Customer Support

NOTICE TO OPERATORS

BR 700 Engines

SUBJECT: **DATE:** March 17th, 2000
Bombardier Global Express® - Engine - Oil Level Reading

NUMBER: 014 **ISSUE:** 001

APPLICABILITY: BR700-710A2-20

PURPOSE: To explain engine oil servicing and oil level reading.

NOTICE TO OPERATORS

(1) Introduction

This Notice to Operators is intended to describe and explain the different methods of oil level indication on the BR700-710 engine. It should be read in conjunction with the Aircraft Maintenance Manual, Chapters 5-21-00, 12-14-00 and 79-30-00. The instructions to be followed when servicing a BR700-710 engine are given in the above chapters.

(2) Oil Level Reading on the Sight Glass (refer to Figure 1)

The most precise method to determine the oil volume in the engine oil tank is by checking the oil level sight glass located on the upper oil tank (see Figure 2). The indication plate features a hatched "FULL"-band. The engine oil tank is full when the oil level can be seen within this band, provided the oil level check is done as instructed in the Aircraft Maintenance Manual Chapter 12-14-01 (i.e 5 to 30 minutes after engine shut-down). The oil level must not be above the "FULL"-band. If it should be above the "FULL"-band, the excessive oil volume must be drained from the upper oil tank in accordance with the Aircraft Maintenance Manual Chapter 79-10-00. Also, the cause for this malfunction must be found. If the oil level is below the "FULL"-band, the amount of usable oil and hence the maximum flight range is reduced. However, if the electronic oil level reading system functions as designed, the oil level will always be within the "FULL"-band.

The lower "FULL"-level corresponds to an oil volume in the engine oil tank of 10.62 ±0.16 US-quarts (10.05 ±0.15 liters). The upper "FULL"-level corresponds to 11.89 ±0.16 US-quarts (11.25 ±0.15 liters). The tolerance of ±0.16 US-quarts (±0.15 liters) is due to

deviations of the casting geometry inside the engine oil tank and is applicable throughout the entire reading range of the sight glass.

The markings below the "FULL"-band indicate how much oil must be added to get to the lower "FULL"-level. The lowest mark corresponds to an oil level in the gearbox of 9.30 ±0.16 US-quarts (8.8 ±0.15 liters).

Because the sight glass is installed at the rear part of the engine oil tank, the accuracy is influenced by the aircraft inclination, e.g. due to uneven ground, incorrect tyre pressure etc. 1° of aircraft nose down or nose up inclination leads to oil level misreading of appr. 0.3 US-quarts. It must therefore be ensured that the aircraft is parked on horinzontal ground and that aircraft weight distribution and tyre pressure is nominal when the sight glass level is read (Note: Bombardier documents L700-009003 and S700-510002 define the nominal engine inclination with reference to the horizon to be 3.97° nose-up. The sight glass marking has been positioned based on this figure).

(3) Electronic Oil Level Reading

The electronic oil level reading delivers the signals for the EICAS-indication, the control of the remote oil replenishment pump in the back of the aircraft and the "low oil level"-warning light. The oil level is detected by an oil level sensor which is installed at the bottom of the upper engine oil tank (see par. (4)). This sensor is a reed-switch type. This means that the sensor does not read linearly but in incremental steps. Considering the installation angle of the sensor, the distance between two adjacent reed switches is evenly 0.21 inches with respect to filling height. Considering the upper oil tank calibration (filled oil volume vs. filling height), the average resolution of the oil level sensor within the reading range of the oil level sight glass is 0.43 US-quarts (0.41 liters). This figure is also the inaccuracy of the oil level sensor. The inaccuracy of the aircraft portion of the oil level indication system must be added to this number in order to obtain the overall system accuracy. It has to be noted that due to the complex internal geometry of the engine oil tank, its calibration is not exactly linear. The oil level sensor resolution therefore varies between 0.63 and 0.35 US-quarts (0.60 and 0.33 liters). Manufacturing tolerances on the oil level sensor are negligible.

The signal delivered by the oil level sensor is processed by the engine EEC.

Different from the sight glass reading, the influence of aircraft inclination on the oil level sensor reading is negligible.

(4) Oil Filling Characteristic (refer to Figure 2)

The engine oil tank of the BR700-710 engine consists of two portions, the upper and lower oil tank. Both tanks are integral parts of the accessory gearbox. The capacity of the lower oil tank is approximately 3.7 US-quarts (3.5 liters), the upper oil tank holds appr. 8.5 US-quarts (8.0 liters). When the engine is running, an ejector pump continously empties the lower into the upper oil tank from where the engine oil supply is drawn.

The two oil tanks are connected by two stack pipes. The lower stack pipe routes the oil from the upper into the lower oil tank, provided the filling height in the upper oil tank is enough to submerge the orifice of the lower stack pipe. There is no other way to fill oil into the lower oil tank. The upper stack pipe vents the lower into the upper oil tank and does not have any influence on oil filling or engine operation characteristics.

The arrangement of oil tanks leads to a non-linear oil level reading (refer to Figure 3). When a completely drained gearbox is re-filled with oil, the level rises on the oil level sight glass as soon as it reaches the reading gauge. After having filled approximately 5.3 US-quarts (5.0 liters) of oil into the upper oil tank, the oil level stops rising on both the sight glass and the oil level sensor, although more oil can be added. After having filled approximately 9.0 US-quarts (8.5 liters) in total, the lower oil tank is completely full, and the oil level continues to rise in the upper tank. This is indicated on the sight glass and the oil level sensor. During engine operation when oil is consumed the same process happens in the opposite direction.

It has to be highlighted here again that since the content of the lower oil tank cannot be reliably detected, the engine oil tank only contains an adequate volume of oil if it is serviced to "FULL" as instructed in the Aircraft Maintenance Manual Chapter 12-14-01. It should be noted that the examination of the engine oil level is a transit check action as per the Time Limits Manual, Chapter 05-21-00.

Please note that the precision of the chart provided in Figure 3 is not sufficient to be used for checking the sight glass calibration. It is for illustration purposes only.

(5) Particular EEC Oil Level Signals (refer to Figure 3)

Beside the normal oil level reading, the engine EEC also provides the following signals with regard to the engine oil tank level.

(a) If the oil volume in the engine oil tank falls below 10.88 US-quarts (10.3 liters), the EEC provides a signal bit which allows the remote oil replenishment to be engaged (provided the aircraft is on ground and the engine has been shut down for at least 5 minutes). If the oil level reaches this point during remote oil replenishment, the replenishment pump is shut off in order to prevent engine overservicing. If the oil level is already above this point when the remote oil replenishment system is activated, the replenishment pump would not be switched on.

(b) If the oil quantity as indicated by the EICAS falls below 3.0 US-quarts (2.8 liters) for more than 10 minutes, and the engine is running, the EEC triggers a low oil level warning EICAS-indication.

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(6) Usable Oil Quantities

6.41 US-quarts (6.07 liters) of the engine oil content cannot be consumed by the engine (unusable oil quantity) because it is required to lubricate the engine or it is hidden in pipes, the oil cooler etc. Considering the worst-case casting tolerance of the accessory gearbox, the minimum usable oil quantity is 4.05 US-quarts (3.83 liters) when the engine was serviced to the lower "FULL" mark. The maximum allowed oil consumption of the engine is 0.2 liters per hour. This leads to a flight duration of 19.15 hours within which the aircraft can be operated throughout the whole attitude envelope without adversely affecting the engine oil supply.

If the engine is serviced and operated correctly, the warning level mentioned in paragraph (5)(b) is never reached.

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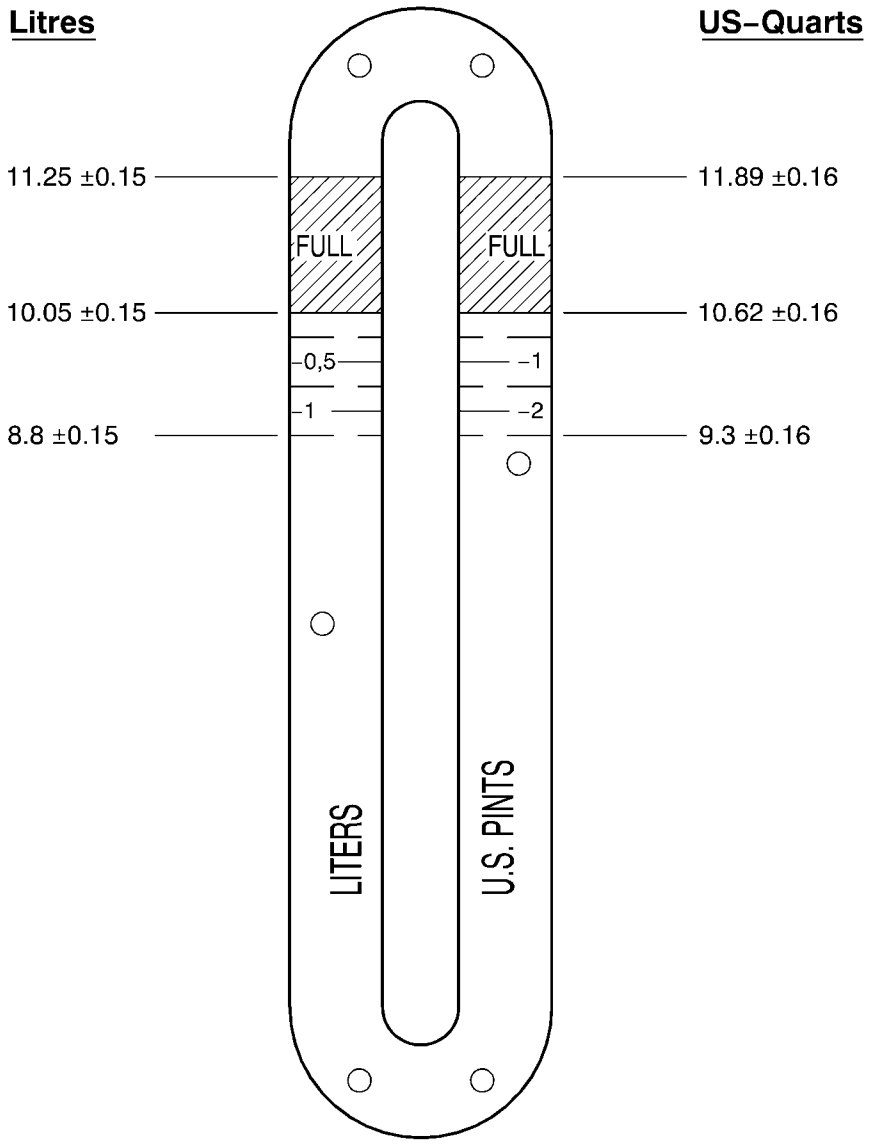

Figure 1: Oil Level Sight Glass

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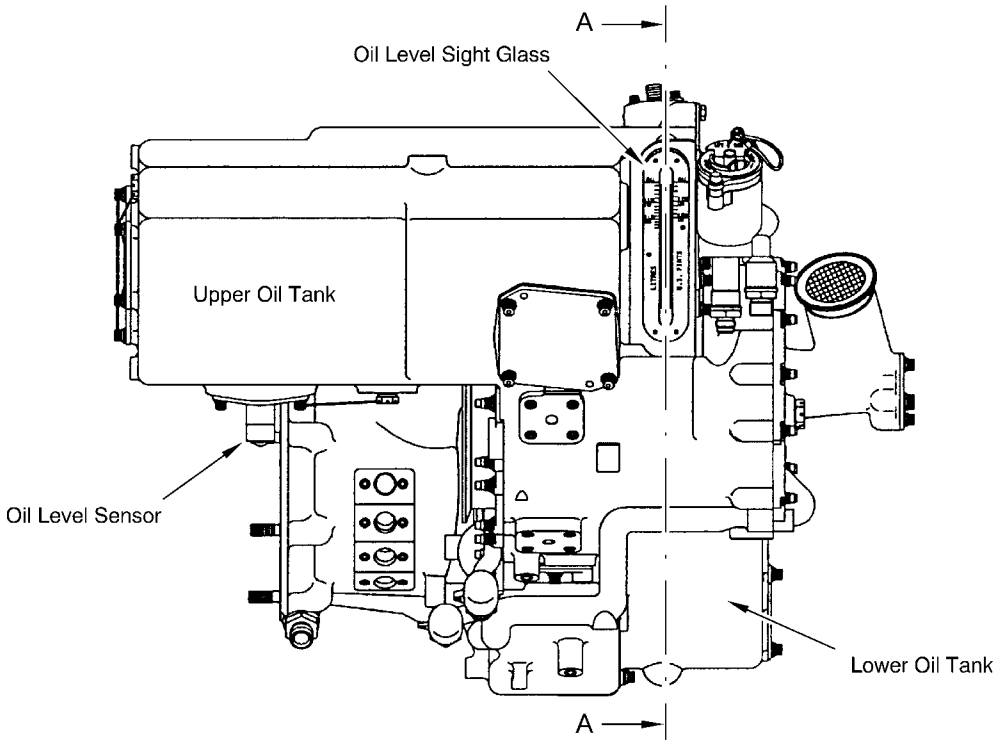
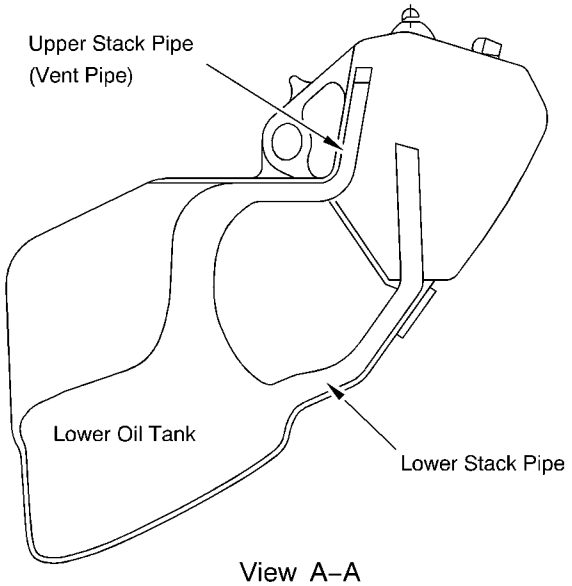


Accessory Gearbox, Starboard View



View A–A

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Figure 2: Engine Oil Tank Arrangement

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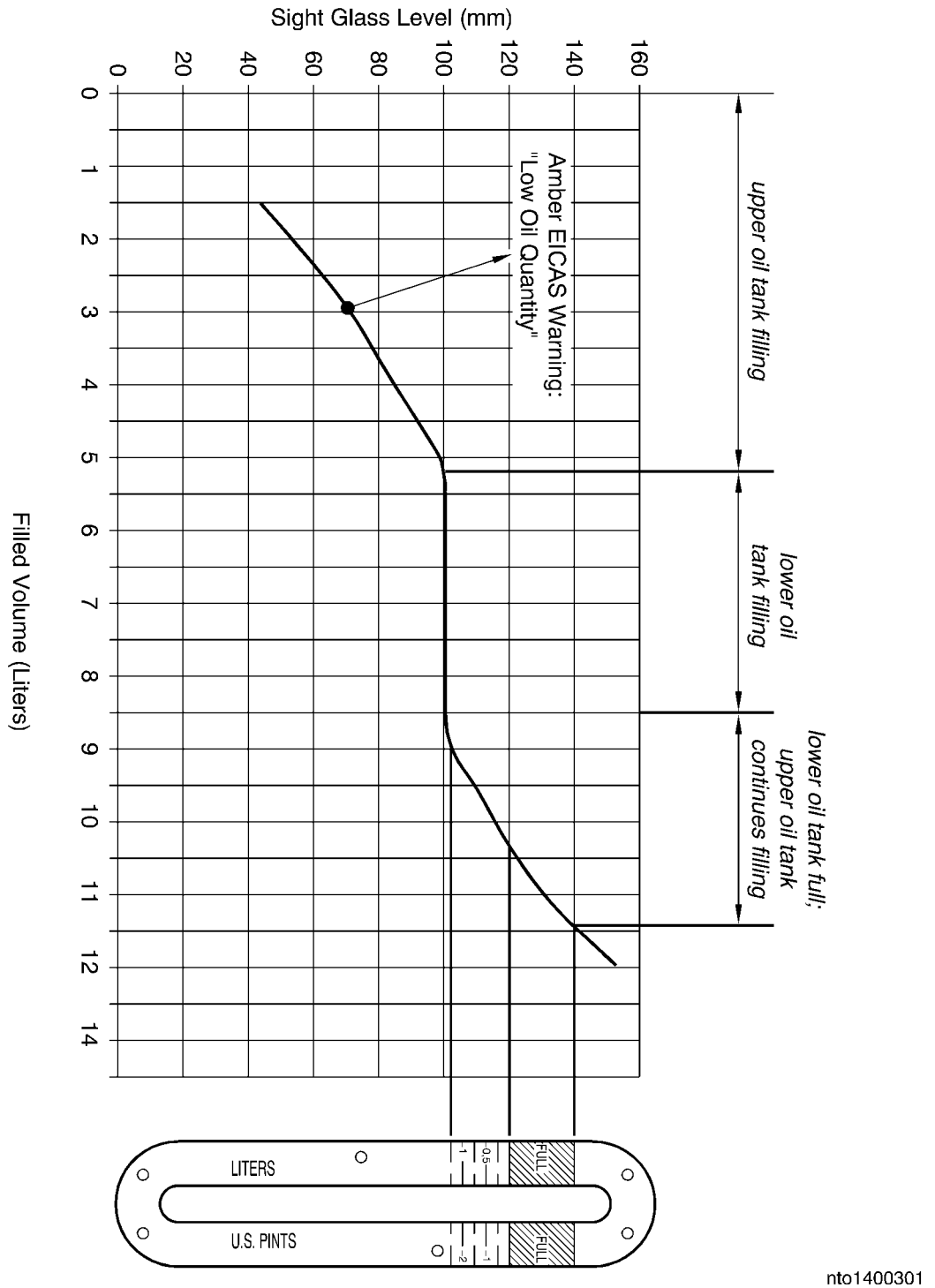

Figure 3: Oil Filling / Draining Characteristic