OVERVIEW OF PLANT OPERATIONS IN LPG (LIQUIFIED PETROLEUM GAS) BOTTLING PLANT

Applies to:

Functional /Domain Experts

Summary

This paper describes LPG filling operations in a LPG Bottling Plant.

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Created on: 06/10/2009

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LPG bottling plant is a plant where LPG is filled into bottles (cylinders) for storage and distribution among various LPG distributors. The plant has the facility to receive bulk LPG by Tank trucks (of various capacities e.g. 12MT, 17MT etc) or pipeline from a reliable source e.g. Refinery or any other LPG Bottling Plant. After receipt of Bulk LPG, filling of LPG into cylinders is done. Here we shall discuss the filling operations in LPG Bottling Plant.

SEQUENCE OF PRIMARY OPERATIONS

OVERVIEW OF PRIMARY OPERATIONS:

Primary Operations in a Bottling plant are main line activities, directly associated with filling of LPG cylinders. Any obstruction in these activities will hamper Plant production. Some activities are Cylinder receipt, filling, Check scale weighing, Tightness testing etc. These are described below:

STAGE - I: RECEIPT OF CYLINDERS

Explanation:

(a) Incoming cylinders fall into following categories:

i. New cylinders from manufactures
ii. Cylinders in circulation from distributors (empty, under-filled, defective).
iii. Cylinders received from Statutory Testing Plants, duly tested.
(iv) Repaired cylinders received from the approved repairers.
(b) All cylinders received should be against valid documents and the actual receipt should be tallied with the details on the relevant document and shortages or any other shortcomings should be endorsed on the body of the document.
(c) All new cylinders received should be supported by Test Certificate for ISI (Indian Standards Institute) inspection and approval from CCE (Chief Controller of Explosives) before they are put to use.
(d) Visual inspection of the cylinders should be done.
(e) Under-filled cylinders received from distributors should be weighed to verify the extent of under-filling.
(f) Reasons for leaky/defective cylinders received from distributors should be verified as marked on the tag attached to the cylinder.
(g) Extra care should be exercised to check for spurious cylinders and efforts made to identify the source of receipt. Spurious cylinders must be segregated for scraping.
(h) New cylinders or cylinders received from Statutory Testing Plant or any cylinder which has undergone pneumatic test must be purged before they are taken up for filling.
(i) Cylinders due for Statutory Testing must not be taken up for filling but sent to testing Plant.
In case of ‘SC’ type valve the valve seat remains in closed position unless pressure is applied against the spring. With the valve outlet open, any

Explanation:

STAGE - VIII: TIGHTNESS TEST - I

Explanation:

(a) ‘SC’ type valve

In case of ‘SC’ type valve the valve seat remains in closed position unless pressure is applied against the spring. With the valve outlet open, any
bubbles emerging out through the valve outlet would indicate leak through the valve seat.

(b) General
i. At this stage, leakage through bung or cylinder body may also be noticed in the form of bubbles emerging out from the leaky spot.
ii. In case of any leak of above nature the cylinder is marked for segregation with appropriate marker to identify the type of leakage.
(c) The tightness tests are intended to check leak through the cylinders which could be through:
  i. Cylinder's parent metal or pin hole in weld joint.
  ii. Cylinder/valve joint commonly known as bung-joint.
  iii. The valve seat (with valve closed).
  iv. The valve spindle (with valve closed or open).
  v. The valve body (very rare occurrence)
  vi. The special adaptor/valve-outlet joint (in case of 'SC' type valve).
(d) The tightness test-I is basically intended to check leaks past the valve seat.
(e) Carousel type of tightness testing baths, which keep the cylinders in vertical position, are ideally suited for checks at this stage.
(f) Painting of interior surface of the test bath with white paint, provision of sufficient lighting arrangement and periodic changing of water for the test to ensure that it is clean, help in easy detection of the leaks.
(g) Whenever leak is observed, attempts should be made to stop it, if possible (e.g. by tight closure of "F" type valve or fixing of security nut/cap etc.)
(h) If the leak cannot be stopped the cylinder should be sent for evacuation.

Suitable markers should be used to identify type of leaks such as valve leak, bung leak, etc.

STAGE - IX: SEGREGATION - III
Explanation
(a) Leaky cylinders from tightness test bath-I should be segregated and sent to Evacuation Unit.

STAGE - X: PREPARING CYLINDER FOR TIGHTNESS TEST - II
Explanation:
(a) Cylinder with 'SC' type valve
  i. Water to be blown from the cavity of the valve, by air. (The cavity may be full of water when the cylinder comes out from the test bath - I)
  ii. Special type of adaptor (dummy pressure regulator) to be fixed, locked and adjusted on the valve. After fixing the adaptor, the knob is to be turned in on position to keep the valve seat open. The adaptor is basically a body of Pressure Regulator with diaphragm and related parts removed and outlet blocked (i.e. dummy Pressure Regulator). Alternatively the effectiveness of the 'O'-ring can also be checked through portable leak-detector which could be mounted on the cylinder valve, and leak, if any, observed through the fluid in the detector.

STAGE - X: TIGHTNESS TEST - II
Explanation:
(a) 'SC' type valve
  i. With the valve seat in open position with the help of special adapter the effectiveness of the 'O' ring (making a joint with the inlet of the pressure regulator) is tested.
(b) General
  i. Tightness test is carried out with the valve seat in open position and outlet closed, with security nut in case of 'F' type valve and with adaptor in case of 'SC' type valve.
  ii. At this stage leakages through bung or cylinder body are also checked which may be noticed in the form of bubbles emerging out from the leaky spot.
(c) Leakage past valve seat having checked at tightness test bath I (STAGE - VII), other possible leaks are tested through tightness test bath II.
(d) Suitable markers should be used to identify types of leaks such as bung leak, valve leak etc.
(e) Immediate action should be taken to stop the leak temporarily wherever practicable. If the leak cannot be stopped, the cylinder should be sent for evacuation and should receive priority over defective cylinders which are not leaking.
(f) The leaky cylinder, before it could be evacuated, should be so placed that the leakage is that of vapor and not liquid.

STAGE - XI: SOAP SOLUTION TEST
Explanation:
(a) Soap solution test is applied to check bung leaks in case of both 'F' type and 'SC' type cylinders. This is in addition to the two tightness tests carried out at stage VIII and Stage XI. A suitable marker should be placed to identify bung leak.
(b) White applying soap solution to the bung/valve joint it must be ensured that the solution is applied all around the valve/bung joint.
(c) Soap only should be used for making a soap solution and not a detergent.
(d) Soap solution test is done to detect minute leaks through the joint which normally remain undetected in water baths.

STAGE - XII: SEGREGATION - IV
Explanation:
(a) Leaky cylinders from tightness test-II should be segregated and sent to Evacuation Unit.

STAGE - XIV: FINISHING OPERATIONS
(b) Cylinders with 'Self-Closing' valve
  i. Remove special adaptor (if fixed).
  ii. Blow cavity of the valve outlet with air in case any water is observed.
  iii. Fix the security cap on the valve outlet.
  iv. Fix appropriate neck label.
  v. Seal the valve outlet using sealing tape.

STAGE - XIII: FINAL INSPECTION
Explanation:
(a) Check the cylinder visually for:-
  i. Apparent sound condition.
  ii. Presence of cap, and neck label in case of cylinders with 'cap' as valve protection.
(b) Correct deficiency noticed, if any.

STAGE - XIV: DISPOSAL OF FILLED CYLINDERS IN SOUND CONDITION.
Explanation:
(a) At this stage the cylinders are ready for delivery:-
i. If required the fit cylinders can be directly sent to the stake trucks for loading.
ii. If no stake-truck is available, the cylinders can be sent for stacking in the area earmarked for the purpose.