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7.52 PERIODIC INSPECTION OF FUEL CYLINDERS

WARNING: With cylinders used for the storage of LPG there is a great danger that residual gas mixed with air will cause a fire or explosion hazard. The cylinder must be emptied and depressurised in a safe manner, then purged with nitrogen (N_2) or other non-oxidising gas prior to any internal inspection or maintenance.

WARNING: There is a risk of fuel being retained in cylinder contents gauge floats, especially if the gauge has failed. The pressure of the retained fuel may cause failure of the float, releasing plastic fragments. Appropriate PPE should be worn (including eye protection and gloves). Removed contents gauges should be stored safely.

WARNING: Contents gauges on CB2990 (Alugas) cylinders must be installed by hand. Use of an impact wrench is not permitted.

7.52.1 GENERAL

This supplement calls for the use of substances and procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage. It has been assumed in the drafting of this supplement that the execution of its provisions is entrusted to appropriately qualified and experienced people. Where judgements are called for, it has been assumed that they are made by competent persons who have been trained specifically for the task. In cases of doubt contact Cameron Balloons Limited. This supplement has been drafted to address both terrestrial transportation and airworthiness criteria.

The periodic inspection is required 10 years from the initial test date of the cylinder and every 10 years subsequent. The procedures for periodic inspection consist of:-

- External Visual Inspection
- Internal Visual inspection
- Hydraulic Proof Pressure test
- Pneumatic leak test

The decision to render the cylinder unserviceable may be taken at any stage in the inspection procedure. With the agreement of the owner the cylinder shall be rendered unserviceable, refer to Section 7.52.9.

NOTE: If any unacceptable defects are found during the external or internal inspections the cylinder must be rejected. A satisfactory proof pressure test does not allow other defects to be ignored.

7.52.1.1 Scope

This supplement is applicable to the following cylinders:-

Brand	Cylinder Material			
	Aluminium	Austenitic Stainless Steel	Titanium	Duplex Stainless Steel
Colt (Including T&C)	Worthington	V20 (V20-1000, CB8420), V30 (830922-1, CB8430), V40 (V40-100, CB8440), H30 (SC2-106, AS82-310, 830201, CB8424, CB9413), H40 (AS82-410, SC2-106, CB8414, CB9412), H55 (880507-1, H55-300)		
Sky		V30, V40		
Lindstrand	CY-010-A-001 (Worthington), CY-011-A-001 (Hopper)	V20 (CY-020-A-001), V30 (CY-030-A-001), Hopper V30 (CY-031-A-001), V40 (CY-040-A-001)	T30 (CY-050-A-001)	
Cameron	CB250, CB901, CB2990	CB426, CB497, CB599, CB959, CB2088	CB2380, CB2383, CB2385, CB2387	CB2900, CB2901, CB2902, CB2903

NOTE: Duplex stainless steel cylinders were also supplied with Lindstrand branding but can be regarded as identical to Cameron cylinders of the same part number.

7.52.1.2 Pressure Relief Valves

Pressure relief valves (PRVs) must be replaced as part of the periodic inspection. PRVs have a permitted shelf life of five years and a projected service life (subject to inspection) of ten years. At the time of installation PRVs must have sufficient life remaining to reach the date of next intended periodic inspection. PRV replacement is part of the periodic inspection and not a separate maintenance action.

Where the PRV is integral with the valve the complete valve should be replaced.

7.52.2 EXTERNAL VISUAL INSPECTION

Remove the cylinder jacket and protective foam. For Lindstrand T30 cylinders the upper and lower guard rings must also be removed.

If required, the cylinder shall be cleaned to remove corrosion products or other foreign matter from its surface.

WARNING: Stainless Steel Cylinders should only be cleaned with products designed for cleaning Austenitic Stainless Steels. Abrasive Pads, wire brushes etc. used for cleaning must be stored and labelled to only be used on a single material. e.g. pads used for cleaning stainless steel cylinders shall not be used for cleaning Titanium cylinders and vice versa.

The entire external surface of the cylinder shall be inspected for:-

a. Dents, cuts, gouges, bulges, cracks and punctures applying the criteria for rejection in the Maintenance Manual (Section 6).

b. Corrosion giving special attention to areas where water can be trapped, to the base of the cylinder, to the joints between the pressure vessel and the upper and lower guard plates and to the longitudinal and circumferential welds.

c. Integrity of permanent attachments, including the cylinder data plate.

d. Any other defects.

7.52.3 INTERNAL VISUAL INSPECTION

7.52.3.1 Preparation

Cylinders shall be depressurised in a safe and controlled manner before proceeding.

Cylinder valves and fitting shall be removed for inspection, maintenance, refurbishment or scrapping in accordance with EN 14912 or national requirements.

7.52.3.2 Cleaning

The cylinder may be cleaned internally by adding a small quantity of kerosene and swilling it around the cylinder, or with a commercially available water-based degreasing agent. The cleaning process can be assisted by a high pressure water or steam jet. Repeat the process as necessary. Care should be taken not to damage the cylinder walls.

WARNING: Alcohol or commercial alcohol based cleaners must never be used to clean or dry titanium cylinders.

7.52.3.3 Inspection

Ensure that any residual cleaning fluid and foreign matter has been removed from the cylinder. Using a suitable inspection lighting system (e.g. an endoscope), inspect the interior of the cylinder for any signs of corrosion or defects that may affect its integrity.

Cylinders showing signs of internal corrosion, except those having only a thin layer of surface rust (stainless steel and Duplex stainless steel only) shall be removed from service for further detailed examination.

If further cleaning is required care shall be taken to avoid damaging the cylinder walls. Cylinders shall be re-inspected after cleaning.

7.52.3.4 Inspection of Cylinder Threads

The internal threads of the cylinder shall be visually examined to ensure that they are full form and clean. They shall be examined for burrs, cracks and other thread damage.

7.52.4 HYDRAULIC PROOF PRESSURE TEST

7.52.4.1 General

WARNING: Liquids that have been used for testing carbon steel cylinders should not used for testing cylinders made of aluminium, stainless steel or titanium to prevent ferritic contamination.

A liquid shall be used as the test medium, e.g. water or kerosene. Water for testing the cylinders shall be potable quality with a chloride ion content of less than 50 ppm.

The test pressure (Ph or Pt) for all cylinders is 3.0 Mpa (30 Bar).

NOTE: Older cylinders have a test pressure of 3.3 Mpa engraved on the data plate. These cylinders should be tested to 3.0 Mpa and the data plate amended (if required).

7.52.4.2 Preparation

In addition to the requirements of 7.52.3.1, the external surface of the cylinder shall be in such condition that any leak can be detected. If the cleaning method involves wetting the outside surface, the outside surface shall be completely dried before commencing the test procedure.

All cylinder ports other than those required for filling or pressure measurement during the test procedure shall be sealed using suitable blanks.

7.52.4.3 Test Equipment

Testing should be carried out using the CB2882 test kit, or equivalent equipment.

The design and installation of the equipment and the cylinders connected to it shall ensure that no air is trapped in the system.

All joints within the system shall be leak tight.

A device shall be fitted to the test equipment to ensure that no cylinder is subjected to pressure in excess of its test pressure by 0.2 Mpa (2 Bar).

Pressure gauges that are used to read the cylinder test pressure shall be in accordance with EN 837-1:1996 and EN 837-3:1996, accuracy class 1,6 or better (alternative standards giving the same level of accuracy can be used). They shall be calibrated or checked for accuracy against a master gauge at regular intervals and not less frequently than once every six months. The master gauge shall be re-calibrated in accordance with national requirements.

The test equipment shall not restrict the expansion of the cylinder.

7.52.4.4 Procedure

More than one cylinder may be tested at a time provided they all have a test pressure within the tolerance specified.

Cylinders shall be depressurized in a safe and controlled manner before proceeding.

The cylinder shall be positioned so that the welds are visible during the test.

The pressure shall be increased gradually until the test pressure is reached.
The test pressure shall be held for the time necessary to inspect the cylinder and examine it for any leak and/or other defects, but not less than 5 minutes.

If there is leakage in the pressure test system, it shall be corrected and the cylinders retested.

Cylinders that do not leak or show any visible permanent distortion after the pressure test shall be deemed to have passed this test.

Cylinders that fail this test shall be rejected. Records of rejected cylinders shall be maintained.

After testing the cylinder should be drained and thoroughly dried and precautions taken to prevent internal corrosion. Standing water should not be allowed to evaporate to dryness, unless de-ionized water is used as a final rinse.

7.52.5 VALVES AND FITTINGS

7.52.5.1 General

New, inspected or refurbished valves approved by the manufacturer shall be fitted (Section 7.52.10). It is recommended that the liquid valve sealing rings (REGO style liquid valves), contents gauge seal and retaining screws are replaced.

7.52.5.2 Fixed Liquid Level Gauge

If the Fixed Liquid Level Gauge (FLLG) is to be refitted, the length shall be checked in accordance with the dimensions given in Figure 7.52.1.

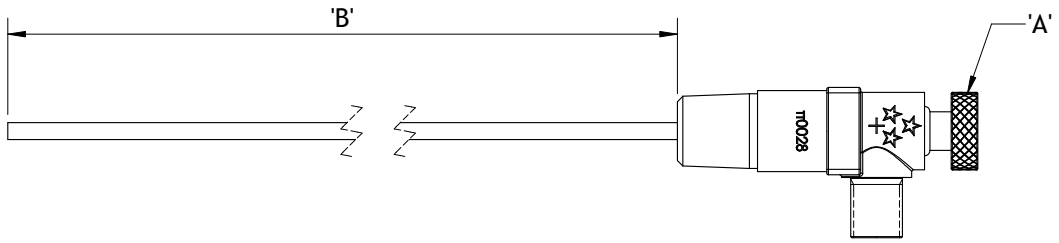
Check that the bleed screw ‘A’ is captive and that the length ‘B’ is correct for the cylinder. If not, the FLLG must be replaced.

These lengths give an approximate 80% fill when filling by volume.

NOTE: If a cylinder type is not listed, contact Cameron Balloons Limited.

NOTE: Sky Balloons V30 and V40 cylinders have integral dip tubes, therefore the FLLG valve does not have a dip tube fitted.

NOTE: For the CB901 Cylinder type the FLLG is integral with the CB981 off-take valve.



'B'	Cylinder Part No. or Description
72	H40 and H55
156	CB497, CB2900, CB2901, COLT V20, LHABL V20
186	CB250, CB426, CB599, CB2380, CB2385, CB2902, CB2903, CB2990, COLT V30, LHABL V30, T30
220	CB959, CB2088, CB2383, COLT V40, LHABL V40
0	SKY V30, V40

Fig 7.52.1 FLLG Details

7.52.5.3 Contents Gauge Screws

When testing several cylinders at the same time take great care that the correct contents gauge screws are re-installed into each cylinder. M6 and 1/4" UNF screws have a similar appearance. If in doubt check the thread pitch with a thread gauge. M6 screws have a 1 mm thread pitch,1/4" UNF screws have 28 threads per inch. The material type may be checked with a magnet. Zinc plated Steel screws are strongly magnetic. Stainless Steel screws are either non-magnetic or weakly magnetic. A variety of head shapes have been used in the past and head shape is not a reliable indicator of screw type.

7.52.5.4 Assembly

Fuel cylinders are manufactured with tapered threads of size ¼" and ¾" NPT or NGT. Effective sealing of a taper thread requires a minimum thread engagement beyond the hand tight position (where the thread binds when installed by hand). This can be reliably achieved by tightening the fitting by a specific number of turns beyond the hand tight position. Table 7.52.1 gives instruction for the number of turns. This method is considered more reliable than an installation torque as it is independent of fitting material and sealing medium which would affect thread friction. Judgement should be made on exactly how many turns should be attempted to correctly position the assembled fitting.

Table 7.52.1 Installation by Number of Turns

Taper Thread Size	No. turns to hand tight (L1)	Hand tight Engagement (L1)	No. of additional turns to tighten (L2)	Tightened Engagement (L3)
1/4"-18	~4	0.2278" (5.79mm)	3	0.1667" (4.23mm)
3/4"-14	~5	0.339" (8.61mm)	3	0.2143"(5.44mm)

NOTE: The values described in Table 7.52.1 are for NPT threads but can also be applied to NGT.

WARNING: Never unwind a taper thread to position a fitting during assembly, as this will likely compromise the thread sealing.

It can still be useful to check the torque of the assembly to ensure proper fitting. Table 7.52.2 gives the minimum torque expected for a good installation. In addition, the recommended sealing/locking method is also given.

Table 7.52.2 Torque values and locking/sealing methods for taper threads

Fitting	Thread Form	Treatment	Check Torque (Nm)
Fixed Liquid Level Gauge (FLLG)	1/4" NPT/NGT	PTFE Tape & Paste	28 - 50
Liquid Offtake	3/4" NPT/NGT		110 - 200
Vapour Offtake	3/4" NPT/NGT		110 - 200
Blanking Plug	3/4" NPT/NGT		110 - 200
Pressure Relief Valve	3/4" NPT/NGT	PTFE Paste	110 - 200
Overfill Protection Device (OPD)	3/4" NPT/NGT	PTFE Tape & Paste	90 - 130
QSO Flanged Adaptor CB437	3/4" NGT		110 - 200
QSO Flanged Adaptor CB2945	3/4" NGT		80 - 130
Threaded Contents Gauge	3/4" NPT/NGT	PTFE Paste	70 - 130
Vapour Regulator	3/4" NPT/NGT	PTFE Tape & Paste	50 - 80
Vapour Regulator Quick Coupling	1/4" BSPT		4 - 6

NOTE: PTFE tape and PTFE paste should be applied in accordance with Section 4 of the Maintenance Manual. Where fittings are supplied with a pre-applied sealant (e.g. Everseal 183), no PTFE tape is required but it is still beneficial to use sealing paste.

For components with parallel threads, such as fasteners, the torque values in Table 7.52.3 can be used to ensure appropriate tightening.

Table 7.52.3 Torque values and locking/sealing methods for parallel threads

Fitting	Thread Form	Treatment	Torque (Nm)
Contents Gauge Screws	M6	Anti-seize compound (Rocol ASC251T or similar)	5 - 7
	1/4"UNF		5 - 7
QSO retaining Bolts	M6	Loctite 270	5 - 7
QSO Outlet - Rego	7/8"UNF	Loctite 270	MIN 50
QSO Outlet - Tema	3/8"BSP	Loctite 270	MIN 50

7.52.5.5 Padded Cover

The main body of Stainless Steel, Duplex Stainless Steel and Titanium cylinders shall be covered by an outer, water-resistant protective layer at least 25mm thick made from structural cellular foam or similar material. However, a thin foam alternative may be used but only with cylinders manufactured in accordance to EN14140 as indicated on the dataplate.

The thin foam alternative adopts a closed cell 10mm high density foam approved by Cameron Balloons LTD and detailed in the Flight Manual Supplement 8.63.

7.52.5.6 PRV Adaptor: CB7922

Colt, Lindstrand, and Sky cylinders were originally fitted with a Sherwood PV435L pressure relief valve. This valve may be replaced with the Omeca 660248 valve (CB8412-1000) by fitting an adaptor, CB7922, into the cylinder boss before fitting the valve.

7.52.6 PNEUMATIC LEAK TEST

1. Close all valves.

2. Charge the cylinder, through the liquid valve, with the pneumatic test medium (e.g. dried compressed air, nitrogen). The minimum pressure in the cylinder should be 0.6 Mpa (6 bar).

3. Isolate the cylinder from the supply.

4. Perform a leak check as detailed in the annual inspection procedure.

5. Vent cylinder to atmospheric pressure.

Cylinders that do not leak shall be deemed to have passed this test.

WARNING: Always vent the cylinder after testing.

7.52.7 TARE WEIGHT

The tare weight or indication of the tare weight shall be re-established if any modification or re-valving has been made which affects the tare weight of the cylinder.

If the new tare indication is different from the old tare indication, it shall be marked on the cylinder and the former tare shall be made unreadable.

7.52.8 MARKING

After successful completion of the periodic inspection, each cylinder shall be legibly and durably marked in accordance with EN14894 or national regulations.

As a minimum the cylinder shall be marked with:

a. The symbol of the re-qualification test station or the symbol of an inspection body.

b. The year and month of the re-qualification.

c. The date of the next re-qualification.

The markings shall be not less than 4 mm in height.

WARNING: The cylinder must only be marked on either the guard ring or foot ring. The cylinder must not be marked on the pressure vessel.

7.52.8 PURGING

Air shall be removed from the cylinder, e.g. by evacuation or by displacement with LPG.

NOTE: This may be done at the test station or during filling.

7.52.9 FAILED CYLINDERS

NOTE: If a cylinder has been deemed unsuitable for further service, it is deemed unsuitable for use in aircraft AND unsuitable for the safe storage liquefied gases.

The rejected cylinder must be rendered unserviceable in accordance with EN 12816 or applicable national regulations.

The serial number of a failed cylinder should be entered in the aircraft logbook.

7.52.10 REPLACEMENT PARTS

In addition to the items listed in the Maintenance Manual Section 8.4.3 the following replacement parts are available.

Where replacement parts are not listed, please contact Cameron Balloons Limited for further information.

7.52.10.1 Contents Gauge

Part No.	Description	Applicability
CB-2561-0000	Gasket, Contents Gauge	All cylinders
CB-2990-5000	Gasket, Contents Gauge (alternative to CB2561-0000)	
CB-2551-0000	Contents Gauge	CB250 (Worthington), CB497, V20 (Colt, Lindstrand, Sky), LHABL T30
CB-7925-1000	Contents Gauge	
CB-2552-0000	Contents Gauge	CB426, CB599, CB2380, CB2385,CB2900, CB2901, CB8430 (V30 Colt, Lindstrand, Sky)
CB-7925-2000	Contents Gauge	
CB-2553-0000	Contents Gauge	CB959, CB2088, CB2383, CB2387, CB2903, CB8440 (V40 Colt, Lindstrand, Sky)
CB-7925-3000	Contents Gauge	
CY-5000-0014	Screw, 1/4"UNF x 7/8" (22mm) long. Zinc plated steel	CB250 (Worthington), CB426, CB497, CB599, CB959, CB2088, CB8424 (H30), CB8414 (H40), CB9412 (H40)
CY-5000-0013	Screw, 1/4"UNF x 7/8" (22mm) long. Stainless Steel.	CB2380, CB2383,CB2385, CB2387, CB2900, CB2901, CB2902, CB2903
CY-0006-3025	M6 x 25, Stainless Steel	V20, V30, V40, T30 (Colt, Lindstrand, Sky)
CB-7913-0000	7381 3/4" Gauge Assembly	CB2990
CB-7917-0000	Cylinder 60l Contents Gauge - Solid Float	CB2900, CB2901
CB-7918-0000	Cylinder 72l Contents Gauge - Solid Float	CB2903

7.52.10.2 Fixed Liquid Level Gauge (FLLG)

Part No.	Description	Applicability
CB-2480-0021	FLLG -186 mm Dip Tube	Refer to Figure 7.52.1
CB-2480-0022	FLLG -220 mm Dip Tube	
CB-2480-0023	FLLG -156 mm Dip Tube	
CB-2480-0024	FLLG -0 mm Dip Tube	
CB-2483-0000	Blanking Nut (Outlet Thread)	All of the above

7.52.10.3 Pressure Relief Valve

Part No.	Description	Applicability
CB-8412-1000	Omeca 660248	CB250 (Worthington), CB426, CB497, CB599, CB959, CB2088, CB2380, CB2383, CB2385, CB2900, CB2901, CB2902, CB2903, CB2990, V20*,V30*, V40* (Colt, Lindstrand,Sky), LHABL T30*
CA-0001-0171	Sherwood PV435L	V20, V30, V40 (Colt, Lindstrand, Sky)
CB-8412-2000	REGO8545AK	CB250 (Worthington), CB426, CB497, CB599, CB959, CB2088, CB2380, CB2383, CB2385, CB2900, CB2901, CB2902, CB2903, CB2990, LHABL T30
CB-8412-3000	Ceodeux 071131	
CB-8412-4000	Sherwood PV435A	
CB-7922-0000	PRV Adaptor	V20, V30, V40, T30 (Colt, Lindstrand, Sky)
CB-0981-0000	Vapour Valve Incorporating PRV	CB901 (6 lb Vapour Cylinder)

*Can only be fitted using adaptor CB-7922-0000

7.52.10.4 Liquid Valve

7.52.10.4.1 Handwheel (REGO) Valve

Part No.	Description	Applicability
CB-2992-0000	Liquid valve with integral dip tube	CB2990
CB-7900-0000	Liquid valve, Hi-Flow	All cylinders except CB2990
CB-0824-0001	Liquid Valve, Handwheel (BMV344)	
CB-2628-0000	Self Seal Repair Kit (BMV344)	All cylinders
CT-8180-9000	Dust Cap	
CB-2629-0000	Main Seal Repair Kit	

7.52.10.4.2 Quick Shut Off (QSO) Valve

Part No.	Description	Applicability
CB-0671-3000	QSO Valve Assembly Tema Duplex	CB2900, CB2901, CB2902, CB2903
CB-0671-3100	QSO Valve Assembly Tema Duplex - Angled	
CB-0671-4000	QSO Valve Assembly Rego Duplex	
CB-0671-4100	QSO Valve Assembly Rego Duplex - Angled	
CB-0671-7000	QSO Valve Assembly Tema CB2990/B	CB2990
CB-0671-8000	QSO Valve Assembly Rego CB2990/B	CB2990
CB-0671-1000	Liquid Valve, QSO, 1¼"ACME Outlet	All cylinders not listed above
CB-0671-2000	Liquid Valve, QSO, TEMA 3800 Outlet	
CB-0392-0018	Seal Kit, QSO, (Worcester Type 44 Ball Valve)	All cylinders
CB-0671-0007	TEMA 3800 Outlet	
CH-3800-0003	Bonded Seal (3/8"BSP)	
CH-3800-0006	Dust Cap (TEMA 3825)	
CB-8407-0000	Outlet Adapter, 1¼"ACME	

7.52.10.5 Vapour Valve

Part No.	Description	Applicability
CB-2884-0000	Vapour Valve, 3/8 NPT outlet	CB426, CB497, CB599, CB959, CB2088
CB-2896-000 + CB-2895-0000	Vapour Valve, PRV 3/8 NPT outlet + dip tube	CB2830,CB2383, CB2385, CB2387 CB2900, CB2901, CB2902, CB2903
CB-2883-0000	Vapour Valve, PRV, POL Outlet	Lindstrand / T&C V20, V30 and V40, CB250, CB426, CB497, CB599, CB959, CB2088
CQ-2000-0001	Vapour Valve, PRV, POL Outlet & dip tube	CB2830,CB2383, CB2385, CB2387 CB2900, CB2901, CB2902, CB2903
CQ-2000-1000	Vapour regulator dynaquip. POL inlet.	All Cylinders
CQ-2000-2000	Vapour regulator Tema. POL inlet.	
CT-0250-0013	Blanking Plug, 3/4 NPT	
CB-0981-0000	Vapour Valve (Incorporating PRV and FFLG.)	CB901

7.52.10.6 COMPONENT ORIENTATION

7.52.10.6.1 Duplex Stainless Steel Cylinders

Correct orientation of the contents gauge is required to prevent a possible clash between the gauge float and the cylinder dip tube.

CB2552-0000 and CB2553-0000 (LIVELLO) gauges must be orientated with the 'TOP' label nearest the PRV. CB7917-0000 and CB7918-0000 (ROCHESTER) gauges must be orientated with the pointed part of the dial cover nearest the PRV. See fig. 7.52.2 for the correct orientation of both types.

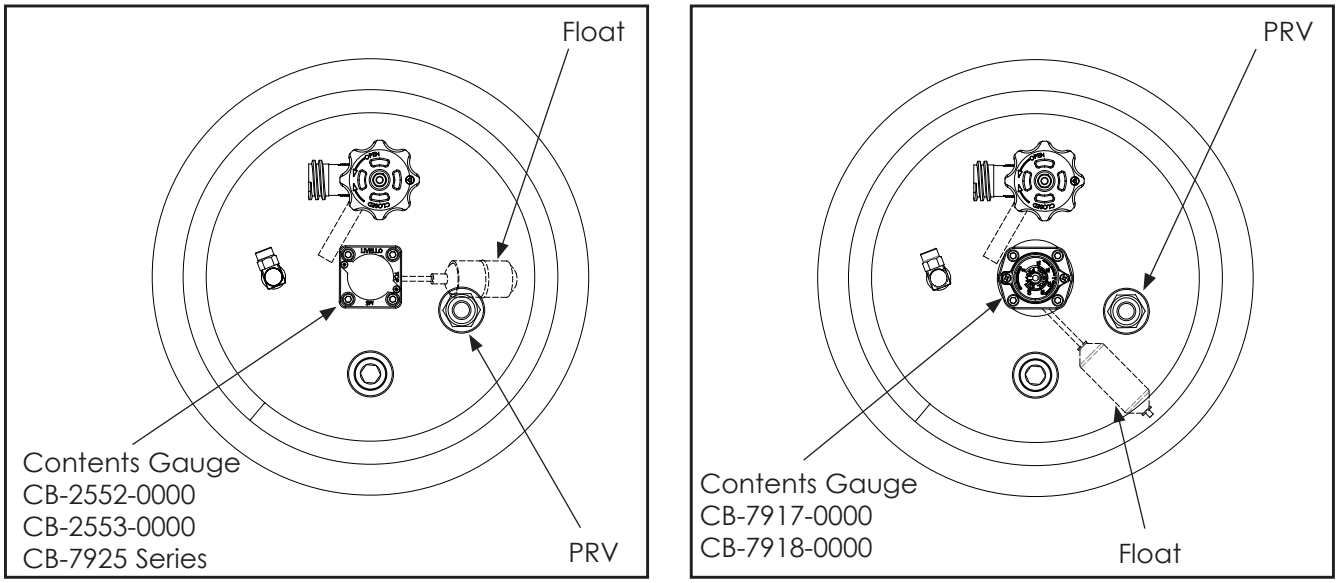


Fig. 7.52.2: Orientation of Contents Gauges

7.52.10.6.2 Alugas cylinders CB2990

Orientation and order of assembly of the cylinder components are important to avoid clashes between components. The following must be observed:

1. The Liquid Handwheel have must be installed before the Gauge and PRV.
2. the QSO Flanged Adaptor must be orientated to the PRV as shown. Ensure the QSO handle is clear of the Gauge when in the closed position.
3. The gauge body must be orientated to the cylinder orientation mark as shown.

   WARNING: The gauge must not be installed with power tools that uses a hammer function. Installation by hand at low rotational speed is required. It is recommended that the gauge is installed last.

4. The FLLG should be installed to ensure it's outlet does not clash with the guard ring, and that the contents gauge has tool access.

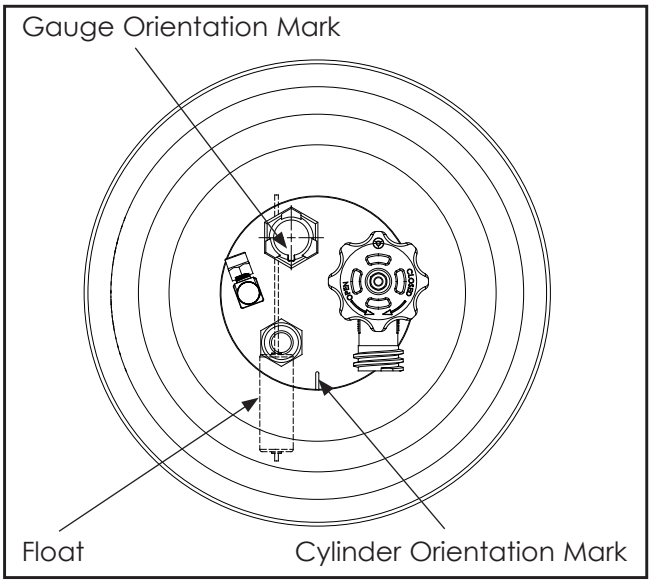


Fig. 7.52.3: Orientation of Gauge

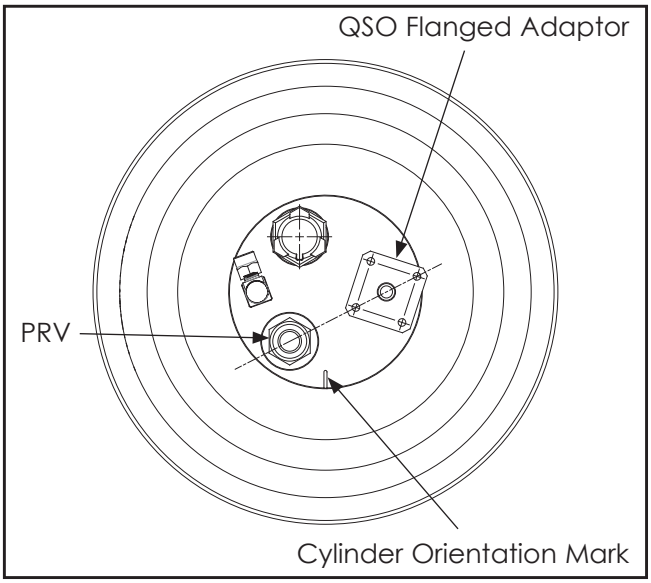


Fig. 7.52.4: Orientation of QSO Flanged Adaptor

7.52.10.7 Overfill Protection Device (OPD)

Part No.	Description	Applicability
CB-2920-0000	Overfill Protection Device	CB2901, CB2902, CB2903, CB959

7.52.10.7.1 OPD Positioning

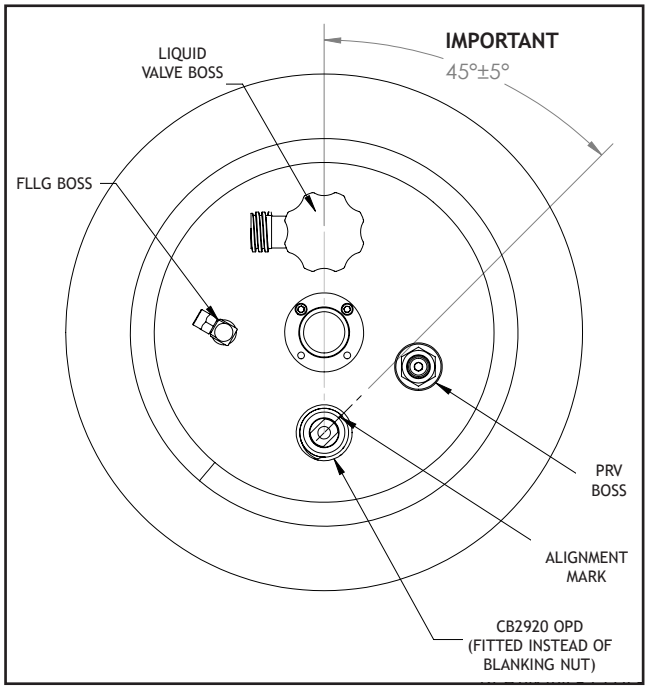


Fig.7.52.5: OPD Alignment Detail for CB2901, CB2902 and CB2903 Cylinders

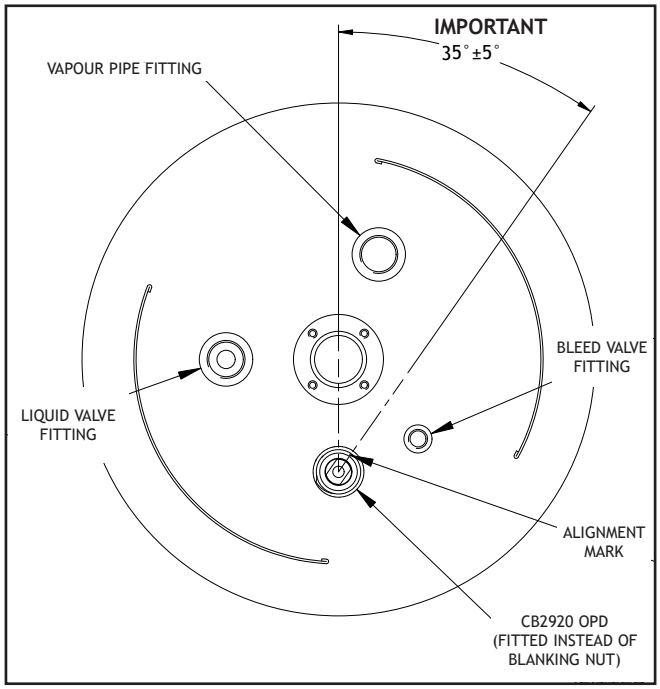


Fig.7.52.6: OPD Alignment Detail for CB959 Cylinders

NOTE: Installation of a OPD into a standard configured CB959 cylinder (not master), may require the PRV to be installed into the vapour take-off boss. In this case, a PRV Adaptor may be required to prevent the the PRV clashing with the vapour pipe fitting.