 946, 949, 960, 961, 963, 966 and 968.



THESE SLOTS MAY BE ANY SHAPE OR SIZE PROVIDED THE DIMENSIONS GIVEN ABOVE ARE NOT APPROACHED TO THE BOTTOM OF THE JOINT FACE BETWEEN RELAY & PLUGBOARD



NOTE NOMINAL DIMENSIONS MUST BE SUCH THAT WHEN THE RELAY IS PLUGGED ON ANY PLUGBOARD THE END OF THE CURL (1) WILL NOT FOLLOW THE PROFILE OF THE PLUGBOARD UNDER LIMIT CONDITIONS
 (T.P) DENOTES TRUE POSITION IN ACCORDANCE WITH BS 2087

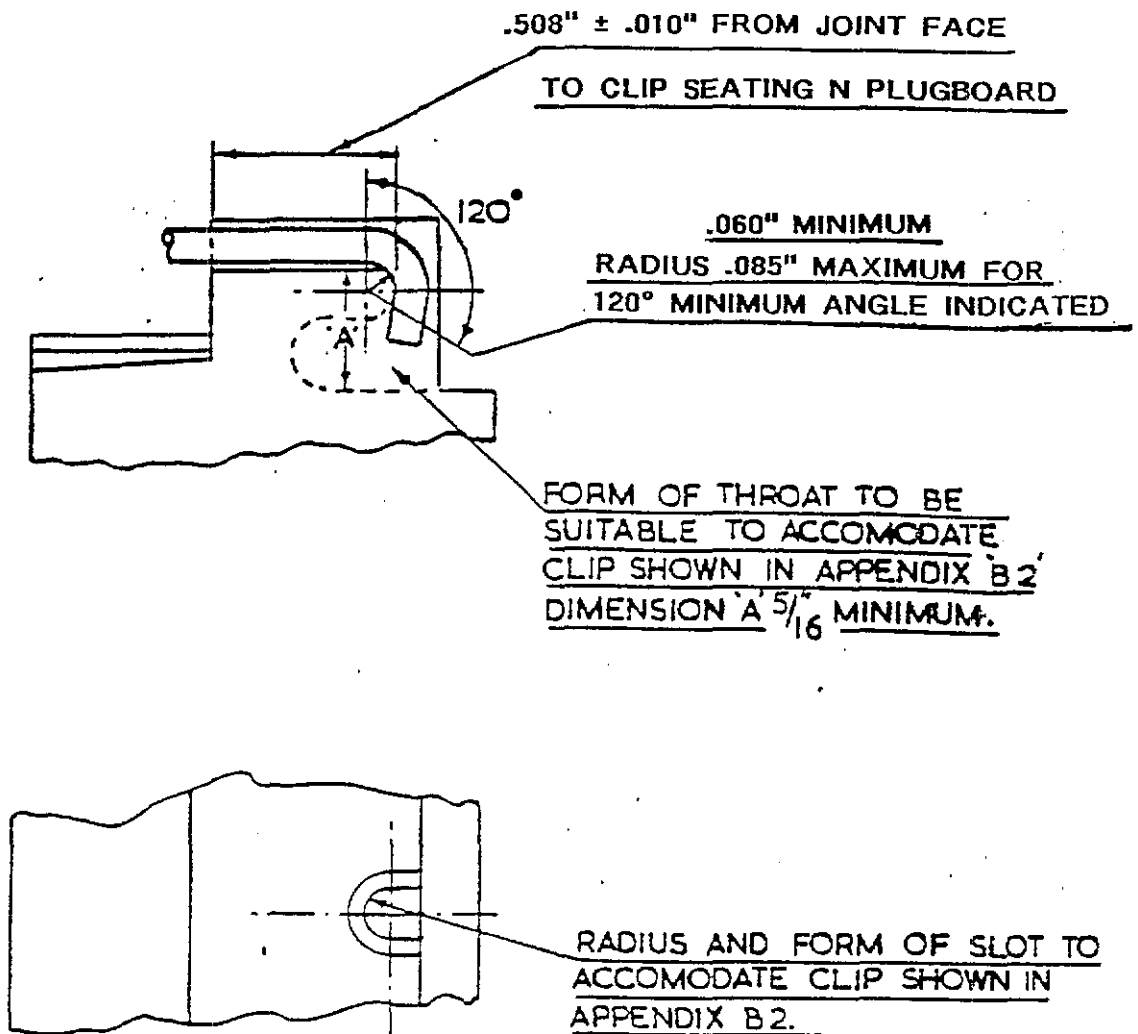
BRITISH RAILWAYS BOARD.
 COMMON APPENDIX FOR MINATURE RELAY SPECIFICATIONS

PLUGBOARD DIMENSIONS

APPENDIX 'A.1'

NOT TO SCALE

Sept 1985



FIRST ANGLE PROJECTION.

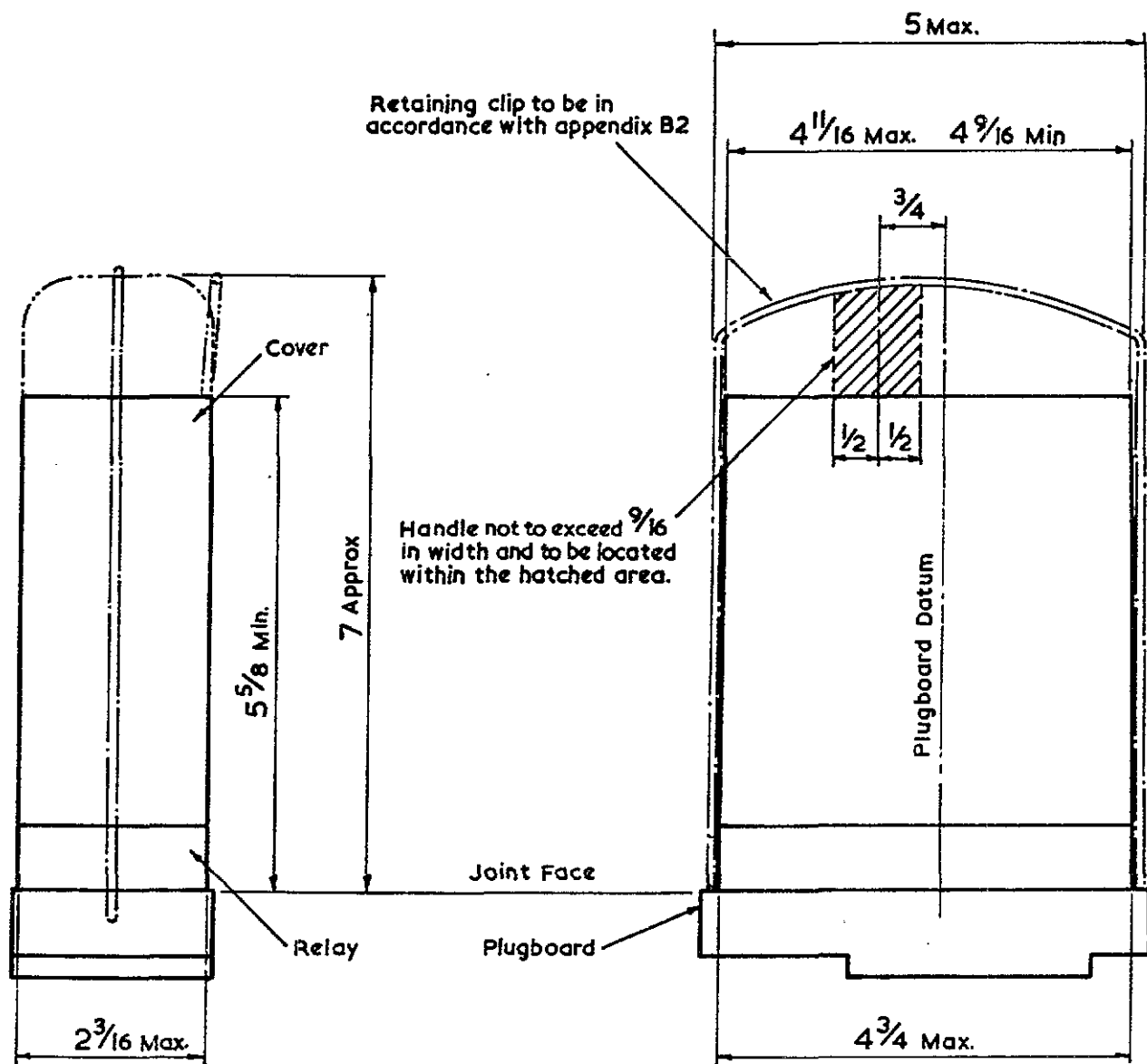
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COMMON APPENDIX FOR MINIATURE RELAY SPECIFICATIONS.

PLUGBOARD DIMENSIONS
 SEATING FOR
 RETAINING CLIP

APPENDIX 'A2'



Dimensions are in inches

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Common Appendix for Miniature
Relay Specifications.

RELAY DIMENSIONS

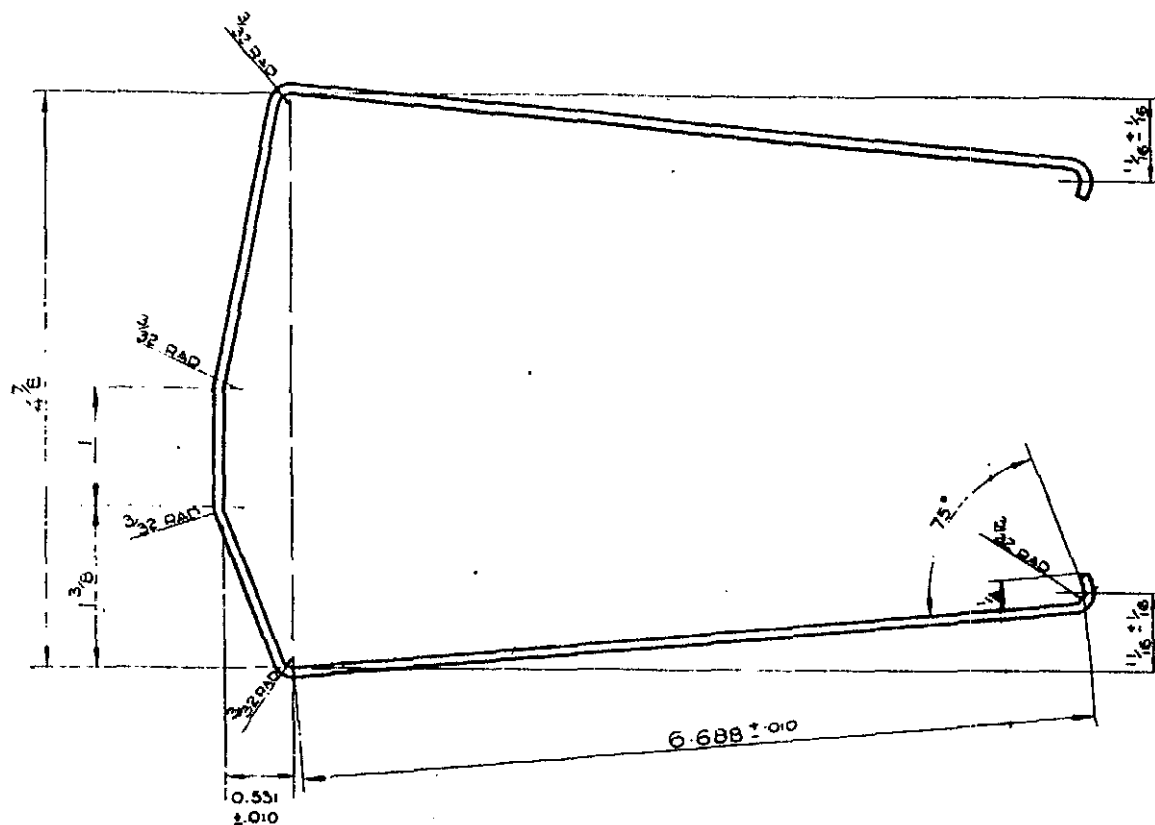


Documents
Appendix B1

Scale - Half Size

Licensee=Weston Williams/5989497001, User=sam, albert
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FIRST ANGLE PROJECTION



MATERIAL:

HARD DRAWN STEEL WIRE B.S. 5216 NO
GRADE 2, 13 S.W.G. OR 2.24 mm DIA.

ALL DIMENSIONS ARE IN INCHES

GENERAL TOLERANCE UNLESS OTHERWISE STATED $\pm .020$

FINISH:

APPROVED ANTI-CORROSIVE

BRITISH RAILWAYS BOARD.

COMMON APPENDIX FOR MINIATURE RELAY SPECIFICATIONS.

RETAINING CLIP
DIMENSIONS

NOT TO SCALE

APPENDIX 'B2'

JAN 1981