

Vogle PEmails

From: Hoellman, Jordan
Sent: Friday, August 25, 2017 11:09 AM
To: Vogle PEmails
Subject: Licensing Basis Document Markups for LAR-193, Raceway/Cable Separation Criteria Changes
Attachments: 2017-08-31 Licensing Basis Document Markups for LAR-193, Raceway Cable Separation Criteria Changes.pdf

Please see the attached Licensing Basis Document Markups for the 8/31/17 pre-submittal public meeting on LAR-193 "Raceway/Cable Separation Criteria Changes".

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Criteria Changes
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ITAAC Table 3.3-6, Items 7.d.i to iii (COL App C items, 799-802) **includes LAR 108 changes**

No.	ITAAC No.	Design Commitment	Inspections, Tests, Analysis	Acceptance Criteria
799	3.3.00.07d.i	7.d) Physical separation is maintained between Class 1E divisions and between Class 1E divisions and non- Class 1E cables.	<p>Inspections of the as-built Class 1E raceways will be performed to confirm that the separation between Class 1E raceways of different divisions and between Class 1E raceways and non-Class 1E raceways is consistent with the following:</p> <p>i) Within the main control room and remote shutdown room (non-hazard areas), the minimum separation for low-voltage power cables is defined by one of the following:</p> <p>1) For configurations involving open top raceways configurations to enclosed configuration with low-voltage power cables, the minimum vertical separation is 3 inches and the minimum horizontal separation is 1 inch.</p> <p>2) For configurations involving an enclosed raceway and an open raceway with low-voltage power cables, the minimum horizontal and vertical separation is 1 inch if the enclosed raceway is below the open raceway.</p> <p>3) For configurations involving enclosed raceways the minimum separation is 1 inch in both horizontal and vertical directions.</p> <p>4) For configurations involving open configurations, and an enclosed raceway and an open raceway with instrumentation and control cables the minimum separation is 1 inch in both horizontal and vertical directions.</p>	<p>Results of the inspection will confirm that the separation between Class 1E raceways of different divisions and between Class 1E raceways and non-Class 1E raceways is consistent with the following:</p> <p>i) Within the main control room and remote shutdown room (non-hazard areas), the minimum separation for low-voltage power cables meets one of the following:</p> <p>1) For configurations involving open top raceways configurations to enclosed configuration with low-voltage power cables, the vertical separation is 3 inches or more and the horizontal separation is 1 inch or more.</p> <p>2) For configurations that involve an enclosed raceway and an open raceway with low-voltage power cables, the minimum horizontal and vertical separation may be reduced to 1 inch if the enclosed raceway is below the open raceway.</p> <p>3) For configurations that involve enclosed raceways, the minimum separation is 1 inch in both horizontal and vertical directions.</p> <p>4) For configurations that involve open configurations, and an enclosed raceway and an open raceway with instrumentation and control cables the minimum separation is 1 inch in both horizontal and vertical directions.</p>
800	3.3.00.07d.ii.a	7.d) Physical separation is maintained between Class 1E divisions and between Class 1E divisions and non- Class 1E cables.	<p>Inspections of the as-built Class 1E raceways will be performed to confirm that the separation between Class 1E raceways of different divisions and between Class 1E raceways and non-Class 1E raceways is consistent with the following:</p>	<p>Results of the inspection will confirm that the separation between Class 1E raceways of different divisions and between Class 1E raceways and non-Class 1E raceways is the following:</p>

No.	ITAAC No.	Design Commitment	Inspections, Tests, Analysis	Acceptance Criteria
			<p>ii.a) Within other plant areas (limited hazard areas), the minimum separation is defined by one of the following:</p> <p>Between Class 1E of different divisions:</p> <p>1) The minimum vertical separation is 5 feet and the minimum horizontal separation is 3 feet.</p> <p>Between Class 1E divisions and non-Class 1E cables:</p> <p>2) The minimum vertical separation is 12 inches and the minimum horizontal separation is 6 inches for raceways containing only instrumentation and control and low-voltage power cables $\leq 2/0$ AWG. This minimum vertical separation is reduced to 3 inches for the configuration with a conduit above and crossing the open tray at an angle greater than 45 degrees.</p> <p>3) The minimum vertical separation is 12 inches, and the minimum horizontal separation is 6 inches between a conduit and an open configuration for low-voltage power cables greater than 2/0 AWG but not greater than 750 kcmil. The vertical distance is reduced to 3 inches if a conduit is above and crossing an open tray at an angle equal to or greater than 45 degrees.</p> <p>34) For configurations that involve exclusively limited energy content cables (instrumentation and control), the minimum vertical separation is 13 inches and the minimum horizontal separation is 1 inch.</p> <p>45) For configurations involving an enclosed raceway and an open raceway, the minimum vertical separation is 1 inch if the enclosed raceway is below the open raceway.</p> <p>56) For configuration involving enclosed raceways, the minimum separation is 1 inch in both</p>	<p>ii.a) Within other plant areas inside containment (limited hazard areas), the separation meets one of the following:</p> <p>Between Class 1E of different divisions:</p> <p>1) The vertical separation is 5 feet or more and the horizontal separation is 3 feet or more except.</p> <p>Between Class 1E divisions and non-Class 1E cables:</p> <p>2) The minimum vertical separation is 12 inches and the minimum horizontal separation is 6 inches for raceways containing only instrumentation and control and low-voltage power cables $\leq 2/0$ AWG. This minimum vertical separation is reduced to 3 inches for the configuration with a conduit above and crossing the open tray at an angle greater than 45 degrees.</p> <p>3) The minimum vertical separation is 12 inches, and the minimum horizontal separation is 6 inches between a conduit and an open configuration for low-voltage power cables greater than 2/0 AWG but not greater than 750 kcmil. The vertical distance is reduced to 3 inches if a conduit is above and crossing an open tray at an angle equal to or greater than 45 degrees.</p> <p>34) For configurations that involve exclusively limited energy content cables (instrumentation and control), the minimum vertical separation is 13 inches and the minimum horizontal separation is 1 inch.</p> <p>45) For configurations that involve an enclosed raceway and an open raceway, the minimum vertical separation is 1 inch if the enclosed raceway is below the open raceway.</p> <p>56) For configurations that involve enclosed raceways, the minimum vertical and</p>

No.	ITAAC No.	Design Commitment	Inspections, Tests, Analysis	Acceptance Criteria
			<p>horizontal and vertical directions.</p> <p>7) For configurations with a non-safety conduit and a free air safety cable, the minimum horizontal separation is 1 inch when in vertical parallel and 90 degree horizontal crossing configurations and in parallel horizontal configurations. The minimum vertical separation is 1 inch when in horizontal 90 degree crossing configurations.</p>	<p>horizontal separation is 1 inch.</p> <p>7) For configurations that involve a non-safety conduit and a free air safety, cable the minimum horizontal separation is 1 inch when in vertical parallel and 90 degree horizontal crossing configurations and in parallel horizontal configurations. The minimum vertical separation is 1 inch when in horizontal 90 degree crossing configurations.</p>
801	3.3.00.07d.ii.b	7.d) Physical separation is maintained between Class 1E divisions and between Class 1E divisions and non- Class 1E cables.	<p>Inspections of the as-built Class 1E raceways will be performed to confirm that the separation between Class 1E raceways of different divisions and between Class 1E raceways and non-Class 1E raceways is consistent with the following:</p> <p>ii.b) Within other plant areas (limited hazard areas), the minimum separation is defined by one of the following:</p> <p>1) The minimum vertical separation is 5 feet and the minimum horizontal separation is 3 feet.</p> <p>2) The minimum vertical separation is 12 inches and the minimum horizontal separation is 6 inches for raceways containing only instrumentation and control and low-voltage power cables $\leq 2/0$ AWG. This minimum vertical separation is reduced to 3 inches for the configuration with a conduit above and crossing the open tray at an angle equal to or greater than 45 degrees.</p> <p>3) The minimum vertical separation is 12 inches, and the minimum horizontal separation is 6 inches between a conduit and an open configuration for low-voltage power cables greater than 2/0 AWG but not greater than 750 kcmil. The vertical distance is reduced to 3 inches if a conduit is above and crossing an open tray at an angle equal to or greater than 45 degrees.</p>	<p>Results of the inspection will confirm that the separation between Class 1E raceways of different divisions and between Class 1E raceways and non-Class 1E raceways is the following:</p> <p>ii.b) Within other plant areas inside the non-radiologically controlled area of the auxiliary building (limited hazard areas), the separation meets one of the following:</p> <p>1) The vertical separation is 5 feet or more and the horizontal separation is 3 feet or more except.</p> <p>2) The minimum vertical separation is 12 inches and the minimum horizontal separation is 6 inches for raceways containing only instrumentation and control and low-voltage power cables $\leq 2/0$ AWG. This minimum vertical separation is reduced to 3 inches for the configuration with a conduit above and crossing the open tray at an angle equal to or greater than 45 degrees.</p> <p>3) The minimum vertical separation is 12 inches, and the minimum horizontal separation is 6 inches between a conduit and an open configuration for low-voltage power cables greater than 2/0 AWG but not greater than 750 kcmil. The vertical distance is reduced to 3 inches if a conduit is above and crossing an open tray at</p>

No.	ITAAC No.	Design Commitment	Inspections, Tests, Analysis	Acceptance Criteria
			<p>34) For configurations that involve exclusively limited energy content cables (instrumentation and control), the minimum vertical separation is 12 inches and the minimum horizontal separation is 1 inch.</p> <p>45) For configurations involving an enclosed raceway and an open raceway, the minimum vertical separation is 1 inch if the enclosed raceway is below the open raceway.</p> <p>56) For configuration involving enclosed raceways, the minimum separation is 1 inch in both horizontal and vertical directions.</p> <p>7) For configurations with a non-safety conduit and a free air safety cable, the minimum horizontal separation is 1 inch when in vertical parallel and 90 degree horizontal crossing configurations and in parallel horizontal configurations. The minimum vertical separation is 1 inch when in horizontal 90 degree crossing configurations.</p>	<p>an angle equal to or greater than 45 degrees.</p> <p>34) For configurations that involve exclusively limited energy content cables (instrumentation and control), the minimum vertical separation is 12 inches and the minimum horizontal separation is 1 inch.</p> <p>45) For configurations that involve an enclosed raceway and an open raceway, the minimum vertical separation is 1 inch if the enclosed raceway is below the open raceway.</p> <p>56) For configurations that involve enclosed raceways, the minimum vertical and horizontal separation is 1 inch.</p> <p>7) For configurations that involve a non-safety conduit and a free air safety cable, the minimum horizontal separation is 1 inch when in vertical parallel and 90 degree horizontal crossing configurations and in parallel horizontal configurations. The minimum vertical separation is 1 inch when in horizontal 90 degree crossing configurations.</p>
802	3.3.00.07d.ii.c	7.d) Physical separation is maintained between Class 1E divisions and between Class 1E divisions and non- Class 1E cables.	<p>Inspections of the as-built Class 1E raceways will be performed to confirm that the separation between Class 1E raceways of different divisions and between Class 1E raceways and non-Class 1E raceways is consistent with the following:</p> <p>ii.c) Within other plant areas (limited hazard areas), the minimum separation is defined by one of the following:</p> <ol style="list-style-type: none"> 1) The minimum vertical separation is 5 feet and the minimum horizontal separation is 3 feet. 2) The minimum vertical separation is 12 inches and the minimum horizontal separation is 6 inches for raceways containing only instrumentation and control 	<p>Results of the inspection will confirm that the separation between Class 1E raceways of different divisions and between Class 1E raceways and non-Class 1E raceways is the following:</p> <p>ii.c) Within other plant areas inside the radiologically controlled area of the auxiliary building (limited hazard areas), the separation meets one of the following:</p> <ol style="list-style-type: none"> 1) The vertical separation is 5 feet or more and the horizontal separation is 3 feet or more-except. 2) The minimum vertical separation is 12 inches and the minimum horizontal separation is 6 inches for raceways containing only

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			<p>and low-voltage power cables ≤2/0 AWG. This minimum vertical separation is reduced to 3 inches for the configuration with a conduit above and crossing the open tray at an angle equal to or greater than 45 degrees.</p> <p>3) The minimum vertical separation is 12 inches, and the minimum horizontal separation is 6 inches between a conduit and an open configuration for low-voltage power cables greater than 2/0 AWG but not greater than 750 kcmil. The vertical distance is reduced to 3 inches if a conduit is above and crossing an open tray at an angle equal to or greater than 45 degrees.</p> <p>34) For configurations that involve exclusively limited energy content cables (instrumentation and control), the minimum vertical separation is 12 inches and the minimum horizontal separation is 1 inch.</p> <p>45) For configurations involving an enclosed raceway and an open raceway, the minimum vertical separation is 1 inch if the enclosed raceway is below the open raceway.</p> <p>56) For configuration involving enclosed raceways, the minimum separation is 1 inch in both horizontal and vertical directions.</p> <p>7) For configurations with a non-safety conduit and a free air safety cable, the minimum horizontal separation is 1 inch when in vertical parallel and 90 degree horizontal crossing configurations and in parallel horizontal configurations. The minimum vertical separation is 1 inch when in horizontal 90 degree crossing configurations.</p>	<p>instrumentation and control and low-voltage power cables ≤2/0 AWG. This minimum vertical separation is reduced to 3 inches for the configuration with a conduit above and crossing the open tray at an angle equal to or greater than 45 degrees.</p> <p>3) The minimum vertical separation is 12 inches, and the minimum horizontal separation is 6 inches between a conduit and an open configuration for low-voltage power cables greater than 2/0 AWG but not greater than 750 kcmil. The vertical distance is reduced to 3 inches if a conduit is above and crossing an open tray at an angle equal to or greater than 45 degrees.</p> <p>34) For configurations that involve exclusively limited energy content cables (instrumentation and control), the minimum vertical separation is 12 inches and the minimum horizontal separation is 1 inch.</p> <p>45) For configurations that involve an enclosed raceway and an open raceway, the minimum vertical separation is 1 inch if the enclosed raceway is below the open raceway.</p> <p>56) For configurations that involve enclosed raceways, the minimum vertical and horizontal separation is 1 inch.</p> <p>7) For configurations that involve a non-safety conduit and a free air safety cable, the minimum horizontal separation is 1 inch when in vertical parallel and 90 degree horizontal crossing configurations and in parallel horizontal configurations. The minimum vertical separation is 1 inch when in horizontal 90 degree crossing configurations.</p>

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8.3.2.4.2 Raceway and Cable Routing

There are five separation groups for the cable and raceway system: group A, B, C, D, and N. Separation group A contains safety-related circuits from division A. Similarly, separation group B contains safety-related circuits from division B; group C from division C; group D from division D; and group N from nonsafety-related circuits.

Cables of one separation group are run in separate raceway and physically separated from cables of other separation groups. Group N raceways are separated from safety-related groups A, B, C and D. ~~Separation between safety-related groups, and between safety-related groups and nonsafety-related cables are routed in the same areas as the safety-related groups~~ ~~Raceways from group N are routed in the same areas as the safety-related groups~~ according to spatial separation stipulated in Regulatory Guide 1.75 and IEEE 384 with the following exceptions listed below.‡

Note: If not explicitly specified below, "enclosed raceway" and "enclosed configuration" refer to conduit, enclosed tray or transition box designed and used for supporting or enclosing wires, cables or busbars. "Open configuration" refers to free air cable and open cable tray. The exceptions are limited to low-voltage power system applications and below (instrumentation and control).

- ~~• Within the main control room and remote shutdown room (nonhazard areas), the minimum vertical separation for open top cable tray is 3 inches and the minimum horizontal separation is 1 inch.~~
- ~~• Within general plant areas (limited hazard areas), the minimum vertical separation is 12 inches, and the minimum horizontal separation is 6 inches for open top cable trays with low-voltage power circuits for cable sizes <2/0 AWG. For configurations that involve exclusively limited energy content cables (instrumentation and control), these minimum distances are reduced to 3 inches and 1 inch respectively.~~
- ~~• Within panels and control switchboards, the minimum horizontal separation between components or cables of different separation groups (both field-routed and vendor-supplied internal wiring) is 1 inch, and the minimum vertical separation distance is 6 inches.~~
- ~~• For configurations involving an enclosed raceway and an open raceway, the minimum vertical separation is 1 inch if the enclosed raceway is below the open raceway.~~

Non-hazard Area Exceptions

- The minimum vertical separation is 3 inches and the minimum horizontal separation is 1 inch between open to enclosed configurations for configurations involving low-voltage power cables.
- The minimum vertical separation is 1 inch and the minimum horizontal separation is 1 inch between open configurations, and between open to closed configurations for configurations that involve exclusively limited energy content cables (Instrumentation and control).
- For configurations involving low-voltage power cables within an enclosed raceway and an open raceway, the minimum vertical separation is 1 inch if the enclosed raceway is below the open raceway.
- Within panels and control switchboards, the minimum horizontal separation between components or cables of different separation groups (both field-routed and vendor-supplied internal wiring) is 1 inch, and the minimum vertical separation distance is ~~16~~ **6** inches.

Limited Hazard Area Exceptions

- The minimum vertical separation is 1 inch, and the minimum horizontal separation is 1 inch with configurations that involve exclusively limited energy content cables (Instrumentation and control).
- The minimum vertical separation is 12 inches, and the minimum horizontal separation is 6 inches with configurations that involve low-voltage power cables for cable sizes less than and equal to 2/0 AWG. The minimum vertical distance can be reduced to 3 inches for the configuration with a conduit above and crossing an open tray at an angle equal to or greater than 45 degrees.
- The minimum vertical separation is 12 inches, and the minimum horizontal separation is 6 inches between a conduit and an open configuration for low-voltage power cables greater than 2/0 AWG but not greater than 750 kcmil. The

vertical distance can be reduced to 3 inches if the conduit is above and crossing an open tray at an angle equal to or greater than 45 degrees.

- The minimum vertical separation is 1 inch if the enclosed raceway is below the open raceway for low-voltage cables.
- For configurations with a non-safety conduit and a free air safety cable with low-voltage power cables:
 - The minimum horizontal separation can be reduced to 1 inch in vertical parallel and horizontal 90 degree crossing configurations and parallel horizontal configurations.
 - The minimum vertical separation is 1" in 90 degree horizontal crossing configurations.
- Within panels and control switchboards, the minimum horizontal separation between components or cables of different separation groups (both field-routed and vendor-supplied internal wiring) is 1 inch, and the minimum vertical separation distance is ~~1.6 inches~~.

Hazard Area Exceptions

- Within hazard areas, the minimum spatial separation distances between non-safety to safety raceway and cable is the same as the spatial separation distances (with exceptions) applicable to raceway and cables in limited hazard areas.

The exceptions to the guidance in Regulatory Guide 1.75 are based on test results used to support exceptions to the separation guidance for operating nuclear power plants. A summary of test results from ten electrical separation test programs is documented in Reference 13. These test programs support the AP1000 exceptions.

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8.3.2.4.3 Hazard Protection

Where redundant safety-related ~~and nonsafety-related~~ raceway systems traverse each other, separation in accordance with Regulatory Guide 1.75 and IEEE 384 is maintained. See UFSAR Subsection 8.3.2.4.2 for separation requirements between non-safety cables and safety -related raceway systems in hazard areas.

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8.3.4 References

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13. Young, G. L. et al., "Cable Separation - What Do Industry Programs Show?," IEEE Transactions of Energy Conversion, September 1990, Volume 5, Number 3, pp 585-602.

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