



Pitot Probe Performance Covered On the Ground

Pitot probes inlet obstruction will affect accuracy of the air data parameters calculated from its measurements such as the aircraft airspeed and Mach number. Pitot probes inlet obstruction on the ground can be caused by unexpected sources such as sand, dirt, dust or insect nesting activity. This is why it is important to think about when to install Pitot probe covers for an aircraft on the ground to protect its air data system performance.



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AN OBSTRUCTED PITOT PROBE MAY OCCUR IN LESS TIME THAN YOU THINK

In-service experience: impacts of a blocked Pitot probe in a context of dispatch under MEL

In a recent incident, the captain of an A330 rejected the take-off attempt after noticing an airspeed indication failure. Troubleshooting conducted subsequently led to swap two of the Air Data Inertial Reference Units (ADIRU) and the aircraft was dispatched with ADIRU 2 inoperative as allowed by the Minimum Equipment List (MEL). A second take-off passed the critical V_1 speed when an airspeed discrepancy was noticed again on the captain's PFD. The take-off had to be continued but a wrong captain airspeed associated with ADIRU 2 inoperative caused the A330's auto-thrust and flight directors to disengage, the flight controls mode

reverted from normal to alternate law and the autopilot became unavailable. The crew performed an immediate in-flight turn-back. After the uneventful landing, a detailed ground inspection found conclusive evidence that the cause of the indicated airspeed discrepancy was due to a Pitot probe partially blocked in less than two hours by nesting wasps.

An investigation of another in-flight turn-back (from a non-Airbus aircraft type) at the same airport also showed that the inlet of the captain's Pitot probe was partly obstructed by material consistent with a mud-dauber wasp nest.

Main reasons for Pitot obstruction: insects but not only...

Insects can cause rejected take-off or in-flight turn-back events and there are other potential sources of Pitot obstruction.

"A mud dauber wasp can build a significant nest capable of completely blocking a Pitot probe, vent, or drain in around 20 minutes" according to a recent airworthiness bulletin

issued by the Australian Civil Aviation Safety Authority (CASA) following an investigation of an in-service occurrence. But it is not only insect activity that can be the cause of Pitot blockage. Pitot probe inlet obstruction by insect, dust, dirt or any materials (sand) is the main root cause of rejected take-off or in-flight turn-back events due to airspeed discrepancy below FL 250. ■

“ The cause of the indicated airspeed discrepancy was due to a Pitot probe partially blocked in less than two hours by nesting wasps. ”

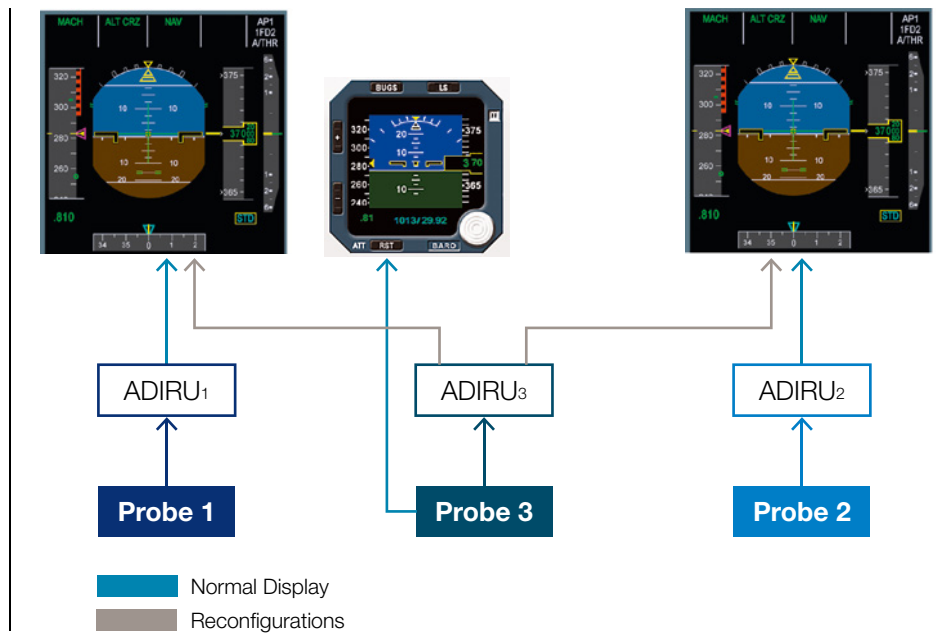
“ The main cause of airspeed discrepancy below FL250 was Pitot obstruction by sand, dust, dirt or insects. ”

PROCEDURES

Pitot Probe Performance Covered On the Ground

(fig.1)

Pitot probe simplified schematic
(applicable for A320, A330
and A340 aircraft)



A PRECISION INSTRUMENT FOR MEASURING AIRSPEED

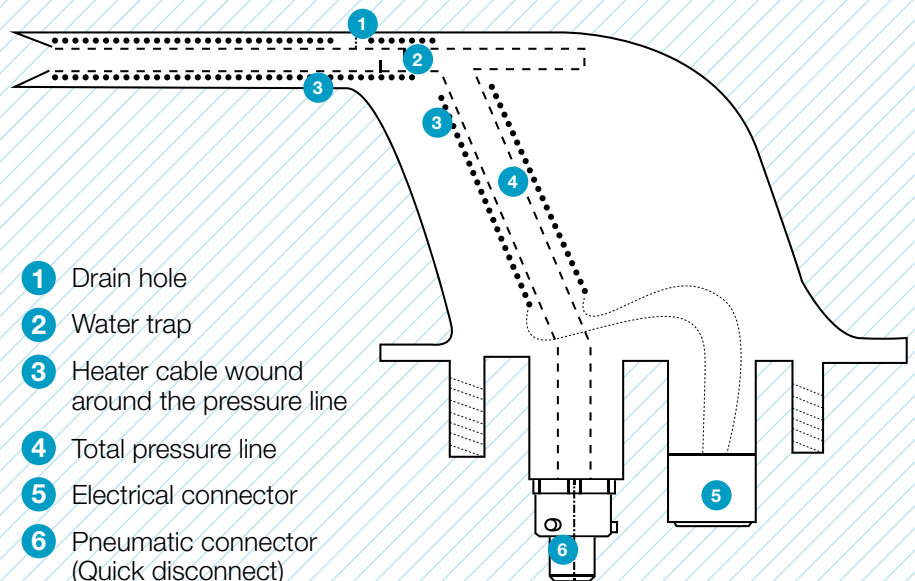
The Pitot probe consists of a tube pointing directly into the air flow (**fig.2**) and measuring the stagnation pressure called total pressure or Pitot pressure.

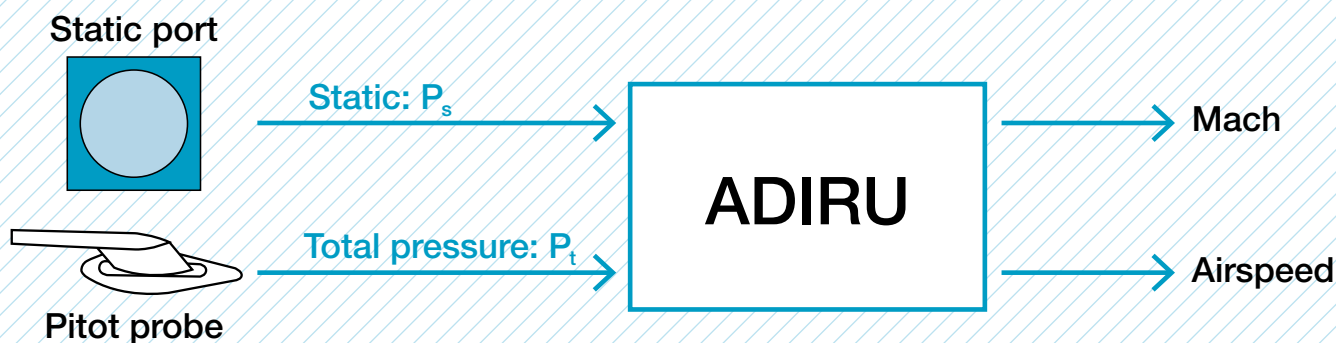
This total pressure information and the static pressure delivered by static ports on the fuselage are used to compute the indicated airspeed and Mach number provided by the ADIRU (**fig.3**).

Like any precision instrument, Pitot probes need to be protected on ground to provide correct airspeed and Mach number measurements in flight in order to fly the aircraft safely.

(fig.2)

Design principle of a Pitot probe
(applicable for A320,
A330 and A340 aircraft)





PREVENTING PITOT PROBE OBSTRUCTION ON GROUND

(fig.3)

Pitot probe principle

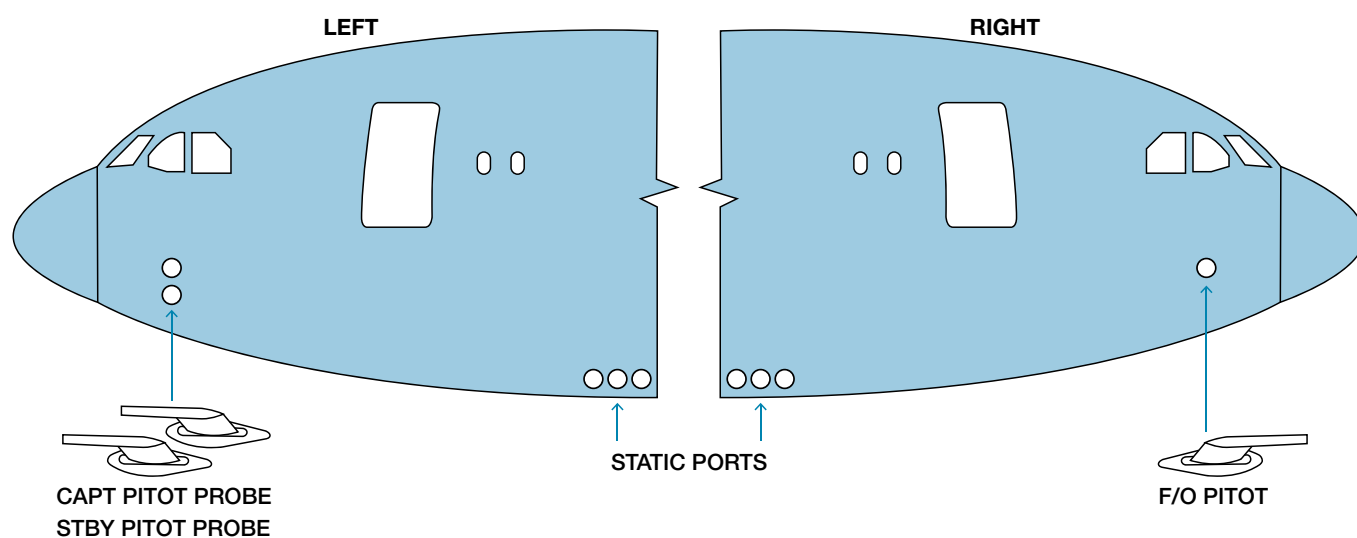
Aircraft Maintenance Manual parking procedure

Parking procedures available in the Aircraft Maintenance Manual (AMM section 10-11-00) will request that approved protective covers are installed on each of the air data probes or

devices, including Pitot probes **(fig.4)**. But many operators will not apply the AMM parking procedure if the aircraft only has a short turn-around time or remains on the flight line.

(fig.4)

Pitot probe locations on an Airbus A330 or A340 aircraft



PROCEDURES

Pitot Probe Performance Covered On the Ground

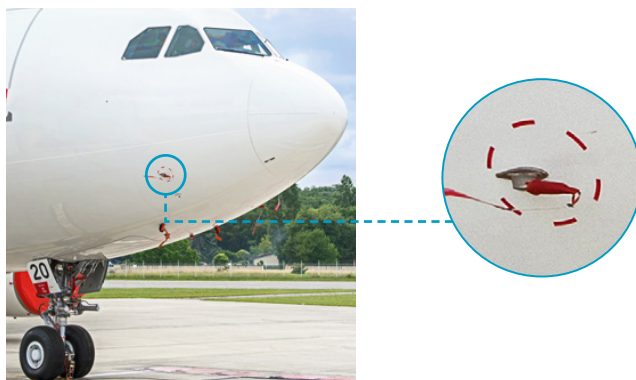
The proper protection for Pitot probes

Using the approved Pitot probe covers (**fig.5**) is important as the covers for other manufacturer's aircraft may not be the correct fit or offer complete protection for the Pitot probes of Airbus aircraft. The same Pitot probe cover can be used on Airbus A310, A320, A330, and A340 aircraft families

(PN: 98A10001005000 or alternate PN: A1000100500000). Airbus A380 and A350 aircraft have Multi-Function Probes (MFP) and a standby Pitot probe that use two different covers. Pitot probe and MFP covers are part of the flight kit for each aircraft.

(fig.5)

Example of Aircraft Pitot probe protective cover



When is Pitot probe too hot to handle on ground?

Protective covers can be installed 30 minutes after engines shut down as the probe heating is deactivated when engines are turned off. After a

period of 15 minutes for the probe tip to cool to 70°C, it can take an additional 15 minutes to reach ambient temperature. ■

AIRLINE ASSESSMENT – FROM OPERATIONAL BASES TO DESTINATION AIRPORTS

Is the Pitot probe protection a priority for ground handlers and maintenance teams?

With the recent finding from the example incident where a Pitot probe obstruction occurred in less than two hours, it is important to know if Pitot probe protection is a priority in local airport ground handling or turn-around procedures. The aircraft operator should collaborate with the local airport authorities to assess the risk of Pitot probes being blocked by sand, dust, dirt or insects activity at their operational base or destination airports.

For example, check if a wildlife management plan is part of the airport's hazard management strategy and what mitigations are in place to detect or manage insect activity. Confirm how each airport will alert airlines or operators where there is evidence that local conditions may contribute to an increased risk of Pitot blockage to aircraft on the ground.

Depending on the outcomes of this risk assessment, the operator should consider implementing a specific policy on the use of Pitot covers even for a short turn-around time. Some airlines already have policies in place for certain airports that require Pitot covers to be used for all aircraft on the ground regardless of turn-around times.

Airlines or operators should also report any in-service incidents of Pitot probe obstruction to the local airport authority and to Airbus. This will help to determine root causes, prevent further occurrences and track any trends of obstructions of Pitot probes on ground. ■

“ Some airlines already have policies in place for certain airports that require Pitot covers to be used for all aircraft on the ground regardless of turn-around times. ”

AIRPORT PROACTIVE PREVENTION STRATEGIES

The airports can also implement preventive actions following an assessment of the locally occurring risks such as regularly inspecting for wasps or other insects at their sites. It is important to continuously monitor and communicate with all airlines and aircraft operators about any seasonal increased insect activity, especially by wasps, and where there are local conditions causing accumulations of sand, dirt or fine particle dust. This will

alert aircraft operators and their ground handlers to consider applying additional preventive measures to protect Pitot probes with the approved covers, even for short aircraft turn-around times. If there is a persisting problem, it may be necessary to issue a Notice to Airmen (NOTAM) making the pilots aware of the risk **(fig.6)** and alert them to pay particular attention when checking their aircraft's Pitot probes for any risk of obstruction. ■

(fig.6)

Example extract from NOTAM with item [3.] warning of mud wasp activity and the recommendation to install Pitot tube covers - Courtesy of Brisbane Airport Corporation

AIP Australia

26 MAY 2016

FAC YBBN - 7

- b. Australian White Ibis flocking on airfield HJ, increased numbers expected February-June.
- c. Straw Necked Ibis present on airfield HJ, increased numbers expected July-October.
- d. Flying Fox HN only.
- e. Cattle Egret present on airfield HJ, increased numbers expected NOV-MAR.
- f. Increased pelican and cormorant in VCY of AD.
- 3. Significant mud wasp ACT WI AD VCY affecting pitot tubes. Pitot tube covers recommended. ←
- 4. Fuel/Oil clean-up/disposal are chargeable and must meet Governmental Environmental standards.
- 5. Due to local effects from structural and topographical features the ground winds advised on the ATIS may vary to the wind aloft. Where there is a significant variation reported in these winds, ATC will advise a reported 500FT wind in addition to the aerodrome wind.

CHARTS RELATED TO THE AERODROME

- 1. WAC 3340.
- 2. Aerodrome Obstruction Chart Type A Charts: RWY 14/32 - 11th Edition (MAR, 2014); RWY 01/19 - 10th Edition (MAR 2014).
- 3. Also refer to AIP Departure & Approach Procedures.

(fig.7)

Mud wasp awareness poster -
Courtesy of Brisbane Airport Corporation



(fig.8)

Array of 3D printed Pitot probes of various designs (A330, B737-400, B737-800, Dash-8, B747 and E190) used for monitoring wasp activity and ecology study at Brisbane airport. - Courtesy of Brisbane Airport Corporation



ADDITIONAL AIRPORT MEASURES – UPPING THE ANTE

An example of where collaboration between Airlines and Airports can enhance the operational safety of aircraft

Like many other airports around the world, being located in a sub-tropical environment means Brisbane Airport (BNE) is ever vigilant about the presence of mud wasps on site. While the airport has always maintained a stringent monitoring and control regime for these pests, following an incident whereby a mud wasp nest blocked the air data instruments of an Airbus aircraft during a standard turn-around at Brisbane Airport, the Brisbane Airport Corporation (BAC) upped the ante by introducing additional measures to mitigate the ongoing risk of Pitot blockage on ground.

Airport to Airline Communication

BAC recommends the use of Pitot probe covers on aircraft at BNE to prevent possible obstructions from mud wasp activity. Results from pest inspections carried out by pest management professionals are emailed out weekly to all airlines and stakeholders. The notifications include the location and number of nests found and treated. Their “Watch out for the Mud Wasp” awareness poster (**fig.7**) is a quick reference guide to the conditions to observe when the wasps are likely to be more active at BNE and details what information to report to the BAC wildlife coordinator via email or at the Brisbane Airport Wildlife Working Group.

Preventative pest control

BAC initiated a wasp ecology study consisting of an array of 3D printed Pitot probes of various designs (A330, B737-400, B737-800, Dash-8, B747 and E190), which are secured to sheets of metal to resemble the aircraft’s fuselage, and they are mounted in different parking positions around the airfield (**fig.8**). Each location is inspected regularly for evidence of mud wasp activity and when there are nests found in any of the 3D printed Pitot tube arrays the contents are hatched and examined by an ecologist. Results from the study are expected in February 2017. This will help BAC achieve a better understanding of the species of mud wasp present at Brisbane, the impacts that they can have on aircraft operations and any further measures that can be taken to mitigate the risk.

FLIGHT CREW FOCUS

ON PITOT PROBES

Additional safety barriers, embedded in Airbus Standard Operating Procedures (SOP), are available to flight crews in order to avoid taking-off with obstructed Pitot probes.

SOP Exterior Walk Around (FCOM section PRO-NOR-SOP-05)

Always look at the Pitot probes carefully during the pre-flight exterior inspection and check that all of the covers are removed before flight. Ensure there is no damage to the Pitot

probe and that the general condition is good. This will give confidence that the correct airspeed readouts will be available on all of the instruments in all flight phases.

SOP Take-off (FCOM section PRO-NOR-SOP-12)

During the take-off phase, a partially or totally obstructed Pitot probe may lead to an underestimated, fluctuating or “flagged” airspeed information on the Primary Flight Display (PFD) or standby instrument for the affected Pitot probe. In this case, there is likely to be an indicated airspeed discrepancy

which should be detected when cross checked with the other PFD. Standard Operating Procedures for Airbus aircraft require the flight crew to scan airspeeds shown on the PFD throughout the take-off and the Pilot Flying shall cross check and confirm the airspeed indicated on reaching 100 knots. ■

Pitot probe protection using the Airbus approved covers is the most effective way to prevent Pitot obstruction on ground.

Airlines and operators should assess and monitor the risk of any obstruction to their aircraft's Pitot probes at the airports where they are based or operating to. Airports can also play an active role by collaborating with their operators to manage airport hazards and communicate on any of the mitigations in place.

Where there is an identified risk of Pitot obstruction due to sand, dirt, dust or insect nesting activity, the operator should consider applying a specific policy to use Pitot covers for aircraft on the ground regardless of turn-around times.

Reporting any occurrences of Pitot probe obstruction to the local airport authorities and Airbus will help to monitor for adverse trends, put specific measures in place and communicate this information to the benefit of all airlines and operators.

Safety first

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