



A Textron Company

Original issue March 18, 2010
Rev A - April 1, 2010

INFORMATION LETTER 204-10-24 Rev A
205-10-39 Rev A
212-10-63 Rev A
412-10-66 Rev A
412CF-10-24

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TO: All Bell Helicopter Medium Owners/Operators Helicopters

SUBJECT: DERIVED EMPTY WEIGHT CLARIFICATIONS.

Helicopter weight calculations are necessary to derive the Certified Empty Weight if weighed in a non-standard condition.

Bell Helicopter specifies for the Models 204/205/212/412 aircraft, a Certified Empty Weight will include all unusable fluids. Specific examples are given in each model's Flight Manual (FM) showing how to take the Certified Empty Weight and determine the most forward and most aft CG conditions to ensure that safe flight is possible. The Maintenance Manuals state that an aircraft should be weighed in this condition (all unusable fluids on board); however clarification is required regarding procedures if this condition does not exist.

There is confusion over the terminology of "Unusable Fuel". Unusable fuel is normally the sum of trapped and drainable fuel. Models addressed in this clarification have considered this the definition when depicting sample weighing in the aircraft's Maintenance Manuals. For clarification purposes the terms trapped and drainable will be used herein. Drainable fuel is the fuel that remains in the tank after all usable fuel is pumped out. This fuel may be removed from the aircraft through the fuel tank sump valves. Trapped fuel is the fuel in the lines and pumps that can not be removed via the fuel tank sumps.

There are three possible fuel conditions that may exist when weighing an aircraft.

1. The aircraft contains all trapped and drainable fuel as specified
2. The aircraft contains trapped fuel and no drainable fuel
3. The aircraft contains no fuel either drainable or trapped

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When these situations exist then the following should be applied to determine the Certified Empty Weight.

Condition 1: All trapped & drainable fuel is on board when weighed. This condition exist when the aircraft has been fully serviced and then defueled without draining fuel from the fuel tank sumps prior to weighing.

- In this case there are no specific adjustments for drainable or trapped fuel that need to be made to the as weighed condition.
- An example of a Model 205 actual weighing in this condition is shown in Example Condition 1

Condition 2: Trapped but no drainable fuel is onboard when weighed. This condition exists when the aircraft has been fully serviced and then defueled but fuel tanks sump drains have been opened and as much fuel as possible is drained from aircraft prior to weighing.

- In this case drainable fuel must be added to the as weighed condition in order to derive the Certified Empty Weight. The specific adjustment for each may be found in Table 1 below. For example: If this was a Model 205 aircraft then the following adjustment to the as weighed condition should be made.
 - Drainable Fuel: +13.0 lbs at F.S. 118.6 for +1,542 in-lbs
- An example of a Model 205 actual weighing in this condition is shown in Example Condition 2

Condition 3: No trapped or drainable fuel is onboard when weighed. This condition might exist when the aircraft tanks are removed and/or replaced and all fuel lines were drained during the operation. In this case the aircraft would not have been fueled and engine(s) run prior to the aircraft weighing

- In this case both drainable and trapped fuel must be added to the as weighed condition in order to derive the Certified Empty Weight. The specific adjustment may be found in Table 1 below. For example: If this was a Model 205 aircraft then the following adjustments to the as weighed condition should be made.
 - Drainable Fuel: +13.0 lbs at F.S. 118.6 for +1,542 in-lbs
 - Trapped Fuel: +15.3 lbs at F.S. 163.4 for +2,499 in-lbs
- An example of a Model 205 actual weighing in this condition (along with all other fluids removed, gearboxes drained, engine and coolers drained, etc.) is shown in Example Condition 3
- This is the dry condition depicted in the maintenance manuals

Model	FUEL								
	@ lb/gal us	Usable		Unusable					
		Usable (lbs)	F.S. (in)	Drainable (lbs)	F.S. (in)	Moment (in-lb)	Trapped (lbs)	F.S. (in)	Moment (in-lb)
204	JP-4 6.5	1,040	136.0	13.8	136.0	1,870	15.3	163.4	2,499
	JP-4 6.5	1,573	136.5	19.5	136.0	2,652	15.3	163.4	2,499
205	JP-4 6.5	1,409	153.3	13.0	118.6	1,542	15.3	163.4	2,499
212									
30501-30999, 31101-31311, 32101-32142, 35001-35049	JP-4 6.5	1,409	153.3	13.0	118.6	1,542	15.3	163.4	2,499
35049 -35103	JP-4 6.5	1,421	152.6	13.0	118.6	1,542	15.3	163.4	2,499
412									
33001 - 33107	JP-4 6.5	1,374	152.8	13.0	118.6	1,542	15.3	163.4	2,499
33108 - 33213	JP-5 6.8	2,247	151.5	28.1	128.6	3,614	19.6	130.7	2,562
36001 - 36086	JP-5 6.8	2,247	151.5	28.1	128.6	3,614	19.6	130.7	2,562
36087 - Sub	JP-5 6.8	2,247	151.5	28.1	128.6	3,614	19.6	130.7	2,562
46400 &sub	JP-5 6.8	2,158	151.5	42.8	119.9	5,133	19.6	130.7	2,562

Table 1 Fuel Quantities

BELL HELICOPTER TEXTRON
ACTUAL WEIGHT RECORD
MODEL 205A-1

DATE WEIGHED _____ SAMPLE _____ SERIAL NUMBER 30
SCALE READINGS SKID CONFIGURATION

	SCALE	TARE	NET
FORWARD JACKPOINT, F.S. 61.69 B.L. -30.0	1888	25	1863
FORWARD JACKPOINT, F.S. 61.69 B.L. +30.0	443	25	418
AFT JACKPOINT, F.S.211.58 B.L. +/-14.53	3122	50	3072
TOTAL	5453	100	5353

* IN LATERAL
CALCULATIONS
- IS LEFT
+ IS RIGHT

LONGITUDINAL C.G., AS WEIGHED

$$C.G = \frac{61.69(2281) + 211.58(3072)}{5353} = \frac{790688.63}{5353} = 147.71 \text{ IN.}$$

LATERAL C.G., AS WEIGHED

$$C.G. = \frac{-30.0(1863) + 30.0(418) + 14.53(3072)}{5353} = \frac{+1286.16}{5353} = +0.24 \text{ IN.}$$

WEIGHT EMPTY DERIVATION	WEIGHT	LONGITUDINAL		LATERAL *	
		ARM	MOMENT	ARM	MOMENT
AS WEIGHED	5353	147.71	790688.63	+0.24	+1286.16
ADD: TRAPPED FUEL	0	0	0	0	0
DRAINABLE FUEL	0	0	0	0	0
UNDRAINABLE OIL	0	0	0	0	0
HYDRAULIC FLUID	0	0	0	0	0
TRANSMISSION & GEARBOX OIL	0	0	0	0	0
CREW SEATS	+73.6	+56.0	+4123	0	0
PASSENGER SEATS	+120.2	+104.8	+12578	0	0
BALLAST (SEE EQUIPMENT LIST)	+53.7		+318		-253
WEIGHT EMPTY, SKID CONFIG.	+5600.6	144.22	807707.63	+0.18	+1033.16

Example Note: Usable Engine Oil assumed not in As Weighed condition. Weight Empty derived above is typical of what is indicated in aircraft log. If usable engine oil was in as weighed condition it would need to be subtracted out prior to updating aircraft log.

MOST FORWARD C.G.

+ PILOT AND COPILOT	340.0	47	15980	0	0
+PASSENGERS (4), CTR SEAT, FACING AFT	680.0	87.0	59160	0	0
+PASSENGERS (5), BACK SEAT, FACING FWD	850.0	117.0	99450	0	0
+ OIL, ENGINE	25.1	175.2	4398	+26	+653
+ FUEL, MOST FORWARD	472.0	127.6	60227	0	0
	7967.7	131.4	1046923	+0.2	+1686

MOST AFT C.G.

+ PILOT	170	47	7990	+22.0	+3740
+ OIL, ENGINE	25.1	175.2	4398	+26	+653
+ FUEL	1409.2	153.3	216066	0	0
	7204.9	143.8	1036162	+0.8	+5426

EXAMPLE CONDITION 1

BELL HELICOPTER TEXTRON
ACTUAL WEIGHT RECORD
MODEL 205A-1

DATE WEIGHED _____ SAMPLE _____ SERIAL NUMBER 30
SCALE READINGS SKID CONFIGURATION

	SCALE	TARE	NET
FORWARD JACKPOINT, F.S. 61.69 B.L. -30.0	1882	25	1857
FORWARD JACKPOINT, F.S. 61.69 B.L. +30.0	440	25	415
AFT JACKPOINT, F.S.211.58 B.L. +/-14.53	3118	50	3068
TOTAL	5440	100	5340

* IN LATERAL
CALCULATIONS
- IS LEFT
+ IS RIGHT

LONGITUDINAL C.G., AS WEIGHED

$$\text{C.G.} = \frac{61.69(2272) + 211.58(3068)}{\text{TOTAL WEIGHT } 5340} = \frac{789287.12}{5340} = 147.80 \text{ IN.}$$

LATERAL C.G., AS WEIGHED

$$\text{C.G.} = \frac{-30.0(1857) + 30.0(415) + 14.53(3068)}{\text{TOTAL WEIGHT } 5340} = \frac{+1318.04}{5340} = +0.25 \text{ IN.}$$

WEIGHT EMPTY DERIVATION	WEIGHT	LONGITUDINAL		LATERAL *	
		ARM	MOMENT	ARM	MOMENT
AS WEIGHED	5340	147.80	789287.12	+0.25	+1318.04
ADD: TRAPPED FUEL	0	0	0	0	0
DRAINABLE FUEL	+13.0	118.6	+1542.0	0	0
UNDRAINABLE OIL	0	0	0	0	0
HYDRAULIC FLUID	0	0	0	0	0
TRANSMISSION & GEARBOX OIL	0	0	0	0	0
CREW SEATS	+73.6	+56.0	+4123	0	0
PASSENGER SEATS	+120.2	+104.8	+12578	0	0
BALLAST (SEE EQUIPMENT LIST)	+53.7		+318		-253
WEIGHT EMPTY, SKID CONFIG.	+5600.6	144.24	807848.12	+0.19	+1065.04

Example Note: Usable Engine Oil assumed not in As Weighed condition. Weight Empty derived above is typical of what is indicated in aircraft log. If usable engine oil was in as weighed condition it would need to be subtracted out prior to updating aircraft log.

MOST FORWARD C.G.

+ PILOT AND COPILOT	340.0	47	15980	0	0
+PASSENGERS (4), CTR SEAT, FACING AFT	680.0	87.0	59160	0	0
+PASSENGERS (5), BACK SEAT, FACING FWD	850.0	117.0	99450	0	0
+ OIL, ENGINE	25.1	175.2	4398	+26	+653
+ FUEL, MOST FORWARD	472.0	127.6	60227	0	0
	7967.7	131.4	1047063.12	+0.2	+1718.04

MOST AFT C.G.

+ PILOT	170	47	7990	+22.0	+3740
+ OIL, ENGINE	25.1	175.2	4398	+26	+653
+ FUEL	1409.2	153.3	216066	0	0
	7204.9	143.8	1036302.12	+0.7	+5458.04

EXAMPLE CONDITION 2

BELL HELICOPTER TEXTRON
ACTUAL WEIGHT RECORD
MODEL 205A-1

DATE WEIGHED _____ SAMPLE _____ SERIAL NUMBER 30
SCALE READINGS SKID CONFIGURATION

	SCALE	TARE	NET
FORWARD JACKPOINT, F.S. 61.69 B.L. -30.0	1861	25	1836
FORWARD JACKPOINT, F.S. 61.69 B.L. +30.0	440	25	415
AFT JACKPOINT, F.S.211.58 B.L. +/-14.53	3075	50	3025
TOTAL	5376	100	5276

* IN LATERAL
CALCULATIONS
- IS LEFT
+ IS RIGHT

LONGITUDINAL C.G., AS WEIGHED

$$C.G = \frac{61.69(2251) + 211.58(3025)}{5276} = \frac{778894}{5276} = 147.62 \text{ IN.}$$

LATERAL C.G., AS WEIGHED

$$C.G. = \frac{-30.0(1836) + 30.0(415) + 14.53(3025)}{5276} = \frac{+1323}{5276} = +0.25 \text{ IN.}$$

WEIGHT EMPTY DERIVATION	WEIGHT	LONGITUDINAL		LATERAL *	
		ARM	MOMENT	ARM	MOMENT
AS WEIGHED	5276.0	147.62	778894	+0.25	+ 1323
ADD: TRAPPED FUEL	+15.3	163.4	+2499	0	0
DRAINABLE FUEL	+13.0	118.6	+1542	0	0
UNDRAINABLE OIL	+6.6	191.0	+1262	0	0
HYDRAULIC FLUID	+15.6	129.4	+2018	-1.9	-30
TRANSMISSION & GEARBOX OIL	+26.6	169.4	+4507	0	0
CREW SEATS	+73.6	+56.0	+4123	0	0
PASSENGER SEATS	+120.2	+104.8	+12578	0	0
BALLAST (SEE EQUIPMENT LIST)	+53.7		+318		-253
WEIGHT EMPTY, SKID CONFIG.	+5600.6	144.20	807741	+0.19	+1040

Example Note: Usable Engine Oil assumed not in As Weighed condition. Weight Empty derived above is typical of what is indicated in aircraft log. If usable engine oil was in as weighed condition it would need to be subtracted out prior to updating aircraft log.

MOST FORWARD C.G.

+ PILOT AND COPILOT	340.0	47	15980	0	0
+PASSENGERS (4), CTR SEAT, FACING AFT	680.0	87.0	59160	0	0
+PASSENGERS (5), BACK SEAT, FACING FWD	850.0	117.0	99450	0	0
+ OIL, ENGINE	25.1	175.2	4398	+26	+653
+ FUEL, MOST FORWARD	472.0	127.6	60227	0	0
	7967.7	131.4	1046956	+0.2	+1693

MOST AFT C.G.

+ PILOT	170	47	7990	+22.0	+3740
+ OIL, ENGINE	25.1	175.2	4398	+26	+653
+ FUEL	1409.2	153.3	216066	0	0
	7204.9	143.8	1036195	+0.8	+5433

EXAMPLE CONDITION 3