



## TITLE OF INVENTION

## ANTI-CORROSION WASHER FOR BELLY FAIRING FANGE OF AIRCRAFT

## BACKGROUND OF THE INVENTION

## (1)Field of the Invention

The present invention relates to a washer structure to prevent corrosion, and more particularly, to an anticorrosion washer for belly fairing flange of an aircraft.

## (2)Background of the Invention

There are many connections involving two flanged components being fastened together. Very often, corrosion occurs at these connections. An example of such occurrence is found on the belly fairing flange of an aircraft, in particular, belly fairing flange of AIRBUS A340-300. The cause of the corrosion problem is due to the contact of dissimilar metals in the presence of moisture and other corrosive solvents, such External condition like Airport Near Sea Coast, Moisture from Cargo Bay, condensation of air-conditioning system, hydraulic fluid from hydraulic systems etc.

Regardless of the type of parts involved or the operating environment concerned, the corrosion at the belly fairing flange is highly undesirable and the damage to the flange has to be solved or prevented. It is imperatively that some sort of solution to the corrosion at the flange could be devised. From the viewpoint of the aircraft manufacturers or the airlines companies, it would be even more desirable to have a solution to permanently correct the corrosion problem and at the same time, to provide a solution to minimize periodic replacement of related corroded parts in the maintenance program.

The belly fairing of an aircraft consists of a series of aluminum alloy flanges which supports a plurality of external belly fairing access panels. These flanges are in the form of T-shaped profile, which are attached to a series of alluminum alloy webs for structural support. These flanges include a plurality of stainless steel



receptacles, washers and stubs which hold the external belly fairing access panels in place to give the aircraft good aerodynamics structure.

The corrosions were found due to the different metallic material, i.e., at the contact of the stainless steel washer and the external surface of the aluminum alloy profile, and the stainless studs in the holes of the T-shaped profile of the flange. If moisture or water is trapped between the T-shaped profile and the TEFLON strip combined with the different contact of the two materials, corrosion as mentioned above will occur. Accordingly, this calls for an anti-corrosion washer, which isolates the contact of the two different metallic materials.

On normal existing maintenance practice, aircraft maintenance technicians use Standard Aircraft Maintenance Procedures supplied by the aircraft manufacturers to inspect and maintain the aircraft structures. The belly fairing flanges are inspected during every C Check (Airlines' Maintenance Procedure after a certain number of flight hours at which the aircraft is open up to a certain level for extensive checks and maintenance). During this period, an aircraft is grounded for various inspection and maintenance. The aircraft's Ground Service Network must be de-energized and the hydraulics system depressurized for safety reasons during the C Check Maintenance.

When the belly fairing access panels are removed, exposing the internal structure, hydraulic systems and air-conditioning units of the aircraft. The belly fairing flanges are then undergone a structural inspection. During the inspection, the maintenance engineers look out for signs of corrosion and structural damage. When corrosion is detected, standard maintenance procedure will be conducted.

Once the flanges have been reworked or replaced, the external surface of the flange is then covered with TEFLON tape with corrosion inhibitor to protect it from moisture and corrosive products. The internal face of the belly fairing structure is covered with water repellant to protect the structure form moisture exposure.

To ensure proper installation of the access panels, the torque of the screws must be checked and controlled during installation. The torque of the screws must be maintained between 0.35 to 0.45m.daN. In case new additional installation is

made, the torque of the screws must be rechecked to ensure proper structural installation.

Despite the maintenance and prevention methods used by aircraft operators, corrosion still occurs around the holes of the T-profile belly fairing flanges. The corrosion reoccurrence are due to the fact that (i) installation of TEFLON tape with corrosion inhibitor does not break the electrical contact of the stainless steel washer and stud from the aluminum alloy T-profile flange, (ii) due to rough handling of the external panels and the T-profile flange during maintenance, the protective coat on the flange is often scratched, exposing the metal to moisture and contact with the washer and stud, and (iii) during the flight operation, the aircraft undergoes a high level of vibration. This vibration will cause the access panels to rub against the TEFLON tape on the T-profile flange, scratching away the protective layer, again exposing the aluminum flange to electrical contact with the stainless steel components and moisture which will cause corrosion to occur.

#### SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide an anti-corrosion washer for belly fairing flange including a series of aluminum alloy flanges and a plurality of external belly fairing access panels, the improvement comprising an anti-corrosion hat-shape washer positioned between each of the aluminum alloy flanges and the access panel by means of a stud, said washer formed of a circular disc having a centre hole and a hollow cylindrical tube, the disc and the tube being bonded integrally as a unit, and the stud passed through the hollow centre of the washer and mount the external belly fairing access panels to the alloy flanges.

Yet another object of the present invention is to provide an anti-corrosion washer for belly fairing flange, which isolates both the steel washer and stud away from the flange.

A further object of the present invention is to provide an anti-corrosion washer for belly fairing flange, which breaks the electrical contact between the two different metals.

Yet a further object of the present invention is to provide an anti-corrosion washer for belly fairing flange, which assists to align the stud (On the External Panel) towards the centre axis of the centre hole and the receptacle of the bell Fair Flange.

Another object of the present invention is to provide an anti-corrosion washer for belly fairing flange, which is made from polytetrafluoroethylene, polyester, or neoprene material.

A further object of the present invention is to provide an anti-corrosion washer for belly fairing flange, which is able to withstand a large amount of stress and vibration and the rough handling and maintenance of the aircraft.

Another object of the present invention is to provide an anti-corrosion washer for belly fairing flange, wherein the washer can isolate the electric potential difference between two metals.

Yet another object of the present invention is to provide an anti-corrosion washer for belly fairing flange, wherein the washer must not chemically affect the neighboring metals in anyway, which promote corrosions.

Other objects and advantages will become apparent from the following specification taken in connection with the accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a perspective of the washer in accordance with the present invention.

FIG. 2 shows a top view of the washer in accordance with the present invention.

FIG. 3 is a schematic sectional view showing corrosion on the belly fairing T-shaped profile of aircraft.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention discloses a hat-shaped washer for belly fairing flange of an aircraft that prevent corrosion. It should be noted that while the following

description of the invention is in the context of washer used in belly fairing flange, no limitation to that specific use is intended except insofar as recited in the appended claims.

Referring initially to FIGS. 1 and 2, there is shown the hat-shaped washer of the present invention. In accordance with the present invention, the washer 100 comprises a circular disc 10 having a center hole 12, and a short cylindrical tube 20 with a channel 22. The cylindrical tube 20 is mounted at one end thereof vertically onto the circular disc 10 at one surface thereof such that the channel 22 of the cylindrical tube 20 aligns with the center hole 12 of the circular disc 10. The hat-shaped washer 100 can be inserted into screw hole (not shown) provided on the aluminum alloy structure of the aircraft belly and accordingly, the washer 100 isolate the stainless steel washer and stud away from the aluminum alloy structure. In the present preferred embodiment, the material used for the fabrication of the washer 100 is durable, non-conductive and capable of being made in large quantities. This material can be selected from polytetrafluoroethylene (TEFLON), polyester (KEVLAR), and neoprene. However, polytetrafluoroethylene is the best material for the fabrication of the washer in accordance with the present invention as this material is known to be non-conductive, non-corrosive, and very durable. Further advantage of this material are that it can easily be fabricated into required shape and size, and in large quantities at a very low cost. Polyester material (KELVAR) is a good material for anti-corrosion purpose but this is a comparatively expensive material for the fabrication. Neoprene is a good insulation material but it cannot be easily fabricated into the required shape.

In the present preferred embodiment, as shown in FIGS. 1 to 3, in particularly to FIG. 3, there is shown in an aircraft having a belly fairing flange including a series of aluminum alloy flanges 26 and a plurality of external belly fairing access panel 200, the improvement comprising an anti-corrosion hat-shape washer 100 positioned between each of the aluminum alloy flanges 26 and the access panel 200 by means of a stud 201, said washer 100 formed of a circular disc 10 having a centre hole 12 and a hollow cylindrical tube 20, the disc 10 and the

tube 20 being bonded integrally as a unit, and the stud 201 passed through the hollow centre of the washer 100 and mount the external belly fairing access panels 200 to the alloy flanges.

In accordance with the present invention, the washer 100 can withstand large amounts of stress and vibration and the rough handling and maintenance of the aircraft. The thickness of the circular disc 10 of the hat-shape washer 100 is preferably ranging from 0.5 mm to 1.0 mm and the height of the cylindrical tube 20 is preferably ranging from 2.5 to 3.5 mm.

In accordance with the present invention, the hat-shape washer is able to isolate the stainless components away from the aluminum alloy structure, and is durable to withstand the large amounts of stress and vibration and rough handling and the maintenance of the aircraft.

It will be appreciated that, although specific embodiment of the invention has been described herein for purposes of illustration, various modifications may be made without departing from the spirit and scope of the invention. Accordingly, the invention is not limited except by the appended claims.

## CLAIMS

1. In an aircraft having a belly fairing flange including a series of aluminum alloy flanges and a plurality of external belly fairing access panels, the improvement comprising an anti-corrosion hat-shape washer positioned between each of the aluminum alloy flanges and the access panel by means of a stud, said washer formed of a circular disc having a centre hole and a hollow cylindrical tube, the disc and the tube being bonded integrally as a unit, and the stud passed through the hollow centre of the washer and mount the external belly fairing access panels to the alloy flanges.

2. The anti-corrosion hat-shape washer of claim 1, wherein the material for fabrication of the washer is selected from the group consisting of polytetrafluoroethylene, polyester or neoprene material.

3. The anti-corrosion hat-shape washer of claim 1, wherein the thickness of the circular disc of the washer is ranging from 0.5 to 1.0 mm.

4. The anti-corrosion hat-shape washer of claim 1, wherein the height of the cylindrical tube is ranging from 2.5 to 3.5 mm.

5. The anti-corrosion hat-shape washer of claim 1 or 3, wherein the thickness of the circular disc of the washer is 0.8 mm.

6. The anti-corrosion hat-shape washer of claim 1 or 4, wherein the height of the cylindrical tube is 3.0 mm.