
WELCOMES
PILOTS
CONFERENCE FOR AIRLINE PILOT
Cold Weather Operation
EXCUSE ME, BUT WHERE IS EVERYBODY?

Cold Weather Operation-General

- Considerations associated with cold weather operation are primarily concerned with low temperatures and with ice, snow, slush, and standing water on the airplane, ramps, taxiways and runways. Icing conditions exist when OAT (on the ground) or TAT (in flight) is 10°C or below, and any of the following exist:
- • visible moisture (clouds, fog with visibility of one statute mile (1600 m) or less, rain, snow, sleet, ice crystals, and so on) is present, or
- • ice, snow, slush, or standing water is present on the ramps, taxiways, or runways.
- **CAUTION:** Do not use nacelle anti-ice when OAT (on the ground) is above 10°C. Do not use nacelle or wing anti–ice when TAT (in flight) is above 10°C.

Operating Limitations

- **Engine ignition**
- Continuous ignition must be on (ENGINE START switch in the CONT position) during takeoff and landing, operation in heavy rain and during engine anti–ice operations.
- **Fuel**

  Minimum tank fuel temperature prior to takeoff and inflight is - 43°C for 737NG or 3°C above the fuel freezing point temperature, whichever is higher.

  Note: The use of Fuel System Icing Inhibitor additives does not change the minimum fuel tank temperature limit.

Учёт низкой температуры топлива (Fuel Freeze Temperature)

- В полете температура топлива постепенно снижается до значения ТАТ. В некоторых географических районах температура топлива может снизиться до значений, близких к температуре начала кристаллизации (Fuel Freeze Temperature). Данное явление обычно характерно для полетов в зимнее время года над Восточной Сибирью, Арктической частью России, Канады, Гренландии. Следует отметить, что температура начала кристаллизации топлива не связана с замерзанием воды в топливе и образованием ледяных кристаллов, а связана с образованием парафинов твердой фракции в виде осадков, входящих в состав топлива. Температура начала кристаллизации топлива ещё не является критической с точки зрения потери тяги вследствие нарушения потока топлива через топливные насосы к двигателям. Но дальнейшее снижение температуры топлива приводит к снижению текучести и переходу топлива в полутвёрдое состояние и, как следствие, нарушению потока

Учёт низкой температуры топлива (Fuel Freeze Temperature)

- Но дальнейшее снижение температуры топлива приводит к снижению текучести и переходу топлива в полутвердое состояние и, как следствие, нарушению потока топлива через топливные насосы. В основном это происходит при температурах примерно на 6ºC ниже температуры начала кристаллизации. Темп снижения температуры топлива составляет обычно около 3ºC/час, но может достигать и 12ºC/час при низких температурах.
- Температуры начала кристаллизации различных сортов топлива: JET A-40ºC; JET A1 - 47ºC; JET B - 50ºC; ТС-1 и РТ - 50ºC
- Заправка различными сортами топлива может привести к тому, что в баках ВС образуется смесь с неизвестной температурой начала кристаллизации. В связи с этим при подготовке к полёту не следует автоматически считать температурой начала кристаллизации топлива на борту температуру начала кристаллизации заправляемого перед полётом топлива. В данном случае температурой начала кристаллизации топлива на борту необходимо считать наивысшую из температур начала кристаллизации сорта топлива, заправляемого в 3 последовательных заправках.
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Учёт низкой температуры топлива (Fuel Freeze Temperature)

- Так, например, в случае последовательных заправок топливом JET A, JET A1, ТС-1 температура начала кристаллизации будет – 40ºС, что соответствует JET A. Чтобы считать температурой начала кристаллизации -50ºС необходимо произвести три последовательных заправки топливом ТС-1.
- В соответствии с установленными ограничениями, на всех ВС фирмы Боинг, эксплуатируемых в АК, не допускается в полете понижение температуры топлива до величины выше на три градуса Цельсия температуры начала кристаллизации топлива.
- Ниже приведена таблица значений ТАТ в зависимости от скорости полёта и температуры окружающего воздуха.

Учет низкой температуры топлива (Fuel Freeze Temperature)

SAT (OAT) ºC	Mach Number									
	0,72	0,74	0,76	0,78	0,79	0,80	0,81	0,82	0,84	0,86
	TAT	TAT	TAT	TAT	TAT	TAT	TAT	TAT	TAT	TAT
- 60	- 38	- 36	- 35	- 35	- 34	- 33	- 32	- 32	- 30	- 29
- 62	- 40	- 39	- 37	- 37	- 36	- 35	- 35	- 34	- 32	- 31
- 64	- 42	- 41	- 40	- 39	- 38	- 38	- 37	- 36	- 35	- 33
- 66	- 45	- 43	- 42	- 41	- 41	- 40	- 39	- 38	- 37	- 35
- 68	- 47	- 45	- 44	- 43	- 43	- 42	- 42	- 40	- 39	- 38
- 70	- 49	- 48	- 46	- 46	- 45	- 44	- 44	- 43	- 41	- 40
- 72	- 51	- 50	- 49	- 48	- 47	- 47	- 46	- 45	- 44	- 42
- 74	- 53	- 52	- 51	- 50	- 50	- 49	- 48	- 47	- 46	- 44

Учёт низкой температуры топлива (Fuel Freeze Temperature)

- На этапе расчета OFP и предполетной подготовки рекомендуется:
- • Беря во внимание географию выполнения рейсов, для анализа возможной кристаллизации топлива в полете в зимнее время, рассматривать марку топлива JET A1.
- • Учитывать ограничения по температуре кристаллизации топлива. При планировании полета значение TAT должно быть на 4º выше начала кристаллизации топлива (один градус добавляется на точность прогноза).
- • Определить прогнозируемое значение TAT по OFP для тех поворотных пунктов, над которыми прогнозируется температура наружного воздуха (SAT/OAT) ниже -64ºC.
- Прогнозируемое значение TAT определяется по таблице «SAT/TAT Conversion Table» по значению прогнозируемой SAT над ППМ и расчетному числу М.

Действия экипажа в полете

- Учитывать тенденцию к снижению температуры топлива в баках до значения ТАТ. В целях исключения снижения температуры топлива в полете ниже допустимой возможно выполнение следующих процедур:
- • увеличение (по возможности) числа М полета. Увеличение числа М на 0.01 приводит к повышению ТАТ на 0.5 – 0.7°С. В данном случае необходимо учесть, что изменение температуры топлива при изменении ТАТ проявляется в течение от 15 минут до 60 минут;
- • изменение маршрута полета в сторону более теплых воздушных масс;
- • снижение до более теплых воздушных масс. Обычно отклонение от оптимального эшелона составляет 3000-5000 футов.
- При экстремально низких температурах, возможно, потребуется снижение до 25000 футов.

Cold Weather Operation Exterior Inspection

- Although removal of surface snow, ice, and frost is normally a maintenance function, during preflight procedures, the captain or first officer should carefully inspect areas where surface snow, ice or frost could change or affect normal system operations. Do the normal Exterior Inspection with the following additional steps:
- Surfaces .....Check
- Takeoff with light coatings of frost, up to 1/8 inch (3mm) in thickness, on lower wing surfaces due to cold fuel is allowable; however, all leading edge devices, all control surfaces, and upper wing surfaces must be free of snow, ice and frost. Thin hoarfrost is acceptable on the upper surface of the fuselage provided all vents and ports are clear. Thin hoarfrost is a uniform white deposit of fine crystalline texture, which usually occurs on exposed surfaces on a cold and cloudless night, and which is thin enough to distinguish surface features underneath, such as paint lines, markings, or lettering.

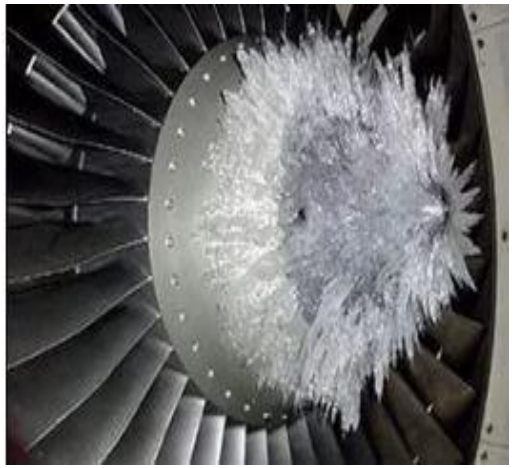
Cold Weather Operation
Exterior Inspection

- **Airplanes 737NG with Defined Cold-Soaked Fuel Frost Area**
- Visually inspect the lower and upper wing surfaces. If there is frost or ice on the lower surface outboard of measuring stick 4, there may also be frost or ice on the upper surface. The distance that the frost extends outboard of measuring stick 4 can be used as an indication of the extent of the frost on the upper surface.
- Takeoff with light coatings of frost on upper wing surfaces due to cold fuel (cold-soaked fuel frost) is allowable, provided the following conditions are met:
- • the frost on the upper surface is less than 1/16 inch (1.5 mm) in thickness
- • the extent of the frost is similar on both wings
- • the frost is on or between the black lines defining the allowable cold-soaked fuel frost area with no ice or frost on the leading edges or control surfaces
- • the ambient air temperature is above freezing (0°C, 32°F)

Cold Weather Operation
Exterior Inspection

- If all the above criteria are not met, all snow, ice and frost on the wings must be removed using appropriate deicing/anti-icing procedures.
- **Note:** If the frost on the lower surface is less than 1/16 inch (1.5 mm) in thickness, the frost on the upper surface will be less than 1/16 inch (1.5 mm) in thickness.
- • Control surface balance panel cavities .....Check
- Check drainage after snow removal. Puddled water may freeze in flight.
- • Pitot probes and static ports .....Check
- Verify that all pitot probes and static ports are free of snow or ice. Water rundown after snow removal may freeze immediately forward of static ports and cause an ice buildup which disturbs airflow over the static ports resulting in erroneous static readings even when the static ports are clear.
- • Air conditioning inlets and exits

Cold Weather Operation
Exterior Inspection



- • Engine inlets .....Check
- Verify that the inlet cowling is free of snow and ice. Verify that the fan is free to rotate. Snow or ice that accumulates on the fan spinner or fan blades during extended shutdown periods must be removed by maintenance or other means before engine start. Snow or ice that accumulates on the fan spinner or fan blades as a result of operation in icing conditions, such as during approach or taxi in, is allowed if the fan is free to rotate and the snow or ice is removed using the ice shedding procedure during taxi out and before setting takeoff thrust.
- • Fuel tank vents ..... Check
- Verify all traces of ice and frost are removed.
- • Landing gear doors ..... Check
- Landing gear doors should be free of snow and ice.

Температура в салонах

- К моменту посадки пассажиров температура воздуха в салоне должна быть не ниже +15°С при пониженных температурах наружного воздуха.

De-icing / Anti-icing Procedure

- Testing of undiluted de-icing/anti-icing fluids has shown that some of the fluid remains on the wing during takeoff rotation and initial climb. The residual fluid causes a temporary decrease in lift and increase in drag, however, the effects are temporary. Use the normal takeoff rotation rate.
- **CAUTION**: Operate the APU during de-icing only if necessary.
- If the APU is running, ingestion of de-icing fluid causes objectionable fumes and odors to enter the airplane. Ingestion of snow, slush, ice, or de-icing/anti-icing fluid can also cause damage to the APU.
- If de-icing/anti-icing is needed:
- • APU .....As needed
- The APU should be shut down unless APU operation is necessary.

De-icing / Anti-icing Procedure

- Call “FLAPS UP”.
- Flaps..... UP
- Prevents ice and slush from accumulating in flap cavities during de-icing.
- Thrust levers.....Idle
- Reduces the possibility of injury to personnel at inlet or exhaust areas.
- **WARNING:** Ensure that the stabilizer trim wheel handles are stowed before using electric trim to avoid personal injury.
- Stabilizer trim..... ____UNITS
- Set the trim for takeoff.
- Verify that the trim is in the green band.

De-icing / Anti-icing Procedure

- • Engine BLEED air switches .....OFF
- Reduces the possibility of fumes entering the air conditioning system.
- • APU BLEED air switch .....OFF
- Reduces the possibility of fumes entering the air conditioning system. After de-icing/anti-icing is completed:
- • APU .....As needed
- Wait approximately one minute after de-icing is completed to turn engine BLEED air switches on to ensure all de-icing fluid has been cleared from the engines:
- • Engine BLEED air switches.....ON

Engine Start Procedure

- Do the normal Engine Start Procedure with the following modifications:
- • If ambient temperature is below -35°C, idle the engine for two minutes before changing thrust lever position.
- • Several minutes may be needed for oil pressure to reach the normal operating pressure. During this period, oil pressure may go above the normal range and the FILTER BYPASS light may illuminate. Operate the engine at idle thrust until oil pressure returns to the normal range.
- • If the oil pressure remains above the normal range after the oil temperature has stabilized within limits, shut down the engine.

Engine Start Procedure

- • If the engine has been cold soaked for one or more hours at ambient temperatures below -40°C, do not start or motor the engine. Maintenance personnel should do appropriate procedures for adverse weather heating of the Hydro-Mechanical Unit.
- • If the engine has been cold soaked for three or more hours at ambient temperatures below -40°C, do not start or motor the engine. Maintenance personnel should do appropriate procedures for adverse weather starter servicing.
- • Display units may require additional warm-up time before displayed engine indications accurately show changing values.
- • Display units may appear less bright than normal.

Engine Anti–Ice Operation On the Ground

- Engine anti-ice must be selected ON immediately after both engines are started and remain on during all ground operations when icing conditions exist or are anticipated, except when the temperature is below –40°C OAT.
- **WARNING**: Do not rely on airframe visual icing cues before activating engine anti-ice. Use the temperature and visible moisture criteria because late activation of engine anti-ice may allow excessive ingestion of ice and result in engine damage or failure.
- **CAUTION:** Do not use engine anti-ice when OAT is above 10°C.
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Engine Anti–Ice Operation On the Ground

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- When engine anti-ice is needed:
- • ENGINE START switches .....CONT
- • ENGINE ANTI-ICE switches .....ON
- Verify that the COWL VALVE OPEN lights illuminate bright, then dim. Verify that the COWL ANTI-ICE lights are extinguished.

. **Note:** If the COWL VALVE OPEN lights remain illuminated bright with engines at IDLE, position APU BLEED air switch to OFF and increase thrust slightly (up to a maximum of 30% N1). When engine anti-ice is no longer needed:

- • ENGINE ANTI-ICE switches .....OFF
- Verify that the COWL VALVE OPEN lights illuminate bright, then extinguish.

Before Taxi Procedure

Do the normal Before Taxi Procedure with the following modifications:

- GENERATOR 1 and 2 switches .....ON

Normally the IDG's will stabilize within one minute, although due to cold oil, up to five minutes may be needed to produce steady power.

- Flight controls .....Check

An increase in control forces can be expected at low temperatures.

CAUTION: The flap position indicator and the leading edge devices annunciator panel should be closely observed for positive movement. If the flaps should stop, the flap lever should be placed immediately in the same position as indicated.

- Flaps .....Check

Move the flaps from Flaps up to Flaps 40 back to Flaps up (i.e., full travel) to ensure freedom of movement.

Before Taxi Procedure

- If taxi route is through ice, snow, slush or standing water in low temperatures or if precipitation is falling with temperatures below freezing, taxi out with the flaps up. Taxiing with the flaps extended subjects the flaps and flap drives to contamination. Leading edge devices are also susceptible to slush accumulations.

Call “FLAPS ___”…….. as needed

- Flap lever ……Set flaps, as needed

Taxi-Out Procedure

- When engine anti-ice is required and the OAT is 3°C or below, do an engine run up, as needed, to minimize ice build-up. Use the following procedure:
- Check that the area behind the airplane is clear. Run-up to a minimum of 70% N1 for approximately 30 seconds duration at intervals no greater than 30 minutes.
- **Note:** Fan blade ice build up is cumulative. If the fan spinner and fan blades were not deiced prior to taxi out, the time the engines were operating during the taxi in should be included in the 30 minute interval.
- If airport surface conditions and the concentration of aircraft do not allow the engine thrust level to be increased to 70% N1, then set a thrust level as high as practical and time at that thrust level.
- **Note:** When operating in conditions of freezing rain, freezing drizzle, freezing fog or heavy snow, run-ups to a minimum of 70% N1 for approximately 1 second duration at intervals no greater than 10 minutes enhance ice shedding.

Takeoff Procedure

- Do the normal Takeoff Procedure with the following modification:
- When engine anti-ice is required and the OAT is 3° C or below, the takeoff must be preceded by a static engine run-up. Use the following procedure:
- • Run-up to a minimum of 70% N1 and confirm stable engine operation before the start of the takeoff roll. A 30-second run-up is highly recommended whenever possible.

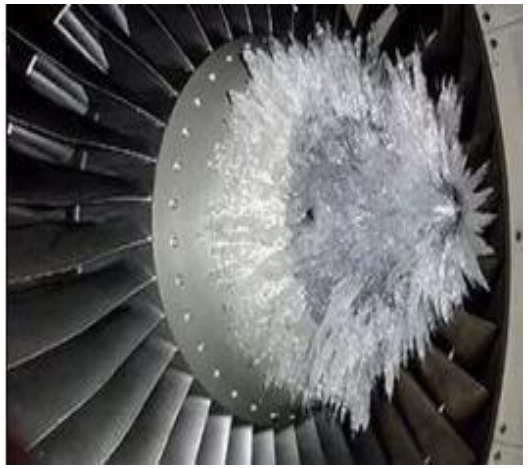
Engine Anti-Ice Operation - In Flight

- Engine anti–ice must be ON during all flight operations when icing conditions exist or are anticipated, except during climb and cruise when the temperature is below -40°C SAT. Engine anti–ice must be ON before, and during descent in all icing conditions, including temperatures below -40°C SAT. When operating in areas of possible icing, activate engine anti–ice before entering icing conditions.
- **WARNING:** Do not rely on airframe visual icing cues before activating engine anti–ice. Use the temperature and visible moisture criteria because late activation of engine anti-ice may allow excessive ingestion of ice and result in engine damage or failure.
- **CAUTION:** Do not use engine anti-ice when TAT is above 10°C.

Engine Anti-Ice Operation - In Flight

- When engine anti-ice is needed:
- • ENGINE START switches .....CONT
- • ENGINE ANTI-ICE switches .....ON
- Verify that the COWL VALVE OPEN lights illuminate bright, then dim.
- Verify that the COWL ANTI-ICE lights are extinguished.
- **Note:** If the COWL VALVE OPEN lights remain illuminated bright with engines at IDLE, increase thrust slightly (up to a minimum of 30% N1).
- When engine anti-ice is no longer needed:
- • ENGINE ANTI-ICE switches .....OFF
- Verify that the COWL VALVE OPEN lights illuminate bright, then extinguish.

Fan Ice Removal



- **CAUTION:** Avoid prolonged operation in moderate to severe icing conditions.
- Severe icing can usually be avoided by a change in altitude and/or airspeed. If flight in moderate to severe icing conditions cannot be avoided, do the following on both engines, one engine at a time at approximately 15 minute intervals:
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- • Thrust .....Increase
- Increase thrust to a minimum of 80% N1 for approximately 1 second to ensure the fan blades and spinner are clear of ice. Engine vibration may occur due to fan blade/spinner icing.
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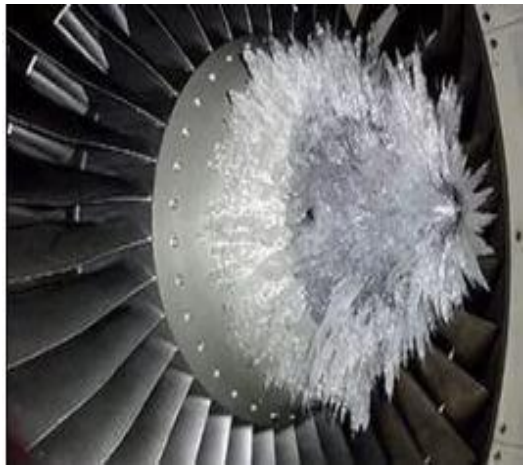
Fan Ice Removal



- If engine vibration continues after increasing thrust, do the following on both engines, one engine at a time:
- • ENGINE START switch .....FLT
- • Thrust .....Adjust
- Adjust thrust to 45% N1. After approximately five seconds, increase thrust lever slowly to a minimum of 80% N1.
- **Note:** Engine vibration may reduce to a low level before 80% N1 is reached, however, thrust increase must continue to a minimum of 80% N1 to remove ice from the fan blades.
- **Note:** Engine vibration may indicate full scale prior to shedding ice, however, this has no adverse effect on the engine.
- If vibration does not decrease, do the procedure for HIGH ENGINE VIBRATION “If not in icing conditions.”
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Wing Anti-Ice Operation In Flight

- Ice accumulation on the flight deck window frames, windshield center post, or on the windshield wiper arm may be used as an indication of structural icing conditions and the need to turn on wing anti-ice.

In flight, the wing anti-ice system may be used as a deicer or as an anti-icer.

The primary method is to use it as a de-icer by allowing ice to accumulate before turning wing anti-ice on. This procedure provides the cleanest airfoil surface, the least possible runback ice formation, and the least thrust and fuel penalty. Normally it is not necessary to shed ice periodically unless extended flight through icing conditions is necessary (holding).

The secondary method is to use wing anti-ice before ice accumulation. Operate the wing anti-ice system as an anti-icer only during extended operations in moderate or severe icing conditions, such as holding.

Wing Anti-Ice Operation In Flight

CAUTION: Do not use wing anti-ice when TAT is above 10°C.

CAUTION: Use of wing anti-ice above approximately FL350 may cause bleed trip off and possible loss of cabin pressure.

Note: Prolonged operation in icing conditions with the leading edge and trailing edge flaps extended is not recommended. Holding in icing conditions with flaps extended is prohibited.

When wing anti-ice is needed:

- WING ANTI-ICE switch .....ON

Verify that the L and R VALVE OPEN lights illuminate bright, then dim.

When wing anti-ice is no longer needed:

- WING ANTI-ICE switch ..... OFF

Verify that the L and R VALVE OPEN lights illuminate bright, then extinguish.

Approach and Landing

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- **For 737 NG airplanes:**
- Use normal procedures and reference speeds unless a flaps 15 landing is planned.
- - If a flaps 15 landing will be made: Set VREF 15.
- - If any of the following conditions apply, set VREF ICE = VREF 15 + 10:
- • engine anti–ice will be used during landing
- • wing anti–ice has been used any time during the flight
- • icing conditions were encountered during the flight and the landing temperature is below 10°C.

After Landing Procedure

- **CAUTION:** Taxi at a reduced speed. Use smaller nose wheel steering wheel and rudder inputs and apply minimum thrust evenly and smoothly. Differential thrust may be used to help maintain airplane momentum during turns. At all other times, apply thrust evenly. Taxiing on slippery taxiways or runways at excessive speed or with high crosswinds may start a skid.
- **CAUTION:** When operating the engines over significant amounts of standing de-icing or anti-icing fluid, limit thrust to the minimum required. Excessive ingestion of de-icing or anti-icing fluid can cause the fluid to build up on the engine compressor blades resulting in compressor stalls and engine surges.

After Landing Procedure

- Do the normal After Landing Procedure with the following modifications:
- After prolonged operation in icing conditions with the flaps extended, or when an accumulation of airframe ice is observed, or when operating on a runway or taxiway contaminated with ice, snow, slush or standing water:
- Do not retract the flaps until the flap areas have been checked to be free of contaminants.
- Engine anti-ice must be selected ON and remain on during all ground operations when icing conditions exist or are anticipated, except when the temperature is below –40°C OAT.

After Landing Procedure

- **CAUTION:** Do not use engine anti-ice when OAT is above 10°C. When engine anti-ice is needed:
- • ENGINE START switches .....CONT
- • ENGINE ANTI-ICE switches .....ON Verify that the COWL VALVE OPEN lights illuminate bright, then dim.
- Verify that the COWL ANTI-ICE lights are extinguished.
- **Note:** If the COWL VALVE OPEN lights remain illuminated bright with engines at IDLE, increase thrust slightly (up to a maximum of 30% N1).
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- When engine anti-ice is no longer needed:
- • ENGINE ANTI-ICE switches ..... OFF
- Verify that the COWL VALVE OPEN lights illuminate bright, then extinguish.
- • ENGINE START switches ..... OFF

After Landing Procedure

- When engine anti-ice is required and the OAT is 3°C or below, do an engine run up, as needed, to minimize ice build-up. Use the following procedure:
- • Check that the area behind the airplane is clear. Run-up to a minimum of 70% N1 for approximately 30 seconds duration at intervals no greater than 30 minutes.
- • If airport surface conditions and the concentration of aircraft do not allow the engine thrust level to be increased to 70% N1, then set a thrust level as high as practical and time at that thrust level.
- **Note:** When operating in conditions of freezing rain, freezing drizzle, freezing fog or heavy snow, run-ups to a minimum of 70% N1 for approximately 1 second duration at intervals no greater then 10 minutes should be considered.

Shutdown Procedure

- After landing in icing conditions do the following step before starting the normal Shutdown Procedure:
- **WARNING:** Ensure that the stabilizer trim wheel handles are stowed before using electric trim to avoid personal injury.
- • Stabilizer trim..... Set 5 units

- Prevents melting snow and ice from running into balance bay areas. Water in these areas can freeze and lock controls.

Secure Procedure

- Do the normal Secure Procedure with the following modifications:
- If the airplane will be attended and warm air circulation throughout the cargo E/E compartments is desired:
- **CAUTION:** Do not leave the interior unattended with a pack operating and all doors closed. With the airplane in this configuration, accidental closure of the main outflow valve can cause unscheduled pressurization of the airplane.
- • APU .....Start
- • APU GENERATOR bus switches .....ON
- • One PACK switch .....AUTO
- • ISOLATION VALVE switch AUTO

Secure Procedure

- **CPCS airplanes**
- • Pressurization mode selector .....MAN AC
- **DCPCS airplanes**
- • Pressurization mode selector .....MAN
- **CPCS airplanes**
- • FLT/GRD .....GRD
- • Outflow valve switch .....OPEN
- Prevents aircraft pressurization.
- **Note:** The airplane must be parked into the wind when the outflow valve is full open.
- • APU BLEED air switch .....ON

Secure Procedure

- If the airplane will not be attended, or if staying overnight at off-line stations or at airports where normal support is not available, the flight crew must arrange for or verify that the following steps are done:
- **CPCS airplanes**
- • Pressurization mode selector ……..…MAN AC
- **DCPCS airplanes**
- • Pressurization mode selector…….……..MAN
- • Outflow valve ……CLOSE
- Position the outflow valve fully closed to inhibit the intake of snow or ice.
- • Wheel chocks .....Verify in place
- • Parking brake.....Released

Secure Procedure

- Cold weather maintenance procedures for securing the airplane may be required. These procedures are normally done by maintenance personnel, and include, but are not limited to:
- • protective covers and plugs installed
- • water storage containers drained
- • toilets drained
- • doors and sliding windows closed
- • battery(batteries) removed. If the battery(batteries) will be exposed to temperatures below -18°C, the battery(batteries) should be removed and stored in an area warmer than -18°C, but below 40°C. Subsequent installation of the warm battery ensures the starting capability of the APU.

Спасибо
за внимание.

РОССИЯ