NFPA 77 Second Draft Meeting Agenda (A2018)

Technical Committee on Static Electricity

Friday, October 27 at 1:00 p.m. (Eastern)

Web/Teleconference Only

To Join the Meeting: https://nfpa.adobeconnect.com/sbershad/

US Toll Free Telephone Number: 1-855-747-8824

Participant Code: 478836

1.0 Call to Order

2.0 Introduction of Attendees and Roll Call, see page 2

3.0 Approval of Minutes from First Draft Meeting, see page 4

4.0 Report of Committee Chair

5.0 Report of Staff Liaison

   o Technical Committee Membership
   o Annual 2018 Document Revision Schedule

6.0 Task Group Reports

   o Chapter 17
   o Annex G

7.0 Review and act on Public Comments, see page 6

8.0 Review Committee Inputs from First Draft, see page 10

9.0 New Business

10.0 Schedule Next Meeting

11.0 Adjourn
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<tr>
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Address List No Phone

Static Electricity

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NFPA 77 Second Draft Meeting  October 27, 2017 Web/Teleconference  Page 3 of 20
I. Attendance

L. G. Britton, Charleston, WV
J. E. Capers, Austin Powder Company
   (Alternate to R. Thomas - Rep. Institute of Makers of Explosives)
V. Ebadat, Chilworth Technology Inc.
S. L. Fowler, Fowler Associates, Inc.
C. G. Noll, XiPro Technologies LLC, CHAIR
J. S. Patton II, The Hanover Insurance Group – Verlan Fire Insurance
B. T. Price, Orbital ATK, Inc.
R. P. Puig, Newson Gale, Inc.
J. R. Reppermund, Howell NJ
K. Robinson, Electrostatic Answers LLC
   (Rep. Association of International Metallizers, Coaters and Laminators)
D. Scarbrough, Elyria, OH
M. T. Sherman, Graco, Inc.
E. R. Winter, The DuPont Company, Inc.
G. H. Wolfe, R. R. Donnelley & Sons

R. P. Benedetti, National Fire Protection Association, STAFF LIAISON
J. E. Shapiro, National Fire Protection Association, STAFF LIAISON

Members Unable to Participate

J. R. Clayton, The Hanover Insurance Group (Alternate to J. S. Patton)
B. Minnich, Schuetz Container Systems
R. Mitchell, Intertek Testing Services
A. Morrison, Fike Corporation
D. A. Rivord, Graco, Incorporated (Alternate to M. T. Sherman)
J. E. Teliszczak, JT Environmental Consulting
R. Thomas, Institute of Makers of Explosives

II. Minutes

1. The web conference was called to order at 10:00 AM on October 20, 2016.

2. Participants in the web conference introduced themselves. The Staff Liaison requested that any change in contact information be sent via email, so that the roster can be updated and a new version posted to the Technical Committee’s web page.
3. The Minutes of last meeting were unanimously approved as submitted.

4. Technical Committee Chair Chuck Noll gave a brief report about the agenda and also pointed out the need to update the reference lists in NFPA 77.

5. The Staff Liaison gave a brief report on the status of Technical Committee membership. He also reviewed the Annual 2018 Document Revision Schedule.

Janna Shapiro gave the First Draft meeting briefing.

6. Member Reports on Current Issues.
   - Technical Committee Chair Chuck Noll reported that new editions of European documents on static electricity have been released and these should be reviewed to ensure that NFPA 77 correlates with these.

7. There were no Task Group reports.

8. The Technical Committee reviewed and took action on all Public Inputs to amend the current 2014 Edition of NFPA 77. The Staff Liaison was directed to prepare the the First Draft Report on NFPA 77 and circulate it for ballot to the Technical Committee.

9. There was no correspondence requiring the Technical Committee's attention.

10. There was no old business requiring the Technical Committee’s attention.

11. The Technical Committee discussed the following items of New Business:
   - Vahid Ebadat raised the issue of inconsistencies in characterizing dusts as conductive, semi-conductive, and nonconductive. He proposed that, prior to the next edition of NFPA 77, the Technical Committee should investigate whether the current ranges are accurate.
   - Kelly Robinson pointed out that control of electrostatic hazards in web processing operations has progressed far beyond what is currently in MFPA 77. He suggested that a Task Group be established to review and upgrade the information in the Recommended Practice.
   - Vahid Ebadat raised the issue of inconsistencies in characterizing dusts as conductive, semi-conductive, and nonconductive. He proposed that, prior to the next edition of NFPA 77, the Technical Committee should investigate whether the current ranges are accurate.
   - Richard Puig suggested that the diagrams in annex G should be updated and redrawn.

12. The Technical Committee deferred scheduling the next meeting, to be conducted by web conference, until the close of the public comment period.

13. The web conference adjourned at 2:30 PM.
Public Comment No. 3-NFPA 77-2017 [ Section No. 7.4.1.3.1 [Excluding any Sub-Sections] ]

Where the bonding/grounding system is all metal, resistance in continuous ground paths typically is less than 10 ohms. Such systems include those having multiple components. Greater resistance usually indicates that the metal path is not continuous, usually because of loose connections or corrosion. A permanent or fixed grounding system that is acceptable for power circuits or for lightning protection is more than adequate for a static electricity grounding system.

Statement of Problem and Substantiation for Public Comment

Typical bonding wires are approximately 12 AWG and made from galvanized steel. 100ft of galvanized steel wire has an end to end resistance of approximately 2 ohms.

However, I have been getting requests to build a cable for this purpose that is made from stainless steel. This has many advantages over galvanized as it does not rust, is more flexible and does not need to be coated to be protected, making it thinner on a spool.

However, stainless steel has a bulk resistivity that is approximately 7X higher than mild steel.

This would yield an end to end resistance of stainless steel for a 100 ft length at over 10 ohms.

This proves problematic when using automated resistance testers in the system that have been designed for an alarm condition of 10 Ohms as per NFPA 77 guidelines.

I suggest that 100 ohms be used for a reference value and some wording to be added, such that it is a function of the method of bonding that dictates overall end to end resistance in the bonding or grounding path.

Open to comments and better understanding.

Andy Kveps,  
Aaki Corp.

Related Item

10 Ohm threshold for the bonding of metal systems

Submitter Information Verification

Submitter Full Name: Andy Kveps  
Organization: Aaki Corp  
Affiliation: Owner  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Wed Mar 29 18:12:31 EDT 2017
Public Comment No. 5-NFPA 77-2017 [ Chapter B [Excluding any Sub-Sections] ]

This annex is not a part of the recommendations of this NFPA document but is included for informational purposes only.

Additional Proposed Changes

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<td>Comment-Ammonia_MIE_value_linked_in_NFPA_77-JLJones_PE-Apr-6-2017.docx</td>
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Statement of Problem and Substantiation for Public Comment

Value for MIE listed in Annex B for ammonia is not the lowest value reported. Values more than an order of magnitude have been reported. Value listed appears to be inaccurate and is misleading. In attachment I have mentioned other values and suggested an expert to discuss this matter further.

Related Item
None found

Submitter Information Verification

Submitter Full Name: Jerry Jones
Organization: Chemical Engineering Consultant
Street Address:
City:
State:
Zip:
Submittal Date: Wed Apr 19 13:50:27 EDT 2017
Comment from JLJones, PE on draft of NFPA 77 concerning Value for MIE for Ammonia Listed in Table B.1 Combustibility Parameter of Gases and Vapors (Submitted April 6, 2017)

I question the identification of the value of 680 mJ listed in Table B.1 for ammonia as being the minimum reported MIE at optimum combustion conditions and fear that this value may be far too high and therefore mislead users of the standard as to the risk of ignition from static electricity.

There have been much lower values reported for ignition of mixtures of ammonia in air at or near stoichiometric conditions for many years and some recent data which I cite below.

I am not surprised to see variations in MIE values in the literature because of issues well known about the influence of test equipment and methods, etc. Measurement of MIE continues to be the subject of experimental studies and debate about matters such as ignition device design and features such as spark gap distance used for fuels with widely varying flame speeds (issue of flame quench distance). Setting the gap to a value that is greater than the flame quench distance for a specific flammable gas or vapor is a key concern and may not be adequately appreciated or addressed by those doing the testing. Perhaps the NFPA committee should discuss this matter of MIE values reported for ammonia with the ASTM subcommittee responsible for ASTM E582 Minimum Ignition Energy and Quenching Distance.

One engineer from Japan 4 or 5 years ago commented at a global meeting on refrigerants and flammability properties (including reference to issues with ignition of ammonia) that "The measured MIE varies considerably depending on electrode size, distance between them and the duration of the spark. If thin electrodes like needles are used, a relatively small MIE can be obtained. If thick electrodes with a narrow gap are used, it requires quite a large energy to ignite..."

I did a quick cursory search this week to look back at some sources often cited for ammonia data and found an IChemE publication from 1977 that cites values in the literature as of that time from 40 to 680 mJ.

In a paper presented in March 2017 by Dr. Scott Davis at the AIChE National Spring meeting in San Antonio he cites a source of a calculated value (at 45mJ) and some values measured by others (from 14 to 100mJ) and states the following about the test method used for his measurements where his team recorded values of 15 – 20 mJ and conducted the experiments “following ASTM E582 and performed in a 2 L cylindrical vessel equipped with a small polycarbonate viewing window” (Source: S. G. Davis et al, Large Scale Flammability and Explosivity Testing of Low Burning Velocity Gases: Validity of Prediction Tools and Impact On Siting Studies and Risk Assessments, paper presented at the AIChE Spring Meeting, Global Process Safety Congress, San Antonio (March 2017))

Scott did not cite the 680 mJ value along with the numerous other references. I will ask him about that and he may have found references showing much lower values that discredit the measurement of 680 mJ. I do not know.
I suggest that Scott may be an individual for the committee to discuss this topic of the MIE value for ammonia before deciding on what value to list in Table B.1 in the next edition of the standard:

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Best regards,

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Chapter 17  Web and Sheet Processes

17.1  General.

17.1.1  In web processes, such as printing, coating, spreading, and impregnating, static electricity is a frequent, annoying, and often expensive source of production problems. If flammable solvents are used in the process, static electric charges can constitute an ignition source.

17.1.2  In practice, paper or any other substrate charged with static electricity will attract or repel other objects. This phenomenon can cause difficulty in controlling the sheet or web, which is the continuous substrate that is being printed or coated. It can also cause problems with delivering and handling the printed product due to static attraction between the sheets or folded signatures. Static electric charges can transfer by induction or by contact with various objects (e.g., during handling of the paper or substrate by personnel). These static electric charges can accumulate on a person who is not adequately grounded.

17.2  Substrates.

17.2.1  Paper.

17.2.1.1  The characteristics of the surface of the paper have a great deal to do with the amount of static electric charge that is generated during processing. Generally, printing on paper causes fewer problems than printing on plastic substrates and other synthetic materials. Static electric charge accumulates on paper during the handling process. On presses and in other handling operations, static electric charge can be generated by belts driving the paper rolls, sliding of the web over idler rollers and angle bars, motion of the web through a nip, and motion of brushes and delivery belts in the folder.

17.2.1.2  In some operations, static electric charge is deliberately deposited on the web to improve certain operations, such as material deposition and sheet transfer. In gravure printing, for example, electrostatic assist is used to improve the transfer of ink. On high-speed offset and high-speed gravure presses, ribbon tacking is used to control the ribbons and signatures in the folder.

17.2.2  Plastics.

Most plastic films are characterized by extremely high surface and bulk resistivities. This resistivity allows static electric charge to accumulate on the web after contact with machine parts, such as rollers and belts, with little dissipation occurring.

17.2.3  Fabrics and Nonwovens.

17.2.3.1  Fabrics are usually made of blends of natural fibers (usually hygroscopic and capable of relaxing a charge) and synthetic fibers (usually highly resistive and capable of holding a charge). The smaller the proportion of natural fibers used, the greater the incidence of static electric problems in subsequent operations. Fabrics are thin, like paper and plastic films, and accumulate static electricity in a similar manner.

17.2.3.2  Nonwovens often have a loft that gives them a three-dimensional structure. They are almost exclusively synthetic, so they tend to generate and hold substantial charges in the forming process. These charges can be more difficult to remove due to the depth of the loft. In a subsequent coating or saturating process, large amounts of charge can again be generated due to relative motion of the fibers and again the charge can be difficult to remove if the loft returns. The solvent-wet batt contains a relatively large volume of flammable vapor, and electrostatic discharge can cause ignition.

17.3  Inks and Coatings.

17.3.1  Inks used in letter presses and offset presses are typically Class IIIB liquids that have flash points above 93°C and present little fire or explosion hazard. However, inks used in silk screen, rotogravure, and flexograph printing are usually Class IB and Class IC liquids with flash points less than 38°C. Fires can occur in these inks due to the use of solvents with vapors that can be ignited by static electric discharge, as well as by other ignition sources.
17.3.2
The solutions and suspensions that are used to coat and saturate webs are diverse. While they are still wet, water-based coatings are generally conductive enough to dissipate any charge that is generated in the process, even though there might be minor concentrations of solvent present that can create an ignitable vapor layer on the web. When dry, however, these coatings are not always capable of dissipating the charge, but vapors are seldom left at this point.

17.3.3
Flammable solvent-based inks and coatings should be considered nonconductive and, therefore, incapable of dissipating a charge. Conductivity enhancers in the ink or coating cannot be relied on to assist dissipation of charge at high processing speeds. Measurement of coating solution conductivity can provide additional data to determine static generation and dissipation characteristics. Solvent-based coatings having conductivities less than $10^4 \text{ pS/m}$ should be carefully evaluated for their ability to dissipate charge.

17.3.4
Black inks used in gravure printing are generally nonconductive. Where accumulations of black ink, particularly black ink used on uncoated papers, are washed or cleaned off the rubber impression rollers, the resin can be washed out of the ink buildup, leaving a residue of conductive carbon (i.e., the pigment). If this conductive residue is not thoroughly wiped off the rollers, sparking and arcing from the roller to the cylinder or other grounded press parts can occur.

17.4 Processes.
17.4.1 Printing Presses.
All other factors being equal, printing presses that operate at higher speeds generate more static electricity. A rotogravure press, for example, can generate static electricity where the rubber roll presses the substrate against an engraved roll, which is wetted with the ink. Charge can be transferred from the engraved roll to the substrate. In a multicolored press, there is a similar arrangement for each color. The generation of charge is a function of the pressure between the rolls and the angle to the roll. The electrostatic assist (ESA) process, where used, deposits large amounts of charge onto the substrate. Note that ESA equipment must be suitable for Class I, Division 1, locations.

17.4.2 Coating.
Coating of web materials is done using both flammable and nonflammable liquids on a wide variety of equipment. Significant charge can be generated where high forces between rollers and web are present, such as in gravure coating, and where web slippage is present due to tension difference across the coating roller. This can result in a static ignition hazard where flammable coatings are used. High charge can also accumulate on the rubber backup roller, and an electrostatic neutralizer might be needed if this poses an ignition hazard.

17.4.3 Saturating.
Saturating is the process of immersion of a web in a liquid so that the liquid fills the pores in the web. The excess liquid is then squeezed or wiped from both sides of the web. Electrostatic charging during saturating operations is not usually a problem for most webs. Where the web is a nonwoven with substantial loft and the liquid is flammable and of low conductivity, a static electric hazard can be created.

17.4.4 Calendaring.
17.4.4.1 Calendaring is a process by which a substrate is squeezed at high pressure between rollers that are generally smooth. This process is used to create a dense product with a smooth surface, such as magazine cover stock. It is also used to mill and form webs from materials such as rubber and plastics. The intimate contact caused by the high pressures and the working of the materials between the nipped rollers creates charge on the web. Charging can be high enough to form corona discharge at the exit of the nip.

17.4.4.2 Because flammable solvents are not usually present, the effect of static electric charge is to cause operator shock and web-handling problems. Static neutralizers can effectively remove the charge.

17.4.5 Web Handling and Converting.
The path of the web through processing machinery often is guided over many rollers. Movement of the web over the rollers produces static electric charge due to friction. A freely turning idler roller imparts little charge to the web. As the speed of the process increases above 60 m/min, air is drawn between the web and the roller, reducing the intimacy of contact and, thus, the rate of charge generation. If the roller does not turn freely, however, the web slips on the roller surface and can generate a large static electric charge. Periodic inspections and maintenance should be performed to ensure that the rollers are always free-turning.

17.4.6 Ribbon Tacking.
On high-speed offset and gravure presses, high-voltage tacking is used to improve the delivery of signatures to the folder. These high-voltage devices should be suitable for Class II, Division 2, locations subject to accumulations of settled paper dust.

17.5 Control of Static Electricity in Web Processes.
17.5.1 Charging in Web-Handling Operations.

Charging of webs can occur during unwinding, travel over rollers, pressing between rolls, or contact with coating rolls. Charging generally will increase with increasing web speed, tension, and roller wrap angle; a finer roll surface finish will enhance charging by increasing the area of roll-web contact. Web slippage over roll surfaces, caused by differential web speed or roll malfunction, can also significantly increase charging.

17.5.2 Potential Hazards of Charged Webs.

17.5.2.1 Static charges on a web can result in brush discharges from the web or spark discharges from ungrounded machine components or personnel that become inductively charged as a result of close proximity to the web. Such discharges can present shock hazards to operators or lead to fires in flammable coating operations and gravure printing.

17.5.2.2 For flammable operations, mechanical ventilation can be used to dilute vapors to a safe concentration well below the lower flammable limit. “Pumping” of vapors by the moving web at higher speeds can increase the volume over which such an atmosphere might be present. Vapors will always be within the flammable range close to the point of coating application; this volume should be minimized by capturing vapors as close to their source as possible. Equipment should be interlocked to shut down upon ventilation system failure or if vapor concentration becomes too high.

17.5.3 Static Charge Control.

17.5.3.1 Conductive Components.

All conductive parts of the machine should be grounded in order to prevent them from becoming a potential spark source due to inductive charging; resistance to ground from fixed metallic objects should not exceed 10 ohms.

17.5.3.1.1* The resistance to ground of rollers should be determined upon initial installation and verified periodically thereafter. Resistance should not exceed 1 megohm. Since lubricant films can significantly increase resistance (because the bearings “float” on the lubricant), measurement should be performed during operation. The grounding of conductive rollers can also be compromised by non-conductive bearing lubricants or excessive bearing clearances, as well as build up of dirt or rust over time. Rolling or sliding contacts, such as conductive brushes, can be used to ground rollers in cases where an acceptably low resistance cannot be obtained.

17.5.3.2 Nonconductive Webs.

Grounding of nonconductive webs is not possible, so other methods are necessary for static control. Existing processes should be audited to determine where significant charge is being generated. Measurements can be made with an electrostatic fieldmeter for web sections well away from grounded objects, such as rollers.

17.5.3.2.1 The first goal of a static-control program should be to minimize charge generation. Possible methods include minimizing web tension (but not to the extent that slippage occurs), ensuring that idler rollers have clean surfaces and are freely-rotating, minimizing web slippage, and increasing roller surface roughness. Nonconductive roller covers can acquire significant charge and should be replaced with static-dissipative covers where possible; otherwise, nonconductive covers, which will minimize contact charging with the web material, should be used.

17.5.3.2.2 Humidification is sometimes used to reduce static charge on nonconductive objects by providing a monolayer of moisture that decreases surface resistivity, enhancing charge dissipation. This is often not possible in web handling operations because the speed of the operation does not allow sufficient time for uptake of atmospheric moisture by the surface of the material. Also, many plastic web materials will not be significantly affected by moisture even with extended exposure time. For those reasons, humidification should not be relied upon as the sole method for static control in web handling processes, although in some cases higher humidity levels can be used to reduce static charge.
17.5.3.2.3
Ionization involves the use of devices that produce ions that neutralize surface charges and is the primary method used for static control on webs. Ionization devices might be needed at various points in a web handling system where charging occurs as shown in Figure 17.5.3.2.3. Such devices should extend across the full width of the web. Passive ionization involves the use of grounded tinsels, strings, needles, or brushes located a short distance (typically 5 to 25 mm) above the web. The electric field above the web is concentrated at the points of the tinsel, string, needle, or brush, resulting in breakdown and ionization of the surrounding air. Air ions having polarity opposite to charges on the web are attracted to the surface of the web, neutralizing the charge. Typically, this method can reduce surface potential to less than 5 kV. It is important that passive ionizing elements be positioned properly, be grounded, and have points that are kept clean and sharp. Performance should be verified by periodic static charge measurements on the web downstream of the ionizer.

Figure 17.5.3.2.3 Typical Locations for Static Neutralizers.

17.5.3.2.4
Active ionization involves the use of electrically powered devices or radiological sources. AC ionizers are most commonly used and contain an array of high-voltage pointed electrodes that emit both positive and negative air ions. Neutralization is achieved by the attraction of air ions having opposite polarity to surface charges on the web. The effectiveness of ionizers decreases greatly with distance from the web; for this reason ionizers are typically located about 25–50 mm from the web. Forced air–assisted units (ionizing blowers) might be capable of neutralizing charge at somewhat greater distances. Ionizers should be located in a position so that ion flow will be toward the web rather than to nearby grounded surfaces and in accordance with manufacturers' recommendations. See Figure 17.5.3.2.3.

17.5.3.2.5
Performance of ionizers should be verified upon initial installation and periodically during use. Electrically powered ionizers used in flammable vapor environments must be listed for the hazardous (classified) location in which they are installed.

17.5.3.2.6
It is particularly important to ensure that web charge is reduced to a safe level as it enters flammable coating stations. Potentially incendive brush discharges can occur if web surface charge density exceeds 10 μC/m². To maintain a margin of safety, it is recommended that maximum indicated voltage above the web not exceed 5 kV as measured at a distance of 25 mm (field strength of 200 kV/m).

17.5.3.2.7
An ionizer should be located after the last contact point prior to entering the coater. Surface charge should be continuously monitored after the ionizer, and the process should be automatically shut down if safe electric field values are exceeded. An additional ionizer might also be required at the coater exit if charging occurs at that point.

17.5.3.3 Personnel.
Personnel should be grounded, preferably by use of static-dissipative footwear and a static-dissipative flooring surface.

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Committee Statement

Committee Statement: The Committee is considering revising this chapter to incorporate current technology in protecting web processes from static electricity hazards.
Response
Message:

Ballot Results

This item has not been balloted
G.1 Diagrams.
Figure G.1(a) through Figure G.1(k) are reprinted from National Paint and Coatings Association (NPCA), Generation and Control of Static Electricity. Refer to this publication for additional diagrams.

Figure G.1(a) Ground Bus Connection to Ground Rod. (Source: NPCA, Generation and Control of Static Electricity.)

Figure G.1(b) Small Ground Clamp. (Source: NPCA, Generation and Control of Static Electricity.)

Figure G.1(c) Large Ground Clamp. (Source: NPCA, Generation and Control of Static Electricity.)

Figure G.1(d) Pipe Grounding Jumper. (Source: NPCA, Generation and Control of Static Electricity.)
Figure G.1(e) Typical Grounding System for Small Volume Solvent Dispensing via Drum Tap. *(Source: NPCA, Generation and Control of Static Electricity.)*

Figure G.1(f) Typical Grounding System for Small Volume Solvent Dispensing via Drum Pump. *(Source: NPCA, Generation and Control of Static Electricity.)*

Figure G.1(g) Typical Grounding System for Small Equipment. *(Source: NPCA, Generation and Control of Static Electricity.)*
Figure G.1(h) Typical Grounding System for Small Volume Solvent Handling at Dispensing Station. (Source: NPCA, Generation and Control of Static Electricity.)

Figure G.1(i) Typical Grounding System for Small Volume for Portable Tank and Drum Transfer Area. (Source: NPCA, Generation and Control of Static Electricity.)

Figure G.1(j) Typical Grounding System for Drum Rack. (Source: NPCA, Generation and Control of Static Electricity.)
Figure G.1(k) Typical Grounding System for Tank Car or Tank Truck Loading/Unloading Station. *(Source: NPCA, Generation and Control of Static Electricity.)*

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Committee Statement

Committee Statement: The committee is considering updating Annex G by revising some of the diagrams and possibly deleting any that are obsolete and possibly adding new, more relevant diagrams. A task group will be looking into this.

Ballot Results

- This item has not been balloted