

Chapter Thirty

COMBUSTION CHAMBERS, RENEWALS, RECONDITIONING, REPAIR AND SALVAGE

Contents

	Page		Page
Acid etch test of hot-formed rivets	9	Flame tube and head (T.R.388).. ..	23
Argon-arc welding	3	Flame tube and head, cracks and renewal of cooling skirts (T.R.344)	6
Expansion chamber (T.R.418)	24	Flame tube and head, interconnector sleeve (T.R.345)	16
Expansion chamber, drain-boss stud holes (T.R.272)	12	Flame tube and head, interconnector sleeve (T.R.370)	21
Expansion chamber, igniter plug stud holes (T.R.305)	14	Flame tube and head, locating ring (T.R.353)	18
Expansion chamber, inlet flanges (T.R.314)	23	Flame tube and head, loose or damaged rivets (T.R.346)	18
Expansion chamber, interconnector bush (T.R.287)	13	Flame tube head, renewal (T.R.347).. ..	11
Expansion chamber, interconnector bushes (T.R.369)	20	Flame tube rear section, renewal (T.R.352)..	10
Expansion chamber, locating plates (T.R.339)	15	General	1
Expansion chamber, locating-plug stud holes (T.R.273)	12	Material identification and fusion welding code	5
Expansion chamber, outlet-flange stud holes (T.R.289)	13	Outer casing, worn ring (T.R.372)	22
Expansion chamber, pressure connection (T.R.300)	14	Oxy-acetylene welding.. ..	5
Expansion chamber, pressure connection ferrules (T.R.373).. ..	22	Preparation for welding	3
		Stress relieving after welding.. ..	5

Illustrations

	Fig.		Fig.
Angles between electrode, filler rod, and work	1	Positional dimensions for cooling skirts ..	9
Location of repairable cracks in flame tube and head	2	Hot-formed rivet showing defects	10
Typical cracks in flame tube rear	3	Hot-formed rivet conforming to specified conditions	11
Typical cracks in flame tube and head ..	4	Flame tube and head assembled to welding fixture	12
Cracks in flame tube head flare	5	Details of replacement interconnector sleeve	13
Crack under flange of flame tube interconnector sleeve	6	Support fixture for interconnector sleeve ..	14
Crack at large air hole in flame tube.. ..	7	Position of cooling skirt rivets	15
Crack at rivet hole	8		

THIS CHAPTER contains instructions for reconditioning and repairing worn or damaged combustion chamber components. Instructions for dismantling and reassembling these components are not given unless they are an essential part of the repair instructions; reference should be made to chapters 16, 23, 24, 33 and 34, as appropriate, for further information on dismantling or reassembling

individual items before, or after, reconditioning or repair. The information given in chapter 32 should be read in conjunction with all repairs dealing with the fitting of 'Cross' wire inserts. Most of the information contained in this chapter is based on the manufacturer's turbine repair (T.R.) schemes and process specifications, and, in each instance, the relevant drawing (T.R.) number and

issue number, or specification number, is quoted ; turbine repair schemes are introduced under the cover of a modification and this modification number is quoted also. After any repair has been completed, an entry should be made in the appropriate record book of the engine in accordance with British Air Registration Board Inspection Procedures, Section ML, Leaflet 1-1 ; refer also to page 6 of chapter 28.

It will be appreciated, of course, that these repairs can be carried out only under the supervision of an Inspection Organisation approved for such repair work by the British Air Registration Board, or an equivalent authority, or under the supervision of an appropriately licensed aircraft engineer. It is assumed also that personnel having the requisite skill and experience will be employed and that the necessary tools and equipment will be available.

Normally, where special tools and equipment are available for carrying out the renewals and repairs described in this chapter they are listed at the beginning of the relevant repair instructions and are referred to in the text as they are used. In some cases, even though no list is given, the tools are referred to in the text as they are used. Where special tools are not mentioned reference should be made to The Service Department of The de Havilland Engine Company.

VIBRO ETCH MARKING

As a result of the flame tube and head operating in high temperatures with consequent discolouration of the material ; location and identification of part numbers and repair scheme numbers—when applied by electrical etching—becomes difficult. In order to ensure that any such marking will be quite legible indefinitely, the 'vibro etch' method must be used.

This method of marking is effected by a hand tool incorporating a vibrating needle which produces a peened track when traversed over the material surface. There is no electrical discharge between the needle and the surface being marked, thus, all traces of surface fusion—as with electrical etching—are entirely eliminated.

Marking by this method is confined to flame tube and head assemblies only.

The first five (5) lines on page 3 should be ignored.

*Revised by Amendment No. 135
November, 1957*

First five lines deleted by Amendment No. 116.

PREPARATION FOR WELDING

In addition to acid pickling, immediately before welding, it is imperative that clean, bright, parent metal be exposed over an area extending two or three inches from the proposed line of welding, on both the inner and outer surfaces of the component to be repaired. This is best accomplished by using a rotary wire brush or light filing with a smooth file; the method depending on the accessibility of the damaged area. The use of a fine abrasive wheel, disc grinder, or emery cloth, is not advisable where fusion welding is to be applied, as minute particles of the abrasive tend to adhere to the parent metal even after thorough cleaning; causing sub-surface porosity and subsequent weld decay.

ARGON-ARC WELDING

Argon-arc welding is to be preferred wherever possible and in certain instances no alternative welding process is permissible. Using a specified filler rod, or its equivalent, argon-arc welding has proved advantageous for most sheet metal repairs. The complete absence of flux, in the majority of repairs, eliminates the need for cleaning after welding. Satisfactory results will be obtained either using direct current with the work connected to the positive pole of the generator or rectifier, or using alternating current with a superimposed high frequency unit. High frequency stabilization of the arc is not essential for direct current welding but it can be of great assistance in striking the arc without making contact between the tungsten electrode and the parent metal.

The tungsten electrode, which should be of the thoriated type, if possible, to minimise contamination at the electrode tip when striking or touching down to start the arc, should protrude not more than $\frac{3}{16}$ inch beyond the ceramic shield—except for

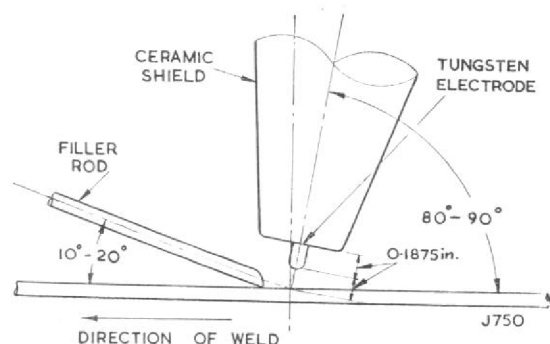


Fig. 1. Diagram indicating the correct angles between the electrode and the filler rod and the work during argon-arc welding.

acute-angle work. The normal angles at which the electrode and filler rod should be held are shown

in Fig. 1; these angles are approximately 80–90 degrees and 10–20 degrees from the horizontal, respectively. For most materials, an average arc length of $\frac{3}{16}$ inch is satisfactory. The filler rod should be fed into the outer edge of the molten pool of metal, either intermittently or by holding the filler rod firmly pressed into contact with the parent metal, so that both filler rod and parent metal are at the same electrical potential; the rod should always be kept within the protection of the argon shroud to prevent oxidation of the heated end of the rod. Selection of the optimum welding conditions for any particular type of repair depends, mainly, on the experience of the individual welder. If any doubt exists as to the required amperage and welding speed, a trial should be made on a piece of scrap material of similar specification to the component to be repaired, and adjustments made as necessary.

To repair an open crack, commence welding just before the end of the crack and work outwards towards its open end; increasing the welding speed slightly as the parent metal warms up. The correct speed can be judged from the two heat lines, indicating the zone of thermal disturbance; they should run parallel with the weld. If these heat lines gradually, but increasingly, run away from the weld, the welding speed is too slow; this may result in burning of the parent metal, especially if it is of thin gauge.

To weld a contained crack—that is, a crack with no open end—it is advisable, in certain instances, to tack weld one end and then weld up to this tack weld. If the length of the crack is sufficient, tack weld at intervals and weld up each section in turn. Thick material should be saw-cut, or drilled, to define the extent of the crack more clearly and to ensure good penetration; where this is necessary, suitable instructions will, usually, be included in the instructions for that particular repair. In certain instances, it will be found advantageous to paint a suitable flux on the underside of the cracked material, as this will prevent oxidation at the root of penetration. Where this has been done, it will, of course, be necessary to thoroughly clean the component, after welding, to remove the surplus flux.

The flow of argon gas should be varied to suit the type and position of the crack; a crack situated in a confined space requires less gas than a crack in an exposed, or sharp angled, area as in the latter position the gas will be, naturally, rapidly deflected away and a greater flow is necessary to compensate for this.

Precautions should be taken to ensure that no contamination of the electrode occurs, during welding, by contact between the electrode and the molten metal. If this occurs as a result of accidental contact, or faulty welding technique, the electrode must be removed and the contaminated portion removed by grinding on a smooth grindstone; if the contamination is slight only, it may often be removed by drawing an arc across a piece of scrap plate for a few seconds. The semi-molten end of the electrode should not, normally, be allowed to become larger in diameter than the electrode itself, as this may cause overheating and melting, resulting in the deposition of tungsten in

COMBINED MATERIAL IDENTIFICATION AND FUSION WELDING CODE

(14-2-1957, 60999, issue 10)

TABLE 1

Material Group Type	Material Specification	Combined Identification Code	
		Welding Group Code	Material Ident. Suffix
Plain Carbon and Low Alloy Steels	S.511 (S.84)	A.1	J
	S.510 (S.3)	A.2	H
	S.14		Y
	S.21		U
	T.26		K
	T.35		L
	T.54		P
	T.56		R
	T.45	A.3	M
	S.92		X
	S.512	A.4	Q
	S.514 (DTD. 124)		O
	T.53		N
	T.59		S
	T.60		T
	DHE.229	B	X
Stainless Steels	S.110	C	M
	S.111		S
	T.55		H
	T.58		J
	DTD.166		T
	S.521 (DTD.171)	D	K
	DTD.511		L
	DHE.207		N
	DHE.228		R
	(Red Fox 33)		W
Nickel Base Alloys	S.523 (DTD.493)	E	P
	DHE.223††		X
	DHE.225††		Y
	DHE.235		Z
	DHE.204	H	Z (X)
	(HR. Crown Max)		X (Y)
	DHE.247		L
	(HR. Crown Max)		N
	DTD.328 (Inconel)		K
	DTD.703 (N.75)	K	H
	DTD.714 (N.75F)		J
	DTD.725 (N.80)		M
	DTD.736 (N.80A)		P
	DTD.747 (N.90)		
	DHE.246 (N.75)		

TABLE 2

FILLER MATERIAL SPECIFICATION BS.1453										
Welding Group Code Letter										
	A.1	A.2	A.3	A.4	B	C	D	E	H	K
K	* A8	* A8	* A8	* A8	* A8	NC82	NC82	NC82	NC82	NC82
H	* A8	* A8	* A8	* A8	* A8	A8	A13	A13	A13	A13
E	* A8	* A8	* A8	* A8	* A8	A8	A13	A13	A13	
D	* A8	* A8	* A8	* A8	* A8	A8	A14			
C	* A8	* A8	* A8	* A8	* A8	A8				
B	A1 A6	A2 A6	A6	A6	A6					
A.4	A1 A2	A2	**	**						
A.3	A1 A2 A3	A2 A3	A3							
A.2	A1 A2	A2								
A.1	A1									

* These combinations not normally recommended for welding.
 ** These applications may require individual consideration by the engine manufacturer before a suitable filler wire is recommended.

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Obsolete Specifications shown in brackets.

† The mechanical properties of steels in these groups will be reduced by welding and could be recovered by heat treatment.

†† Extra care should be exercised when welding these sheets, due to the possibility of unfavourable balance of chemical compositions resulting in cracking.

the weld material. After switching off the current, upon completion of welding, it is advisable to maintain the flow of argon gas for a few seconds, until the electrode has cooled; this will prevent oxidation of the electrode tip which would have a detrimental effect on future welding.

The argon-arc welding bay must be effectively screened to exclude harmful radiation from all, except the operator, who, of course, must be suitably protected. All air currents must be excluded, as draughts are likely to reduce the effective shielding of the arc by the argon gas—giving rise to oxidised and porous welds. When an air-cooled, direct current, rectifier is used, it should be situated outside the welding bay, or, if this is not convenient, the current of air escaping from the top of the rectifier should be deflected away from the welding zone.

When finished, the weld should show a light, and consistent, rippled effect on the surface, with an unbroken ridge of deposited metal on the underside of the weld. There should be no sign of porosity, burning or undercutting. The weld may be cleaned by wire brushing but should not be smoothed by grinding or filing unless instructions to do so are contained in the particular repair instructions.

OXY-ACETYLENE WELDING

Oxy-acetylene welding must not be employed except where specifically mentioned in the relevant repair instructions, as its use on cracks exceeding a certain length will cause shrinkage and distortion. Where oxy-acetylene welding is permissible, the filler rod specified and a vigorous 'boron-free' flux must be used. Fluxes containing boron compounds—e.g., borax, boric acid—must not be used as these are liable to cause cracking.

Whilst welding, 'weaving' or 'puddling' of the molten metal must be avoided, as this agitation of the molten metal, either by manipulation of the blowpipe, or by stirring with the filler rod, produces two unwanted effects. It burns out the deoxidizers which are present, in small quantities, in the parent metal—the removal of these deoxidizers leaving the metal in a brittle unsound condition. Agitation of the molten metal also produces porosity in the weld—the result of gas pockets forming when the metal solidifies.

When finished, the weld should appear smooth, not rough or burnt, and there should be no sign of porosity or undercutting. After all traces of flux have been removed, the weld may be cleaned by wire brushing but should not be smoothed by grinding or filing unless instructions to do so are contained in the particular repair instructions.

STRESS RELIEVING AFTER WELDING

When stress relieving is specified in any repair scheme dealing with the rectification of components by welding, the component must be heated for 10 minutes in a high temperature furnace at 1050

deg. C., followed by cooling in air at room temperature.

MATERIAL IDENTIFICATION AND FUSION WELDING CODE

A combined material identification and fusion welding code has been introduced in order to enable service and repair departments to ascertain, from Table 1 (on facing page), the welding group of any component, and, by reference to Table 2 (on facing page), select the correct filler rod for any group combination. The inclusion of the material identification suffix—in conjunction with the welding group letter—serves to identify the particular material, and thus provides a key, which should enable any material to be identified readily.

For example, if a machined boss in S110 has to be welded to a sheet-metal component in DTD.703, the parts will be marked 'C/M' and 'K/N' respectively. Therefore, the welding group letters are, in this instance, C and K. On Table 2, note where the columns C and K respectively cross and read off the Filler Rod Specification—i.e., NC82. If it were merely a matter of welding material of the same specification to itself—i.e. welding a crack, or where both parts are made from material of the same specification—the welding group letter of each will, inevitably, be the same and, therefore, on Table 2 it is merely necessary to note where the vertical column headed with that letter crosses the horizontal column which begins with the same letter and read off the required filler rod. Where the filler rod specification is marked*, that combination of materials should be avoided if at all possible.

As from October, 1952, all components (with the exception of nuts, bolts and tab-washers) which are manufactured from materials outlined in Table 1 will be identified in accordance with this code; components which were manufactured before this date will not be so identified as no retrospective marking action is being taken with existing components.

The method of marking the code letters will normally be similar to that employed for marking the part number. In every instance the welding group code letter will be given first followed by a 'stroke' and the material identity suffix. Example for S.92 Material:—'A.3/X'. This code will normally appear directly below the part number, and in instances where component details are subsequently absorbed into a unit, the code will be found marked on each component in such a position as to be legible on the assembled unit.

When a component manufactured from one of a number of alternative materials, cannot be identified owing to complete, or partial, obliteration of the code letters, the filler rod specified in the repair scheme should be used; the specified rod having been selected as being the most suitable for such a contingency. Conversely, however, when the code letters on the component are discernable, the filler rod quoted in the table must take precedence over that specified in the repair scheme.

COMBUSTION CHAMBER, FLAME TUBE AND HEAD, CRACKS, AND RENEWAL OF COOLING SKIRTS

T.R. 344 issue 5—Mod. 978

This repair may be applied to all type 5 flame tube and head assemblies.

The following new parts will be required if any of the three cooling skirts are damaged beyond the repairable limits.

Description	Part No.	No. off
Front cooling skirt	602469	1
Centre cooling skirt	602470	1
Rear cooling skirt	602473	1

nearest adjacent air hole or rivet hole at B, C and D, and also three air holes at C—but in this instance, only on the same row of holes—may be repaired.

Unless extensive buckling has taken place, and excluding the inner row of holes in the flare, single cracks between any two adjacent air holes at position F may be repaired. Cracks in the inner row of holes are not acceptable for repair. Cracks at G may be repaired as required, provided that the permissible limit for this location is not exceeded.

Failure or cracking of the welded joints at X may be repaired as required, but where the part concerned has become almost detached, relative concentricity must be maintained during welding, by means of a welding jig.

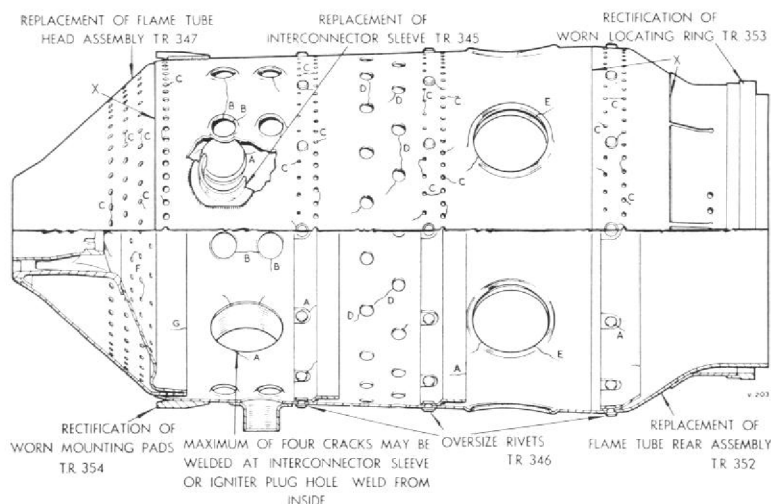


Fig. 2. Diagram showing possible position of various cracks in flame tube and head, which are repairable subject to the limits specified in the diagram and the text.

Cracking of the flame tube and head at the points indicated in Fig. 2 may be repaired by argon-arc welding, subject to the cracks not exceeding the limits specified below (refer also to Fig. 2).

- Approx. 0.500 inch in length at points marked 'A'
- Approx. 1.000 inch in length at points marked 'B'
- Approx. 0.300 inch in length at points marked 'C'
- Approx. 1.000 inch in length at points marked 'D'
- Max. 1.500 inch in length at points marked 'E'
- Max. 0.300 inch in length at points marked 'F'
- Max. 0.300 inch in length at points marked 'G'

A crack running from an air hole to the

Loose rivets must be replaced by oversize rivets in accordance with T.R.346. Fretting of the material around a rivet hole in the flame tube or a cooling skirt—normally caused by the hammering effect of a loose rivet—is acceptable for fitting an oversize rivet, provided that the depth of fretting does not exceed 0.008 inch. Not more than two cracks at any one rivet hole are acceptable for repair.

Cracks at A in any of the three cooling skirts will necessitate detaching the skirt from the flame tube to facilitate cleaning and welding the cracks. Excessive cracking beyond the repairable limits will entail renewal of the cooling skirt concerned.

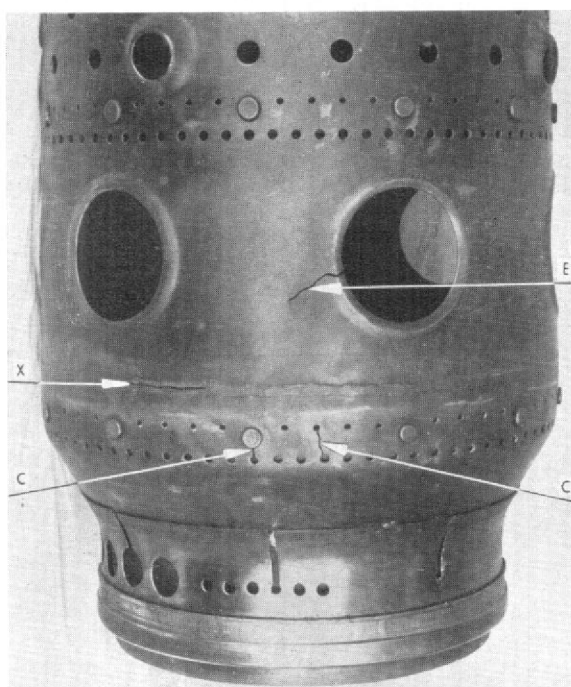


Fig. 3. Example of typical cracks at points C, E and X which are repairable.

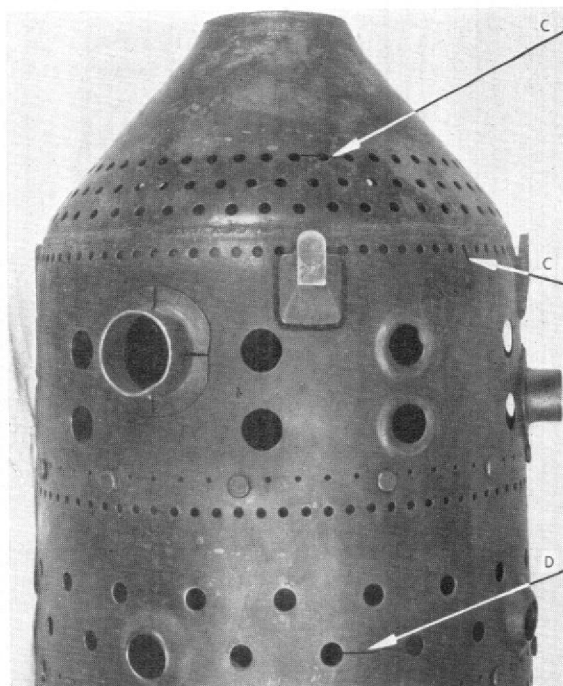


Fig. 4. Example of typical cracks at points C and D which are repairable.

Fig. 3 and 4 indicate typical examples of repairable cracks in the flame tube and head at points C, D, E and X. Fig. 5 shows the flare of the flame tube head when viewed from the flame tube rear. The three cracks at F would normally be acceptable for repair, but circumferential cracks on the flare skirt as shown at Y are unacceptable for repair, therefore, the head concerned must be

renewed in accordance with T.R.347. Fig. 6 illustrates an irreparable single crack under the flange of an early-type interconnector sleeve. A crack similar in appearance to this example, should be carefully inspected to ensure that it is not in fact two separate cracks originating from the periphery of the hole in the flame tube, as in this instance, the two cracks—provided that they did

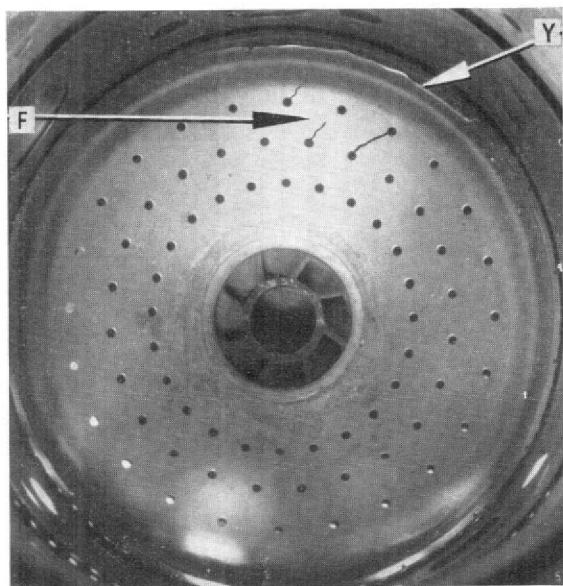


Fig. 5. View through rear end of flame tube showing cracks in the flare.

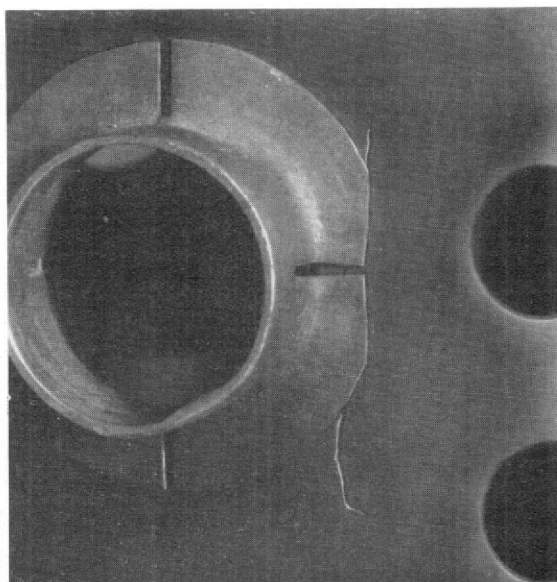


Fig. 6. Example of a single crack under the flange of an early-type interconnector sleeve; not repairable.

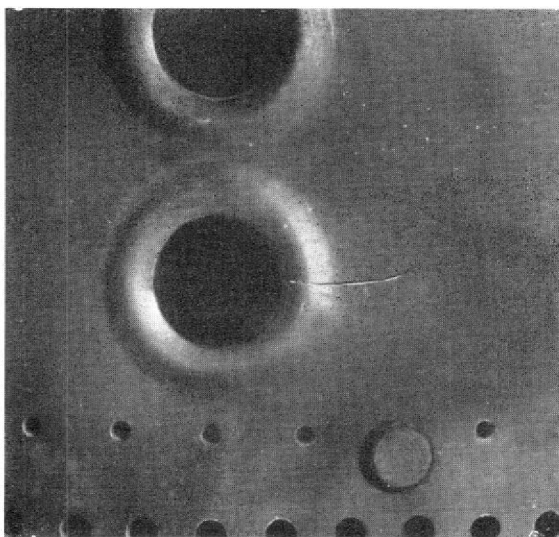


Fig. 7. A repairable crack at one of the large air holes in the front section of the flame tube.

not exceed the limit specified at A—would be acceptable for repair.

An example of a repairable crack at point B is illustrated in Fig. 7. Fig. 8 illustrates a repairable crack at a rivet hole point C.

The argon-arc welding process with filler rod NC 82 must be used for repairing cracks at any of the points specified in Fig. 2.

The general procedure for repair of cracks is as follows.

Remove the products of combustion from the flame tube and head in accordance with the instructions given on page 3 of chapter 25.

If a rivet hole in the flame tube or a cooling skirt is cracked, drill and chip off the heads of the twelve rivets and remove the cooling skirt concerned, leaving it inside the flame tube.

Using suitable steel dollies and a wooden mallet, correct all distorted areas of the flame tube and head by normal sheet-metal methods. Clean in and around the crack, on both surfaces, with a rotary wire brush.

Using a $\frac{1}{16}$ in. dia. drill, carefully locate the end of the crack and drill a hole at this point and if possible cut into the crack with a "junior" hacksaw blade. An interconnecting crack between two holes cannot be drilled but should be saw cut.

Commencing approximately $\frac{1}{4}$ in. before the drilled end of the crack and finishing on the periphery of the hole, argon-arc weld the crack with filler rod NC 82. An interconnecting crack may be welded from either end.

To repair a crack in a cooling skirt and having detached it from the flame tube, position the skirt in a convenient welding position inside the flame tube and weld the crack on the inner circumference.

Grind welded cracks at any of the rivet holes only sufficiently to prevent fouling when re-riveting a cooling skirt to the flame tube.

Radius the edge of repaired air holes and polish with smooth emery cloth. To facilitate inspection of the repairs, the welds may be cleaned by wire brushing.

Locate the repaired cooling skirt back into position by means of 'Ardel' locating pins or slave bolts inserted into four equidistant rivet holes in the flame tube and cooling skirt, and re-rivet in accordance with T.R.346. If necessary, rectify any rivet holes that are worn or damaged, by fitting oversize rivets in accordance with T.R.346.

If a cooling skirt is damaged beyond the repairable limits, ovalize, and withdraw it through the rear end of the flame tube. Ovalize the diameter of the replacement cooling skirt sufficiently to permit insertion through the rear end of the flame tube. If the flame tube head has been removed, insertion of the skirt may be effected through the front end of the flame tube with consequent reduction in the amount of compression. Locate the cooling skirt in accordance with

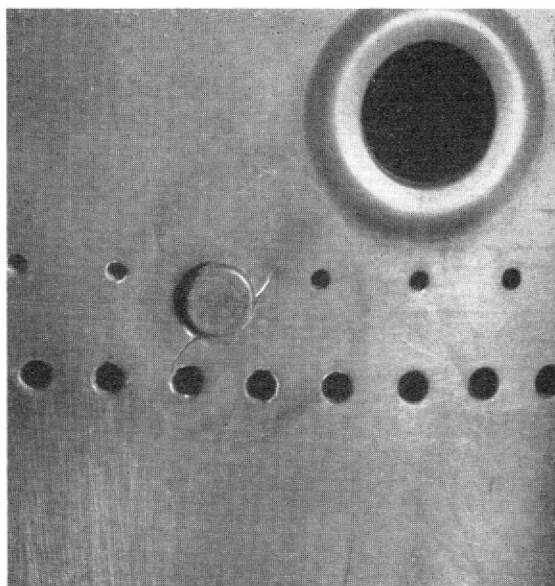


Fig. 8. A repairable crack at a rivet hole; inaccessible for repair unless the rivets and cooling skirt are removed.

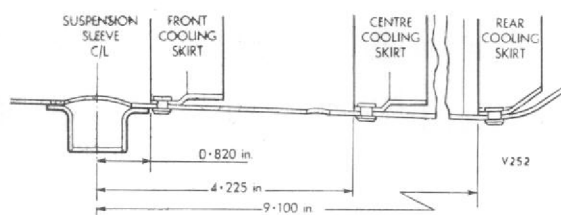


Fig. 9. Positional dimensions of front, centre, and rear cooling skirts in the flame tube.

the appropriate dimensions given in Fig. 9, and drill twelve holes through from the existing holes in the flame tube, ensuring that the angular location of each hole in the cooling skirt is on the centre-line of its recess. Details of a cooling skirt locating fixture will be issued later.

Cracking or failure of the circumferential argon-arc welding joints X at the front and rear of the flame tube may be repaired as follows. Drill a $\frac{1}{16}$ in. dia. hole right through one end of the crack, to prevent any further opening during welding, and then remove the original outline of the crack by countersinking with a $\frac{1}{16}$ in. dia. drill along the full length. Clean, by wire brushing on both surfaces of the crack. Commencing just before the end of the crack and working towards and just past the drilled hole at the opposite end, argon-arc weld the crack.

Failure of the seamwelding between the key-hole slots at the rear section of the flame tube, marked X in Fig. 2, may be repaired by fillet welding the detached section by the argon-arc process.

Lightly etch T.R.344 adjacent to the existing part number and make an entry in the appropriate record book of the engine.

ELECTRICAL HOT RIVETING, ACID ETCH TEST

Equivalent D.H. Process Specification: No. 151/1, April, 1953.

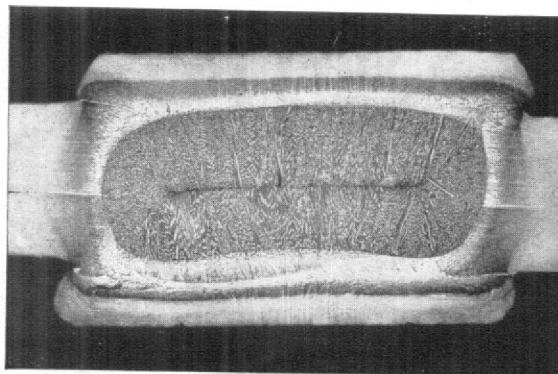


Fig. 10. Example of a hot-formed rivet showing the type of defects to avoid; enlarged.

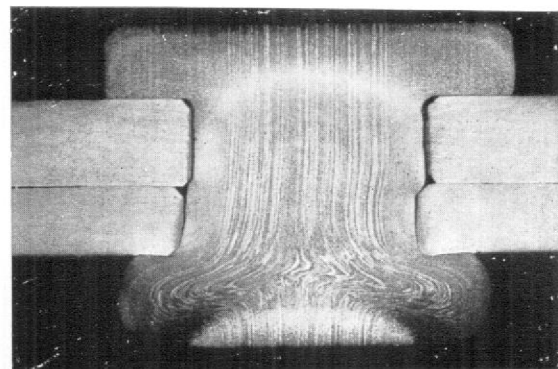


Fig. 11. Example of a well-formed rivet which conforms to the conditions specified in the text; enlarged.

The material of the test piece to be riveted, must be of the same composition, condition and thickness as in the component. The holes to receive the rivets must be the same size and tolerance as in the component. A transverse section should be taken in a plane including the longitudinal axis of the rivet.

The section should be prepared by filing, then by grinding on successively finer grades of emery paper to a suitable finish for low-power microscopical examination.

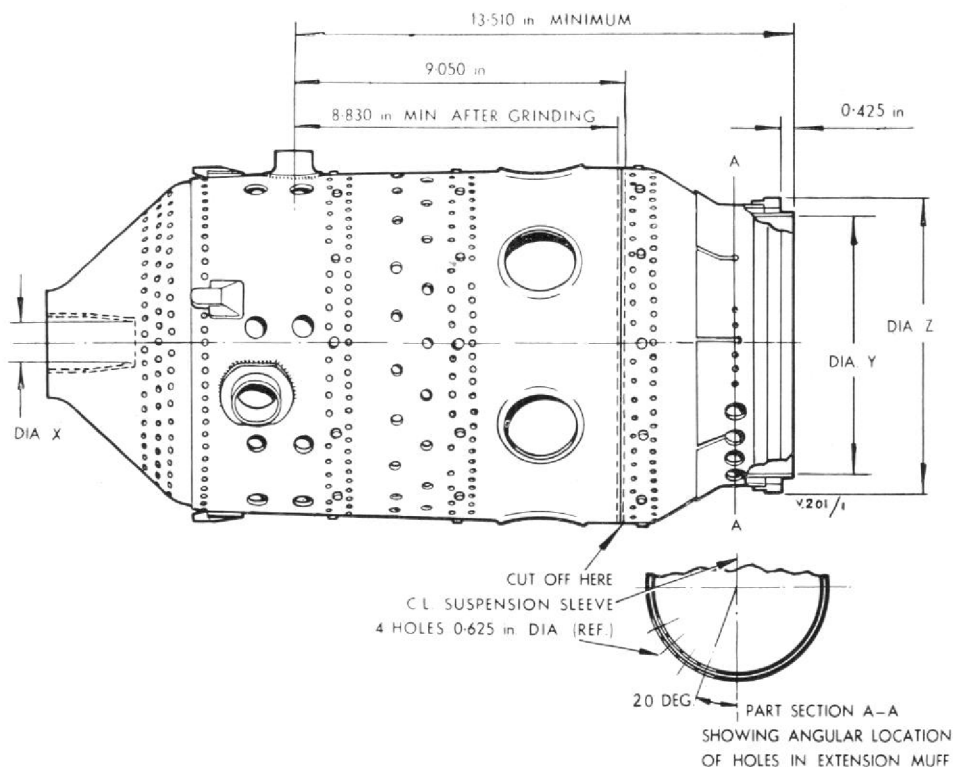
Composition of the electrolyte should be 10 per cent. oxalic acid at room temperature and sufficient current density can be obtained from a 12 volt accumulator which will etch specimens up to 0.500 in. square.

Copper wire 16 S.W.G. electrodes should be used. The positive lead will be connected to the specimen when immersed in the solution, and the negative lead dipped into the solution above the surface to be etched. Agitation of the cathode will improve the uniformity of the etch, but care must be taken to ensure that the cathode does not come into contact with the surface of the specimen otherwise burning will occur.

The time taken for etching will vary; Nimonic 75 and 80a will require about one second; whilst a longer period will be required for D.T.D.171, 493, and 571.

The specimen when etched, should be examined at low power magnification of $\times 16$ and the following conditions must apply (see Fig. 10 and 11):—

- (1) The grainflow of the rivet must be reasonably uniform and the rivet head not seriously offset from the stem.
- (2) Large blowholes must not be present in the stem.
- (3) The stem must not have melted and distorted the material around the hole.
- (4) The formed head must be free from cracks or signs of 'bursting'.



COMBUSTION CHAMBER, FLAME TUBE AND HEAD ASSEMBLY, FITTING NEW REAR SECTION T.R.352 issue 4—Mod. 978

This repair may be applied to all type 5 flame tube and head assemblies.

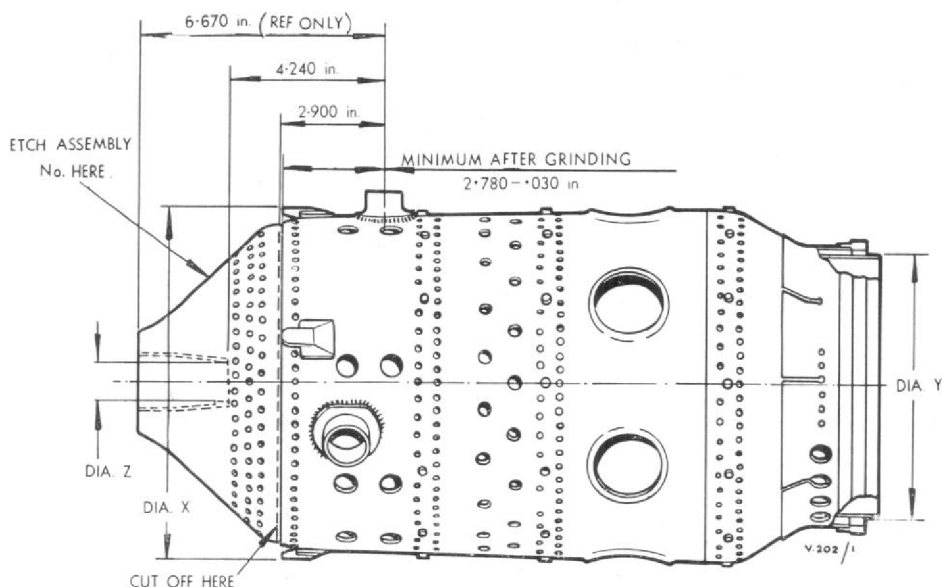
Where the rear section of a flame tube has become cracked or damaged beyond the limits of repair, a complete new section consisting of rear section Part No. 95083 and extension muff and ring Part No. 95085, may be fitted in accordance with these instructions.

This repair is based on the assumption that the parts not affected have been inspected, and if necessary, rectified to a serviceable standard.

SEQUENCE OF OPERATIONS

1. Cut off the existing rear section to the dimensions shown.
2. Grind the end face of the flame tube to remove the existing weld to the dimensions shown. The finished face after grinding must be square to the horizontal centre-line of the flame tube.
3. Fit new rear section Part No. 95083 to the flame tube to the dimension shown, and argon-arc fillet weld all round.
4. Fit new extension muff and ring Part No. 95085 to rear section to the dimension shown (refer also to section A-A), and seamweld right round between the key-hole slots.
5. Check that diameter Z is within 0.010 in. total clock reading when the flame tube and head assembly is rotated about diameters X and Y.
6. Etch T.R.352 adjacent to the existing part number and make an entry in the appropriate record book of the engine.

Revised by Amendment No. 131
February, 1957



COMBUSTION CHAMBER, FLAME TUBE
AND HEAD ASSEMBLY,
FITTING NEW HEAD
T.R.347 issue 3—Mod. 978

This repair may be applied to all type 5 flame tube and head assemblies.

Flame tube heads which are cracked or damaged beyond the repairable limits of T.R.344, may be rectified by fitting a replacement head Part No. 95077 in accordance with these instructions.

This repair is based on the assumption that the parts not affected have been inspected, and if necessary, rectified to a serviceable standard.

SEQUENCE OF OPERATIONS

1. Cut off the existing head to the dimension shown.

2. Grind the front edge of the flame tube to the dimension shown, sufficiently to remove the existing weld. The finished face after grinding must be square to the horizontal centre-line of the flame tube.
3. Fit new head Part No. 95077 to the flame tube in accordance with the dimensions shown, and argon-arc fillet weld in the same location as the original weld.
4. Check that diameter Z is within 0.010 in. total clock reading when the flame tube and head assembly is rotated about diameters X and Y.
5. Etch the appropriate assembly number of the flame tube and head together with T.R.347 at the position shown and make an entry in the appropriate record book of the engine.

Revised by Amendment No. 131
February, 1957

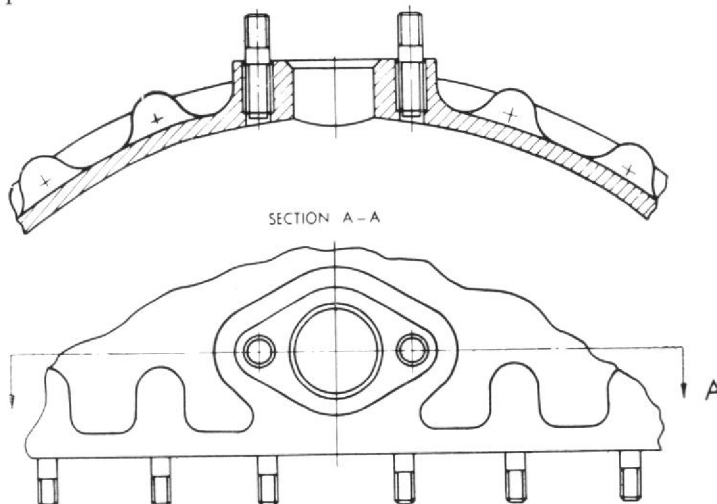
COMBUSTION CHAMBER, EXPANSION
CHAMBER, LOCATING-PLUG STUD HOLES
T.R. 273 issue 2—Mod. 311

This repair may be applied to all Ghost expansion chambers.

Expansion chambers in which the thread of any of the locating-plug stud holes have become damaged may be rectified in accordance with these instructions.

SEQUENCE OF OPERATIONS

1. Remove existing stud.
2. Drill right through the damaged stud hole to a diameter of 0.257 inch (letter 'F' drill).
3. Thread the hole to a diameter of 0.3012 inch by 26 T.P.I. Whitworth thread form to a depth of 0.525 inch. The effective diameter of the thread is to be $0.2766 + .002$ inch, and the minor diameter $0.252 + .0117$ inch. Counter-bore the hole to a diameter of $\frac{5}{16}$ inch by 0.025 inch deep.
4. Screw in the wire insert Part No. N.4968 and then break off and remove the tang.
5. Re-fit the original stud if serviceable, or a new stud if unserviceable.
6. Lightly stamp T.R.273 adjacent to the existing part number and make an entry in the appropriate record book of the engine.



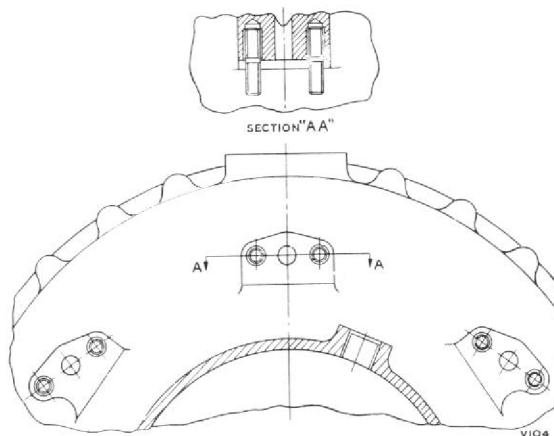
COMBUSTION CHAMBER, EXPANSION
CHAMBER, DRAIN-BOSS STUD HOLES
T.R. 272 issue 2—Mod. 311

This repair may be applied to all Ghost Forty-eight expansion chambers.

Expansion chambers in which the thread of any of the drain-boss stud holes have become damaged, may be rectified in accordance with these instructions.

SEQUENCE OF OPERATIONS

1. Remove existing stud.
2. Drill the damaged stud hole to a diameter of 0.257 inch (letter 'F' drill) by 0.600 inch deep.
3. Thread the hole to a diameter of 0.3012 inch by 26 T.P.I. Whitworth thread form to a depth of 0.525 inch. The effective diameter of the thread is to be $0.2766 + .002$ inch, and the minor diameter $0.252 + .0117$ inch. Counter-bore the hole to a diameter of $\frac{5}{16}$ inch by 0.025 inch deep.
4. Screw in wire insert Part No. N.4968 and then break off and remove the tang.
5. Re-fit the original stud if serviceable, or a new stud if unserviceable.
6. Lightly stamp T.R.272 adjacent to the existing part number and make an entry in the appropriate record book of the engine.



COMBUSTION CHAMBER, EXPANSION
CHAMBER, LOOSE INTERCONNECTOR
BUSH

T.R. 287 issue 7—Mod. 751

This repair may be applied to all Ghost expansion chambers.

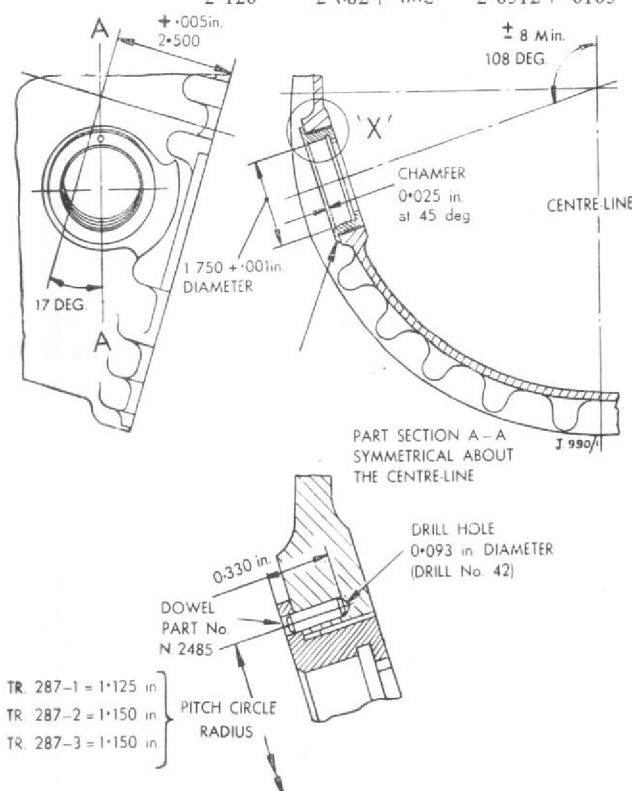
Expansion chambers in which the interconnector bushes have become loose may be rectified in accordance with these instructions. If the existing thread in the expansion chamber is undamaged, standard bush Part No. 600929 may be fitted, and ops. 2, 3 and 4 omitted.

SEQUENCE OF OPERATIONS

1. Remove defective bush.
2. Open out the threaded hole in the expansion chamber to within tolerance of the appropriate truncated diameter specified in the table.
3. Refer to the table, and thread the hole to the

Thread O/Dia. inch	Effective Dia. inch	Minor Dia. Truncated inch
2.080	2.042 + .002	2.0112 + .0103
2.100	2.062 + .002	2.0312 + .0103
2.120	2.082 + .002	2.0512 + .0103

C/Bore Dia. inch	Oversize Bush	Ident. No.
2.090 + .010	MR.600929-80	TR.287-1
2.110 + .010	MR.600929-100	TR.287-2
2.130 + .010	MR.600929-120	TR.287-3



appropriate diameter shown, 16 T.P.I. Whitworth thread form; the effective and truncated diameters to be as shown.

4. Counterbore to the appropriate diameter shown in the table and to a depth of 0.050 in.
5. Heat the expansion chamber to a temperature of 175 deg. C., and chill the replacement bush to a temperature of minus 20 deg. C.

NOTE: All parts must be kept free of foreign matter during assembly.

6. Fit the bush to the modified hole, ensuring that it is screwed right home.
7. Drill dowel hole in accordance with dimensioned sketch; fit dowel and peen over to secure. If the dowel hole in the bush aligns within 0.250 in. of the original hole in the expansion chamber, a new dowel hole must be drilled in the forward half of the bush in accordance with the dimensions given in detail 'X' in the sketch. The radial position of the hole is not important.
8. Finish-machine bush to dimension given in sketch.
9. Lightly stamp T.R.287 and the appropriate suffix adjacent to the existing part number and make an entry in the appropriate record book of the engine.

COMBUSTION CHAMBER, EXPANSION
CHAMBER, OUTLET-FLANGE STUD HOLES
T.R. 289 issue 2—Mod. 311

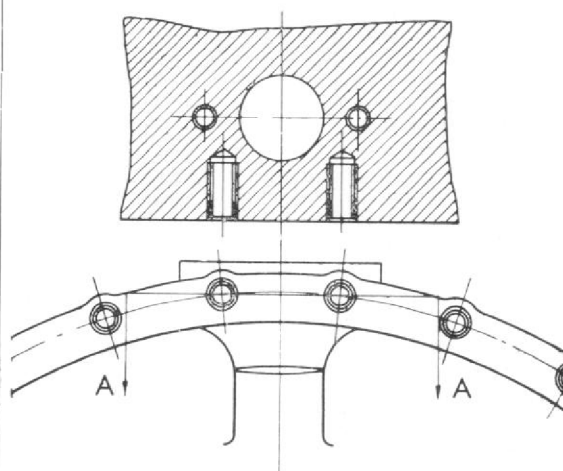
This repair may be applied to all Ghost expansion chambers.

Expansion chambers in which the threads of any of the twenty-six $\frac{1}{4}$ inch B.S.F. stud holes are damaged may be rectified in accordance with these instructions.

SEQUENCE OF OPERATIONS

1. Drill the damaged hole to a diameter of 0.257 inch (letter 'F' drill) by 0.650 inch deep.
2. Thread the hole to a diameter of 0.3012 inch by 26 T.P.I. Whitworth thread form to a depth of 0.575 inch. The effective diameter of the thread is to be 0.2766 + .002 inch, and the

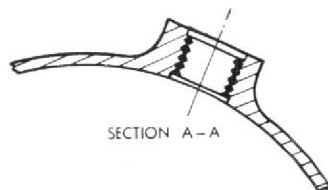
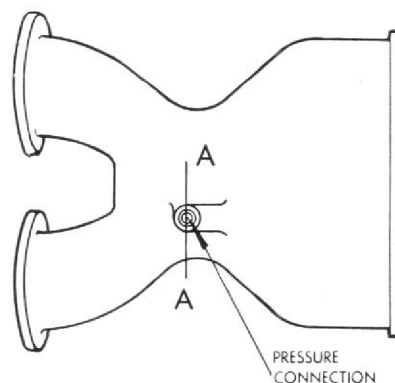
SECTION A-A



Revised by Amendment No. 131
February, 1957

minor diameter is to be $0.252 + .0117$ inch. Counterbore the hole to a diameter of $\frac{5}{16}$ inch by 0.025 inch deep.

3. Screw in the wire insert Part No. N.4972 and then break off and remove the tang.
4. Re-fit the original stud if serviceable, or a new stud if unserviceable.
5. Lightly stamp T.R.289 adjacent to the existing part number and make an entry in the appropriate record book of the engine.



COMBUSTION CHAMBER, EXPANSION CHAMBER, PRESSURE CONNECTION T.R. 300 issue 2—Mod. 751

This repair may be applied to all Ghost expansion chambers.

Expansion chambers in which the threaded hole for the pressure connection has become damaged may be rectified in accordance with these instructions.

SEQUENCE OF OPERATIONS

1. Drill the damaged $\frac{9}{16}$ in. B.S.F. threaded hole right through to a diameter of $\frac{31}{64}$ inch.
2. Thread the hole to a diameter of 0.6445 inch by 16 T.P.I. Whitworth thread form to a depth of 0.450 inch. The effective diameter of the thread is to be $0.6045 + .0032$ inch, and the minor diameter $0.5645 + .0195$ inch.
3. Counterbore the hole to a diameter of $\frac{31}{32}$ inch by 0.050 inch deep.
4. Screw in wire insert Part No. N.5047 and then break off and remove the tang.
5. Lightly stamp T.R.300 adjacent to the existing part number and make an entry in the appropriate record book of the engine.

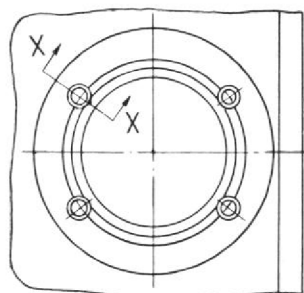
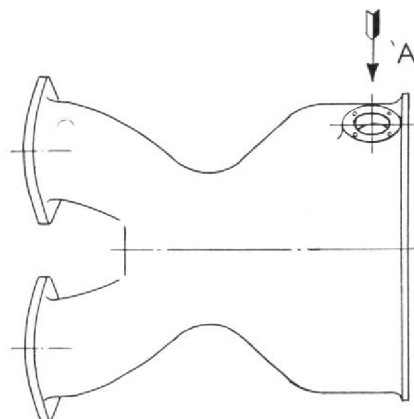
COMBUSTION CHAMBER, EXPANSION CHAMBER, IGNITER PLUG STUD HOLES T.R. 305 issue 2—Mod. 751

This repair may be applied to all Ghost expansion chambers.

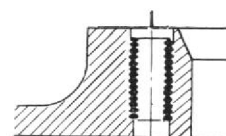
Expansion chambers in which any of the four 2 B.A. threaded igniter plug stud holes have become damaged may be rectified in accordance with these instructions.

SEQUENCE OF OPERATIONS

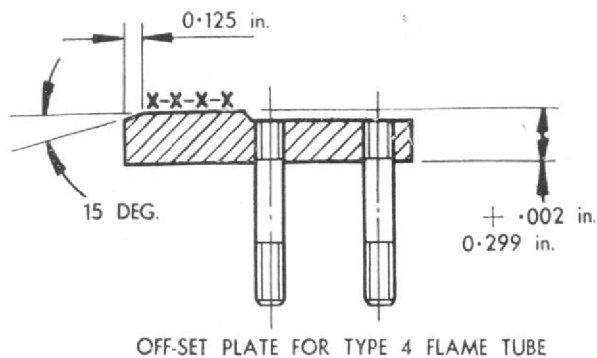
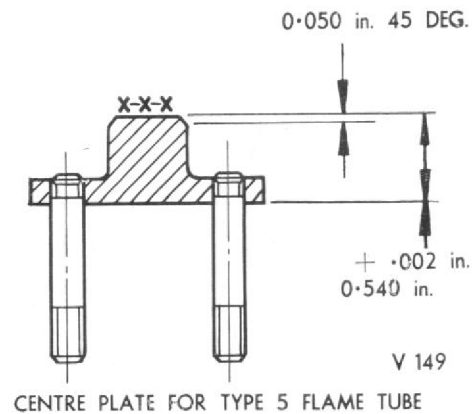
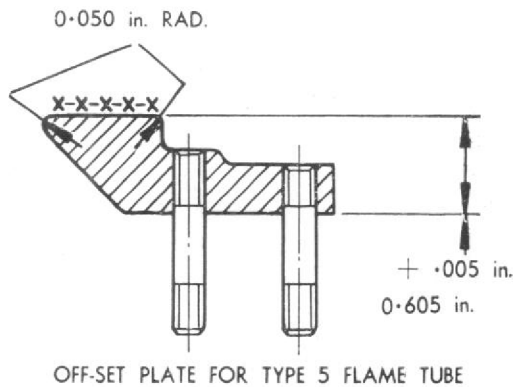
1. Drill right through the damaged stud hole to a diameter of 0.1935 inch (No. 10 drill).
2. Thread the hole to a diameter of 0.2252 inch by 31.30 T.P.I. B.A. thread form to a depth of 0.500 inch. The effective diameter of the thread is to be $0.2061 + .0021$ inch and the minor diameter $0.1870 + .0121$ inch.
3. Counterbore the hole to a diameter of $\frac{3}{8}$ inch by 0.050 inch deep.
4. Screw in wire insert Part No. N.5048 and then break off and remove the tang.
5. Re-fit existing stud if serviceable, or a new stud if unserviceable.
6. Lightly stamp T.R.305 adjacent to the existing part number and make an entry in the appropriate record book of the engine.



VIEW IN DIRECTION OF ARROW 'A'



SECTION X-X



COMBUSTION CHAMBER, EXPANSION CHAMBER, LOCATING PLATES T.R. 339 issue 2—Mod. 901

This repair may be applied to all Ghost type 4 and 5 expansion chamber locating plates.

Expansion chamber locating plates which are worn on the surface, may be repaired in accordance with these instructions.

SEQUENCE OF OPERATIONS

1. Grind the surface of the locating plate marked X-X-X in the sketch until signs of wear are

eradicated, and the surface is flat; the minimum amount of metal should be removed, up to a maximum permissible depth of 0.030 inch.

2. Build up the ground area by nickel plating in accordance with D.H. Process Specification No. 134, followed by chrome plating 0.002 to 0.003 inch thick to the dimension indicated in accordance with D.H. Process Specification No. 132.
3. Lightly stamp T.R.339 adjacent to the existing part number and make an entry in the appropriate record book of the engine.

Revised by Amendment No. 113
June, 1954

COMBUSTION CHAMBER, FLAME TUBE
AND HEAD, INTERCONNECTOR SLEEVE
T.R. 345 issue 1—Mod. 978

This repair may be applied to all type 5 flame tube and head assemblies.

Flame tube and head assemblies on which the material thickness of an interconnector sleeve has been reduced by wear at any point around the sides to less than 0.030 inch, may be rectified by fitting a new interconnector sleeve Part No. 600651 in accordance with these instructions.

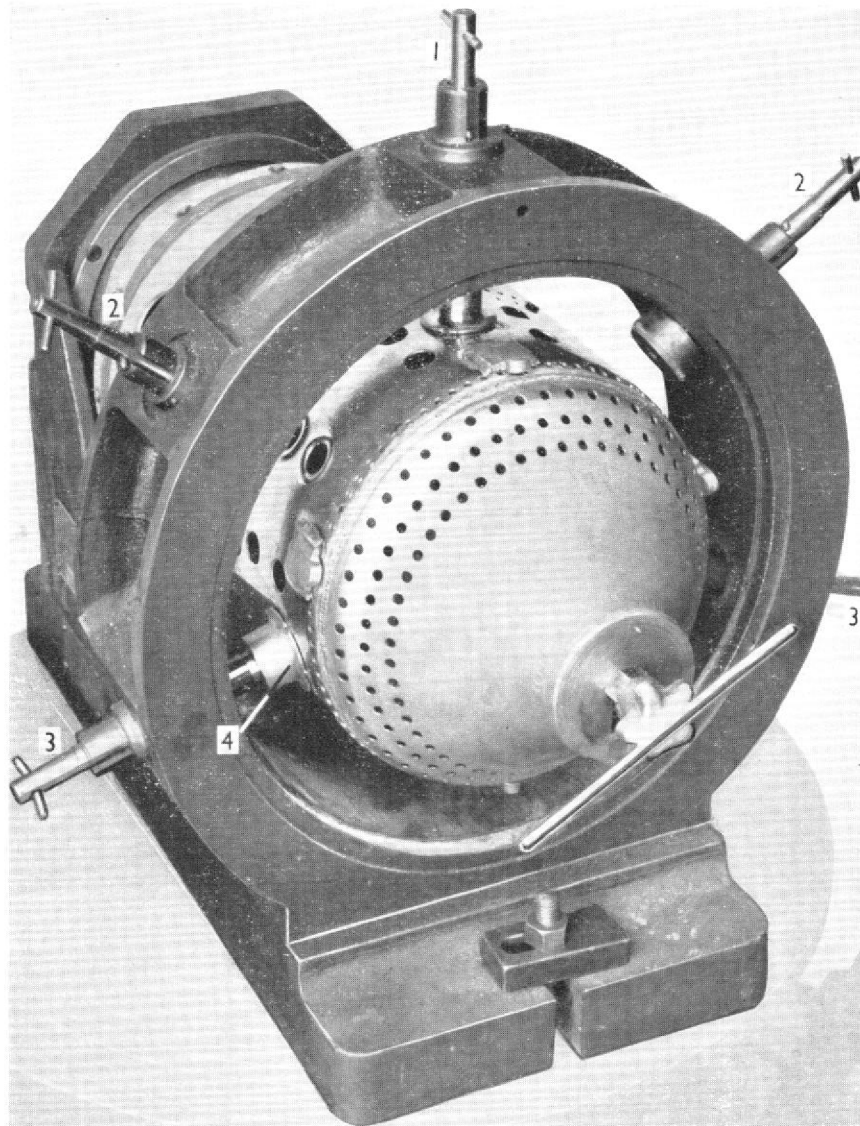


Fig. 12. Flame tube and head assembled to welding fixture, and replacement interconnector sleeve tack-welded in position.

1. Suspension sleeve locating plug.
2. Igniter plug hole locating plug.
3. Interconnector sleeve, locating plug.
4. Replacement interconnector sleeve tack-welded.

Grind off the damaged interconnector sleeve, and clean the flame tube and new interconnector ready for welding.

Assemble the flame tube and head to fixture T..... as shown in Fig. 12 and insert the appro-

pletely round the interconnector sleeve flange and then remove the expanding fixture.

Assemble to boring fixture T....., and, using cutter T.77035 and cutting arbor T.77034, ream the bore of the new interconnector sleeve to the dimensions given in Fig. 13. Use ring gauge T.76703 in conjunction with a John Bull SBY to check the bore dimension. Check also that the minimum wall thickness of the material is not less than 0.045 inch at any point.

Dismantle the flame tube and head assembly from the boring fixture; assemble to fixture T..... and check the position of the new interconnector sleeve by inserting the appropriate locating plugs into the two interconnector sleeves, the suspension sleeve and if fitted, the igniter plug hole. Remove the locating plugs and dismantle the flame

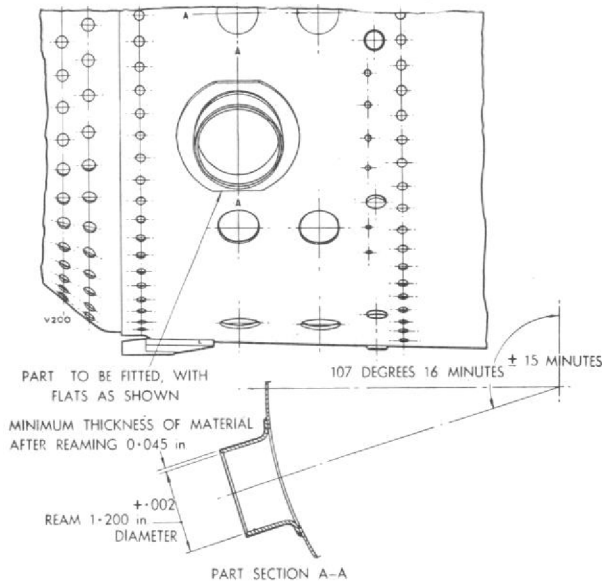


Fig. 13. Location of replacement interconnector sleeve on the flame tube, with section giving the reaming dimension of the sleeve bore.

priate locating plugs into the suspension sleeve, the serviceable interconnector sleeve and if fitted, the igniter plug hole. Insert the small locating plug (1.175 in. dia.) to locate the new interconnector sleeve on to the flame tube ensuring that the flats on the sleeve flange are positioned as shown in Fig. 13.

Using the argon-arc welding process and filler rod NC 82, deposit a bead of filler rod at three equidistant points against the edge of the interconnector sleeve flange and thus secure it to the flame tube.

Take out the locating plugs and remove the flame tube and head from the fixture. Fit the expanding fixture T..... inside the flame tube to provide support for the interconnector sleeve during welding, as shown in Fig. 14. Weld com-

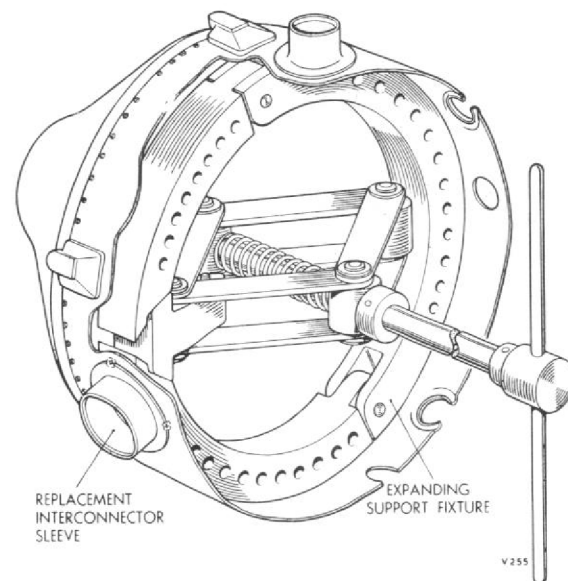


Fig. 14. Method of providing support inside the flame tube when welding the interconnector sleeve in position.

plete the flame tube and head from the fixture.

Etch T.R.345 adjacent to the existing assembly part number and make an entry in the appropriate record book of the engine.

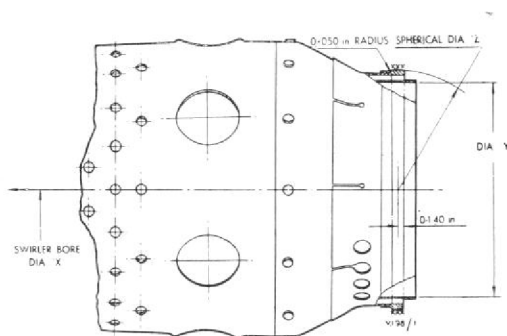
COMBUSTION CHAMBER, FLAME TUBE
AND HEAD,
LOCATING RING WEAR
T.R.353 issue 2—Mod. 978

This repair may be applied to all type 5 flame tube and head assemblies.

Flame tube and head assemblies on which the locating ring has become worn or damaged below the permissible limit of 7.685 inch diameter, may be rectified in accordance with these instructions.

SEQUENCE OF OPERATIONS

1. Grind spherical diameter "Z" on locating ring to a diameter of 7.682 - .002 inch.
2. If the preceding operation fails to remove the wear marks, then grind diameter "Z" to 7.672 - .002 inch.
3. Chromium plate spherical diameter marked xxx on sketch to a thickness of 0.006 + .002 inch if operation 1 was carried out, or, 0.012 + .002 inch if operation 2 was carried out. The process must be applied in accordance with British Specification D.T.D.916—equivalent D.H. Process Specification No. 132.
4. Regrind spherical diameter "Z" to a diameter of 7.690 - .003 inch. If the locating pads are to be rectified in accordance with T.R.354, the two grinding operations should be carried out on the same machine set-up.



5. Check that diameter "Z" is within 0.010 inch total clock reading when the component is rotated about diameters "X" and "Y."
6. Etch T.R.353 adjacent to the existing assembly part number and make an entry in the appropriate record book of the engine.

COMBUSTION CHAMBER FLAME TUBE
AND HEAD ASSEMBLY,
LOOSE OR DAMAGED RIVETS
T.R.346 issue 4—Mod. 978

This repair may be applied to all type 5 flame tube and head assemblies.

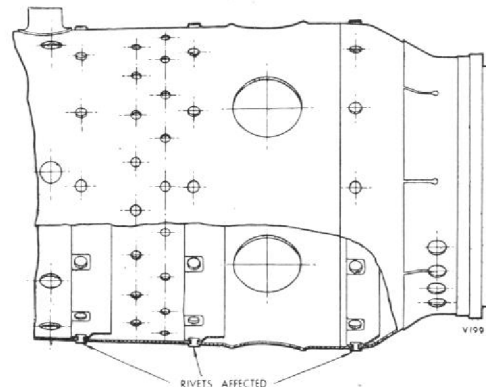


Fig. 15. Position of cooling skirt rivets.

If one or more of the rivets securing any of the three cooling skirts to the flame tube (Fig. 15) are found to be loose or damaged, the appropriate oversize rivets specified below may be fitted; it is permissible to rectify damaged rivets which are not loose, by replacing them with rivets of the same size.

The following new parts will be required.

Description	Part No.	No. off	Remarks
Rivet	603426	as required	Standard size $\frac{3}{16}$ in.
Rivet	603426-32	as required	1st Oversize $\frac{7}{32}$ in.
Rivet	603426-63	as required	2nd Oversize $\frac{1}{4}$ in.

The sequence of operations detailed, describes the method of renewing one rivet only; in practice, where more than one rivet is to be removed, each operation when applicable, should be repeated to the additional defective rivets, in preference to completing the renewal of one rivet at a time.

To carry out this repair proceed as follows.

Carefully centre-punch the outer head of the defective rivet and drill through with a twist drill. Using a hammer and small steel chisel, knock off the rivet head.

Surface fretting on both sides of the hole—caused by the hammering effect of a loose rivet—is acceptable, provided that the depth of fretting does not exceed 0.008 in.

Correct any distortion around the rivet hole by normal sheet-metal methods. If it is necessary to fit an oversize rivet, drill and ream the hole to a diameter of $0.219 + .002$ inch, or, if the hole has been previously modified, drill and ream to a diameter of $0.250 + .002$ inch. File off with a smooth half-round file, any sharp edges around each end of the hole. A wooden cradle which may be made locally to the dimensioned sketch given in chapter 21 (*to be issued later*), will hold the flame tube and head in a convenient position when drilling and reaming operations are in progress.

Insert the requisite standard or oversize rivet specified in the table, through the hole from the inside. Attach a spring clip (Terry's No. 80/00) or rubber washer to the shank until ready for riveting.

To obviate the risk of faulty riveting, it is advisable to rivet a test piece, the material of which must be of the same composition, condition, and thickness as in the flame tube and cooling skirt. The diameter, thickness, and shape of the formed head must be identical to the head on the other end of the rivet as supplied. The test rivets must then be sectioned, acid etched, and examined under low power magnification as described in de Havilland Specification No. 151/1 on page 9 of this chapter.

The hot-riveting machine to be used should preferably be the Sciaky 60 KVA machine which incorporates a 'two-pressure cycle' thus providing closer control over the process and also decreasing the number of cracked rivets.

The settings of individual riveting machines may differ slightly under varying working conditions; those given below, although intended for guidance only, will serve to indicate the adjustments that will require control.

RIVETING MACHINE SETTINGS

Type Sciaky 60 KVA.

Standard $\frac{3}{16}$ inch rivet Part No. 603426 or 603427.

Heat tap 1—phase shift 78.

Initial pressure—75 lb.

Back pressure—25 lb.

Back pressure delay timer, medium range 100—65 cycles.

Heat time, long range 100—65 cycles.

Dwell time, long range 100—15 cycles.

1st Oversize $\frac{1}{2}$ inch rivet Part No. 603426-32.

Heat tap 3—phase shift 93.

Initial pressure—80 lb.

Back pressure—25 lb.

Back pressure delay timer, medium range 100—65 cycles.

Heat time, long range 100—65 cycles.

Dwell time, long range 100—15 cycles.

2nd Oversize $\frac{1}{4}$ inch rivet Part No. 603426-63.

Heat tap 3—phase shift 85.

Initial pressure	} as for $\frac{3}{16}$ inch rivet
Back pressure	
Back pressure delay timer	
Heat time	
Dwell time	

When renewing a number of rivets, the diameter of each head when formed, can be speedily and efficiently checked by means of a gauge similar to that shown in chapter 21 (*to be issued later*). Three of these gauges—which can be manufactured locally—should be provided to check standard and oversize rivets.

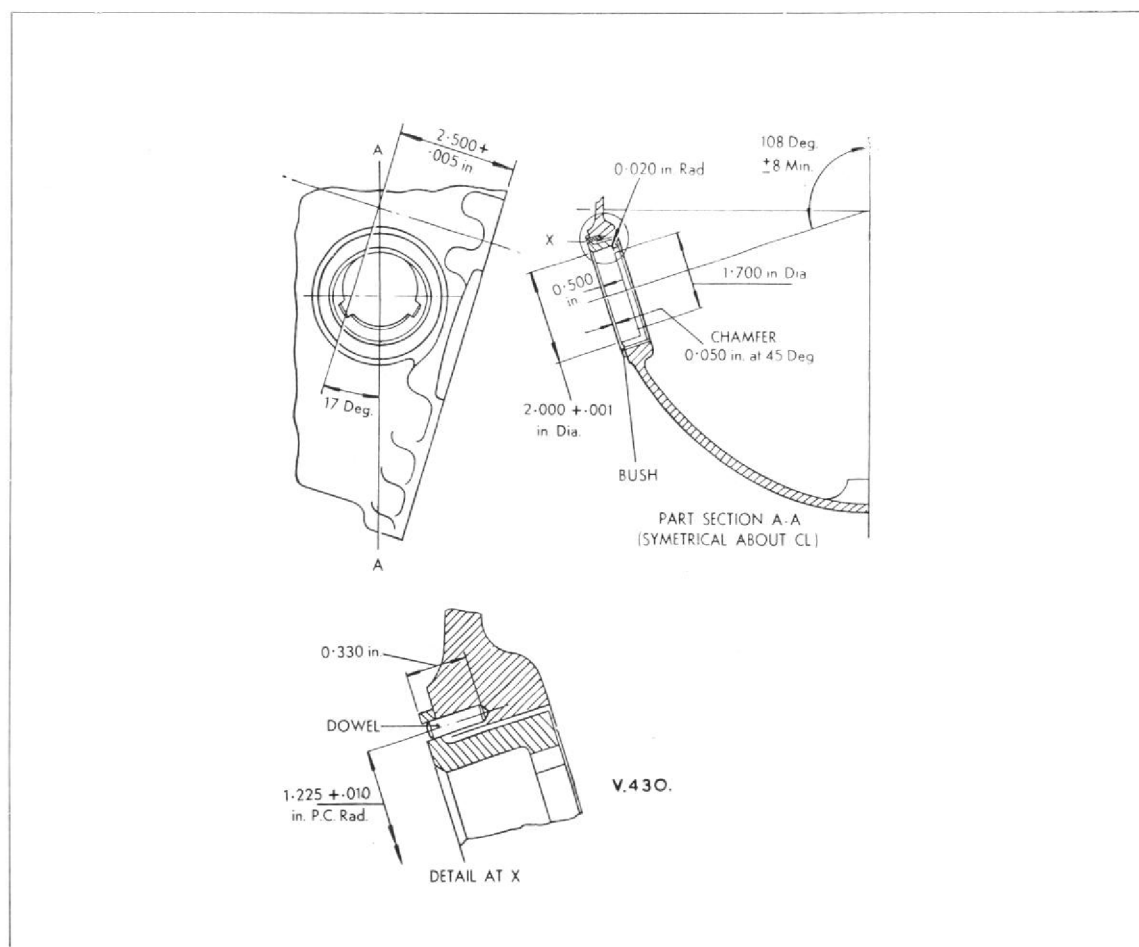
A steel punch should also be provided—locally manufactured to the dimensions given in chapter 21—in order to press together the surfaces of the flame tube and cooling skirt before forming the rivet head.

The sequence of operations when hot riveting, is as follows. Having made final adjustments to the settings of the machine, which must be determined by inspection of a riveted test piece in accordance with de Havilland Specification 151/1; position the flame tube and head over the lower electrode, with the head of the new rivet resting on the electrode tip. Remove the spring clip or rubber washer from the shank of the rivet and turn off the current supply to the electrodes. Place the hollow end of the steel punch over the protruding shank of the rivet; depress the foot pedal to bring the upper electrode to bear against the top of the punch, thus pressing together the two surrounding surfaces of the flame tube and cooling skirt. Release the pedal and remove the punch. Switch on the current and depress the pedal; the heating current will continue to flow until interrupted by the heating timer, and by this time the head of the rivet should be formed. After the approximate time taken for the heating process has elapsed, release the pedal and switch off the current. Release of the pedal during the heating period will not permit the upper electrode to rise until the cycle is completed.

Check the diameter of the formed head, which should be 0.370 in. for rivet MR.603426-32 and 0.400 in. for rivet MR.603426-63.

Etch T.R.346 adjacent to the existing part number and make an entry in the appropriate record book of the engine.

Revised by Amendment No. 131
February, 1957



EXPANSION CHAMBER, INTERCONNECTOR BUSHES T.R. 369 issue 2—Mod. 1019

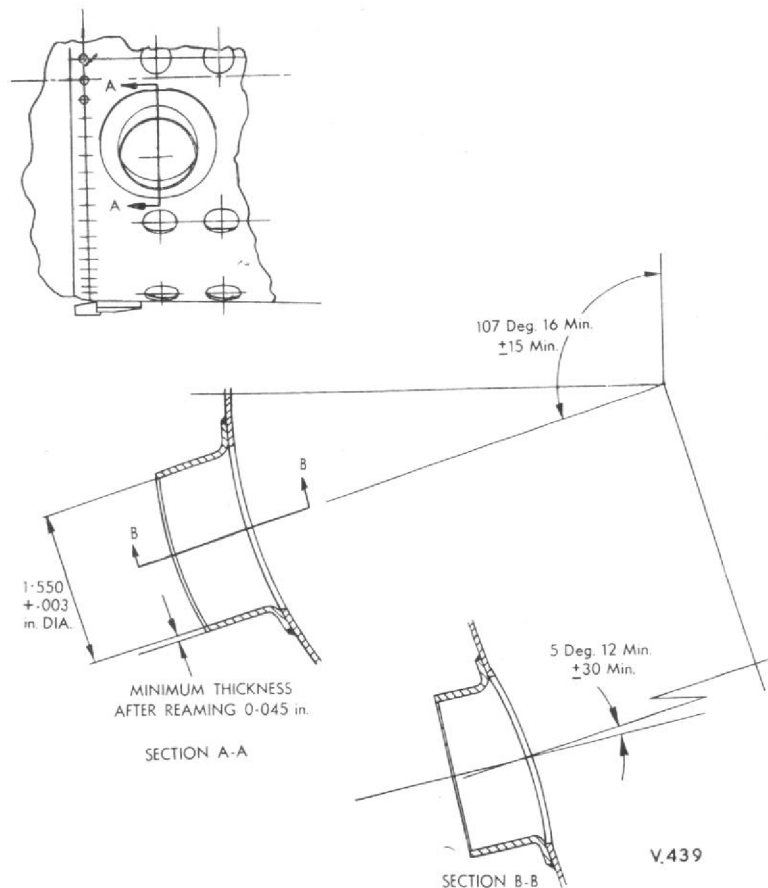
This repair may be applied to Ghost 48 Mk. 1 expansion chambers which embody mod. 1019.

Expansion chambers in which the interconnector bushes have become loose may be repaired in accordance with these instructions.

SEQUENCE OF OPERATIONS

1. Remove the existing bush. If the threaded hole in the expansion chamber is not damaged, a standard size replacement bush, Part No. 603765, may be fitted. If the threaded hole is damaged, it must be enlarged as described in operations 2, 3 and 4 and replacement bush, Part No. MR.603765-80, fitted.
2. Enlarge the threaded hole in the expansion chamber to $2.2612 + .0103$ inches diameter.
3. Thread the hole 2.330 inches diameter by 16 T.P.I. right through, Whitworth thread form, effective diameter $2.292 + .002$, minor diameter $2.2612 + .0103$ (truncated).
4. Counterbore $2.340 + .010$ inches diameter to a depth of 0.050 inch.
5. Heat the expansion chamber to 175 deg. C. and maintain it at this temperature for 30 minutes: chill the replacement bush to minus 20 deg. C.
6. Ensure that the parts are clean and insert and tighten the replacement bush fully into its location in the expansion chamber. Allow the expansion chamber to cool.
7. Drill a dowel hole 0.093 inch diameter (No. 42 drill) to a depth of 0.330 inch, as shown at 'X' in the sketch. Normally, this hole may be positioned by locating the drill through the existing hole in the bush flange, but if the hole thus drilled would be within 0.250 inch of the existing dowel hole in the expansion chamber, a new hole must be drilled in the radial position indicated; in this latter case the circumferential position of the hole is not important. Fit dowel, Part No. N.2485, and lock by peening.
8. Machine the bush to the dimensions shown.
9. Lightly stamp T.R.369 adjacent to the existing part number and make an entry in the appropriate record book of the engine.

Issued by Amendment No. 116
February, 1955



**FLAME TUBE AND HEAD,
INTERCONNECTOR SLEEVE**
T.R. 370 issue 1—Mod. 1019

This repair may be applied to all Ghost type 5, mod. 1019, flame tubes and heads.

Flame tubes and heads on which the interconnector sleeve has worn at any point around its side to less than 0.030 inch, may be repaired in accordance with these instructions.

SEQUENCE OF OPERATIONS

1. Remove the existing sleeve by grinding.
2. Clean the surfaces in preparation for welding.
3. Position new sleeve, Part No. 603477, as shown in the sketch and secure by argon-arc welding round the circumference of the flange.
4. Ream the sleeve bore to the dimensions shown.
5. Etch T.R.370 adjacent to the existing part number and make an entry in the appropriate record book of the engine.

*Issued by Amendment No. 116
February, 1955*

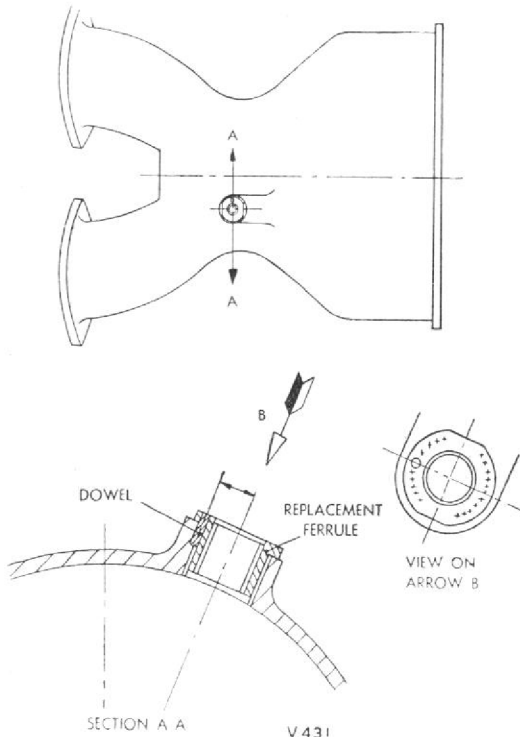
EXPANSION CHAMBER, PRESSURE CONNECTION FERRULES T.R. 373 issue 1—Mod. 1057

This repair may be applied to Ghost 48 Mk. 1 and 2 Pre-mod. 1057 expansion chambers, Part No. 94988 and 94989.

Expansion chambers in which the threaded hole in the ferrule has become worn or damaged, or in which the ferrule has become loose, may be repaired in accordance with these instructions.

SEQUENCE OF OPERATIONS

1. Remove the existing dowel.
2. Remove the existing ferrule, Part No. N.2647.
3. Enlarge the existing thread in the expansion chamber, right through, to 0.780 inch diameter by 16 T.P.I., Whitworth thread form, effective diameter $0.7400 + .0033$ inch, minor diameter $0.7000 + .0195$ inch.
4. Counterbore $\frac{5}{16}$ inch diameter by 0.100 inch deep.
5. Insert, and tighten hard, replacement ferrule, Part No. N.6192.
6. Drill a dowel hole, 0.0935 inch diameter (No. 42 drill) to a depth of 0.350 inch, in the radial position shown in the sketch. The circumferential position of this hole is not important, but it must not be within 0.250 inch of the existing dowel hole, and must be within the area indicated (xxxxx) in the sketch.
7. Insert dowel, Part No. N.2485, and lock by peening.

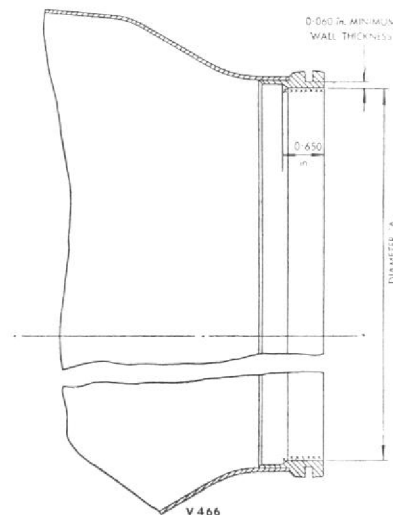


8. Lightly stamp T.R.373 adjacent to the existing part number and make an entry in the appropriate record book of the engine.

COMBUSTION CHAMBER, OUTER CASING, WORN RING T.R. 372 issue 1—Mod. 1114

This repair may be applied to all Ghost Forty-eight type 5 combustion chamber outer casings.

Combustion chamber outer casings in which the bore of the ring has worn beyond the permis-



sible limits of 7.730 inch diameter may be repaired in accordance with these instructions.

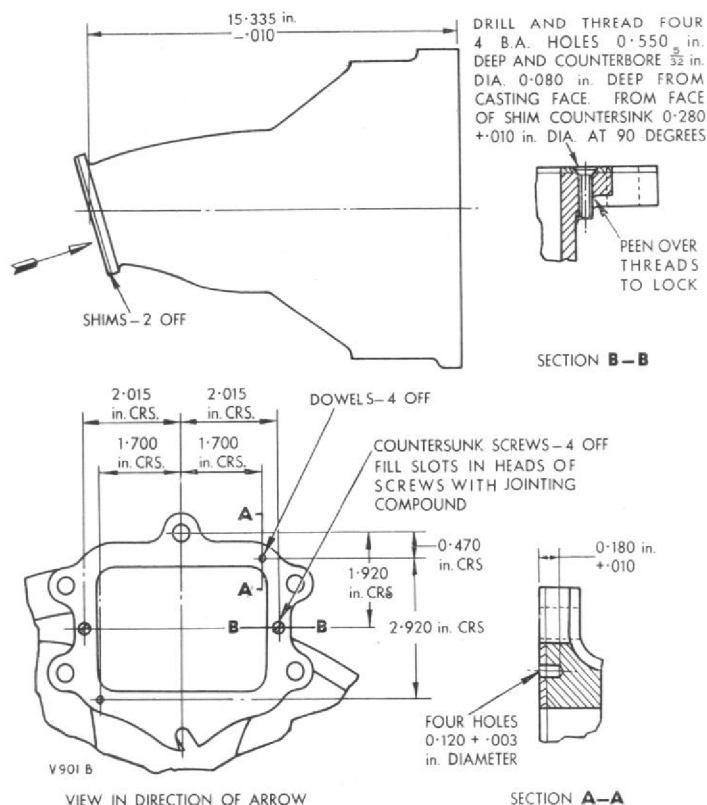
SEQUENCE OF OPERATIONS

Stage 1

1. Grind diameter 'A' to $7.731 + .002$ inch.
2. Chromium plate, $0.009 + .002$ inch thick, the bore where indicated XXX in sketch. Chromium plating must be in accordance with D.H. Process Specification No. 132 (conforms to British Specification D.T.D.916).
3. Re grind diameter 'A' to $7.715 + .010$ inch.

Stage 2 (to be carried out only if stage 1 does not eliminate the wear marks).

1. Grind diameter 'A' to $7.739 + .002$ inch.
2. Chromium plate, $0.013 + .002$ inch thick, the bore where indicated XXX in sketch. Chromium plating must be in accordance with D.H. Process Specification No. 132 (conforms to British Specification D.T.D.916).
3. Re grind diameter 'A' to $7.715 + .010$ inch.
4. After either stage of repair, etch T.R.372 adjacent to the existing part number on the exterior of only the joint ring. Make an entry in the appropriate record book of the engine.



T.R.314. Expansion Chamber, inlet flanges.

EXPANSION CHAMBER, INLET FLANGES, SHIMMED.

T.R.314 issue 1—Mod. 717

For Information Only

If the number T.R.314 is found adjacent to the existing part number, this indicates that a shim has been fitted to each of the two inlet flange faces. These shims take the form of light-alloy packing washers about 0.050 inch thick, and each is secured in place by two countersunk screws. These packing washers should be regarded as an integral part of the expansion chamber.

Where sufficiently skilled personnel and adequate workshop facilities are available, this repair can be employed as a means of rectifying damage to the inlet flange faces.

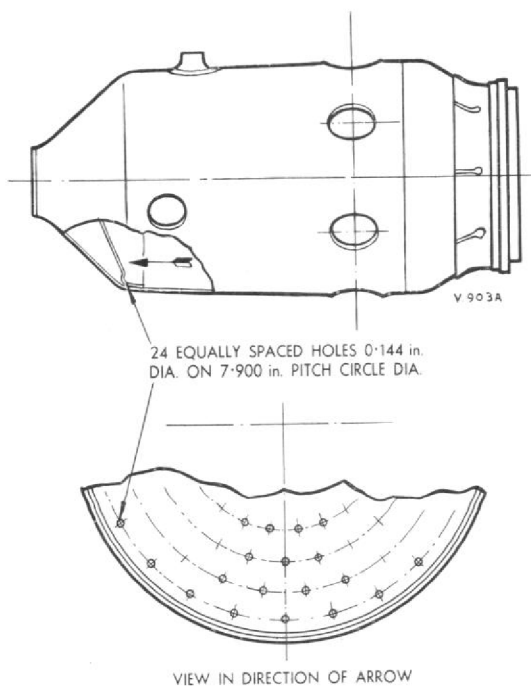
Before attempting this repair, however, it is advisable to consult the Service Department of The de Havilland Engine Company Ltd., at the address given in the Foreword to this handbook.

FITTING ASSEMBLY FLAME TUBE AND HEAD

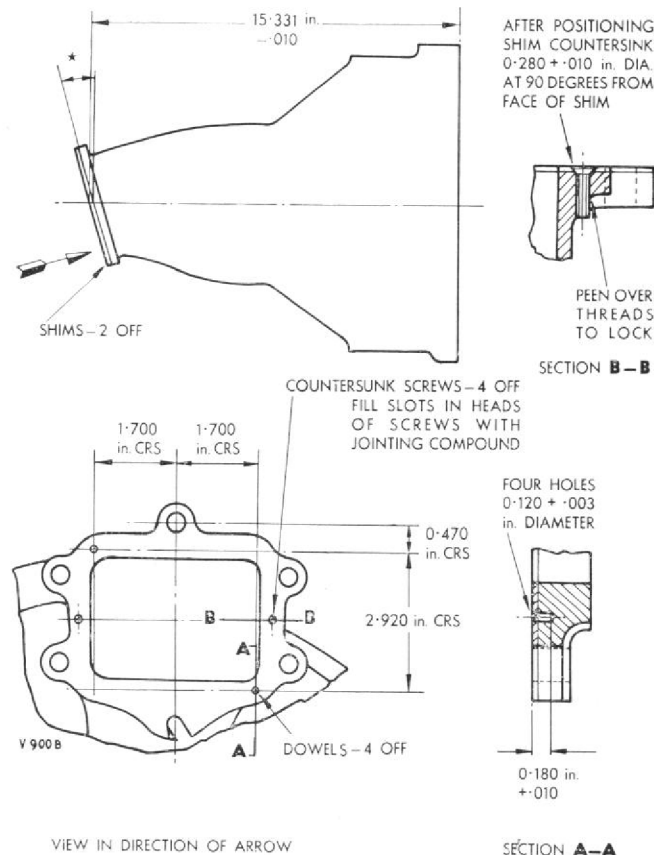
T.R.388 issue 1—Mod. 1106

For Information Only

If Part Number 604671 or 604672 is etched on a type 5 flame tube and head, then this assembly



T.R.388. Flame tube and head.



★ Machine inlet flange faces to 15.283 in. - 0.010 from combustion chamber joint faces at an angle of 17 degrees 6 minutes and 30 seconds.

EXPANSION CHAMBER T.R.418 issue 2—Mod. 862

For Information Only

If the number T.R.418 is found on a Ghost 48 Mk. 1 or 48 Mk. 2 expansion chamber, adjacent to the existing part number, this indicates that the component has had the principles of Mod. G.T.1147 incorporated.

Where sufficiently skilled personnel and adequate workshop facilities are available, this T.R. may be employed to incorporate Mod. G.T.1147 in expansion chambers to which T.R.314 has been embodied.

Before attempting this repair, however, it is advisable to consult the Service Department of The de Havilland Engine Company Ltd., at the address given in the Foreword to this Handbook.

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