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# SPECIFICATION FOR LIQUID & POWDER COMPOSITION FOR NEUTRALIZATION AND SAFE DISPOSAL OF PYROPHORIC SUBSTANCES OF LPG AND BTPN (PETROL) TANK WAGONS

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# SPECIFICATION FOR LIQUID & POWDER COMPOSITION FOR NEUTRALIZATION AND SAFE DISPOSAL OF PYROPHORIC SUBSTANCES OF LPG AND BTPN (PETROL) TANK WAGONS

## 0.0 PREAMBLE:

Cleaning of LPG and BTPN Tank Wagons during P.O.H. at Workshop poses two major problems as under:

1. LPG entrapped can catch fire & explosion may take place if spark is generated while removing the sludge from the Tank Wagon.
2. Sulphur present in LPG and Petrol reacts with wall of the Tank Wagon to produce sludge, which has FeS (Ferrous Sulphide) as major constituent. It is Pyrophoric by nature, which under goes rapid oxidation, with release of heat, when comes in contact with air. There may be major fire hazard because of this, during storage & disposal of the sludge.
3. Suitable compositions are available which can prevent explosion and fire during cleaning of Tank Wagons & storage of the sludge.
4. The recommended practices on " Storage and Handling of Bulk Liquefied Petroleum Gas (LPG), Oil Industry safety directorate specification no OISD-RP- 158 and OISD-STD-116 on Fire Protection Facilities for Petroleum Depot & Terminals shall be applicable to this specification.

## 1.0 SCOPE :

**1.1** This standard prescribes the requirements and method of tests including the Performance Test, for the compositions to be used for preventing Pyrophoric risks.

**1.2** The product in liquid form is suitable for neutralization of Pyrophoric materials in Tank Wagons used for transportation of Liquid Petroleum Gas and Petrol. The material in Powder form is suitable during storage and safe disposable of Pyrophoric materials. Wherever necessary, both types of the products may be used simultaneously.

**NOTE**: "**Firm should comply Make in India Policy and Public Procurement (Preference to Make in India) Order-2017 under this specification" and subsequent Amendment done time to time.**

## 2.0 TENDER EVALUATION

For tender evaluation, the total cost of 100 liters of diluted liquid concentrate in ready to use condition and the cost of that quantity of powder which is to be used for neutralization of 100 kg of freshly removed LPG Tank Wagon sludge shall be taken into consideration for cost comparison.

## 3.0 SAMPLING

**3.1** Representative samples of the product shall be drawn from the supplied lot at random for the testing including the performance tests as prescribed in APPENDIX- A & B. Test certificate for those tests which cannot be carried out at the consumer's end may be carried out at outside reputed Testing Lab. and its Test Report shall be submitted along with the material.

# 4.0 REQUIREMENTS

## 4.1 PRODUCT-I : LIQUID CONCENTRATE

4.1.1 This product shall be a liquid formulation, which meets special fire risks of Pyrophoric substances-LPG and BTPN sludge and also general CLASS- A fires. It shall be formulated with specialty surfactants, stabilizers, wetting agents, preservatives and solvents. The formulation should give satisfactory performance over wide temperature range.

4.1.2 It shall also be an efficient fire extinguishing agent for CLASS- A fires.

4.1.3 It shall have very good penetrating power to reach up to the bottom of sludge layer and shall control deep-seated fires.

4.1.4 It shall be stable and effective in cooling the fuel surface and suppress release of fuel vapors.

4.1.5 It shall produce thick, stable foam blanket which acts as an insulating layer to reduce heat radiation.

4.1.6 The product shall be easily miscible to give stable solution with fresh water when diluted in the ratio recommended by the manufacturer.

4.1.7 It shall meet required parameters & field performance test as per TABLE-I

## 4.2 PRODUCT- II: POWDER

4.2.1 The formulation shall be in dry powder form, which shall be effective in preventing fire of Pyrophoric sludge collected from LPG and BTPN Tank Wagons.

4.2.2 It shall be composed of metal salt, adsorbing materials and treated with additives to impart free flow and anti caking properties.

4.2.3 It shall adsorb fuel vapors & heat from the sludge of LPG and BTPN Tank Wagons and prevent initiation of fire.

4.2.4 It shall not allow any re-ignition when mixed with the sludge in ratio recommended by the Manufacturer.

4.2.5 Nitrogen gas is preferred compare to $CO_2$ as expelling agent when this powder is to be applied to a Tank Wagon.

4.2.6 It shall meet the required parameters & Field Performance test as per TABLE-II.

**4.3** The rounding off the value observed on calculated result of test or analysis shall be done in accordance with IS: 2-1960 Reaffirmed 2016 or its latest version.

**4.4** All the tests shall be conducted at room temperature (27±2)ºC and a Relative Humidity at (65±5)% in a well-ventilated chamber free from draughts and dust, unless and otherwise specified.

## 5.0 STORAGE & SHELF LIFE

The products shall be stable and shall not degrade or deteriorate when stored at 0º C to 50º C, in original packing protected from direct light heat & humidity.

## 6.0 ENVIRONMNETAL ASPECTS

The products should be safe to store & handle and hazards if any associated with them shall be clearly marked on the packing. Material Safety Data Sheet(MSDS) shall be given for each product at the time of supply. Product shall be biodegradable and safe for disposal in wastewater treatment plant, as per requirements of respective Pollution Control Boards.

## 7.0 COMPATIBILITY

Both the products-I (LIQUID CONCENTRATE) & II (POWDER) shall not degrade or adversely harm the following materials even in prolong contact:

a) Mild Steel IS: 2862
b) Low Alloy Steel IRS: M 41
c) Outside painted surfaces, Rubber items, Stainless steel parts of wagon etc.

## 8.0 PACKING

The products shall be packed in suitable airtight HDPE/HMHDPE containers of 20 Liters capacity, unless otherwise specified.

## 9.0 MARKING

Each container shall be marked with following legible & indelible legends:

1. Name of the Product with Grade/Type
2. Name of the Manufacturer and/or his Trade Mark if any
3. Quantity of the Product Packed
4. Batch no or Lot No
5. Specification No.
6. Month & Year of Manufacturing
7. Storage conditions
8. Product is Environmental friendly

## 10.0 OTHERS:

**10.1** Supplier shall submit Tender samples for each product packed in three different sealed & duly labeled containers, each containing not less than 2 kg of the product. One of the containers will be selected at random and tested as per the requirements of the specification. Remaining two containers will be treated as controlled sample for future reference.

**10.2** Manufacturer shall be capable of supplying both type of the products i.e. Liquid Concentrate and Powder.

**TABLE - I REQUIREMENTS FOR LIQUID CONCENTRATE**

| S.No. | PARAMETER | REQUIREMENTS | TEST METHOD |
|---|---|---|---|
| 1. | Appearance | Clear, Homogenous liquid | Visual inspection |
| 2. | pH (as such ) | 7.0 - 8.0 | APPENDIX -C, Para 2 |
| 3. | Sp. Gravity | 1.0 ± 0.1 | APPENDIX -C, Para 3 |
| 4. | Viscosity by Ford Cup No.4, at 27± 2ºC | 20-150 cps | APPENDIX -C, Para 4 |
| 5. | Refractive Index | 1.33 -1.37 | APPENDIX -C, Para 5 |
| 6. | Infra red Spectra | * To match the Approved spectrum | APPENDIX- C, Para 6 FT-IR SPECTROMETER |
| 7. | Performance Test | To pass the test. | APPENDIX -A |
| 8. | Shelf life, when stored at 0ºC to 50ºC, Minimum | 07 years | The product should retain all the properties during this period |

* Refer. APPENDIX-C, Para 6, for the Approved Spectrum. This test shall be carried out at the time of approval. During supply of the material, every 5th Batch and if Batches to be supplied are less than 05, then last Batch of the supplies made shall be tested and spectrum obtained should match the Approved Spectrum.

**TABLE- II REQUIREMENTS FOR POWDER**

| S.No. | PARAMETER | REQUIREMENTS | TEST METHOD |
|---|---|---|---|
| 1. | Apparent Density | 0.5 – 0.8 | APPENDIX -D, Para 1 |
| 2. | Heat stability | To pass the test | APPENDIX -D, Para 3 |
| 3. | Particle size distribution, retention on 45-microns/325-mesh sieve, % by mass, max. | 25.0 | APPENDIX D, Para 2 |
| 4. | Infra Red Spectra | *To match the Approved spectrum. | APPENDIX- D, Para 4 FT-IR SPECTROMETER |
| 5. | Performance Test | To pass the test | APPENDIX -B |
| 6. | Shelf life, when stored at 0ºC to 50ºC, Minimum | 02 years | The product should retain all the properties during this period |

* Refer. Appendix-D, Para 4, for the Approved Spectrum. This test shall be carried out at the time of approval. During supply of the material, every 5th Batch and if Batches to be supplied are less than 05, then last Batch of the supplies made shall be tested and spectrum obtained should match the Approved Spectrum.

# APPENDIX- A

## PERFORMANCE TEST FOR LIQUID CONCENTRATE

**1.0** This test is carried out to determine performance of liquid concentrate on the sludge of LPG and BTPN Tank wagons.

**1.1 LOCATION AND AMBIENT CONDITIONS**

Carry out the test indoor or outdoor, when the wind speed is not more than 3m/s. Ambient temp. should be (15 – 50)° C

**1.2 SUBSTRATE** - Freshly removed, dry sludge of LPG or BTPN Tank Wagons.

**1.3 PROCEDURE:**

(i) Take a rectangular box with open top, made up from mild steel sheet of 0.5 mm thickness of dimension 10 cm X 10 cm X 15 cm having one side removable as shown in the diagram, at page no 10, Appendix-E.
(ii) Fill it completely with freshly removed sludge of the LPG or BTPN Tank Wagon. Tap the sides gently and add sludge to box completely. Repeat till box is fully filled.
(iii) Prepare 2 kg-diluted solution of liquid concentrate by mixing 0.2 kg liquid concentrate with 1.8 kg water. Mix well.
(iv) Pour slowly (within 5 Minutes), 1kg of the above-diluted solution on the surface of the sludge filled in the rectangular box.
(v) Allow to stand for 10 minutes.
(vi) Expose the side of the heap by removing the movable side.

**1.4 CRITERIA FOR ACCEPTANCE**

The test is considered successful if the diluted solution of the Liquid concentrate has penetrated the sludge heap till the bottom and wetting of sludge can be seen.

**1.5 TEST TO CHECK RESISTANCE TO FIRE**

(i) Close the open side. Pour remaining diluted solution of the liquid concentrate on the sludge from the open top.
(ii) Allow to stand for 15 Minutes.
(iii) Drain off excess liquid.
(iv) Remove sludge from the box and mix well.
(iv) Allow to stand for 30 Minutes to drain off further liquid.
(v) Carry out torch test with Oxy-Acetylene torch.

**1.6 CRITERIA FOR ACCEPTANCE**

The test is considered successful if the sludge does not catch fire. Smoke or small flickers, which are self-extinguishing in less than 150 Seconds, are to be accepted.

# APPENDIX- B

## PERFORMANCE TEST FOR POWDER

**1.0** This test is carried out to determine performance of powder on the sludge of LPG and BTPN Tank Wagons.

### 1.1 LOCATION AND AMBIENT CONDITIONS

Carry out the test indoor or outdoor, when the wind speed is not more than 3m/s. Ambient temperature should be (15 – 50)º C

**1.2 SUBSTRATE** - Freshly removed, dry sludge of LPG or BTPN Tank Wagon.

### 1.3 PROCEDURE

(i) Take 10 kg of freshly removed sludge of the LPG or BTPN Tank wagon.
(ii) Mix it thoroughly with 2kg of Powder.
(iii) Allow to stand for 5 Minutes.
(iv) Carry out torch test with Oxy-Acetylene torch.

### 1.4 CRITERIA FOR ACCEPTANCE.

The test is considered successful if the sludge heap does not catch fire. Smoke or small flickers, which are self-extinguishing in less than 150 Seconds, are to be accepted.

### 1.5 TEST TO CHECK RESISTANCE TO RE-IGNITION

(i) Prepare a fresh heap of 10 kg of freshly removed sludge of LPG or BTPN Tank Wagon.
(ii) Weigh 2 kg of Powder..
(iii) Ignite the heap of sludge with torch and allow to burn for 5 Minutes.
(iv) Spread the 2 kg powder gently on the burning sludge heap.
( v) Ensure complete coverage
(vi) Wait for 5 Minutes.
(vii) Carry out Torch test with Oxy-Acetylene torch, immediately after 5 minutes, if fire has extinguished completely (or immediately after extinguishments of the flicks).

### 1.6 CRITERIA FOR ACCEPTANCE

The test is considered successful if the sludge heap stops burning within 5 minutes. Smoke or small flickers, which are self-extinguishing in less than 150 seconds, are to be accepted.

# APPENDIX- C

## PROCEDURE FOR LIQUID CONCENTRATE TESTING

### 1.0 APPEARANCE

Take 100 ml clean glass beaker. Fill it with the composite sample of the liquid concentrate. No layer separation formation, lumps, sediments and suspended impurities shall be observed.

### 2.0 pH (AS SUCH)

Take 100 ml of composite sample of the liquid concentrate in a clean 100 ml glass beaker and measure its pH with a standard pH meter using glass electrode at (27±2)º C. (Ref IS: 4309 -1979 latest version).

### 3.0 SPECIFIC GRAVITY

Determine sp. gravity of 100 ml of composite sample using pyknometer or a specific gravity bottle at (27 ± 2)º C or as per IS:1448-2014(P-16)or its latest version.

### 4.0 VISCOSITY

### 4.1 BY FORD CUP NO. B-4

Take clean Ford cup No. B- 4-viscosity measuring cup. Take approximate 300 ml of the composite sample of the liquid concentrate and bring its temp. to (27 ± 5)º C. Fill the Ford cup to the brim and allow slight over flow after closing the orifice with finger. Level liquid surface with a scale. Remove finger and immediately start stopwatch. Measure time taken in seconds for the entire liquid to pass through orifice.

$$\text{Viscosity (in cps)} = \frac{\text{Time in second X 220*}}{60}$$

(*Use factor given by the cup manufacturer if different)

### 5.0 REFRACTIVE INDEX

Take composite sample of the liquid and bring its temp. to (27 ± 2)º C. Measure its Refractive Index using Abbe's Refractometer.

### 6.0 INFRA RED SPECTRA

Infra red spectra of the composite sample to be obtained, using suitable FT-IR spectrometer. The spectrum of the sample shall be identical to the original spectrum obtained/submitted by the firm at the time of firm's approval / approval of tender sample. Care shall be taken to avoid contamination. During supply of the material, every 5th Batch and if Batches to be supplied are less than 05, then last Batch of the supplies made shall be tested. If test facilities for the same are not available at consignee's end, then the test may be carried out, at approved out side testing agencies.

# APPENDIX- D

## PROCEDURES FOR POWDER TESTING:

### 1.0 APPARENT DENSITY

The apparent density of the powder when determined as under shall be between 0.5 to 0.8 g/ml.

**1.1** A sample of 100 g of dry powder shall be placed in a clean dry 250 ml glass stopper graduated cylinder.
The cylinder shall be rotated slowly, end over end, for ten complete cycles and then set upright to let the powder settle for 60 seconds. After shaking it gently to level off the surface of the powder, the volume of the powder in the cylinder shall be noted and the apparent density calculated as follows:

$$\text{Apparent Density} = \frac{100}{\text{Volume of the powder}}$$

### 2.0 PARTICLE SIZE DISTRIBUTION

Weigh correctly 25 gm. of the material. Transfer the material on 45-microns/325-mesh sieve and shake the sieve for 30 minutes for hand sieving and 10 minutes for machine sieving. After sieving for the specified time, the retention of the particle shall not be more than 25% by mass.

### 3.0 HEAT TEST

Weigh 150 g of dry powder in a tinned steel cup, 75 mm in diameter and 50 mm deep with a closely fitted cover. Place the cup in a thermostatically controlled oven at a temperature of $60^0$ C for a week. The sample shall then be examined for caking or lump formation. The lump or cake, when dropped from a height of 100 cm on a smooth hard surface, shall be friable to pass the requirement.

### 4.0 INFRA RED SPECTRA

Infra Red Spectra of the composite sample to be obtained using suitable FT-IR Spectrometer. The spectrum of the sample shall be identical to the original spectrum submitted by the firm at the time of firm's approval / approval of tender sample approval. Care shall be taken to avoid contamination. During supply of the material, every 5th Batch and if Batches to be supplied are less than 05, then last Batch of the supplies made shall be tested. If test facilities for the same are not available at consignee’s end then the test may be carried out at approved outside agencies.

# APPENDIX –E

**DRAWING OF BOX**