

NENA PSAP Site Characteristics Information Document



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Reason for Issue/Reissue

NENA reserves the right to modify this document. Upon revision, the reason(s) will be provided in the table below.

Document Number	Approval Date	Reason For Issue/Reissue
NENA 04-502	03/31/2004	Initial Document
NENA-INF-024.2-2018	02/14/2018	This revision updates references to external documents and applies the current NENA Information Document template and document numbering scheme.

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1 Executive Overview

This Information Document is a guide for PSAP managers and for the designers, manufacturers and installers of PSAP CPE (Customer Premises Equipment). Most of the material in this document applies to equipment hosted in both E9-1-1 and NG9-1-1 PSAPs. It identifies the required and desirable characteristics of the PSAP facilities that house the supporting CPE. “Supporting CPE” includes all of the equipment and facilities that support PSAP operations with the exception of call taker or dispatch related equipment that is located in the workspace. Supporting CPE is often located in a “back room” and is sometimes referred to as “backroom” equipment.

This document is not intended to describe the optimum environmental conditions of the PSAP’s workspace.

This document is not intended to provide complete design specifications for PSAP equipment. Adherence to these recommendations will not ensure the quality of the performance of the Customer Premises Equipment. This document should not be used as an exclusive procurement specification.

This document is published as part of NENA’s continuing effort to improve the understanding of the issues shared by the various participants who are responsible for the effective operation of the 9-1-1 system. The environment where customer premises equipment resides is critical to the operation of the equipment. The purpose of this standard is to identify the minimum recommendations as well as desirable recommendations for PSAP sites in place today as well as to identify recommendations for PSAP’s beginning new construction or remodeling. This document contains NENA’s recommendations for PSAP site design.

2 SITE PREPARATION RECOMMENDATIONS AND GUIDELINES

2.1 General Recommendations and Guidelines

The customer should inform its architect or contractor of this section of this document and ensure that the recommendations are met and applicable local ordinances and regulations are followed. This Information Document applies to permanent structures, i.e. not to any trailers. Any local building codes may override related recommendations within this document.

It is strongly recommended that the customer provide its contractor(s) with the [Equipment Room Checklist](#) and the [Electrical Contractor Checklist](#). The Check Lists can then be signed and dated by the respective contractor or delegated authority as a permanent record of the customer’s preparation.

The 9-1-1 equipment should have a program for service monitoring and recovery plan in the event of a service outage. Items to consider in the plan include but are not limited to:

1. Transfer of AC power to an alternate power source
2. Transfer of 9-1-1 service to an alternate PSAP
3. Handling of 9-1-1 equipment alarms.

2.2 Equipment Area

A maintenance space or access area around the equipment racks should be available. The area around equipment racks should remain clear of all desks, machines, shelves, and storage cabinets. This area should also remain clear of any hazardous materials.

The equipment area should be as dust free as possible during and after installation. The floor should be clean, dry, level and free from vibration. The wall and ceiling finish should be a dust free surface that can be cleaned and will not flake.

A minimum clear ceiling height of 7'6" under girders or other obstructions throughout the equipment area should be provided.

A sheet of ¾ inch plywood, mounted 2 feet from the floor, (in a size to accommodate current equipment with sufficient space for realistic future growth.) should be provided for mounting cross connect blocks and other 9-1-1 equipment. The plywood should be painted or sealed per local building and fire codes. In general, if the plywood is fastened to gypsum or plaster, total equipment mounted to board should not exceed 75 pounds. If plywood is fastened to concrete, hollow block with embedded anchors, total equipment mounted to board should not exceed 100 pounds. A sufficient number of wall anchors should be used to comply with applicable building codes when securing the plywood to the building wall. Workspace around the equipment should allow for safe access to all equipment and in accordance with local building and fire codes.

2.3 Structural Recommendations and Guidelines

The site floor condition should be checked before installing 9-1-1 equipment. Questionable floor construction may require moving equipment to another location or reconfiguring the equipment package. The floor should be of sufficient strength to be capable of supporting equipment of current install and future growth and in compliance with state and local building codes.

The size of the 9-1-1 equipment location should be sized to accommodate the planned equipment appropriate access space. However, the actual size recommendations will be determined and agreed upon during the equipment provider's site visit.

Any desks or tables used for 9-1-1 equipment should be of a design that cannot be easily overturned, i.e. low profile, wide footprint. 9-1-1 equipment will not be installed in a customer provided frame unless the frame conforms to the requirements.

2.4 Equipment Room Environmental Recommendations and Guidelines

The ambient temperature and relative humidity in the 9-1-1 equipment area should be maintained in a range of 60 to 80 degrees Fahrenheit with relative humidity in the range of 40 to 60 percent.

The 9-1-1 equipment location should be an air-conditioned space, with adequate airflow and no condensation. **NOTE:** Vendors may have additional requirements for their equipment.

9-1-1 equipment should not be installed in rooms in which a major heat source (i.e., boiler room, furnace room) can affect the ambient room temperature significantly.

9-1-1 equipment should not be installed in a flood-prone space or area with high risk of water damage or damage from equipment room access doors.

To avoid contamination by any process or condition involving silicone based lubricants, inks, dust, solvents or other airborne contaminants, the 9-1-1 equipment should not be located in the same room with copying machines, printing presses, asbestos materials and/or wet cell batteries.

2.5 Electromagnetic Interference

The 9-1-1 equipment should be located in an area that meets the following objectives:

1. Interference from electromagnetic fields less than 2 volts per meter and frequencies from 10 KHz to 1 GHz.
2. No interference from licensed radio communication equipment, such as equipment covered by FCC Title 47 CFR, Part 15.
3. No interference from electromagnetic noise, such as might be generated by electric motors with commutators.

2.6 Acoustics

The sound levels in the 9-1-1 equipment area should comply with OSHA requirements and applicable state requirements.

2.7 Lighting

A light intensity of 30 to 100 foot-candles should be provided around the 9-1-1 equipment cabinet for maintenance activities.

Emergency lighting should be available in case of power outage at the site.

2.8 Fire Protection

The customer should provide chemical fire protection equipment at the 9-1-1 equipment location. Water or fire extinguishers not rated for use on electrical fires should not be used.

Fire rating in accordance with applicable fire codes, of wall, floor and ceiling penetrations required for the 9-1-1 equipment installation is recommended.

Equipment should not be located under fire suppression sprinklers. If sprinklers must be located with the equipment due to fire or building code requirements, the sprinkler heads should be caged and deflected to not allow water spray on the electronic equipment. The heads should be rated for high temperature.

2.9 Electrical Protection

For satisfactory performance of the 9-1-1 system, the customer should arrange for the outside plant distribution cable entrance to be checked for proper electrical protection as defined by your local service provider or Electrical Engineer.

Protection considerations for a specific cable installation should include all the exposures encountered, whatever the source, and the protection measures should be coordinated to reduce the effects of these exposures. Protection from lightning requires bonding and grounding of all metallic sheath components and metallic strength members and the application of protectors to metallic pairs at specified locations, to be determined by an electrical engineer. Power protection requires a fusible link in addition to the application of protectors and bonding and grounding. Fusible links, however, are not effective for lightning protection or sneak current protection and are not a substitute for protectors.

An electrical engineer should determine the proper spacing between power and telephone facilities. Should power contacts occur, the design should provide for paths to ground on the telephone plant sufficient to prevent excessive voltage rise. This path should conduct enough power line fault current to ground to rapidly operate fuses or breakers on the faulted power line or to cause line conductors to open at the fault point.

Low impedance paths to ground are an effective aid for lightning mitigation and are achieved by the following:

1. Establishing and maintaining continuity of metallic cable components (shield, strength member, vapor barrier) in cables
2. Bonding the metallic sheath components and strength members of cables to metallic support strands as required
3. Bonding the metallic sheath components, strength members and strands of separate cables together
4. Bonds to Multi-Grounded Neutrals (MGN)
5. Proper grounding at buildings.

Telecommunications cables entering a PSAP location should have all metallic components, such as the shield, strength member, or vapor barrier grounded.

All working and non-working metallic telecommunications pairs exposed to power and/or lightning that are terminated in the building should have protectors.

The National Electrical Code (NEC), Articles 770 and 800, covers the installation of telecommunications facilities at customer locations.

The NEC requires the bonding of all available electrodes into a grounded electrode system and the preferential choice for grounding the electric power is to any point on that system. The system consists of a bonded assembly of all of the following electrodes if available at the premises or structure:

1. The metal frame of a building where effectively grounded
2. Concrete encased electrode as defined by the NEC
3. A buried ground ring as defined by the NEC
4. A metal underground public or private water pipe with at least 10 feet of metal pipe in direct contact with the earth

The first choice for a station protector ground is the nearest accessible location on the power grounding system. For new construction, the NEC, in Article 250, requires that an accessible means be provided (as part of the power service installation) for bonding and grounding other systems (such as the telephone) to the power ground. This may consist of the following:

1. A metallic service entrance conduit
2. A power grounding conductor
3. An external connector provided on the electric power service equipment or service raceway

The power grounding system for grounding the protector should result in the shortest run of grounding conductor.

The NEC requires that the power and telephone grounds be bonded. This is accomplished automatically when the station protector is grounded to the power grounding system. Where the power ground is inaccessible or the power is not grounded, the customer should be notified that an unsafe condition might exist.

It is desirable to have external pipes labeled within the site. Gas pipes should not be used as a grounding electrode or bonding conductor for any component.

The power and protector grounds should be common.

2.9.1 Grounding and Bonding Information, Recommendations and Guidelines

Care should be taken at PSAP sites to avoid the creation of grounding arrangements that are above and beyond those needed to provide adequate fault current paths and reliable equipment operation. Unwarranted arrangements may result in undesirable conditions, including violations of electrical codes. It is essential that an electrical engineer be consulted.

Isolated ground type AC receptacles are not recommended for any equipment unless required by the equipment manufacturer. All AC receptacles serving 9-1-1 equipment should be grounded type receptacles.

If the PSAP site is equipped with radio equipment and one or more radio antennas, it is strongly recommended that the site, including the building, the equipment within the building, each antenna and/or antenna support structure and other external and internal objects are equipped with a grounding system and lightning protection that, at minimum, conforms with the applicable requirements for radio sites.

AC equipment grounding (ACEG) conductors serving receptacles for 9-1-1 equipment components should meet all applicable requirements in Article 250 of the NEC and all other applicable codes. The ACEG conductor serving the 9-1-1 circuit breaker box should be electrically continuous from the source of the AC system.

The 9-1-1 equipment area may be equipped with a bus bar and/or a system of grounding conductors connected to the site's earth electrode system. If so equipped, the customer should allow access to the bus bar and/or grounding conductors for connection of grounding conductors serving 9-1-1 equipment, when required.

When required by the 9-1-1 equipment manufacturer or when 9-1-1 equipment contains a DC power source, the customer in the area where the 9-1-1 equipment is located should furnish a point of connection to the PSAP site's earth electrode system. The preferred means of providing this point of connection is a small bus bar (Square D PK7GTA or equivalent). When a point of connection is required, a minimum #6 AWG bond should be made from this point, in order of preference, to one or more of the following:

1. Dedicated grounding conductor extended from the site's earth electrode system
2. Building structural steel, provided it is bonded to the site's earth electrode system
3. Continuous metallic water pipe, provided it is accessible along its entire length to the point where it is bonded to the site's earth electrode system
4. Metallic conduit, raceway or panel containing service conductors

5. Metallic shield of a copper or fiber cable that has been bonded to the site's earth electrode system at the cable entrance
 6. If it furnishes a continuous metallic path to the site's earth electrode system, a metallic conduit, raceway or panel containing feeder conductors
 7. If it furnishes a continuous metallic path to the site's earth electrode system, a metallic conduit, raceway or panel containing branch circuit conductors
- NOTE: The locations in 6) and 7) should only be used when no other location is available.
NOTE: All conduit bonding hardware (bushings, clamps, etc.) should be listed for the purpose.

2.10 AC Power Recommendations and Guidelines

AC surge protection should be provided at all circuits and/or electrical outlets providing power to customer owned equipment, such as workstations, displays and printers that interface with 9-1-1 equipment.

All customer provided AC power circuitry should comply with the NEC and local codes.

The electrical load center should be provided as follows:

1. The main 9-1-1 circuit breaker box should be wired from the commercial AC load center through a UPS with an appropriately sized circuit.
2. The feeder breaker should be designated "9-1-1 Panel."

The circuit breaker box should be surface mounted to the wall in the 9-1-1 equipment location. The circuit breaker box should be dedicated and used exclusively for 9-1-1 equipment. In the event that this exclusivity is unavailable the individual 911 circuits should be tagged as such.

The dedicated E-911 AC power service cabinets should be designated with name, number, voltage and type of service, e.g., "PWR DISTG SERVICE CAB 001 208V AC 60 HZ 3PH 4W. E-911 Circuits Only." All UPS supplied outlets used for 9-1-1 should be labeled with circuit ID "For 9-1-1 use only".

The conduit serving the 9-1-1 circuit breaker box should have a permanent tag attached that identifies the physical location of the serving load center. Example: From Panel A in Room 104.

The "serving load center" for the 9-1-1 circuit breaker box should be connected to the local emergency generator bus, to provide continued electrical service in the event of a commercial power failure.

To prevent 9-1-1 equipment failure caused by the loss of commercial power source, a dedicated Uninterruptable Power Supply (UPS) system is recommended. The UPS should provide a minimum of 15 minutes of emergency power to be used as a transitional power source till generator power can be brought on-line for full functionality of the following listed elements of the 9-1-1 system:

1. Operator positions (telephone sets, displays and PC workstations)
2. ANI and ALI controllers
3. ALI link modems and network interfaces
4. Telephone common equipment
5. TDD/TTY devices
6. Recording devices
7. Intelligent Workstation (IWS) network
8. PBX, key systems and radio equipment serving emergency and administrative non-emergency communications
9. Emergency lighting for equipment room
10. Any other devices necessary to receive, process and/or reroute 9-1-1 calls and other critical circuits

The UPS should be equipped with a manual by-pass switch to allow maintenance. Each receptacle serving 9-1-1 equipment should be dedicated to 9-1-1 equipment. Inductive loads (like personal heaters and motorized equipment) shall not be plugged into UPS circuits along with 9-1-1 equipment.

The electrical outlets should be wired from the 9-1-1 circuit breaker box with conductors sized per NEC or local prevailing codes. Label the dedicated E-911 circuit breaker with the location of the circuit being served.

Extension power cords should not be used in permanent installation for power to 9-1-1 equipment.

When power strips are used, the total load should not exceed the capacity of the over-current protection device for the circuit.

Each answering position should have, at the minimum, a duplex outlet for every device, including the CRT and telephone set. Different applications may require additional outlets.

The AC service provided for the 9-1-1 recording devices (tape drives/printers, etc.) may be served by a different AC load center than was provided for the 9-1-1 equipment location. However, these circuits also should be transferable to the emergency bus.

2.11 Physical Access

Suitable access should be provided for movement of equipment into and out of the building. A suitable route should be provided, per local ordinances, for installing cable:

1. From the 9-1-1 equipment location to the call center space where personnel are located
2. From the cable entry of the building to the 911 equipment area/room.

Parking facilities should be provided for installation and maintenance personnel.

If PSAP provides telephone set, printers and/or ALI displays, the demarcation strip should be readily accessible to the CPE provider / supplier.

The 9-1-1 equipment location should be secured to prevent access by unauthorized personnel. However, access to CPE provider / supplier installation and maintenance personnel should be provided on a 24-hour basis.

3 Impacts, Considerations, Abbreviations, Terms, and Definitions

3.1 Operations Impacts Summary

With the implementation of recommendations in this document, the equipment that supports operations should perform more reliably and with fewer failures caused by environmental factors, thereby mitigating the impact on those who depend on the equipment.

3.2 Technical Impacts Summary

Implementation of recommendations in this document includes the addition of products and facilities intended to protect the equipment that is critical to 9-1-1 operations. The recommendations also include guidelines for the correct installation and support of equipment and communications facilities.

3.3 Security Impacts Summary

The site characteristics described in the document have little impact on security issues except for the restrictions of access to the equipment.

3.4 Recommendation for Additional Development Work

It is not anticipated that this document will evolve into a NENA standard. Some of the standards referenced here may already be required by various state, local and national codes.

3.5 Anticipated Timeline

The recommendations contained in the document are not new and should already be implemented. If not, they should be implemented as soon as possible.

3.6 Cost Factors

Cost factors are not considered in this document.

3.7 Cost Recovery Considerations

Normal business practices should be applied to the implementation of recommendations in this document.

3.8 Additional Impacts (non-cost related)

The information or requirements contained in this NENA document are not expected to have additional impacts, based on the analysis of the authoring group.

3.9 Abbreviations, Terms, and Definitions

See NENA Master Glossary of 9-1-1 Terminology, NENA-ADM-000 [1], for a complete listing of terms used in NENA documents. All abbreviations used in this document are listed below, along with any new or updated terms and definitions.

Term or Abbreviation (Expansion)	Definition / Description
<i>ATIS (Alliance for Telecommunications Industry Solutions)</i>	A U.S.-based organization that is committed to rapidly developing and promoting technical and operations standards for the communications and related information technologies industry worldwide using a pragmatic, flexible and open approach. www.atis.org
<i>NEC (National Electrical Code)</i>	A regionally adoptable standard for the safe installation of electrical wiring and equipment in the United States. Also known as NFPA 70 published by the National Fire Protection Association (NFPA).
<i>AWG (American Wire Gauge)</i>	A standardized wire gauge system used since 1857 predominantly in North America for the diameters of round, solid, nonferrous, electrically conducting wire.

4 Recommended Reading and References

[1] NENA Master Glossary of 9 1 1 Terminology, [NENA-ADM-000](#)

5 Exhibits

This section contains two sample checklists to be used with this Information Document. These are “9-1-1 Equipment Room Checklist” and “9-1-1 Electrical Contractor Checklist”.

5.1 Equipment Room Checklist Example

Customer _____

Location _____

	Complied			<u>Section #</u>
	<u>Yes</u>	<u>No</u>	<u>N/A</u>	
1. The 911 Equipment is located in a room:				2.2
• Containing no contaminants or hazardous materials.	_____	_____	_____	
• Having sufficient maintenance area and ceiling clearance.	_____	_____	_____	
• That is dust free.	_____	_____	_____	
• Where floors are clean, dry, level and free from defects.	_____	_____	_____	
• Free from damaging vibration	_____	_____	_____	
2. Suitable routes are accessible for cable and ground wire routing to locations.	_____	_____	_____	2.9
3. If an overhead sprinkler system exists, 9-1-1 equipment has been protected from water damage.	_____	_____	_____	2.8
4. An appropriate type Fire Extinguisher system or unit has been provided.	_____	_____	_____	2.8
5. A backboard has been provided, painted/sealed per local codes.	_____	_____	_____	2.2
6. If Customer provides external equipment (telephone sets, printers, displays, etc.), the demarcation terminal strip has been installed.	_____	_____	_____	2.11
7. There is suitable access for movement of 9-1-1 equipment into and out of the building.	_____	_____	_____	2.11
8. The 9-1-1 equipment location is secured from access by unauthorized personnel.	_____	_____	_____	2.11

	<u>Yes</u>	Complied <u>No</u>	<u>N/A</u>	<u>Section #</u>
9. AC power surge protection is provided at all electrical outlets providing power to customer owned equipment, such as displays and printers that interface with 9-1-1 equipment.	_____	_____	_____	2.10
10. All customer provided AC power circuitry complies with the NEC and local codes.	_____	_____	_____	2.10
11. The outside plant distribution cable entrance has been checked for electrical protection per communications provider standards.	_____	_____	_____	2.9
12. The proposed equipment room meets the following environment recommendations.				2.4
• Ambient room temperature and relative humidity maintained in a range of 16 to 27 degrees Centigrade (60 to 80 degrees Fahrenheit) with relative humidity in the range of 40 to 60 percent.	_____	_____	_____	
• The 9-1-1 equipment location is in an air-conditioned space, with adequate airflow and no condensation.	_____	_____	_____	
• The room does not contain a major heat source (i.e., boiler room, furnace room) which could affect the ambient room temperature significantly.	_____	_____	_____	
13. The size of the 9-1-1 equipment location is sufficient to support environmental and maintenance access.	_____	_____	_____	2.2
14. The desks or tables used for 9-1-1 equipment are of a design that cannot be easily overturned, i.e. low profile, wide footprint.	_____	_____	_____	2.3

	<u>Yes</u>	Complied <u>No</u>	<u>N/A</u>	<u>Section #</u>
15. The proposed equipment rooms meet the following Electromagnetic Interference recommendations.				2.5
• Interference from electromagnetic fields less than 2 volts per meter in a frequency range of 10 kHz TO 1 GHZ	_____	_____	_____	
• No interference from licensed radio communication equipment. (Refer FCC Part 15	_____	_____	_____	
• No interference from electromagnetic noise.	_____	_____	_____	
16. The proposed equipment room meets the following acoustic recommendations.				2.6
• The sound levels in the 9-1-1 equipment area comply with OSHA requirements.	_____	_____	_____	
17. The lighting in the proposed equipment room meets a light intensity of 30 to 100 foot-candles provided around the 9-1-1 equipment cabinet for maintenance and provides for emergency lighting.				2.7
	_____	_____	_____	
18. If the 9-1-1 equipment is located near or connected to radio equipment that is directly connected to an outside antenna, the customer's radio equipment has been reviewed per the CPE provider / supplier recommendation.				2.9.1
	_____	_____	_____	
19. Is the space protected with properly rated ceiling, walls and doors in accordance with local requirements?				2.8
	_____	_____	_____	
20. Please note any other site unique items that may affect personnel safety or 9-1-1 equipment reliability.				

ADDITIONAL POSSIBLE REQUIREMENTS:

-----	_____	_____	_____
-----	_____	_____	_____
-----	_____	_____	_____
-----	_____	_____	_____
-----	_____	_____	_____
-----	_____	_____	_____

VERIFIED BY: _____ **DATE:** _____
TITLE: _____

5.2 Electrical Contractor Checklist Example

Customer _____

Location _____

	Complied			<u>Section #</u>
	<u>Yes</u>	<u>No</u>	<u>N/A</u>	
1. The main 9-1-1 circuit breaker box is wired from the commercial AC load center, transformer and UPS with an appropriately sized circuit.	_____	_____	_____	2.10
2. The feeder breaker in the load center is designated "9-1-1 Panel".	_____	_____	_____	2.10
3. The circuit breaker box is surface mounted to the wall in the 9-1-1 equipment location.	_____	_____	_____	2.10
4. The circuit breaker box is dedicated and used exclusively for 9-1-1 equipment.	_____	_____	_____	2.10
5. The front panel of the breaker box designated is "9-1-1 CIRCUITS ONLY" (Or where this is not possible the panel is marked "9-1-1 CIRCUITS" and each breaker is individually identified with specific markings)	_____	_____	_____	2.10
6. The conduit serving the 9-1-1 circuit breaker box is equipped with a permanent tag that identifies the physical location of the serving load center.	_____	_____	_____	2.10
7. The "serving load center" for the 9-1-1 circuit breaker box is connected to the local emergency generator bus.	_____	_____	_____	2.10
8. If a UPS is provided, the UPS is equipped with a manual by-pass switch to allow maintenance.	_____	_____	_____	2.10

	<u>Yes</u>	Complied <u>No</u>	<u>N/A</u>	<u>Section #</u>
9. All 9-1-1 A/C Electrical circuits are wired from the 9-1-1 circuit breaker box and equipped with: <ul style="list-style-type: none"> • Conductors sized per NEC or local prevailing codes. • Dedicated and separate AC circuit breaker and AC receptacle for each 9-1-1 equipment circuit. • Non-isolated AC receptacles. 	_____	_____	_____	2.10
10. No extension power cords for power to 9-1-1 equipment.	_____	_____	_____	2.10
11. All AC receptacles serving 9-1-1 equipment are grounded type receptacles.	_____	_____	_____	2.9.1
12. A point of connection to the PSAP site's earth electrode ground system has been furnished. I.e.: grounding bar.	_____	_____	_____	2.9.1
13. All AC equipment grounding (ACEG) conductors serving receptacles for 9-1-1 equipment meet all applicable codes.	_____	_____	_____	2.9.1
14. All AC receptacles are tagged for easy identification, i.e. dedicated 9-1-1 circuit; on UPS or Not; Breaker number; etc.	_____	_____	_____	2.10

VERIFIED BY: _____ **DATE:** _____

TITLE: _____

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The National Emergency Number Association (NENA) Agency System Committee, Document Review Working Group developed this document.

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