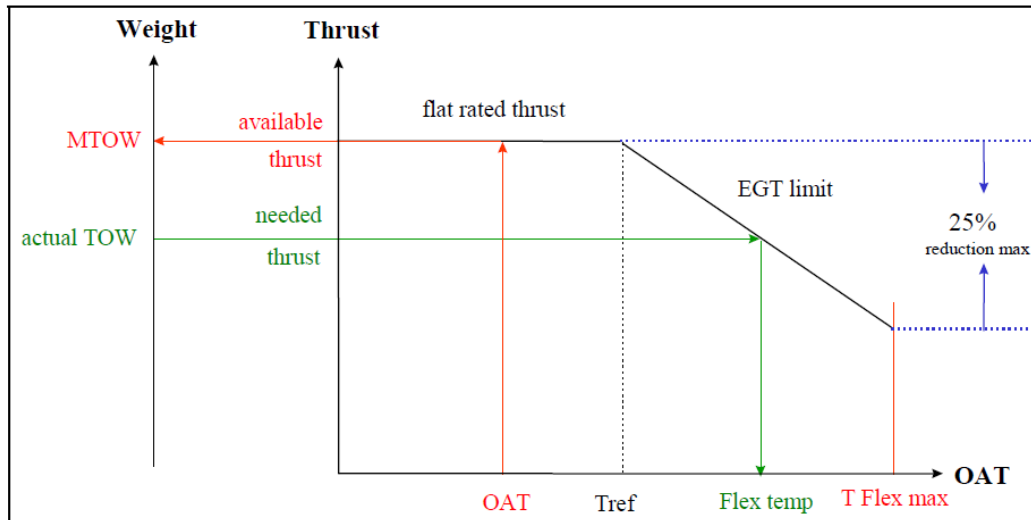


A320 TAKEOFF PERFORMANCE

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DETERMINING THE MAX PERMISSIBLE TOW AND SPEEDS

BASIC STEPS

- Determine the Weight and Speeds
- Apply Corrections
- Speed Check
- CG Check

DETERMINING THE FLEX TEMPERATURE AND SPEEDS

BASIC STEPS

- Determine the Temperature and Speeds
- Apply Corrections
- Speed Check
- Temp Check
- CG Check

DETERMINING THE MAX PERMISSIBLE TOW AND SPEEDS

A320214 - JAA	CFM56-5B4 engines	ISB INT'L AIRPORT ISB - OPIS	28L	34.0.3 05-Apr-18 AE214B02 V20				
QNH 1013.25 HPA Air cond. Off Anti-icing Off All reversers inoperative Dry check		Elevation 1761 FT TORA 3658 M Isa temp 12 C TODA 3848 M Rwyslope -1.00% ASDA 3658 M Line up dist. TOD/ASD: 0 M / 0 M	1 obstacle	DRY				
OAT	CONF 1+F			CONF 2				
C	TAILWIND -10 KT	WIND 0 KT	HEADWIND 10 KT	HEADWIND 20 KT	TAILWIND -10 KT	WIND 0 KT	HEADWIND 10 KT	HEADWIND 20 KT
64	64.3 4/6 147/51/52	65.8 4/6 159/60/61	66.0 1/4 163/63/64	66.0 2/4 161/63/64	64.2 2/4 146/49/52	65.3 4/6 157/57/61	65.4 2/4 156/58/62	65.4 2/4 155/58/62
60	66.6 4/6 145/51/52	68.3 2/4 156/59/60	68.7 4/6 160/63/63	69.0 4/6 164/66/67	66.6 4/6 143/48/52	67.9 4/6 154/57/61	68.3 2/4 158/60/64	68.4 2/4 160/62/66
56	69.1 4/6 142/50/52	70.9 4/6 153/59/60	71.4 4/6 157/62/63	71.8 4/6 161/65/66	69.1 4/6 141/48/52	70.7 4/6 151/56/60	71.1 4/6 155/59/64	71.5 4/6 159/63/67
52	71.6 4/6 139/50/52	73.6 4/6 150/59/60	74.2 4/6 154/62/63	74.7 4/6 158/65/66	71.8 4/6 138/48/52	73.5 4/6 149/56/60	74.0 4/6 152/59/63	74.4 4/6 156/62/67
48	74.1 4/6 137/50/52	76.3 4/6 148/59/60	76.9 4/6 152/62/63	77.5 4/6 156/65/66	74.3 4/6 135/47/52	76.3 4/6 146/56/61	76.8 4/6 150/59/64	77.4 4/6 154/62/67
44	76.6 4/6 134/50/52	79.0 4/6 145/59/61	79.7 4/6 149/62/64	80.3 4/6 153/65/67	76.8 4/6 133/47/52	79.1 4/6 144/56/61	79.6 4/6 148/59/64	80.3 4/6 151/62/67
40	78.7 4/6 133/51/53	81.6 4/6 143/59/61	82.4 4/6 147/62/64	83.1 4/6 151/65/67	79.3 4/6 131/48/52	81.7 4/6 142/56/61	82.4 4/6 145/59/64	83.0 4/6 149/62/67
38	78.9 4/6 133/51/54	81.7 4/6 144/59/62	82.5 4/6 148/63/65	83.2 4/6 151/66/68	79.4 4/6 131/48/53	81.8 4/6 142/56/62	82.5 4/6 146/59/65	83.1 4/6 150/63/68
36	79.0 4/6 133/51/54	81.8 4/6 144/60/62	82.6 4/6 148/63/65	83.3 4/6 152/66/68	79.5 4/6 132/48/53	81.9 4/6 143/57/62	82.6 4/6 146/60/65	83.2 4/6 150/63/68

Select the configuration (CONF 1+F or CONF 2) for takeoff that offers to carry maximum weight against the OAT. If weight is equal then select the one with lowest speeds.

Apply corrections to the weight and speeds determined above in sequence (top to bottom). It is allowed to extrapolate linearly for greater QNH deviation.

	Speed Correction										INFLUENCE OF RUNWAY CONDITION																					
WET	-1.9 -4	-1.7 -3	-1.1 -2	-0.7 -2	-1.0 -2	-1.1 -2	-0.7 -1	-0.5 -1	-13/ -2/ -2	-14/ -4/ -4	-14/ -4/ -4	-11/ -3/ -3	-13/ -3/ -3	-13/ -4/ -4	-10/ -3/ -3	-8/ -2/ -2	(+64) -1.9 -4	(+64) -3.1 -5	(+64) -3.4 -6	(+64) -1.9 -3	(+64) -2.1 -4	(+64) -3.4 -5	(+64) -1.8 -3	(+64) -0.6 -1	-13/ 0/ 0	-13/ 0/ 0	-13/ 0/ 0	-11/ 0/ 0	-12/ 0/ 0	-12/ 0/ 0	-10/ 0/ 0	-8/ 0/ 0
D QNH HPA	INFLUENCE OF DELTA PRESSURE																															
-10.0	-0.8 -2	-0.8 -2	-1.3 -2	-0.8 -2	-0.8 -2	-0.8 -2	-0.8 -2	-0.8 -2	0/ -1/ -1	0/ -1/ -1	0/ 0/ -1	0/ 0/ 0	0/ 0/ 0	0/ 0/ -1	0/ 0/ 0	0/ -1/ -1	(+64) -0.8 -2	(+64) -0.8 -2	(+64) -1.3 -2	(+64) -0.8 -2	(+64) -0.8 -2	(+64) -0.8 -2	(+64) -0.8 -2	(+64) -0.8 -2	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0
	Weight Correction										INFLUENCE OF AIR COND.																					
On	-1.6 -3	-1.7 -3	-1.8 -3	-1.8 -3	-1.6 -3	-1.8 -3	-1.9 -3	-1.9 -3	0/ 0/ 0	0/ 0/ 0	0/ 0/ -1	0/ -1/ -1	0/ 0/ 0	0/ 0/ -1	0/ -1/ -1	0/ -1/ -1	(+64) -1.6 -3	(+64) -1.7 -3	(+64) -1.8 -3	(+64) -1.8 -3	(+64) -1.6 -3	(+64) -1.8 -3	(+64) -1.9 -3	(+64) -1.9 -3	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0
											IF OAT < TVMC					IF OAT > TVMC																

For the first correction, no speed check is required after applying the correction.

For a second (and third as applicable) correction, if OAT < TVMC, a speed check is required after applying the correction. The resulting speeds have to be higher than the minimum speeds displayed on the RTOW chart.

LABEL FOR INFLUENCE	MTOW(1000 KG) codes V1min/VR/V2 (kt)	VMC LIMITATION	Tref (OAT) = 41 C Tmax (OAT) = 51 C	Min acc height 400 FT Max acc height 1739 FT	Min QNH alt 2161 FT Max QNH alt 3500 FT
DW (1000 EG) DTFLX DV1-DVR-DV2 (KT) (TVMC OAT C) DW (1000 EG) DTFLX DV1-DVR-DV2 (KT)	LIMITATION CODES: 1=1st segment 2=2nd segment 3=runway length 4=obstacles 5=tire speed 6=brake energy 7=max weight 8=final take-off 9=VMU			Min V1/VR/V2 = 111/17/20 CHECK VMU LIMITATION Correct. V1/VR/V2 = 1.0 KT/1000 KG	

In addition to above speed check, V2 has to be checked again to confirm that it is higher than the VMU limited speed (FCOM > PER-TOF-TOD-25-20 MINIMUM V2 LIMITED BY VMU/VMCA).

MINIMUM V2 LIMITED BY VMU/VMCA (KT IAS)

The following tables, one per configuration, provide the V2 limited by minimum unstick speed and minimum control speed in the air.

MINIMUM V2 LIMITED BY VMU/VMCA (KT IAS)								
CONFIGURATION 1+F								
PRESSURE ALTITUDE (FT)	TAKE OFF WEIGHT (1000 KG)							
	45	50	55	60	65	70	75	80
-2000	118	124	129	134	139	145	150	154
-1000	118	124	129	134	140	145	150	155
0	118	124	129	134	140	145	150	155
1000	118	124	129	134	140	145	150	155
2000	118	123	129	134	140	145	151	155
3000	118	123	129	135	140	145	151	155

If the speed checks are not fulfilled, the corrections must be recalculated using those provided on lines 3 and 4 i.e. the shaded area used for the case when OAT > TVMC as highlighted below:

-1.9/ -2/ -2	-1.7/ -4/ -4	-1.1/ -4/ -4	-0.7/ -3/ -3	-1.0/ -3/ -3	-1.1/ -4/ -4	-0.7/ -3/ -3	-0.5/ -2/ -2
(+64) -1.9/ -4	(+64) -3.1/ -5	(+64) -3.4/ -6	(+64) -1.9/ -3	(+64) -2.1/ -4	(+64) -3.4/ -5	(+64) -1.8/ -3	(+64) -0.6/ -1
-13/ 0/ 0	-13/ 0/ 0	-13/ 0/ 0	-11/ 0/ 0	-12/ 0/ 0	-12/ 0/ 0	-10/ 0/ 0	-8/ 0/ 0

If **TO CG < 27 %** then decrease the TOW by 1,000 Kgs and increase V1, VR and V2 by 1 kt.

The final weight and associated speeds will be the maximum permissible for takeoff. Compare it with max structural limit and take the lower value as the takeoff limit. If your actual takeoff weight is less than the max permissible TOW, you can go for a flex takeoff.

Download the [Excel Calculator](#) for playing around with the TOW and speed calculations.

NOTE: No speed check is required for the first correction. However, if the first influence correction follows a conservative FCOM correction, a speed check is required.

Conservative FCOM Correction PER-TOF-TOD-24 (to be used when not given on the chart)

EFFECT OF QNH AND BLEEDS (UP TO 9200 FT)		
CORRECTIONS ON TEMPERATURE IF FLEX TAKEOFF IS PERFORMED		CORRECTIONS ON WEIGHT IF TAKEOFF WITH FULL THRUST IS PERFORMED
Add 1 °C/40 hPa until pressure altitude equals zero. No correction for pressure altitude below 0 ft.	QNH above 1 013 hPa	Add 20 kg/hPa until pressure altitude equals zero. No correction for pressure altitude below 0 ft.
Subtract 1 °C/6 hPa	QNH below 1 013 hPa	Subtract 90 kg/hPa
Subtract 5 °C	Engine A/ICE ON ⁽¹⁾	Subtract 250 kg
Subtract 11 °C	Total A/ICE ON ⁽¹⁾	Subtract 750 kg
Subtract 5 °C	Air Conditioning ON	Subtract 2 200 kg

DETERMINING THE FLEX TEMP AND SPEEDS

A320214 - JAA		CFM56-5B4 engines		ISB INT'L AIRPORT ISB - OPIS			28L		34.0.3 05-Apr-18 AE214B02 V20	
QNH 1013.25 HPA Air cond. Off Anti-icing Off All reversers inoperative Dry check				Elevation 1761 FT TORA 3658 M Isa temp 12 C TODA 3848 M Rwyslope -1.00% ASDA 3658 M Line up dist. TOD/ASD: 0 M / 0 M			1 obstacle		DRY	
OAT	CONF 1+F				CONF 2					
C	TAILWIND -10 KT	WIND 0 KT	HEADWIND 10 KT	HEADWIND 20 KT	TAILWIND -10 KT	WIND 0 KT	HEADWIND 10 KT	HEADWIND 20 KT		
64	64.3 4/6 147/51/52	65.8 4/6 159/60/61	66.0 1/4 163/63/64	66.0 2/4 161/63/64	64.2 2/4 146/49/52	65.3 4/6 157/57/61	65.4 2/4 156/58/62	65.4 2/4 155/58/62		
60	66.6 4/6 145/51/52	68.3 2/4 156/59/60	68.7 4/6 160/63/63	69.0 4/6 164/66/67	66.6 4/6 143/48/52	67.9 4/6 154/57/61	68.3 2/4 158/60/64	68.4 2/4 160/62/66		
56	69.1 4/6 142/50/52	70.9 4/6 153/59/60	71.4 4/6 157/62/63	71.8 4/6 161/65/66	69.1 4/6 141/48/52	70.7 4/6 151/56/60	71.1 4/6 155/59/64	71.5 4/6 159/63/67		
52	71.6 4/6 139/50/52	73.6 4/6 150/59/60	74.2 4/6 154/62/63	74.7 4/6 158/65/66	71.8 4/6 138/48/52	73.5 4/6 149/56/60	74.0 4/6 152/59/63	74.4 4/6 156/62/67		
48	74.1 4/6 137/50/52	76.3 4/6 148/59/60	76.9 4/6 152/62/63	77.5 4/6 156/65/66	74.3 4/6 135/47/52	76.3 4/6 146/56/61	76.8 4/6 150/59/64	77.4 4/6 154/62/67		
44	76.6 4/6 134/50/52	79.0 4/6 145/59/61	79.7 4/6 149/62/64	80.3 4/6 153/65/67	76.8 4/6 133/47/52	79.1 4/6 144/56/61	79.6 4/6 148/59/64	80.3 4/6 151/62/67		
40	78.7 4/6 133/51/53	81.6 4/6 143/59/61	82.4 4/6 147/62/64	83.1 4/6 151/65/67	79.3 4/6 131/48/52	81.7 4/6 142/56/61	82.4 4/6 145/59/64	83.0 4/6 149/62/67		
38	78.9 4/6 133/51/54	81.7 4/6 144/59/62	82.5 4/6 148/63/65	83.2 4/6 151/66/68	79.4 4/6 131/48/53	81.8 4/6 142/56/62	82.5 4/6 146/59/65	83.1 4/6 150/63/68		
36	79.0 4/6 133/51/54	81.8 4/6 144/60/62	82.6 4/6 148/63/65	83.3 4/6 152/66/68	79.5 4/6 132/48/53	81.9 4/6 143/57/62	82.6 4/6 146/60/65	83.2 4/6 150/63/68		

First check that actual TOW < Max Permissible TOW. Select the configuration (CONF 1+F or CONF 2) for takeoff that gives the highest temperature against the actual TOW. If temperature is equal then select the one with lowest speeds.

If TOW is lower than that displayed on the chart, note the speeds associated with TOW in the row displaying the highest temperature.

A320214 - JAA		CFM56-5B4 engines		ISB INT'L AIRPORT ISB - OPIS			28L		34.0.3 05-Apr-18 AE214B02 V20	
QNH 1013.25 HPA Air cond. Off Anti-icing Off All reversers inoperative Dry check				Elevation 1761 FT TORA 3658 M Isa temp 12 C TODA 3848 M Rwyslope -1.00% ASDA 3658 M Line up dist. TOD/ASD: 0 M / 0 M			1 obstacle		DRY	
OAT	CONF 1+F				CONF 2					
C	TAILWIND -10 KT	WIND 0 KT	HEADWIND 10 KT	HEADWIND 20 KT	TAILWIND -10 KT	WIND 0 KT	HEADWIND 10 KT	HEADWIND 20 KT		
64	64.3 4/6 147/51/52	65.8 4/6 159/60/61	66.0 1/4 163/63/64	66.0 2/4 161/63/64	64.2 2/4 146/49/52	65.3 4/6 157/57/61	65.4 2/4 156/58/62	65.4 2/4 155/58/62		
60	66.6 4/6 145/51/52	68.3 2/4 156/59/60	68.7 4/6 160/63/63	69.0 4/6 164/66/67	66.6 4/6 143/48/52	67.9 4/6 154/57/61	68.3 2/4 158/60/64	68.4 2/4 160/62/66		

Then apply corrections provided at the bottom of RTOW chart limited to the minimum speeds.

LABEL FOR INFLUENCE DW (1000 KG) DTFLEX DV1-DVR-DV2 (KT) (TVMC OAT C) DW (1000 KG) DTFLEX DV1-DVR-DV2 (KT)	MTOW(1000 KG) codes V1min/VR/V2 (kt)	VMC LIMITATION	Tref (OAT) = 41 C Tmax (OAT) = 51 C	Min acc height 400 FT Max acc height 1739 FT	Min QNH alt 2161 FT Max QNH alt 3500 FT
	LIMITATION CODES: 1=1st segment 2=2nd segment 3=runway length 4=obstacles 5=tire speed 6=brake energy 7=max weight 8=final take-off 9=VMU				Min V1/VR/V2 = 111/17/20 CHECK VMU LIMITATION Correct. V1/VR/V2 = 1.0 KT/1000 KG

Apply corrections to the temperature and speeds determined above in sequence (top to bottom). No speed correction is required for QNH and bleed influence and it is allowed to extrapolate linearly for greater QNH deviation. However, for wet influence both speed and temperature corrections are required.

Speed Correction -- For Wet Only INFLUENCE OF RUNWAY CONDITION									
WET	-1.9 -2/ -4 (+64) -1.9 -4 -13/ 0/ 0	-1.7 -3 (+64) -3.1 -5 -13/ 0/ 0	-1.1 -2 (+64) -3.4 -6 -13/ 0/ 0	-0.7 -2 (+64) -1.9 -3 -11/ 0/ 0	-1.0 -2 (+64) -2.1 -4 -12/ 0/ 0	-1.1 -2 (+64) -3.4 -5 -13/ -4/ -4	-0.7 -1 (+64) -1.8 -3 -10/ 0/ 0	-0.5 -1 (+64) -0.6 -1 -8/ -2/ -2	-0.5 -1 (+64) -0.6 -1 -8/ -2/ -2
Flex Temp Correction INFLUENCE OF DELTA PRESSURE									
D QNH HPA									
-10.0	-0.8 -2 0/ -1/ -1 (+64) -0.8 -2 0/ 0/ 0	-0.8 -2 0/ -1/ -1 (+64) -0.8 -2 0/ 0/ 0	-1.3 -2 0/ 0/ -1 (+64) -1.3 -2 0/ 0/ 0	-0.8 -2 0/ 0/ 0 (+64) -0.8 -2 0/ 0/ 0	-0.8 -2 0/ 0/ 0 (+64) -0.8 -2 0/ 0/ 0	-0.8 -2 0/ 0/ -1 (+64) -0.8 -2 0/ 0/ 0	-0.8 -2 0/ 0/ 0 (+64) -0.8 -2 0/ 0/ 0	-0.8 -2 0/ 0/ 0 (+64) -0.8 -2 0/ 0/ 0	-0.8 -2 0/ -1/ -1 (+64) -0.8 -2 0/ 0/ 0
INFLUENCE OF AIR COND. IF OAT < TVMC IF OAT > TVMC									
On	-1.6 -3 0/ 0/ 0 (+64) -1.6 -3 0/ 0/ 0	-1.7 -3 0/ 0/ 0 (+64) -1.7 -3 0/ 0/ 0	-1.8 -3 0/ 0/ -1 (+64) -1.8 -3 0/ 0/ 0	-1.8 -3 0/ -1/ -1 (+64) -1.8 -3 0/ 0/ 0	-1.6 -3 0/ 0/ 0 (+64) -1.6 -3 0/ 0/ 0	-1.8 -3 0/ 0/ -1 (+64) -1.8 -3 0/ 0/ 0	-1.9 -3 0/ -1/ -1 (+64) -1.9 -3 0/ 0/ 0	-1.9 -3 0/ -1/ -1 (+64) -1.9 -3 0/ 0/ 0	-1.9 -3 0/ -1/ -1 (+64) -1.9 -3 0/ 0/ 0

Speed check is required after applying the correction to check that V2 is higher than the VMU limited speed (FCOM > PER-TOF-TOD-25-20 MINIMUM V2 LIMITED BY VMU/VMCA).

MINIMUM V2 LIMITED BY VMU/VMCA (KT IAS)

The following tables, one per configuration, provide the V2 limited by minimum unstick speed and minimum control speed in the air.

MINIMUM V2 LIMITED BY VMU/VMCA (KT IAS)								
CONFIGURATION 1+F								
PRESSURE ALTITUDE (FT)	TAKE OFF WEIGHT (1000 KG)							
	45	50	55	60	65	70	75	80
-2000	118	124	129	134	139	145	150	154
-1000	118	124	129	134	140	145	150	155
0	118	124	129	134	140	145	150	155
1000	118	124	129	134	140	145	150	155
2000	118	123	129	134	140	145	151	155
3000	118	123	129	135	140	145	151	155

To combine a second and/or a third correction speeds must be checked higher than the minimum speed displayed on the RTOW chart.

LABEL FOR INFLUENCE	MTOW(1000 EG) codes V1min/VR/V2 (kt)	VMC LIMITATION	Tref (OAT) = 41 C Tmax (OAT) = 51 C	Min acc height 400 FT Max acc height 1739 FT	Min QNH alt 2161 FT Max QNH alt 3500 FT
DW (1000 EG) DTIFLEX DV1-DVR-DV2 (KT) (TVMC OAT C) DW (1000 EG) DTIFLEX DV1-DVR-DV2 (KT)	LIMITATION CODES: 1=1st segment 2=2nd segment 3=runway length 4=obstacles 5=tire speed 6=brake energy 7=max weight 8=final take-off 9=VMU			Min V1/VR/V2 = 111/17/20 CHECK VMU LIMITATION Correct. V1/VR/V2 = 1.0 KT/1000 KG	

If the speed checks are not fulfilled, flex takeoff is not possible.

Flex temperature check is required to confirm if it is above OAT and TREF:

LABEL FOR INFLUENCE	MTOW(1000 KG) codes V1min/VR/V2 (kt)	VMC LIMITATION	Tref (OAT) = 41 C Tmax (OAT) = 51 C	Min acc height 400 FT Max acc height 1739 FT	Min QNH alt 2161 FT Max QNH alt 3500 FT
DW (1000 KG) DT FLEX DV1-DVR-DV2 (KT) (TVMC OAT C) DW (1000 KG) DT FLEX DV1-DVR-DV2 (KT)	LIMITATION CODES: 1=1st segment 2=2nd segment 3=runway length 4=obstacles 5=tire speed 6=brake energy 7=max weight 8=final take-off 9=VMU			Min V1/VR/V2 = 111/17/20 CHECK VMU LIMITATION Correct. V1/VR/V2 = 1.0 KT/1000 KG	

Limited to TMAX FLEX:

OAT C	CONF 1+F				CONF 2			
	TAILWIND -10 KT	WIND 0 KT	HEADWIND 10 KT	HEADWIND 20 KT	TAILWIND -10 KT	WIND 0 KT	HEADWIND 10 KT	HEADWIND 20 KT
64	64.3 4/6 147/51/52	65.8 4/6 159/60/61	66.0 1/4 163/63/64	66.0 2/4 161/63/64	64.2 2/4 146/49/52	65.3 4/6 157/57/61	65.4 2/4 156/58/62	65.4 2/4 155/58/62

If the temperature check is not fulfilled, flex takeoff is not possible.

If flex takeoff not possible, then set TOGA thrust and retain the speeds associated with maximum permissible takeoff weight or the speeds read in the chart of the actual weight if they are all lower.

If TO CG < 27 % then decrease flex temperature by 2°C and increase V1, VR and V2 by 1 kt.

This will give you the final flex temperature and associated speeds.

Download the [Excel Calculator](#) for playing around with flex temperature and speed calculations.

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