Tutorial A2A B377 Captain Of The Ship

Pressurized Cabin Operation

The following checklist/tutorial is a Standard of Operation (SOP) which applies to all similar systems although with small variations in altitude settings and timing. However, safe operation is nevetheless guaranteed for this operation within Flight Simulator X. It is intended for people who have never operated a pressurization system before and therefore it is a bit more expanded and descriptive than might be found in a conventional SOP or even a Flight Checklist. Most of the checklist items in this SOP would be depicted as a single item 'Pressurization ..... CHECKED' in the Flight Checklist.

The B377 Stratocruiser features a standard pressurized cabin with standard controls much like those found in almost any vintage A/C but also up to 'almost' modern airliners like a DC 9 for example. The main controls of such systems are generally:

- Cabin Rate Controller
- Cabin Altitude Selector
- Cabin Altitude/Differential Pressure Indicator
- Turbo Bleeder Switches*
- Cabin Differential Pressure Gauges*
- Dump (safety) Valve
  *those are unique on turbocharged piston engine systems

For proper operation of the Turbochargers see the respective tutorial.

The maximum differential pressure is around 6.5 PSI which can be derived from the differential pressure indicator. This 6.5 PSI equals the differential pressure between a flight altitude of 30'00' ft and a cabin altitude of 8000 ft.

For safety reasons cabin altitude should not be set much above 8000 ft and for comfort reasons the climb/descend rate should not exceed the magnitude of 300 FPM in normal operation.

The B377 uses – very much like all turbocharged piston engined aircraft - pressurized air from the turbos. Unlike other A/C however the B377 SOP for the engine handling does not allow turbosuperchargers to operate on takeoff. Therefore no pressurized air is available during the take-off run. Furthermore like in all pressurized systems a Turob Differential Pressure of min. 2 PSI is required for proper operation of the whole Pressurization System. This means that the turbos should not be reduced to supply just enough power for the engines. It is imperative to observe the minimum required pressure of 2 PSI on Cabin Differential Pressure Gauges.

A few more hints for pressurized cabin operation:

1. A different reading of the two hands in the Cabin Difference Pressure Indicator indicates the build-up of differential pressure. The cabin altitude can NEVER be higher than the A/C altitude. This would indicate a negative differential pressure. This is inibited by Negative Pressure Relief Valves.

2. Be careful not to 'overtake' the cabin during descent. A sporty descent might be spectacular but the passengers will be less pleased if they get to feel the high rate of descent of the aircraft instead of a gentle descent with some 300 FPM towards landing altitude.

3. Before landing and definitely before door operation by the cabin crew make sure that the differential pressure is ZERO. Not all A/C are equipped with a safety switch for dump valve operation. Two conditions for cabin residual pressure can be distinguished:

   a) There's a considerable residual pressure: even the strongest Flight Attendant will not be able to operate any door. This is the safe variant.

   b) There's only a small residual pressure: The Flight Attendant will be able to open the door, however due to the large air mass even behind a relatively small residual pressure the door will slam open and it wouldn't be the first time that a Flight Attendant – firmly holding the door handle – will swing freely outside the aircraft.... A funny look but quite unpleasant for all concerned.

Checklist for Cabin Pressurization Operation

BEFORE STARTING ENGINES

1. Dump Valve	OPEN
2. Cabin Altitude Selector	SET PRESS. ALT. +1000 ft
3. Cabin Rate Controller	SET ZERO RATE
4. Differential Pressure	CHECK ZERO

AFTER STARTING ENGINES

1. Dump Valve	CLOSED
2. Differential Pressure	CHECK ZERO

AFTER TAKE-OFF

1. Turbos Active	CHECK
2. Cabin Altitude Selector	SET DESIRED ALTITUDE
3. Cabin Rate Controller	OPEN
4. Cabin Rate Indicator	CHECK

DURING CLIMB

1. Selected Altitude	VERIFY/RESET
2. Cabin Rate Indicator	CHECK
3. Differential Pressure	CHECK

REACHING CRUISE LEVEL

1. Selected Altitude	CHECK
2. Cabin Rate Indicator	CHECK ZERO

TOP OF DESCENT

1. Cabin Rate Selector	SET ZERO
2. Cabin Altitude Selector	SET PRESS. ALT +1000 ft
3. Cabin Rate Selector	OPEN
4. Cabin Rate Indicator	CHECK

DURING DESCENT

1. Cabin Altitude	CHECK
2. Differential Pressure	CHECK

AT INITIAL APPROACH ALTITUDE

1. Cabin Altitude	CHECK
2. Cabin Rate Indicator	CHECK ZERO

ON GROUND

1. Differential Pressure	CHECK ZERO
2. Dump Valve	OPEN
3. OK to Cabin Attendants	SIGNALLED

Expanded Checklist for Cabin Pressurization Operation

BEFORE STARTING ENGINES

1. **Dump Valve** **OPEN**

This is to ensure that no cabin pressure can build up despite any malfunction/mishandling.

2. **Cabin Altitude Selector** **SET PRESS. ALT. +500 ft**

Calculate the Pressure Altitude of the Departure Airport by following method: For each Hectopascal QNH above STD deduct 27 ft from the official Airport Elevation. For each Hectopascal QNH below STD add 27 ft to the official Airport elevation. Add 1000 ft to the result and set the Cabin Altitude Selector to that value on the outermost scale.

3. **Cabin Rate Controller** **SET ZERO RATE**

To avoid pressure surges during initial pressurizing of the whole system the rate controller set to ZERO adds considerable comfort.

4. **Differential Pressure** **CHECK ZERO**

This is a system check. If all the previous steps were conducted no differential pressure is allowed. If there is still an indication most probably the indication instrument is faulty.

AFTER STARTING ENGINES

1. **Dump Valve** **CLOSED**

The system is now active and ready to be pressurized.

2. **Differential Pressure** **CHECK ZERO**

As no turbosupercharger should be active at this time no differential pressure is allowed to build up. A differential pressure ZERO can be verified by the cabin altitude indication which must be equal to the aircraft's altitude indication.

AFTER TAKE-OFF

1. **Turbos Active** **CHECK**

A quick look to the Cabin Diffferential Pressure Gauges will confirm that the turbos are active after take-off.

2. **Cabin Altitude Selector** **SET DESIRED ALTITUDE**

Calculate the desired cabin altitude according to the selected Flight Level using the chart at the end of this section. Always use the lowest possible altitude for passenger comfort.

3. **Cabin Rate Controller** **OPEN**

Open the Cabin Rate Controller very slowly to avoid pressure surges. Select a climb rate which ensures that the cabin altitude is reached before the aircraft is at its cruising level. If the rate is selected too low the maximum differential pressure might be reached before the cabin has reached it's target altitude. In this case the maximum differential pressure would be the limiting factor and the cabin would be 'pulled up' by the climbing aircraft. Not an issue with the low climb rates of the B377 at high altitudes. In jets however this would be very uncomfortable for the passengers.

4. **Cabin Rate Indicator** **CHECK**

Check that the Cabin Rate Indicator is moving into the climb range. Showing a descend or no rate at all indicates a system malfunction. However there's no hurry to set the cabin altitude. A cabin climb to 8000 ft will take some 25 min. which is much less than what the aircraft needs to 30'000 ft.

DURING CLIMB

1. **Selected Altitude** **VERIFY/RESET**

Check whether the initial climb schedule/selected Flight Level is still valid. A change in Flight Level Selection will require the Cabin Altitude Selector to be readjusted. For low cruising altitudes where the maximum differential will not be reached leave the initial cabin altitude or set the landing airport pressure altitude + 1000 ft.

2. **Cabin Rate Indicator** **CHECK**

The Cabin Rate Indicator should either still show the selected rate or indicate ZERO if the desired cabin altitude is already reached.

3. **Differential Pressure** **CHECK**

The differential pressure can be verified by the difference between the cabin altitude hand and the aircraft altitude hand. It should always be within the green band.

REACHING CRUISE LEVEL

1. **Selected Altitude** **CHECK**

When reaching Cruising Altitude the Cabin Altitude Indication should be equal to the selected altitude. Furthermore it should not enter the red sector of the differential pressure band. This indicates either a system malfunction or a miscalculation.

2. **Cabin Rate Indicator** **CHECK ZERO**

The cabin rate must be zero at this time. If not a system malfunction must be presumed and appropriate measures should be taken.

TOP OF DESCENT

1. **Cabin Rate Selector** **SET ZERO**

This is a general rule: whenever you change the Selected Altitude at a steady cabin altitude always set the rate controller to ZERO before you move the Cabin Altitude Selector. It is a pure comfort item for the passengers and has nothing to do with safe operation. Do not hurry with the cabin descent. A descent from 8000 ft to 1000 ft will take approx. 24 min. for a cabin rate of 300 FPM. The aircraft's descent however will take much longer. So it is a good idea to wait some 5 min. after Top of Descent to start with the cabin descent.

2. **Cabin Altitude Selector** **SET PRESS. ALT +1000 ft**

Do the same calculations for your Destination Airport as you did before departure. If not sure about the local QNH just add 1000 ft to the airport altitude.

3. **Cabin Rate Selector** **OPEN**

Again open the Cabin Rate Controller very slowly to avoid pressure surges. Select a descend rate that will allow the cabin to be a its target altitude before the aircraft.

4. **Cabin Rate Indicator** **CHECK**

Check that the Cabin Rate Indicator is moving into the descend range. Showing a climb or no rate at all indicates a system malfunction.

DURING DESCENT

1. **Cabin Altitude** **CHECK**

Make frequent quick checks to ensure the cabin altitude corresponds to the selected average descent rate.

2. **Differential Pressure** **CHECK**

Make sure the maximum differential pressure is never reached during descent.

AT INITIAL APPROACH ALTITUDE

1. **Cabin Altitude** **CHECK**

This is the moment of truth. The cabin altitude must be steady at the selected value. If not be sure to undertake corrective actions immediately. There's not too much time left.

2. **Cabin Rate Indicator** **CHECK ZERO**

Also the cabin rate must be zero at this stage. If you had time to check the instruments (of course you don't....) you would see that after passing the last 1000 ft AAL the Cabin Rate Indicator would indicate the same descent rate as the aircraft which confirms that from now on the cabin is unpressurized.

ON GROUND

1. **Differential Pressure** **CHECK ZERO**

Those are the last securing operations. Of course there will be no residual pressure.

2. **Dump Valve** **OPEN**

Another safety operation. Whatever happens during an engine test run or any non-standard operation on ground the cabin is secured from being pressurized on ground.

3. **OK to Cabin Attendants** **SIGNALLED**

A good idea to give a 'thumbs up' to the Flight Attendants. Still an issue in today's operation however modern aircraft have a residual pressure warning light in the door operating mechanism.

Cabin Altitude Selection Table for DP 6.5 PSI

Pressure Altitude	Cabin Target Altitude
30'000 ft	8000 ft
28'000 ft	7100 ft
26'000 ft	6200 ft
24'000 ft	5100 ft
22'000 ft	4000 ft
20'000 ft	2900 ft
18'000 ft	1800 ft