



Department of Health

Disposition of comments for HTM 06-01 – ‘Electrical services supply and distribution’

General questions

Author	Question	Comment
IPEM	In review discussions there was submissions that the previous “clinical risk categories” of chapter 4 (now chapter 3) were conflicting with the IET clinical risk categories for final circuits. The consultation document (ch 3) changes the wording to use the term “Grade” of risk and more positively identifies this with the resilience of the electrical supply. Does the new approach make this clearer?	Yes – but: The use of “Grade” and “A, B, C ...” (instead of 1, 2, 3 ...”) reduces risk of confusion between these and the IET Groups, but there is insufficient explanation of how the two systems relate to each other.
IPEM	In keeping with other HTMs the consultation document introduces the formation of a safety group within the healthcare organisation (in this document to be known as the Electrical Safety Group (ESG)) and shows how this would work. Is this helpful and if not then why not? Ged; reworded slightly from PC’ original	Yes. IPEM welcomes the contribution to this group that can be made by clinical engineers who understand the healthcare technology and understand the clinical implications of that technology. A consistent problem of such groups is their relationship to managerial groups that actually have resources to wield. A clause always seems absent that the relation to such actual “ability to affect the real world” is needed – it’s not quite enough to specify the necessary seniority of the chair or board reporting.
IPEM	The previous HTM 06-01 part B has been refreshed and brought into the main document as chapter 18 is this helpful?	Yes. Maintenance should not be seen as an ‘add-on’; it is fundamental to continuing safety.
IPEM	Throughout the document, references to other standards and or guidance have been updated but the year of reference is not shown. This is taken as meaning the current version of the document, rather than write “the current version” in front of every reference. Is this approach acceptable?	Yes. This is in line with the convention used when citing standards in other standards. However make this clear at an early point in the document; see suggestion at line 265. It is important that the current versions at the time of publication of the HTM are listed – as they are- in the References.
IPEM	Since the current version of HTM06-01 there has been significant uptake in the provision of electrical services to special clinical areas and the wider overall support for management. Has this been adequately met in the consultation version?	In part; however there are non-medical areas within which there is increased risk of electrical shock by virtue of the nature of the activities conducted within them. Suggestions are made to cover such areas.
IPEM	Many chapters make reference to BS 7671 (The IET wiring regulations) but specifically chapter 13 earthing and chapter 16 final circuits have been updated to reflect the approach to medical locations. Do these chapters adequately explain the special measures needed?	There is a lack of explanatory rationale to support proper understanding / interpretation of the requirements for medical locations in Chapters 13 &16, or to support ESG risk-based decision-making. This is in contrast to the significant rationale provided in Chapter 3 concerning risks associated with loss of power supply. Chapter 3 ought also to have a section covering electrical shock risks associated with medical locations that require special measures &

Author	Question	Comment
		IPEM risk management. See suggestions at 3.10. See also specific suggestions and comments at line 47 and 4129
IPEM	Some guidance is included in the appendices as not being suitable for the main document. Are these helpful?	In general Yes

Template for technical/general comments on the document on next page

Author	Para/line number	Comment	Suggested amendment
IPEM	General	The overall approach of early chapters has changed to one closer to, for instance, MHRA guidance and other HTMs: directing there to be a committee and for responsibility to be taken. The former HTM 06-01 was less prescriptive about this. In principle this is a useful approach but managing the consequences within budgets is increasingly difficult.	
IPEM	General	Suggest that the final PDF version has Content Copying Allowed so that figures and text can be cut and pasted from the document into local policies and procedures	Amend Security permissions
IPEM	General	The usual convention in publishing is to have the caption for Tables above the table and the caption for Figures below the figure as in Figure 4.	Amend as appropriate
IPEM	General	Throughout, <i>etc</i> should be followed by a full-stop.	Amend as appropriate
IPEM	General	Throughout, <i>group</i> when meaning a medical location group, should be <i>Group</i>	Amend as appropriate
IPEM	General	Many hyphenated words, such as <i>single- conversion</i> at line 632 have an inappropriate space after the hyphen as shown.	Amend as necessary ; see line 643
IPEM	General	Suggest that where the term <i>board of directors</i> is used, it is capitalised as a title as is Electrical Safety Group. In particular the word <i>board</i> is also used in its other English/electrical engineering meaning.	Board of Directors
IPEM	General	Notes have not been presented in a consistent way; some are within the paragraph text, some on a separate line with Note as a heading. Sometimes they are given a § number as at 4769 & 4783.	Use a consistent style
IPEM	General	For consistency throughout, when referring to low voltage (LV), either use 400 V or 0.4 kV	400 V preferred
IPEM	General	The terms essential distribution circuits, life-safety services and safety services are used (see particularly §6.42). Are the similarities/differences between these sufficiently clear? There is possibility for confusion with SELV.	
IPEM	p2	Contents list	only one of the Appendices is listed – add the others

IPEM	General 1929, 1950, 2073, 2141, 2312, 2389, 2526, 2557, 2653, 2671, 2701,2712, 2748, 2847, 2858, 2878, 3032, 3110, 3148, 3196, 3206, 3211, 3212, 3220, 3236, 3326, 3330, 3525, 3539, 3671, 3804, 3909, 3919, 3963, 3998, 4002, 4006, 4009, 4203,5680, 5991,	Font error in the paragraph numbers or style	
IPEM	47	Amended to included the statement from BS7671	Note: In existing medical Locations the equipotential bonding busbar (EBB) is also referred to as the earth reference bar (ERB).
IPEM	after 49	no ELV	add: ELV: Extra-Low Voltage
IPEM	after 55	no ESG	add ESG: Electrical Safety Group

IPEM	131-133	<p>The use of the term “Applied Part” and its role in the definition of Groups 0, 1 & 2 is problematical.</p> <ul style="list-style-type: none"> - It is an electric safety consideration that originates from the 60601 standard, but that also specifies (clause 4.6) that parts that are not required to make contact functionally but are likely to make patient contact during use, should also be considered in risk management – this caveat is not in 710 or 7671 - Its inclusion in the HTM is an unnecessary complication & potentially confusing; it only appears in the Group definitions, but not elsewhere in the HTM; The use of ‘Applied Parts’ in Group definitions is a relic from the initial 710 concept that Group allocation was based upon consideration of both supply continuity criticality and increased electrical shock risk – since the HTM now considers that only the former applies, the inclusion of Applied Part is an irrelevance. <p style="text-align: center;">(see related notes on lines 169 -181, and 182 - 186)</p>	Consider the necessity and therefore removal of the Applied Part definition
IPEM	147	<p>definition of ‘Essential’ seems confusing - in that whilst an essential service needs to be able to automatically transfer between supplies, the converse – the ability to do so – does not make it essential</p>	<p>Edit:</p> <p>... and/or final circuits that needs and is able to be automatically transferred between ...</p>
IPEM	after 160	<p>Insert an entry for Medical electrical system (MES)</p>	<p>Medical electrical system (MES)</p> <p>A combination, as specified by its manufacturer, of items of equipment, at least one of which is Medical electrical equipment to be inter-connected by functional connection or by use of a multiple socket-outlet (MSO)</p>
IPEM	161	<p>This Note should be indented or in a smaller font to distinguish it from an entry in the Glossary. cf. line 190</p>	Amend as appropriate
IPEM	169-181	<p>Medical Locations - Group definitions.</p> <p>Groups 0, 1 and 2 were originally distinguished in terms of safety requirements with regard to both electrical shock hazards (the presence & nature of Applied Parts) and continuity of supply. It appears to be the position of the HTM that the revised interpretation of Groups is based solely upon continuity of supply.</p> <p>We understand the constraint that Group definitions should be consistent with those in 7671, but retention of references to Applied Parts in Group definitions is now superfluous and, more importantly, confusing.</p> <p style="text-align: center;">(see related notes on lines 131 -133, and 182 - 186)</p>	<p>If these Group definitions must be kept to be consistent with BS 7671, then some explanation of the current HTM interpretation of Groups is needed, so that requirements can be properly understood by designers/installers and risks properly understood and managed by ESG.</p>

IPEM	171-181	<p>These Group definitions conflate two issues which are not really related. We appreciate that they are in line with the definitions in the current edition of BS 7671. There are very few types of MEE that do not have an Applied Part. So any location used for the care of patients will likely fall into Group 1; e.g. a doctor's consulting room in a GP practice where an electronic sphygmomanometer is used.</p> <p>The key issue is not whether Applied Parts are used but whether the failure of supply for a certain length of time may cause danger to life.</p>	<p>Consider the implications of having every medically used room in Group 1. Is it necessary.</p> <p>Consider re-defining these Groups.</p> <p>However, we appreciate there may be an overriding view to keep them in line with BS7671. Therefore work with IET to redefine them at the Standards level. We understand that this is being proposed at the CENELEC level</p>
IPEM	182	Typographical: See comment at line 161	
IPEM	182-186	<p>Note on intracardiac procedures</p> <p>The need for this note is a relic from the 'old' (original) definitions that made a distinction between Group 1 and Group 2 based upon microshock hazards. Its retention potentially perpetuates the confusion between the old & new interpretations of Groups. If Groups are now solely distinguished according to supply reliability, then whether a procedure is intracardiac or not is irrelevant – it is the consequences of loss of supply that matters.</p> <p>(see related note on lines 131 -133, and 169 - 181)</p>	Consider removing this Note on intracardiac procedures
IPEM	206	Typographical: <i>Residual risk</i> should be a separate entry in the Glossary	
IPEM	after 207	A definition of <i>Safety service</i> should be added to the Glossary	
IPEM	218	Grammar: <i>stakeholders</i> (plural) vs. <i>an employee</i> (singular)	... Stakeholders will normally be employees of the ...
IPEM	219	<p>Tertiary Power Supply definition is included, but no definitions for Primary and Secondary</p> <p>-----</p> <p>There are also various references to Standby and Back-up (sometimes Backup) power and supplies in the HTM - also Emergency Power, and also Essential and Non-Essentials Supplies – what is the intended difference and should these also be defined?</p>	<p>Add definitions for Primary and Secondary Power supplies</p> <p>-----</p> <p>Agree meaning of these additional terms, rationalise/standardise on which terms will be used in in HTM, and define intended meanings of terms that are retained</p>
IPEM	240	There is no longer a Part B	
IPEM	247 Table 1	<p>Table 1</p> <p>PELV / SELV values are lower in Medical Locations - (ie: 25Vac / 60VDC, rather than nominal 50Vac / 120VDC values quoted in table)?</p>	Add a note identifying that the values of PELV/SELV are reduced in Medical Locations
IPEM	247 Table 1	The first five entries are duplicated below	
IPEM	256	Punctuation consistency	semi-colon rather than a full-stop

IPEM	265	Add a brief paragraph explaining the use of undated standards references	2.5a Throughout the document, the content of other standards and/or guidance has been taken into account but the year of publication is not shown in the respective references. This is taken as meaning the current version of the document, rather than write “the current version” in front of every reference. As of the date of publication of this HTM, the current versions of Standards etc. are listed in the References section but into the future, a check should be made to see that there has not been an updated version published.
IPEM	268-272	The revised order of these chapters is an improvement	
IPEM	273-718 General	3. Understanding Risk & Ownership The Chapter title implies comprehensive consideration of risk and – as one example – states that “ <u>all</u> electrical safety issues” must be monitored by the ESG (line 285) – yet the Chapter deals with only one safety issue – namely that of continuity of supply. Other electrical safety hazards (in particular shock hazards in special locations) are not addressed at all, (though there is reference to a need to consider climate change).	Expand the chapter to include other electrical safety issues – especially electrical shock hazards associated with medical (and non-medical) special locations. Otherwise it is misleading and does not equip the ESG and other stakeholders to properly scope their risk management . This is an important need which we would urge be added – to ensure proper understanding of requirements (such as those in Chapters 13 and 16) by all stakeholders and also to inform ESG decision-making. (If not addressed then the title of the Chapter should be changed to make it clear that it only addresses one type of electrical risk – namely loss of supply – other important risks not being included).
IPEM	273-718 General	3. Understanding Risk & Ownership It is confusing that the distinction between Group 1 and Group 2 Medical locations in BS 7671 is based upon need for power supply resilience, yet they are not mentioned in this Chapter which is essentially about power supply resilience.	Add some explanation of how the advice in Chapter 3 relates to classification of Medical Groups in BS 7671.
IPEM	273-718 General	3. Understanding Risk & Ownership Some areas will need to be designated as Safety Services with corresponding installation implications under 7671 – this Chapter should offer some guidance on identification of Safety Services as part of the overall supply resilience assessments	Add some guidance on identification of Safety Services as part of overall supply resilience requirements assessment.
IPEM	284	On first reading, healthcare organisations will not have and ESG. Therefore include an introductory sentence.	... Healthcare organisation should have or should establish an Electrical Safety Group – a multidisciplinary group responsible for ...
IPEM	344	Suggest risks (plural)	... and risks be managed proactively.
IPEM	348	It is usual to put the words Work and Act with capitals; they are part of the title	... Work Act (HSAW) ...

IPEM	after 356	Either as an additional sentence or as a new paragraph, (suggested) insert	3.10a The design process should also identify any areas, medical or non-medical, within which there is increased risk of electrical shock by virtue of the nature of the activities conducted within them. Appropriate modifying or supplementary safety measures should be determined and implemented accordingly.
IPEM	after 374	In the context of the heading Need for risk assessment , relating to electrical risks, we suggest introducing some text to cover other electrical safety risks over and above those presented by loss of supply. All have implications for the design and use of the electrical supply	3.10b Medical locations can also present increased risk of harmful electric shock on account of factors such as - - the deliberate contact of applied parts of medical electrical equipment with patients, or the foreseeable contact of patients with medical electrical equipment during use, often involving contact with more the one item of equipment simultaneously; - the absence of normal protective reactions against shock in some patients, (who may be ill, unconscious, anaesthetised, immobilised, etc.), and the inability of operators to detect this; - the bypassing of natural protection afforded to patients by skin resistance, which may be wet, deliberately reduced (to establish functional electromedical contacts), or bypassed (by inserted or penetrating applied parts of medical electrical equipment); - the intimate and / or invasive nature of some applied parts of medical electrical equipment may, depending upon anatomical location, result in locally concentrated leakage current densities that are hazardous in sensitive tissues at current levels that would ordinarily be considered safe; in particular leakage currents from applied parts in contact or close proximity to the heart can interfere with cardiac function at 'microshock' current levels.

IPEM			3.10c Medical electrical equipment is not the subject of this memorandum; equipment meeting the requirements of the BS EN-60601 series standards is considered safe in the context of the considerations in 3.10b above. (Non-medical equipment should not be used in a patient environment, unless it meets electrical safety requirements of BS EN-60601-1, with particular regard to touch and leakage currents). Corresponding safety measures are required for electrical installations for medical locations, in particular with regard to touch voltages arising from and transient fault currents, as detailed in the requirements for Group 1 and Group 2 medical locations in Chapter 13.
IPEM			3.10d Trailing multi-outlet extension leads should not be used in medical locations; a single instance of damage to the trailing cord can expose a patient to the cumulative earth leakage currents of all items of connected medical electrical equipment (in the event of damage to the protective earth conductor), or the simultaneous loss of power to several items of medical electrical equipment (in the event of damage to live conductors). Therefore, installation designers must ensure that sufficient fixed installation socket outlets have been provided to meet the needs within a given medical location, and that such socket outlets are appropriately located with due consideration to the operational deployment of electrical equipment according to the activities to be undertaken there. See 16.38a
IPEM			3.10e Certain non-medical locations may require enhanced measures for electrical safety by virtue of the activities undertaken within them. Particular supplementary safety requirements for electrical services installations should be identified and implemented according to an understanding and risk assessment of pertinent environmental and work activity factors. Examples of areas requiring particular consideration include mortuaries, decontamination facilities, water treatment plants, medical engineering (live-working) workshops, etc.
IPEM	376	Surely the risk assessment should be undertaken <u>before</u> the change	... space is to undergo a change ...

IPEM	380 & 382	DNOs – are there likely to be more than one DNO for a particular site? I guess there may well be for a multi-site organization. Perhaps this paragraph should be site specific.	... PFI contractors and the relevant DNO of such failures for each site within the organisation. ...
IPEM	397	It is unlikely that an organisation will choose not to implement ALL of the recommendation of the HTM.	... implement some of the recommendations ...
IPEM	426	The word <i>provider</i> is redundant and reads awkwardly	Delete ... <i>provider</i> ...
IPEM	452-457	Prose in these lines was a little awkward to read and follow	Lines would benefit from editing to improve readability
IPEM	Fig 1	This important figure is small and difficult to read;	Consider putting it in landscape on a full page
IPEM	Fig 1	Amend the Note	Note: the risk grading system ...
IPEM	459	Improved punctuation	Add a comma after ... <i>terms</i> : ... risk or business continuity risk terms, together with the
IPEM	460-64 §3.25	The point re. IT systems is well made but do generator supplies provide a quick enough restoration of supply to eliminate the need for individual UPS supplies to individual computers or more particularly network hub and switch cabinets? Also increasingly much electromedical equipment now has internal embedded ICT.	For further consideration
IPEM	§3.29	Font size discrepancy	Amend as appropriate
IPEM	485-487	Level of care required by patient condition isn't necessarily the only indicator of severity of consequence of power failure? Power loss to some equipment may create a hazard unrelated to severity of patient condition	Reconsider this wording
IPEM	500	Change tense; replace ... <i>would be</i> power supplies is appropriate.
IPEM	501	The word ... section. Does this refer to Chapter 3?	... to be absolute, this chapter should ...
IPEM	515	Change text ... (see Figure 2) ...	Change to ... (see Figure 2 for examples) ...
IPEM	521 & 531	This important phrase is used repeatedly.	Use consistent wording and add in one other requirement to compliment the use of etc.; <i>etc</i> should be followed by a full-stop. Suggest : (notwithstanding the requirements of escape lighting, fire alarm systems etc. that may be provided from a local tertiary power source)
IPEM	524	Change text ... <i>As an example</i> ...	change to: ...As examples ...

IPEM	537 vs 547	The example of patient monitors at line 537 would be better swapped with the example of ECG machines at line 547	At 537 ... (for example ECG or ultrasound machines). ... At 547 delete ECG areas; <i>monitoring</i> which implies a longer term connection is covered at line 550.
IPEM	538	Change text ... <i>will not be compromised</i> ...	change to: ... will not be immediately compromised
IPEM	545	change text ... <i>As an example</i> ...	change to: ... As examples ...
IPEM	545 - 591	Consideration of tertiary power supplies with restoration within 0.5 seconds: - Some medical equipment with internal microprocessors may require a 0 second no-break supply; (most modern equipment with critical function will have an internal battery supply to protect against brief outages, but some equipment – electrosurgical units for example – may not, and would require resetting/rechecking after a power interruption)	Consider need for ‘no-break’ supplies too, in risk assessment
IPEM	578	Add a comma	... power supply needed, balanced against ...
IPEM	561	Change text ... <i>As an example</i> ...	change to: ... As examples ...
IPEM	617	Add in an example	... measures such as emergency lighting with the provision of ...
IPEM	592 - 648	Grading of Business Continuity risk ... Whilst the grades A – D seems sensible categorisations, it is not obvious that that the sequence D to A necessarily represents an increasing progression of risk; some elements of B or C may pose greater risk than some elements of A	reconsider framing of business continuity risks: A to D as defined are useful business service categories rather than risk grades
IPEM	594	Figure 3 It is not clear from the subsequent Risk Grade definitions that D – A represents an escalating risk progression as suggested by the arrow in the diagram (e.g. environmental controls less important than medical services? – such as loss of hot water a lower risk than physiotherapy?)	Review business continuity Risk Grade detentions Most services could ultimately affect patient care if lost - it would be useful to consider risk in terms of how quickly loss of a particular service would affect care? (i.e. duration of loss of power)
IPEM	609 - 617	Prolonged outages of areas such as clinical engineering workshops or laundries – for example, would affect patient treatment	Reconsider content

IPEM	631 - 632	Risk Grade B <i>... could represent a compromise to the treatment or welfare of patients ...</i> 'could'? – loss of hot water or heating, for example, would quite quickly compromise care	Change 'could' to 'would'?
IPEM	641 - 642	Risk Grade A <i>... interruption of supply may represent a slight disruption to treatment or welfare of patients. ...</i> Is 'slight' correct? – this is highest risk grade?	Change wording: remove the word 'slight'
IPEM	651	Should the reference be to paragraphs 3.27-3.47. We are already in para 3.48	Amend
IPEM	651	Grammar: consider whether this should read:	...The selection ... is not definitive or exhaustive but is given ...
IPEM	652 - 653	<i>... five clinical groupings and four business groupings ...</i> these 'groups' have been re-named as 'grades' to avoid confusion with the Medical Location 0, 1, 2 Groups	Change text to: <i>... five clinical grades and four business grades ...</i>
IPEM	657 §3.49	Electrical Infrastructure It would be helpful for ESG oversight, for the distinction between essential and non-essential supplies, and the identification of Safety Services, to be included here	Add some explanatory text on designation of Essential Supplies and Safety Service Supplies, and the additional requirements for the latter
IPEM	674	Figure 4: In the diagram all final circuits appear to be supplied by the Secondary Source, i.e. there is no "non-essential"?	Adjust diagram?
IPEM	674	Figure 4: Arrow shows increasing resilience moving rightwards, but maximum resilience (Tertiary + IT) not right-most in the diagram	Adjust diagram - move 'Tertiary Power' box to the right - extend 'Medical IT' box to the left (beyond the limit of the re-positioned 'Tertiary Power' box)
IPEM	821 & 831	DSR does not appear in the Glossary	
IPEM	825	VSD does not appear in the Glossary	
IPEM	835	Should the document deal somewhere with cyber security? It should at least be mentioned somewhere.	
IPEM	855	Does "N+1" need to be explained? Some members of the ESG will not know what it means.	Suggest a reference to §6.9
IPEM	857	Put BREEAM in full as in 867 to 870 below	
IPEM	920	Missing word	...provision of any ... or ...provision for any ...
IPEM	924	Is the reference to 4.30 and 4.31 correct; relevance not clear	

IPEM	962-3	Yes	
IPEM	989 §4.33	Diversity Factors Should due caution be advised in applying diversity factors to areas with critical equipment – in which highest loading may be relatively rare but essential when such demand does occur?	Add cautionary note when considering diversity for critical equipment areas
IPEM	1008 Table 2	Table 2 This information may be problematic - - Values offered in an HTM likely to simply be used by some as design criteria in lieu of proper local assessment. - This is intended as rough guidance yet quoting values to 2 decimal places confers a misleading degree of accuracy to the tabulated values. - Density and demands of electromedical equipment vary widely between different medical application locations. - 'Connected Load Diversity' is said to relate to 'fixed medical equipment' – but what about non-fixed equipment loads (which are more common)?	Rethink the value and wisdom of this table – its inclusion may be ill-advised; if retained then edit content
IPEM	1008 Table 2	AHU is not in the Glossary	
IPEM	1018	Not clear what is meant by <i>public health</i> services: water and drains?	
IPEM	1020	Font typo	4.39 The following ...
IPEM	1038	? a missing 'close-bracket'	(PES), the DNO will be ...
IPEM	1047	Check that the reference to 8.25 to 8.43 is correct	Should perhaps be 8.26
IPEM	1087	Insert a comma after 5 th	... 5th, 7th, ...
IPEM	1135-1141	§5.9 is almost a repeat of 5.2. Consider using the text of 5.9 at 5.2 and deleting 5.9	
IPEM	1142-1144	§5.10 seems out of place.	Suggest putting it at the end of the Harmonics section at line 1208
IPEM	1221	Typo	Replace comma with a full-stop at the end of the line
IPEM	1240	... <i>battery pack fitted to medical equipment</i> ... could be read as guidance to retrofit such packs. This would be inappropriate. Reword	... the resilience can be enhanced by the use of medical equipment such as intravenous (IV) pumps which incorporate internal battery packs.
IPEM	1254	Again, for consistency:	Use 400 V rather than 0.4 kV
IPEM	1272	Typo – inappropriate capital letter in <i>Sharing</i>	... sharing ...
IPEM	1306-1308	Move the phrase ... <i>where space allows</i> secondary circuits, where space allows , separate cable trays ...
IPEM	1364	Punctuation	Replace full-stop with a semi-colon

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Consultation closes 20 January 2017

IPEM	1364	Style consistency	No leading capital P
IPEM	1502	what is a “life-safety service”?	Change to: ... safety service ...
IPEM	1522	Consider a small reword for clarity	... and hence give opportunities for maintenance windows that do not impact business continuity.
IPEM	1642	Typo; repeat of the word <i>risk</i> and <i>areas</i>	... high risk clinical areas risk areas and ...
IPEM			
IPEM	1866-1868	Most of this paragraph is a repeat of §7.6. Is it needed or could the additional bit about flooding be added to 7.6 and this para. deleted?	
IPEM	1938	I2R should be:	I ² R
IPEM	2718	Typo;	delete S from the end of the line
IPEM	2741	Punctuation	Add coma;... policy, consideration should ...
IPEM	2875	Question; although the phase wiring is no longer identified by colour, is it still the convention to identify the actual phase by a colour reference?	
IPEM	2929	?	... restore supplies to the healthy section ...
IPEM	3080	?? Capitals for the title of a document	...Electrical Safety Regulations ...
IPEM	3331	IT network hub and switch cabinets are usually provided with single conversion UPS units. Should this be mentioned as an example?	
IPEM	3343	Group 2 medical locations are defined in this document. There is no need to reference Section 710, but if it is to be referenced, this must include the BS number as well.	
IPEM	3357	Font inconsistency	
IPEM	3601	Figure 21	Replace ‘integrator’ with ‘installer’ or ‘installer/integrator’
IPEM	3632 §11.8	The Directive for medical equipment is the Medical Devices Directive but is about to be replaced by the Medical Devices Regulation. The RTTE Directive has been replaced by the Radio Equipment Directive (2014/53/EU) on 2016-06-13 See http://www.conformance.co.uk/adirectives/doku.php?id=rtte	
IPEM	3666 - 3669	Tables 7 & 8 These tables are of limited value and subject to continual change – the reader has already been referred to OJEU in line 3665 so Table 7 misleading - Table 8 selective and incomplete (e.g. no medical equipment, etc.) therefore limited value here.	Consider revising or removing Tables 7 & 8?

IPEM	3688 -3701	Tables 9, 10 & 11 Tables of selected EMC criteria are of no value here – in that they are highly selective, incomplete, subject to change and dependent upon test methods & other constraints	Consider revising removing Tables 9, 10 & 11 ? – readers should be advised to consult appropriate standards for technical details relevant to particular equipment types.
IPEM	Table 10	The modulation % for 60601-1-2 is a typo	Should be 80% AM at 1 kHz
IPEM	3717	For clarity	... higher transmission power levels ...
IPEM	3764-3747	Cathode ray tube display monitors are now virtually obsolete. I am not aware of the effect of magnetic fields on flat screen displays of various types.	Consider
IPEM	3781	Font size	
IPEM	3862	Font size	
IPEM	3937	The <i>where possible</i> in this statement is at odds with §12.4. Consider deleting the first sentence and rewording:	The normal earthing arrangement will be a TN-S system. Exceptions ...
IPEM	3939	This sentence seems incomplete; <i>by the application of what?</i>	Consider
IPEM	3963-3966	m2 and mm2 should be:	m² and mm²
IPEM	4143	Missing word	... placed nearby out of direct sight ...
IPEM	4157 - 4158	“... resistance of protective conductors and assigns maximum values depending on Group rating (1 or 2)” - isn't this difference between Group 1 and Group 2 going to be removed?	Remove the words “ depending on Group rating (1 or 2)” ?
IPEM	4157 - 4161	Following wording is confusing - ... assigns maximum values However these maximum values may need to be lower than the stated maximum values ...	change to: ... However actual design values may need to be lower than the stated maximum values ...
IPEM	4187	Figure 32 caption not required at this line	
IPEM	4262	Font size: also at 4277, ,	
IPEM	4345	Font size: also at 4350, 4358, 4375, 4387, 4396, 4400, 4407	
IPEM	4469-4470	Piped medical oxygen is not a flammable gas; suggest:	... close to flammable gases or piped medical oxygen.
IPEM	4673	Suggest	(I ² R losses)
IPEM	4862	Is the word <i>safety</i> the correct one to use here? See our 10 th General note one of which should have an appropriate level of resilience. ...
IPEM	4921	... <i>critical to life safety</i> - serious harm other than death should also be a consideration	change to ... critical to safety
IPEM	4940	Concept of Patient Environment relates to touch currents / voltages, not supply continuity.	change 'Patient Environment' to "Medical Location"

IPEM	4958	... <i>supplementary equipotential bonding should be applied.</i> ...	Cross reference this to Chapter 13 (Section 13.18)
IPEM	4977	First 4 words are in a smaller font size	
IPEM	4993	Capitalize	... Electrical Safety Group.
IPEM	4982	16.35 Sockets for Special Locations. Particular examples of special locations are (briefly) considered in this Section, but this may be misleading in as much as there are other example that are not included. (e.g. dialysis water treatment plants, sterile service departments, etc.)	Refine text to include acknowledgement / examples of other types of non-medical special locations
IPEM	4990	Terminology	Change ... <i>biomedical</i> ... to ... medical engineering ...
IPEM	4991	Terminology	Change ... <i>biomedical equipment</i> ... to ... medical equipment ...
IPEM	4993-4994	In medical electronic labs/workshops, all workstations need to have appropriate protection for working on equipment with covers removed. Thus a singel special test room or test bay is insufficient. Individual works stations, each partitioned from the next and each having all sockets powered from a 10 mA RCD have proved to be an effective and safe solution over many years.	Replace the final sentence with: ... Electrical Safety Group. This may include measures such as non-conductive individual workstations, each partitioned from the next and each having all sockets powered from a 10 mA RCD.
IPEM	4995-5003	Operating Theatres need both Medical (IT) and non Medical Sockets (TN). On more than one project that an IPEM member has recently been involved with, the designer has only provided Blue Medical sockets (IT) with a single cleaners socket. Theatres need a mix of both Medical and non-medical sockets and this should be emphasized in this paragraph.	Amend: ... the SSP standby generator. A reasonable number of appropriately located non-medical sockets should also be provided. These should be connected to ...
IPEM	4998	The word ... <i>consideration</i> ... is duplicated	Delete

IPEM	after 5003	This might be a suitable point to insert some words regarding MSOs	Mains extension leads – multiple socket outlets 16.38a Mains extension leads (formally called multiple-socket outlets – MSOs) should not be used in group 1 and group 2 medical locations without a full assessment being performed by a competent person who has an understanding of BS EN 60601-1. Plugging multiple items of equipment at least one of which is an item of medical electrical equipment into an MSO is in effect manufacturing a medical electrical system. Such arrangements increase leakage currents and, without careful design, can give rise to additional risk. Clause 16 of BS EN 60601-1 and the associated guidance in the linked part of Annex A provide requirements and advice. The requirements of the Medical Devices Regulation 2017 Article 4.4 also apply.
IPEM	5017	The number of socket outlets suggested is unclear; <i>6on</i>	Clarify
IPEM	5029	Grammar:	delete ... <i>which</i> ...
IPEM	5039	Suggest reordering the second part of this sentence	... <i>agreed with the Electrical Safety Group together with the clinicians for this area.</i>
IPEM	5093	Amend	... avoid the need of <i>for</i> temporary ...
IPEM	5129-5132	The exact meaning of this sentence [Where ... only.] is not clear	Reword for clarity
IPEM	5142	See the 10 th General comment above re. <i>safety service</i> .	
IPEM	5150	The concept of Patient Environment relates to touch currents / voltages, not location illumination	Change ... <i>Patient Environment</i> ... to ... Medical Location ...
IPEM	5151	As above at line 5142	
IPEM	5161	Include the ESG	... stakeholders who may including the ...
IPEM	5185-5186	Formatting	
IPEM	5195	Should this be an 'if' requirement? If so, reword into a single sentence	If , due to the nature of ...
IPEM	5243	Grammar	Capitalize the first word: 16.93 Cables
IPEM	5359- 5475	Most section titles and paragraph numbers are in a non-consistent font	
IPEM	5505	Use the original. Generally Standards are not intended to be applied retrospectively (except where, very unusually, developments in 'state of the art' indicate that previously accepted norms are unsafe).	

IPEM	5512-5517	The listing of qualifications is unnecessary: but the text from line 5517 ... <i>It is important to recognise</i> ... to the end of the section is worth including once corrected for grammar.	Remove the lists of qualifications. ... <i>It is important that the signatories for ... recognise their responsibilities.</i> While the test engineer ...
IPEM	5528	Use the alternative wording	
IPEM	5540	The concept of Patient Environment relates to touch currents / voltages, not location illumination	Change ... <i>Patient Environment</i> ... to ... <i>Medical Location</i> ...
IPEM	5541	Keep the original wording.	
IPEM	5545	ESQR not defined	Add ESQR to the Glossary list in Chapter 1
IPEM	5550	Requires further consideration	
IPEM	5555	Requires further consideration	
IPEM	5565-5578	If this text or something like it is included, it should be noted that where the EBB is the reference point for earth bonding measurements, the measured value between the EBB and any point should not exceed half of the values quoted in 17.27 for Group 1 and Group 2 Medical Locations	Add at line 5578: Where the EBB is the reference point for earth bonding measurements then the measured value between the EBB and any point should not exceed half of the values quoted in for Group 1 and Group 2 Medical Locations. See also §18.62.
IPEM	5570	Is it expected that the 0.7 ohm will be removed in the next version of the standards?	In which case do not explicitly refer to 0.7 ohm in the HTM?
IPEM	5595-5612	Requires further consideration	
IPEM	5618	Alternative seems very detail but perhaps this is useful. Further consideration	
IPEM	5644	... HTM requirements 1, 2, 3 4 or 5 ... should be "A, B C, D or E"	Correct accordingly
IPEM	5662	The alternative seem better; but does it really mean ... load <i>shredding</i> ... at line 5668	
IPEM	5673	The alternative requires some rewording but may be an improvement.	
IPEM	5732	The additional list items seem sensible	
IPEM	5762	The paragraph style in Chapter 18 is different from earlier chapters	
IPEM	5952-5954	Not certain what this example means.	
IPEM	6031	... <i>Authorising Engineer</i> ...	Add definition of Authorising Engineer to Chapter 1 definitions?
IPEM	6189	Sound advice but in the current heavily utilised NHS, finding a time to carry this out without undue risk to patients is difficult.	Suggest a note, perhaps at the beginning of this chapter to make the point that tests involving shut down of the main DNO must be carefully planned to minimise risk to patients.

	6395	Include radiology equipment in this list of examples	
	6408	IPEM is not convinced that this section is relevant for this HTM. However, if it is left in then there needs to be a strong statement that excluded medical electrical equipment from the scope of this section.	
	6410	The testing involved in portable appliance testing, particularly earth continuity, should be applied to any plugged-in equipment, therefore linking portable appliance testing only to hand-held equipment is too restrictive.	<p>Portable appliances include all items of electrical equipment that are plugged-in to the mains supply, excluding medical electrical equipment. Electrical safety testing of medical electrical equipment requires specialist knowledge and understanding and specialist test equipment. It should be excluded from any portable appliance testing regime. Medical electrical equipment should be tested under other arrangements.</p> <p>Particular attention should be paid to hand-held portable appliances such as power tools, floor polishers, vacuum cleaners. Estates managers should make a comprehensive list of all non-medical electrical equipment that may be plugged into</p> <p>In general, non-medical equipment should not be brought into the Patient Environment. Where this is required, specialist advice and testing should be sought from clinical engineers.</p>
	6442	Appropriate test intervals will vary according to the type of equipment	... This might will vary ...
	6540	The usual convention is to give Standard numbers followed immediately by the publication date thus: For consistency, follow this convention	BS 5266-1:2016 ...
	6607	Add reference for electrical testing installations	BS EN 50191:2010: Erection and operation of electrical test equipment
	6649	Add reference to medical equipment EMC standard	BS EN 60601-1-2:2015: Medical electrical equipment. General requirements for basic safety and essential performance. Electromagnetic disturbances. Requirements and tests