B-767/B-757 REDUCED POWER VS. DE-RATED POWER FOR TAKEOFF AND CLimb

Confusion may exist as to how to differentiate between all of the possibilities and more importantly, how to apply these concepts operationally. The following paragraphs summarize the options that may be encountered on the line (please note the differentiation between ACTIVE vs. ARMED and TAKEOFF vs. CLIMB as it pertains to thrust REDUCTION or thrust DE-RATE):

All 757’s: Use the Assumed Temperature Method (ATM) only (by definition REDUCED, as opposed to De-Rated thrust, and therefore not an operating limit) for TAKEOFF thrust reduction. Fixed DE-RATE for CLIMB thrust reduction of 6% (1) or 12% (2) of full rated climb thrust is available. It is ARMED on the ground (indicated by a white 1 or 2 on the upper EICAS) and automatically ACTIVATES at the thrust reduction altitude when VNAV or FLCH is selected (1000’AGL for NADP-2). The 757 APS data is not yet modified to include data for DE-RATE (1 or 2) CLIMB capability. Full rated thrust on one or both engines is available during TAKEOFF. In the example on the left, an ATM T/O with a pre-selected DE-RATE for CLB 2 is selected. A green D-TO with a white 2 is shown, indicating a fixed de-rate is ARMED for the automatic CLIMB thrust reduction...nominally at 1000’AGL. In the example on the right, an ATM T/O with no de-rated climb is selected.

KIND B-767 side numbers - 077, 078, 079: Exactly the same as all of the 757’s for takeoff (ATM, REDUCED) but NOT operationally the same for climb because the APS allows us to confirm climb gradient capability above 1000’ AGL utilizing DE-RATED climb thrust 1 or 2. Fixed DE-RATE for climb thrust reduction may be set on the ground (indicated by a white 1 or 2 on the upper EICAS) or selected at thrust reductions altitude. Full rated thrust available on one or both engines during takeoff.
**All 767LDS and KIND 297 and 298:** ATM REDUCED thrust (as much as 25% reduction) OR fixed DE-RATE of 10% (1) or 20% (2) OR a combination of the two methodologies are available for TAKEOFF thrust reduction. Unlike the ATM REDUCED thrust used in the 757, fixed DE-RATE (green TO 1 or TO 2 on the upper EICAS) or a combination of fixed DE-RATE and ATM (green +53 D TO 1 or +53 D TO 2), is an operationally limited thrust given the conditions entered in the APS for a given runway. This thrust limit constitutes an operational limit and therefore must not be exceeded during takeoff (VMCG/VMCG considerations) unless BOTH engines are advanced beyond the reduced and/or de-rated thrust value.

Selection of 1 or 2 on the TMSP in addition to entering an assumed temperature in the FMS Takeoff Ref page allows for the combination of reduced and de-rated thrust for takeoff.

Selection of 1 or 2 on the TMSP prior to takeoff also ARMS the fixed DE-RATE climb thrust reductions (auto activated at thrust reduction altitude)

If you see a GREEN D-TO 2 or 1, on the upper EICAS prior to takeoff, then you have selected a fixed de-rate for TAKEOFF and it is active, regardless of whether or not an assumed temp is entered.
CLIMB
In the example on the left, we can climb at max climb thrust as indicated by the green CLB. In the example in the center, a fixed DE-RATE climb thrust reduction of 10% has auto activated (if armed on deck) at thrust reduction altitude. In the example on the right, a fixed DE-RATE climb thrust reduction of 20% has auto activated (if armed on deck) at thrust reduction altitude.

Note: In 767LDS and KIND 297 and 298 aircraft, CLB 2 de-rate will automatically increase to CLB1 thrust at approximately 10,000’. CLB1 thrust will automatically increase to CLB thrust at approximately 30,500’. If CLB 2 is auto activated at thrust reduction altitude, the TMSP thrust selection display will stay in CLB2 through cruise altitude. If CLB1 is auto activated at thrust reduction altitude, the TMSP thrust selection display will stay in CLB1 until 30,500’ and then will indicate CLB through cruise.

All 757 and LAN 767’s require manual selection/de-selection of climb thrust modes.

SUMMARY
1. Thrust reduction during takeoff and climb is utilized in order to reduce operating costs of engines, increase engine reliability, and prolong engine life. In some circumstances, de-rated takeoff thrust can also increase MTOGW if MTOGW is limited by V1MCG.

2. Thrust reduction for takeoff and thrust reduction for climb are two separate events. Takeoff begins at thrust lever advance on the runway and ends (nominally) at 1000’ AGL. Climb begins at the thrust reduction altitude (as programmed...nominally 1000’) and ends at TOC. Takeoff reductions reduce from a baseline max rated takeoff thrust. Climb reductions reduce from a baseline max rated climb thrust.
3. There are three ways to reduce takeoff thrust for takeoff:
757: ATM (REDUCED) only.
767 Lan airplanes: ATM (REDUCED) only.
767LDS and 767 Silkway: ATM (REDUCED), fixed de-rate (DE-RATE 1 or 2), or combination (typical) of the two.

4. There is one way to reduce climb thrust for climb: DE-RATE as selected on the ground prior to departure (ARMED) or as selected in flight (presumably after clearing a climb gradient altitude).

5. The Takeoff Ref page is exactly that: A takeoff page. The only thing on the Takeoff Ref page that applies to climb is the altitude at which thrust is reduced from the takeoff thrust setting (standard or max) to the climb thrust setting (de-rated or not de-rated).

6. There is a difference between arming and selecting (activating). If 1 or 2 is pushed on the TMSP prior to departure it ARMS the auto de-rated climb thrust selection in the 757's and Lan 767's. It selects and displays a de-rated takeoff thrust setting and ARMS a de-rated climb thrust setting in the Silk airplanes.

7. Reading and understanding the APS, Upper EICAS and Takeoff Ref page is the key. 757's and 767 Lans: If the APS allows for a standard power takeoff, the takeoff ref page and the upper EICAS screen will display an assumed temperature (upon entry by the captain) and D-TO. IE; 51 *C D-TO. The "D" is confusing because by definition ATM is a REDUCED thrust setting, not a DE-RATE takeoff thrust setting as selected from the TMSP. It would be more accurate and easier to understand if it read: 51*C R-TO. But it doesn't. On these airplanes we won't ever see a number (1 or 2) associated with a takeoff thrust setting on the takeoff reference page because a fixed de-rate for TAKEOFF cannot apply. Fixed de-rates only apply to the CLIMB thrust selection. If 1 or 2 is armed for climb, the fixed de-rates of 6 or 12 percent will occur at the thrust reduction altitude displayed on the FMS Takeoff Ref page.

If there is a number (1 or 2) on the Takeoff Ref page, a fixed de-rate has been selected for takeoff (and armed for climb) and the takeoff thrust setting is an operational limit (Upper EICAS Thrust Reference Mode displayed in GREEN). Fully rated thrust is NOT available on the good engine in the event of an engine failure during takeoff.

8. All 757's: If there is a climb gradient requirement above 1000' we do not select (Arm) the 1 or 2 fixed de-rated climb thrust selections because the APS on the 757's does not yet (it will eventually) allow for the selection of climb one or climb two data which would prove that we can meet the published climb gradient requirements. Consequently, thrust is reduced to the full rated climb thrust at the thrust reduction altitude.
9. All 767's: The APS has been modified to include CLB1 and CLB2 performance data (by definition, climb is above 1000') which is why we can pre-select (Arm) 1 or 2 on the TMSP if we can meet or exceed the climb gradient requirements, even above 1000'.

10. According to Boeing: 757 & 767 TMC also limits the reduced takeoff thrust setting to no lower than the armed climb thrust setting

11. As a technique, a crew may want to brief thrust capabilities during takeoff in the event of an engine failure at or after V1. IE: "we may (or may not) advance the thrust lever on the good engine in the event of an engine failure at or after V1"