Cold air inlet plenum installation

Classification Highly recommended

Applicability Europas fitted with Rotax 912 engines (Pre-XS engine installation)

Compliance N/A

Introduction

The original Rotax 912 engine installation in the Europa causes the inlet air to be heated slightly as it passes through the radiators and then goes past the hot engine. This results in a power loss which is noticed most when taking off with a heat soaked engine.
Re-routing the inlet air such that it enters a plenum chamber which directly feeds the carburettors ensures that the coolest air available is used at all times. A general arrangement of the installation is shown in figure 1.

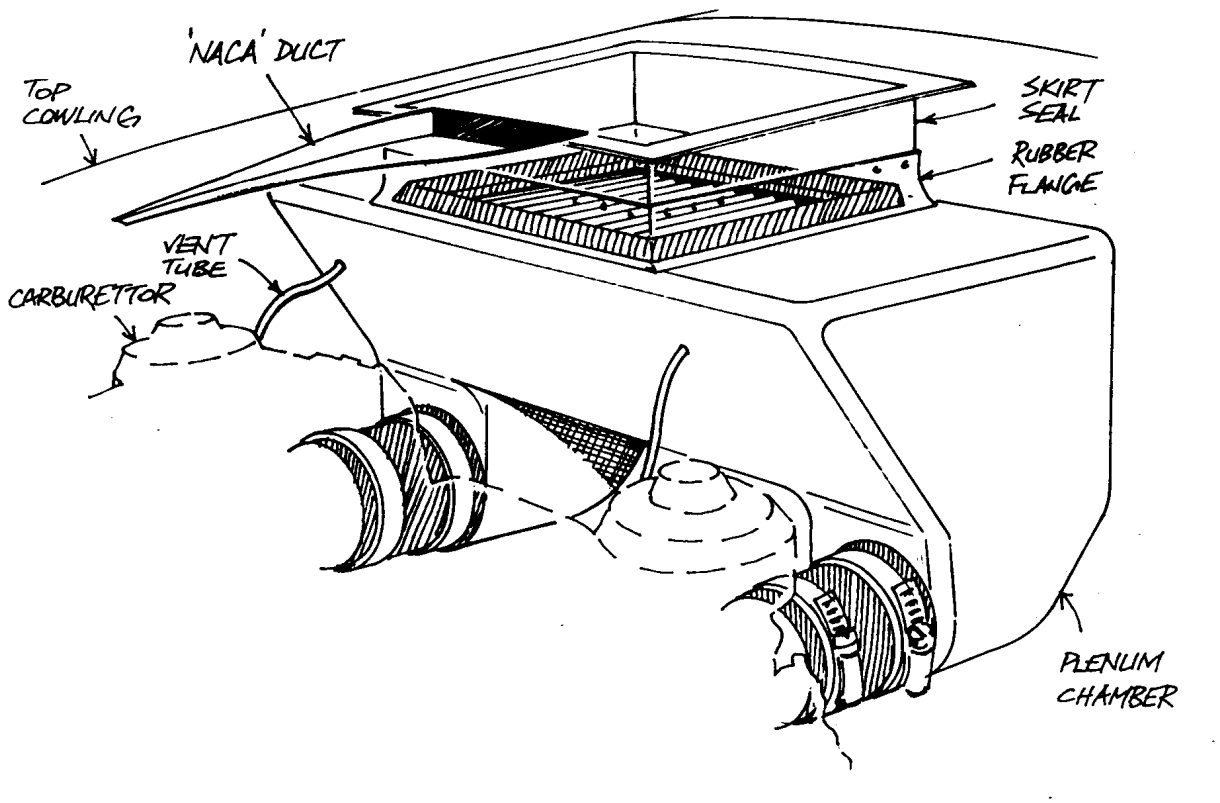

Fig 1. General arrangement of plenum chamber installation.

Action

Plenum chamber

Preparation

Drain holes

In the lowest point of each inlet tube drill a 3.3mm (1/8") hole to allow any collected water to drain from the plenum. See figure 2.

Carburettor Vent Tubes

The 6mm diameter plastic vent tubes on the starboard side of each carburettor must be inserted onto the plenum chamber for the engine to run properly. Position the plenum chamber with the carburettors and, checking that the tubes will reach, mark and drill a 1/4" hole into the sloping face of the plenum about 4-5cm (1.5" - 2") down from the upper face. See figure 2.

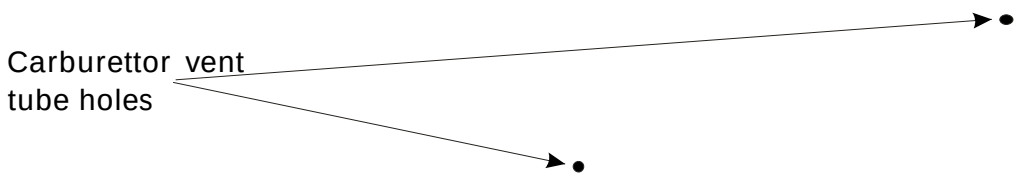

Fig 2. View of plenum chamber (inverted) showing drain holes

Air filter

The air filter should be a tight fit into the square hole cut into the top of the plenum chamber. The radius under the filter flange will cause the flange to not quite reach the plenum chamber surface. This is normal.

Installation

Cut the 2"diameter rubber hose to make two 2" long pieces, then clamp the hoses to the tubes of the plenum chamber and to the two carburettors using four size 3 hose clamps.

Taking the weight of the plenum chamber, measure the gap between the top of the engine mount upright members and the base of the plenum chamber. Make spacers from plywood to fit onto the engine mount and attach them with RTV silicone. Bond the plenum to the spacers also with silicone.

Insert the carburettor vent tubes into their respective holes and, from the inside of the plenum, push into a plastic tee piece (part no. HT-4) to secure it. Push the tee into the hole so that the tube is clamped onto it. See figure 3.

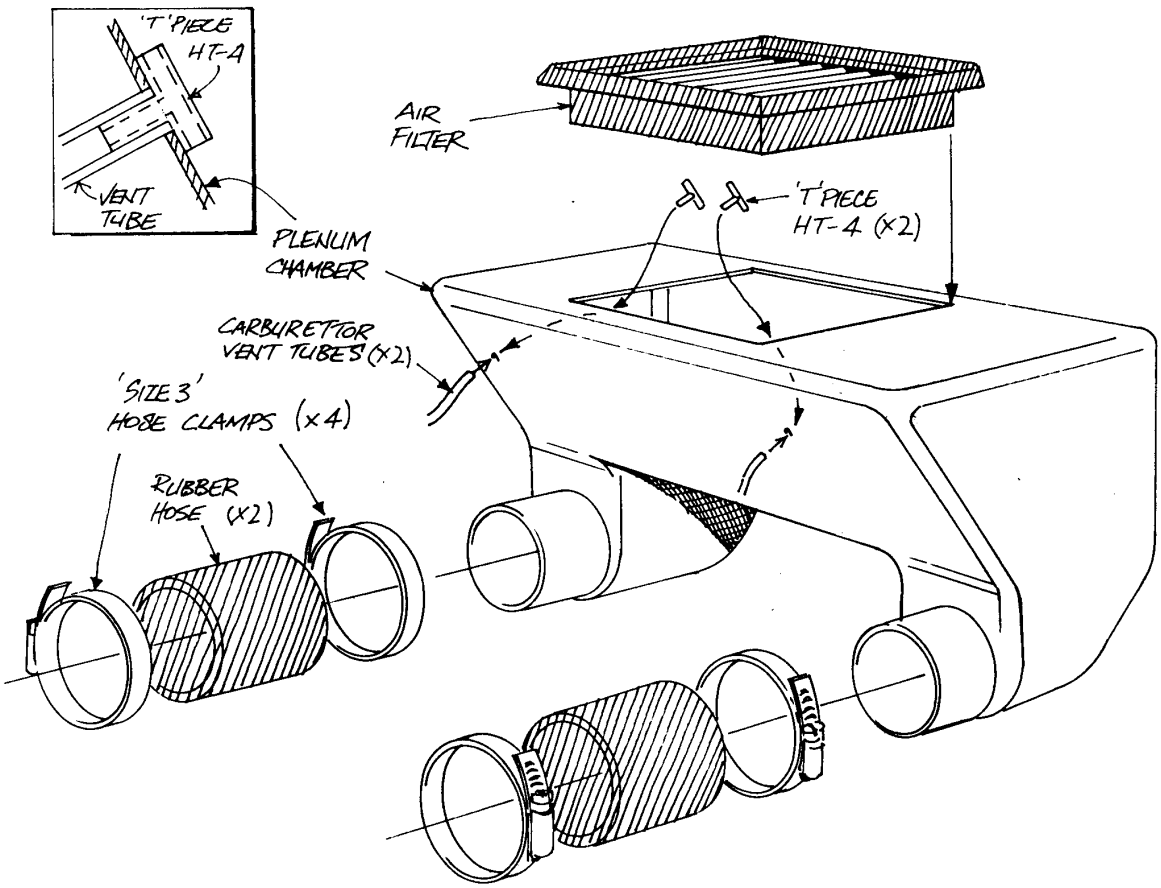

Fig 3. Assembly of plenum chamber.

Air inlet

The air inlet is a NACA flush inlet which is made in the top cowling. Ideally the inlet should be positioned on the aircraft centreline, but it may be located to one side if the coolant water access door is in the way. Allow at least 15mm (5/8") clearance from any access hole to leave room for the side wall lay-ups to lap onto the cowling.

Use the full size template to mark out the shape of the NACA inlet onto the top cowling, then cut through the skin leaving the narrow piece of skin at the front intact to act as a hinge. Push the cut-out flap down to form the inlet ramp and fix the opening to be 32mm (1.1/4") deep. The ramp should be flat over most of its length; only the first few centimetres will be curved slightly.

Side pieces

The side pieces of the inlet are to be made with a glassfibre lay-up, so make some formers, using cardboard or similar, which can be curved to follow the shape of the inlet. See figure 4.

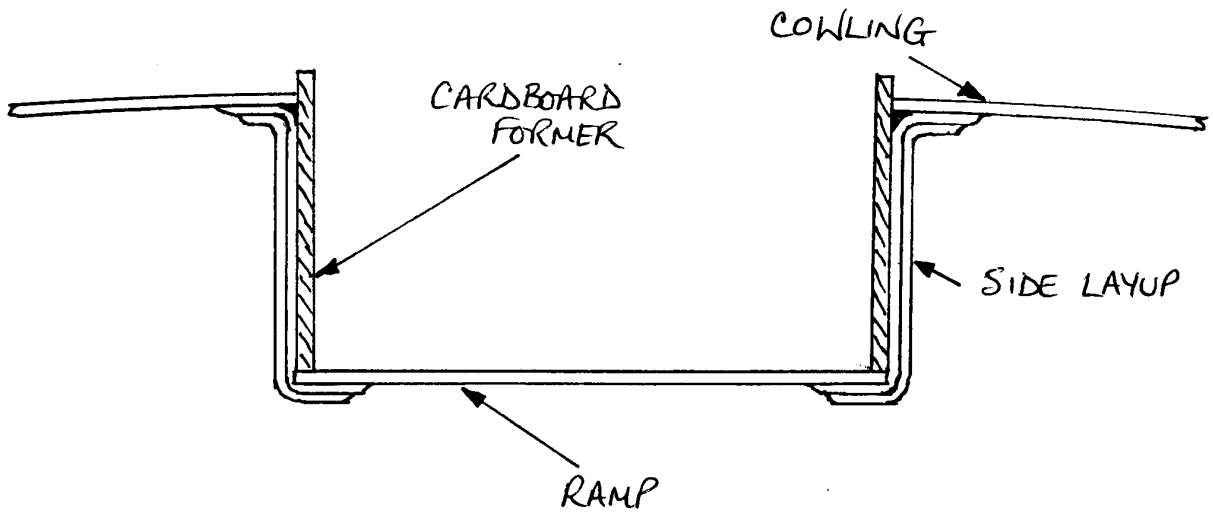

Fig 4. Layup of NACA duct sides.

Cover the formers with plastic sheeting to prevent the layup from sticking. Having scuff sanded the surrounding area, layup 2 plies of 'bid' at +- 45º onto the former, lapping about 1-2cm (1/2 -3/4") onto the ramp and the cowling underside. Peel ply the edges and allow to cure.

After cure remove the formers and peel ply, and fill any gaps there may be in the corners of the inlet with micro, which should be sanded after cure.

Skirt seal flanges

To seal the NACA inlet to the top of the plenum chamber a skirt of reinforced rubber sheeting will be used.

The skirt seals against the top surface of the plenum chamber on the periphery of the air filter. An air tight seal is not required.

A flange, made from glassfibre much like the side pieces of the inlet, is moulded to the cowling underside, onto which the skirt is attached with pop rivets. If your NACA inlet is offset from the centreline such that it is not completely over the air filter, the skirt will have to be extended on one side.

The flange may be made at the same time as making the NACA side pieces. Make cardboard formers in the manner described for the side pieces, and fix them to the cowling underside so that the front and rear flanges are as shown in figure 5, and the side flanges are just outboard of the air filter edges, not the plenum edges as the front and rear faces are. It will be necessary for the front flange to be stepped, being fitted to the underside of the cowling and the bottom of the NACA duct, flush with its outlet.

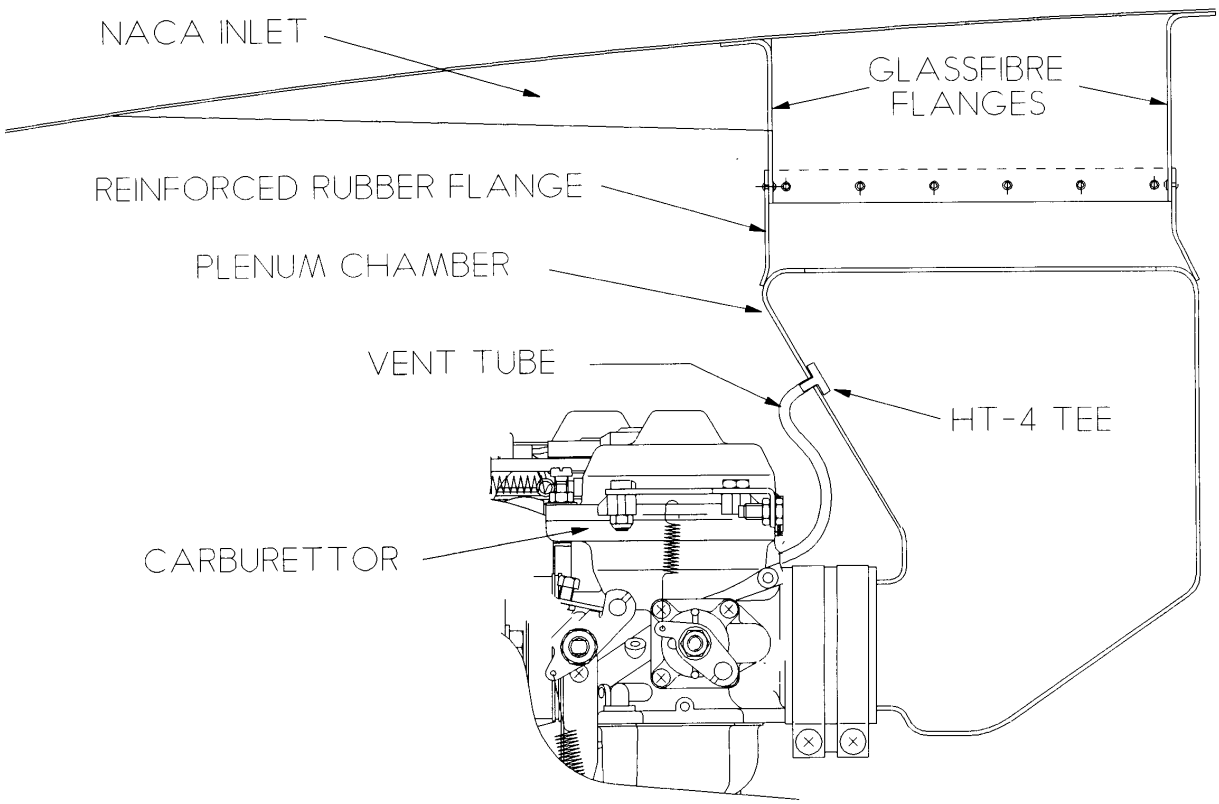

Fig 5. Sectional view showingNACA duct and skirt seal.

Layup three plies of 'bid' onto the cowling and duct underside, lapping onto the formers, Peel ply the edges and allow to cure.

After cure, remove the formers and peel ply, then trim the flanges to finish about 25 mm (1") above the top of the plenum chamber.

Skirt seal

Cut the length of the reinforced rubber strip so that it goes around the skirt seal flange from one side of the inlet to the other. Drill both the flange and the rubber strip with a 3.3mm (1/8") drill at about 3cm (1 1/4") intervals, and rivet the two together using TAPD46 BS rivets and load spreading washers EUR011. The rivet head is best against the glassfibre so that the washer is against the rubber to prevent it pulling through.

Cut the rubber at each corner as required to allow the skirt to spread on contact with the plenum chamber. Gaps here are not critical; the air above the filter is normally at a higher pressure than its surroundings so that warm air will not inter the plenum chamber. The skirt should not fit too tightly onto the chamber to avoid any transmission of vibration from the engine.

Annotate the aircraft records - Mod 42 incorporated.