CHAPTER 3

DUNLOP HYDRAULIC BRAKE UNITS (Steel plate type)

1. This chapter contains information to guide personnel in the repair of certain hydraulic brakes of the steel plate type that have been made unserviceable through wear or damage.

2. Each brake repair is given the code letter "RP" followed by the repair number. The repairable brakes are listed in the List of Brake Units and Relevant Repair Schemes, and the RP and relevant Volume 1 appendix numbers are given in the adjoining columns. Details of any special tools and repair parts which are fundamentally similar, are given in Tables that follow the latest repair scheme issued.

3. The repairs are generally confined to the reclamation of friction plates which have become badly worn or distorted during service. The basic scheme is detailed in RP113 which is supplemented by Data sheets which are issued for each brake unit.

4. Other repairs may involve the restoration of damaged cylinder bolt attachment holes, the bushing or worn or damaged torque plate bolt holes, and the repolishing of worn or scored cylinder walls.

5. It should be noted that where no tolerances are given for certain dimensions shown on the repair drawings, the following limits will apply:— ± 0·005 in. for dimensions shown in decimal figures, ± 0·015 in. for dimensions shown in fractional figures.

RP 113

REPAIR SCHEME FOR STEEL BRAKE FRICTION PLATES

Introduction

1. Steel brake friction plates (nickel and chrome plated and non-plated) which have been badly scored or distorted during service may be repaired by using one or more of the processes described in this repair scheme. The scheme detailed in the following paragraphs is a basic scheme and is supplemented by a series of data sheets which give the checking dimensions etc. pertinent to individual brakes. Figures given on the applicable data sheet should be substituted for the code letters quoted in the basic scheme.

2. At all stages of repair, care must be taken to protect the ground faces of the plates from damage as a high grade finish is required. When stacking a layer of suitable protective material, for example, corrugated cardboard is to be placed between each pair of plates. Steel plates which are not chrome plated as a final operation (see individual data sheets) must be protected with a coat of Primer S.2 before painting the colour identification.

3. Generally examine the plates for damage or distortion as detailed in para. 4. Plates which are within the limits quoted may be returned to service, plates exceeding these limits in any way may be reclaimed as detailed in para. 5 to 8.

DEFECTS

4. At the servicing periods detailed in the Aircraft Servicing Schedules, the brake plates must be checked for wear and/or distortion. The following instructions cover possible defects which may develop during the course of service. For details of applicable wear and/or distortion limits reference should be made to the relevant data sheet. Before handling the brake plates and friction pad assemblies of the dismantled brake unit ensure that the instructions in the servicing notes regarding identification of these components have been strictly enforced. It is essential that plates and friction pads which are considered to be suitable for further service after examination, are assembled in their original relative position on the brake unit. Care should therefore be taken not to obliterate such identification markings during the examination procedure given below:—

"Dishing" of plates

(1) If the amount of "dishing" is not in excess of the figure given (C or I) the brake plates may be returned to service. If, however, the plates are rejected on account of excessive dishing, then the complete brake set of friction pads and plates must be renewed.

Shrinkage of plates

(2) The plates must be withdrawn from service when their internal diameter at any point falls below the dimension B or H.

"Waisting" of plates

(3) Brake plates may tend to become concave on both friction faces. This condition is acceptable provided the plates conform with the conditions quoted in sub-para. (1), (2), and (4), but when waisting has occurred, the complete set of plates must always be renewed when a new set of brake friction pads is fitted. Similarly, if waisted plates are renewed for any reason new pads must be fitted.

Tenon wear

(4) As the result of heavy loading during brake application, particularly during emergency stops, the brake plate tenons may become distorted or worn. Where distortion of the tenons is apparent or if the width of the tenons is reduced below the figure given (D) or above the figure given (J) the plates must be scrapped. Burrs which may have formed on the side surfaces of the tenons may be removed with a smooth file; the tenon thickness must not be reduced during this operation.

Surface condition

(5) If the plates are otherwise considered serviceable, some surface deterioration including "creep" and circumferential scoring is permissible providing there is no roughness which would be likely to

accelerate friction pad wear. It is emphasised that the prolonged use of badly scored plates will ultimately result in excessive pad wear and a reduction in brake efficiency. Surface corrosion other than on the friction surface of the plates may be polished out with fine emery cloth.

Cracking

(6) Thoroughly examine the plates for cracks at the base of the slots and/or tenons. Cracks at the base of the slots are acceptable provided the length of the crack does not exceed R (refer to the relevant data sheet). Cracks at the base of the tenons render the plate unserviceable.

REMEDIES

"Dished" plates

5. Plates which are dished may be rectified as follows:—

(*a*) When the diameters of the plates are within the serviceable limits quoted within the relevant data sheet then they need only be reformed and flattened.

(*b*) When the diameters of the plates do not conform to the serviceable limits quoted in the relevant data sheet then the dished plates must be re-formed, flattened, expanded or contracted, to size, reformed again and re-flattened. After rectification the plates must not depart from the flat by more than F or L (refer to the relevant data sheet).

Shrinkage of plates

6. When the plates have shrunk beyond the limit B or H, they must first be flattened. The internal diameter may be opened out in the press to the dimensions E or K. All plates sent for reclaim are to be reformed to E and F or K and L whether they conform to codes B and H or not.

"Waisted" plates

7. When waisted plates are withdrawn from service for renewal of pads etc. (*para.* 4 (3)), they must be reclaimed by machining as described in para. 11.

8. Waisted plates, or plates whose surface condition has deteriorated beyond the provisions of para. 4 (5) may be reclaimed by grinding to the dimensions N, O, or P as applicable with corner radii Q. The code letters N, O, and P indicates first, second, and third stages of reduction and the data sheet will state whether all three stages may be used or not. Where two or three stage reduction is permitted, plates may be successively reduced at different periods or reduced to the maximum stage in one grinding operation where distortion necessitates it.

Method of reclaiming dished and shrunk plates or dished and expanded plates

9. Before reclaiming the plates as detailed here, the nickel and/or chrome plating must be removed (refer to Appendix 1). To reclaim dished plates affected by shrinking or expansion (refer to para. 5 and 6) the following instructions should be adhered to. Information on the tools and loads required is given in the relevant data sheet.

(1) The operations should be undertaken in the hot state and for this purpose the plates should be heated in a controlled atmosphere furnace or salt bath to minimize scale effects.

(2) The preferred temperature of heating is 900 deg. C. but in view of difficulties likely to be experienced by operators, without controlled atmosphere furnaces, with the heavy scale produced at 900 deg. C. any suitable temperature up to 900 deg. C. may be used, provided that the finishing temperature is not below 650 deg. C. If the finishing temperature is below 650 deg. C. some cold work may be introduced into the finished plate which is likely to cause increased distortion in subsequent service.

(3) If the press employed by operators is not sufficiently powerful to do the two operations with one heat, it will be necessary to re-heat for the second press operation.

(4) To conserve heat in the plates while they are being pressed, it would help if cold tools are raised in temperature by means of a propane torch or something similar, before press work operations are started.

(5) After the rings have been finally expanded and flattened they should be thoroughly examined for cracks particularly at the base of the slots if these are present.

Sequence of press operations for reclaiming plates

10. Information on the tools and loads required for carrying out these operations is given in the relevant data sheet. The plates and tools should be heated as described in *para.* 9. The sequence of operations is as follows:—

(1) Position the flattening tools in the press and operate the press to reverse the out-of-flat dished effect already present in the plate. Each plate is to be put through the same operation and the press must be set to close the tools.

(2) Reverse the plate in the tools and press out the dishing. The setting for the operation is peculiar to each plate and the stop on the set up must be adjusted to suit each individual condition.

(3) With the special expanding or contracting tool in position, set the stops for the first plate. Subsequent plates of the same part number can be expanded or contracted to the same stop.

(4) Repeat operation 1 (after operation 3 a certain amount of dishing re-appears).

(5) Repeat operation 2.

Sequence of plate grinding operations

11. The following is the sequence of grinding operations for plates which after examination according to *para.* 8 must be re-ground:—

(1) Grind one surface of the friction plate, removing no more material than is necessary to present a surface free from score marks and other surface irregularities liable to have an abrasion effect on friction pads. Providing the plate so ground meets the micro-finish requirement given in *sub-para.* (2) it is not necessary to remove all surface irregularities. As a guide, the finished surface should be at least 75 per cent re-ground, the unground area to be evenly distributed. Where only a small area is left unground this need not be evenly distributed. For example, it is not necessary to remove all traces of circumferential scoring and indentations if doing so will carry the plate to the next repair stage or beyond the final repair limit.

(2) The final finish of the ground area should not exceed 30 micro-inch (centre line average). Measure the plate thickness and determine approximately the amount of material to be removed from the second friction face to establish whether the first, second or third stage final thickness reduction can be achieved.

(3) Grind the second surface of the friction plate and reduce the thickness to the pre-determined figure. Failure to clean up the friction plate at an intended first stage thickness reduction will necessitate continued grinding until the next stage reduction has been completed.

(4) Remove the plate and check the final thickness against the tolerance quoted. There must be no variation of thickness, the friction surfaces must be parallel within 0·001 in. and the surface finish must conform to the requirements detailed in *sub-para.* (1) and (2).

(5) Using a smooth file, carefully restore the corner radii at the internal and external peripheries on each side of the plate. Blend the radii cleanly into the friction surfaces of the plate by polishing with fine grade emery cloth. The polishing operation must be restricted entirely to the radii and must not extend any further across the friction surface than is necessary to effect a clean blending.

(6) The original code marking must be obliterated from the diametrically opposed points on each plate.

Protective treatment

12. For details of protective treatment for the plate refer to the relevant data sheet.

Code letters

13. Code letters and numbers are marked on friction plates to indicate their repair stage and thickness after plating if the plate is chromed or after grinding if the plate is subsequently painted. The new code marking (refer to data sheet) to indicate the first, the second or third stage reduced thickness whichever applies, must be made with $\frac{3}{16}$ in. high metal stamps at two diametrically opposed points on each plate. The new identification code should be arranged on the internal periphery of the outer plate and on the external periphery of the inner plate. The following are typical examples of markings.

Code	*Meaning of code*
1062	Indicates a standard plate 1·062 in. thick.
RP.1032/1	Indicates a repaired plate after a first stage reduction in thickness of 0·030 in. (1·032 in. thick).
RP.1002/2	Indicates a repaired plate after a second stage reduction in thickness of 0·060 in. (1·002 in. thick).
RP.0972/3	Indicates a repaired plate after a third stage reduction in thickness of 0·090 in. (0·972 in. thick).

Colour identification

14. In addition to the relevant code letters

F.S./4

RP.113

Data Sheet No. 2

BRAKE UNIT, PART No. AH.9899

BRAKE PLATE, PART No. AHM.2513

Maximum permitted serviceable dimensions given in the table are based on a check cycle as given in the aircraft servicing schedule.

Dimensions given in the following table are to be substituted for the applicable code letter quoted in the basic scheme.

The press loads for expanding and planishing tools are not given below because deformation of the plate is unlikely.

Code	Applicable dimension (in.)	Remarks
A	7·000	Nominal internal diameter
B	6·965	Minimum permitted serviceable internal diameter
C	0·03	Maximum permissible plate dishing
D	0·825	Maximum permitted slot width using gauge number AO.108414
M	0·1875	Nominal plate thickness
N	0·1775	First stage reduction (plate thickness)
Q	0·030/ 0·035	Corner radii
		Code indicating plate thickness (1st stage reduction)

RP.01775/1

F.S./5

RP.113

Data Sheet No. 3

BRAKE UNIT, PART No. AH.50577

BRAKE PLATE, PART No. AHM.3941

Maximum permitted serviceable dimensions given in the table are based on a check cycle as given in the aircraft servicing schedule.

Dimensions given in the following table are to be substituted for the applicable code letters quoted in the basic scheme.

The press loads for expanding and planishing tools are not given below because deformation of the plate is unlikely.

Code	Applicable dimension (in.)	Remarks
A	7·130	Nominal internal diameter
B	7·100	Minimum permitted serviceable internal diameter
C	0·030	Maximum permissible plate dishing
D	0·825	Maximum permitted slot width using gauge number AO.108414
M	0·1875	Nominal plate thickness
N	0·1775	First stage reduction (plate thickness)
Q	0·035/ 0·030	Corner radii
RP.01775/1		Code indicating plate thickness (1st stage reduction)

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Appendix 1

REPAIR SCHEME RP 113

NICKEL AND CHROME PLATING OF STEEL FRICTION PLATES

Introduction

1. Some steel friction plates are nickel and chrome plated. The procedure for re-plating these after grinding is as detailed in this appendix. Reference should be made to the data sheet relevant to the plate under repair to determine whether the plates should be re-plated.

Stripping

2. To strip the chromium deposit from steel plates, the plates should be made anodic at about 6V in a solution of 5 per cent Sodium Hydroxide, working it at room temperature. When all the chrome deposit is removed swill the plate well in water and then dry it to prevent rusting.

Nickel plating

3. The following is the process for nickel plating when the plates have been ground to pre-plating dimensions:—

(1) Vapour degrease the plates in trichlorethylene and then allow them to cool.

(2) Mount each plate in a jig and cathodic clean for 3-5 minutes in an alkali cleaning solution of 10 per cent sodium cyanide and 10 per cent sodium hydroxide at normal room temperature.

(3) Rinse in cold running water.

(4) Scour each plate with pumice powder and sulphuric acid (25 per cent).

(5) Rinse in cold running water.

(6) Anodic etch in sulphuric acid (1·55-1·60 specific gravity).

(7) Rinse in cold running water.

(8) Nickel plate to a depth of 0·0003 in. on each face. The nickel plating vat is to be maintained as follows:—

	Grammes per litre
Nickel sulphate	290-330
Sodium chloride	20- 25
Boric acid	20- 25

Note . . .
The pH value for the solution must be between 5 *and* 5·5. *The solution must be agitated and the temperature must be* 110 *to* 115 *deg.* F.

(9) Rinse the plate thoroughly in cold running water and then remove it from the jig and dry it.

Note . . .
After nickel plating the plate is lapped to remove nickel from both friction faces. It is essential that no traces of nickel are left on either face. Do not remove the nickel from the inside and outside diameter faces of the plate. Follow up with chrome plating as soon as possible.

Chrome plating

4. (1) Mount the plate in a jig.

(2) Scour the plate with sulphuric acid (25 per cent) and thoroughly rinse it in cold running water.

(3) Load it into the chrome vat with no current applied. The plate is then made anodic at 3·5V for 20 seconds, at the end of which period the current is then reversed and the plate chrome plated to give a depth of 0·002 in. on each face.

(4) Rinse the plate in cold running water, then remove it from the jig and dry it.

Note . . .
The plating solution must be maintained at 290-320 *grammes per litre of chromium trioxide and the ratio of free sulphuric acid to chromium trioxide between* 1:100/120. *The working temperature must be between* 115 *to* 125 *deg. F—preferably* 120 *deg. F.*

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320 grammes per litre of chromium s.
and the ratio of free sulphuric acid
ium trioxide between 1:100/120.
ing temperature must be between
5 deg. F—preferably 120 deg. F.

RP.585

REPAIR TO REMOVE CORROSION FROM THE TORQUE PLATE

(Brake Units AH.50875, AH.50876, AH.50418, AH.50419, and AH.51607)
(Torque Plate AH.41118)

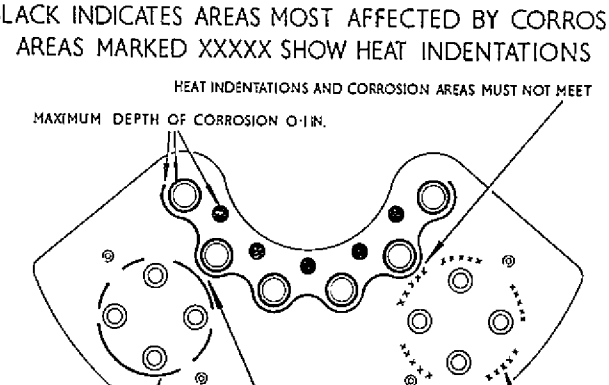

Fig. 1

Scheme

1. To remove corrosion from the torque plate. The areas most affected by corrosion, and the areas showing indentations due to heat, are indicated in fig. 1.

Requirements

2. Selenious acid solution:—2 oz. selenious acid crystals dissolved in one pint of water. Araldite AV.121 and Hardener HY.951.

Method of repair

3. (1) Dismantle the brake unit in accordance with Vol. 1, Book 2, Sect. 3, Chap. 3.

(2) Grit blast the torque plate to remove the corrosion (refer to Vol. 1, Book 1, Sect. 1, Chap. 1 for details of grit blasting).

(3) Measure the depth of corrosion pitting and the maximum depth of indentations due to heat at the locations shown in fig. 1. These must not exceed the limits given. Areas of 0·1 in. and 0·05 in. maximum permissible corrosion must not meet nor must heat indentations and corrosion areas.

(4) Treat the bare metal with selenious acid or, if facilities are available, black

chromate in accordance with DTD.911. Before chromating stamp the RP. number as detailed in para. 5.

(5) Fill in corrosion pitting by using Araldite AV.121 and Hardener HY.951 as detailed for Process 1 in Chap. 1 of Sect. 1.

(6) Refer to Sect. 1, Chap. 1, App. 3 of this volume and fill in the corrosion pitting with Araldite AV.121 and Hardener HY.951 as detailed for Process 1.

(7) Dress off flush with the face of the torque plate.

4. The repair must be to the satisfaction of the supervisory Inspecting Authority.

5. With $\frac{1}{8}$ in. metal stamps, impress RP.585 adjacent to the port number of the torque plate. Protect the indentations with selenious acid solution.

6. Re-paint the torque plate in accordance with Vol. 1, Book 1, Sect. 1, Chap. 1, para. 69 to 70. Assemble the brake unit as detailed in Vol. 1, Book 2, Sect. 3, Chap. 3.

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must be to the satisfaction of
y Inspecting Authority.

metal stamps, impress RP.585
port number of the torque
ie indentations with selenious

torque plate in accordance
1, Part 1, Chap. 1, para. 69
the brake unit as detailed
Sect. 3, Chap. 3.

RP. 113

Data Sheet No. 1

(Dunlop Ref. No. 4)

Pad wear addendum

1	In situ checks		Cyclic dismantled checks		
	2	3	4	5	6
Unit Part No.	1st stage wear limit* (in.)	2nd stage wear limit* (in.)	Permitted wedging per pad (in.)	Minimum "Return to service" thickness measured at the thinnest point	
				Carrier plate assembly (in.)	Backing plate assembly (in.)
AH.50171/2 AH.51047/8	0·785	0·457	0·040	0·599	0·313

*While the pad wear figures given in columns 5 and 6 permit the return to service of the assemblies for a further landing cycle, it must be noted that the figures given in columns 2 and 3 are limiting dimensions. When the dimension quoted in column 2 is reached the first stage piston rod nut assembly must be removed and replaced by the second stage nut. When the dimension quoted in column 3 is reached the brake must be dismantled for renewal of pads and plates. The dimensions in columns 2 and 3 should be checked by pressurizing the assembled brake and measuring between the brake plates.

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