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To,
The Secretary
Petroleum and Natural Gas Regulatory Board
1st Floor, World Trade Centre,
Babar Road, New Delhi - 110001

Subject: Comment on the draft regulation “Technical Standards and Specifications including Safety Standards for Refineries and Gas Processing Plants Regulations, 2020”

Dear Sir,

This is with reference to the Public Notice dated 17.02.2020 & 02.03.2020 regarding the submission of views/comments to the above-mentioned draft regulation.

We are pleased to submit our comments for your kind review and incorporate in the regulation.

In Chapter 5.8 Equipment, Sub-chapter 5.8.13 Lightning protection – it is currently mentioned as quoted below.

“Lightning protection shall be provided as per IEC 62305 or IE rules”.

We suggest for detailing of the lightning protection requirement considering human safety and equipment protection during operation of plant. **Following are our comments to be included in sub-chapter.**

5.8.13 Lightning Protection

5.8.13.1. Lightning hazards

- i. A lightning strike is an electrical discharge between the cloud and the earth. It is a natural, unpredictable phenomenon having independent current source. The lightning has number of components such as lightning current, very high peak current, charges, specific energy with a wave shape of 10/350 μ s.
- ii. The lightning current parameters playing a role in the integrity of an LPS are peak current I, the charge Q, the specific energy W/R, the duration T, and the average steepness of the current di/dt. With this form of discharge, very high current densities occur at the point of impact. The high currents lead to heating and potential shifts along the discharge line. The lightning current has electromagnetic effects. These can be galvanic, inductive or capacitive coupling, conducted shock waves and electromagnetic pulse fields.
- iii. A lightning strike can ignite an explosive atmosphere both through a direct impact and from the effects of a further impact.
- iv. In case of a direct lightning strike, the high currents along the lightning current path can heat up these system parts, spray discharges can occur. Spark discharges or arcing are possible due to potential differences to adjacent parts of the system. This will ignite explosive atmospheres. And therefore, proper lightning protection system shall be provided.

5.8.13.2. Measures to reduce the negative effects of lightning

- i. The lightning strike in potentially explosive areas must be prevented, otherwise the explosive atmosphere will ignite. All parts of a system with potentially explosive atmosphere must be protected with a lightning protection system to ensure human safety and minimum loss to property and environment.
- ii. In general, a lightning protection system shall be designed and installed minimum in LPL II as per IEC 62305-2 for areas with risk of explosion. However, a detailed risk assessment according to IEC 62305-2 shall recommend for higher/stricter values i.e. LPL I and accordingly LPL I to be followed for designing LPS.
- iii. The Lightning protection system must be planned and installed strictly according to method and specification given in IEC 62305. A risk assessment according to IEC 62305 part 2 is recommended for all cases.
- iv. Lightning discharge paths must be designed in such a way that their heating or ignitable sparks cannot become the ignition source of the dangerous explosive atmosphere.
- v. When discharging lightning currents, flashovers should be avoided, especially in potentially explosive areas of Zone 1/21 and 0/20. In order to achieve this, the discharge paths must be in a sufficient safety distance from all parts of the system considering electrical separation distance based on formula given in IEC 62305-3.
- vi. All operational buildings like unit substation, unit control rooms, fire control rooms, ETP buildings, administrative buildings etc. shall be protected against direct lightning and installed with external LPS, designed in minimum LPL II or higher depending upon actual risk assessment calculation.
- vii. All critical and emergency equipment shall be provided with surge protection device as per type classified in IEC 62305 part 4.
- viii. All equipment signals related to electrical fault, tripped, alarms, indication, and malfunction bring up in central control room or in DCS shall have surge protection device able to handle 10/350 lightning impulse current.
- ix. All Intrinsically safe circuits/signals for process units, storage tanks etc. shall have PESO approved surge protection device in the field in hazardous area and in the central control room in safe area, strictly in accordance with IEC 60079 and IEC 62305.
- x. Fire and Gas detection system and emergency shutdown system shall have surge protection device to minimise the loss to life and property by ensuring maximum availability of fire protection facilities.
- xi. All emergency response system like Public Address system, CCTV surveillance, Access control system etc. shall be protected with proper surge protection device able to handle 10/350 lightning impulse current.
- xii. Storage tanks shall be protected against lightning using rolling sphere method and the discharge paths must be in a sufficient safety distance from all parts of the system. The safety distance shall be maintained in such a way that the system doesn't hinder the movement or limit the space available inside dyke area and doesn't add up to any safety hazard due to non-maintenance. This safety hazard can be avoided by using special cables tested as per IEC /TS 62561-Part 8 from a recognised international lab for compensating equivalent separation distance while discharging 10/350 lightning impulse current of 150KA (level 2) or higher.
- xiii. The installation of the Lightning protection system shall be done under close supervision of the manufacturer of LPS components.
- xiv. The plant/entity shall prepare report for approval for conformities to the requirements mentioned in this regulation as per provided checklist as per annexure (attached) for ease of planning and execution of the non-conformities/ protection measures.

Certificate Ref. No.:

**INSPECTION & TESTING OF LIGHTNING PROTECTION SYSTEM
AS PER IS/IEC 62305**

1 LIGHTNING PROTECTION SYSTEM DESIGNER AND EXECUTOR DETAIL

1.1. Name:

1.2. Address:

1.3. Contact:

Email:

2 BUILDING/STRUCTURE DETAILS

2.1. Name:

2.2. Location:

2.3. Dimension:

2.4. Type of Construction:

2.5. Roof type: Concrete/Metal

2.6. Roof shape: Flat/Pitched

3 PRE-REQUISITE OF TESTING/INSPECTION

3.1. Design & drawing of LPS as per IS/IEC 62305

3.2. Lightning protection standards: IS/IEC 62305

3.3. Class of LPS adopted:

4 INSPECTION/TESTING CRITERIA

External LPS

Internal LPS

4.1. Information of External LPS components

4.1.1. Air Termination System (Design report as per one or more of below methods)

4.1.2. Mesh method Size: Min 10 mm dia

4.1.3. Angle of protection method Height: Qty:

4.1.4. Rolling sphere method Height: Qty:

4.1.5. Electrical Separation considered - YES / NO

4.1.6. Support with structure: Firm support or not

4.1.7. Material: Aluminum/Copper/GI/stainless steel

4.1.8. Roof superstructures:

Comments (if any):

4.2. Down Conductor system

- 4.2.1. Numbers: Min. distance btw DC is maintained
- 4.2.2. Material: Al/Cu/GI Type: Flat/round
- 4.2.3. Cross-section: min 50 sq mm (bare conductor) or 19 sq mm (for mechanically protected, eg. special cable)
- 4.2.4. Separation distance calculated to avoid uncontrolled flash over
- 4.2.5. Separation distance is maintained or compensated using isolators or special cable (If special cable is used then attach third party test report)
- 4.2.6. Test joints: Bimetalic/stainless steel
- 4.2.7. Support with structure: Every one meter, using tested clamps
- 4.2.8. Metal compatibility: Bimetalic or stainless steel clamp to interface two different metal
- 4.2.9. Test report of down conductors
 - Bare conductor - Manufacturer test report as per IEC 62561-2
 - Special cable - Recognised lab KEMA, Vde etc. (IEC 62561-8 for lightning current and equivalent separation distance)
 - Comments (if any):

4.3. Earth Termination system

- 4.3.1 Type:
 - All Earthings are connected together - YES / NO (e.G. Electrical, Instrumentation, Safety, Lightning)
- 4.3.2. Material: Cu/GI/Graphite
- 4.3.3. Test report of Earth electrode from UL or NABL lab
 - Comments (if any):

5 INFORMATION OF INTERNAL LPS COMPONENT

- 5.1. **Power supply system:**
- 5.1.1. Type of System: TT TN-C TN-S/TNCS
 - 3 Phase 4 w
 - 1 phase 3 w
- 5.1.2. Power supply Details
- 5.1.3. Lightning current arrester SPD Type 1 Yes No
 - Other details:
- 5.1.4. Manufacturer:
- 5.1.5. Technology: Encapsulated Spark gap MOV
- 5.1.6. Total limp (Lightning current rating) 100 KA (10/350 µs)
Installation location: Near Main Distribution Board
- 5.1.7. Indication: Mechanical (L-N and N-PE)
- 5.1.8. Test report from Independent third party: KEMA/VDE
- 5.1.9. Additional Line Fuse: Yes Inbuilt..... or External.....
External fuse tested for lightning current: YES/NO
 - Comments (if any):

5.2. **Testing of technical documentation:**

- 5.2.1 Complete Incomplete
(Design criteria, design calculation, drawings, installation test report etc.)

6 **TESTING AT SITE**

6.1. External LPS:

- 6.1.1. Installation of all conductors and system components:
- 6.1.2. Installation and condition of the air-termination system:
- 6.1.3. Installation and condition of the down-conductors:
- 6.1.4. All earth connections:
- 6.1.5. Components affected by corrosion:

COMMENTS:

(Condition of down conductors, jointing of down conductors, crossing of electrical/metal lines, rust or corrosion, hanging of down conductors, improper termination, corroded earth electrode, no earth pit chamber, no nameplate etc.)

6.2. Internal LPS:

- 6.2.1. Correct installation of all lightning current (SPD Type 1): Yes/No, measure requires
- 6.2.2. Surge arresters (SPD Type 2): Yes/NO, Measures required
- 6.2.3. Damage or activation of the lightning current arrester: Incase of periodic check, if faulty need to be replaced
Changes in supply connections which require additional protection measures during periodic check
- 6.2.4. Improper looping of connection wires: Need to be rectified
- 6.2.5. Improper grounding facility for arresters: Need to be rectified

7 **MEASUREMENT:**

7.1. Electrical conductivity of connections for lightning protection components

Sample #1	<input type="checkbox"/> Yes	<input type="checkbox"/> No	Value: ≤0.2 Ohm
Sample #2	<input type="checkbox"/> Yes	<input type="checkbox"/> No	Value: ≤0.2 Ohm
Sample #3	<input type="checkbox"/> Yes	<input type="checkbox"/> No	Value: ≤0.2 Ohm
Sample #4	<input type="checkbox"/> Yes	<input type="checkbox"/> No	Value: ≤0.2 Ohm
Sample #5	<input type="checkbox"/> Yes	<input type="checkbox"/> No	Value: ≤0.2 Ohm

7.2. Earth pit resistance value: (sampling basis)

EP#1	EP#2	EP#3	EP#4
EP#5	EP#6	EP#7	EP#8
EP#9	EP#10	EP#11	EP#12
EP#13	EP#14	EP#15	EP#16
EP#17	EP#18	EP#19	EP#20

Overall resistance of the Earth Termination System

8 **TEST/INSPECTION REPORT**

8.1. The LPS has no defects Yes No

The test revealed the following defects

- | | |
|----|----|
| 1 | 11 |
| 2 | 12 |
| 3 | 13 |
| 4 | 14 |
| 5 | 15 |
| 6 | 16 |
| 7 | 17 |
| 8 | 18 |
| 9 | 19 |
| 10 | 20 |

8.2. **Details on administrative regulations**

8.2.1. Interval between complete inspections:

8.2.2. All LPS should be inspected on the following occasions:

8.2.3. during installation of the LPS, especially during installation of components which are

8.2.4. concealed in the structure and will become inaccessible;

8.2.5. after the completion of the LPS installation;

8.2.6. on a regular basis according to Table below

Protection Level	Visual inspection year	Complete inspection year	Critical situations (a, b) complete inspection year
I and II	1	2	1
III and IV	2	4	1

a. Lightning protection systems utilized in applications involving structures with a risk caused by explosive materials should be visually inspected every 6 months. Electrical testing of the installation should be performed once a year. An acceptable exception to the yearly test schedule would be to perform the tests on a 14 to 15 month cycle where it is considered beneficial to conduct earth resistance testing over different times of the year to get an indication of seasonal variations.

b. Critical situations could include structures containing sensitive internal systems, office blocks, commercial buildings or places where a high number of people may be present.

9 **Next inspection in (year):**

10 **Notes for the proprietor of the system:**

The proprietor has to remedy the defects.

Check if additional internal lightning protection measures are necessary

Date of Inspection:

Place of Inspection:

Name & Signature of Inspector

Seal: