

BRITISH RAILWAYS

WORKSHOP OVERHAUL SCHEDULE

·DIESEL MULTIPLE UNITS

GEARBOXES: R.14, S.E.4 & D173/D173X

FINAL DRIVES: R.F.28, F239/F280 & WALKER

C.M. & E.E. INSPECTORATE,
DERBY LOCO. WORKS.

AMENDMENT NO. 5 D.M.U. GEARBOXES

JANUARY, 1970.

WORKSHOP OVERHAUL SCHEDULE

R14 SELF-CHANGING GEARBOX
SE4 SELF-CHANGING GEARBOX
D173 & 173X 4 SPEED DIRECT-
ACTING TYPE GEARBOX.
CARDAN SHAFT.

1. This Workshop Overhaul Schedule replaces forthwith any previously issued.
2. The only classification of repair is GENERAL.

General repairs are those which are normally carried out on a regular basis after the gearbox has been in service for a pre-determined number of miles.
3. The periodicity of classified repair is 180,000 miles for all but Western Region gearboxes; for these the periodicity is 220,000 miles.
4. Cardan shafts are shopped and overhauled at the same time as the associated gearboxes (except London Midland Region shafts which are shopped separately at 120-144,000 miles).
5. Cardan shafts are overhauled in accordance with Repair Procedure No. D.M.U./Gen./4.
6. The shopping periods between classified repairs may be extended from time to time as equipment is more fully developed and becomes more reliable.
7. Inspection under the Red Label procedure is used to ascertain reasons for failure before scheduled life is attained, where these are obscure. (Refer to Standing Order No. T.& R.S./W/G/5).

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AMENDMENT NO. 162 JULY 1983

COMPONENTS	WORK TO BE CARRIED OUT	REMARKS
<u>GEARBOX</u>	<u>Stripping and cleaning</u>	
	Rough clean. Completely strip gearbox.	Note: Clutch plates to be kept in sets and in correct order, for possible re-use.
	Sub-components to receive additional cleaning following stripping.	
<u>OUTER CASING</u>	Examine visually and crack detect suspect areas by dyepenetrant method.	When crack detecting, special attention must be given to areas surrounding mounting bracket locations and at point between bottom of front cover flange face and bottom cover.
	Repair by welding or "Metalock" method, except at mounting bracket areas, or renew as necessary.	
	Examine oil filler plug hole threads and recondition as necessary.	
	Check fit of intermediate bearing housing in casing, recondition housing as necessary.	Reconditioning consists of building up of exterior of housing to ensure security in casing.
<u>MOUNTING BRACKET STUDS, DOWELS AND SETSCREWS</u>	Examine studs visually for damage and by light hammer tap for security.	
	All damaged and/or insecure studs shall be removed and scrapped. Examine the threaded hole for damage and check it dimensionally using a plug thread gauge. If damaged, or the NO GO section of the gauge enters the hole, the thread shall be restored using a 'Helicoil insert' secured with Loctite 270.	

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COMPONENT	WORK TO BE CARRIED OUT	REMARKS
<u>MOUNTING BRACKET STUDS, DOWELS AND SETSCREWS CONT'D.</u>	<p>Where a previously 'Helicoiled' thread is not acceptable the case is to be considered for scrapping. Where this is not possible, the hole is to be filled with weld, drilled, tapped and a 'Helicoil insert' fitted.</p> <p>Fit new studs using Loctite 270 and check that dowels are free from damage and secure.</p> <p>Re-fit mounting bracket using nuts, bolts and locking tabs in pairs.</p>	See Dat Section Item 1.
Filler Plug and Breather Assembly	Examine, renew plug as necessary.	Ensure breather holes are clear.
Top Covers (Small and Large)	Check for level, straighten or renew as necessary.	

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
<u>OUTER CASING (Continued)</u>		
Mounting Brackets	Check suspension bolt holes, weld and machine as necessary.	See Data Section Item 2.
Dipstick	Examine, renew as necessary.	
Tail Pins (Automatic Adjusters)	Examine and ensure security in casing; renew as necessary.	See Data Section Item 3.
<u>BOTTOM COVER AND SUMP</u>		
Blanking Plates	Renew joints.	
Oil Feed Adaptor	Check threads. Renew as necessary.	Ensure oil feed hole is clear.
<u>MAIN JOINT (OUTER CASING TO BOTTOM COVER)</u>		
<u>LINKAGE (INTERNAL AND EXTERNAL BRAKE BANDS)</u>		
Hooks (Front and Rear)	Examine, particularly fulcrum rod holes, and renew as necessary.	See Data Section Item 4.
Links	Examine pin holes. Renew as necessary.	See Data Section Item 5.
Fulcrum Pins and Centraliser Rods	Examine, renew as necessary.	See Data Section Item 6.

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
<u>CYLINDER BLOCK ASSEMBLY</u>		
Cylinder Block	Examine, renew as necessary. Check studs and dowels, renew as necessary.	
Liners	Examine visually for fractures and wear, renew as necessary.	See Data Section Item 7. Ensure liners are fitted correctly, i.e. internal chamfer to cover plate end.
Rubber 'O' Rings	Renew.	
Pistons, 1st, 2nd and 3rd Speeds	Examine, renew as necessary.	Ensure all pistons are modified to B.U.T. Bulletin No.71 and fitted with additional retaining rings.
Seals (Piston)	Renew.	
Retaining Rings	Renew.	
Springs, 1st, 2nd and 3rd Speeds	Check spring length, renew as necessary.	See Data Section Item 8. Ensure pistons are fitted with correct springs.
Piston Rods	Examine link pin holes, renew piston rods as necessary.	See Data Section Item 9.
Bottom Cover	Examine adaptors (Air Restrictors), renew as necessary. Examine drain plugs and wire-lock after refitting.	Ensure air holes are clear and that the correct restrictors are fitted to each adaptor:- 1st Speed Restrictor marked 1 and R 2nd Speed Restrictor marked 2 and 3 3rd Speed Restrictor marked 2 and 3 Ensure dust protection caps are fitted following assembly.
Top Cover	Examine shaft holes, recondition or renew cover as necessary. Wire-lock nuts. Test assembly by applying 100 lb/in ² air pressure to 1st, 2nd and 3rd speed pistons in turn and checking for air leakage. No leakage is permissible.	See Data Section Item 10.

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
<u>BRAKE BANDS AND LININGS, 1st 2nd AND 3rd SPEEDS</u>		
Steel Bands (Internal and External)	Examine and check for permanent set by measuring the "Free Gap" Crack detect internal band by magnetic particle method. Renew any band found cracked.	See Data Section Item 11 Special attention to be given to the area of the anchor lugs of the internal band.
	Check size and condition of rivet holes and drill out as necessary	See Data Section Item 12
Linings (Internal and External)	Renew	See Data Section Item 12. When riveting ensure close fit of lining to steel band is maintained.
Adjuster Screw and Locking Nut	Examine, renew as necessary.	See Data Section Item 13. Ensure latest hardened type are fitted.
<u>BRAKE BAND ADJUSTING LINKAGE</u>		
Centralisers, Springs and Distance Pieces	Examine, check spring length. Renew items as necessary.	See Data Section Item 14.
Pull Rods and Adjuster Nuts (Automatic)	Examine, renew items as necessary.	See Data Section Item 15. Ensure adjuster nuts run easily on the pull rods throughout full length of thread.
Adjuster Table and Thrust Pad (Automatic)	Examine, and check security of spring locating pin. Renew items as necessary.	
Adjuster Ring (Automatic) (Striking Plate)	Examine, renew as necessary.	Ensure latest type hardened rings are fitted. Special attention to be given to the striking edge for wear and security of spring locating pin.
Adjuster Spring (Automatic)	Renew.	Ensure 'interference push' fit exists between spring bore and exterior of

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
<u>BRAKE BAND ADJUSTING LINKAGE (Continued)</u>		
Operating Levers	Examine pinholes and inner faces for wear. Weld and machine, or renew as necessary	See Data Section Item 16. Special attention to be given to inner faces when checking for wear.
Cams (Needle Roller Assembly)	Examine needle rollers, pins and main roller; renew assemblies as necessary	
<u>OUTPUT HOUSING</u>		
Bearing Sleeve	Examine, renew as necessary.	See Data Section Item 17. Ensure that thrust bearing is a sliding fit in housing. Ensure that oilway at base is clear.
Thrust Bearing	Examine, renew as necessary.	Ensure that all portion of the bearing are kept together.
Roller Bearing	Examine, renew as necessary.	Ensure that inner and outer portions of the bearing are kept as a matched pair.
Oil Seal and Housing	Examine housing and repair or renew as necessary. Renew oil seal.	See Data Section Item 18. Pack grease between lips on assembly.
<u>FRONT COVER ASSEMBLY</u>		
Front Cover	Examine housing and crack detect suspect areas by dye penetrant method. Weld and machine, or renew, as necessary. Examine studs, renew as necessary. Examine pivot pin (Clutch) for condition and security, renew as necessary. Examine drain hole threads, recondition as necessary.	See Data Section Item 19.
Drain Plug	Remove, examine and renew as necessary. Renew joint washer.	

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
<u>FRONT COVER ASSEMBLY</u> (Continued)		
Cylinder Liner, 4th Speed	Examine for fractures and wear, renew as necessary.	See Data Section Item 20. Special attention must be given to ensure that liner is fitted correctly, i.e. internal chamfer to cover plate end.
Rubber 'O' Ring (Cover to Liner)	Renew.	
Piston, 4th Speed	Examine, renew as necessary.	Ensure all pistons are modified to B.J.T. Bulletin No.71 and fitted with additional retaining rings.
Seals (Piston)	Renew.	
Retaining Rings	Renew.	
Spring, 4th Speed	Check spring length, renew as necessary.	See Data Section Item 21. Special attention must be given to ensure that pistons are fitted with correct springs.
Cylinder Cover, 4th Speed	Examine drain plug hole thread, recondition , or renew cover, as necessary.	
Drain Plug	Examine, renew as necessary. Renew joint washer.	
Piston Rod and Pin, 4th Speed	Examine, renew items as necessary.	See Data Section Item 22.
Clutch Operating Lever and Pivot Pin	Examine, renew items as necessary.	See Data Section Item 23

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COMPONENT	WORK TO BE CARRIED OUT	REMARKS
<u>CLUTCH ASSEMBLY, 4th SPEED</u>		
Inner Member	Examine splines and gear teeth for wear, renew inner member as necessary. *Check condition and security of rear plate, re-rivet or renew plate as necessary. Check circlip groove for wear.	See Data Section Item 24. *See Appendix A
Clutch Springs	Check for length, renew as necessary.	See Data Section Item 25.
Spigot Pins	Examine Body portion for wear, renew as necessary.	See Data Section Item 26. * See Appendix A
Sliding Panel	Examine, renew as necessary. * Check condition and security of the inner front plate, re-rivet or renew inner plate as necessary.	See Data Section Item 27. Ensure clutch bearing is a good fit on the sliding panel. Note: Old pattern 6-rivet type plates and panels to be modified to 12-rivet type.
Circlip	Check for damage, renew as necessary.	
Clutch Plates (Inner, Steel)	Examine gear teeth and surfaces for wear, check plates for distortion. Renew as necessary. Check new type inner clutch plates (BR Cat No 15/9053) as follows:- 1. Sandwich the clutch plates between a surface table and a surface plate of 9½in. diam. and 3/8in. thickness. 2. Measure the gap between these plates at three places (approx. 120° apart). The average thickness shall be within the limits 0.120in - 0.131in; at no point is a thickness of less than 0.11 acceptable.	See Data Section Item 28.

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COMPONENT	WORK TO BE CARRIED OUT	REMARKS
<u>TRUNNION RING ASSEMBLY</u>		
Trunnion Ring	Examine, particularly pivot pin slots, and renew as necessary.	See Data Section Item 29.
Clutch Actuating Pins	Examine, and check security of studs. Renew as necessary.	
Bearing Housing	Examine, repair or renew as necessary.	See Data Section Item 30. Ensure bearing is a good fit in housing.
Bearing (Clutch)	Examine, renew as necessary.	

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COMPONENT	WORK TO BE CARRIED OUT	REMARKS
<u>INPUT SHAFT ASSEMBLY</u>		
Input Shaft	Check alignment of shaft between centres. Examine splines, gear teeth and end thread (Coupling Retaining) for condition; size journal and check condition of surface. Recondition or renew shaft as necessary. Reclaim the sealing area if grooved as in Appendix D.	See Data Section Items 24 and 31. Special attention to be given to splines (out put end) & ensure that clutch inner member is a free sliding fit along the entire length of the splined section. Ensure oil holes are clear.
Oil Seal Housing	Examine for condition, check bolt and withdrawal holes for damage. Repair or renew as necessary.	See Data Section Item 32.
Oil Seal	Renew. Seals must conform to Spec. TDM/74/R/50	Pack grease between lips on assembly.
Bearing	Examine, repair or renew as necessary.	
Bearing Housing	Examine, renew as necessary.	See Data Section Item 33.
Gear (Lubricating Oil Pump Driving)	Examine gear teeth and internal splines. Renew as necessary.	
Sleeve	Examine, renew as necessary.	
Bushes (Front and Rear)	Examine internally and externally, renew as necessary.	See Data Section Item 34.
Coupling	Examine location for oil seal, flange face, internal splines, bolt holes, pulley grooves and bearing abutment face. Renew or reclaim as necessary.	See Data Section Item 35 & Appendix B.
Nut (Special)	Check condition of locking bar slots, bolt hole threads and main thread. Renew as necessary.	See Data Section Item 36.
Washer (Special)	Examine, and renew rubber insert.	
'O' Ring	Renew.	Ensure rubber 'O' ring is correctly fitted.
Locking Bar & Tab Washer	Examine locking bar and renew as necessary. Renew tab washer.	

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COMPONENT	WORK TO BE CARRIED OUT	REMARKS
<u>OUTPUT SHAFT ASSEMBLY</u>		
Shaft	Examine splines and end thread (Coupling Retaining). Recondition or renew shaft as necessary. Reclaim the sealing area if grooved as in Appendix D.	
Coupling	Examine location for oil seal, flange face, internal splines bolt holes, pulley grooves and bearing abutment face. Reclaim or renew as necessary.	See Data Section Item 37 and Appendix B.
Nut (Special)	Examine, renew as necessary	
Washer (Special)	Examine, and renew rubber insert	
'O' Ring	Renew	Ensure rubber 'O' ring is correctly fitted.
Bearing Collar (Thrust)	Examine faces for wear, repair or renew as necessary.	See Data Section Item 38.
Oil Muff Coupling	Check bore for wear, renew as necessary.	See Data Section Item 39.
Intermediate Bearing Housing	Examine, renew as necessary.	See Data Section Item 40. Ensure the bearing is a good fit in the housing.
Intermediate Bearing	Examine, renew as necessary.	Ensure the inner and outer portions of the bearing are kept as a matching pair.
Bearing Collar	Examine internal splines and external faces, repair or renew as necessary.	See Data Section Item 41.

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
<u>OIL PUMP ASSEMBLY</u>		
Oil Pump Casing	Check visually for fractures, particularly flange; repair or renew as necessary.	Use cast iron casings only.
Adaptors (Oil Feed)	Examine threads for condition, renew adaptors as necessary. Renew joint washers.	Ensure oil holes are clear.
Bearing (Special)	Renew.	Bearings with 30,000 miles or less only to be renewed if damaged.
Cover and Bush	Examine, renew bush and/or cover as necessary.	See Data Section Item 42.
Pump Gear and Driving Spindle	Examine spindle and gear teeth for wear, check condition of keyway. Renew assembly as necessary.	See Data Section Item 43.
Driven Gear	Examine, renew as necessary.	See Data Section Item 44.
Gear Spindle	Examine, renew as necessary.	See Data Section Item 45.
Pump Main Drive Gear	Examine, renew as necessary.	See Data Section Item 46. Wire-lock cover stud nuts following assembly.
<u>LUBRICATING OIL FILTER</u>		
	Strip and clean.	
Outer Casing (Sump)	Examine for damage, renew as necessary. Renew seal (under bolt head).	
Top Cover	Examine visually for fractures, renew as necessary. Renew seal.	
Element (Paper)	Renew.	Brass type, where fitted, to be cleaned.
Relief Valve	Remove from cover and examine seat, ball and spring. Renew items as necessary.	

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
<u>LUBRICATING OIL FILTER (Continued)</u>		
Centre Bolt	Examine, renew as necessary.	
Gasket	Renew.	
Spring	Examine and check length. Renew as necessary.	See Data Section Item 47.
<u>LUBRICATING OIL PIPES</u>		
		Ensure all oilways are clear.
Inlet Pipe (Steel)	Examine for cone wear and security, check condition of union nut threads. Renew as necessary.	
Flexible Hoses (12" and 34")	Examine for chafing, cone wear and security of end fittings; check condition of union nut threads. Renew as necessary.	
Union, Oil Feed (Flexible Hose to Oil Muff)	Examine for cone wear and thread condition. Renew adaptor as necessary.	
<u>1st SPEED GEAR TRAIN (OUTPUT SHAFT)</u>		
Planet Pinions and Rivets	Examine gear teeth for wear, check pinions for lift and rivets for security; if necessary, strip assembly and renew defective items.	See Data Section Item 48.
Planet Inner Races (Special)	Examine external diameter for wear. Renew as necessary.	See Data Section Item 49.
Rollers (Planet) 5/16" x 5/16" Long	Examine, renew as necessary.	Renew rollers in sets.
Spacing Collars	Examine, renew as necessary.	See Data Section Item 50.
Plate (Planet Retaining)	Examine planet mating face for wear. Renew as necessary.	See Data Section Item 51. and Appendix 'C' for Reclamation Scheme.

COMPONENT	WORK TO BE CARRIED OUT	REMARKS
<u>2nd SPEED GEAR TRAIN</u>		
Planet Pinions and Rivets	Examine gear teeth for wear, check pinions for lift and rivets for security; if necessary, strip assembly and renew defective items.	See Data Section Item 52.
Planet Inner Races (Special)	Examine external diameter for wear. Renew as necessary.	See Data Section Item 53.
Rollers (Planet) 5/16" x 5/16" Long	Examine, renew as necessary.	Renew rollers in sets.
Spacing Collars	Examine, renew as necessary.	See Data Section Item 54.
1st Speed Annulus	Examine internal gear teeth and external ribbing for condition. Crack detect by magnetic method, renew as necessary.	See Data Section Item 55. Ensure the ribbed and internal gear portions have not 'closed in'.
3rd Speed Annulus	Examine gear teeth for wear. Crack detect by magnetic method. Renew as necessary.	See Data Section Item 56.
Bush (Flanged)	Examine, renew as necessary.	See Data Section Item 57.
Adjusting Washer (Special)	Examine, renew as necessary.	See Data Section Item 58. See Page S.24, Fig.22, and Page S.25 of R.14 Gearbox Service Manual for method of determining thickness of adjusting washer.

OCTOBER 1981

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COMPONENT	WORK TO BE CARRIED OUT	REMARKS
<u>3rd SPEED GEAR TRAIN</u>		
Planet Pinions	Examine gear teeth for wear, and check pinions for lift if necessary, strip assembly and renew defective items.	See Data Section Item 59
Planet Pinion Rivets	Renew	
Planet Inner Races (Special)	Examine external diameter for wear. Renew as necessary.	See Data Section Item 60
Rollers (Planet) 5/16" x 5/16" long	Examine, renew as necessary.	Renew rollers in sets.
Spacing Collars	Examine, renew as necessary.	See Data Section Item 61
2nd Speed Annulus	Examine internal gear teeth and external ribbing for condition	See Data Section Item 62 Ensure the ribbed and internal gear portions have not 'closed in'.
Bush (Flanged)	Crack detect by magnetic method. Renew as necessary. Examine, renew as necessary.	See Data Section Item 63.
Plate (Planet Retaining)	Examine planet mating face for wear. Renew as necessary.	See Data Section Item 64. and Reclamation Scheme 1 Appendix 'C'.
<u>3rd SPEED SUNWHEEL AND BRAKE DRUM ASSEMBLY</u>		
3rd Speed Sunwheel	Examine gear teeth and bore for wear, and check security of welding to 3rd speed brake drum. Repair or renew items as necessary.	See Data Section Item 65
3rd Speed Brake Drum	Examine internal gear teeth and external ribbing for condition. Crack detect by magnetic method. Renew as necessary.	See Data Section Item 66 Ensure the ribbed portion has not 'closed in'.
Bushes (Input Shaft to Sunwheel)	Examine externally and internally for wear, check condition of thrust faces. Renew as necessary.	See Data Section Item 67. Ensure oil feed holes are clear.
Split Ring	Renew	Must be renewed as a pair.

RECLAMATION OF COUPLINGS.

Bearing abutment faces subject to wear should be machined to produce a smooth parallel surface. Reclamation should be carried out as indicated in the following tables:-

INPUT COUPLING DIMENSION 'X' FIG. 1.			OUTPUT COUPLING DIMENSION 'Y' FIG. 1.	STAGE	RECLAMATION
15/93056 95030	15/94832	15/95387	15/95941		
greater than 4.803 ins.	greater than 3.365 ins.	greater than 5.365 ins.	greater than 3.015 ins.	I	Machine lead-in chamfer as shown in Fig. 2
4.793 - 4.803 ins.	3.355 - 3.365 ins.	5.355 - 5.365 ins.	3.005 - 3.015 ins.	II	Metal spray to maximum thickness of 0.010 ins. and machine lead-in chamfer as shown in Fig. 2.
less than 4.793 ins.	less than 3.355 ins.	less than 5.355 ins.	less than 3.005 ins.	III	Machine as indicated in Fig. 3 and fit appropriate washer to BR Drg. No. C-A4-8757 as shown in Fig. 4.
less than 4.700 ins.	less than 3.260 ins.	less than 5.260 ins.	less than 2.900 ins.	-	SCRAP

APPENDIX 'B'.

RECLAMATION OF COUPLINGS. - CONTINUED.

Couplings may be subjected to an unlimited number of stage I reclamations.

Couplings may be subjected to more than one Stage II reclamation provided that the dimensions 'X' and 'Y' are still within the tolerance at subsequent repair when all the original sprayed metal has been removed.

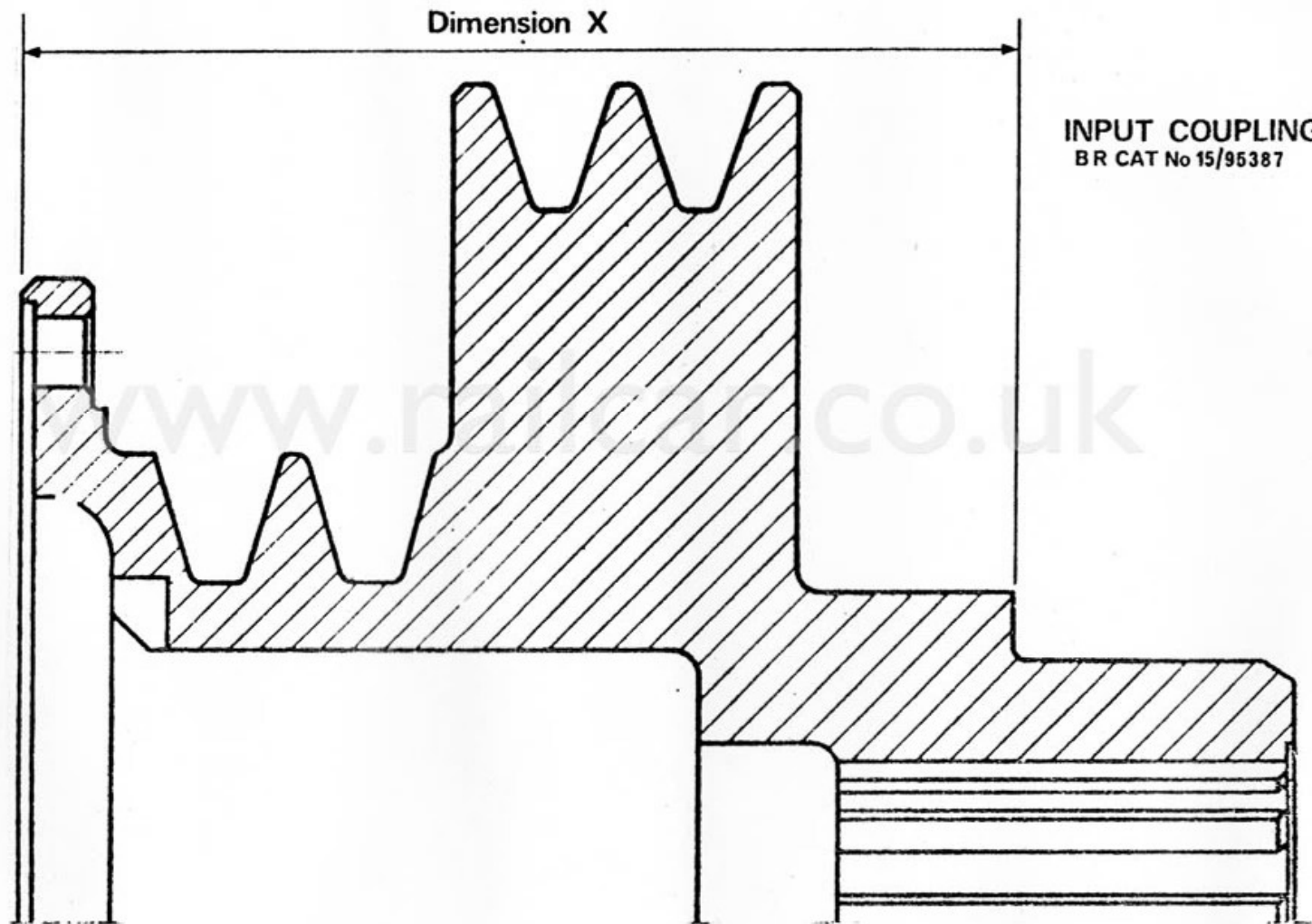
An unlimited number of Stage III reclamations is permissible. The first Stage III reclamation should be carried out as described above and subsequent reclamations should remove only sufficient metal to produce a smooth parallel surface.

The washers used in the Stage III reclamation may be left in position at Workshop Overhaul provided that they are not worn or damaged. Washers removed at Workshop Overhaul must be scrapped.

When the minimum dimension shown in Fig. 3 is reached the coupling should be scrapped.

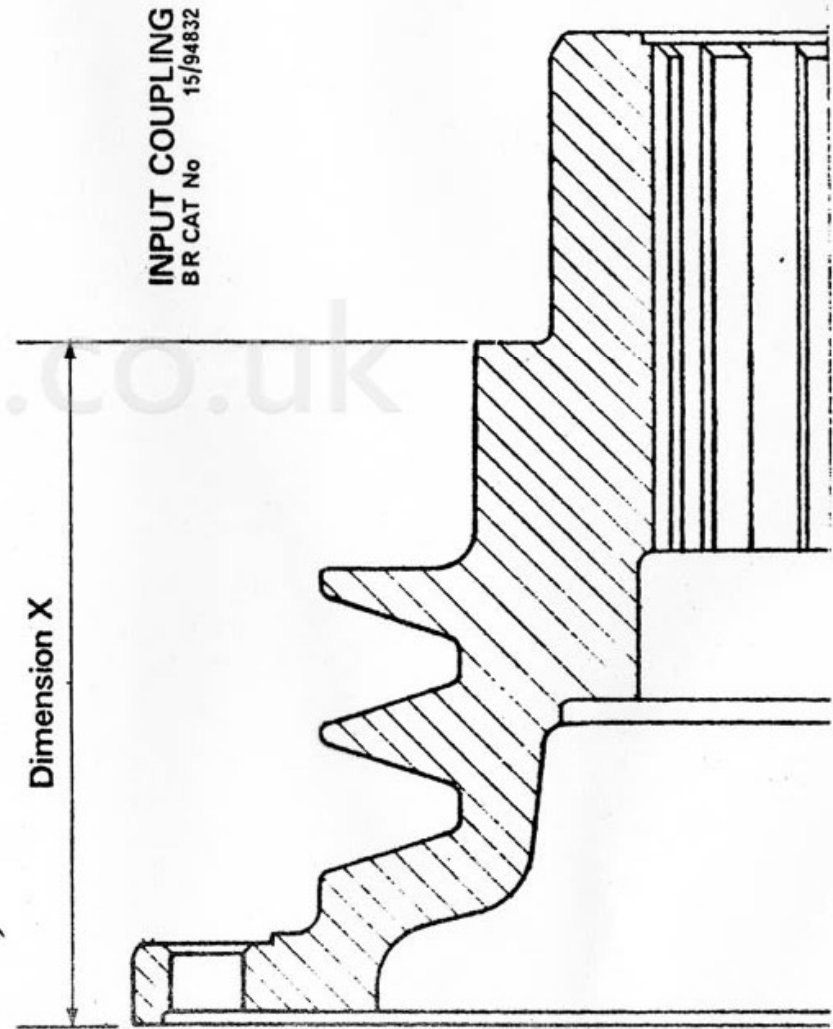
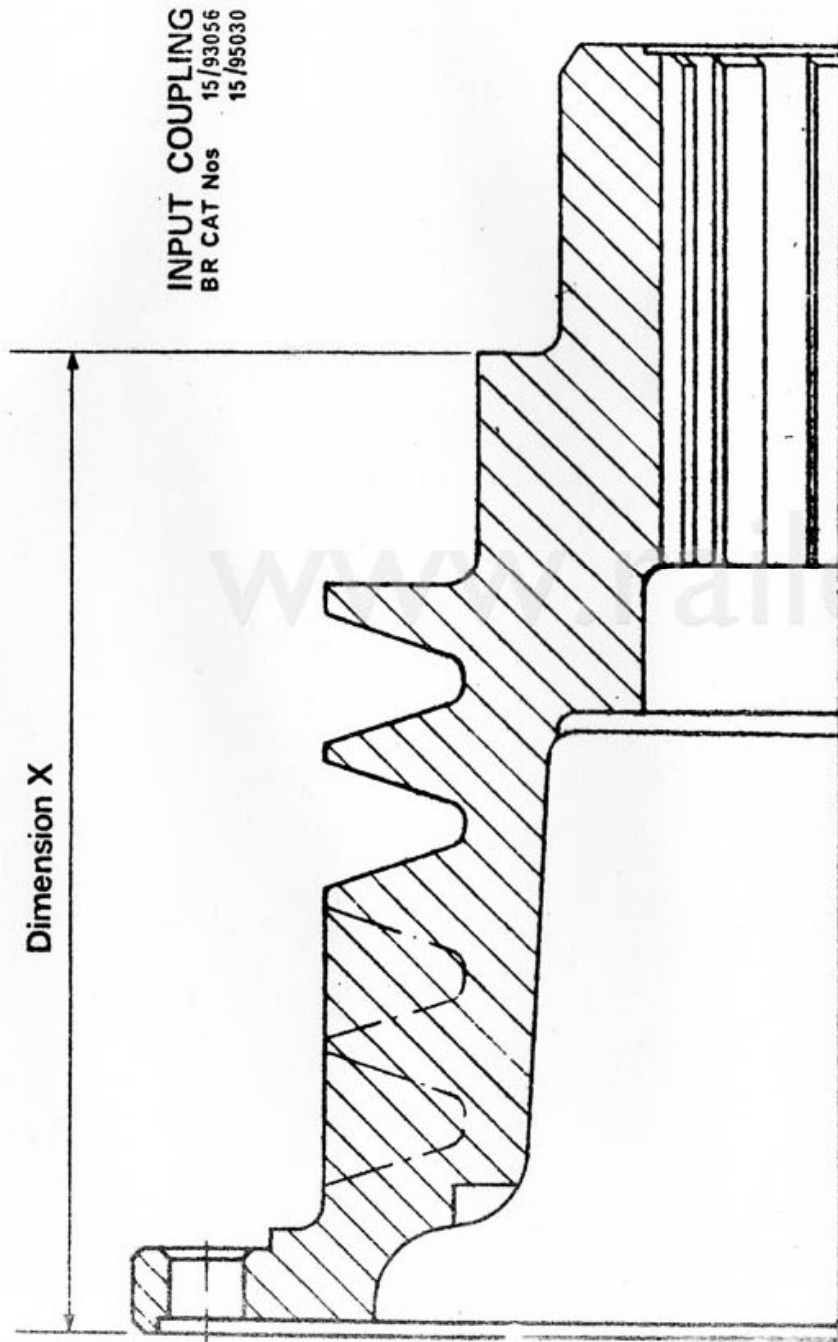
APPENDIX 'B' - CONTINUED.

PART OF FIG. 1 - CRITICAL DIMENSIONS FOR RECLAMATION (AFTER INITIAL MACHINING)



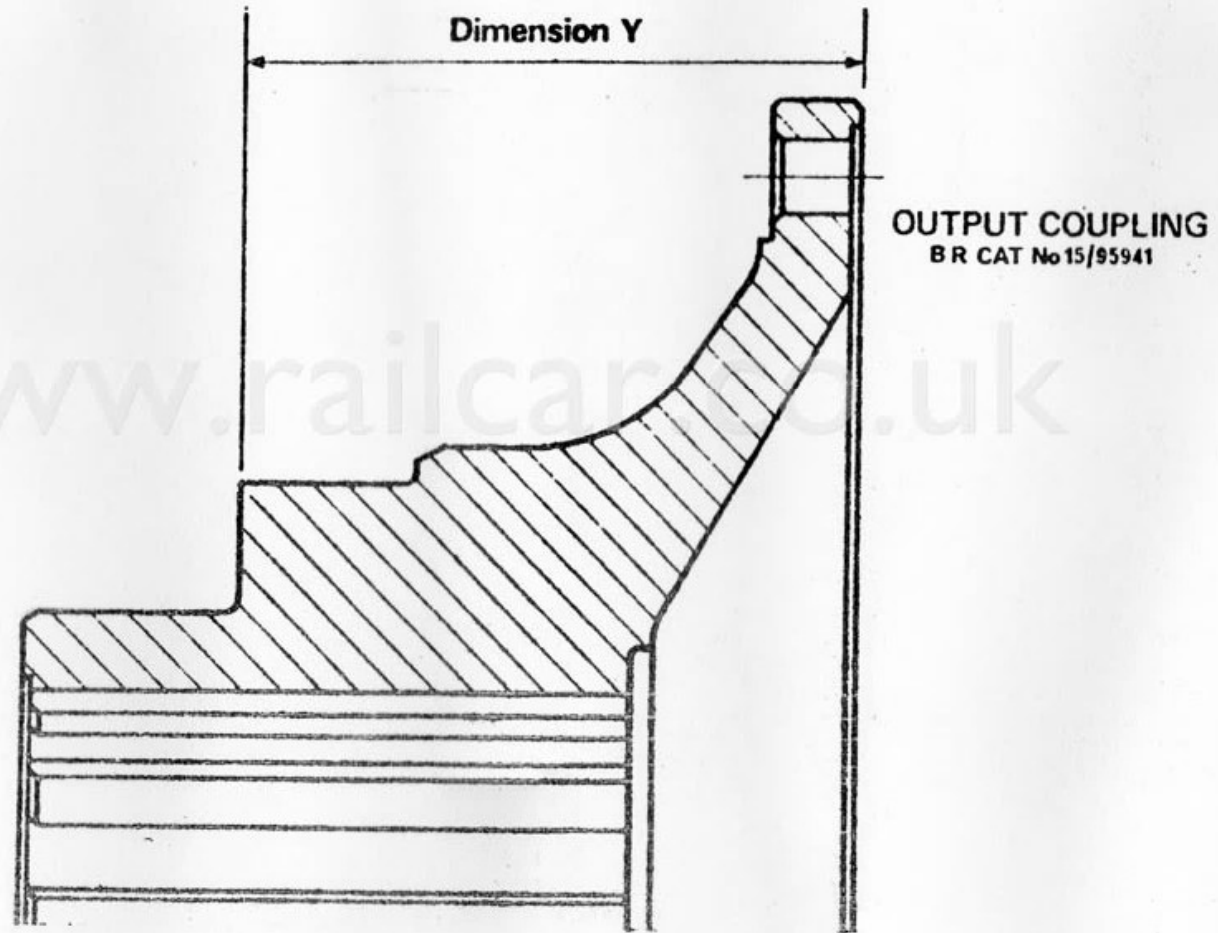
APPENDIX 'B' - CONTINUED

PART OF FIG. 1 - CRITICAL DIMENSIONS FOR RECLAMATION (AFTER INITIAL MACHINING)



APPENDIX 'B' - CONTINUED.

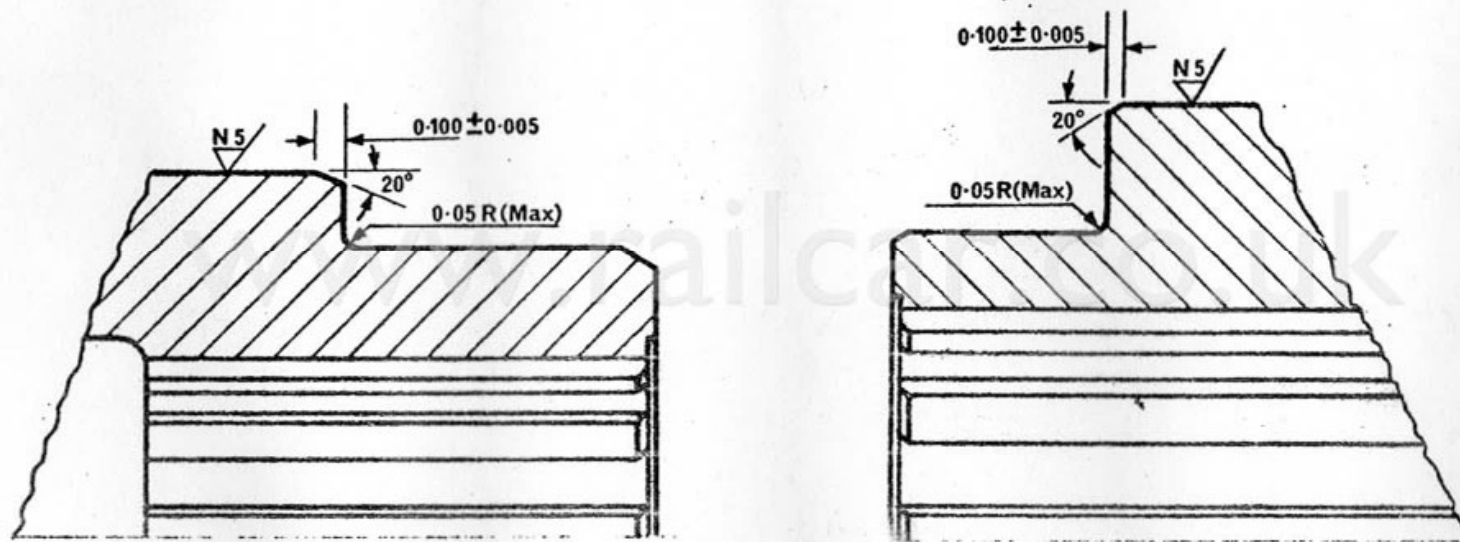
PART OF FIG. 1 - CRITICAL DIMENSIONS FOR RECLAMATION (AFTER INITIAL MACHINING)



APPENDIX 'B' - CONT

FIG. 2 - COUPLING LEAD-IN CHAMFER

(All dimensions in inches)



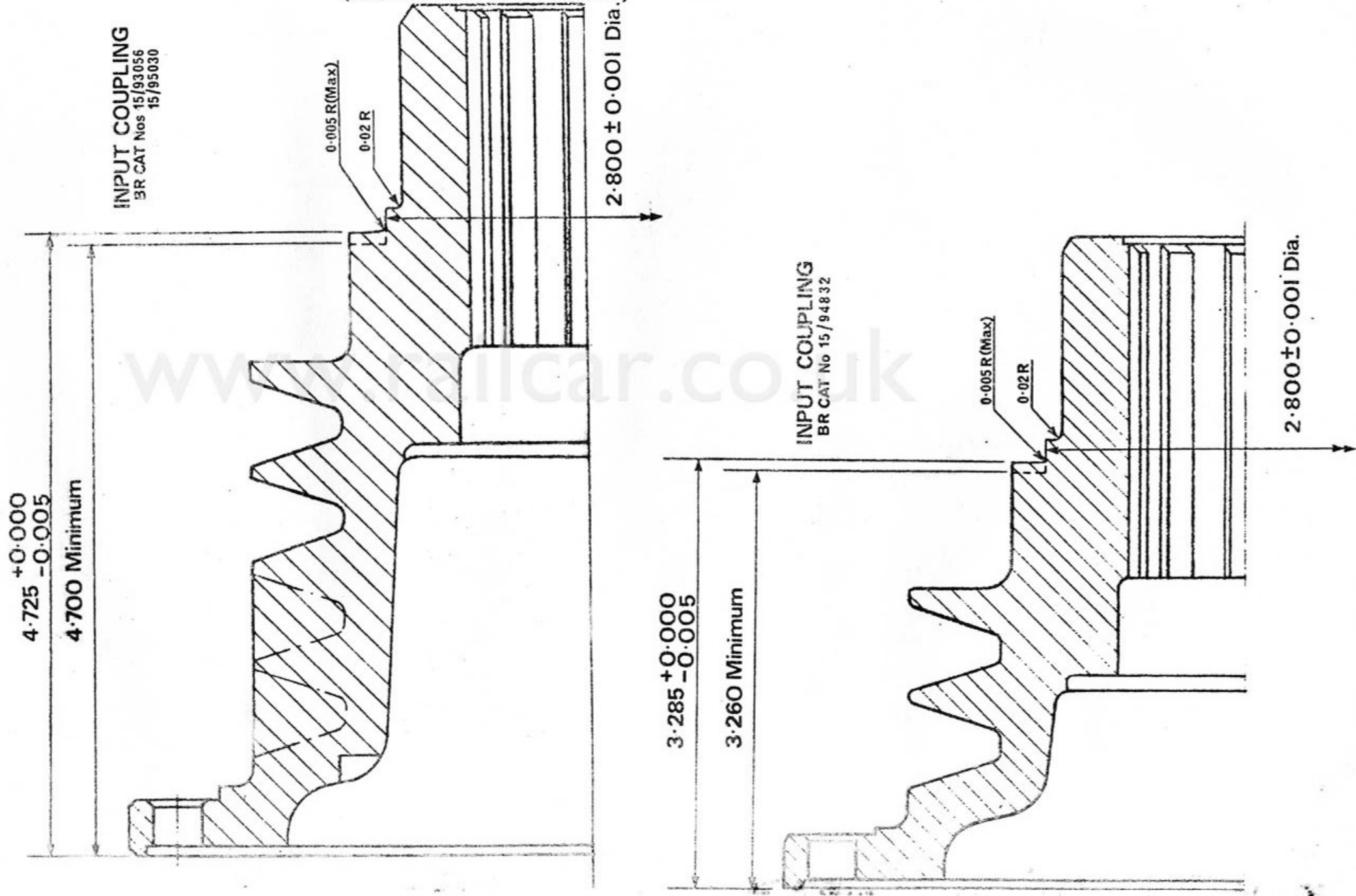
INPUT FLANGE

OUTPUT FLANGE

APPENDIX 'B' - CONTINUED.

PART OF FIG. 3 - STAGE III RECLAMATION MACHINING

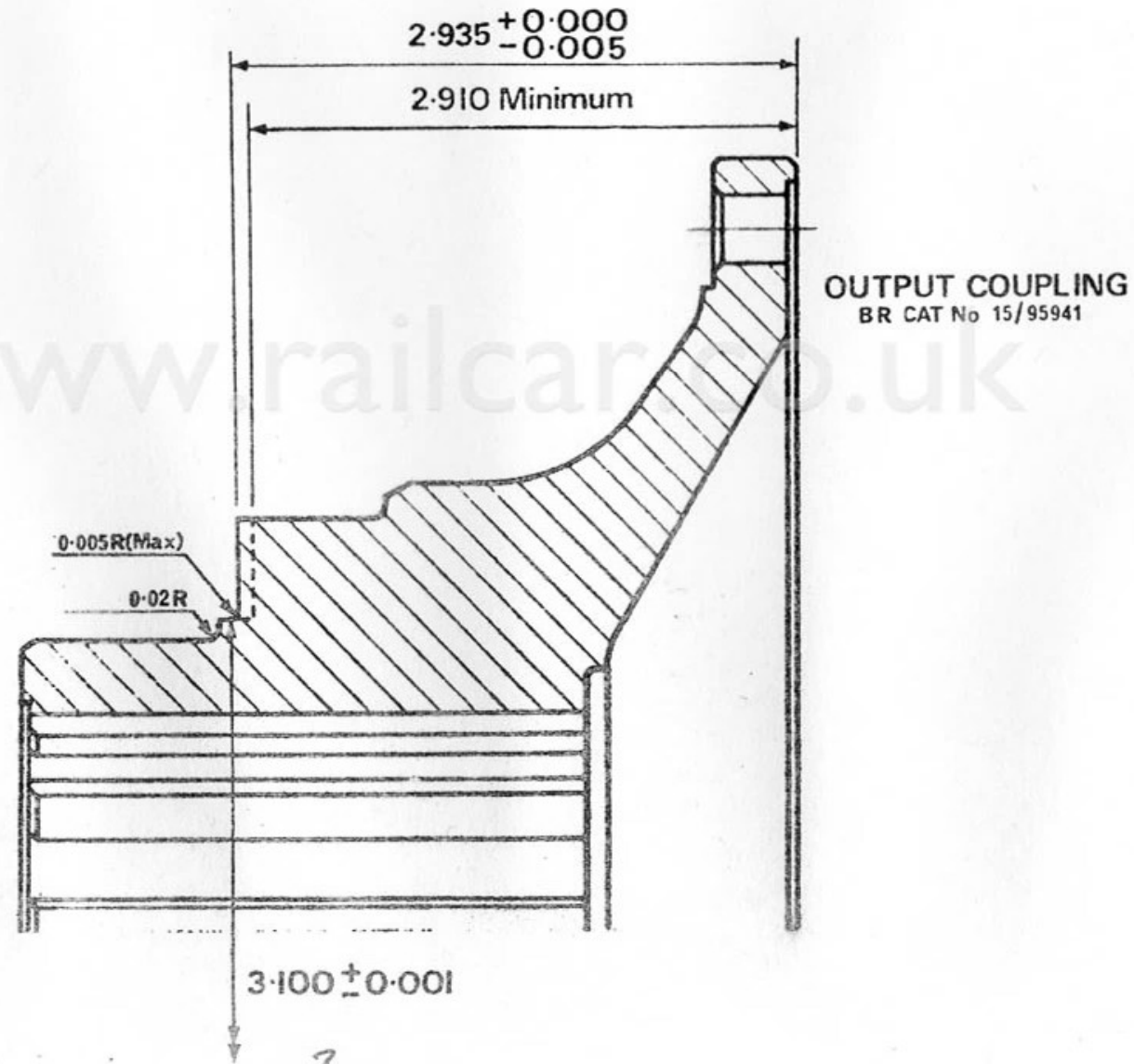
(All dimensions in inches)



APPENDIX 'B' - CONTINUED

PART OF FIG. 3 - STAGE III RECLAMATION MACHINING

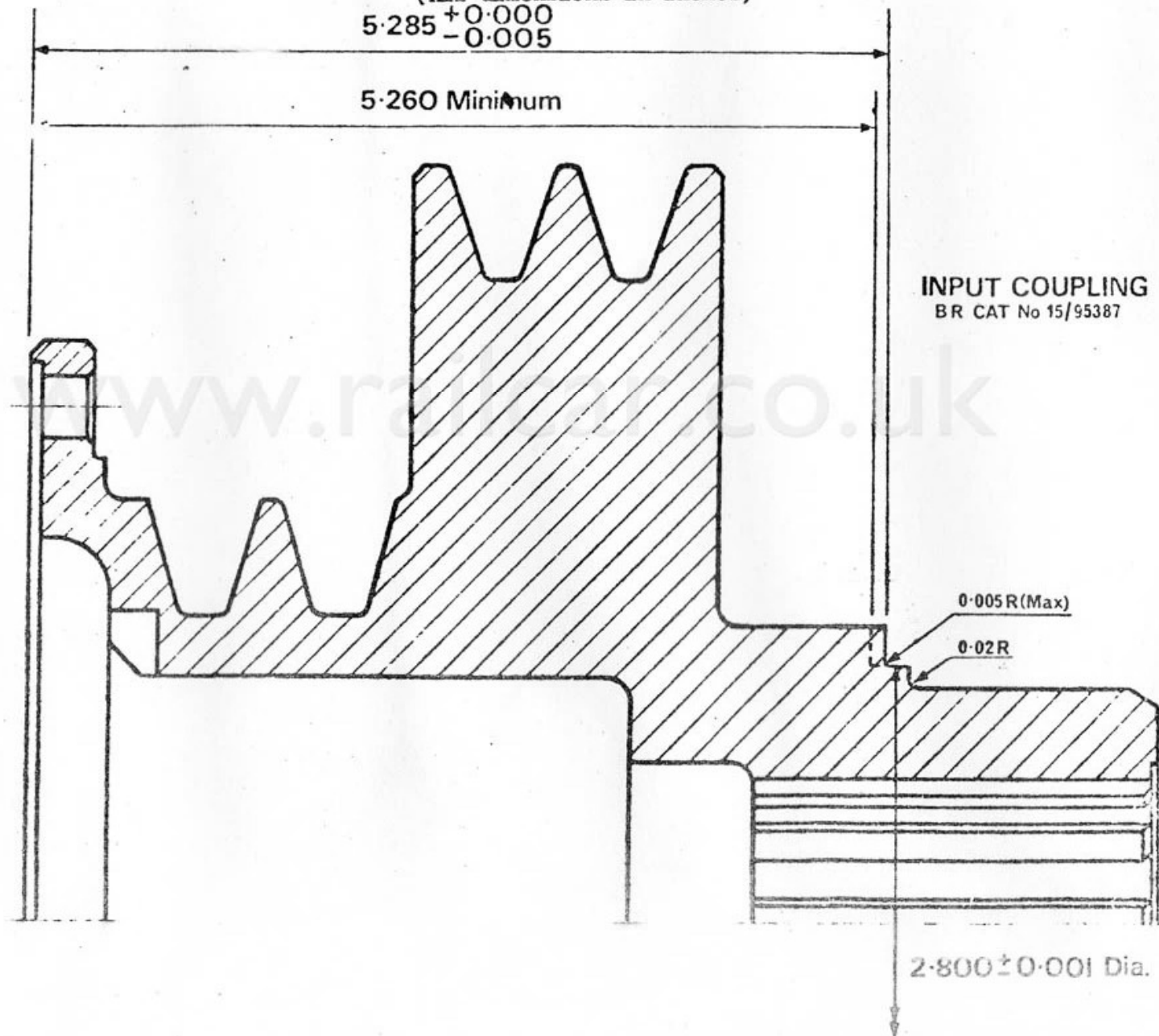
(All dimensions in inches)



APPENDIX 'B' - CONTINUED

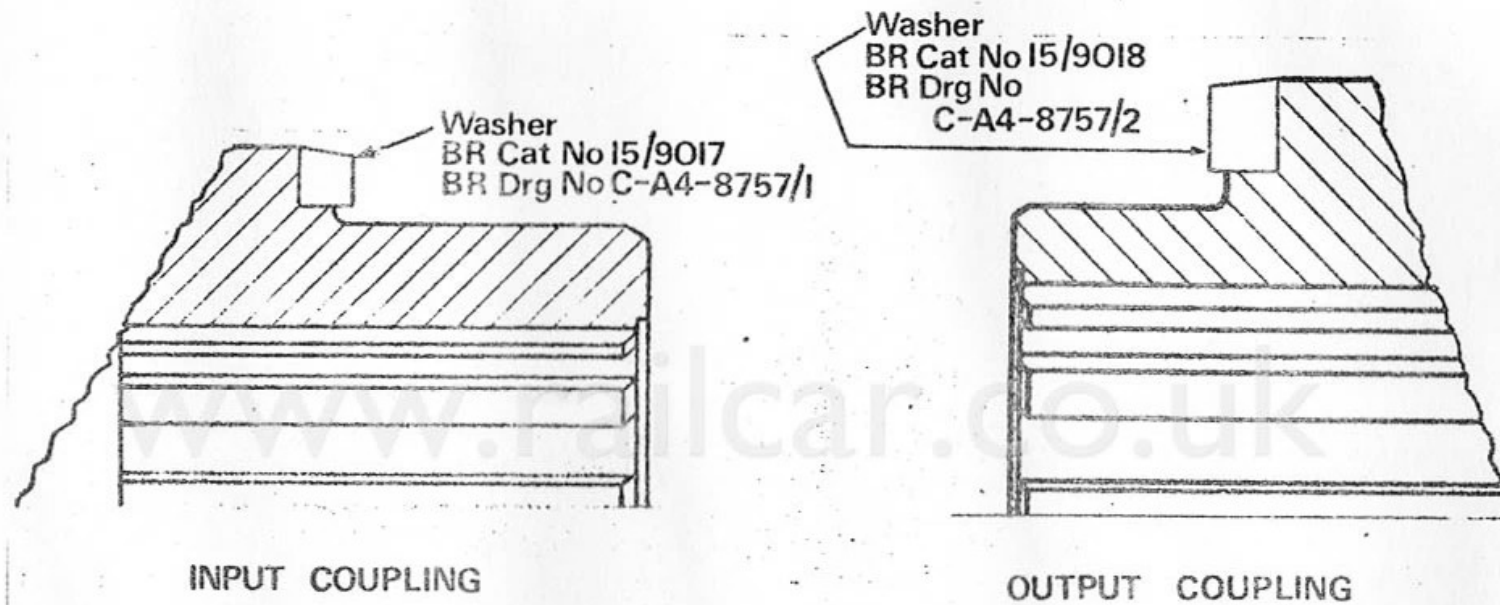
PART OF FIG. 3 - STAGE III RECLAMATION MACHINING

(All dimensions in inches)



APPENDIX 'B' - CONTINUED

FIG. 4 - ASSEMBLY OF COUPLING AND WASHER



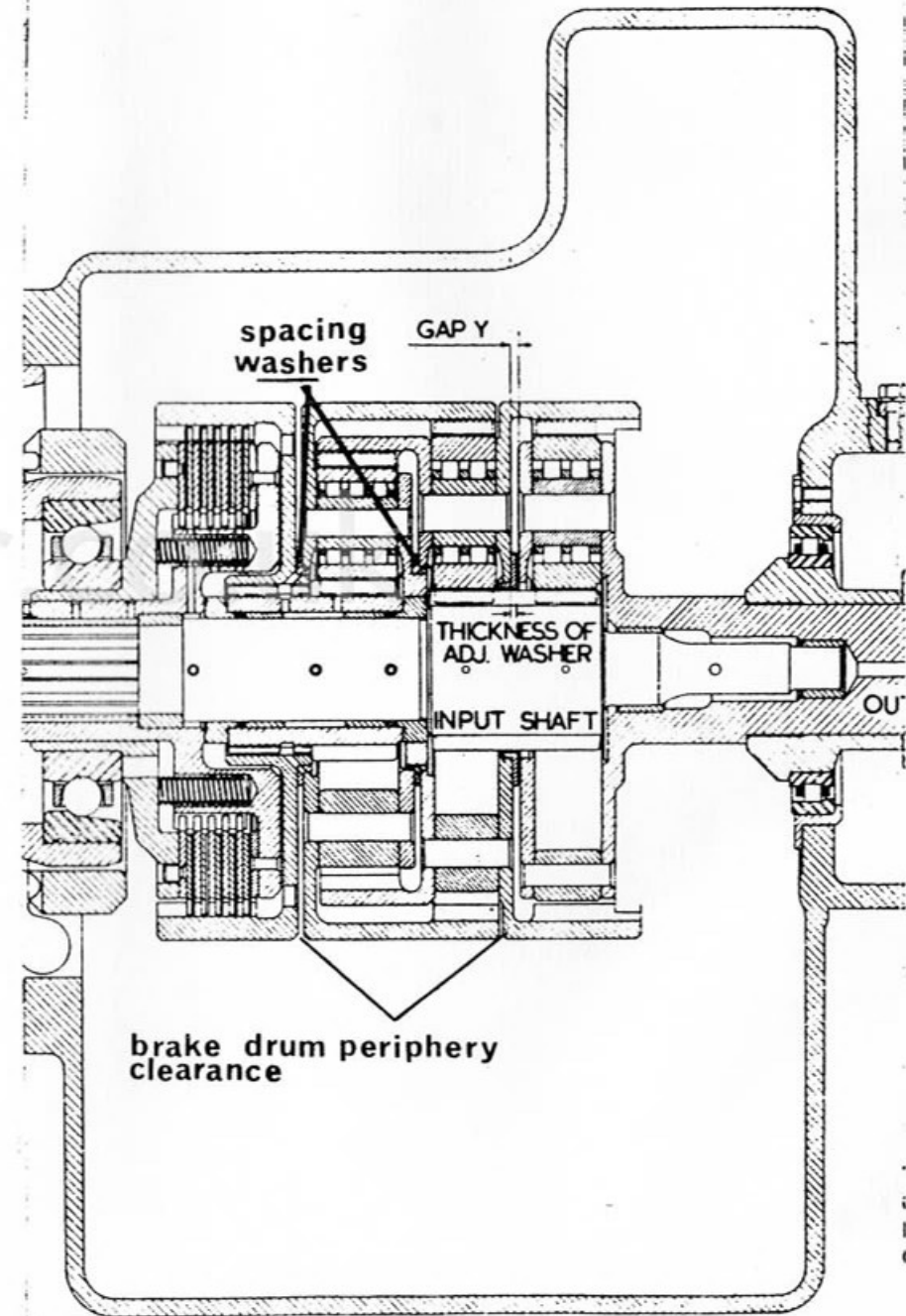
NOTE: The position of the washer, relative to the coupling, is dependent on the number of Stage III reclamations which have been carried out.

GENERAL REPAIR SECTION.APPENDIX 'C'.PLANET CARRIER PLATE WEAR

Indentations of more than 0.003" in the face of carrier plates must be removed by machine grinding, removing as little material as possible, to remove the marks. Up to 0.010" of metal may be removed from the faces and the total running clearance adjusted on the special washer (See Data Section Item 58) , Gap Y.

A further 0.010" of metal may be removed but oversize spacing washers must be fitted to restore the clearances between brake drum peripheries to 0.060".

See Data Section Item 57 for oversize bushes.



JULY, 1979

GENERAL

SHEET 27

INPUT AND OUTPUT SHAFTSRECLAMATION OF SEALING AREA

Input and output couplings which have been grooved in service by the cutting action of the shaft seal may be reclaimed by grinding out the groove. The surface finish after grinding shall not be coarser than roughness number N5 and the minimum diameter of the coupling at seal area shall be in accordance with the following.

Coupling	Nominal Dia. Dia. D. Fig. 1	Minimum Dia. Dia. D. Fig. 1
R14 Gearbox		
input shaft	3.500 ins.	3.485 ins.
output shaft	4.250 ins.	4.235 ins.
SE4 Gearbox		
input shaft	2.250 ins.	2.235 ins.
output shaft	2.750 ins.	2.735 ins.

At each reclamation the minimum amount of metal shall be removed to give the specified sealing area surface finish.

After removal of 0.015" and when the seal area is worn, it shall be reduced by a further 0.005" + 0.003", making a total of 0.017" to 0.023" and a speedi-sleeve fitted in accordance with the following instructions and sizes:-

/Continued....

JULY, 1979

GENERAL

SHEET 28

INPUT AND OUTPUT SHAFTS (Cont'd.)

B.R. Cat. No.	Vulcascot Speedi-Sleeve No.	Shaft Diameter	Width (Not including flange)
15/9062	92230	2.230" \pm .003"	.750"
15/9061	99268	2.730" \pm .003"	.750"
15/9060	99340	3.480" \pm .003"	.875"
15/9059	99366	3.730" \pm .003"	.875"
15/9058	99423	4.230" \pm .003"	.750"

Ensure that the seal area is free from dirt, lubricant or metal burrs, locate the speedi-sleeve squarely onto the shaft, flanged end first, fit the installation tool over the sleeve, place a block of hardwood across the face of the tool and, using a hammer, gently drive the sleeve onto the shaft until correctly positioned over the centre of the seal contact area.

When worn, the sleeve may be removed by splitting with a small, sharp chisel before fitting a new sleeve in accordance with the above.

D.M.U. Gearbox - R.14

TEST SCHEDULE

1. Mount gearbox on stand; fill with specified gearbox lubricant (See Appendix A) and couple driving motor (6 h.p.) to input shaft; gear changing effected by a relay air valve.
2. Couple to air supply (65 P.S.I.) to check operation of brake bands.
3. Fit transparent cover in place of normal cover plate.
4. Carry out running tests as under:-

Gear Engaged	Period of Test Run in each Gear (In Minutes)			Total Running Period In Minutes
	875 rev/min	1450 rev/min	1800 rev/min	
3rd	15	15	15	45
2nd	15	15	15	45
1st	15	15	15	45
4th	-	15	15	30
	45	60	60	165

5. Record the relevant data on Test Form (See Appendix 'A').
6. Check for oil leaks.
7. Check outside details.

DATA

AMENDMENT NO. 163 JULY 1983

ITEM NO.	COMPONENT	MINIMUM	MAXIMUM	REMARKS
<u>OUTER CASING</u>				
1	Studs, Mounting Bracket - Torque Load - Standard	70 lbf ft	75 lbf ft	
	- After reclamation with 'Heli-coil' inserts		80 lbf ft	
2	Mounting Bracket - Suspension Bolt Hole Diameter			
	- Front	1.508"	1.510"	
	- Rear	1.258"	1.266"	
3	Tail Pins (Automatic Adjusters) - Diameter	0.365"	0.375"	Turn through 180° when worn to minimum size. Renew when again worn to 0.365".
<u>LINKAGE (INTERNAL AND EXTERNAL BRAKE BANDS)</u>				
4	Hooks (Front and Rear) - Fulcrum Rod Hole Diameter	0.5625"	0.5675"	Renew at maximum size.
5	Links - Pin Hole Diameter	0.500"	0.505"	Renew at maximum size.
6	Fulcrum Pins and Centraliser Rods			
	- Fulcrum Pin Diameter	0.556"	0.561"	Renew at minimum size.
	- Centraliser Rod Pin Hole Diameter	0.375"	0.380"	Renew at maximum size.
<u>CYLINDER BLOCK ASSEMBLY</u>				
7	Liners			
	- Bore - 1st Speed	3.250"	3.255"	Renew at maximum size.
	- 2nd Speed	2.375"	2.380"	Renew at maximum size.
	- 3rd Speed	2.000"	2.005"	Renew at maximum size.

ITEM NO	COMPONENT	MINIMUM	MAXIMUM	REMARKS	ITEM NO
<u>CYLINDER BLOCK ASSEMBLY (CONTINUED)</u>					
8	Springs - Length - 1st Speed	6.000"	6.250"	Renew at minimum size.	8
	- 2nd Speed	4.750"	5.000"	Renew at minimum size.	
	- 3rd Speed	4.250"	4.500"	Renew at minimum size.	
9	Piston Rods - Link Pin Hole Diameter	0.625"	0.630"	Renew at minimum size.	9
10	Top Cover - Shaft Hole Diameter	0.625"	0.630"	Renew at minimum size.	10
<u>BRAKE BANDS AND LININGS</u>					
11	Steel Bands (Internal and External) - "Free Gap" Dimension	2.000"	-		11
	Rivet hole diameter	-	0.175"	Where rivet hole diameter exceeds 0.175", drill out to 0.182" using No 14 drill	
		0.182"	0.187"	Renew at maximum size	
12	Linings (Internal and External) - Rivet diameter	0.165"	0.168"	For use in holes up to 0.175" dia	12
		0.171"	0.174"	For use in holes 0.182" and above (see Data Section Appendix 'C' for rivet details)	
13	Adjuster Screw and Locking Nut - Brake Setting Dimensions-				13
	- 1st Speed		1.300"		
	- 2nd Speed		1.300"		
	- 3rd Speed		1.450"		
<u>BRAKE BAND ADJUSTING LINKAGE</u>					
14	Centralising Spring - Length	1.000"		Renew at minimum size.	14
15	Adjuster Nut (Automatic) - Thread Size	11/16"	U.N.S. 2A		15
16	Operating Levers - Pin Hole Diameter	0.625"	0.630"	Renew at maximum.	16
	- Inner Face Wear	-	0.015"		

ITEM NO.	COMPONENT	MINIMUM	MAXIMUM	REMARKS	ITEM NO.
	<u>OUTPUT HOUSING</u>				
17	Bearing Sleeve - Inside Diameter	5.750"	5.752"	Renew at maximum size.	17
18	Oil Seal and Housing - Inside Diameter of Housing	5.498"	5.500"	Renew at maximum size.	18
	<u>FRONT COVER ASSEMBLY</u>				
19	Front Cover - Pivot Pin Length	1.455"	1.465"	Renew at minimum size.	19
20	Cylinder Liner, 4th Speed - Bore	2.750"	2.755"	Renew at maximum size.	20
21	Spring, 4th Speed - Length	4.500"	4.750"	Renew at minimum size.	21
22	Piston Rod and Pin, 4th Speed				22
	- Pin Hole Diameter	0.312"	0.315"	Renew at maximum size.	
	- Pin Diameter	0.307"	0.310"	Renew at minimum size.	
23	Clutch Operating Lever and Pivot Pin				23
	- Pin Hole Diameter	0.375"	0.381"	Renew at maximum size.	
	- Pivot Pin Diameter	0.372"	0.375"	Renew at minimum size.	
	<u>CLUTCH ASSEMBLY, 4TH SPEED</u>				
24	Inner Member				24
	- Gear Teeth Indentation	-	0.005"		
	- Male Spline Width (Shaft)	0.264"	-	Ensure that backlash between any two assemblies does not exceed 0.004".	
	- Female Spline Width (Inner Member)	-	0.276"		
	- Circlip Groove		0.089"		
25	Clutch Springs - Length	2.1975"	-		25
26	Spigot Pins - Body Diameter	0.315"	0.325"	Renew at minimum size.	26

ITEM NO.	COMPONENT	MINIMUM	MAXIMUM	REMARKS	ITEM NO.
	<u>CLUTCH ASSEMBLY, 4TH SPEED</u> (CONTINUED)				
27	Sliding Panel - Outside Diameter - Inside Diameter	2.754" 2.400"	2.757" 2.404"	Renew at minimum size. Renew at maximum size.	27
28	Clutch Plates (Inner, Steel and Outer Sintered) - Distortion - Gear Teeth Wear - Face Wear - Plate Thickness (New)	- - - 0.124"	0.005" 0.010" 0.005" 0.126"		28
	<u>TRUNNION RING ASSEMBLY</u>				
29	Trunnion Ring - Pivot Pin Slot Depth	0.250"	0.260"	Reclaim or renew at maximum size.	29
30	Bearing Housing - Inside Diameter	5.90625"	5.90825"	Renew at maximum size.	30
	<u>INPUT SHAFT ASSEMBLY</u>				
31	Input Shaft - Misalignment - Journal Sizes	- 1.746"	0.003" 1.748"	Recondition or renew at minimum size.	31
32	Oil Seal Housing - Inside Diameter	-	7.090"		32
33	Bearing Housing - Inside Diameter	7.088"	7.090"	Renew at maximum size.	33

ITEM NO.	COMPONENT	MINIMUM	MAXIMUM	REMARKS	ITEM NO.
	<u>INPUT SHAFT ASSEMBLY</u>				
34	Bushes				34
	- Front - Inside Diameter	0.750"	0.760"	Renew at maximum size	
	- Outside Diameter	0.988"	0.998"	Renew at minimum size	
	- Rear - Inside Diameter	1.250"	1.260"	Renew at maximum size	
	- Outside Diameter	1.438"	1.448"	Renew at minimum size	
35	Coupling				35
	- Flange Face Distortion	-	0.005"		
	- Bolt Hole Elongation Diameter	-	0.390"		
	- Pulley Grooves	-	-	Remachine grooves at total stepping of 0.020". Renew pulley when a total of 0.125" has been removed.	
	- Seal surface diameter	3.470"	3.505"		
	- Sealing area surfade finish		N5		
36	Nut (Special)				36
	- Thread size	1.25"	12 U.N.F.		
	<u>OUTPUT SHAFT ASSEMBLY</u>				
37	Coupling				37
	- Flange Face Distortion	-	0.005"		
	- Bolt Hole Elongation Diameter	-	0.390"		
	- Pulley Grooves	-	-	Remachine grooves at total stepping of 0.020". Renew pulley when a total of 0.125" has been removed.	
	- Seal surface diameter	4.220"	4.255"		
	- Sealing area surface finish		N5		
38	Bearing Collar (Thrust)				38
	- Length	1.685"	1.700"	Renew at minimum size	
	- Flange thickness	0.724"	0.739"	Renew at minimum size	
39	Oil Muff Coupling				39
	- Inside diameter	2.750"	2.759"	Renew at maximum size	
40	Intermediate Bearing Housing				40
	- Inside Diameter	5.000"	5.992"	Renew at maximum size	

ITEM NO.	COMPONENT	MINIMUM	MAXIMUM	REMARKS	ITEM NO.
<u>OUTPUT SHAFT ASSEMBLY (CONTINUED)</u>					
41	Bearing Collar				
	- Length	2.735"	2.750"	Renew at minimum size.	41
	- Spline Width - Male (Shaft)	0.342"	-	Ensure that backlash between any two assemblies does not exceed 0.004".	
	- Female (Collar)	-	0.356"		
<u>OIL PUMP ASSEMBLY</u>					
42	Bush				
	- Inside Diameter	0.5312"	0.5362"	Renew at maximum size.	42
	- Outside Diameter	0.6510"	0.6560"	Renew at minimum size.	
43	Pump Gear and Driving Spindle				
	- Spindle Diameter	0.528"	0.530"	Renew at minimum size.	43
	- Backlash between Gears		0.030"		
44	Driven Gear				
	- Backlash between Gears		0.030"		44
45	Gear Spindle				
	- Diameter	0.498	0.500"	Renew at minimum size.	45
46	Pump Main Drive Gear				
	- Backlash between Gears		0.015"		46
<u>LUBRICATING OIL FILTER</u>					
47	Spring				
	- Length	1.125"	1.375"	Renew at minimum size.	47
<u>1ST SPEED GEAR TRAIN</u>					
48	Planet Pinions				
	- Gear Teeth Indentation		0.002"		48
	- Lift		0.002"		
49	Planet Inner Races				
	- Outside Diameter	1.119"	1.120"		49
50	Spacing Collar				
	- Thickness	0.169"	0.172"		50
51	Plate (Planet Retaining)				
	- Thickness	0.230 in.	0.250 in.	Renew at Minimum size.	51

ITEM NO.	COMPONENT	MINIMUM	MAXIMUM	REMARKS	ITEM NO.
<u>2ND SPEED GEAR TRAIN</u>					
52	Planet Pinions - Gear Teeth Indentation - Lift		0.002" 0.002"		52
53	Planet Inner Races - Outside Diameter	1.119"	1.120"		53
54	Spacing Collar - Thickness	0.169"	0.172"	Renew at minimum size.	54
55	1st Speed Annulus - Gear Teeth Indentation - Serration Wear		0.005" 0.020"		55
56	3rd Speed Annulus - Gear Teeth Indentation		0.005"		56
57	Bush (Flanged) - Outside diameter - Inside diameter - Flange thickness	3.483" 3.250" 0.088"	3.495" 3.263" 0.100"	Renew at minimum size. Renew at maximum size. Renew at minimum size.	57
	Bush (Flanged) Oversize 1 - Flange thickness	0.108"	0.120"	Renew at minimum size.	
	Oversize 2 - Flange thickness	0.128"	0.140"	Renew at minimum size.	
58	Adjusting Washer - Thickness (Standard)		0.240"	See Page S.24, Fig.22, and Page S.25 of R.14 Gearbox Service Manual for method of determining thickness of adjusting washer.	58
58A	Plate (Planet Retaining) - Thickness	0.230"	0.250" *	* Renew at Minimum size.	58/
<u>3RD SPEED GEAR TRAIN</u>					
59	Planet Pinions - Gear Teeth Indentation - Lift		0.002" 0.002"		59
60	Planet Inner Races - Outside Diameter	0.899"	0.900"		60
61	Spacing Collar - Thickness	0.157"	0.160"	Renew at minimum size.	61

ITEM NO.	COMPONENT	MINIMUM	MAXIMUM	REMARKS	ITEM NO.
	<u>3RD SPEED GEAR TRAIN</u> (CONTINUED)				
62	2nd Speed Annulus - Gear Teeth Indentation - Serration Wear		0.005" 0.020"		62
63	Bush (Flanged) - Outside Diameter - Inside Diameter - Flange Thickness	3.483" 3.250" 0.088"	3.495" 3.263" 0.100"	Renew at minimum size. Renew at maximum size. Renew at minimum size.	63
	Bush (Flanged) Oversize- Flange Thickness - Flange Thickness	0.108" 0.128"	0.120" 0.140"	Renew at minimum size. Renew at minimum size.	
64	Plate (Planet Retaining)- Thickness <u>3RD SPEED SUNWHEEL AND BRAKE DRUM ASSEMBLY</u>	0.230"	0.250"	Renew at minimum size.	64
65	3rd Speed Sunwheel - Bore Diameter	-	-	Diametral clearance between outside diameter of sunwheel bushes and inside diameter of sunwheel must not be less than 0.005".	65
66	3rd Speed Brake Drum - Gear Teeth Indentation - Serration Wear		0.005" 0.020"		66
67	Bushes (Input Shaft to Sunwheel) Bush (Front End)- Bore Clearance - Outside Diameter Clearance - Flange Thickness Bush (Rear End) - Bore Clearance - Outside Diameter Clearance - Flange Outside Diameter Clearance - Flange Thickness	0.0005" 0.002" 0.387" 0.0005" 0.002" 0.004" 0.387"	0.015" 0.015" 0.015" 0.015"		67
68	<u>Planet Wheels</u> Planet wheel rivets - protrusion .		0.032"		68

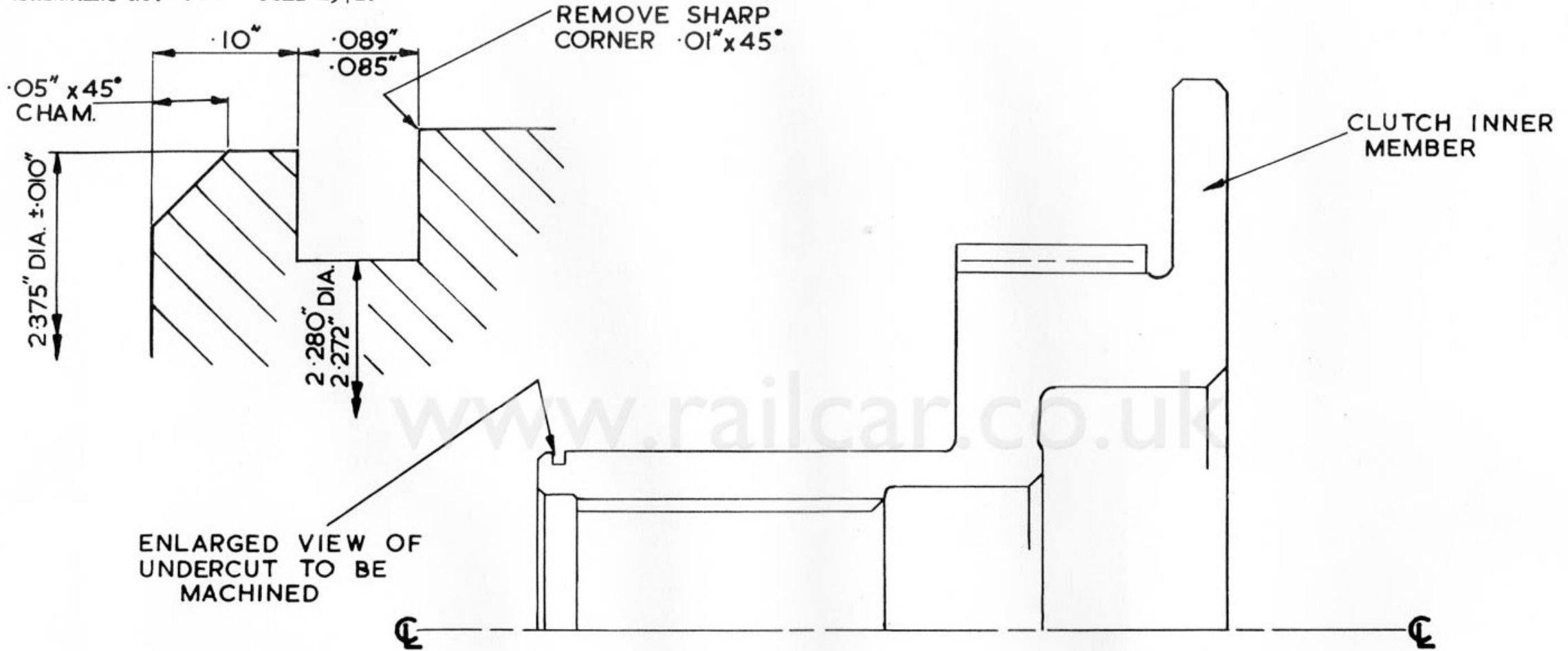
Inner Member and Sliding Panel

Spare inner members and sliding panels are now supplied as S.C.G. part No. 827007 (B.R. Cat. No. 15/272) and 827008 (B.R. Cat. No. 15/271) respectively. These components are designed to use a circlip S.C.G. part No. 38700 (B.R. Cat. No. 15/313) which prevents the end clutch plate from disengaging at any time due to wear.

When it becomes necessary to fit 827007 or 827008 with inner member 518783 or sliding panel 541793, the old type component must be machined as shown in Figure 1 or Figure 2, whichever is applicable.

In assembly the circlip 38700 (B.R. Cat. No. 15/313) must be fitted.

AMENDMENT NO. 18 JULY 1972.



MACHINING REQUIRED TO PART No. 518783 FOR
USE WITH NEW TYPE SLIDING PANEL TO PART No. 827008.

FIG 1.

AMENDMENT NO. 19 JULY 1972.

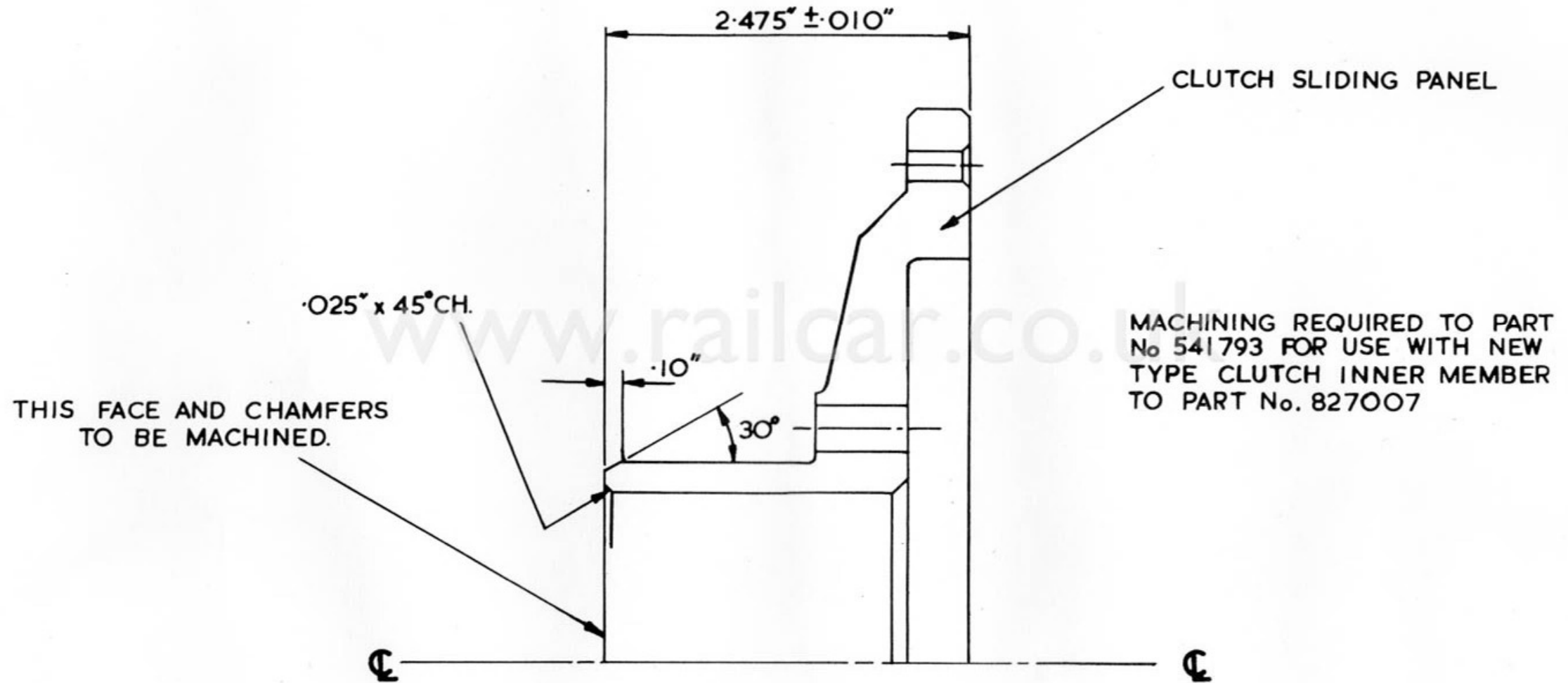


FIG 2.

D.M.U. GEARBOX - R.14.

AMENDMENT NO.20 JULY 1972

Sheet 12

DATA SECTION

APPENDIX B

COMPONENT

LUBRICANT

B.R. CAT. NO.

GEARBOX

D.M.U. Gearbox Oil

27/20765.

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AMENDMENT NO. 144 JULY 1981

DATA SECTION

APPENDIX C

Gear band rivet sizes and quantities per Brake Band.

R14 Gearbox Brake BandStubs 8 BWG (.165" to .168" dia).

<u>BR Cat No</u>	<u>Length (ins)</u>	<u>Qty/brake band</u>	<u>SCG. Part No.</u>
30/1440	5/16"	26	52539
30/1442	7/16"	8	52540
30/1444	1/2"	8	52541
30/1446	9/16"	1	52542
30/1448	7/8"	1	52543
30/1450	1.1/16"	1	52544

Type 'H', BS 3575 (.171" to .174" dia).

30/1490	9/32"	26) These are alternatives and shall) be selected according to band thickness.
30/1460	5/16"	26	
30/1462	7/16"	8	
30/1464	1/2"	8	
30/1466	9/16"	1	
30/1468	7/8"	1	
30/1470	1.1/16"	1	