Second Revision No. 187-NFPA 70B-2022 [Detail]

See attached for ballot detail of Table 10.1.2.1 [renumbered Table 9.2.2] associated with SR 201

Supplemental Information

File Name	Description	Approved
SR_187_Table_10.1.2.1.docx	For staff use only	
70B_Detail_SR-187_Table_9.2.2_for_ballot.docx	For ballot	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 19:05:48 EDT 2022

Committee Statement

Committee Statement: Table 10.1.2.1 is re-organized for consistency and usability.

Basic equipment maintenance tasks have been standardized for clarity and consistency.

Detailed maintenance tasks have been relocated from Table 10.1.2.1 into the respective chapters for each type of equipment.

The entries for similar types of equipment have been consolidated. Where an equipment chapter exists but an entry for the equipment in Table 10.1.2.1 did not exist, an entry has been added for completeness. Likewise, where an equipment entry existed in the table that did not exist as a chapter, it was removed from the table.

Maintenance intervals were adjusted and aligned with other intervals for similar equipment to allow for a reasonable equipment maintenance cycle to be built into the EMP program.

The reference column has been removed because many of the references were incorrect, and the column was inconsistently used for references and advice that a particular task was to be done “as needed”.

Response Message: SR-187-NFPA 70B-2022

Public Comment No. 619-NFPA 70B-2022 [Section No. 10.1.2.1]

Public Comment No. 633-NFPA 70B-2022 [Section No. 10.1.2.1]

Public Comment No. 648-NFPA 70B-2022 [Section No. 10.1.2.1]

Public Comment No. 639-NFPA 70B-2022 [Section No. 10.1.2.1]

Public Comment No. 618-NFPA 70B-2022 [Section No. 10.1.2.1]

Public Comment No. 287-NFPA 70B-2022 [Global Input]

Public Comment No. 616-NFPA 70B-2022 [Section No. 10.1.2.1]
Public Comment No. 731-NFPA 70B-2022 [Section No. 10.1.2]
Public Comment No. 538-NFPA 70B-2022 [Section No. 10.1.2.1]
Public Comment No. 628-NFPA 70B-2022 [Section No. 10.1.2.1]
Public Comment No. 83-NFPA 70B-2022 [Section No. 10.1.2.1]
Public Comment No. 626-NFPA 70B-2022 [Section No. 10.1.2.1]
Public Comment No. 644-NFPA 70B-2022 [Section No. 10.1.2.1]
Public Comment No. 586-NFPA 70B-2022 [Section No. 10.1.2.1]
Public Comment No. 517-NFPA 70B-2022 [Section No. 10.1.2.1]
Public Comment No. 181-NFPA 70B-2022 [Section No. 10.1.2.1]
Public Comment No. 625-NFPA 70B-2022 [Section No. 10.1.2.1]
Public Comment No. 629-NFPA 70B-2022 [Section No. 10.1.2.1]
Public Comment No. 652-NFPA 70B-2022 [Section No. 10.1.2.1]
Public Comment No. 646-NFPA 70B-2022 [Global Input]
Public Comment No. 627-NFPA 70B-2022 [Section No. 10.1.2.1]
Public Comment No. 94-NFPA 70B-2022 [Section No. 10.1.2.1]
Public Comment No. 636-NFPA 70B-2022 [Section No. 10.1.2.1]
Public Comment No. 641-NFPA 70B-2022 [Section No. 10.1.2.1]
Public Comment No. 621-NFPA 70B-2022 [Section No. 10.1.2.1]
Public Comment No. 164-NFPA 70B-2022 [Section No. 10.1.2.1]
Public Comment No. 241-NFPA 70B-2022 [Section No. 10.1.2.1]
Public Comment No. 647-NFPA 70B-2022 [Section No. 10.1.2.1]
Public Comment No. 620-NFPA 70B-2022 [Section No. 10.1.2.1]
Public Comment No. 635-NFPA 70B-2022 [Section No. 10.1.2.1]
Public Comment No. 643-NFPA 70B-2022 [Section No. 10.1.2.1]
Public Comment No. 624-NFPA 70B-2022 [Section No. 10.1.2.1]
Public Comment No. 617-NFPA 70B-2022 [Section No. 10.1.2.1]
Public Comment No. 623-NFPA 70B-2022 [Section No. 10.1.2.1]

Table 10.1.2.1 Maintenance Intervals

Product	Scope of Work	Equipment Condition Assessment			Reference
		Condition 1	Condition 2	Condition 3	
All equipment	Infrared thermography	12 months	12 months	6 months	11.17
Molded-case/insulated case-circuit breakers	Mechanical operation cycling	60 months	36 months	12 months	17.1
	Visual inspection	12 months	12 months	6 months	17.8
	Maintenance and testing	60 months	36 months	12 months	17.9, 11.10
Power circuit breakers	Mechanical operation cycling	60 months	36 months	12 months	17.1
	Visual inspection	12 months	12 months	6 months	17.8
	Maintenance and testing	60 months	36 months	12 months	17.9, 11.10
Fuses, 1000 volts or less	Visual inspection	12 months	12 months	6 months	AN
	Maintenance and testing	60 months	36 months	12 months	AN
Fuses, greater than 1000 volts	Visual inspection	12 months	12 months	6 months	AN
	Maintenance and testing	60 months	36 months	12 months	AN
Medium-voltage circuit breakers, air — magnetic	Mechanical operation cycling	60 months	36 months	12 months	AN
	Visual inspection	12 months	12 months	6 months	AN
	Maintenance and testing	60 months	36 months	12 months	AN
Medium-voltage circuit breakers, vacuum	Mechanical operation cycling	60 months	36 months	12 months	AN
	Visual inspection	12 months	12 months	6 months	AN
	Maintenance and testing	60 months	36 months	12 months	AN

Product	Scope of Work	Equipment Condition Assessment			Reference
		Condition 1	Condition 2	Condition 3	
Medium-voltage circuit breakers, oil	Mechanical operation cycling	60 months	36 months	12 months	AN
	Oil dielectric breakdown test	12 months	12 months	12 months	AN
	Visual inspection	12 months	12 months	6 months	AN
	Maintenance and testing	60 months	36 months	12 months	AN
Medium-voltage interrupter switches	Mechanical operation cycling	60 months	36 months	12 months	AN
	Visual inspection	12 months	12 months	6 months	AN
	Maintenance and testing	60 months	36 months	12 months	AN
High-voltage substation insulators	Visual inspection	12 months	12 months	6 months	15.1.2.1
	Corona detection	12 months	6 months	4 months	15.1.2.2
	Maintenance and testing	60 months	36 months	12 months	11.9
High-voltage substation conductors	Visual inspection	12 months	12 months	6 months	15.1.3
	Mechanical checks	60 months	36 months	12 months	15.1.3
High-voltage substation air disconnecting switches	Visual inspection	12 months	12 months	6 months	15.1.4.3
	Mechanical checks	60 months	36 months	12 months	15.1.4.3
High-voltage substation grounding equipment	Visual inspection	12 months	12 months	6 months	15.1.5
	Mechanical checks	36 months	24 months	12 months	15.1.5
	Maintenance and testing	60 months	36 months	12 months	11.13.1, 11.13.2, 11.13.3
High-voltage substation enclosures	Security/operation check	6 months	3 months	1 month	15.1.6
Switchgear assemblies	Security/operational check	6 months	6 months	1 month	15.2.5

Product	Scope of Work	Equipment Condition Assessment			Reference
		Condition 1	Condition 2	Condition 3	
	Enclosure visual inspection	6 months	3 months	1 month	15.2.6 through 15.2.7.2
	Ventilation visual inspection	6 months	3 months	1 month	15.2.9
	Space heater operational check	12 months	12 months	6 months	15.2.8
	Maintenance and testing	60 months	36 months	12 months	11.9
Surge arresters	Visual inspection	12 months	6 months	3 months	15.9.2.1
	Maintenance and testing	60 months	36 months	12 months	15.9.2.2
Capacitors	Visual inspection	6 months	6 months	3 months	15.8.3.4
	Maintenance and testing	60 months	36 months	12 months	15.9.3.3
Batteries and chargers	Visual inspection/clean	1 month	1 month	1 month	15.9.4.4 through 15.9.4.4.13
	Check connection resistance	12 months	12 months	6 months	11.14.2.4, 15.9.4.4.12
	Pilot cell measurements	1 month	1 month	1 month	11.14.2.2
	All lead-acid cell specific gravity	3 months	3 months	3 months	11.14.2.1
	Capacity test	60 months	36 months	12 months	11.14.2.3
Protective relays, electromechanical	Maintenance and testing	36 months	24 months	12 months	15.9.7.3, 11.12
Protective relays, solid state	Maintenance and testing	36 months	36 months	12 months	15.9.7.3, 11.12

Product	Scope of Work	Equipment Condition Assessment			Reference
		Condition 1	Condition 2	Condition 3	
Supervisory control and data acquisition electrical/electronic systems	Lamp test/verify indicators	6 months	1 month	1 month	12.14.11.1, 12.14.11.2
	Inspect enclosures for dirt, heat, water	6 months	1 month	1 month	8.7.1, Table L.1
	Physically exercise valves and actuators	12 months	6 months	3 months	AN
	Actuate switches	12 months	6 months	3 months	AN
	Run PLC diagnostics	12 months	6 months	3 months	22.4.4
	Calibrate sensors and transmitters	12 months	12 months	6 months	11.7
	Calibrate actuators	12 months	12 months	6 months	11.7
	Calibrate meters	12 months	12 months	6 months	AN
	Test batteries	12 months	6 months	3 months	15.9.4.6
	Test automatic control sequences	12 months	12 months	6 months	AN
	Verify alarms	12 months	12 months	6 months	15.9.6.1, 12.4.11, 15.9.6
Supervisory control and data acquisition pneumatic system/components	Check regulators and filters	6 months	1 month	1 month	AN
	Inspect tubing and piping	6 months	1 month	1 month	AN
	Actuate pressure switches	12 months	6 months	3 months	AN
	Physically exercise valves and actuators	12 months	6 months	3 months	AN
	Calibrate switches and sensors	12 months	12 months	6 months	AN
	Calibrate pressure gauges	12 months	12 months	6 months	AN

Product	Scope of Work	Equipment Condition Assessment			Reference
		Condition 1	Condition 2	Condition 3	
	Calibrate thermometers	12 months	12 months	6 months	AN
Power and distribution transformers, liquid-filled	Current and voltage readings	1 month	1 month	weekly	21.2.2.2, 21.2.3
	Temperature readings	1 month	1 month	weekly	21.2.4
	Liquid level check	1 month	1 month	weekly	21.2.5.1
	Pressure/vacuum gauge readings	1 month	1 month	weekly	21.2.5.2
	Liquid analysis	12 months	12 months	6 months	21.2.8
	Comprehensive liquid tests	12 months	12 months	6 months	11.11.9, 11.19
	Maintenance and testing	60 months	36 months	12 months	21.2.9, 11.11.2
	Fault gas analysis	12 months	12 months	6 months	21.2.9, 11.11.9
	Dissolved-gas-in-oil analysis	12 months	12 months	6 months	11.11.10
Power and distribution transformers, dry-type, air-cooled	Maintenance and testing	60 months	36 months	12 months	11.9, 11.11.2
Power cables	Visual inspection	36 months	12 months	6 months	19.2
	Maintenance and testing	60 months	36 months	12 months	19.5, 11.9.2.4
Motor control equipment	Enclosures visual inspection/clean	12 months	12 months	6 months	16.2.1 through 16.3.5
	Busbar, wiring, and terminal connections —	36 months	24 months	12 months	16.4.2

Product	Scope of Work	Equipment Condition Assessment			Reference
		Condition 1	Condition 2	Condition 3	
	check connections for tightness				
	Busbar, wiring, and terminal connections — visual inspection of insulators	24 months	12 months	6 months	16.4.4
	Busbar, wiring, and terminal connections — visual inspection of wiring	24 months	12 months	6 months	16.4.5
	Busbar, wiring, and terminal connections — electrical tests	36 months	24 months	12 months	11.9.2.3
	Disconnects visual inspection/clean	24 months	12 months	6 months	16.5.3
	Disconnects operation check	24 months	12 months	6 months	16.5.5
	Contactors visual inspection/clean	24 months	12 months	6 months	16.8.2.1 through 16.8.3
	Motor overload relays (thermal) cleaning, calibration, and function tests	36 months	24 months	12 months	16.9.4
	Motor overload relays (electronic) cleaning, calibration, and function tests	36 months	36 months	12 months	16.9.1.3, 16.9.2
	Electrical interlock inspection	24 months	12 months	6 months	16.11.1.2

Product	Scope of Work	Equipment Condition Assessment			Reference
		Condition 1	Condition 2	Condition 3	
	Mechanical interlock inspection	24 months	12 months	6 months	16.11.2
Electronic equipment	Inspection	12 months	12 months	6 months	AN
	Cleaning	60 months	36 months	12 months	AN
	Adjustments/calibration	60 months	36 months	12 months	AN
Rotating equipment	Vibration analysis	12 months	6 months	Continuous	26.7
	Stator and rotor electrical testing	12 months	12 months	6 months	11.2
	Brushes, collector rings, and commutators visual and mechanical inspection	12 months	12 months	6 months	25.4
	Bearings (sleeved) oil level check	1 week	1 week	1 week	25.5
	Bearings (sleeved) drain, flush, and lubricate	12 months	12 months	6 months	AN
	Ball and roller inspection and lubrication	Per manufacturer	Per manufacturer	Per manufacturer	25.5.3
Wiring devices, attachment plugs, cord connector bodies	Inspection	Monthly and when used	Monthly and when used	Monthly and when used	24.2.1 through 24.6
Wiring devices, receptacles	Inspection	Monthly and when used	Monthly and when used	Monthly and when used	24.3.1
	Operation check	Monthly and when used	Monthly and when used	Monthly and when used	24.3.2
Wiring devices, general-use snap switches	Operation check	Monthly and when used	Monthly and when used	Monthly and when used	24.5.2 through 24.5.4

Product	Scope of Work	Equipment Condition Assessment			Reference
		Condition 1	Condition 2	Condition 3	
Wiring devices, pin-and-sleeve devices, heavy-duty industrial-type plugs, cord connectors, and receptacles	Inspections, cleaning, and checks	Monthly and when used	Monthly and when used	Monthly and when used	24.8
Portable electric tools	Inspections/cleaning	Monthly and when used	Monthly and when used	Monthly and when used	29.1.3, 29.3.1, 29.3.2
	Lubrication	Per manufacturer	Per manufacturer	Per manufacturer	29.3.3
	Electrical tests	3 months	3 months	3 months	29.7
Low-voltage busway	Visual inspection	12 months	12 months	6 months	20.4.3.2
	Maintenance and testing	60 months	36 months	12 months	20.4.8
Uninterruptible power supplies	Visual inspection	6 months	3 months	1 month	28.3.8
	Routine maintenance	12 months	6 months	3 months	28.3.8
	System tests	36 months	24 months	12 months	28.5
	Battery tests	See scope of work and maintenance intervals in row "Batteries and Chargers"	See scope of work and maintenance intervals in row "Batteries and Chargers"	See scope of work and maintenance intervals in row "Batteries and Chargers"	15.9.4
	Test run, exercise	1 month	1 month	1 month	28.3.5

AN: As necessary.

Table 9.2.2 Maintenance Intervals

Product	Scope of Work	Equipment Condition Assessment		
		Condition 1	Condition 2	Condition 3
All equipment	Infrared thermography	12 months	12 months	6 months
Battery ESSs	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months
	Lubrication		Reserved	
	Mechanical servicing		Reserved	
	Electrical testing	60 months	36 months	12 months
Busways	Visual inspection	60 months	60 months	12 months
	Cleaning	60 months	36 months	12 months
	Lubrication	60 months	36 months	12 months
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
	Special	60 months	36 months	12 months
Cable trays	Visual inspection	12 months	12 months	6 months
	Cleaning	60 months	36 months	12 months
	Lubrication	60 months	36 months	12 months
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
Electric vehicle power transfer systems	Visual inspection	60 months	36 months	12 months
	Mechanical inspection	60 months	36 months	12 months

Product	Scope of Work	Equipment Condition Assessment		
		Condition 1	Condition 2	Condition 3
	Electrical testing	60 months	36 months	12 months
Electronic equipment			Reserved	
Fuses	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months
	Lubrication	60 months	36 months	12 months
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
GFCIs	Visual inspection	12 months	12 months	6 months
	Cleaning	60 months	36 months	12 months
	Lubrication	60 months	36 months	12 months
	Mechanical servicing		Reserved	
Grounding and bonding	Visual inspection	12 months	12 months	6 months
	Cleaning		Reserved	
	Lubrication		Reserved	
	Mechanical servicing		Reserved	
	Electrical testing	60 months	36 months	36 months
High-voltage substation insulators	Visual inspection	12 months	12 months	6 months
	Corona detection	12 months	6 months	4 months
	Maintenance and testing	60 months	36 months	12 months

Product	Scope of Work	Equipment Condition Assessment		
		Condition 1	Condition 2	Condition 3
Lighting	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months
	Servicing	60 months	36 months	12 months
Lighting control systems			Reserved	
Low-voltage ground-fault protection systems	Visual inspection	12 months	12 months	6 months
	Cleaning	60 months	36 months	12 months
	Lubrication		Reserved	
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
Medium-voltage ground-fault protection systems	Visual inspection	12 months	12 months	6 months
	Cleaning	60 months	36 months	12 months
	Lubrication		Reserved	
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
Medium-voltage power circuit breakers	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months
	Lubrication	60 months	36 months	12 months
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months

Product	Scope of Work	Equipment Condition Assessment		
		Condition 1	Condition 2	Condition 3
Molded-case/insulated-case/low-voltage power circuit breakers	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months
	Lubrication	60 months	36 months	12 months
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
Motor control equipment	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months
	Lubrication	60 months	36 months	12 months
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
Panelboards and switchboards	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months
	Lubrication	60 months	36 months	12 months
	Mechanical inspections	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
Photovoltaic systems	Visual inspection	60 months	36 months	12 months
	Cleaning		Reserved	
	Lubrication		Reserved	
	Mechanical servicing		Reserved	

Product	Scope of Work	Equipment Condition Assessment		
		Condition 1	Condition 2	Condition 3
	Electrical testing	60 months	36 months	12 months
Portable electrical tools and equipment	Visual inspection	Before each use	Before each use	Before each use
	Cleaning	Before each use	Before each use	Before each use
	Lubrication	In accordance with the manufacturer's instructions	In accordance with the manufacturer's instructions	In accordance with the manufacturer's instructions
	Mechanical servicing	In accordance with the manufacturer's instructions	In accordance with the manufacturer's instructions	In accordance with the manufacturer's instructions
	Electrical testing	3 months	3 months	3 months
Power and distribution transformers	Visual inspection	12 months	12 months	6 months
	Cleaning	60 months	36 months	12 months
	Lubrication		Reserved	
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
Power cables	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months
	Mechanical servicing	Reserved	Reserved	
	Electrical testing	60 months	36 months	12 months
Power-factor correction capacitors	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months

Product	Scope of Work	Equipment Condition Assessment		
		Condition 1	Condition 2	Condition 3
	Lubrication		Reserved	
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
	Special		Reserved	
Protective relays, electromechanical	Visual inspection	36 months	24 months	12 months
	Cleaning	36 months	24 months	12 months
	Lubrication		Reserved	
	Mechanical servicing	36 months	24 months	12 months
	Electrical testing	36 months	24 months	12 months
Protective relays, solid state and microprocessor	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months
	Lubrication		Reserved	
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
Public pools, fountains, and similar installations			Reserved	
Rotating equipment	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months
	Lubrication	60 months	36 months	12 months

Product	Scope of Work	Equipment Condition Assessment		
		Condition 1	Condition 2	Condition 3
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
Stationary standby batteries	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months
	Mechanical servicing		Reserved	
	Electrical testing	60 months	36 months	12 months
Substations	Visual inspection	12 months	12 months	6 months
	Cleaning	60 months	36 months	12 months
	Lubrication	60 months	36 months	12 months
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
	Special	60 months	36 months	12 months
	Mechanical checks	60 months	36 months	12 months
Switches	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months
	Lubrication	60 months	36 months	12 months
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
Switchgear	Visual inspection	12 months	12 months	6 months

Product	Scope of Work	Equipment Condition Assessment		
		Condition 1	Condition 2	Condition 3
	Cleaning	60 months	36 months	12 months
	Lubrication	60 months	36 months	12 months
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
	Special	60 months	36 months	12 months
Uninterruptible power supplies	Visual inspection	6 months	3 months	1 month
	Cleaning	12 months	6 months	3 months
	Lubrication		Reserved	
	Mechanical servicing	12 months	6 months	3 months
	Electrical testing	12 months	6 months	3 months
	Special procedures	24 months	24 months	24 months
Wind power electric systems	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months
	Lubrication		Reserved	
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
Wiring devices	Visual inspection	12 months	3 months	1 month
	Cleaning	60 months	36 months	12 months
	Lubrication		Reserved	

Product	Scope of Work	Equipment Condition Assessment		
		Condition 1	Condition 2	Condition 3
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months

Second Revision No. 196-NFPA 70B-2022 [Detail]

Changes to 6.7 title and annex material.

6.7* Incident Energy ~~Analyses~~Analysis (Arc-Flash ~~Studies~~Study).

A.6.7

Performing an incident energy analysis (arc-flash study) is an important aspect to risk assessment. A risk assessment ~~study~~ is conducted on facility electrical systems to determine the following for each designated piece of electrical equipment:

(1) Incident energy exposure at working distance

(2) Arc-flash boundary

(3) ~~Appropriate arc-rated personal protective equipment required within the arc flash boundary~~

A risk assessment ~~study~~ is an important consideration for electrical safe work practices. Refer to NFPA *70E* and IEEE 3007.3, *~~IEEE~~ Recommended Practice for Electrical Safety in Industrial and Commercial Power Systems*, for guidance on risk assessment and selection of PPE.

The available short-circuit current and the total clearing time at each designated piece of electrical equipment is needed to perform a risk assessment. NFPA *70E* and OSHA provides the requirements. IEEE 1584, *Guide for Performing Arc-Flash Hazards Calculations*, provides suggested calculation methods.

Where the result of the ~~risk assessment~~incident energy analysis at a designated piece of equipment is greater than what is appropriate for the available PPE, a means to reduce the hazard level should be implemented.

The risk assessment ~~study~~ results are field marked by a label on the equipment. The documentation for the ~~arc flash hazard analysis~~ assessment should be retained for reference and use as needed.

The ~~risk~~ assessment should be repeated if there are changes that occur that affect the arc-flash hazard, such as changes in the available short-circuit current or in the overcurrent protective devices.

The benefit of a risk assessment is being able to provide the necessary information to a qualified electrical worker so that proper safe work practices can be followed if the worker has to work on or near electrical equipment not in an electrically safe work condition.

Supplemental Information

File Name	Description	Approved
SR_196_Section_6.6.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon May 02 15:11:57 EDT 2022

Committee Statement

Committee Statement: Title updated to more appropriate terms. Introductory statement added to the annex material to provide clarity of terms with Section 6.6 verbiage. Item 3 was removed from A.6.6 because the PPE selection is not part of the incident energy analysis.

Response Message: SR-196-NFPA 70B-2022

Public Comment No. 514-NFPA 70B-2022 [Section No. 6.6]

Public Comment No. 720-NFPA 70B-2022 [Section No. 6.6]

Second Revision No. 199-NFPA 70B-2022 [Detail]

Changes to Tables 7.2.1.4.2 (a)-(c):

Table 7.2.1.4.2(a) Bolt-Torque Values for Electrical Connections, US Standard Fasteners — Cadmium or Zinc Plated

Bolt Diameter (in.)	Torque (Pound-Feet)
1/4	6
5/16	11
3/8	~~19~~20
7/16	~~30~~32
1/2	~~40~~48
9/16 ~~or larger~~	~~55~~70
5 / 8	96
3 / 4	160
7 / 8	240
1.0	370

Notes:

(1) ~~The~~Consultthemanufacturer ~~should be consulted~~ for equipment supplied with metric fasteners.

(2) The table is based on national coarse thread pitch.

(3) The grade is SAE ~~2~~5.

(4) The minimum tensile (strength) ~~in~~is105,000lbf/in.^{2} ~~= 60–74 K~~.

~~(5) See Figure A.7.2.1.4.2 for an example of a head marking.~~

Table 7.2.1.4.2(b) Bolt-Torque Values for Electrical Connections, US Standard Fasteners — Silicon Bronze ~~Fasteners Torque (Pound-Feet)~~

Bolt Diameter (in.)	~~Lubricated~~Torque(Pound-Feet)	
	Nonlubricated	Lubricated
5/16	15	10
3/8	20	15

Bolt Diameter (in.)	~~Lubricated~~Torque (Pound-Feet)	
	Nonlubricated	Lubricated
1/2	40	25
5/8	55	40
3/4	~~8~~70	60

Notes:

(1) Consult the manufacturer for equipment supplied with metric fasteners.

(2) ~~Table~~ This table is based on national coarse thread pitch.

(3) This table is based on bronze alloy bolts having a minimum 70,000 lb/in.^{2} tensile strength. ~~of 70,000 lb/in.^{2}~~

Table 7.2.1.4.2(c) Bolt-Torque Values for Electrical Connections, US Standard Fasteners — Aluminum ~~Fasteners Torque (Pound-Feet)~~

Bolt Diameter (in.)	Torque (Pound-Feet), Lubricated
5/16	10
3/8	14
1/2	25
5/8	40
3/4	~~5~~60

Notes:

(1) Consult the manufacturer for equipment supplied with metric fasteners.

(2) ~~Table~~Thistable is based on national coarse thread pitch.

(3) This table is based on aluminum alloy bolts having a minimum 55,000 lb/in.^{2} tensile strength ~~of 55,000 lb/in.^{2}~~.

Supplemental Information

File Name	Description	Approved
SR_199_Section_7.2..1.4.2.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon May 02 15:39:17 EDT 2022

Committee Statement

Committee Statement: Table 7.2.1.4.2(a) Added additional bolt diameters, torque values, and updated tensile strength values to correlate with industry information.

Revised tensile strength value in note (4) for consistency with other tables.

Removed Note (5) from deletion of annex material in other second revision.

Table 7.2.1.4.2(b)

Added “nonlubricated” to column header and added torque values for alignment with industry standards

Table 7.2.1.4.2(c)

Revised tensile strength note for consistency with other tables in this section.

Response Message: SR-199-NFPA 70B-2022

Public Comment No. 276-NFPA 70B-2022 [Section No. 7.2.1.4.2]

Public Comment No. 470-NFPA 70B-2022 [Section No. 7.2.1.4.2]

Public Comment No. 472-NFPA 70B-2022 [Section No. 7.2.1.4.2]

Public Comment No. 469-NFPA 70B-2022 [Section No. 7.2.1.4.2]

Second Revision No. 202-NFPA 70B-2022 [Detail]

Revised existing 10.1 General to become Scope.

10.1 Scope

This chapter identifies the required frequency of maintenance for electrical equipment

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon May 02 16:24:07 EDT 2022

Committee Statement

Committee Statement: This revision adds a scope for Chapter 10.

Response Message: SR-202-NFPA 70B-2022

Second Revision No. 205-NFPA 70B-2022 [Detail]

Add annex to 17.3 Periodic Maintenance Procedures.

A.17.3.

For additional information and guidance on inspection and preventive maintenance of switches, reference NEMA KS-3, *Guidelines for Inspection and Preventive Maintenance of Switches Used in Commercial and Industrial Applications*.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon May 02 17:02:44 EDT 2022

Committee Statement

Committee Statement: Referenced guidelines provide additional information concerning switch maintenance.

Response Message: SR-205-NFPA 70B-2022

Public Comment No. 528-NFPA 70B-2022 [New Section after A.17.3.3]

Public Comment No. 526-NFPA 70B-2022 [Section No. 17.3]

Second Revision No. 228-NFPA 70B-2022 [Detail]

Revise title of section

21.3.1* Ground-Fault Circuit Interrupters (GFCI) and Special-Purpose GFCI (SPGFCI).

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Tue May 03 09:42:47 EDT 2022

Committee Statement

Committee Statement: Special-purpose GFCI was added to the title for completeness.
Response Message: SR-228-NFPA 70B-2022

Second Revision No. 237-NFPA 70B-2022 [Detail]

Revised title to add hyphens between medium and voltage, and between ground and fault

21.3.3 Medium-Voltage Ground-Fault Protection Systems.

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Tue May 03 10:18:35 EDT 2022

Committee Statement

Committee Statement: Added missing hyphens in the title and section.
Response Message: SR-237-NFPA 70B-2022

Public Comment No. 351-NFPA 70B-2022 [Section No. 21.3.3]

Second Revision No. 257-NFPA 70B-2022 [Detail]

See revisions to original 25.4.2 through 25.4.2.3.4

25.4.2 ~~Enhanced System Tests~~LoadTransfer and Load Testing.

~~Enhanced system~~System tests shall be performed in accordance with the following:

(1) When warranted by special circumstances, such as repeated failure of a system to pass routine maintenance checks

(2) Periodically, where the desired degree of reliability justifies the procedure

25.4.2.1 ~~Enhanced~~ System Test Conditions.

25.4.2.1.1

The UPS shall be placed under load using ~~an external~~a load bank during the tests described in 25.4.2~~25.4.2.2 and 25.4.2.3~~.

25.4.2.1.2

~~The~~Ifthe UPS has batteries, thebatteries shall be fully charged prior to the tests described in 25.4.2~~25.4.2.2 and 25.4.2.3~~.

25.4.2.1.3

While the tests described in 25.4.2~~25.4.2.2 and 25.4.2.3~~ are conducted, critical loads shall be placed on isolation bypass, if available, or connected to another source.

25.4.2.1.4

Manual and automatic load transfers from UPS to bypass shall be tested.

25.4.2.1.5

Each module shall be individually load-tested to verify that it is functioning prior to parallel load testing.

25.4.2.1.6

Simultaneous input and output readings of voltage, current, and frequency shall be recorded.

25.4.2.1.7

The external power source shall be removed and reapplied to verify output stability.

25.4.2.1.8

Voltage and frequency ~~recordings~~measurements of UPS operation during ~~transient response voltage tests~~load testing shall be ~~provided~~performed.

25.4.2.1.9

~~A high-speed recording device, such as an oscillograph, shall be used to document the load tests described in 25.4.2.2.2 through 25.4.2.2.2.3~~The results of the tests described in 25.4.2 shall be recorded.

~~25.4.2.2 Alarm and Emergency Shutdown Functions.~~

~~**25.4.2.2.1**~~

~~Operation of all alarm and emergency shutdown functions shall be verified.~~

~~**25.4.2.2.2**~~

~~Manual and automatic load transfers from UPS to bypass shall be tested.~~

~~**25.4.2.2.3**~~

~~Each module shall be individually load-tested to verify that it is functioning prior to parallel load testing.~~

Supplemental Information

File Name	Description	Approved
SR_257_Section_25.4.2.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 11:45:00 EDT 2022

Committee Statement

Committee Statement: 25.4.2.3.3 - Clarifying that measurements are to be recorded. 'Transient response' is removed since this is not defined. Load steps are the intended function during testing.

25.4.2 - Renamed 'Load Transfer and Load Testing'. The section title is updated to reflect the actual content of this section. The existing title was not appropriate as the section included more than what was indicated in the title.

25.4.2.1 - Renamed 'System Test Conditions'.

25.4.2.1.1 - The type/location of the load bank should not be a requirement. This would prevent the use of an internal load bank that could be offered by a UPS provider. The reference to "external" is removed to remove an unnecessary requirement.

25.4.2.1.2 - Clarifying requirement that UPS system batteries are to be fully charged prior to testing. Explanatory material regarding UPS systems not requiring batteries has been removed.

25.4.2.2 – Section title deleted.

25.4.2.2.1 - The testing of alarms is moved to the electrical tests section. Relocated to Table 25.3.5 Line 13.

25.4.2.3 - Section title deleted.

25.4.2.3.4 - The existing wording can be interpreted to mean some external device (like an oscillograph) must be used to determine the results of the tests. The UPS may have an internal device that will provide acceptable data. The reference to "high speed" has been removed since that is subjective and is not defined. The text has been updated to indicate the results of the tests are to be documented.

25.4.2.3.1 - 25.4.2.3.4 – Renumbered under Section 25.4.2.1

Response Message: SR-257-NFPA 70B-2022

Public Comment No. 362-NFPA 70B-2022 [Section No. 25.4.2.1.2]

Public Comment No. 364-NFPA 70B-2022 [Section No. A.25.4.2.1.2]

Public Comment No. 608-NFPA 70B-2022 [Section No. 25.4]

Public Comment No. 369-NFPA 70B-2022 [Section No. 25.4.2.3.3]

Public Comment No. 368-NFPA 70B-2022 [Section No. 25.4]

Public Comment No. 363-NFPA 70B-2022 [Section No. A.25.4.2.1.2]

Public Comment No. 365-NFPA 70B-2022 [Section No. 25.4.2.1.1]

Public Comment No. 370-NFPA 70B-2022 [Section No. 25.4.2.3.4]

Second Revision No. 3-NFPA 70B-2022 [Detail]

Delete the existing sections: 11.1.3, 12.1.2, 13.1.2, 14.1.2, 15.1.2, 16.1.2, 17.1.2, 18.1.1.3, 19.1.2, 20.1.2, 21.1.2, 22.1.2, 23.1.2, 24.1.2, 25.1.3, 27.1.2, 28.1.2, 29.1.3, 30.1.2, 31.1.2, 32.1.3, 33.1.2, 34.1.3, 35.1.2, 36.1.2

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon Apr 25 17:59:16 EDT 2022

Committee Statement

Committee Statement: This change places the requirement in one location (new 5.1.2) so it does not need to be repeated in almost every chapter.

Response Message: SR-3-NFPA 70B-2022

Second Revision No. 315-NFPA 70B-2022 [Detail]

Add following standard annex statement to Annex J and K:

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

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 14:24:50 EDT 2022

Committee Statement

Committee Statement: The change aligns with this document becoming a standard that includes mandatory language. All annexes are informative and not normative.

Response Message: SR-315-NFPA 70B-2022

Public Comment No. 684-NFPA 70B-2022 [Chapter J]

Second Revision No. 335-NFPA 70B-2022 [Detail]

7.2.1

The quality of undisturbed bolted electrical bus connections, conductor terminations, and conductor connectors shall be verified using one or more of the methods described in 7.2.1.1 through 7.2.1.4.

Supplemental Information

File Name	Description	Approved
SR_335_Section_7.2.1.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed May 11 15:24:34 EDT 2022

Committee Statement

Committee Statement: Combining 7.2 “Bolted Bus Connections” and 7.3 “Conductor Terminations and Connectors”, which is the same material other than the section titles, provides greater usability of the document.

Response Message: SR-335-NFPA 70B-2022

Second Revision No. 337-NFPA 70B-2022 [Detail]

9.3 [original 10.2] Equipment Condition Assessment.

The equipment condition shall be the highest condition category in accordance with 9.3.1, 9.3.2, and 9.3.3 as determined by the owner or their designee. ~~in accordance with 9.3.1, 9.3.2, 9.3.3, and 10.3.4.~~

Supplemental Information

File Name	Description	Approved
SR_337_Section_10.2.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Wed May 11 16:30:19 EDT 2022

Committee Statement

Committee Statement: The equipment condition category is clarified to correspond to the highest category determined by 10.2.1, 10.2.2 and 10.2.3.
Response Message: SR-337-NFPA 70B-2022

Second Revision No. 345-NFPA 70B-2022 [Detail]

B.1 General.

~~These suggested~~The items suggested in this annex are directed toward minimizing day-to-day electrical hazards. The list is not complete, nor do the items necessarily appear in order of importance. It is presented as a guide for the preparation of a checklist that should be developed for each ~~plant~~facility. ~~Because of the similarity to the plant fire prevention inspection, both inspections can be carried out by the same personnel.~~

Supplemental Information

File Name	Description	Approved
SR_345_Section_B.1.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu May 12 16:13:45 EDT 2022

Committee Statement

Committee Statement: The word "plant" is changed to "facility" since the application section of this standard indicates the standard applies to facilities including certain commercial and large occupancy dwelling units. The term "plant" is considered more of an industrial or manufacturing facility. The last sentence is deleted as NFPA 70B does not know or have controls over the requirements of a fire prevention inspection. Facility personnel would be the group to determine who is/is not qualified for doing both the inspections outlined in this chapter and the fire prevention inspection

Response Message: SR-345-NFPA 70B-2022

Public Comment No. 196-NFPA 70B-2022 [Section No. B.1 [Excluding any Sub-Sections]]

Second Revision No. 349-NFPA 70B-2022 [Detail]

Delete lead paragraph to 16.3: Fuses shall be maintained in accordance with this section and the manufacturer's instructions.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Fri May 13 11:25:00 EDT 2022

Committee Statement

Committee Statement: Maintenance in accordance with manufacturer's instructions is addressed in 5.1.1

Response Message: SR-349-NFPA 70B-2022

Public Comment No. 111-NFPA 70B-2022 [Section No. 16.3 [Excluding any Sub-Sections]]

Second Revision No. 35-NFPA 70B-2022 [Detail]

Swap Chapter 4 and Chapter 5

(Renumber Chapter 4 as Chapter 5)

(Renumber Chapter 5 as Chapter 4)

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 06:45:02 EDT 2022

Committee Statement

Committee Statement: Chapter 4 in the first draft report is being replaced with Chapter 5 from the first draft report. Chapter 4 in the first draft report is being relocated to Chapter 5. Chapter 4 is consistently used for general requirements in other NFPA documents.

Response Message: SR-35-NFPA 70B-2022

Public Comment No. 658-NFPA 70B-2022 [Global Input]

Public Comment No. 659-NFPA 70B-2022 [Global Input]

Second Revision No. 350-NFPA 70B-2022 [Detail]

See changes for ballot detail of Table 18.3.1 associated with SR 213

Table 18.3.1 Power Cable and Conductor Visual Inspections ~~and Mechanical Tests~~

No.	Task	Test Type*	Notes
1	Physical condition, including operating environment	1 or 2	Damage or deterioration, supports or restraints, bending radius, excessive tension, signs of overheating, corrosion, swelling or soft spots
2	Correct labeling or identification	1 or 2	Phasing, cable ID, multiple sources, hazard, ~~or~~ other warning labels
3	Grounding/bonding	1 or 2	Damage, missing or loose terminations, ~~proper~~ clearance from energized parts, protection from physical damage
4	Vaults containing cables	1 or 2	Damage, concrete deterioration, ~~proper~~ drainage~~if equipped~~
~~5~~	~~Cables in vaults~~	~~1 or 2~~	~~Damage or deterioration, supports, bending radius, excessive tension, swelling or soft spots, proper grounding~~
~~6~~5	~~Pot heads~~Cable and conductor terminations	1 or 2	Oil or compound leaks, cracks or damaged bodies, cleanliness, terminations
~~7~~6	Aerial installations	1 or 2	Damage, deteriorating supports, suspension systems, pinched or damaged insulation at dead ends, animal~~,~~ or bird infestation
~~8~~7	Raceway~~/cable tray~~	1 or 2	Damage or deterioration, ~~cable jacket~~ abrasion or wear~~when exposed~~, continuity, tight joints, missing or loose bonding jumpers, corrosion
~~9~~8	Barriers, guards, and assemblies	1 or 2	Damage or signs of deterioration, arcing, tracking, supports and mounting hardware

*Types specified in accordance with Section 8.4, as follows: Type1 = online standard test~~,~~; Type1A = online enhanced test~~,~~; Type2 = offline standard test~~,~~; Type2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_350_Table_18.3.1.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Fri May 13 14:48:41 EDT 2022

Committee Statement

Committee Statement: Line 1 - Added ‘corrosion’ and ‘swell or soft spots’ as specific examples of damage.

Lines 3 and 4 - The word ‘proper’ is ambiguous and has been removed.

Line 5 - Deleted line for ‘cables in vaults’. This is covered in Line 1.

Line 6 - Changed outdated industry term ‘pot heads’ term to ‘cable and conductor terminations’.

Line 8 – Removed ‘when expose’ which is covered in the introduction to the table. Removed ‘cable tray’ which is covered in Chapter 19.

Response Message: SR-350-NFPA 70B-2022

Public Comment No. 688-NFPA 70B-2022 [Sections 18.3.1, 18.3.2, 18.3.3]

Public Comment No. 152-NFPA 70B-2022 [Section No. 18.3.1]

Second Revision No. 352-NFPA 70B-2022 [Detail]

Delete head paragraph 34.4.

34.4 Periodic Maintenance Procedures.

~~Field testing and test methods shall be conducted in accordance with this chapter to assess the overall condition of service-aged electrical equipment and ancillary devices associated with these installations.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Fri May 13 16:46:14 EDT 2022

Committee Statement

Committee Statement: Wording was changed to align with other chapter outlines and to remove redundant and ambiguous text.

Response Message: SR-352-NFPA 70B-2022

Second Revision No. 354-NFPA 70B-2022 [Detail]

Move existing A.27.3.6 as annex to new 27.3.5 Electrical Testing

27.3.5 Electrical Testing

A.27.3.5
In addition to the electrical tests in Table 27.3.4, if applicable, a resistance check should be made to ensure that bearing insulation is not short-circuited by bearing temperature detectors or by lubricating-oil piping. This type of check might require uncoupling the machine or lifting the noninsulated end (after disassembling the bearing) of the shaft if both bearings are not insulated.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Fri May 20 10:44:12 EDT 2022

Committee Statement

Committee Statement: Existing Section 27.3.6 is deleted and associated annex material is moved to new Section 27.3.5 Electrical Testing.

Response Message: SR-354-NFPA 70B-2022

Second Revision No. 355-NFPA 70B-2022 [Detail]

APPEND EXISTING A.27.3.7.1 TO END OF existing annex for 27.3.5 Mechanical Servicing which has moved as new 27.3.4 Mechanical Servicing. Annex should end up being all one under A.27.3.4.

A.27.3.5
Where possible, bearings, gears, and couplings should be uniformly preheated before installation to minimize damage. All rotating elements should be dynamically balanced to within standard tolerance.
All rotating equipment should be properly aligned at operating temperature when installed. Rim and face or reverse indicator methodology should be used. Dial indicators or laser alignment equipment should be used for alignment.
Machines with Brushes. If safely possible, the following should be performed offline: Check brushes in holders for fit and free play, and those that are worn down almost to the brush rivet should be replaced. Inspect brush faces for chipped toes or heels and for heat cracks; replace damaged brushes. Check the brush spring pressure and readjust in accordance with the manufacturer's instructions. Constant tension springs with incorrect tension should be replaced. Check that brush shunts are properly secured to brushes and holders.
Machines with Collector (Slip) Rings. The ring surface should be smooth and concentric. If the rings are worn or eccentric, they should be machined to restore smoothness and concentricity.
Machines with Commutators. Commutator concentricity should be checked with a dial indicator if it is suspected that the commutator is out of round. If the commutator is out of round, it should be machined to concentricity. The commutator surface should be examined for high bars, grooving, evidence of scratches, roughness, and excessive filming. In light cases of surface roughness, several surface rounding brushes can be installed; but for extreme roughness, turning the commutator in the lathe should be performed. If there is high mica between bars, the commutator should be turned and undercut. After servicing a commutator, it should be completely clean, with traces of copper, carbon, or other dust removed. One reference for servicing commutators is ANSI/EASA AR100, Recommended Practice for the Repair of Rotating Electrical Apparatus.

A.27.3.7.1
Vibration analysis equipment is useful in isolating the source of vibration that might appear to be the result of other malfunctions within a machine. It is also useful for ensuring proper installation of critical production equipment. Today there are computerized data collecting analyzers that store vibration spectrums, using fast fourier transform (FFT) methodology. In addition to detecting vibration due to unbalance, FFT analysis of the instruments can identify faults in stator windings, rotor bars and end rings, and bearings.
A formal vibration analysis program can reduce costly machine failures. The program can range from the use of simple hand-held analyzers to sophisticated multichannel recorders with permanently mounted sensors to provide data for comparison. Such a program makes it possible to keep track of the condition of rotating equipment, particularly high-speed types. Trend charts assist in establishing maintenance needs.
The most common methods of measuring vibration are in units of velocity. Velocity measurements are in millimeters per second or inches per second. Vibration is usually measured at the bearing housing.
Displacement is generally used as an indicator of vibration severity for both low-speed equipment operating at less than 1200 rpm and low-frequency vibration. When measured as displacement, the units are microns peak-to-peak or mils peak-to-peak. Velocity is independent of machine speed and therefore a better general indicator of overall vibration severity.
Suggested vibration limits for machines are specified in Table A.27.3.7.1.

Table A.27.3.7.1 Vibration Severity Chart
Velocity rms

mm/sec	in./sec	Class 1	Class 2	Class 3	Class 4
0.71	0.028	A	A	A	A
1.12	0.044	B	A	A	A
1.8	0.071	B	B	A	A
2.8	0.110	C	B	B	A
4.5	0.177	C	C	B	B
7.1	0.279	D	C	C	B
11.2	0.440	D	D	C	C
18.0	0.708	D	D	D	C
28.0	1.10	D	D	D	D

Notes
(1) Class 1: up to 20 hp on fabricated steel foundation; Class 2: 25 hp–100 hp on fabricated steel foundation, 100 hp–400 hp on heavy solid foundation; Class 3: above 400 hp on heavy solid foundation; Class 4: above 100 hp on fabricated steel foundation.
(2) Grade A: good; Grade B: usable; Grade C: just acceptable; Grade D: not acceptable.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Fri May 20 10:49:58 EDT 2022

Committee Statement

Committee Statement: Existing A.27.3.7.1 is appended to existing A.27.3.5 which has been moved under new 27.3.4 Mechanical Servicing.

Response Message: SR-355-NFPA 70B-2022

Public Comment No. 436-NFPA 70B-2022 [Section No. A.27.3.7.1]

Second Revision No. 363-NFPA 70B-2022 [Detail]

Revise title of 4.7 delete "guidelines and"

4.7 Guidelines and Impact of Additions/Rework to Retrofitting Equipment.

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Thu Jul 28 10:33:50 EDT 2022

Committee Statement

Committee Statement: NFPA 70B is a standard and provides requirements not guidelines.
Response Message: SR-363-NFPA 70B-2022

Second Revision No. 37-NFPA 70B-2022 [Detail]

Delete asterisk and annex for Section 4.1 Introduction.

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Tue Apr 26 06:49:58 EDT 2022

Committee Statement

Committee Statement: Deleted the Annex A material for Section 4.1 as it is no longer necessary based on the change to 4.1.1.
Response Message: SR-37-NFPA 70B-2022

Second Revision No. 55-NFPA 70B-2022 [Detail]

Change the order of chapters 9 and 10. Chapter 9 moves to Chapter 10. Chapter 10 moves to Chapter 9.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 15:19:46 EDT 2022

Committee Statement

Committee Statement: The order of Chapters 9 and 10 are changed to provide better information flow to the standard. All chapters after Chapter 9 refer to Chapter 9.

Response Message: SR-55-NFPA 70B-2022

Public Comment No. 397-NFPA 70B-2022 [Global Input]

Second Revision No. 56-NFPA 70B-2022 [Detail]

Append existing A.9.10 to A.9.1. All should end up as one under A.9.1.

A.9.1

Hazardous location electrical equipment is used in areas that are recognized to commonly or infrequently contain ignitible vapors or dusts. Designs of hazardous location electrical equipment include explosionproof, dust-ignitionproof, dusttight, purged pressurized, intrinsically safe, nonincendive, oil immersion, hermetically sealed, and other types. Maintenance of each type of equipment requires attention to specific items.

Explosionproof enclosures, dust-ignitionproof enclosures, dusttight enclosures, raceway seals, vents, barriers, and other protective features are required for electrical equipment in certain occupancies.

Intrinsically safe equipment and wiring is permitted in locations for which specific systems are approved. Such wiring is to be separate from the wiring of other circuits. *NFPA 70,* Article 504, Intrinsically Safe Systems, describes control drawings, grounding, and other features involved in maintenance programs.

Purged and pressurized enclosures can be used in hazardous (classified) areas. NFPA 496 provides guidance useful to maintenance personnel.

~~**A.9.10**~~ **[Relocate annex to existing 9.1 General]**

~~Explosionproof enclosures, dust-ignitionproof enclosures, dusttight enclosures, raceway seals, vents, barriers, and other protective features are required for electrical equipment in certain occupancies.~~

~~Intrinsically safe equipment and wiring is permitted in locations for which specific systems are approved. Such wiring is to be separate from the wiring of other circuits. *NFPA 70,* Article 504, Intrinsically Safe Systems, describes control drawings, grounding, and other features involved in maintenance programs.~~

~~Purged and pressurized enclosures can be used in hazardous (classified) areas. NFPA 496 provides guidance useful to maintenance personnel.~~

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Tue Apr 26 15:28:26 EDT 2022

Committee Statement

Committee Statement: A.9.10 was relocated to A.9.1 since Section 9.10 was deleted.
Response Message: SR-56-NFPA 70B-2022

Public Comment No. 408-NFPA 70B-2022 [Sections A.9.1, A.9.1.2, A.9.2.2, A.9.4.1, A.9.5.2.1, A.9.6...]

Second Revision No. 73-NFPA 70B-2022 [Detail]

Revise title of section 7.2 to read:

7.2 Bolted Bus Connections, Conductor Terminations and Conductor Connectors.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 09:47:42 EDT 2022

Committee Statement

Committee Statement: Combining 7.2 “Bolted Bus Connections” and 7.3 “Conductor Terminations and Connectors”, which is the same material other than the section titles, provides greater usability of the document.

Response Message: SR-73-NFPA 70B-2022

Public Comment No. 479-NFPA 70B-2022 [Chapter 7]

Second Revision No. 82-NFPA 70B-2022 [Detail]

Delete asterisk from chapter number.

Chapter 11* Power and Distribution Transformers

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 10:59:50 EDT 2022

Committee Statement

Committee Statement: The asterisk on Chapter 11 is being removed as there is no annex material for this Chapter. An asterisk indicates the presence of annex material.

Response Message: SR-82-NFPA 70B-2022

Public Comment No. 37-NFPA 70B-2022 [Chapter 11]

Public Comment No. 665-NFPA 70B-2022 [Chapter 11 [Title Only]]

Second Revision No. 347-NFPA 70B-2022 [Section No. 1.1]

1.1 Scope.

This standard covers the ~~development, implementation, and operation of an electrical maintenance program (EMP)~~ preventive maintenance of electrical, electronic, and communications systems and equipment .

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Fri May 13 08:25:44 EDT 2022

Committee Statement

Committee Statement: The scope has been revised to be consistent with the document title and the contents of the standard. The technical committee understands that scope statements are the responsibility of the Correlating Committee.

Response Message: SR-347-NFPA 70B-2022

Public Comment No. 670-NFPA 70B-2022 [Section No. 1.1]

Second Revision No. 5-NFPA 70B-2022 [Section No. 1.2 [Excluding any Sub-Sections]]

The purpose of this standard is to provide for the practical safeguarding of persons, property, and processes from the risks associated with failure, breakdown, or malfunction and ~~to provide~~ a means to establish ~~an acceptable~~ a condition of maintenance of electrical equipment and systems ~~to address~~ for safety and reliability.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon Apr 25 18:14:09 EDT 2022

Committee Statement

Committee Statement: Section 1.2 Purpose has been revised for clarity and to comply with Section 1.6.1.3 of the Manual of Style for NFPA Technical Committee Documents.

Response Message: SR-5-NFPA 70B-2022 The technical committee reviewed the use of equivalency in 1.4 and has determined its use in this section is in accordance with 1.6.1.6 and A.1.6.1.6 of the NFPA Manual of Style for NFPA Technical Committee Documents and no changes are necessary.

Public Comment No. 672-NFPA 70B-2022 [Chapter 1]

Second Revision No. 7-NFPA 70B-2022 [Section No. 1.3.1]

1.3.1

This standard applies to maintenance for electrical, electronic, and communications systems and equipment and is not intended to duplicate or supersede instructions ~~that~~ provided by manufacturers ~~normally provide~~ . Systems and equipment covered are typical of those installed ~~in~~ for industrial plants, institutional and commercial buildings, and large multifamily residential complexes.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon Apr 25 18:21:22 EDT 2022

Committee Statement

Committee Statement: The first sentence was revised to simplify the wording and to be consistent with how those words are used elsewhere in the standard. The word "in" was replaced with "for" because equipment covered by this standard can be on or outside of buildings.

Response Message: SR-7-NFPA 70B-2022

Public Comment No. 34-NFPA 70B-2022 [Section No. 1.3.1]

Public Comment No. 1-NFPA 70B-2021 [Section No. 1.3]

Second Revision No. 6-NFPA 70B-2022 [Section No. 1.3.2]

1.3.2

Consumer appliances and equipment intended primarily for use in the home are not ~~included~~ covered .

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon Apr 25 18:19:07 EDT 2022

Committee Statement

Committee Statement: Section 1.3.2 has been revised to utilize the more concise term “covered” for improved clarity

Response Message: SR-6-NFPA 70B-2022

Public Comment No. 35-NFPA 70B-2022 [Section No. 1.3.2]

Second Revision No. 8-NFPA 70B-2022 [Section No. 1.5.3.1]

1.5.3.1

The values presented in this standard are expressed with a degree of precision that is appropriate for practical application and enforcement.

~~**A.1.5.3.1**~~

~~It is not intended that the application or enforcement of these values be more precise than the precision expressed.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon Apr 25 18:27:12 EDT 2022

Committee Statement

Committee Statement: The explanatory material is being deleted because it does not add anything to the requirement.

Response Message: SR-8-NFPA 70B-2022

Public Comment No. 542-NFPA 70B-2022 [Section No. A.1.5.3.1]

Public Comment No. 543-NFPA 70B-2022 [Section No. 1.5.3.1]

Second Revision No. 353-NFPA 70B-2022 [Section No. 2.4]

2.4 References for Extracts in Mandatory Sections.

NFPA 70®, National Electrical Code®, ~~2020~~ 2023 edition.

NFPA *70E®, Standard for Electrical Safety in the Workplace®,* 2021 edition.

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Mon May 16 08:39:51 EDT 2022

Committee Statement

Committee Statement: This been updated to the NFPA 70 -2023 for consistency.
Response Message: SR-353-NFPA 70B-2022

Second Revision No. 9-NFPA 70B-2022 [Section No. 3.1]

3.1 General.

3.1.1

The definitions contained in this chapter shall apply to the terms used in this ~~recommended practice~~ standard .

3.1.2

Where terms are not defined in this chapter or within another chapter, they ~~should~~ shall be defined using their ordinarily accepted meanings within the context in which they are used.

3.1.3

Merriam-Webster's Collegiate Dictionary, 11th edition, ~~is~~ shall be the source for the ordinarily accepted meaning.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon Apr 25 18:31:56 EDT 2022

Committee Statement

Committee Statement: Section 3.1 has been modified to reflect the transition of this document from a recommended practice to a standard. The word "should" is changed to "shall" in in the second sentence to comply with 2.3.1.3.1 of the NFPA Manual of Style. The word "is" is changed to "shall be" in in the third sentence to comply with 2.3.1.3.1 of the NFPA Manual of Style.

Response Message: SR-9-NFPA 70B-2022

Public Comment No. 675-NFPA 70B-2022 [Chapter 3]

Public Comment No. 2-NFPA 70B-2021 [Section No. 3.1]

Second Revision No. 10-NFPA 70B-2022 [New Section after 3.3.2]

3.3.2 Appliance.

Utilization equipment, generally other than industrial, that is fastened in place, stationary, or portable; is normally built in a standardized size or type; and is installed or connected as a unit to perform one or more functions such as clothes washing, air-conditioning, food mixing, deep frying, and so forth. [**70**, 2023]

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon Apr 25 18:33:59 EDT 2022

Committee Statement

Committee Statement: The definition of "appliance" based on NFPA 70 - 2023 was added because it is used in this standard.

Response Message: SR-10-NFPA 70B-2022

Public Comment No. 207-NFPA 70B-2022 [Section No. 3.2]

Second Revision No. 12-NFPA 70B-2022 [Section No. 3.3.4]

3.3.5 Bonding Conductor ~~or~~ (Bonding Jumper) .

A ~~reliable~~ conductor ~~to ensure~~ that ensures the required electrical conductivity between metal parts that are required to be electrically connected. [**70,**~~2020~~ 2023]

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Mon Apr 25 18:37:52 EDT 2022

Committee Statement

Committee Statement: The wording was changed to be consistent with that in NFPA 70 - 2023.
Response Message: SR-12-NFPA 70B-2022

Public Comment No. 89-NFPA 70B-2022 [Section No. 3.3.4]

Second Revision No. 195-NFPA 70B-2022 [Section No. 3.3.8]

3.3.9* Circuit Breaker.

A device designed to open and close a circuit by nonautomatic means and to open the circuit automatically on a predetermined overcurrent without damage to itself when properly applied within its rating. [**70**, 2023]

A.3.3.9 Circuit Breaker.

One example of a listing standard for ~~molded-case~~ circuit breakers is UL 489, *Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures*.

Molded-Case Circuit Breaker (MCCB). ~~Molded-case circuit breakers~~ MCCBs are most often available in one-, two-, three-, or four-pole versions and are available in 120 ~~volt~~ V to 1000 ~~volt~~ V ratings. All ~~molded-case circuit breakers~~ MCCBs , including ~~the subset known as~~ ICCBs , will include some sort of instantaneous protection, which might ~~or might not~~ be adjustable but cannot be completely disabled.

Insulated-Case Circuit Breaker (ICCB) . There is no specific definition or mention of ICCB within the MCCB standard. However, their stated ratings will be those of MCCBs but they can operate like LVPCBs ~~, .~~ ~~including~~ ICCBs can either include a two-step stored energy operating mechanism that will require manual charging of closing and opening springs when the circuit breaker is manually operated~~,~~ or ~~they can~~ include internal charging motors for closing and opening springs. ICCBs are normally housed in a case of dielectric materials providing a layer of insulation between its exterior and internal mechanisms. The characteristics of ICCBs vary widely between models and manufacturers. ~~One example of a listing standard for circuit breakers is UL 489, *Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures* .~~

Low-Voltage Power Circuit Breaker (LVPCB). LVPCBs are mechanical switching devices consisting of a frame that contains some number of field replaceable component parts or subassemblies capable of making, carrying, interrupting, and breaking currents. Modern LVPCBs are rated 1000 V ac or less, or 1500 V dc or less, and do not include MCCBs. They are typically larger circuit breakers with frames rated at 600 A or more that have a significant degree of maintainability, such as the ability to replace contact structures, arc chutes, and other parts subject to wear. Modern versions are listed to UL 1066, *Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures* , and are commonly installed in switchgear as draw-out devices. More rarely, they might be installed as fixed mounted devices in older equipment. LVPCBs manufactured prior to 2000 generally had metal frames; those manufactured after 2000 tend to use frames made from nonconductive materials. LVPCBs are sometimes also referred to as metal frame or air frame breakers.

~~**3.3.9.1***~~ ~~Insulated-Case Circuit Breaker (ICCB).~~

~~Insulated case circuit breakers (ICCBs) are a type of molded case circuit breaker (MCCB) that share characteristics with low-voltage power circuit breakers (LVPCBs).~~

~~**A.3.3.8.1** Insulated-Case Circuit Breaker.~~

~~There is no specific definition or mention of ICCB within the MCCB standard. However, their stated ratings will be those of MCCBs but they can operate like LVPCB, including a two-step stored energy operating mechanism that will require manual charging of closing and opening springs when the circuit breaker is manually operated, or they can include internal charging motors for closing and opening springs. ICCBs are normally housed in a case of dielectric materials providing a layer of insulation between its exterior and internal mechanisms. The characteristics of ICCBs vary widely between models and manufacturers. One example of a listing standard for circuit breakers is UL 489, *Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures* .~~

~~**3.3.9.2*** Molded-Case Circuit Breaker (MCCB).~~

~~A circuit breaker that is assembled as an integral unit in a supporting and enclosing housing of insulating material.~~

~~**A.3.3.8.2** Molded-Case Circuit Breaker (MCCB).~~

~~One example of a listing standard for molded-case circuit breakers is UL 489, *Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures* .~~

~~Molded-case circuit breakers are most often available in one-, two-, three-, or four-pole versions and are available in 120 volt to 1000 volt ratings. All molded-case circuit breakers, including the subset known as ICCB, will include some sort of instantaneous protection, which might or might not be adjustable but cannot be completely disabled.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon May 02 14:17:51 EDT 2022

Committee Statement

Committee Statement: The definition of circuit breaker from NFPA 70 - 2023 was added because it is used in NFPA 70B and it will help users in applying this standard. Other circuit breaker definitions were deleted and all annex material moved under the general definition of circuit breaker to explain the different types of circuit breakers.

Response Message: SR-195-NFPA 70B-2022

Public Comment No. 81-NFPA 70B-2022 [New Section after 3.3.8.2]

Public Comment No. 683-NFPA 70B-2022 [Section No. 3.3.8]

Second Revision No. 27-NFPA 70B-2022 [Section No. 3.3.9]

3.3.10 Commissioning.

~~A qualitative and quantitative process used to (1) develop procedures to verify and document functional system-level and component-level requirements; (2) develop a testing and operational tune-up (system and component final adjustment) plan; (3) determine and record baseline information for operation and maintenance procedures; and (4) evaluate initial system performance results and measurements.~~ The process, procedures, and testing used to set up and verify the initial performance, operational controls, safety systems, and sequence of operation of electrical devices and equipment, prior to it being placed into active service. [**70,** 2023]

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 06:38:05 EDT 2022

Committee Statement

Committee Statement: This definition has been updated to the one in NFPA 70 -2023 for consistency.

Response Message: SR-27-NFPA 70B-2022

Second Revision No. 14-NFPA 70B-2022 [Section No. 3.3.15]

~~**3.3.16** Duty.~~

~~**3.3.16.1** Duty, Continuous.~~

~~Operation at a substantially constant load for an indefinitely long time. [**70,** 2020]~~

~~**3.3.16.2** Duty, Intermittent .~~

~~Operation for alternate intervals of (1) load and no load; or (2) load and rest; or (3) load, no load, and rest. [**70,** 2020]~~

~~**3.3.16.3** Duty, Periodic.~~

~~Intermittent operation in which the load conditions are regularly recurrent. [**70,** 2020]~~

~~**3.3.16.4** Duty, Short-Time.~~

~~Operation at a substantially constant load for a short and definite, specified time. [**70,** 2020]~~

~~**3.3.16.5** Duty, Varying.~~

~~Operation at loads, and for intervals of time, both of which may be subject to wide variation. [**70,** 2020]~~

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Mon Apr 25 18:41:47 EDT 2022

Committee Statement

Committee Statement: These terms are not used in the standard therefore are being deleted.
Response Message: SR-14-NFPA 70B-2022

Public Comment No. 571-NFPA 70B-2022 [Chapter 3]

Second Revision No. 15-NFPA 70B-2022 [Section No. 3.3.16]

3.3.16* Electrical Maintenance Program (EMP).

A managed program of inspecting, testing, monitoring, analyzing, and servicing electrical systems and equipment with the purpose of maintaining safe operations and production by reducing or eliminating system interruptions and equipment ~~breakdowns~~ failures .

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon Apr 25 18:42:57 EDT 2022

Committee Statement

Committee Statement: The word "breakdowns" was replaced with "failures" as it is more appropriate.

Response Message: SR-15-NFPA 70B-2022 RESPONSE TO PC 686: The technical committee has reviewed the document and verifies that the correct acronym for the defined term “Electrical Maintenance Program” is “EMP”.

Public Comment No. 456-NFPA 70B-2022 [Section No. 3.3.16]

Public Comment No. 686-NFPA 70B-2022 [Section No. 3.3.16]

Second Revision No. 32-NFPA 70B-2022 [Section No. 3.3.18]

~~**3.3.19** Electrostatic Discharge (ESD) Grounding (Static Grounding).~~

~~The conductive path created to reduce or dissipate the electrostatic charge where it builds up as a result of equipment operation or induced from an electrostatically charged person or material coming in contact with the equipment.~~

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Tue Apr 26 06:43:07 EDT 2022

Committee Statement

Committee Statement: This definition has been deleted because the term is not used in NFPA 70B.
Response Message: SR-32-NFPA 70B-2022

Second Revision No. 358-NFPA 70B-2022 [Section No. 3.3.20]

3.3.19* Energy Storage System (ESS).

One or more ~~components assembled together~~ devices installed as a system capable of storing energy and providing electrical energy into the premises wiring system or an electric power production and distribution network. [**70,**~~2020~~ 2023]

A.3.3.19 Energy Storage System (ESS).

An ESS(s) can include but is not limited to batteries, capacitors, and kinetic energy devices (e.g., flywheels and compressed air). ~~Energy storage systems~~ An ESS(s) can include inverters or converters to change voltage levels or to make a change between an ac or a dc system. [**70,**~~2020~~ 2023]

~~These systems differ from other storage systems such as a UPS system, which is a power supply used to provide alternating current power to a load for some period of time in the event of a power failure.~~ These systems differ from a stationary standby battery installation where a battery spends the majority of the time on continuous float charge or in a high state of charge, in readiness for a discharge event. [**70,**~~2020~~ 2023]

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Wed Jun 15 12:06:47 EDT 2022

Committee Statement

Committee Statement: The wording was changed to be consistent with that in NFPA 70 - 2023
Response Message: SR-358-NFPA 70B-2022

Second Revision No. 28-NFPA 70B-2022 [Section No. 3.3.25]

3.3.25 Ground Fault.

An unintentional, electrically conductive connection between an ungrounded conductor of an electrical circuit and the normally non–current-carrying conductors, ~~metallic~~ metal enclosures, ~~metallic~~ metal raceways, ~~metallic~~ metal equipment, or earth. [**70,**~~2020~~ 2023]

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 06:39:45 EDT 2022

Committee Statement

Committee Statement: This definition has been updated to the one in NFPA 70 -2023 for consistency.

Response Message: SR-28-NFPA 70B-2022

Second Revision No. 333-NFPA 70B-2022 [New Section after 3.3.26]

3.3.54 Special-Purpose Ground-Fault Circuit Interrupter (SPGFCI).

A Class C, Class D, or Class E device designed to protect a person from electrocution when contact between a live part of a protected circuit and ground causes current to flow through a person's body.

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Wed May 11 11:44:19 EDT 2022

Committee Statement

Committee Statement: A definition of SPGFCI was added since the term is used in the standard.
Response Message: SR-333-NFPA 70B-2022

Second Revision No. 17-NFPA 70B-2022 [Sections 3.3.29, 3.3.30]

3.3.29 Grounding Electrode.

A conducting object through which a direct connection to earth is established. [**70,**~~2020~~ 2023]

~~**A.3.3.29** Grounding Electrode.~~

~~See 250.52 of *NFPA 70* for information on grounding electrodes.~~

3.3.30 Grounding Electrode Conductor.

A conductor used to connect the system grounded conductor or the equipment to a grounding electrode or to a point on the grounding electrode system. [**70,**~~2020~~ 2023]

~~**A.3.3.30** Grounding Electrode Conductor.~~

~~This conductor must be connected to provide the lowest impedance to earth for surge current due to lightning and switching activities from either or both the supply and load side and to reduce touch potentials when equipment insulation failures occur.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 06:15:02 EDT 2022

Committee Statement

Committee Statement: The Annex A material has been deleted because it is not helpful or necessary for applying NFPA 70B.

Response Message: SR-17-NFPA 70B-2022

Public Comment No. 313-NFPA 70B-2022 [Sections 3.3.29, 3.3.30]

Public Comment No. 314-NFPA 70B-2022 [Sections A.3.3.29, A.3.3.30]

Second Revision No. 18-NFPA 70B-2022 [Sections 3.3.34, 3.3.35]

3.3.34 Harmonics.

Voltages or currents whose frequencies are integer multiples of the fundamental system frequency.

3.3.35* Interharmonics.

~~A frequency component of a periodic quantity that is not an integer multiple of the frequency at which the supply system is operating (i.e., the fundamental frequency).~~ Voltages or currents whose frequencies are not integer multiples of the fundamental system frequency

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 06:18:55 EDT 2022

Committee Statement

Committee Statement: The word system was added to be clear about which frequency is being referred to. The word "system" is also used repeatedly in Annex J. The wording in 3.3.35 was simplified to better relate to 3.3.34.

Response Message: SR-18-NFPA 70B-2022

Public Comment No. 461-NFPA 70B-2022 [Sections 3.3.34, 3.3.35]

Second Revision No. 359-NFPA 70B-2022 [Section No. 3.3.38]

3.3.20 Equipment, Mobile (Mobile Equipment) .

Equipment with electrical components that is suitable to be moved only with mechanical aids or is provided with wheels for movement by a person(s) or powered devices. [**70,**~~2020~~ 2023]

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Jun 15 12:10:04 EDT 2022

Committee Statement

Committee Statement: The wording was changed to be consistent with that in NFPA 70 - 2023

Response Message: SR-359-NFPA 70B-2022

Second Revision No. 19-NFPA 70B-2022 [Section No. 3.3.41.1]

3.3.41 Overcurrent Protective Device, Branch-Circuit (Branch-Circuit Overcurrent Protective Device) .

A device capable of providing protection for service, feeder, and branch circuits and equipment over the full range of overcurrents between its rated current and its interrupting rating. ~~Such devices are provided with interrupting ratings appropriate for the intended use but no less than 5000 amperes.~~ [**70,**~~2020~~ 2023]

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 06:20:58 EDT 2022

Committee Statement

Committee Statement: The definition and reference date were revised to match that in NFPA 70-2023 for consistency.

Response Message: SR-19-NFPA 70B-2022

Public Comment No. 91-NFPA 70B-2022 [Section No. 3.3.41.1]

Second Revision No. 33-NFPA 70B-2022 [Section No. 3.3.41.2]

~~**3.3.40.2** Overcurrent Protective Device, Supplementary.~~

~~A device intended to provide limited overcurrent protection for specific applications and utilization equipment such as luminaires and appliances. This limited protection is in addition to the protection provided in the required branch circuit by the branch-circuit overcurrent protective device. [**70,** 2020]~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 06:43:48 EDT 2022

Committee Statement

Committee Statement: This definition has been deleted because the term is not used in NFPA 70B.

Response Message: SR-33-NFPA 70B-2022

Second Revision No. 360-NFPA 70B-2022 [Section No. 3.3.43]

3.3.43 Panelboard.

A single panel or group of panel units designed for assembly in the form of a single panel, including buses and automatic overcurrent devices, and equipped with or without switches for the control of light, heat, or power circuits; designed to be placed in a cabinet, enclosure, or cutout box placed in or against a wall, partition, or other support; and accessible only from the front. [**70,**~~2020~~ 2023]

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Jun 15 12:11:58 EDT 2022

Committee Statement

Committee Statement: The wording was changed to be consistent with that in NFPA 70 - 2023

Response Message: SR-360-NFPA 70B-2022

Second Revision No. 20-NFPA 70B-2022 [Section No. 3.3.45]

3.3.45 Power Quality.

~~A plethora of electrical~~ Electrical phenomena that ~~encompass~~ can be used to quantify the quality of the electrical supply ~~not being compatible with the requirements of the loads powered from such~~ , including, but not limited to, voltage transients, voltage sags, voltage swells, voltage interruptions, voltage and current harmonics, voltage fluctuations resulting in light flicker, voltage and current unbalance, power frequency deviations, voltage and current interharmonics, and electrical noise (conducted or radiated).

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 06:22:42 EDT 2022

Committee Statement

Committee Statement: The definition was revised to better describe power quality fur use in determining the quality of an electric supply. That can be used to determine if it is suitable for the loads.

Response Message: SR-20-NFPA 70B-2022 RESPONSE TO PC 6: Light flicker was not deleted because that is a common power quality issue.

Public Comment No. 6-NFPA 70B-2021 [Section No. 3.3.45]

Public Comment No. 462-NFPA 70B-2022 [Section No. 3.3.45]

Second Revision No. 21-NFPA 70B-2022 [Section No. 3.3.46]

3.3.46 Predictive Techniques.

Analytics, algorithms, or software that interpret and analyze data from ~~multiple~~ input sources and provide ~~proactive~~ recommendations to address identified problems .

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 06:25:14 EDT 2022

Committee Statement

Committee Statement: The definition was revised to remove "multiple" because "input sources" is already plural and to simplify the wording.

Response Message: SR-21-NFPA 70B-2022

Public Comment No. 463-NFPA 70B-2022 [Section No. 3.3.46]

Second Revision No. 34-NFPA 70B-2022 [Section No. 3.3.51]

~~**3.3.50** Separately Derived System.~~

~~An electrical source, other than a service, having no direct connection(s) to circuit conductors of any other electrical source other than those established by grounding and bonding connections.~~ [~~**70,** 2020~~]

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Tue Apr 26 06:44:18 EDT 2022

Committee Statement

Committee Statement: This definition has been deleted because the term is not used in NFPA 70B.
Response Message: SR-34-NFPA 70B-2022

Second Revision No. 22-NFPA 70B-2022 [New Section after 3.3.52]

3.3.52* Servicing.

The process of following a manufacturer's set of instructions or applicable industry standards to analyze, adjust, or perform prescribed actions upon equipment with the intention to preserve or restore the operational performance of the equipment. [**70**, 2023]

A.3.3.52 Servicing.

Servicing often encompasses maintenance and repair activities. [**70**, 2023]

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 06:27:22 EDT 2022

Committee Statement

Committee Statement: The definition of servicing from NFPA 70 - 2023 was added because it is used in NFPA 70B and it will help users in applying this standard.

Response Message: SR-22-NFPA 70B-2022

Public Comment No. 77-NFPA 70B-2022 [New Section after 3.3.53]

Second Revision No. 23-NFPA 70B-2022 [Section No. 3.3.58]

3.3.59* Switchboard.

A large single panel, frame, or assembly of panels on which are mounted on the face, back, or both, switches, overcurrent and other protective devices, buses, and usually instruments. ~~These assemblies are generally accessible from the rear as well as from the front and are not intended to be installed in cabinets.~~ [**70,**~~2020~~ 2023]

A.3.3.59 Switchboard.

These assemblies ~~are generally~~ can be accessible from the rear or side as well as from the front and are not intended to be installed in cabinets. [**70,** 2023]

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 06:29:51 EDT 2022

Committee Statement

Committee Statement: The definition and reference date were revised to match that in NFPA 70-2023 for consistency.

Response Message: SR-23-NFPA 70B-2022

Public Comment No. 92-NFPA 70B-2022 [Section No. 3.3.58]

Second Revision No. 24-NFPA 70B-2022 [Sections 3.3.60.2, 3.3.60.3]

3.3.61.2 As-Found Tests.

Tests performed on equipment before ~~any~~ maintenance work is performed.

3.3.61.3 As-Left Tests.

Tests performed on equipment after maintenance work is performed .

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Tue Apr 26 06:33:09 EDT 2022

Committee Statement

Committee Statement: The wording was changed to make the definitions consistent.
Response Message: SR-24-NFPA 70B-2022

Public Comment No. 464-NFPA 70B-2022 [Sections 3.3.60.2, 3.3.60.3]

Second Revision No. 25-NFPA 70B-2022 [Section No. 3.3.60.4]

3.3.61.4* Enhanced Tests.

Tests performed on equipment that is thought or known to be defective or equipment that has been subjected to conditions that could adversely affect its condition or operating characteristics.

A.3.3.61.4 Enhanced Tests.

Examples of enhanced tests are cable fault-locating tests or tests performed on a circuit breaker that has interrupted a high level of fault current. Tests can be performed at the discretion of the EMP and provide additional diagnostic information about equipment.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 06:34:45 EDT 2022

Committee Statement

Committee Statement: Annex was modified to include additional information in cases where equipment was not necessarily defective.

Response Message: SR-25-NFPA 70B-2022

Public Comment No. 315-NFPA 70B-2022 [Section No. 3.3.60.4]

Second Revision No. 348-NFPA 70B-2022 [Section No. 3.3.61]

3.3.62 Transformer.

~~A device for changing energy in an alternating current system from one voltage to another; usually includes two or more insulated coils on an iron core.~~ Equipment, either single-phase or polyphase, that uses electromagnetic induction to convert current and voltage in a primary circuit into current and voltage in a secondary circuit. [**70,** 2023]

3.3.62.1 Transformer, Power.

A transformer rated ~~for~~ greater than 500 kVA.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Fri May 13 08:57:21 EDT 2022

Committee Statement

Committee Statement: The definition of transformer was revised and the reference date was added to match that in NFPA 70-2023 for consistency.

The word "for" in the power transformer definition has been deleted to remove a grammatical error.

Response Message: SR-348-NFPA 70B-2022

Public Comment No. 312-NFPA 70B-2022 [Section No. 3.3.61.1]

Public Comment No. 465-NFPA 70B-2022 [Section No. 3.3.61 [Excluding any Sub-Sections]]

Second Revision No. 11-NFPA 70B-2022 [New Section after 3.3.63]

3.3.65 Utilization Equipment.

Equipment that utilizes electric energy for electronic, electromechanical, chemical, heating, lighting, or similar purposes. [**70**, 2023]

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon Apr 25 18:36:04 EDT 2022

Committee Statement

Committee Statement: The definition of "utilization equipment" based on NFPA 70 - 2023 was added because it is used in this standard.

Response Message: SR-11-NFPA 70B-2022

Second Revision No. 36-NFPA 70B-2022 [Section No. 4.1.1]

5.1.1

Electrical maintenance shall be performed only by qualified persons ~~trained in safe work practices and the special considerations necessary to maintain electrical equipment~~ .

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 06:48:25 EDT 2022

Committee Statement

Committee Statement: The requirements in 4.1.1 have been modified to remove the second requirement in accordance with as required by Section 1.8.3 of the Manual of Style for NFPA Technical Committee Documents.

Response Message: SR-36-NFPA 70B-2022

Public Comment No. 676-NFPA 70B-2022 [Chapter 4]

Second Revision No. 334-NFPA 70B-2022 [Section No. 4.2]

~~**4.2** Training for Safety and Technical Skills.~~

~~**4.2.1** Training Requirements.~~

~~**4.2.1.1**~~

~~All employees who face a risk of electrical hazard shall be trained to understand the specific hazards and related injuries associated with electrical energy.~~

~~**4.2.1.2**~~

~~All employees shall be trained in electrical safety-related work practices and required procedures as necessary to provide protection from electrical hazards associated with their jobs or task assignments.~~

~~**4.2.1.3**~~

~~Refresher training shall be provided as identified in the electrical maintenance program (EMP).~~

~~**4.2.2***~~ Type of Training.

~~Training shall be permitted to be conducted in the classroom, on the job, or both.~~

~~**A.4.2.2**~~

~~The type of training should be determined by the needs of the employee.~~

~~**4.2.3***~~ Emergency Procedures.

~~Employees working on or near exposed energized electrical conductors or circuit parts shall be instructed on and be familiar with methods of first aid and emergency procedures.~~

~~**A.4.2.3**~~

~~Examples of emergency procedures include, but are not limited to, approved methods of resuscitation and release of victims from contact with exposed energized conductors or circuit parts.~~

~~**4.2.4** Training Scope.~~

~~Employees shall be trained and knowledgeable in the following:~~

~~Construction and operation of equipment~~

~~Specific work method~~

~~Electrical hazards that can be present with respect to specific equipment or work method~~

~~Proper use of special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools and test equipment~~

~~Skills and techniques necessary to distinguish exposed, energized parts from other parts of electrical equipment~~

~~Skills and techniques necessary to determine the nominal voltage of exposed energized parts~~

~~Decision-making process necessary to determine the degree and extent of hazard~~

~~Job planning necessary to perform the task safely~~

~~Self-discipline necessary to maintain a safe work environment~~

~~**4.2.5** Record Keeping.~~

~~Records of training shall be maintained for each employee.~~

~~**4.2.6** Tools, Instruments and Test Equipment.~~

~~**4.2.6.1**~~

~~Proper tools, instruments, and other test equipment shall be used.~~

~~**4.2.6.2**~~

~~Storage facilities shall be provided for tools, instruments, and test equipment.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed May 11 14:49:41 EDT 2022

Committee Statement

Committee Statement: All of Section 4.2 and associated Annex A material has been deleted because electrical safety requirements are already covered in NFPA 70E and do not need to be duplicated here.

Response Message: SR-334-NFPA 70B-2022

Public Comment No. 226-NFPA 70B-2022 [Section No. 4.2]

Public Comment No. 231-NFPA 70B-2022 [Section No. 4.2.6]

Public Comment No. 225-NFPA 70B-2022 [Section No. 4.2.6]

Public Comment No. 227-NFPA 70B-2022 [Sections A.4.2.2, A.4.2.3]

Second Revision No. 2-NFPA 70B-2022 [New Section after 5.1.1]

4.1.2

This standard is not intended to duplicate or supersede manufacturer's instructions.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon Apr 25 17:54:56 EDT 2022

Committee Statement

Committee Statement: This change places a requirement in one location so it does not need to be repeated in almost every chapter.

Response Message: SR-2-NFPA 70B-2022

Public Comment No. 172-NFPA 70B-2022 [Global Input]

Public Comment No. 671-NFPA 70B-2022 [Global Input]

Second Revision No. 40-NFPA 70B-2022 [Section No. 5.1.1]

4.1.1

~~Equipment~~ Electrical equipment shall be ~~installed,~~ maintained~~, and used~~ in accordance with the manufacturer's instructions and applicable codes and standards.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 06:58:21 EDT 2022

Committee Statement

Committee Statement: The scope and purpose of NFPA 70B is about maintaining electrical equipment. The wording was changed to be consistent with that.

Response Message: SR-40-NFPA 70B-2022

Public Comment No. 487-NFPA 70B-2022 [Section No. 5.1.1]

Second Revision No. 41-NFPA 70B-2022 [Section No. 5.1.2]

4.1.3

In the absence of manufacturer's instructions, equipment shall be maintained in accordance with industry consensus standards. ~~In the absence of manufacturer's instructions, equipment shall be maintained in accordance with industry consensus standards.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 06:59:58 EDT 2022

Committee Statement

Committee Statement: The second sentence was deleted because it is a duplicate of the first sentence.

Response Message: SR-41-NFPA 70B-2022

Public Comment No. 8-NFPA 70B-2021 [Section No. 5.1.2]

Public Comment No. 25-NFPA 70B-2022 [Section No. 5.1.2]

Public Comment No. 171-NFPA 70B-2022 [Section No. 5.1.2]

Public Comment No. 175-NFPA 70B-2022 [Section No. 5.1.2]

Public Comment No. 212-NFPA 70B-2022 [Section No. 5.1.2]

Public Comment No. 575-NFPA 70B-2022 [Section No. 5.1.2]

Public Comment No. 576-NFPA 70B-2022 [Section No. 5.1.2]

Second Revision No. 318-NFPA 70B-2022 [Section No. 5.2.4.2]

4.2.4.2*

The EMP shall include the following elements:

(1) An electrical safety program that addresses the condition of maintenance

(2) Identification of personnel responsible for implementing each element of the program

(3) Survey and analysis of electrical equipment and systems to determine maintenance requirements and priorities

(4) Developed and documented maintenance procedures for ~~all~~ equipment ~~within the scope of the EMP~~

(5) A plan of inspections, servicing, and suitable tests

(6) A maintenance, equipment, and personnel documentation and records-retention policy

(7) A process to prescribe, implement, and document corrective measures based on collected data

(8) A process for incorporating design for maintainability in electrical installations

(9) A program review and revision process that considers failures and findings for continuous improvement

A.4.2.4.2

The ~~qualified~~ person developing the EMP should verify if the local codes or ordinances include an electrical maintenance requirement. If an electrical maintenance requirement has been adopted into the local codes or ordinances, the ~~qualified~~ person should verify that all requirements for this standard and the local codes or ordinances are satisfied in the EMP.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon May 09 08:59:52 EDT 2022

Committee Statement

Committee Statement: The wording "within the scope of the EMP" in 5.2.4.2 (4) was deleted because it is not necessary in this list item. That phrase applies to all items in the list. The word "all" was grammatically deleted.

The word "qualified" was deleted in two locations in the annex because the person responsible for developing the EMP does not necessarily need to be qualified as that term is defined in Chapter 3.

Response Message: SR-318-NFPA 70B-2022

Public Comment No. 490-NFPA 70B-2022 [Section No. 5.2.4.2]

Public Comment No. 500-NFPA 70B-2022 [Section No. A.5.2.4.2]

Second Revision No. 39-NFPA 70B-2022 [Section No. 5.3.3.2]

4.3.3.2

The employer shall determine through regular supervision or through inspections conducted on at least an annual basis that each employee is ~~properly performing~~ complying with the electrical maintenance procedures and testing required by this standard.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 06:56:48 EDT 2022

Committee Statement

Committee Statement: The phrase “properly” is replaced in 5.3.3.2 because it could be considered vague and unenforceable as outlined in Section 2.2.2.3 of the Manual of Style for NFPA Technical Committee Documents. The replacement language provides additional clarity.

Response Message: SR-39-NFPA 70B-2022

Public Comment No. 678-NFPA 70B-2022 [Chapter 5]

Second Revision No. 44-NFPA 70B-2022 [Section No. 5.3.3.3]

4.3.3.3

A person responsible for conducting electrical maintenance shall be provided additional training (or retraining) if any of the following conditions exists:

(1) The supervision or annual inspections indicate the person is not complying with the maintenance procedures and testing requirements.

(2) New technology, new types of equipment, or changes in procedures necessitate the use of maintenance procedures and testing requirements different from those that the person would normally use.

(3) The person needs to review tasks that are performed less often than once per year.

(4) The person needs to review maintenance procedures and testing requirements that they do not normally ~~used by the person~~ use during regular job duties.

(5) The person's job duties change.

(6) A new edition of this standard is adopted~~.~~ that includes changes applicable to the person's job duties.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 07:05:40 EDT 2022

Committee Statement

Committee Statement: Changes can occur in this standard that might not apply to all or any maintenance persons at a given location. The additional wording was added to require additional training only if applicable changes in this standard are made.

Response Message: SR-44-NFPA 70B-2022

Public Comment No. 16-NFPA 70B-2022 [Section No. 5.3.3.3]

Second Revision No. 45-NFPA 70B-2022 [Section No. 5.8]

4.8* Equipment Cleaning.

Electrical equipment cleaning shall be a part of the EMP.

A.4.8

When cleaning equipment, the method used should be determined by the type of contamination to be removed and whether the apparatus is to be returned to service immediately. Drying is necessary after using a solvent or water. Insulation should be tested to determine if it has been properly cleaned. Enclosure and substation room filters should be cleaned at regular intervals and replaced if they are damaged or clogged. Loose hardware, dust, and debris should be removed from equipment enclosures. When properly cleaned, new or unusual wear or loss of parts can be detected during subsequent maintenance operations.

~~*Methods of Cleaning.*~~ Wiping off dirt with a clean, dry, lint-free cloth or soft brush is usually satisfactory if the apparatus is small, the surfaces to be cleaned are accessible, and only dry dirt is to be removed. Lint-free rags should be used so lint will not adhere to the insulation and act as a further dirt-collecting agent. Care should be used to avoid damage to delicate parts.

To remove loose dust, dirt, and particles, suction cleaning methods should be used.

Where dirt cannot be removed by wiping or vacuuming, compressed-air blowing might be necessary.

If compressed air is used, protection should be provided against injury to workers' faces and eyes from flying debris and to their lungs from dust inhalation. The use of compressed air should comply with OSHA regulations in 29 CFR 1910.242(b), “Hand and Portable Powered Tools and ~~Other Hand Held~~ Equipment, General — Compressed Air Used for Cleaning, ” including limiting air pressure for such cleaning to less than a gauge pressure of 208.85 kPa (30 psi) and the provision of effective chip guarding and appropriate ~~personal protective equipment~~ PPE .

Care should be exercised ~~as~~ because compressed air can cause contaminants to become airborne, which can compromise the integrity of insulation surfaces or affect the mechanical operation of nearby equipment. Protection might also be needed against contamination of other equipment if the insulation is cleaned in place with compressed air. ~~Provisions should be made to remove the~~ Either equipment should be removed to a suitable location for cleaning or ~~to cover~~ other equipment ~~and guard it~~ should be covered and guarded from cross contamination. Air should be dry and directed in a manner to avoid further blockage of ventilation ducts and recesses in insulation surfaces.

~~Protection might also be needed against contamination of other equipment if the insulation is cleaned in place with compressed air. If feasible, equipment should be removed to a suitable location for cleaning, or other exposed equipment should be covered before cleaning to keep the debris from entering exposed equipment.~~

Accumulated dirt, oil, or grease might require a solvent to remove it. A lint-free cloth barely moistened (not wet) with a nonflammable solvent can be used for wiping. Solvents used for cleaning of electrical equipment should be selected carefully to ensure compatibility with the materials being cleaned. Liquid cleaners, including spray cleaners, are not recommended unless solvent compatibility is verified with the equipment manufacturer~~,~~ ~~as~~ because residues could cause damage, interfere with electrical or mechanical functions, or compromise the integrity of insulation surfaces.

Some equipment could require cleaning by nonconductive abrasive blasting.

Shot blasting should not be used.

CAUTION: Cleaning with abrasives or abrasive blasting methods can create a hazard to personnel and equipment.

Abrasive blasting operations should comply with OSHA regulations in 29 CFR 1910.94(a), “~~Occupational Health and Environmental Control —~~ Ventilation — Abrasive Blasting .” Protection should be provided against injury to workers’ faces and eyes from abrasives and flying debris and to their lungs from dust inhalation.

Airborne asbestos fibers can endanger health and are subject to government regulations. Knowledge of government regulations related to the handling of asbestos is required before handling asbestos and other such materials. (Copies of the Toxic Substances Control Act as

defined in the US Code of Federal Regulations can be obtained from the US Environmental Protection Agency.)

If sweeping of an electrical equipment room is required, a sweeping compound should be used to limit the amount of dirt and dust becoming airborne. During mopping, the mop bucket should be kept as far as practical from the electrical equipment.

~~**5.8.1**~~

~~Cleaning of electrical equipment shall be performed in accordance with the manufacturer's instructions.~~

~~**5.8.2**~~

~~In the absence of manufacturer's instructions, cleaning shall be performed in accordance with the applicable industry best practices for the device being cleaned.~~

4.8.1 Cleaning Personnel.

4.8.1.1

Electrical equipment cleaning shall be performed by personnel who are familiar with the cleaning materials required and methodologies necessary for effective removal of contaminants, debris, and other foreign materials that compromise electrical equipment performance.

4.8.1.2

The persons assigned to the task of electrical equipment cleaning shall be trained in the following:

(1) Potential damage to the equipment from cleaning procedures

(2) Potential personal injury

(3) Specific cleaning procedures

(4) Equipment not to be cleaned

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 07:09:09 EDT 2022

Committee Statement

Committee Statement: Subsections 5.8.1 and 5.8.2 are being deleted because they are required by 5.1.1 and 5.1.3.

The Annex A material for 5.8.2 is being relocated to 5.8 because it is still applicable to equipment cleaning.

The words "methods of cleaning" were deleted in the Annex A material as a heading because methods of cleaning are also included in the first paragraph.

Response Message: SR-45-NFPA 70B-2022

Public Comment No. 497-NFPA 70B-2022 [Section No. 5.8]

Public Comment No. 498-NFPA 70B-2022 [Section No. A.5.8.2]

Public Comment No. 502-NFPA 70B-2022 [Section No. A.5.8.2]

Second Revision No. 64-NFPA 70B-2022 [Chapter 6 [Title Only]]

Single-Line Diagrams and System Studies

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Wed Apr 27 09:00:34 EDT 2022

Committee Statement

Committee Statement: Title of chapter revised to address topics covered.
Response Message: SR-64-NFPA 70B-2022

Second Revision No. 65-NFPA 70B-2022 [Section No. 6.1]

6.1 Introduction.

6.1.1*

System studies shall be completed in accordance with this chapter.

6.1.2

Single-line diagrams shall be maintained in accordance with this chapter.

6.2 Single-Line Diagrams .

Up-to-date single-line diagrams shall be the primary reference for ~~the~~ system ~~study~~ studies .

6.2.1

~~The single~~ Single -line diagrams shall be maintained in a legible condition.

6.2.2

~~The single~~ Single -line diagrams shall be kept accurate.

6.2.3

~~The single~~ Single -line diagram shall indicate the date of the last revision.

6.2.4

When single-line diagrams are not available, the facility or equipment owner shall be responsible for providing an equally effective means of obtaining the necessary information.

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Wed Apr 27 09:02:01 EDT 2022

Committee Statement

Committee Statement: The revised wording is more appropriate.
Response Message: SR-65-NFPA 70B-2022

Public Comment No. 510-NFPA 70B-2022 [Section No. 6.1.2]

Public Comment No. 715-NFPA 70B-2022 [Section No. 6.1.2]

Public Comment No. 509-NFPA 70B-2022 [Chapter 6]

Public Comment No. 506-NFPA 70B-2022 [Chapter 6]

Second Revision No. 66-NFPA 70B-2022 [Section No. 6.2.6]

~~6.3.6*~~

~~When modifications to the electrical system increase the available fault current, a review of overcurrent protection device interrupting ratings, equipment withstand ratings, and equipment short-circuit ratings shall take place for the equipment within the scope of the study.~~

~~A.6.2.6~~

~~This might require replacing overcurrent protective devices with devices having higher interrupting ratings or installing current-limiting devices such as current-limiting fuses, current-limiting circuit breakers, or current-limiting reactors. For silicon control rectifier (SCR) or diode input devices, change of the source impedance can affect equipment performance. Proper operation of this equipment depends on maintaining the source impedance within the rated range of the device. The solutions to these engineering problems are the responsibility of the maintenance supervisor, the facility engineering department, or the electrical engineer.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 09:10:32 EDT 2022

Committee Statement

Committee Statement: Section 6.2.6 and A.6.2.6 are redundant and not necessary.

Response Message: SR-66-NFPA 70B-2022

Public Comment No. 716-NFPA 70B-2022 [Section No. 6.2]

Public Comment No. 516-NFPA 70B-2022 [Sections 6.2.5, 6.2.6]

Public Comment No. 518-NFPA 70B-2022 [Section No. A.6.2.6]

Second Revision No. 67-NFPA 70B-2022 [Section No. 6.3.1]

6.4.1

~~Where a~~ A coordination study ~~does not exist, one~~ shall be created~~,~~ as necessary to support ~~the arc-flash~~ risk assessments and the intended system design goals.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 09:12:24 EDT 2022

Committee Statement

Committee Statement: The revision to wording improves clarity. Arc flash is removed to address other risk assessments. The intended system design goals will determine the necessity for a coordination study.

Response Message: SR-67-NFPA 70B-2022

Public Comment No. 520-NFPA 70B-2022 [Section No. 6.3.1]

Public Comment No. 717-NFPA 70B-2022 [Section No. 6.3]

Public Comment No. 519-NFPA 70B-2022 [Section No. 6.3]

Second Revision No. 68-NFPA 70B-2022 [New Section after 6.3.4]

6.4.5

When the coordination study is updated, the electrical equipment overcurrent protective devices and equipment ratings shall be reviewed and verified for the equipment within the scope of the study.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 09:14:49 EDT 2022

Committee Statement

Committee Statement: Ratings review text added to be consistent with similar requirements in this section.

Response Message: SR-68-NFPA 70B-2022

Public Comment No. 140-NFPA 70B-2022 [New Section after 6.3.4]

Second Revision No. 69-NFPA 70B-2022 [Sections 6.4.1, 6.4.2]

~~6.5.1~~

~~A load-flow study shall be performed to support electrical maintenance tasks that require deviations from the intended system design goals.~~

~~A.6.4.1~~

~~One example of such a task is changing load-flow conditions during maintenance to minimize impact.~~

6.5.1

~~Where~~ If a load-flow study is needed to ~~safely perform~~ allow maintenance to be performed , the load-flow study shall be updated when changes occur that could affect the results of the study.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 09:20:28 EDT 2022

Committee Statement

Committee Statement: The revised language simplifies the intent and A.6.4.1 is not necessary. The word “If” identifies a condition and is a more accurate statement, versus “where” that identifies a location.

Response Message: SR-69-NFPA 70B-2022

Public Comment No. 718-NFPA 70B-2022 [Section No. 6.4]

Public Comment No. 512-NFPA 70B-2022 [Section No. A.6.4.1]

Public Comment No. 511-NFPA 70B-2022 [Section No. 6.4]

Second Revision No. 70-NFPA 70B-2022 [New Section after 6.4.2]

6.5.2

The load-flow study shall be reviewed for accuracy at intervals not to exceed 5 years.

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Wed Apr 27 09:24:14 EDT 2022

Committee Statement

Committee Statement: The five-year review is consistent with other sections of the standard.
Response Message: SR-70-NFPA 70B-2022

Public Comment No. 78-NFPA 70B-2022 [Section No. 6.4]

Second Revision No. 71-NFPA 70B-2022 [Section No. 6.5.1]

6.6.1

A reliability study shall be conducted as necessary on critical or important facility electrical systems to identify equipment and circuit configurations that can lead to unplanned outages.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 09:27:34 EDT 2022

Committee Statement

Committee Statement: "Critical or important" was added to narrow the focus on the need for reliability studies on electrical systems.

Response Message: SR-71-NFPA 70B-2022

Public Comment No. 254-NFPA 70B-2022 [Section No. 6.5]

Public Comment No. 719-NFPA 70B-2022 [Section No. 6.5]

Second Revision No. 72-NFPA 70B-2022 [New Section after 6.5.2]

6.6.3

The reliability study shall be reviewed for accuracy at intervals not to exceed 5 years.

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Wed Apr 27 09:30:06 EDT 2022

Committee Statement

Committee Statement: The five-year review is consistent with other sections of the standard.
Response Message: SR-72-NFPA 70B-2022

Public Comment No. 79-NFPA 70B-2022 [Section No. 6.5]

Second Revision No. 197-NFPA 70B-2022 [Section No. 6.7]

6.8* Electrical Maintenance-Related Design.

Where a recognized hazard presents ~~a~~ an increased risk ~~to~~ during maintenance ~~or daily operations, an electrical maintenance-related design~~ , a study shall be conducted to develop design options that ~~eliminate or reduce the~~ could be implemented to reduce risk.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon May 02 15:22:12 EDT 2022

Committee Statement

Committee Statement: Added the word “study” to the end of the title to clarify this is a study. The revised wording provides a more concise description of electrical maintenance-related design study.

Response Message: SR-197-NFPA 70B-2022

Public Comment No. 721-NFPA 70B-2022 [Section No. 6.7]

Public Comment No. 532-NFPA 70B-2022 [Section No. 6.7]

Second Revision No. 75-NFPA 70B-2022 [Section No. 7.2.1.1]

7.2.1.1 Infrared Thermography Inspection of Electrical Connections.

Infrared thermographic inspection of electrical connections and terminations ~~that have nominal current flow~~ shall be performed in accordance with Section 7.4.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 10:16:34 EDT 2022

Committee Statement

Committee Statement: The reference to “that have nominal current flow” is not needed.

Response Message: SR-75-NFPA 70B-2022

Public Comment No. 467-NFPA 70B-2022 [Section No. 7.2.1.1]

Second Revision No. 46-NFPA 70B-2022 [Section No. 7.2.1.2]

7.2.1.2 Thermal Sensors.

Permanently mounted thermal sensors shall be permitted to monitor the ~~in-use~~ temperature of electrical connections and terminations.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 13:35:01 EDT 2022

Committee Statement

Committee Statement: The term “in-use” is not necessary, thermal sensors monitor temperatures whether in use or not in use.

Response Message: SR-46-NFPA 70B-2022

Public Comment No. 468-NFPA 70B-2022 [Section No. 7.2.1.2]

Second Revision No. 47-NFPA 70B-2022 [Section No. 7.2.1.3]

7.2.1.3 Contact Resistance ~~by Millivolt Drop~~ Test.

7.2.1.3.1

A calibrated tester shall be used to obtain contact resistance test values.

7.2.1.3.2

Where contact resistance ~~is determined by millivolt drop~~ tests are used , the ~~microohm or millivolt drop~~ resistance values shall not exceed the maximum values published by the manufacturer.

~~**7.2.1.3.3**~~

~~Where manufacturer's data is not available, differences in values between similar connections shall be used to determine if further investigation is required.~~

7.2.1.3.3

If contact resistance values exceed the maximum values published by the manufacturer, the cause for the excess values shall be investigated.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 13:46:38 EDT 2022

Committee Statement

Committee Statement: The words "millivolt drop test" are not necessary and have been deleted for clarity. The methodology to obtain contact resistance results, whether by digital low-resistance ohmmeter (DLRO or "ducter") or a digital multimeter measuring voltage across a known current are both methods of test that shall be performed with calibrated instruments, but do not need the words "millivolt drop."

Response Message: SR-47-NFPA 70B-2022

Public Comment No. 485-NFPA 70B-2022 [Section No. 7.2.1.3]

Public Comment No. 564-NFPA 70B-2022 [Section No. 7.2.1.3]

Second Revision No. 76-NFPA 70B-2022 [Section No. 7.2.1.4.1]

7.2.1.4.1

When using a calibrated torque wrench to confirm the torque of previously installed threaded hardware, the retightening value shall not exceed 90 percent of the manufacturer's specified initial torque value.

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Wed Apr 27 10:25:46 EDT 2022

Committee Statement

Committee Statement: The revised wording adds clarity.
Response Message: SR-76-NFPA 70B-2022

Public Comment No. 80-NFPA 70B-2022 [Section No. 7.2.1.4]

Second Revision No. 361-NFPA 70B-2022 [Section No. 7.2.1.4.2]

Detail SR-199

7.2.1.4.2

Where initial threaded hardware torque value data is not available, torque values shall be in accordance with Table 7.2.1.4.2(a), Table 7.2.1.4.2(b), or Table 7.2.1.4.2(c).

Table 7.2.1.4.2(a) Bolt-Torque Values for Electrical Connections, US Standard Fasteners — Cadmium or Zinc Plated

Bolt Diameter (in.)	Torque (Pound-Feet)
1/4	6
5/16	11
3/8	~~19~~20
7/16	~~30~~32
1/2	~~40~~48
9/16 ~~or larger~~	~~55~~70
5/8	96
3/4	160
7/8	240
1.0	370

Notes:

(1) ~~The~~ Consult the manufacturer ~~should be consulted~~ for equipment supplied with metric fasteners.

(2) The table is based on national coarse thread pitch.

(3) The grade is SAE ~~2~~ 5 .

(4) The minimum tensile (strength) ~~in~~ is 105,000 lbf/in.^{2} ~~= 60–74 K~~ .

~~(5) See Figure A.7.2.1.4.2 for an example of a head marking.~~

Table 7.2.1.4.2(b) Bolt-Torque Values for Electrical Connections, US Standard Fasteners — Silicon Bronze ~~Fasteners Torque (Pound-Feet)~~

Bolt Diameter (in.)	~~Lubricated~~ Torque (Pound-Feet)	
	Nonlubricated	Lubricated
5/16	15	10
3/8	20	15
1/2	40	25
5/8	55	40
3/4	~~87~~70	60

Notes:

(1) Consult the manufacturer for equipment supplied with metric fasteners.

(2) ~~Table~~ This table is based on national coarse thread pitch.

(3) This table is based on bronze alloy bolts having a minimum 70,000 lb/in.^{2} tensile strength. ~~of 70,000 lb/in.^{2}~~

Table 7.2.1.4.2(c) Bolt-Torque Values for Electrical Connections, US Standard Fasteners — Aluminum ~~Fasteners Torque (Pound-Feet)~~

Bolt Diameter (in.)	Torque (Pound-Feet), Lubricated
5/16	10
3/8	14

Bolt Diameter (in.)	Torque (Pound-Feet), Lubricated
1/2	25
5/8	40
3/4	~~54~~60

Notes:

(1) Consult the manufacturer for equipment supplied with metric fasteners.

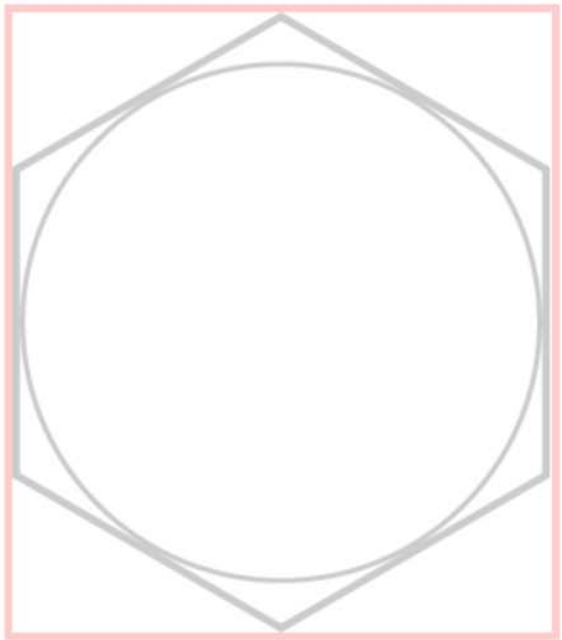
(2) ~~Table~~ This table is based on national coarse thread pitch.

(3) This table is based on aluminum alloy bolts having a minimum 55,000 lb/in.^{2} tensile strength ~~of 55,000 lb/in.^{2}~~ .

~~**A.7.2.1.4.2**~~

~~See Figure A.7.2.1.4.2 for an example of a head marking.~~

~~**Figure A.7.2.1.4.2 Head Marking.**~~



Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon Jun 20 09:54:00 EDT 2022

Committee Statement

Committee Statement: Removed A.7.2.1.4.2. The figure does not provide value to the user of the document.

Response Message: SR-361-NFPA 70B-2022

Public Comment No. 483-NFPA 70B-2022 [Section No. 7.2.1.4.2]

Public Comment No. 482-NFPA 70B-2022 [Section No. A.7.2.1.4.2]

Public Comment No. 680-NFPA 70B-2022 [Section No. A.7.2.1.4.2]

Second Revision No. 77-NFPA 70B-2022 [Sections 7.2.2.1, 7.2.2.2]

7.2.2.1

Newly installed threaded hardware connections shall be ~~tightened by calibrated torque wrench method~~ torqued to the manufacturer's published data .

~~**7.2.2.2**~~

~~Connections shall be torqued to manufacturer's published data.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 10:27:37 EDT 2022

Committee Statement

Committee Statement: Revised to clarify wording.

Response Message: SR-77-NFPA 70B-2022

Public Comment No. 475-NFPA 70B-2022 [Section No. 7.2.2]

Public Comment No. 724-NFPA 70B-2022 [Section No. 7.2.2]

Public Comment No. 722-NFPA 70B-2022 [Section No. 7.2.1.1]

Second Revision No. 78-NFPA 70B-2022 [Section No. 7.2.2.3]

7.2.2.2

Where the manufacturer's data is not available, torque values shall be in accordance with Table 7.2.1.4.2(a), Table 7.2.1.4.2(b), or Table 7.2.1.4.2(c) based on the hardware used .

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 10:29:39 EDT 2022

Committee Statement

Committee Statement: The revised wording clarifies the intent and which hardware is applicable.

Response Message: SR-78-NFPA 70B-2022

Public Comment No. 477-NFPA 70B-2022 [Section No. 7.2.2.3]

Second Revision No. 79-NFPA 70B-2022 [Section No. 7.3]

~~**7.3** Conductor Terminations and Connectors.~~

~~**7.3.1**~~

~~The quality of undisturbed terminations and mechanical connectors for conductors shall be verified using one or more of the methods described in 7.3.1.1 through 7.3.1.4 .~~

~~**7.3.1.1** Infrared Thermography Inspection of Electrical Connections.~~

~~Infrared thermographic inspection of electrical connections and terminations that have nominal current flow shall be performed in accordance with Section 7.5 .~~

~~**7.3.1.2** Thermal Sensors.~~

~~Permanently mounted thermal sensors shall be permitted to monitor the in-use temperature of electrical connections and terminations.~~

~~**7.3.1.3** Contact Resistance by Millivolt Drop Test.~~

~~**7.3.1.3.1**~~

~~Where contact resistance is determined by millivolt drop tests the microohm or millivolt drop values shall not exceed the maximum values published by the manufacturer.~~

~~**7.3.1.3.2**~~

~~Where manufacturer's data is not available, differences in values between similar connections shall be used to determine if further investigation is required.~~

~~**7.3.1.4** Torque Verification.~~

~~**7.3.1.4.1**~~

~~When using a calibrated torque wrench to confirm the torque of previously installed threaded hardware, the retightening value shall not exceed 90 percent of the specified initial torque value.~~

~~**7.3.1.4.2**~~

~~Where initial torque value data is not available, torque values shall be in accordance with Table 7.2.1.4.2(a) , Table 7.2.1.4.2(b) , or Table 7.2.1.4.2(c) .~~

~~**7.3.2** Newly Installed Threaded Hardware Torque Values.~~

~~**7.3.2.1**~~

~~Newly installed threaded hardware connections shall be tightened by calibrated torque wrench method.~~

~~**7.3.2.2**~~

~~Connections shall be torqued to manufacturer's published data.~~

~~**7.3.2.3**~~

~~Where manufacturer's data is not available, torque values shall be in accordance with Table 7.2.1.4.2(a) , Table 7.2.1.4.2(b) , or Table 7.2.1.4.2(c) .~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 10:32:01 EDT 2022

Committee Statement

Committee Statement: Combining 7.2 “Bolted Bus Connections” and 7.3 “Conductor Terminations and Connectors”, which is the same material other than the section titles, provides greater usability of the document.

Response Message: SR-79-NFPA 70B-2022

Public Comment No. 505-NFPA 70B-2022 [Section No. 7.3.1.3]

Public Comment No. 568-NFPA 70B-2022 [Section No. 7.3.1.3]

Public Comment No. 570-NFPA 70B-2022 [New Section after 7.3.1.3]

Public Comment No. 725-NFPA 70B-2022 [Section No. 7.3.2]

Second Revision No. 80-NFPA 70B-2022 [Sections 7.4.1.1.3, 7.4.1.1.4]

~~**7.4.1.1.3**~~

~~The length of the circuit conductors under test shall be documented.~~

~~**7.4.1.1.4**~~

~~The ambient air temperature and humidity surrounding the circuit shall be documented.~~

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Wed Apr 27 10:37:37 EDT 2022

Committee Statement

Committee Statement: Cable length and temperature are not practical requirements of this section.
Response Message: SR-80-NFPA 70B-2022

Public Comment No. 480-NFPA 70B-2022 [Section No. 7.4.1.1]

Second Revision No. 81-NFPA 70B-2022 [New Section after 7.5.1]

7.4.2

All accessible and necessary covers shall be removed prior to infrared thermography inspection to provide a clear line of sight to the equipment being scanned.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 10:41:15 EDT 2022

Committee Statement

Committee Statement: Section was added to clarify a clear line of sight to equipment is required when thermography is required.

Response Message: SR-81-NFPA 70B-2022

Public Comment No. 85-NFPA 70B-2022 [Section No. 7.5]

Second Revision No. 48-NFPA 70B-2022 [Section No. 8.1]

8.1 Introduction.

Field testing and test methods shall be conducted in accordance with this chapter to assess the overall condition of ~~service-aged~~ electrical equipment and systems and to accomplish the following objectives:

(1) Ascertain the ability of the device under test to continue to perform its function as designed

(2) Determine whether any corrective maintenance or replacement is necessary

(3) ~~Chart~~ Document the ~~deterioration~~ condition of the equipment over its service life

(4) Provide results to ascertain the overall condition of maintenance of the device under test

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 14:24:09 EDT 2022

Committee Statement

Committee Statement: Section 8.1 is modified to remove the phrase “service aged” which is not necessary. The phrase “chart the deterioration” is replaced with “document the condition” to permit multiple forms of documentation.

Response Message: SR-48-NFPA 70B-2022 RESPONSE TO PC 246 – The word “systems” is retained for clarity as Chapters 30, 31, 32 and 33 of this standard include systems. The term “device under test” is retained to differentiate it from the equipment used to perform the test.

Public Comment No. 246-NFPA 70B-2022 [Section No. 8.1]

Public Comment No. 726-NFPA 70B-2022 [Section No. 8.1]

Second Revision No. 49-NFPA 70B-2022 [Section No. 8.2]

~~**8.2** Safety Considerations.~~

~~Tasks shall be performed in accordance with Chapter~~ 4 ~~.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 14:29:19 EDT 2022

Committee Statement

Committee Statement: Section 8.2 is removed as it is not necessary to repeat the requirements of Chapter 4 in this section.

Response Message: SR-49-NFPA 70B-2022

Public Comment No. 727-NFPA 70B-2022 [Section No. 8.2]

Public Comment No. 247-NFPA 70B-2022 [Chapter 8]

Second Revision No. 50-NFPA 70B-2022 [Section No. 8.3]

8.2 ~~Electrical Testing~~ Risk Assessment ~~Unique Elements~~ Special Considerations .

~~Prior to beginning work, a risk assessment shall consider the following unique elements related to hazards associated with electrical equipment maintenance tasks~~ Where the following special considerations are present, a risk assessment shall be performed to identify hazards and determine if additional protective measures are required prior to beginning work :

(1) Electrical, as follows:

- (a) X-ray
- (b) Overpotential

(2) Mechanical, as follows:

- (a) Stored energy
- (b) Mass energy

(3) Chemical, as follows:

- (a) SF_6 gas fault by-products
- (b) Electrolytes

(4) Environmental, as follows:

- (a) Asbestos
- (b) SF_6 gas
- (c) Insulating fluids, as follows:
  - i. PCBs
  - ii. Tetrachloroethylene

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 14:31:08 EDT 2022

Committee Statement

Committee Statement: The title and charging sentence in 8.3 is reworded for clarity and to provide a specific requirement in this section. The word “gas” is added to 8.3(3) for improved clarity.

Response Message: SR-50-NFPA 70B-2022

Public Comment No. 249-NFPA 70B-2022 [Section No. 8.3]

Public Comment No. 728-NFPA 70B-2022 [Section No. 8.3]

Second Revision No. 51-NFPA 70B-2022 [Section No. 8.4 [Excluding any Sub-Sections]]

Electrical maintenance testing tasks shall be identified as one of the following category types:

(1) Category 1 — Online standard test

(2) Category 1A — Online enhanced test

(3) Category 2 — Offline standard test

(4) Category 2A — Offline enhanced test

WARNING: Testing of electrical equipment while it is connected to the source of supply introduces additional hazards to the worker. Workers should understand the hazards and risks of the test being performed. ~~Refer to Chapter~~ 4 ~~.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 14:40:59 EDT 2022

Committee Statement

Committee Statement: The phrase “Refer to Chapter 4” is removed from the warning message. The message is clear as modified and inclusion of this additional phrase is not necessary.

Response Message: SR-51-NFPA 70B-2022

Public Comment No. 729-NFPA 70B-2022 [Section No. 8.4]

Second Revision No. 52-NFPA 70B-2022 [Section No. 8.6]

8.5 Test Equipment and Tools .

8.5.1

The test equipment shall be maintained in satisfactory mechanical and electrical condition.

8.5.2

The test equipment shall be applied in accordance with the manufacturer's specifications.

8.5.3*

Test equipment that provides measurements shall be calibrated.

8.5.4

~~Dated calibration labels~~ Calibration information shall be ~~visible on~~ readily available for all test equipment.

8.5.5

~~The~~ Test equipment calibration intervals shall be appropriate to ensure the accuracy of the test instrument with consideration for the conditions of use.

8.5.6

Proper tools, instruments, and other test equipment shall be used when performing maintenance activities.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 14:44:28 EDT 2022

Committee Statement

Committee Statement: For completeness the title of Section 8.6 is updated to reflect the inclusion of tools that may be required when performing maintenance activities.

Section 8.6.4 is reworded to allow alternative methods for having ready access to calibration information. Labels are the most common method to accomplish this.

The previous 4.2.6 is more correctly located in Section 8.6.

Response Message: SR-52-NFPA 70B-2022

Public Comment No. 251-NFPA 70B-2022 [Section No. 8.6.5]

Public Comment No. 232-NFPA 70B-2022 [Section No. 8.6]

Public Comment No. 250-NFPA 70B-2022 [Section No. 8.6.4]

Second Revision No. 53-NFPA 70B-2022 [Section No. 8.7.2]

8.6.2

Test records shall contain the following minimum information:

(1) Identification of the testing person and organization

(2) Identification of the equipment under test

(3) Nameplate or label data from the equipment under test

(4) Environmental conditions, such as humidity and temperature, that could affect the results of the tests or calibrations

~~Identification and calibration date(s) of test equipment~~

(5) Date~~(s)~~ of the test~~(s)~~

(6) Indication of test~~(s)~~ performed

(7) Indication of pass/fail criteria, where applicable

(8) Indication of as-found and as-left test result~~(s)~~ s, where applicable

(9) Test operator's comments or recommendations, where applicable

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 15:02:09 EDT 2022

Committee Statement

Committee Statement: Section 8.7.2 is edited for clarity. The phrase "or label" is added to 8.7.2(3) to accommodate electrical equipment that may not include a traditional nameplate, such as power cables.

Response Message: SR-53-NFPA 70B-2022

Public Comment No. 252-NFPA 70B-2022 [Section No. 8.7.2]

Second Revision No. 54-NFPA 70B-2022 [Sections 8.8.2, 8.8.3]

~~8.7.2~~

~~Condition of maintenance as required by 8.8.1~~

~~Date of test or calibration~~

~~Person or organization who performed the testing or calibration~~

~~8.7.3~~

~~The owner or responsible party of the failed unit shall be notified of the nonserviceable condition of the electrical equipment or device.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 15:10:15 EDT 2022

Committee Statement

Committee Statement: Sections 8.8.2 and 8.8.3 are redundant and not necessary.

Response Message: SR-54-NFPA 70B-2022

Public Comment No. 730-NFPA 70B-2022 [Sections 8.8.2, 8.8.3]

Public Comment No. 256-NFPA 70B-2022 [Section No. 8.8.3]

Public Comment No. 9-NFPA 70B-2021 [Section No. 8.8.3]

Public Comment No. 255-NFPA 70B-2022 [Section No. 8.8]

Second Revision No. 57-NFPA 70B-2022 [Section No. 9.1.1]

10.1.1

~~Electrical maintenance documentation shall~~ Documentation shall be readily available to identify the classification, group, ~~and~~ temperature code specification, ~~the~~ and extent of the classified area~~, and the equipment maintenance required~~ .

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 16:25:52 EDT 2022

Committee Statement

Committee Statement: The changes to the text improve clarity.

Response Message: SR-57-NFPA 70B-2022

Public Comment No. 399-NFPA 70B-2022 [Section No. 9.1.1]

Second Revision No. 58-NFPA 70B-2022 [Section No. 9.3]

10.3 Elimination of Hazardous Atmospheres.

For maintenance involving permanent electrical installations, the following procedures shall be followed:

(1) ~~Any sources of hazardous~~ Hazardous vapors, dust, or flyings shall be removed from the area.

(2) Enclosed or trapped hazardous vapors shall be cleared.

(3) Atmosphere shall be tested to confirm it is within safe limits for the required maintenance.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 16:29:51 EDT 2022

Committee Statement

Committee Statement: Removal of “any sources of” clarifies the intent.

Response Message: SR-58-NFPA 70B-2022

Public Comment No. 409-NFPA 70B-2022 [Section No. 9.3]

Second Revision No. 59-NFPA 70B-2022 [Section No. 9.5.1]

10.5.1

Electrical equipment designed for use in hazardous (classified) locations shall be fully reassembled with original components or approved replacement components before the hazardous atmosphere is reintroduced ~~and before power is restored~~ .

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 16:32:19 EDT 2022

Committee Statement

Committee Statement: Removal of “and before power is restored” from 9.5.1 improves the intent of 9.5.1.

Response Message: SR-59-NFPA 70B-2022 No change to 9.4.1, establishing an ESWC and removing ignition sources is important and should not be deleted.

Public Comment No. 412-NFPA 70B-2022 [Sections 9.4, 9.5]

Second Revision No. 60-NFPA 70B-2022 [Section No. 9.7 [Excluding any Sub-Sections]]

Where bolts or screws used to secure an electrical equipment cover require torqueing to meet ~~operating~~ installation specifications, the bolts or screws shall be maintained with the ~~proper~~ torque ~~as~~ specified by the manufacturer.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 16:33:53 EDT 2022

Committee Statement

Committee Statement: The word “installation” versus “operating” improves the clarity of the section. The word “proper” is removed as it is not needed.

Response Message: SR-60-NFPA 70B-2022

Public Comment No. 413-NFPA 70B-2022 [Section No. 9.7 [Excluding any Sub-Sections]]

Second Revision No. 356-NFPA 70B-2022 [Section No. 9.7.1]

~~**9.7.1**~~

~~Electrical equipment shall not be energized when any such bolts or screws are missing.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Fri May 20 14:30:59 EDT 2022

Committee Statement

Committee Statement: Removal of 9.7.1 is appropriate, as it is not applicable in this section.

Response Message: SR-356-NFPA 70B-2022

Public Comment No. 414-NFPA 70B-2022 [Section No. 9.7]

Second Revision No. 62-NFPA 70B-2022 [Section No. 9.10]

~~**9.10***~~ ~~Equipment and Facility Maintenance.~~

~~Equipment and facilities in which hazardous (classified) locations exist shall be maintained in a way that does not compromise safety or equipment performance.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 16:52:54 EDT 2022

Committee Statement

Committee Statement: Section 9.10 is a generic statement and not necessary for this section of the document.

Response Message: SR-62-NFPA 70B-2022

Public Comment No. 405-NFPA 70B-2022 [Section No. 9.10]

Second Revision No. 201-NFPA 70B-2022 [Sections 10.1.1, 10.1.2]

9.2 Frequency of Maintenance.

9.2.1*

~~Manufacturer's~~ The manufacturer's recommendations shall be followed for each of the maintenance scopes specified in this standard for the required intervals.

Detail SR-187

9.2.2*

Where the manufacturer's recommendations are not provided, or available and failure, breakdown, or malfunction of the equipment will present an unacceptable risk for personnel or the environment, equipment maintenance shall be performed at not greater the intervals specified in Table 9.2.2, in accordance with the equipment condition assessment in Section 9.2, and as modified by the other parts of this chapter .

Table 10.1.2.1 Maintenance Intervals

-	-	Equipment Condition Assessment			-
Product	Scope of Work	Condition 1	Condition 2	Condition 3	Reference
All equipment	Infrared thermography	12 months	12 months	6 months	11.17
Molded-case/insulated case circuit breakers	Mechanical operation cycling	60 months	36 months	12 months	17.1
	Visual inspection	12 months	12 months	6 months	17.8
	Maintenance and testing	60 months	36 months	12 months	17.9, 11.10
Power circuit breakers	Mechanical operation cycling	60 months	36 months	12 months	17.1
	Visual inspection	12 months	12 months	6 months	17.8
	Maintenance and testing	60 months	36 months	12 months	17.9, 11.10
Fuses, 1000 volts or less	Visual inspection	12 months	12 months	6 months	AN
	Maintenance and testing	60 months	36 months	12 months	AN
Fuses, greater than 1000 volts	Visual inspection	12 months	12 months	6 months	AN
	Maintenance and testing	60 months	36 months	12 months	AN
Medium-voltage circuit breakers, air — magnetic	Mechanical operation cycling	60 months	36 months	12 months	AN
	Visual inspection	12 months	12 months	6 months	AN
	Maintenance and testing	60 months	36 months	12 months	AN
Medium-voltage circuit breakers, vacuum	Mechanical operation cycling	60 months	36 months	12 months	AN
	Visual inspection	12 months	12 months	6 months	AN
	Maintenance and testing	60 months	36 months	12 months	AN
Medium-voltage circuit breakers, oil	Mechanical operation cycling	60 months	36 months	12 months	AN
	Oil dielectric breakdown test	12 months	12 months	12 months	AN
	Visual inspection	12 months	12 months	6 months	AN
	Maintenance and testing	60 months	36 months	12 months	AN
Medium-voltage interrupter switches	Mechanical operation cycling	60 months	36 months	12 months	AN
	Visual inspection	12 months	12 months	6 months	AN
	Maintenance and testing	60 months	36 months	12 months	AN
High-voltage	Visual inspection	12 months	12 months	6 months	15.1.2.1

Product	Scope of Work	Equipment Condition Assessment			Reference
		Condition 1	Condition 2	Condition 3	
substation insulators	Corona detection	12 months	6 months	4 months	15.1.2.2
	Maintenance and testing	60 months	36 months	12 months	11.9
High-voltage substation conductors	Visual inspection	12 months	12 months	6 months	15.1.3
	Mechanical checks	60 months	36 months	12 months	15.1.3
High-voltage substation air disconnecting switches	Visual inspection	12 months	12 months	6 months	15.1.4.3
	Mechanical checks	60 months	36 months	12 months	15.1.4.3
High-voltage substation grounding equipment	Visual inspection	12 months	12 months	6 months	15.1.5
	Mechanical checks	36 months	24 months	12 months	15.1.5
	Maintenance and testing	60 months	36 months	12 months	11.13.1, 11.13.2, 11.13.3
High-voltage substation enclosures	Security/operation check	6 months	3 months	1 month	15.1.6
Switchgear assemblies	Security/operational check	6 months	6 months	1 month	15.2.5
	Enclosure visual inspection	6 months	3 months	1 month	15.2.6 through 15.2.7.2
	Ventilation visual inspection	6 months	3 months	1 month	15.2.9
	Space heater operational check	12 months	12 months	6 months	15.2.8
	Maintenance and testing	60 months	36 months	12 months	11.9
Surge arresters	Visual inspection	12 months	6 months	3 months	15.9.2.1
	Maintenance and testing	60 months	36 months	12 months	15.9.2.2
Capacitors	Visual inspection	6 months	6 months	3 months	15.8.3.4
	Maintenance and testing	60 months	36 months	12 months	15.9.3.3
Batteries and chargers	Visual inspection/clean	1 month	1 month	1 month	15.9.4.4 through 15.9.4.4.13
	Check connection resistance	12 months	12 months	6 months	11.14.2.4, 15.9.4.4.12
	Pilot cell measurements	1 month	1 month	1 month	11.14.2.2
	All lead–acid cell-specific gravity	3 months	3 months	3 months	11.14.2.1
	Capacity test	60 months	36 months	12 months	11.14.2.3
Protective relays, electromechanical	Maintenance and testing	36 months	24 months	12 months	15.9.7.3, 11.12

Product	Scope of Work	Equipment Condition Assessment			Reference
		Condition 1	Condition 2	Condition 3	
Protective relays, solid state	Maintenance and testing	36 months	36 months	12 months	15.9.7.3, 11.12
Supervisory control and data acquisition electrical/electronic systems	Lamp test/verify indicators	6 months	1 month	1 month	12.14.11.1, 12.14.11.2
	Inspect enclosures for dirt, heat, water	6 months	1 month	1 month	8.7.1, Table L.1
	Physically exercise valves and actuators	12 months	6 months	3 months	AN
	Actuate switches	12 months	6 months	3 months	AN
	Run PLC diagnostics	12 months	6 months	3 months	22.4.4
	Calibrate sensors and transmitters	12 months	12 months	6 months	11.7
	Calibrate actuators	12 months	12 months	6 months	11.7
	Calibrate meters	12 months	12 months	6 months	AN
	Test batteries	12 months	6 months	3 months	15.9.4.6
	Test automatic control sequences	12 months	12 months	6 months	AN
	Verify alarms	12 months	12 months	6 months	15.9.6.1, 12.4.11, 15.9.6
Supervisory control and data acquisition pneumatic system/components	Check regulators and filters	6 months	1 month	1 month	AN
	Inspect tubing and piping	6 months	1 month	1 month	AN
	Actuate pressure switches	12 months	6 months	3 months	AN
	Physically exercise valves and actuators	12 months	6 months	3 months	AN
	Calibrate switches and sensors	12 months	12 months	6 months	AN
	Calibrate pressure gauges	12 months	12 months	6 months	AN
	Calibrate thermometers	12 months	12 months	6 months	AN
Power and distribution transformers, liquid-filled	Current and voltage readings	1 month	1 month	weekly	21.2.2.2, 21.2.3
	Temperature readings	1 month	1 month	weekly	21.2.4
	Liquid level check	1 month	1 month	weekly	21.2.5.1
	Pressure/vacuum gauge readings	1 month	1 month	weekly	21.2.5.2
	Liquid analysis	12 months	12 months	6 months	21.2.8
	Comprehensive liquid tests	12 months	12 months	6 months	11.11.9, 11.19
	Maintenance and testing	60 months	36 months	12 months	21.2.9, 11.11.2
	Fault gas analysis	12 months	12 months	6 months	21.2.9, 11.11.9

Product	Scope of Work	Equipment Condition Assessment			Reference
		Condition 1	Condition 2	Condition 3	
	Dissolved-gas-in-oil analysis	12 months	12 months	6 months	11.11.10
Power and distribution transformers, dry-type, air-cooled	Maintenance and testing	60 months	36 months	12 months	11.9, 11.11.2
Power cables	Visual inspection	36 months	12 months	6 months	19.2
	Maintenance and testing	60 months	36 months	12 months	19.5, 11.9.2.4
Motor control equipment	Enclosures visual inspection/clean	12 months	12 months	6 months	16.2.1 through 16.3.5
	Busbar, wiring, and terminal connections — check connections for tightness	36 months	24 months	12 months	16.4.2
	Busbar, wiring, and terminal connections — visual inspection of insulators	24 months	12 months	6 months	16.4.4
	Busbar, wiring, and terminal connections — visual inspection of wiring	24 months	12 months	6 months	16.4.5
	Busbar, wiring, and terminal connections — electrical tests	36 months	24 months	12 months	11.9.2.3
	Disconnects visual inspection/clean	24 months	12 months	6 months	16.5.3
	Disconnects operation check	24 months	12 months	6 months	16.5.5
	Contactors visual inspection/clean	24 months	12 months	6 months	16.8.2.1 through 16.8.3
	Motor overload relays (thermal) cleaning, calibration, and function tests	36 months	24 months	12 months	16.9.4
	Motor overload relays (electronic) cleaning, calibration, and function tests	36 months	36 months	12 months	16.9.1.3, 16.9.2
	Electrical interlock inspection	24 months	12 months	6 months	16.11.1.2
	Mechanical interlock inspection	24 months	12 months	6 months	16.11.2
Electronic equipment	Inspection	12 months	12 months	6 months	AN
	Cleaning	60 months	36 months	12 months	AN
	Adjustments/calibration	60 months	36 months	12 months	AN

Product	Scope of Work	Equipment Condition Assessment			Reference
		Condition 1	Condition 2	Condition 3	
Rotating equipment	Vibration analysis	12 months	6 months	Continuous	26.7
	Stator and rotor electrical testing	12 months	12 months	6 months	11.2
	Brushes, collector rings, and commutators visual and mechanical inspection	12 months	12 months	6 months	25.4
	Bearings (sleeved) oil level check	1 week	1 week	1 week	25.5
	Bearings (sleeved) drain, flush, and lubricate	12 months	12 months	6 months	AN
	Ball and roller inspection and lubrication	Per manufacturer	Per manufacturer	Per manufacturer	25.5.3
Wiring devices, attachment plugs, cord connector bodies	Inspection	Monthly and when used	Monthly and when used	Monthly and when used	24.2.1 through 24.6
Wiring devices, receptacles	Inspection	Monthly and when used	Monthly and when used	Monthly and when used	24.3.1
	Operation check	Monthly and when used	Monthly and when used	Monthly and when used	24.3.2
Wiring devices, general-use snap switches	Operation check	Monthly and when used	Monthly and when used	Monthly and when used	24.5.2 through 24.5.4
Wiring devices, pin-and-sleeve devices, heavy-duty industrial-type plugs, cord connectors, and receptacles	Inspections, cleaning, and checks	Monthly and when used	Monthly and when used	Monthly and when used	24.8
Portable electric tools	Inspections/cleaning	Monthly and when used	Monthly and when used	Monthly and when used	29.1.3, 29.3.1, 29.3.2
	Lubrication	Per manufacturer	Per manufacturer	Per manufacturer	29.3.3
	Electrical tests	3 months	3 months	3 months	29.7
Low-voltage busway	Visual inspection	12 months	12 months	6 months	20.4.3.2
	Maintenance and testing	60 months	36 months	12 months	20.4.8
Uninterruptible power supplies	Visual inspection	6 months	3 months	1 month	28.3.8
	Routine maintenance	12 months	6 months	3 months	28.3.8
	System tests	36 months	24 months	12 months	28.5
	Battery tests	See scope of work and maintenance	See scope of work and maintenance	See scope of work and maintenance	15.9.4

Product	Scope of Work	Equipment Condition Assessment			Reference
		Condition 1	Condition 2	Condition 3	
		intervals in row "Batteries and Chargers"	intervals in row "Batteries and Chargers"	intervals in row "Batteries and Chargers"	
	Test run, exercise	1 month	1 month	1 month	28.3.5

AN: As necessary.

Table 9.2.2 Maintenance Intervals

Product	Scope of Work	Equipment Condition Assessment		
		Condition 1	Condition 2	Condition 3
All equipment	Infrared thermography	12 months	12 months	6 months
Battery ESSs	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months
	Lubrication		Reserved	
	Mechanical servicing		Reserved	
	Electrical testing	60 months	36 months	12 months
Busways	Visual inspection	60 months	60 months	12 months
	Cleaning	60 months	36 months	12 months
	Lubrication	60 months	36 months	12 months
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
	Special	60 months	36 months	12 months
Cable trays	Visual inspection	12 months	12 months	6 months
	Cleaning	60 months	36 months	12 months
	Lubrication	60 months	36 months	12 months
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
Electric vehicle power transfer systems	Visual inspection	60 months	36 months	12 months
	Mechanical inspection	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
Electronic equipment			Reserved	
Fuses	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months
	Lubrication	60 months	36 months	12 months
	Mechanical servicing	60 months	36 months	12 months

Product	Scope of Work	Equipment Condition Assessment		
		Condition 1	Condition 2	Condition 3
	Electrical testing	60 months	36 months	12 months
GFCIs	Visual inspection	12 months	12 months	6 months
	Cleaning	60 months	36 months	12 months
	Lubrication	60 months	36 months	12 months
	Mechanical servicing		Reserved	
Grounding and bonding	Visual inspection	12 months	12 months	6 months
	Cleaning		Reserved	
	Lubrication		Reserved	
	Mechanical servicing		Reserved	
	Electrical testing	60 months	36 months	36 months
High-voltage substation insulators	Visual inspection	12 months	12 months	6 months
	Corona detection	12 months	6 months	4 months
	Maintenance and testing	60 months	36 months	12 months
Lighting	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months
	Servicing	60 months	36 months	12 months
Lighting control systems			Reserved	
Low-voltage ground-fault protection systems	Visual inspection	12 months	12 months	6 months
	Cleaning	60 months	36 months	12 months
	Lubrication		Reserved	
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
Medium-voltage ground-fault protection systems	Visual inspection	12 months	12 months	6 months
	Cleaning	60 months	36 months	12 months
	Lubrication		Reserved	
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
Medium-voltage power circuit breakers	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months

Product	Scope of Work	Equipment Condition Assessment		
		Condition 1	Condition 2	Condition 3
	Lubrication	60 months	36 months	12 months
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
Molded-case/insulated-case/low-voltage power circuit breakers	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months
	Lubrication	60 months	36 months	12 months
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
Motor control equipment	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months
	Lubrication	60 months	36 months	12 months
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
Panelboards and switchboards	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months
	Lubrication	60 months	36 months	12 months
	Mechanical inspections	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
Photovoltaic systems	Visual inspection	60 months	36 months	12 months
	Cleaning		Reserved	
	Lubrication		Reserved	
	Mechanical servicing		Reserved	
	Electrical testing	60 months	36 months	12 months
Portable electrical tools and equipment	Visual inspection	Before each use	Before each use	Before each use
	Cleaning	Before each use	Before each use	Before each use
	Lubrication	In accordance with the manufacturer's instructions	In accordance with the manufacturer's instructions	In accordance with the manufacturer's instructions
	Mechanical servicing	In accordance with the manufacturer's instructions	In accordance with the manufacturer's instructions	In accordance with the manufacturer's instructions

Product	Scope of Work	Equipment Condition Assessment		
		Condition 1	Condition 2	Condition 3
	Electrical testing	3 months	3 months	3 months
Power and distribution transformers	Visual inspection	12 months	12 months	6 months
	Cleaning	60 months	36 months	12 months
	Lubrication		Reserved	
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
Power cables	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months
	Mechanical servicing	Reserved	Reserved	
	Electrical testing	60 months	36 months	12 months
Power-factor correction capacitors	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months
	Lubrication		Reserved	
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
	Special		Reserved	
Protective relays, electromechanical	Visual inspection	36 months	24 months	12 months
	Cleaning	36 months	24 months	12 months
	Lubrication		Reserved	
	Mechanical servicing	36 months	24 months	12 months
	Electrical testing	36 months	24 months	12 months
Protective relays, solid state and microprocessor	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months
	Lubrication		Reserved	
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
Public pools, fountains, and similar installations			Reserved	
Rotating equipment	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months
	Lubrication	60 months	36 months	12 months

Product	Scope of Work	Equipment Condition Assessment		
		Condition 1	Condition 2	Condition 3
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
Stationary standby batteries	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months
	Mechanical servicing		Reserved	
	Electrical testing	60 months	36 months	12 months
Substations	Visual inspection	12 months	12 months	6 months
	Cleaning	60 months	36 months	12 months
	Lubrication	60 months	36 months	12 months
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
	Special	60 months	36 months	12 months
	Mechanical checks	60 months	36 months	12 months
Switches	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months
	Lubrication	60 months	36 months	12 months
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
Switchgear	Visual inspection	12 months	12 months	6 months
	Cleaning	60 months	36 months	12 months
	Lubrication	60 months	36 months	12 months
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
	Special	60 months	36 months	12 months
Uninterruptible power supplies	Visual inspection	6 months	3 months	1 month
	Cleaning	12 months	6 months	3 months
	Lubrication		Reserved	
	Mechanical servicing	12 months	6 months	3 months
	Electrical testing	12 months	6 months	3 months
	Special procedures	24 months	24 months	24 months
Wind power electric systems	Visual inspection	60 months	36 months	12 months
	Cleaning	60 months	36 months	12 months
	Lubrication		Reserved	

Product	Scope of Work	Equipment Condition Assessment		
		Condition 1	Condition 2	Condition 3
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months
Wiring devices	Visual inspection	12 months	3 months	1 month
	Cleaning	60 months	36 months	12 months
	Lubrication		Reserved	
	Mechanical servicing	60 months	36 months	12 months
	Electrical testing	60 months	36 months	12 months

A.9.2.2

For more information on risk management, see ISO 31000, *Risk Management — Principles and Guidelines* , and Annex F of NFPA *70E* .

9.2.2.1

The intervals in Table 9.2.2 shall only be required if referenced by a specific section in another chapter.

9.2.2.2

The maintenance interval for electrical equipment shall be permitted to be altered based on the potential risk to personnel or facility operations due to a failure of the equipment to operate as expected.

9.2.2.3

Any deviations from the maintenance intervals described in Table 9.2.2 to extend the maintenance interval and the justification for the deviation shall be documented in the EMP.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon May 02 16:20:38 EDT 2022

Committee Statement

Committee Statement: With the addition of a scope for Chapter 10 under a separate revision, the frequency-of-maintenance requirements is put on the same section “level”.

Language permitting the change of the maintenance intervals for equipment that does not pose an unacceptable risk to personnel or the environment in Table 10.1.2.1 has been added. The existing language excluded the maintenance frequency modifications permitted by 10.1.2.2. to 10.1.4.2. This adds language that permits the modification of the maintenance frequencies as permitted throughout Chapter 10.

Response Message: SR-201-NFPA 70B-2022

Public Comment No. 553-NFPA 70B-2022 [Chapter 10]

Public Comment No. 555-NFPA 70B-2022 [Section No. 10.1.2.1]

Second Revision No. 184-NFPA 70B-2022 [Section No. 10.1.4]

9.1.2 Maintenance Frequency Modifications.

9.1.2.1

Once the initial frequency for inspection and tests has been established based on the intervals listed in Table 9.2.2 and the equipment condition assessment , this frequency shall be adhered to for at least ~~four~~ two maintenance cycles unless unexpected failures occur.

9.1.2.1.1

For equipment that has unexpected failures, the ~~interval between inspections shall be immediately reduced by 50 percent~~ cause of the failure shall be used to determine if the maintenance interval for the equipment needs to be increased .

9.1.2.1.2*

If more than two inspections are completed without requiring additional service, the equipment owner shall be permitted to resume the original inspection period.

9.1.2.2

If more than two inspections are completed without detecting equipment problems, the maintenance cycle shall be permitted to be decreased to longer intervals than listed in Table 9.2.2 .

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 17:55:46 EDT 2022

Committee Statement

Committee Statement: A title was added to Section 10.1.4 to clearly indicate that this section is about modifications to the maintenance frequency.

The requirement to wait four maintenance cycles is too long. The number of maintenance cycles is reduced from four to two because four cycles in some cases could span the entire life of the equipment.

The requirement to immediately reduce the interval between inspections by 50% based on an unexpected failure is modified. For some failures, the 50% increase in inspection is not required to address the cause of the equipment failure. The reason for the failure should be used to determine the need for the change in maintenance frequency.

The item concerning returning to the original maintenance cycle is revised to make it clear the topic of that cycle change is the equipment that had failed. The section is also numbered to tie the new 10.1.4.1.1 and 10.1.4.1.2 together.

The new section allows a maintenance interval longer than what is shown in the table based on the results of the maintenance testing.

Response Message: SR-184-NFPA 70B-2022

Public Comment No. 732-NFPA 70B-2022 [Section No. 10.1.4]

Public Comment No. 556-NFPA 70B-2022 [Section No. 10.1.4]

Public Comment No. 557-NFPA 70B-2022 [Section No. A.10.1.4.2]

Second Revision No. 185-NFPA 70B-2022 [Sections 10.2.1, 10.2.2, 10.2.3]

9.3.1 ~~Electrical Equipment~~ Physical Condition of Electrical Equipment .

~~Electrical equipment~~ Equipment that is included in the electrical EMP shall be assessed for current equipment condition in accordance with 9.3.1.1 through 9.3.1.3.

9.3.1.1

Equipment Physical Condition 1 shall be ~~permitted to be~~ assigned where all the following criteria apply:

(1) The equipment appears in like new condition.

(2) The enclosure is clean, ~~dry,~~ free from moisture intrusion, and tight.

~~The equipment type is suitable for the environmental conditions.~~

~~The equipment is not subjected to harsh chemicals, contaminants, or extreme operating conditions.~~

(3) No unaddressed notification from the continuous monitoring system has occurred.

(4) There are no active recommendations from predictive techniques.

(5) Previous maintenance has been performed in accordance with the EMP.

9.3.1.2

Equipment Physical Condition 2 shall be assigned where ~~any~~ all of 9.3.1.1 apply, and where any of the following criteria apply:

~~The enclosure appears to be deteriorated due to age, use, or abuse.~~

~~There is evidence of prior arcing or overheating.~~

~~There is loose or bound equipment parts.~~

~~There is visible damage.~~

~~There are unused openings.~~

~~There is evidence of corrosion or deterioration.~~

~~There is visible insulation degradation.~~

~~There is build-up of contaminants, dust, or debris.~~

(1) Maintenance results deviate from past results or have indicated more frequent maintenance in accordance with manufacturer's published data.

(2) The previous maintenance cycle has revealed issues requiring the repair or replacement of major equipment components.

(3) There ~~has~~ have been ~~unaddressed~~ notifications from the continuous monitoring system since the prior assessment .

(4) There are active recommendations from predictive techniques.

9.3.1.3

Equipment Physical Condition 3 shall be assigned where changes in operation are noted or where any of the following criteria applies:

(1) ~~There is evidence of active arcing or overheating~~ The equipment has missed the last two successive maintenance cycles in accordance with the EMP .

(2) ~~There is evidence of severe corrosion or deterioration~~ The previous two maintenance cycles have revealed issues requiring the repair or replacement of major equipment components .

(3) There is an active or unaddressed notification from the continuous monitoring system.

(4) There are urgent actions identified from predictive techniques.

9.3.1.4 Nonserviceable Equipment.

9.3.1.4.1

Equipment that poses an imminent risk of injury or negative health effects to personnel shall be designated as nonserviceable in accordance with 8.7.1.3 .

9.3.1.4.2

Access to nonserviceable equipment by unqualified persons shall be restricted.

9.3.1.5 Nonconforming Equipment.

Equipment exhibiting characteristics that do not conform to any of the above conditions shall be identified as requiring corrective measures before returning it to a normal operating condition.

9.3.2* Criticality Condition of Equipment .

9.3.2.1*

~~The criticality of equipment shall be evaluated based on the threat to personnel safety, environmental impact, and damage to other equipment~~ Criticality Condition 1 or Criticality Condition 2 shall be permitted to be assigned where the failure of the equipment or system will not endanger personnel .

9.3.2.2

~~The owner or their designee shall determine what is a low, moderate, and high value for equipment damage and what is minimal or moderate for compromising operational continuity.~~ Criticality Condition 3 shall be assigned where the failure of the equipment or system will endanger personnel.

~~**10.3.2.3**~~

~~Equipment shall be considered Criticality Condition 1 if its failure to operate normally and under complete control will do all of the following:~~

~~Not pose a serious threat to personnel safety or the environment~~

~~Create only low damage~~

~~Minimally compromise operational continuity~~

~~**10.3.2.4**~~

~~Equipment shall be considered Criticality Condition 2 if its failure to operate normally and under complete control will do any of the following:~~

~~Not pose a serious threat to personnel safety or the environment~~

~~Create only moderate damage~~

~~Moderately compromise operational continuity~~

~~**10.3.2.5**~~

~~Equipment shall be considered Criticality Condition 3 if any of the following conditions exist:~~

~~The equipment or component is necessary for the safe shut down of the system, in the event of an emergency, to avoid catastrophe.~~

~~The equipment or component monitors the process and automatically shuts down equipment or takes other action necessary to prevent catastrophe.~~

~~Failure of the equipment to operate normally and under complete control will do any of the following:~~

~~Pose a serious threat to personnel safety or the environment~~

~~Create high-value damage~~

~~Compromise operational continuity~~

9.3.3 Operating Environment Condition of Equipment .

9.3.3.1

Operating Environment Condition 1 or Operating Environment Condition 2 shall be permitted to be assigned where the equipment is used in an operating environment for which it is rated. ~~Equipment shall be considered Operating Environment Condition 1 when all the following criteria are met:~~

~~The air is clean or filtered to remove dust, harmful vapor, excess moisture, and other contaminants.~~

~~The temperature is maintained between 15°C (60°F) and 29°C (85°F).~~

~~The relative humidity is maintained between 40 percent and 70 percent.~~

9.3.3.2

Operating Environment Condition 3 shall be assigned where the equipment is used in an environment with harsh chemicals, contaminants, or extreme operating conditions for which it is not specifically rated or evaluated. ~~Equipment shall be considered Operating Environment Condition 2 when both the following criteria are met:~~

~~The space is not climate controlled.~~

~~The equipment is in a properly rated enclosure for the environmental conditions or is designed for weather exposure.~~

~~**9.3.3.3***~~

~~Equipment shall be considered Operating Environment Condition 3 when the equipment is exposed to salt air, sulfur, extreme temperature, high levels of atmospheric moisture (noncondensing), excessive dust, dripping water, airborne particulates, or other similar conditions.~~

~~**A.9.3.3.3**~~

~~Where possible, both the electrical apparatus and its protective equipment should be located within the same ambient temperature. Where the ambient temperature difference between equipment and its protective device is extreme, compensation in the protective equipment should be made.~~

Supplemental Information

File Name	Description	Approved
SR_185_Sections_10.2.1_thru_10.2.3.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 18:46:56 EDT 2022

Committee Statement

Committee Statement: Section 10.2.1 is modified to clarify that the section is about the physical condition of the equipment. The criteria for assigning equipment condition have been modified so that potentially dangerous equipment conditions that need prompt attention do not end up in a maintenance cycle. The condition of specific parts of equipment is addressed in the individual equipment chapter maintenance requirements, so having them also in 10.2.1 was redundant.

A new requirement at Section 10.2.1.4 directs the user to address equipment that is in a dangerous operating condition and restrict access to it for the sake of personnel safety.

A new requirement at Section 10.2.1.5 directs the user to perform corrective measures on equipment that does not confirm to any of the three equipment physical conditions.

Section 10.2.2 has been modified to allow the user to determine the criticality of the equipment in their facility and tie it back to their maintenance cycle determination. It also clarifies that condition 3 shall be assigned when there is risk of equipment creating a hazard in the case of failure.

Section 10.2.3 has been modified to allow the user to assign an operating condition level based on the environmental operating condition. It clarifies that equipment that operates in environments for which the equipment is not specifically designed shall be assigned condition 3.

Response Message: SR-185-NFPA 70B-2022 RESPONSE TO PC 14: The specific changes in the PC have been rejected because Section 10.2 is being modified to require that equipment in a potentially dangerous operating condition be addressed as soon as possible. The PC sought to address this condition as well, but Section 10.2 has been modified in a way different than what was shown in the comment.

Public Comment No. 733-NFPA 70B-2022 [Section No. 10.2.2]

Public Comment No. 559-NFPA 70B-2022 [Section No. 10.2.1.1]

Public Comment No. 574-NFPA 70B-2022 [Section No. 10.2]

Public Comment No. 562-NFPA 70B-2022 [Section No. 10.2.1.1]

Public Comment No. 15-NFPA 70B-2021 [Section No. 10.2.1 [Excluding any Sub-Sections]]

Public Comment No. 14-NFPA 70B-2021 [Sections 10.2.1.1, 10.2.1.2, 10.2.1.3]

Public Comment No. 734-NFPA 70B-2022 [Section No. 10.2.3]

Second Revision No. 320-NFPA 70B-2022 [Section No. 10.2.4]

~~**10.3.4** Load Condition.~~

~~**10.3.4.1***~~

~~The load condition of electrical equipment shall be considered when determining the appropriate basis for maintenance intervals.~~

~~**A.10.2.4.1**~~

~~The five most common types of duty are the following:~~

- ~~Continuous duty (see 3.3.15.1)~~
- ~~Intermittent duty (see 3.3.15.2)~~
- ~~Periodic duty (see 3.3.15.3)~~
- ~~Short-time duty (see 3.3.15.4)~~
- ~~Varying duty (see 3.3.15.5)~~

~~Some devices used to measure duty are running-time meters (to measure total "on" or "use" time), counters to measure number of starts and stops (load-on and load-off) and rest periods, and recording ammeters to graphically record load and no-load conditions. These devices can be applied to any system or equipment and will help to determine and appropriate maintenance interval.~~

~~**10.3.4.2***~~

~~Safety and limit controls shall be periodically inspected, checked, and tested to be certain that they are in reliable operating condition.~~

~~**A.10.2.4.2**~~

~~Safety and limit controls are devices whose sole function is to ensure that values remain within the safe design level of the system.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon May 09 11:05:08 EDT 2022

Committee Statement

Committee Statement: Safety and limit controls are covered in specific equipment chapters. Section 10.2.4 and its related annex do not add clarity or give direction for the establishment of maintenance intervals for equipment.

Response Message: SR-320-NFPA 70B-2022 Response to PC 567 – The proposed revision is not included due to the deletion of 10.2.4.

Public Comment No. 735-NFPA 70B-2022 [Section No. 10.2.4]

Public Comment No. 565-NFPA 70B-2022 [Section No. 10.2.4]

Public Comment No. 567-NFPA 70B-2022 [Sections A.10.2.4.1, A.10.2.4.2]

Public Comment No. 569-NFPA 70B-2022 [Section No. A.10.2.4.1]

Second Revision No. 83-NFPA 70B-2022 [Section No. 11.1.1]

11.1.1

This chapter identifies electrical maintenance requirements for power and distribution transformers ~~included as part of an EMP~~ .

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 11:10:25 EDT 2022

Committee Statement

Committee Statement: The text “included as part of an EMP” is removed for consistency with other chapter language. This language is not necessary as Section 5.2.1 requires that the equipment owner implement and document an overall EMP that directs activity appropriate to the safety and operational risks

Response Message: SR-83-NFPA 70B-2022

Public Comment No. 38-NFPA 70B-2022 [Section No. 11.1.1]

Second Revision No. 89-NFPA 70B-2022 [Section No. 11.2]

11.2 Frequency of Maintenance.

The periodic maintenance procedures specified in Section 11.3 shall be performed in accordance with the frequencies specified in Chapter 9, unless otherwise specified in ~~this chapter~~ Table 11.2 .

Table 11.2 Frequency of Maintenance

	Equipment Condition Assessment			
Scope of Work	**Condition 1**	**Condition 2**	**Condition 3**	**Notes**
Sample insulating fluid and tests	12 months	12 months	6 months	See 11.3.5.

Supplemental Information

File Name	Description	Approved
SR_89_Table_11.2.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 11:43:28 EDT 2022

Committee Statement

Committee Statement: Table 11.2 and associate changes to parent text of 11.2 are necessary as the table item included is to be performed more frequently than the frequencies identified in Chapter 10.

Health of the oil in oil transformers is critical to the life of these products and maintenance intervals here are important to support the goals of this standard. The frequencies recommended here are a bare minimum based on industry practice.

Response Message: SR-89-NFPA 70B-2022

Second Revision No. 84-NFPA 70B-2022 [Section No. 11.3.1]

11.3.1 Visual Inspections.

Transformers shall be visually inspected in accordance with Table 11.3.1.

Table 11.3.1 Transformer Visual Inspections

No.	Task	Dry Type, Air-cooled Cooled		-	Notes
-	-	Small, Windings,	Large, Windings,	-	-
-	-	≤ ≦ 600 Volts,	>600 Volts,	-	-
-	-	≤ ≦ 167 kVA 1-ph,	>167 kVA 1-ph,	-	-
-	-	≤ ≦ 500 kVA 3-ph	>500 kVA 3-ph	Liquid-filled Filled	-
-	-	Test Type*	Test Type*	Test Type*	-
1	Bolted connections resistance.	2	2	2	
2	Cooling devices	NA 2	2	2	
3	Liquid level gauge(s) and alarm(s)	NA	NA	2	
4	Neutral grounding impedance devices	NA 2	2	2	
5	Nitrogen bottle pressure alarm(s) system	NA	NA	2	
6	Percent oxygen in insulating blanket	NA	NA	2A	
7 6	Pressure relief device(s)	NA	NA	2	
8 7	Sudden pressure relay(s)	NA	NA	2	
9 8	Tank over/under pressure gauge and alarms	NA	NA	2	
9	Transformer enclosure	1 or 2	1 or 2	1 or 2	Ensure ventilation and equipment enclosure integrity has not been compromised.

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test, ; Type 1A = online enhanced test, ; Type 2 = offline standard test, ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_84_Table_11.3.1.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 11:14:24 EDT 2022

Committee Statement

Committee Statement: Line 1: The word resistance is being removed as that would be considered an electrical test and not a visual inspection.

Lines 2 and 4 have changed the test type to “2” for the small winding dry type air-cooled transformers. If a small transformer has a cooling system or neutral impedance, then it should be visually checked just like for larger transformers. These technologies are important for safety. Cooling devices are important for integrity of this equipment. They are mechanical and could have a tendency to fail.

Transformers that do not have cooling devices or neutral grounding impedance devices would not be required to have that aspect maintained. Where employed it is important for the transformer.

Line 5: The requirements for nitrogen bottle pressure visual inspections was expanded ot include the entire nitrogen bottle pressure system.

Line 6 is being deleted as percent oxygen is a test and not a visual inspection. This requirement is being moved to a testing section elsewhere in this document.

New Line 9 is being added to include a visual inspection of the transformer enclosure. Some of the inspections can be done externally with the equipment energized. Other inspections (like the air terminal chamber for a liquid filled transformer) should be done with the equipment deenergized hence these visual inspections have been identified as a test type 1 or 2. A note was also added for clarity on what to look for when visual inspections occur.

Response Message: SR-84-NFPA 70B-2022 RESPONSE TO PC 45: Removal of bolted connection resistance was not accepted as a visual inspection of the bolted connection is still possible and is important. RESPONSE TO PC 52: The additions and modifications to item 9 and new item 10 are not necessary as this is already included in this table. Pressure gauge is addressed in the tank over/under pressure gauge.

Public Comment No. 240-NFPA 70B-2022 [Section No. 11.3.1]

Public Comment No. 45-NFPA 70B-2022 [Section No. 11.3.1]

Public Comment No. 52-NFPA 70B-2022 [Section No. 11.3.1]

Public Comment No. 39-NFPA 70B-2022 [Section No. 11.3.1]

Public Comment No. 43-NFPA 70B-2022 [Section No. 11.3.1]

Public Comment No. 47-NFPA 70B-2022 [Section No. 11.3.1]

Public Comment No. 49-NFPA 70B-2022 [Section No. 11.3.1]

Second Revision No. 85-NFPA 70B-2022 [Section No. 11.3.2]

11.3.2 Cleaning. ~~(Reserved)~~

11.3.2.1

Transformers shall be cleaned to remove buildup of accumulated dirt and debris.

11.3.2.2

Transformer bushings and any accessible insulators and conductors shall be wiped clean to remove surface buildup of contaminants.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 11:17:58 EDT 2022

Committee Statement

Committee Statement: This section includes language for the cleaning of transformers. The added text are minimum requirements for removing buildup of accumulated dirt and debris on the surfaces of the transformer as well as bushings and any accessible insulators and conductors. Accumulation of dirt and debris impedes heat loss which can cause degradation of the equipment and early failure.

Response Message: SR-85-NFPA 70B-2022

Public Comment No. 48-NFPA 70B-2022 [Section No. 11.3.2]

Second Revision No. 86-NFPA 70B-2022 [Section No. 11.3.4]

11.3.4 Mechanical Servicing. ~~(Reserved)~~

Transformers shall be mechanically serviced in accordance with Table 11.3.4 .

Table 11.3.4 Transformer Mechanical Servicing

No.	Task	Test Type*			Notes
		Dry Type, Air-Cooled		Liquid-Filled	
		Small, Windings ≤600 V ≤167 kVA 1-ph, ≤500 kVA 3-ph	Large, Windings >600 V >167 kVA 1-ph, >500 kVA 3-ph		
1	Bolted connection	2	2	2	
1A	Verify tightness of accessible bolted electrical connections	2	2	2	
1B	Verify as-left tap connections are as specified	2	2	2	
2	Inspect anchorage, alignment, and grounding	2	2	2	
3	Cooling devices	2	2	2	
4	Transformer enclosures, ventilation filters, and screens inspected and replaced or cleaned, as needed	2	2	NA	
5	Control cabinets connections and cleaning	2	2	2	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test; Type 1A = online enhanced test; Type 2 = offline standard test; Type 2A = offline enhanced test.

Supplemental Information

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SR_86_Table_11.3.4.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 11:20:37 EDT 2022

Committee Statement

Committee Statement: A new table is added for the mechanical servicing of transformers. This table aligns with similar sections for other equipment as well as other areas within this same Chapter. All of the tests are listed as offline standard tests except for Item 4 for liquid filled transformers as ventilation filters and screens are not present on transformers that are cooled using these other liquids.

The items included in this table are for mechanical servicing which differs considerably from a visual inspection.

Response Message: SR-86-NFPA 70B-2022

Public Comment No. 51-NFPA 70B-2022 [Section No. 11.3.4]

Second Revision No. 87-NFPA 70B-2022 [Section No. 11.3.5]

11.3.5* Electrical Testing.

Transformers shall be electrically tested in accordance with Table 11.3.5 ~~and Table 11.3.5(b)~~ .

Table 11.3.5 Transformer Electrical Tests

No.	Task	Dry Type, Air-~~cooled~~ Cooled			Notes
		Small, Windings, ≤ ≦ 600 Volts, ≤ ≦ 167 kVA 1-ph, ≤ ≦ 500 kVA 3-ph	Large, Windings, >600 Volts, >167 kVA 1-ph, >500 kVA 3-ph	Liquid-~~filled~~ Filled	
		Test Type*	Test Type*	Test Type*	
1	Core insulation resistance	NA	2A	2A	
2	Excitation current on each phase	NA	2	2	
3	Insulation power factor	NA	2	2	
4	Insulation power factor tip-up	NA	2A	NA	
5	Main insulation resistance	2	2	2	
6	Neutral grounding impedance devices	NA	2	2	
7	Online partial discharge on MV/HV windings	NA	1A	1A	
8	Insulation power factor on each bushing	NA	NA	2†	
9	Sweep frequency response analysis	NA	NA	2A	
10	Turns ratio on all load tap changer (LTC) taps	NA	NA	2A	
11	Turns ratio on all no-load tap changer (NLTC) taps	2A	2A	2A	
12	Turns ratio on designated tap	2	2	2	
13	Winding resistance at designated tap	~~NA~~ 2A	2A	2	
14	Bolted connection resistance	2	2	2	
15	Applied voltage test	NA	2A	NA	
16	Sample insulating fluid and test for:				
	Dielectric breakdown	NA	NA	1 or 2	
	Acid neutralization number	NA	NA	1 or 2	
	Specific gravity	NA	NA	1 or 2	
	Interfacial tension	NA	NA	1 or 2	
	Color	NA	NA	1 or 2	
	Visual condition	NA	NA	1 or 2	
	Water content	NA	NA	1 or 2	
	Power factor	NA	NA	1 or 2	
	Dissolved gas analysis	NA	NA	1, 1A or 2, 2A	
	Furan analysis	NA	NA	1, 1A or 2, 2A	
17	Sweep frequency response analysis	NA	NA	2A	

No.	Task	Dry Type, Air-cooled Cooled			Notes
		Small, Windings,	Large, Windings,		
		≤ ≤ 600 Volts,	>600 Volts,		
		≤ ≤ 167 kVA 1-ph,	>167 kVA 1-ph,		
		≤ ≤ 500 kVA 3-ph	>500 kVA 3-ph	Liquid-filled Filled	
		Test Type*	Test Type*	Test Type*	
18	Percent oxygen in insulating blanket	NA	NA	2A	
19	Testing of transformer alarms, including temperature, liquid level, nitrogen bottle pressure, tank over/under pressure, sudden pressure	NA	NA	2	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

†Transformers applied at voltages greater than 1000 volts.

~~Table 11.3.5(b) Transformer Enhanced and Special Tests and Inspections~~

~~No.~~	~~Task~~	~~Dry Type, Air-cooled~~	~~Liquid-filled~~	~~Notes~~
		~~> 600 Volts~~		
		~~> 167 kVA 1-ph, > 500 kVA 3-ph~~		
		~~Test Type*~~	~~Test Type*~~	
~~1~~	~~Applied voltage test~~	~~2A~~	~~NA~~	
~~2~~	~~Sample insulating fluid and test for:~~			
	~~Dielectric breakdown~~	~~NA~~	~~1 or 2~~	
	~~Acid neutralization number~~	~~NA~~	~~1 or 2~~	
	~~Specific gravity~~	~~NA~~	~~1A or 2A~~	
	~~Interfacial tension~~	~~NA~~	~~1 or 2~~	
	~~Color~~	~~NA~~	~~1 or 2~~	
	~~Visual condition~~	~~NA~~	~~1 or 2~~	
	~~Water content~~	~~NA~~	~~1 or 2~~	
	~~Power factor~~	~~NA~~	~~1A or 2A~~	
	~~Dissolved gas analysis~~	~~NA~~	~~1 or 2~~	
	~~Furan analysis~~	~~NA~~	~~1A or 2A~~	
~~3~~	~~Sweep frequency response analysis~~	~~NA~~	~~2A~~	

~~NA: Not applicable.~~

~~*Types specified in accordance with Section 8.4, as follows: 1 = online standard test, 1A =~~

~~online enhanced test, 2 = offline standard test, 2A = offline enhanced test.~~

Supplemental Information

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SR_87_Table_11.3.5_a_.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA
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Committee Statement

Committee Statement: Deleted reference to Table 11.3.5(b) as it was deleted and merged into Table 11.3.5(a). Table 11.3.5(a) is now simply Table 11.3.5.

Small winding dry type transformers 600kVA are now included through correction of the language in the heading row of this table.

Line 8: Liquid filled transformers was changed to recognize this test of insulation power factor on each bushing is applicable to some transformers but not all transformers. A note was added for this line item to limit the application of this test. Voltage application of the transformer is the important parameter with regard to how much damage and safety is at stake.

Line 13: Even though the turns ratio test is required, this is an important test to pick up changes that may not be found in one or the other test. One test alone won't always pickup issues found in the other. This is especially true before the short occurs. Bad connections or other impending failure indicators can be found. Small transformers this is not a typical test, but this test could be performed as an optional test as a method used at the discretion of the testing agency. These tests are used to find shorted windings and winding deterioration. Higher resistance values will be seen before it fails. Result will be seen in turns ratio as well. Both the turns ratio and winding resistance tests complement each other. .

New Line 14: A bolted connection resistance test is important to identify termination failures before they occur.

New Lines 15, 16, and 17: Used to be a part of Table 11.3.5(b) as that content was moved into this table and Table 11.3.5(b) is deleted.

New Line 18: Added percent oxygen in insulating blanket as an enhanced test for liquid filled transformers.

New Line 19: "" The testing of alarms was moved from Line 5 of former Table 11.3.5(b) to this table. Transformer temperature alarms are included in the same line item as these are all alarms. The alarms tests are offline standard tests performed and not offline enhanced tests. Temperature alarms on dry type transformers are listed as "NA" because a lot of the dry type transformer sensors are embedded in the coil. These are usually not accessible and not typically performed. By listing this as "NA" it should be noted that if manufacturer instructions require this test it must be performed but if not it is purely optional.

Table 11.3.5(b) is being incorporated into former Table 11.3.5(a) (new Table 11.3.5) to consolidate all of the electrical tests into one location. The title of Table 11.3.5(b) was "Transformer Enhanced and Special Tests and Inspections". This same messaging is

achieved through test types 1A and 2A in the main table. There is no need to have an entire separate table to address these enhanced tests

Response Message: SR-87-NFPA 70B-2022 RESPONSE TO PC 41: Liquid filled test is important so not optional.

Public Comment No. 50-NFPA 70B-2022 [Section No. 11.3.5]

Public Comment No. 44-NFPA 70B-2022 [Section No. 11.3.5]

Public Comment No. 40-NFPA 70B-2022 [Section No. 11.3.5]

Public Comment No. 41-NFPA 70B-2022 [Section No. 11.3.5]

Public Comment No. 46-NFPA 70B-2022 [Section No. 11.3.5]

Public Comment No. 53-NFPA 70B-2022 [Section No. 11.3.5]

Public Comment No. 42-NFPA 70B-2022 [Section No. 11.3.5]

Second Revision No. 90-NFPA 70B-2022 [Section No. 12.1.3]

12.1.2*

This chapter does not address requirements of individual components of substations and switchgear that are addressed in the ~~appropriate chapter(s)~~ chapters for those components.

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Wed Apr 27 13:11:23 EDT 2022

Committee Statement

Committee Statement: Deleted the word appropriate as it is vague and unenforceable.
Response Message: SR-90-NFPA 70B-2022

Second Revision No. 91-NFPA 70B-2022 [Section No. 12.3.1]

12.3.1* Visual Inspection.

Substations and switchgear shall be visually inspected in accordance with Table 12.3.1.

Table 12.3.1 Substation and Switchgear Visual Inspections

No.	Task	1000 Volts or Below Test Type*	Greater than 1000 Volts Test Type*	Notes
1	Inspect external physical condition	1	1	~~Document any signs of deterioration. Correct as necessary to maintain operational integrity.~~ This includes condition and integrity of applied labels.
2	Inspect anchorage and grounding	1	1	Document if anchorage is not appropriate ~~per~~ in accordance with current seismic requirements so improvements can be considered.
3	Ensure maintenance devices and tools are available for equipment servicing	1	1	
4	Verify circuit breakers, fuses, protective relays, and other type of overload elements are the right sizes and types and correspond to the drawings and the ~~coordination study~~ power system studies	1 or 2	1 or 2	Verify against plans, drawings, and pertinent records, as well as against evidence of current load levels. Some devices might be able to be checked while panel doors are closed.
5	For connected communicating addressable devices, verify the device addresses are set in accordance with ~~the drawings and coordination study~~ documentation	1 or 2	1 or 2	Confirm addressing or ~~proper~~ correct device association where protective devices or the human-machine interface (HMI) are connected to multiple devices via a communication network.
6	Verify instrument transformer ratios are correct as installed	2A	2A	
7	Inspect insulators for damage or contaminated surfaces	2	2	
8	Verify air filters or screens are clean and in place	1 or 2	1 or 2	
9	Check all ventilation openings for obstructions and ~~proper~~ correct operation of any flap or automatic cover intended to assist in arc resistant ratings	2	2	
10	Inspect arc resistant equipment to ensure all doors are secured and in place	1 or 2	1 or 2	
~~10~~ 11	Verify switch phase barriers are in place and in good condition	2	2	

No.	Task	1000 Volts or Below Test Type*	Greater than 1000 Volts Test Type*	Notes
~~11~~ 12	For individual components ~~and exposed conductors~~ , refer to the appropriate chapter(s) of this standard	NA	NA	
13	Visually inspect environmental controls, where provided	1 or 2	1 or 2	Includes, but is not limited to, fans, heaters, thermostats and humidity control equipment and settings.

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

A.12.3.1

Insulators and Insulating Supports. Insulators, insulating stand-offs, and insulating supports should be inspected for evidence of contaminated surfaces or physical damage, such as cracked or broken segments. Contaminated surfaces should be cleaned, and damaged components should be replaced. Where insulators and insulating stands-offs are not accessible, dielectric integrity tests should be used to determine the condition of dielectric properties.

Evidence of corona should be documented, and investigation of the root cause and potential for failure should be planned.

All exposed conductors should be visually inspected for evidence of overheating at bolted joints and other connections, as well as for corrosion and evidence of any galvanic or chemical action that could deteriorate a connection. All bolts associated with connections that show evidence of overheating should be examined for integrity and tightness. Torque should be verified in accordance with Chapter 7. Manufacturer's instructions should be followed with respect to torque, method of termination, lubrication, and coatings.

Extreme overheating can discolor copper conductors, deteriorate the insulation, and could require additional maintenance. When the substation is de-energized, these bolted connections should be checked. There are infrared detectors that can be used on energized systems to check for overheating by scanning from a distance. Where aluminum-to-copper joints exist, they should be inspected carefully for evidence of corrosion, overheating, or looseness. In all cases, manufacturer's specifications should be followed.

Enclosures and Rooms. The security of fences and other enclosures and rooms should be checked to ensure against entry of animals or unauthorized personnel. ~~Enclosures & rooms. The security of fences and other enclosures and rooms should be checked to ensure against entry of animals or unauthorized personnel.~~

The gates and doors, especially where equipped with panic hardware, should be checked for security and proper operation.

The enclosed area should not be used for storage of anything other than spare parts or other assemblies needed for operations directly associated with the enclosed equipment. Such parts and assemblies should not be stored within the required working space, except where the room is large and an area has been designated for other equipment without negatively impacting working space or egress or impinging within the arc flash boundary.

Spare parts and operating assemblies stored within the area should be identified. Where applicable, the date of acquisition should be marked, any need for periodic evaluation or maintenance should be appropriately noted and planned, and the equipment should be stored per the manufacturer's recommendations.

Equipment Enclosures and Housings. All enclosures, especially arc-resistant enclosures, provide a degree of protection for nearby personnel. However, that protection is compromised if panel bolts, door latches, or any other type of fastening and cover system is not fully utilized and fully secure. This is especially true for arc-resistant equipment ratings that are used to determine the arc flash PPE requirements and the acceptable operating and maintenance practices.

Equipment enclosures should be inspected for any signs of deterioration, oxidation, impact from environmental factors, looseness or lack of fasteners, lack of proper grounding, or worn surfaces or coatings. Where noted, the as-found condition should be recorded, and proper corrective action should be taken or planned.

All equipment doors and access panels should be inspected to ensure that all hardware is in place and in good condition. Hinges, locks, and latches should be lubricated, if recommended by the manufacturer or as needed.

Screens covering ventilation openings should be determined to be in place to prevent entry of rodents or small animals.

On outdoor assemblies, roof or wall seams should be checked for evidence of leakage, and any leaking seams should be repaired. The base should be checked for openings that could permit water to drain into the interior, and any such openings should be repaired in an

appropriate manner.

Moisture accumulation might occur on internal surfaces of enclosures even if they are weathertight. The source of this moisture could be condensation. Condensation is prevented by heat and air circulation.

All internal surfaces should be examined for signs of previous moisture such as the following:

(1) Droplet depressions or craters on dust-laden surfaces

(2) Excessive oxidation anywhere on the metal housing

(3) Deposits of salts from water or other liquid evaporation

Where ventilators are supplied on enclosures, including metal-enclosed bus enclosures, they should be checked to ensure that they are clear of obstructions and that the air filters are clean and in good condition. Base foundations should be examined to ensure that structural members have not blocked floor ventilation.

All enclosures and housings for circuit breakers (switchgear, switchboards, or other) should be inspected and checked for integrity of all fasteners annually or as indicated in the maintenance plan.

All ventilation openings should be checked for obstructions and proper operation of any flap or automatic cover intended to assist in arc-resistant ratings. (See ANSI/IEEE C37.20.7, *Guide for Testing Switchgear Rated Up to 52 kV for Internal Arcing Faults* .)

Barriers, Insulation, and Insulators. Evidence of corona when the substation is energized should be documented, the root cause investigated, and the potential for failure planned.

Insulating or isolating barriers between compartments should be examined for signs of wear or looseness.

Grounded metal barriers around compartments and conductors should be examined for integrity and looseness. When barriers surround a power conductor, the barrier should be examined to ensure that the metal around the conductor is not continuous, creating eddy currents that can lead to losses and potential fire hazards.

The following specific areas in which insulation failure is more likely to occur should be inspected where they exist:

(1) Boundaries between two adjoining insulators

(2) Boundaries between an insulating member and the grounded metal structure

(3) Taped or compounded splices or junctions

(4) Bridging paths across insulating surfaces, either phase-to-phase or phase-to-ground

(5) Hidden surfaces such as the adjacent edges between the upper and lower members of split-type bus supports or the edges of a slot through which a busbar protrudes

(6) Edges of insulation surrounding mounting hardware either grounded to the metal structure or floating within the insulating member

Corona. Damage caused by dielectric stress could be evident on the surface of insulating members in the form of corona erosion or markings or tracking paths.

If corona occurs in switchgear assemblies, it is usually localized in thin air gaps that exist between a high-voltage busbar and its adjacent insulation or between two adjacent insulating members. It might form around bolt heads or other sharp projections that are not properly insulated or shielded.

Organic insulating materials, when exposed to corona discharge, initially develop white powdery deposits on their surface. These deposits can be wiped off with solvent. If the surface has not eroded, further maintenance is not required. Prolonged exposure to corona discharge will result in erosion of the surface of the insulating material. In some materials, corona deterioration has the appearance of worm-eaten wood. If the corrosion paths have not progressed to significant depths, surface repair probably can be accomplished.

Manufacturer's recommendations should be followed for such repair.

Tracking. Tracking is an electrical discharge phenomenon caused by electrical stress on insulation. This stress can occur phase-to-phase or phase-to-ground. Tracking, when it occurs in switchgear assemblies, typically is found on insulation surfaces.

Tracking develops in the form of streamers or sputter arcs on the surface of insulation, usually adjacent to electrodes. One or more irregular carbon lines in the shape of tree branches are the most common sign of tracking.

Surface tracking can occur on the surfaces of organic insulation or on contaminated surfaces of inorganic insulation. The signs of tracking on organic materials are eroded surfaces with carbon lines. On track-resistant organic materials, these erosion patterns are essentially free of carbon.

Tracking can propagate from either the voltage terminals or the ground terminal. It does not necessarily progress in a regular pattern or by the shortest possible path.

Tracking conditions on surfaces of inorganic material can be completely removed by cleaning the surfaces, because no actual damage to the material occurs. In the case of organic material, the surface is damaged in varying degrees, depending on the intensity of the electric discharge and the duration of exposure. If the damage is not too severe, it can be repaired by sanding and application of track-resistant varnish in accordance with the manufacturer's instructions. Organic material that has been damaged should be replaced or repaired in accordance with manufacturer's instructions.

Supplemental Information

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Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 13:13:34 EDT 2022

Committee Statement

Committee Statement: Item 1: The note was modified to remove the requirement to document signs of deterioration as it is addressed in Section 5.2.4.2(7). Section 8.7 addresses the test records for documenting signs of deterioration. The note was also modified to include the inspecting of applied labels which is not addressed elsewhere in NFPA 70B.

Item 4: Replaced "coordination studies" with "power system studies" as it is more than just the coordination study that is important when verifying circuit breaker, fuses, protective relays, and other types of overload elements are the right sizes and types. Equipment evaluation studies and others are important as well as the coordination study.

Item 5: Clarity was added to ensure the addressable devices are reviewed that are connected to and communicating on a network. Some devices may have the ability to communicate but are not connected. Verifying the address of that equipment that has the capability of communicating is not a necessary task. The text "the drawings and coordination study" is being removed and replaced with "documentation". Ensuring that connected and communicating addressable devices have their addresses set in accordance with the more generic reference of "documentation" is all encompassing as the addresses of this equipment could be found in many different forms. It would not be appropriate to mandate the communication addresses be located on drawings and/or a coordination study. The term "proper" is being replaced with "correct" as proper is a vague and unenforceable term.

Item 6: Changed to an enhanced test as all equipment may not readily accessible for inspection.

Item 8: The term “screens” was added. In addition to air filters, a screen is common and should be an item that is cleaned and in place. The screen plays an important in keeping larger debris from the filters. In addition, some equipment may have a screen and not a filter. The type is now “1 or 2” instead of just “1” for both 1000 Volts or below and greater than 1000 volts as the visual inspection of filters and screens can be performed online or offline and should be a standard test. Some screens and filters are not accessible with the equipment energized so the category was change to "1 or 2".

Item 9: Replaced the word “proper” with “correct” as the term proper is vague and unenforceable.

New Item 10: Arc resistant equipment is being added because arc resistant equipment must be maintained to ensure the equipment maintains its arc resistant qualities. This addition provides inspection guidance for the doors which are critical to performance.

Item 12 (Former Item 11)): Removed “and exposed conductors” because there are no other chapters that address exposed conductors, and this line item tells the user to go to individual components “and exposed conductors” is addressed in other chapters of this standard.

New Line 13: Environmental controls were added since they were not included in the table, but they play an important role in the integrity of the equipment.

Response Message: SR-91-NFPA 70B-2022 RESPONSE TO PC 148: Adding the suggested change of “communicating” was not accepted as the current language is inclusive of any type of addressable device. The environmental controls additions suggested were not included in this table as they are not visual inspections. These would be considered electrical tests and so are included in Table 12.3.5.

Public Comment No. 59-NFPA 70B-2022 [Section No. 12.3.1]

Public Comment No. 54-NFPA 70B-2022 [Section No. 12.3.1]

Public Comment No. 673-NFPA 70B-2022 [Sections 12.1, 12.2, 12.3]

Public Comment No. 148-NFPA 70B-2022 [Section No. 12.3.1]

Public Comment No. 56-NFPA 70B-2022 [Section No. 12.3.1]

Second Revision No. 92-NFPA 70B-2022 [Section No. 12.3.2]

12.3.2 Cleaning.

~~Bus insulation, cable insulation, terminals or terminations, electrical~~ Electrical equipment surfaces, enclosures, insulating materials, and surrounding areas shall be kept ~~in a clean and contaminant-free state~~ clean to prevent a buildup of contaminants that negatively affect performance, reduce life expectancy, or create a safety hazard .

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 13:20:28 EDT 2022

Committee Statement

Committee Statement: Clarity was added to recognized that some buildup of dust may have no negative impact on the equipment operation.

Response Message: SR-92-NFPA 70B-2022

Public Comment No. 541-NFPA 70B-2022 [Section No. 12.3.2]

Second Revision No. 93-NFPA 70B-2022 [Section No. 12.3.4]

12.3.4* Mechanical Servicing.

Substation and switchgear shall be mechanically serviced in accordance with Table 12.3.4.

Table 12.3.4 Substation and Switchgear Mechanical Servicing

No.	Task	1000 Volts or Below Test Type*	Greater than 1000 Volts Test Type*	Notes
1	Check circuit breakers and switches — mechanical operation	2	2	See manufacturer's instructions, ~~See Chapters 15~~ Chapter 15, and Chapter 17.
2	Check bolted connection resistance	2	2	See Chapter 7.
3	Verify lubrication on moving current-carrying parts and sliding surfaces	2	2	See manufacturer's instructions.
4	Verify mechanical interlock systems for correct sequencing	2	2	
5	Verify mechanical systems for correct sequencing, including shutters, racking mechanisms, and similar	2	2	
~~5~~ 6	Verify mechanical indicating devices are functional	2	2	
~~6~~ 7	Verify filters or screens are clean and in place	1 or 2	1 or 2	Include filters and screens in the room related to the substation or switchgear.
~~7~~ 8	Verify fuse holders provide ~~adequate~~ mechanical support and contact integrity	2	2	
~~8~~ 9	For individual components, refer to the appropriate chapter(s) of this standard	NA	NA	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_93_Table_12.3.4.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 13:24:23 EDT 2022

Committee Statement

Committee Statement: New Item 5: A new item is added to address mechanical systems and sequencing of shutters, racking and similar equipment.

Item 7 (Former Item 6): Screens was added as in addition to air filters a screen is common and should be an item that is cleaned and in place as the screen plays an important in keeping larger debris from the filters. In addition, some equipment may have a screen and not a filter. The type is now “1 or 2” instead of just “1” for both 1000 Volts or below and greater than 1000 volts as the visual inspection of filters and screens can be performed online or offline and should be a standard test. Some screens and filters are not accessible with the equipment energized so the category was change to "1 or 2". A note was added recognizing that screens and filters may be in place directly related to the area around the equipment important for the proper operation of the equipment over time. These should be included and reviewed.

Response Message: SR-93-NFPA 70B-2022 RESPONSE TO PC 149: The word interlock was not removed from Item 4 as it is important for that verification of the mechanical interlock systems for sequencing

Public Comment No. 55-NFPA 70B-2022 [Section No. 12.3.4]

Public Comment No. 149-NFPA 70B-2022 [Section No. 12.3.4]

Second Revision No. 94-NFPA 70B-2022 [Section No. 12.3.5]

12.3.5* Electrical ~~Tests~~ Testing .

Substations and switchgear shall be electrically tested in accordance with Table 12.3.5.

Table 12.3.5 Substation and Switchgear Electrical Tests

No.	Task	1000 Volts or Below Test Type*	Greater than 1000 Volts Test Type*	Notes
1	Inspect electrical connections for high resistance	2	2	See ~~Chapter 7~~ Section 7.2 .
2	Perform ground resistance test	2	2	See ~~Section~~ 20.3.5. Perform point-to-point test to determine the resistance between the main grounding system and substation/switchgear frames, system neutral, or derived neutral points. Perform fall-of-potential or alternative test on the grounding electrode system.
3	Measure insulation resistance	2	2	
4	Measure insulation resistance of control wiring	2A	2A	
5	Test ~~protection~~ protective devices and systems	2	2	~~For circuit breakers, see Chapter 15.~~ ~~For protective relays, see Chapter 35.~~ ~~For fuses, see Chapter 16.~~ ~~For ground-fault protective devices, see Chapter 21.~~ For surge protective devices, surge arresters, and arc-energy reduction systems, see the manufacturer's instructions. ~~For surge arresters, see manufacturer's instructions.~~ ~~For arc-energy reduction systems, see manufacturer's instructions.~~
6	Perform system operational tests	2	2	Include emergency or standby sources of power systems to ensure they are available when needed, automatic throw-overs, paralleling controls, interlock systems, or any other operational or maintenance-related control that might be installed.
7	Perform dielectric withstand test	NA	2A	
8	Perform online partial discharge (PD) survey	NA	1A	

No.	Task	1000 Volts or Below Test Type*	Greater than 1000 Volts Test Type*	Notes
9	~~Test the operation of equipment space heaters and controllers related to the heating system~~ Where environmental controls are provided, check for correct operating condition	1 or 2	1 or 2	Includes, but is not limited to, fans, heaters, thermostats and humidity control equipment and settings.
10	~~Verify~~ Test control power transformers, instrument transformers, and metering ~~are operating correctly~~ to ensure correct operation	1 or 2	1 or 2	
11	Verify operation of communications systems	1 or 2	1 or 2	
12	For ~~other~~ individual components ~~or additional capabilities~~ , refer to the appropriate chapter(s) of this standard ~~or manufacturer's instructions~~	~~1 and 2~~ NA	~~1 and 2~~ NA	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_94_Table_12.3.5.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 13:27:20 EDT 2022

Committee Statement

Committee Statement: This change seeks consistency with other titles for this section in other areas of NFPA 70B. In other sections within this document "ing" is at the end of each.

Table 12.3.5:

Item 1: Added specific reference to Section 7.2 for clarity.

Item 2: Resistance added for consistency with the note.

Item 5: Removed those items that are duplicate to requirements found in other chapters. Leaving those items that are not covered in other chapters. The last line in

the table provides direction to see other chapters for individual component requirements.

Item 9: Added the option to perform this test online. These tests can be performed either online or offline but are still a required test. Replaced existing text with a more generic language of environmental controls.

Item 10: Added the option to perform this test online. These tests can be performed either online or offline but are still a required test. Removed verify as this is a test and made the sentence a complete sentence for testing to ensure correct operation.

Item 11: Added the option to perform this test online. These tests can be performed either online or offline but are still a required test.

Item 12: The language is edited to match the language in other tables to make the language consistent. The inspection type in the table for this item should be NA as the other chapters will drive the inspection types.

Response Message: SR-94-NFPA 70B-2022

Public Comment No. 67-NFPA 70B-2022 [Section No. 12.3.5]

Public Comment No. 60-NFPA 70B-2022 [Section No. 12.3.5]

Public Comment No. 62-NFPA 70B-2022 [Section No. 12.3.5]

Public Comment No. 61-NFPA 70B-2022 [Section No. 12.3.5]

Second Revision No. 96-NFPA 70B-2022 [Section No. 12.3.6.1.2]

12.3.6.1.2

If ~~missing or~~ found to be defective, the dedicated maintenance or operational tools or other test equipment shall be taken out of service, replaced, or repaired, according to the manufacturer's specifications.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 13:49:21 EDT 2022

Committee Statement

Committee Statement: Section 12.3.6.1.2 is revised to remove the words "missing or" as this standard addresses existing miscellaneous equipment that is inspected and if found to be defective must be addressed. Text was added for taking the defective tool out of service as an additional option.

Response Message: SR-96-NFPA 70B-2022

Public Comment No. 63-NFPA 70B-2022 [Section No. 12.3.6.1]

Second Revision No. 97-NFPA 70B-2022 [Section No. 12.3.6.2]

12.3.6.2 Auxiliary Apparatus.

Area lighting, exit and emergency lighting, room HVAC or ventilation systems, and other auxiliary apparatus shall be checked for proper operation.

~~**12.3.6.2.2**~~

~~If found to be defective, the area lighting, exit and emergency lighting, room HVAC or ventilation systems, and other auxiliary apparatus shall be replaced or repaired, according to manufacturer's recommendations.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 13:56:31 EDT 2022

Committee Statement

Committee Statement: Section 12.3.6.2.2 is not necessary. Section 5.2.4.2(7) requires that the EMP include a process to prescribe, implement, and document corrective measures based on collected data.

Response Message: SR-97-NFPA 70B-2022

Public Comment No. 65-NFPA 70B-2022 [Section No. 12.3.6.2]

Second Revision No. 204-NFPA 70B-2022 [Section No. 13.1.1]

13.1.1*

This chapter identifies electrical maintenance requirements for panelboards and switchboards rated 1000 V or below .

A.13.1.1

Panelboards or switchboards are either fuse or circuit breaker type. Where critical circuits are involved, panelboards or switchboards should be appropriately identified by tags, labels, or color coding.

Seldom are panelboards or switchboards de-energized, and then only for circuit changes; it is for those times that electrical maintenance can be scheduled. There is always the possibility of an error or accidental tripping of a main circuit breaker causing an unscheduled shutdown. During operating periods, the panels can be checked only for hot spots or excessive heat. This electrical maintenance should be done at reasonable intervals in accordance with the importance of the circuit. A record should be made of areas that have given trouble; memory should not be relied on.

~~During a shutdown and while the panelboard or switchboard is in an electrically safe work condition, all bolted connections should be checked for tightness and visually inspected for discoloration. Should there be discoloration, further investigation should be made and possibly the parts affected replaced.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon May 02 16:43:25 EDT 2022

Committee Statement

Committee Statement: The tables in this section all refer to equipment rated 1000 V or below. This equipment voltage rating is added to the scope as it applies to all of that which is found in Chapter 13.

The deleted annex paragraph is not necessary in this annex material for 13.1.1. The parent text of 13.1.1 identifies the scope and does not attempt to address the details around maintenance of this equipment. Maintenance requirements for this equipment that includes checking for torque and secure connections are addressed elsewhere. Including this annex material is not complete and could lead to confusion.

Response Message: SR-204-NFPA 70B-2022

Public Comment No. 19-NFPA 70B-2022 [Section No. 13.1.1]

Public Comment No. 32-NFPA 70B-2022 [Section No. A.13.1.1]

Second Revision No. 100-NFPA 70B-2022 [Section No. 13.1.3]

13.1.2*

~~Individual~~ This chapter does not address requirements of individual components of panelboards and switchboards ~~shall be maintained in accordance with the appropriate chapter(s)~~ that are addressed in the chapters for those components.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 14:05:35 EDT 2022

Committee Statement

Committee Statement: Proper text for a scope statement. Existing language was not written correctly and conflicted with text found in the tables as the last item to address components within.

Response Message: SR-100-NFPA 70B-2022

Second Revision No. 101-NFPA 70B-2022 [Section No. 13.3.1]

13.3.1 Visual Inspection.

Panelboards and switchboards shall be visually inspected in accordance with Table 13.3.1.

Table 13.3.1 Panelboard and Switchboard Visual Inspections

No.	Task	~~1000 Volts or Below~~ Test Type*	Notes
1	Inspect external physical condition	1	This includes condition and integrity of applied labels.
2	Inspect anchorage and grounding	1	
3	Verify circuit breakers, fuses, and overload elements are the right sizes and types and correspond to the drawings and ~~the coordination study~~ power system studies	2	
4	For connected communicating addressable devices, verify the device addresses are set in accordance with ~~the drawings and coordination study~~ documentation	2	Confirm addressing or ~~proper~~ correct device association where protective devices or the human machine interface (HMI) are connected to multiple devices via a communication network.
5	Verify instrument transformer ratios are correct	2	
6	Inspect insulators for damage or contaminated surfaces	2	
7	Verify filters are clean and in place	2	
8	Ensure maintenance devices and tools are available for equipment servicing	1	
9	Verify phase barriers are in place	2	
10	Visually inspect environmental controls, where provided	1 or 2	Includes, but is not limited to, fans, heaters, thermostats and humidity control equipment and settings.
11	For individual components, refer to the appropriate chapter(s) of this standard	NA	
~~10~~	~~Visually inspect circuit breakers~~	~~NA~~	~~See Chapter 15.~~
~~11~~	~~Visually inspect switches~~	~~NA~~	~~See Chapter 17.~~

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_101_Table_13.3.1.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 14:07:02 EDT 2022

Committee Statement

Committee Statement: Removed 1000 volts or below from the table column title.

Item 1: Added a note to include the inspecting of applied labels which is not addressed elsewhere in NFPA 70B.

Item 3: Replaced “coordination studies” with “power system studies” as it is more than just the coordination study that is important when verifying circuit breaker, fuses, protective relays, and other types of overload elements are the right sizes and types. Equipment evaluation studies and others are important as well as the coordination study.

Item 4: Clarity was added to ensure the addressable devices are reviewed that are connected to and communicating on a network. Some devices may have the ability to communicate but are not connected. Verifying the address of that equipment that has the capability of communicating is not a necessary task. The text “the drawings and coordination study” is being removed and replaced with “documentation”. Ensuring that connected and communicating addressable devices have their addresses set in accordance with the more generic reference of “documentation” is all encompassing as the addresses of this equipment could be found in many different forms. It would not be appropriate to mandate the communication addresses be located on drawings and/or a coordination study. The term “proper” is being replaced with “correct” as proper is a vague and unenforceable term.

Item 10 and 11 (Existing): These were deleted as not to duplicate what is already found in Chapters 15 and 17. A pointer is not necessary.

Item 10 (New): Added provisions for visually inspecting environmental controls as it was not covered in this list but plays an important role in the integrity of equipment when and where required and installed.

Item 11(New): Added for consistency with language found in Table 12.3.1 Item 11. Panelboards and switchboards may have other equipment installed within that are addressed in other Chapters of NFPA 70B. this new line item ensures that additional equipment is not missed.

Response Message: SR-101-NFPA 70B-2022 RESPONSE TO PC 179: Adding the suggested change of “communicating” to Item 4 was not accepted as the current language is inclusive of any type of addressable device.

Public Comment No. 179-NFPA 70B-2022 [Section No. 13.3.1]

Public Comment No. 27-NFPA 70B-2022 [Section No. 13.3.1]

Public Comment No. 20-NFPA 70B-2022 [Section No. 13.3.1]

Public Comment No. 682-NFPA 70B-2022 [Section No. 13.3]

Second Revision No. 321-NFPA 70B-2022 [Section No. 13.3.3]

13.3.3 Lubrication.

Terminating devices, mechanical parts, and operating parts that exist to open, close, insert, and trip a circuit breaker, switch, or protective device shall be lubricated as required ~~per~~ in accordance with the manufacturer's instructions.

~~**13.3.3.2**~~

~~Lubrication shall be performed with the equipment in an electrically safe work condition.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon May 09 11:22:15 EDT 2022

Committee Statement

Committee Statement: Section 13.3.3.2 is being deleted as this is already addressed in Chapter 4 titled "Personnel Safety".

Response Message: SR-321-NFPA 70B-2022

Public Comment No. 29-NFPA 70B-2022 [Section No. 13.3.3]

Second Revision No. 103-NFPA 70B-2022 [Section No. 13.3.4]

13.3.4 Mechanical ~~Inspections~~ Servicing .

Panelboards and switchboards shall be mechanically ~~inspected~~ serviced in accordance with Table 13.3.4.

Table 13.3.4 Panelboard and Switchboard Mechanical ~~Inspections~~ Servicing

No.	Task	~~1000 Volts or Below~~ Test Type*	Notes
1	Inspect mechanical condition	2	
2	Ensure maintenance devices and tools are available for equipment servicing	1 or 2	
3	Inspect anchorage and grounding	2	
4	~~Inspect circuit breakers and switches — mechanical operation~~ Mechanically operate circuit breakers and switches	2	
~~5~~	~~Inspect circuit breakers and switches — contact condition~~	~~2~~	~~See Chapters 15 and 17.~~
~~6~~ 5	Inspect bolted connection integrity	2	See Chapter 7.
~~7~~ 6	Verify lubrication on moving current-carrying parts and sliding surfaces	2	See the manufacturer's instructions.
~~8~~ 7	Verify mechanical interlock systems for correct sequencing	2	
~~9~~ 8	Verify mechanical indicating devices are functional	2	
~~10~~ 9	Verify filters are clean and in place	2	
~~11~~ 10	Verify fuse holders provide ~~adequate~~ mechanical support and contact integrity	2	
~~12~~ 11	For individual components, refer to the appropriate chapter(s) of this standard	NA	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_103_Table_13.3.4_For_staff_use_only.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 14:22:09 EDT 2022

Committee Statement

Committee Statement: Changing “Inspections” to “Servicing” in the title of 13.3.4 brings this section into alignment with other areas of 70B with same language. This section is servicing and not inspections.

Parent text of 13.3.4 is modified replacing “inspected” with “serviced” to align with the title change of this section.

Title of Table 13.3.4 replaces “inspected” with “serviced” to align with the title change of this section.

1000 Volts or below is removed from the column header for test type. The scope of Chapter 13 includes panelboards and switchboards 1000 Volts or below and this is not necessary at this location in the table.

Item 2: Made this an online or offline instead of just online test. These can be accomplished in either state.

Item 4: Modified to require mechanical operation of circuit breakers and switches. Existing language of inspecting circuit breakers and referencing mechanical was not clear. The new language adds clarity. This is also addressed in 15.3.4.

Item 5: This table item is removed as it is not necessary. The generic line item that references other chapters of 70B addresses this item.

Item 11: The vague word “adequate” was deleted.

Response Message: SR-103-NFPA 70B-2022

Public Comment No. 178-NFPA 70B-2022 [Section No. 13.3.4]

Public Comment No. 21-NFPA 70B-2022 [Section No. 13.3.4]

Public Comment No. 30-NFPA 70B-2022 [Section No. 13.3.4]

Public Comment No. 23-NFPA 70B-2022 [Section No. 13.3.4]

Second Revision No. 106-NFPA 70B-2022 [New Section after 13.3.5]

13.3.6 Special. (Reserved)

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Wed Apr 27 14:58:12 EDT 2022

Committee Statement

Committee Statement: This reserved section was added to maintain consistency with other chapters.
Response Message: SR-106-NFPA 70B-2022

Public Comment No. 24-NFPA 70B-2022 [New Section after 13.3.5]

Second Revision No. 104-NFPA 70B-2022 [Section No. 13.3.5]

13.3.5 Electrical ~~Tests~~ Testing .

Panelboards and switchboards shall be electrically tested in accordance with Table 13.3.5.

Table 13.3.5 Panelboard and Switchboard Electrical ~~Tests~~ Testing

No.	Task	~~1000 Volts or Below~~ Test Type*	Notes
-	-		-
1	Check electrical hardware connections	NA	See Chapter 7.
2	Measure insulation resistance of the main bus	2	
3	Measure insulation resistance of control wiring	2A	
4	Test ~~protection~~ protective devices and systems	2	~~For circuit breakers, see Chapter 15.~~ For surge protective devices, surge arresters, and arc-fault energy reduction systems, see the manufacturer's instructions. ~~For protective relays, see Chapter 35.~~ ~~For fuses, see Chapter 16.~~ ~~For ground-fault protective devices, see Chapter 21.~~ ~~For surge protective devices, see manufacturer's instructions.~~ ~~For surge arresters, see manufacturer's instructions.~~ ~~For arc-fault energy reduction systems, see manufacturer's instructions.~~
5	Perform system operational tests	1 or 2	Includes emergency or standby ~~sources of~~ power systems ~~to ensure they are available when needed, and automatic throw-overs, paralleling controls, interlock systems, or any other operational or maintenance-related control that might be installed~~ .
6	Test control power transformers, instrument transformers, and metering to ensure correct operation	2	
7	For ~~other~~ individual components ~~or additional capabilities~~ , refer to the appropriate chapter(s) of this standard ~~or manufacturer's instructions~~	NA	
8	Where environmental controls are provided, check for correct operating condition	1 or 2	Includes, but is not limited to, fans, heaters, thermostats, and humidity control equipment and settings.

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_104_Table_13.3.5.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 14:26:53 EDT 2022

Committee Statement

Committee Statement: The word “tests” is replaced with “testing” for consistency with other chapters of this standard.

Title of Column 3 removed 1000 volts or below as this language is not necessary due to the scope change.

Item 4: Removed those items that are duplicate to requirements found in other chapters. Leaving those items that are not covered in other chapters. The last line in the table provides direction to see other chapters for individual component requirements.

Item 5: Removed most of the language from the note to simply reference that this includes the emergency power system. Because these can come in many shapes or forms the other details are deleted in the note.

Item 6: Language was added to bring this table item into constancy with Chapter 12.

Item 7: Language was added to bring this table item into constancy with Chapter 12.

New Item 8: Adds environmental controls electrical tests as when present, this equipment is important to the continued safe operation of the equipment.

Response Message: SR-104-NFPA 70B-2022

Public Comment No. 22-NFPA 70B-2022 [Section No. 13.3.5]

Public Comment No. 180-NFPA 70B-2022 [Section No. 13.3.5]

Public Comment No. 68-NFPA 70B-2022 [Section No. 13.3.5]

Public Comment No. 540-NFPA 70B-2022 [Section No. 13.3.5]

Public Comment No. 31-NFPA 70B-2022 [Section No. 13.3.5]

Second Revision No. 107-NFPA 70B-2022 [Section No. 14.3.1]

14.3.1* Visual Inspection.

Busways shall be visually inspected in accordance with Table 14.3.1.

Table 14.3.1 Busway Visual Inspections

No.	Task	Busways Rated 600 Volts or Less Test Type*	Busways Rated Over 600 Volts Test Type*	Notes
1	Visually inspect the physical condition of the busway and associated fittings	1	1	Look for evidence of moisture contamination, corrosion, and excessive buildup of dust, dirt, or debris.
2	Visually inspect anchorage, hangers, and alignment of busway system	1	1	Look for loose connections and twisting or bending of lifted supports.
3	Visually inspect all areas near electrical joints, terminations, and connections	2	2	Visually check connections to be certain that they are clean and secure and show no signs of overheating or discoloration.
4	~~Confirm physical orientation in accordance with manufacturer's labels.~~	~~1~~	~~1~~	
~~5~~ 4	Examine outdoor busway to ensure that weepholes are not obstructed and that the joint shield is installed correctly	1	1	
~~6~~ 5	Inspect ventilation openings on busway and associated fittings	1	1	
~~7~~ 6	Look for signs of deterioration of visible seals and gaskets	1	1	Outdoor and drip-resistant busways can contain seals and gaskets.
7	For individual components, refer to the appropriate chapter(s) of this standard	NA	NA	

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_107_Table_14.3.1.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 15:01:53 EDT 2022

Committee Statement

Committee Statement: Item 4: Deleted as busway can be installed upside down. This would cause the weep holes to be located on top instead of bottom and would be a violation of the NEC but has been seen in the field. This issue should be caught in commissioning.

New Item 7: Added to align with other areas of this document.

Response Message: SR-107-NFPA 70B-2022

Public Comment No. 72-NFPA 70B-2022 [Section No. 14.3.1]

Second Revision No. 108-NFPA 70B-2022 [Section No. 14.3.2]

14.3.4 Mechanical Servicing.

Busways shall be mechanically serviced in accordance with Table 14.3.4.

Table 14.3.4 Busway Mechanical Servicing

No.	Task	Busways Rated 600 Volts or Less Test Type*	Busways Rated Over 600 Volts Test Type*	Notes
1	Adjust or repair anchorage or hangers to ensure ~~proper~~ support of the busway	2	2	
2	Exercise plug-in unit operating mechanisms and external operators to confirm they operate to their full ON and OFF positions	2	NA	
3	Confirm operation of mechanical interlocks and ~~padlocking~~ locking means of plug-in units	2	NA	
4	Clean ventilation openings and weep holes	2	2	
~~5~~	~~Inspect overcurrent protective devices and switches located inside plug in units~~	~~2~~	~~NA~~	~~See Chapter 15 for information on circuit breakers.~~ ~~See Chapter 16 for information on fuses.~~ ~~See Chapter 17 for information on switches.~~
~~6~~ 5	Inspect forced-air cooling system	NA	2	Verify operation of forced-air cooling that could be included in metal enclosed bus systems.
~~7~~ 6	Inspect for loose, open, or missing covers or doors on busways and associated fittings	2	2	Inspect all plug-in openings, plug-in units, and joints between busway sections. Some covers are not designed to be removed for inspection.
7	For individual components, refer to the appropriate chapter(s) of this standard	NA	NA	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

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SR_108_Table_14.3.2.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 15:05:44 EDT 2022

Committee Statement

Committee Statement: Item 3: Padlocking is changed to locking as it is more generic term.

Existing Item 5: This item is deleted as it is not necessary. These requirements are covered in the other related sections and listing here is not needed.

New Item 7: Added to address all of the other components that could be found in this equipment. Test types are shown as NA as this is covered in other chapters.

Response Message: SR-108-NFPA 70B-2022

Public Comment No. 74-NFPA 70B-2022 [Section No. 14.3.2]

Public Comment No. 73-NFPA 70B-2022 [Section No. 14.3.2]

Second Revision No. 109-NFPA 70B-2022 [Sections 14.3.3, 14.3.4]

14.3.2* Cleaning.

14.3.2.1*

~~Substantial accumulations~~ Accumulations of dust, dirt, and debris shall be removed from busways using a brush, vacuum cleaner, or clean, lint-free rags.

~~**14.3.3.2**~~

~~Busway cleaning shall be performed while in an electrically safe work condition.~~

14.3.2.2

Compressed air shall not be used to remove dust, dirt, or debris from busways or associated fittings.

14.3.3* Lubrication.

14.3.3.1

Operating mechanisms and interlocks on plug-in units shall be lubricated ~~as required per~~ in accordance with the manufacturer's instructions.

14.3.3.2

Where no manufacturer's instructions are available, non-current-carrying mechanisms and interlocks shall be lubricated with a clean, light grease.

14.3.3.3

Excess lubrication shall be wiped off to avoid accumulation of foreign material.

14.3.3.4

Where plug-in units are relocated, electrical plug-in connections on plug-in units shall be lubricated ~~as required per~~ in accordance with the manufacturer's instructions with a conductive lubricant labeled for use on electrical power connections.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 15:07:50 EDT 2022

Committee Statement

Committee Statement: Moving cleaning and lubrication after visual and before mechanical servicing for consistency with other chapters.

Section 14.3.2.1 edited to remove the vague and unenforceable word substantial.

Section 14.3.2.2 text referring to performing in an electrically safe work condition is removed as this is covered in another chapter.

Response Message: SR-109-NFPA 70B-2022

Public Comment No. 102-NFPA 70B-2022 [Sections A.14.3.3, A.14.3.3.1, A.14.3.4]

Public Comment No. 693-NFPA 70B-2022 [Sections 14.3.2, 14.3.3]

Public Comment No. 75-NFPA 70B-2022 [Section No. 14.3.3]

Public Comment No. 99-NFPA 70B-2022 [Chapter 14]

Second Revision No. 338-NFPA 70B-2022 [Section No. 14.3.5]

14.3.5* Electrical ~~Tests~~ Testing .

Busways shall be electrically tested in accordance with Table 14.3.5.

Table 14.3.5 Busway Electrical Tests

No.	Task	Busways Rated 600 Volts or Less Test Type*	Busways Rated Over 600 Volts Test Type*	Notes
1	~~Inspect bolted electrical connections for high resistance.~~ Perform bus resistance tests	1 ~~and~~ or 2	1 ~~and~~ or 2	See Chapter 7.
2	Perform insulation resistance tests	2	2	See A.14.3.5 for additional information.
3	Perform a dielectric withstand voltage test	NA	2	See A.14.3.5 for additional information.
4	~~Verify operation of busway space heaters~~ Where environmental controls are provided, check for correct operating condition	~~NA~~ 1 or 2	~~2~~ 1 or 2	Includes, but is not limited to, fans, heaters, thermostats, and humidity control equipment and settings.
5	Perform insulation power-factor or dissipation-factor tests	NA	2A	
6	Perform online partial-discharge survey	NA	1A	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_338_Table_14.3.5.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu May 12 10:30:11 EDT 2022

Committee Statement

Committee Statement: The title is modified for consistency with other similar sections in this document.

Item 1: Language is changed from an inspection to a test. If technology exists to enable active monitoring of the bolted electrical connections, the test type is changed to 1 or 2 as these tests can be performed online or offline due to existence of technologies.

Item 4: Adds environmental controls electrical tests as when present, this equipment is important to the continued safe operation of the equipment. The test type was changed from NA to 1 or 2 because there may be low voltage bus ducts that have a heater that should be check. If present it would need to be tested. Otherwise, if not present, it would not need to be tested. The testing may be able to be performed online or offline.

Response Message: SR-338-NFPA 70B-2022

Public Comment No. 97-NFPA 70B-2022 [Section No. 14.3.5]

Public Comment No. 69-NFPA 70B-2022 [Section No. 14.3.5]

Public Comment No. 107-NFPA 70B-2022 [Section No. 14.3.5]

Public Comment No. 106-NFPA 70B-2022 [Section No. 14.3.5]

Second Revision No. 113-NFPA 70B-2022 [Section No. 15.1.1]

15.1.1

This chapter identifies electrical maintenance requirements for the following circuit breakers and their enclosures. :

(1) Molded-case circuit breakers (MCCBs) rated less than or equal to 1000 V ac

(2) Insulated-case circuit breakers (ICCBs) rated less than or equal to 1000 V ac

(3) Low-voltage power circuit breakers (LVPCBs) rated less than or equal to 1000 V ac

(4) Medium-voltage power circuit breakers (MVPCBs) rated greater than 1000 V ac to less than or equal to 69 kV ac

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 16:27:54 EDT 2022

Committee Statement

Committee Statement: Scope is revised for clarity breaking out the proper voltage classifications for each of the circuit breaker types addressed.

Response Message: SR-113-NFPA 70B-2022

Public Comment No. 259-NFPA 70B-2022 [Section No. 15.1.1]

Second Revision No. 114-NFPA 70B-2022 [Section No. 15.2]

15.2 Frequency of Maintenance.

The periodic maintenance procedures in Section 15.3~~through~~ and Section 15.4 shall be performed in accordance with the frequencies in Chapter 9, unless otherwise specified in this chapter.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 16:37:35 EDT 2022

Committee Statement

Committee Statement: The word Chapter is added before “10” for clarity. The section reference has been corrected to Section 15.4.

Response Message: SR-114-NFPA 70B-2022 RESPONSE PC 703: Frequencies is retained as the title of 10.4.2 is frequency. Use the word is consistent with other chapters. See other revisions for additional edits.

Public Comment No. 258-NFPA 70B-2022 [Section No. 15.2]

Public Comment No. 703-NFPA 70B-2022 [Chapter 15]

Public Comment No. 66-NFPA 70B-2022 [Section No. 15.2]

Second Revision No. 115-NFPA 70B-2022 [Section No. 15.3.2.2]

15.3.2.2

If contamination ~~is found,~~ such as ~~the presence of~~ dust, dirt, soot, grease, or moisture is found , cleaning shall be performed in accordance with ~~Section~~ 5.8 ~~and~~ Table 15.3.2.2.

Table 15.3.2.2 MCCB, ICCB, and LVPCB Cleaning

No. -	Task	MCCB Test Type*	ICCB Test Type*	LVPCB Test Type*	Notes -
1	Clean insulating surfaces of the circuit breaker using a lint-free dry cloth, brush, or vacuum cleaner~~. Avoid~~ (avoid blowing material into the circuit breaker or into surrounding equipment)	2	2	2	
2	Clean contact surfaces ~~per~~ in accordance with the manufacturer's instructions	NA	2	2	
3	Clean circuit breaker interior frame	NA	2	2	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 16:43:02 EDT 2022

Committee Statement

Committee Statement: The extra period is deleted.

Response Message: SR-115-NFPA 70B-2022

Public Comment No. 260-NFPA 70B-2022 [Section No. 15.3.2.2]

Second Revision No. 116-NFPA 70B-2022 [Section No. 15.3.3]

15.3.3 Lubrication.

Moving and sliding surfaces shall be lubricated in accordance with Table 15.3.3.

Table 15.3.3 MCCB, ICCB, and LVPCB Lubrication

No. -	Task	MCCB Test Type*	ICCB Test Type*	LVPCB Test Type*	Notes -
1	Apply a thin coating of conductive lubricant to exposed contacts as specified by the manufacturer	NA	2	2	
2	Apply nonconductive lubricant as needed to mechanism parts as specified by the manufacturer	NA	2	2	
3	Apply conductive lubricant to pivot points, as well as moving and sliding surfaces as specified by the manufacturer	NA	2	2	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 16:47:29 EDT 2022

Committee Statement

Committee Statement: The language “as specified by the manufacturer” is redundant the requirement in 5.1.1. However, this is a critical item that the user of this document must be reminded of to seek guidance from the manufacturer before selecting the lubricant identified in this table. Some manufacturers maintenance instructions prohibit the use of conductive lubricant on contacts. This added language will ensure the user of this document consults the manufacturer instructions.

Response Message: SR-116-NFPA 70B-2022

Public Comment No. 100-NFPA 70B-2022 [Section No. 15.3.3]

Second Revision No. 117-NFPA 70B-2022 [Section No. 15.3.4]

15.3.4 Mechanical Servicing.

Circuit breakers shall be mechanically serviced in accordance with Table 15.3.4.

Table 15.3.4 MCCB, ICCB, and LVPCB Mechanical Servicing

No.	Task	MCCB Test Type*	ICCB Test Type*	LVPCB Test Type*	Notes
1	Check all accessible electrical hardware connections for ~~proper~~ correct torque	2	2	2	See Chapter 7.
~~2~~	~~Replace any barriers and parts that have been removed for maintenance.~~	~~2~~	~~2~~	~~2~~	
~~3~~ 2	Operate the circuit breaker ~~in a test fashion~~ three times	2	2	2	
~~4~~ 3	Verify operation and alignment of mechanical safety interlocks, where applicable	2	2	2	
~~5~~ 4	Verify ~~proper~~ correct operation of shutter assemblies on draw-out circuit breakers	2	2	2	
~~6~~ 5	Measure and record trip bar force	NA	2A	2A	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_117_Table_15.3.4.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 16:57:26 EDT 2022

Committee Statement

Committee Statement: Table Items 1 and 5: The vague term proper has been replaced with correct.

Table Item 2: This item is not necessary. Replacement of barriers and parts that have been removed for maintenance is a task that is performed as part of maintenance. The purpose of this table is not to cover each action item to be performed. Removing this item reduces confusion that may arise by omission of other individual tasks associate with maintenance.

Table Item 3: “In a test fashion” is removed as it is vague and unenforceable.

Response Message: SR-117-NFPA 70B-2022

Public Comment No. 261-NFPA 70B-2022 [Section No. 15.3.4]

Public Comment No. 262-NFPA 70B-2022 [Section No. 15.3.4]

Second Revision No. 118-NFPA 70B-2022 [Section No. 15.3.5]

15.3.5* Electrical Testing.

~~Electrical tests~~ Circuit breakers shall be electrically tested in accordance with Table 15.3.5.

Table 15.3.5 MCCB, ICCB, and LVPCB Electrical Tests

No.	Task	MCCB* † 250 Amperes and Less Frame Test Type† *	MCCB* † Over 250 Amperes Frame Test Type† *	ICCB - Test Type† *	LVPCB - Test Type† *	Notes
1	Perform infrared thermography	1	1	1	1	
2	Measure contact resistance of each switching pole	2A	2	2	2	
3	Perform insulation-resistance tests, phase-to-phase and phase-to-ground with circuit breaker closed and across each open pole	2A	2	2	2	
4	Operate circuit breaker auxiliary and control devices such as local and remote-control switches, shunt trips coils, close coils, motors, auxiliary switches, and under-voltage coils	2	2	2	2	
4	~~Functional tests only for circuit breakers with motor operators:~~ ~~Verify control power for close and trip functions~~ ~~Verify the electrical operation of circuit breaker~~ ~~Perform trip and close tests~~ ~~Verify operation of the circuit breaker from local switches or terminal blocks~~	~~2~~	~~2~~	~~2~~	~~2~~	
5	Verify the calibration of all functions of the trip unit by means of the manufacturer's specified test set for circuit breakers equipped with electronic trip units	2A	2	2	2	
6	Perform inverse time trip test at 300% of rated continuous current of thermal magnetic circuit breakers ~~where the overcurrent device installed in the circuit breaker is rated or can be adjusted to 250 amperes or over~~	2A	2	NA	NA	
7	Perform inverse time trip test at 300% of rated continuous current of electronic trip circuit breakers	2A	2A	2A	2A	

No.	Task	MCCB* † 250 Amperes and Less Frame Test Type‡ *	MCCB* † Over 250 Amperes Frame Test Type‡ *	ICCB - Test Type‡ *	LVPCB - Test Type‡ *	Notes
8	Perform the instantaneous overcurrent trip test for thermal-magnetic circuit breakers by “run-up” or “pulse” method	2A	2	NA	2	
9	Perform the instantaneous overcurrent trip test for electronic trip breakers by “run-up” or “pulse” method	2A	2A	2A	2A	
10	Perform rated hold-in test	2A	2A	2A	2A	
11	Test current-limiter resistance	2	2	2	2	
12	Check status of rating plug battery	2	2	2	2	
13	Perform millivolt drop test	2A	2A	2A	2A	
~~14~~	~~Test shunt trip and under-voltage release devices~~	~~2~~	~~2~~	~~2~~	~~2~~	
~~15~~	~~Verify proper operation of auxiliary switches~~	~~2~~	~~2~~	~~2~~	~~2~~	
~~16~~ 14	Test arc reduction technology in accordance with the manufacturer’s instructions	2	2	2	2	

NA: Not applicable.

‡ * Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

* † The rating of adjustable-trip circuit breakers shall be the maximum setting possible.

A.15.3.5

For additional information and guidance on testing molded case circuit breakers reference NEMA AB-4-~~2017~~ , *Guidelines for Inspection and Preventive Maintenance of Molded-Case Circuit Breakers Used in Commercial and Industrial Applications* .

Supplemental Information

File Name	Description	Approved
SR_118_Table_15.3.5.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 17:02:49 EDT 2022

Committee Statement

Committee Statement: The word “frame” is added to the titles of the columns for molded case circuit breakers to ensure all circuit breakers with a frame rating are included regardless of the setting of the long-time pickup which may establish the circuit breaker rating. This aligns with removal of language from Table Item 6 which seeks to achieve the same goal.

Existing Table Item 4 is replaced with new language that encompasses also existing Table Items 14 and 15 which have been deleted.

Response Message: SR-118-NFPA 70B-2022

Public Comment No. 269-NFPA 70B-2022 [Section No. 15.3.5]

Public Comment No. 279-NFPA 70B-2022 [Section No. 15.3.5]

Public Comment No. 13-NFPA 70B-2021 [Section No. 15.3.5]

Second Revision No. 120-NFPA 70B-2022 [Section No. 15.4.1]

15.4.1

~~Visual inspections~~ Circuit breakers shall be visually inspected in accordance with Table 15.4.1.

Table 15.4.1 Medium-Voltage Power Circuit Breakers Visual Inspections

No.	Task	Air Magnetic Circuit Breakers	Vacuum Circuit Breakers	Gas Insulated Circuit Breakers	Oil Circuit Breakers	Notes
-	-	Test Type*	Test Type*	Test Type*	Test Type*	-
1	Verify ratings for proper system application	1 or 2	1 or 2	1 or 2	1 or 2	
2	Inspect insulating materials and frame for evidence of physical damage, cracks from stresses of operation, or contamination	2	2	2	2	
3	Inspect wiring, bus, cables, and connections for damaged insulation, broken leads, tightness of connections, proper crimping, and overall general condition including corrosion	2	2	2	2	
4	Inspect visible current-carrying parts and control devices, if applicable, for signs of overheating or deterioration	2	2	2	2	
5	Inspect each arc chute for cracks or excessive erosion ~~if applicable~~	2	NA	NA	NA	
6	Inspect ground contact, secondary disconnect, close and trip interlocks, levering latch, mechanism-operated contact (MOC), and truck-operated contact (TOC) switches, and all other interlocks	2	2	2	2	
7	Check all markings on the circuit breaker are legible	1 or 2	1 or 2	1 or 2	1 or 2	
8	Inspect contact erosion indicator mark on vacuum interrupter moving stem	NA	2	NA	NA	Some manufacturers have visual inspections to determine contact erosion.

No.	Task	Air Magnetic Circuit Breakers	Vacuum Circuit Breakers	Gas Insulated Circuit Breakers	Oil Circuit Breakers	Notes
-	-	Test Type*	Test Type*	Test Type*	Test Type*	-
9	Inspect contact	NA	2	NA	NA	Some manufacturers have visual inspections to determine contact wipe.
10	Verify correct oil level	NA	NA	NA	2	
11	Check for oil leaks	NA	NA	NA	2	
12	Visually inspect bushings for cracks, chips, loss of porcelain, evidence of corona damage, or other physical damage	2	2	2	2	
13	Check for low gas pressure ~~where possible as per manufacturer's instructions~~	NA	NA	2A	NA	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_120_Table_15.4.1.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 17:15:52 EDT 2022

Committee Statement

Committee Statement: Table item 5: The text "if applicable" is not necessary as all air magnetic circuit breakers have arc chutes.

Table Item 9: The space between contact and the period is deleted.

Table Item 13: Removed reference to manufacturer instructions. Removed "where possible" as that is vague and unenforceable language. Gas pressure on these circuit breakers can be checked as the manufacturer provides a means to achieve this.

Response Message: SR-120-NFPA 70B-2022

Public Comment No. 270-NFPA 70B-2022 [Section No. 15.4.1]

Public Comment No. 271-NFPA 70B-2022 [Section No. 15.4.1]

Second Revision No. 121-NFPA 70B-2022 [Section No. 15.4.2]

15.4.2 Cleaning.

Electrical equipment surfaces, enclosures, and insulating materials shall be kept in a clean and contaminant-free state in accordance with Table 15.4.2.

Table 15.4.2 Medium-Voltage Power Circuit Breakers Cleaning

No.	Task	Air Magnetic Circuit Breakers	Vacuum Circuit Breakers	Gas Insulated Circuit Breakers	Oil Circuit Breakers	Notes
-	-	Test Type*	Test Type*	Test Type*	Test Type*	-
1	Clean insulating surfaces of the circuit breaker using a lint-free dry cloth, brush, or vacuum cleaner~~. Avoid~~ (avoid blowing material into the circuit breaker or into surrounding equipment)	2	2	NA	NA	For vacuum circuit breakers, follow the manufacturer's instructions to avoid shock due to inherent capacitance from the technology used in the circuit breaker.
2	Clean contact surfaces ~~per manufacturer's instructions~~	2	~~2~~ NA	~~2~~ NA	2	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_121_Table_15.4.2.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 17:17:40 EDT 2022

Committee Statement

Committee Statement: Table Item 1: Added a note to raise awareness of potential hazards due to static charge.

Table Item 2: Added NA for vacuum breakers and gas insulated as those contacts

	are not accessible. Manufacturer instructions reference is removed as that is covered in Section 5.1.1.
Response Message:	SR-121-NFPA 70B-2022

Public Comment No. 98-NFPA 70B-2022 [Section No. 15.4.2]

Public Comment No. 177-NFPA 70B-2022 [Section No. 15.4.2]

Second Revision No. 122-NFPA 70B-2022 [Section No. 15.4.3]

15.4.3 Lubrication.

Moving and sliding surfaces shall be lubricated in accordance with Table 15.4.3.

Table 15.4.3 Medium-Voltage Power Circuit Breakers Lubrication

No.	Task	Air Magnetic Circuit Breakers Test Type*	Vacuum Circuit Breakers Test Type*	Gas Insulated Circuit Breakers Test Type*	Oil Circuit Breakers Test Type*	Notes
1	Apply a thin coating of conductive lubricant to exposed contacts as specified by the manufacturer	2	2	2	2	
2	Apply nonconductive lubricant as needed to mechanism parts as specified by the manufacturer	2	2	2	2	
3	Apply conductive lubricant to pivot points, as well as moving and sliding surfaces, as specified by the manufacturer	2	2	2	2	

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 17:18:37 EDT 2022

Committee Statement

Committee Statement: Some manufacturers maintenance instructions prohibit the use of conductive lubricant on contacts. This added language will ensure the user of this document consults the manufacturer instructions.

Response Message: SR-122-NFPA 70B-2022

Public Comment No. 101-NFPA 70B-2022 [Section No. 15.4.3]

Second Revision No. 123-NFPA 70B-2022 [Section No. 15.4.4]

15.4.4 Mechanical Servicing.

Circuit breakers shall be mechanically serviced in accordance with Table 15.4.4.

Table 15.4.4 Medium-Voltage Power Circuit Breakers Mechanical Servicing

No.	Task	Air Magnetic Circuit Breakers Test Type*	Vacuum Circuit Breakers Test Type*	Gas Insulted Circuit Breakers Test Type*	Oil Circuit Breakers Test Type*	Notes
1	Check all accessible electrical hardware connections for proper torque	2	2	2	2	See Chapter 7.
2	Replace any barriers and parts that have been removed for maintenance	2	2	2	2	
3	~~Operate~~ Close and open the circuit breaker ~~per manufacturer's instructions~~	2	2	2	2	
4	Verify operation and alignment of mechanical safety interlocks, where applicable	2	2	2	2	
5	Verify the proper operation of all circuit breaker/cell accessories, shutters, auxiliary switches, cell MOC and TOC switches, and key interlocks	2	2	2	2	
6	Verify proper operation of all cell status indicators	2	2	2	2	
7	Charge closing spring and close manually ~~per manufacturer's instructions~~	2	2	2	2	
8	Measure and record trip bar force	2A	2A	2A	2A	
9	Perform gas leakage detection	NA	NA	2	NA	
10	Inspect pneumatic and hydraulic fittings and connections for leaks	2	2	2	2	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_123_Table_15.4.4.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 17:19:34 EDT 2022

Committee Statement

Committee Statement: Table Item 3: Changed “Operate” to “close and open” for clarity. Also removed reference to manufacturer instructions as this is already addressed in 5.1.1.

Table Item 7: Removed the reference for “per manufacturer instructions” as this is already addressed in 5.1.1.

Response Message: SR-123-NFPA 70B-2022 Did not remove Item 7 as this item includes “manually” charging and closing the circuit breaker which is not a part of Item 3.

Public Comment No. 272-NFPA 70B-2022 [Section No. 15.4.4]

Second Revision No. 124-NFPA 70B-2022 [Section No. 15.4.5]

15.4.5 Electrical Testing.

Circuit breakers shall be electrically tested in accordance with Table 15.4.5.

Table 15.4.5 Medium-Voltage Power Circuit Breakers Electrical Tests

No.	Task	Air Magnetic Circuit Breaker Test Type*	Vacuum Circuit Breaker Test Type*	Gas Insulated Circuit Breaker Test Type*	Oil Insulated Circuit Breaker Test Type*	Notes
1	~~Perform infrared thermography~~ Inspect electrical connections for high resistance	1 or 2	1 or 2	1 or 2	1 or 2	See Section 7.2.
2	Measure contact resistance of each switching pole	2	2	2	2	
3	Perform insulation-resistance tests, phase-to-phase and phase-to-ground with circuit breaker closed and across each open pole	2	2	2	2	
4	Verify control power for close and trip functions	2	2	2	2	
5	Perform trip and close tests with control switch	2	2	2	2	
6	Verify operating mechanism charge, anti-pump, and trip-free functions	2	2	2	2	
7	Perform vacuum integrity test by ac overpotential across each vacuum bottle	NA	2	NA	NA	
8	Verify proper operation of space heaters, if equipped	2	2	2	2	
9	Perform an ac overpotential test one pole at a time with the other poles and structure grounded	2A	2A	2A	2A	
10	Perform an ac overpotential test ~~in accordance with manufacturer's instruction~~ on control wiring ~~**WARNING:** Do not perform this test on wiring connected to solid-state components~~	2A	2A	2A	2A	**WARNING:** Do not perform this test on wiring connected to solid-state components.

No.	Task	Air Magnetic Circuit Breaker Test Type*	Vacuum Circuit Breaker Test Type*	Gas Insulated Circuit Breaker Test Type*	Oil Insulated Circuit Breaker Test Type*	Notes
11	Verify blow-out coil continuity	2	NA	NA	NA	
12	Perform circuit breaker motion analysis	2A	2A	2	2	
13	Perform circuit breaker contact timing test	2	2	2	2	
14	Perform trip/close coil current signature analysis	2A	2A	2A	2A	
15	Perform pickup test on trip and/or close coil	2A	2A	2A	2A	
16	Measure power/dissipation factor	2A	NA	2A	2	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_124_Table_15.4.5.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 17:24:42 EDT 2022

Committee Statement

Committee Statement: Table Item 1: Infrared inspections on this equipment of little benefit. Circuit breakers often have a barrier blocking any visibility to any current carrying conductors. For breakers where there may be visibility of current carrying parts, the equipment doors/covers would need to be opened or removed, potentially exposing personnel to extremely high values of arc-flash incident energy. Due to the limited benefit of performing infrared inspection on this equipment and potential for personnel injury, these tests are included here as enhanced tests and not required tests. Other tests in this section require measuring of circuit resistance so poor connections should be identified by that test. This line item is changed to more appropriately recognize a generic approach to determine the connections are adequate by use of “inspect electrical connections for high resistance.” This is achieved through referencing Section 7.2.

Table Item 9: Tests are made as enhanced as this test is not required but could be used if necessary. Item 3 requires insulation resistance tests and Item 7 is specific to vacuum bottles and is a required test in both of those applications.

Table Item 10: Moved warning to notes. Removed the reference to manufacturer instructions as this is already addressed in Chapter 5.

New Table Item 16: This is a measurement of capacitance to ground. On oil circuit breakers this is a standard test. This test will provide an indicator if there is a problem with the circuit breaker internal mechanism. This is a standard tool to evaluate all of the insulating components within the circuit breaker.

Response Message: SR-124-NFPA 70B-2022 RESPONSE TO PC 419: Did not accept removing notes pertaining to tests not included in the table. Even though this table is not referencing those types they are being left in the foot notes for consistency and possible future inclusion. RESPONSE TO PC 277: Did not change Item 7 as this is mandatory per manufacturer instructions anyway.

Public Comment No. 419-NFPA 70B-2022 [Section No. 15.4.5]

Public Comment No. 275-NFPA 70B-2022 [Section No. 15.4.5]

Public Comment No. 277-NFPA 70B-2022 [Section No. 15.4.5]

Second Revision No. 125-NFPA 70B-2022 [Section No. 15.4.6]

15.4.6 Special. (Reserved)

~~**15.4.6.1** Ground-Fault Protection.~~

~~The function of ground-fault- type circuit breakers shall be verified in accordance with Chapter 21 .~~

~~**15.4.6.2** Arc Reduction. (Reserved)~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 17:27:13 EDT 2022

Committee Statement

Committee Statement: Deleted 15.4.6.1 for multiple reasons. First, for medium voltage applications this will be a relay which is covered under a different chapter. In addition, this addresses GFPE which is covered under Chapter 21. This selection is not needed as those other chapters will apply. Inclusion here leads the user of this document to possibly think that Chapter 21 would not apply if not directly referenced by other chapters.

Section 15.4.6.2 is deleted since it has no content.

Section 15.4.6 is changed to reserved since there is no content.

Response Message: SR-125-NFPA 70B-2022

Public Comment No. 103-NFPA 70B-2022 [Section No. 15.4.6.1]

Second Revision No. 126-NFPA 70B-2022 [Section No. 15.5]

~~**15.5** High-Voltage Circuit Breakers. (Reserved)~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Wed Apr 27 17:29:02 EDT 2022

Committee Statement

Committee Statement: The title of this chapter refers to low- and medium-voltage circuit breakers. Therefore, having a reserved section for high-voltage circuit breakers is not appropriate.

Response Message: SR-126-NFPA 70B-2022

Public Comment No. 257-NFPA 70B-2022 [Section No. 15.5]

Second Revision No. 341-NFPA 70B-2022 [Section No. 16.3.1]

16.3.1* Visual Inspections.

Fuses shall be visually inspected in accordance with Table 16.3.1.

Table 16.3.1 Fuse Visual Inspections

No.	Task	1000 Volts or Less	Greater than 1000 Volts	Notes
-	-	Test Type*	Test Type*	-
1	Check for discoloration of fuse terminals and clips caused by heat ~~due to poor contact, insufficient pressure, or corrosion~~	1 or 2	1 or 2	
2	Check fuse indicating device status, if applicable	1 or 2	1 or 2	
3	Confirm that ~~all~~ fuses, in any one circuit, have the same catalog number to ensure that they have the same current rating, voltage rating, interrupting rating, time delay, and type (e.g., UL class)	1 or 2	1 or 2	
4	Confirm that all fuses match the most recent short-circuit, coordination, and arc flash studies~~, if available~~	1 or 2	1 or 2	
~~5~~	~~Replace any fuse clips that make poor contact or install clip clamps~~	~~2~~	~~2~~	
~~6~~ 5	Where current-limiting fuses are required, confirm that ~~appropriate~~ correct rejection-type mountings are used so that the current-limiting fuses cannot be replaced by non-current-limiting fuses	2	2	
~~7~~ 6	Verify ratings for ~~proper~~ correct system application	1 or 2	1 or 2	
~~8~~ 7	Inspect insulators for breaks, cracks, tracking, corona, burns, or overheating	NA	2	
~~9~~ 8	Inspect contact surfaces for pitting or burning, ~~proper~~ alignment, and contact pressure	NA	2A	
~~10~~ 9	Examine the fuse unit, fuse tube, and renewable element, if used, for evidence of corrosion and wear	NA	2	
~~11~~ 10	Inspect bolts, nuts, washers, pins, and terminal connectors to ensure they are in place, in good condition, and properly installed	NA	2	
~~12~~	~~Verify that each fuse holder has adequate mechanical support~~	~~NA~~	~~2~~	
11	Inspect seals of vented expulsion type fuses	NA	2	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_341_Table_16.3.1.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu May 12 11:10:07 EDT 2022

Committee Statement

Committee Statement: Table Item 1: Added language to clarify of where to check for discoloration and removed language that described the discoloration would occur.

Table Item 4: Removed the language “if available” as these studies are required by Chapter 6.

Table Item 5: Removed as inspection of fuse clips for contact pressure is covered in 16.3.4.

Table Item 12: Moved to mechanical support as a visual inspection is not able to ascertain the mechanical support of a fuse holder.

Table Item 13: Inspection of seals of vented expulsion type fuses is carried over from the previous edition. It is important for the proper operation of these fuses.

Response Message: SR-341-NFPA 70B-2022 RESPONSE TO PC 95: Table Item 4 is not removed as verification of the fuses is an important aspect to ensure the goals of the studies are achieved over the life of the installation. Existing / old Table Item 12 is not deleted. It is an important aspect of visual inspection.

Public Comment No. 95-NFPA 70B-2022 [Section No. 16.3.1]

Public Comment No. 115-NFPA 70B-2022 [Section No. 16.3.1]

Public Comment No. 712-NFPA 70B-2022 [Section No. 16.3.1]

Public Comment No. 113-NFPA 70B-2022 [Section No. 16.3.1]

Public Comment No. 112-NFPA 70B-2022 [Section No. 16.3.1]

Second Revision No. 188-NFPA 70B-2022 [Section No. 16.3.2]

16.3.2 Cleaning.

~~Cleaning~~ If contamination is present, fuses shall be ~~performed~~ cleaned in accordance with ~~Section~~ 5.8 ~~and~~ Table 16.3.2 ~~if contamination is present~~ .

Table 16.3.2 Fuse Cleaning

No.	Task	1000 Volts or Less	Greater than 1000 Volts	Notes
-	-	Test Type*	Test Type*	-
1	Clean fuse terminals and clips that have become corroded or oxidized ~~with a noncorrosive cleaning agent or replaced such that silver-plated surfaces are abraded~~	2	2	
2	Clean insulators of accumulated dust and foreign matter	NA	2	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_189_Tablle_16.3.2.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Fri Apr 29 08:15:14 EDT 2022

Committee Statement

Committee Statement: The reference to Section 5.8 is not required since that section is already required per that section. This reference is not made in most of equipment sections of the document so removing the reference here makes the document more consistent,

Table Item 1: The last portion of the sentence is deleted as manufacturer instructions must be followed to ensure proper cleaning agents are used.

Response Message: SR-188-NFPA 70B-2022

Public Comment No. 157-NFPA 70B-2022 [Section No. 16.3.2]

Second Revision No. 190-NFPA 70B-2022 [Section No. 16.3.4]

16.3.4 Mechanical Servicing.

Fuses shall be mechanically serviced in accordance with Table 16.3.4.

Table 16.3.4 Fuse Mechanical Servicing

No.	Task	1000 Volts or Less Test Type*	Greater than 1000 Volts Test Type*	Notes
1	Check ~~all~~ fuse holder terminations for tightness	2	2	See Chapter 7.
~~2~~	~~Check fuse clips to ascertain whether they exert enough pressure to maintain good contact.~~	~~2~~	~~2~~	
~~3~~	~~Refinish fuse tubes made of organic (Class A) material as required and specified by the manufacturer.~~	~~NA~~	~~2~~	
2	Verify that each fuseholder has adequate mechanical support	NA	2	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_190_Table_16.3.4.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Fri Apr 29 08:19:30 EDT 2022

Committee Statement

Committee Statement: Table Item 1: Removed the unnecessary word “all”.

Table Item 2: Deleted as it is vague and unenforceable. “Maintain good contact” is non-enforceable and vague requirement.

Existing Table Item 3: Refinishing of fuse tubes made of organic (Class A) material is no longer applicable to medium voltage fuses. The existing language is confusing since medium voltage fuses cannot be reconditioned

New Table Item 2: Relocated from visual inspection and placed here as it is a mechanical test.

Response Message: SR-190-NFPA 70B-2022

Public Comment No. 11-NFPA 70B-2021 [Section No. 16.3.4]

Public Comment No. 110-NFPA 70B-2022 [Section No. 16.3.4]

Public Comment No. 105-NFPA 70B-2022 [Section No. 16.3.4]

Second Revision No. 191-NFPA 70B-2022 [Section No. 16.3.5]

16.3.5* Electrical Testing.

Fuses shall be electrically tested in accordance with Table 16.3.5.

Table 16.3.5 Fuse Electrical Tests

No.	Task	1000 Volts or Less Test Type*	Greater than 1000 Volts Test Type*	Notes
1	Perform infrared thermography	1	1	When equipment has infrared viewing port or is accessible while in operation.
2	Measure fuse connection resistance	2A	2	
3	Measure fuse resistance	2A	2	

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

A.16.3.5

Fuses can be tested with a continuity tester to verify that the fuse is not open. Resistance readings can be taken using a sensitive 4-wire instrument such as a Kelvin bridge or micro-ohmmeter. Fuse resistance values should be compared against values recommended by the manufacturer. Where the manufacturer's data is not readily available, resistance deviations of more than 15 percent for identical fuses in the same circuit should be investigated.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Fri Apr 29 08:21:04 EDT 2022

Committee Statement

Committee Statement: When Chapter 11 was deleted, the text from Section 11.18 for fuse testing was deleted. That text is added in the annex for the new 16.3.5.

Table Items 2 and 3: Revised to 2A: For fuses operating at 1000 Volts or less, requiring the measuring and documentation of the fuse connection resistance and fuse resistance is made as an enhanced offline test. This may not provide significant value for all locations that are covered by this requirement, and not needed as a required test, especially at the frequency identified in another chapter.

Response Message: SR-191-NFPA 70B-2022

Public Comment No. 108-NFPA 70B-2022 [Section No. 16.3.5]

Public Comment No. 90-NFPA 70B-2022 [New Section after A.16.3.1]

Second Revision No. 193-NFPA 70B-2022 [Section No. 17.1.1]

17.1.1

This chapter identifies electrical maintenance requirements for ~~enclosed and dead-front (safety) switches, bolted-pressure switches (BPS), high-pressure contact switches (HPC) rated 1000 volts or less, and switches used in metal enclosed load interrupter switchgear rated over 1000 volts.~~ the following:

(1) ~~enclosed~~ Enclosed and dead-front (safety) switches, bolted-pressure switches (BPS), high-pressure contact switches (HPC), automatic transfer switches, bypass-isolation switches, and other transfer switch equipment rated 1000 volts or less~~, and~~

(2) ~~switches~~ Switches used in metal-enclosed load interrupter switchgear and automatic transfer switches, bypass-isolation switches, and other transfer switch equipment rated over 1000 volts

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Fri Apr 29 08:30:39 EDT 2022

Committee Statement

Committee Statement: The scope of the chapter is modified to clarify that it also includes transfer switches

A hyphen is added between "metal" and "enclosed" to match the format as used in the IEEE standard for this equipment

Response Message: SR-193-NFPA 70B-2022

Public Comment No. 304-NFPA 70B-2022 [Section No. 17.1.1]

Public Comment No. 533-NFPA 70B-2022 [Section No. 17.1.1]

Second Revision No. 194-NFPA 70B-2022 [Section No. 17.2]

17.2 Frequency of Maintenance.

The periodic maintenance procedures specified in Section 17.3 shall be performed in accordance with the frequencies specified in Chapter 9, ~~or when the switch has performed 100 interruptions under load~~ unless otherwise specified in this chapter .

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Fri Apr 29 08:33:04 EDT 2022

Committee Statement

Committee Statement: The change was made to align Section 17.2 with other sections from other chapters. The reference to 100 interruptions under load is not appropriate for Section 17.2.

Response Message: SR-194-NFPA 70B-2022

Public Comment No. 182-NFPA 70B-2022 [Section No. 17.2]

Public Comment No. 308-NFPA 70B-2022 [Section No. 17.2]

Public Comment No. 426-NFPA 70B-2022 [Section No. 17.2]

Public Comment No. 561-NFPA 70B-2022 [Section No. 17.2]

Second Revision No. 206-NFPA 70B-2022 [Section No. 17.3.1]

17.3.1 Visual Inspection.

Switches shall be visually inspected in accordance with Table 17.3.1.

Table 17.3.1 Switch Visual Inspections

No.	Task	1000 Volts or Less Test Type*	Greater than 1000 Volts Test Type*	Notes
1	Inspect doors and latches for fit, dents, corrosion, and missing hardware	1 or 2	1 or 2	
2	Inspect insulating materials and switch base for evidence of physical damage, cracks from stresses of operation, or contamination	2	2	
3	Inspect wiring, bus, cables, and connections for damaged insulation, broken leads, tightness of connections, ~~proper~~ crimping, and overall general condition, including corrosion	2	2	
4	Check that exposed switch contacts, both moving and stationary, are free from environmental contamination	2	NA	
5	Inspect visible current-carrying parts and control devices, if applicable, for signs of overheating or deterioration	2	2	
6	Check that ~~plug-in~~ fuses are secured ~~in clips~~	2	~~NA~~ 2	
7	Examine switches with exposed contacts for evidence of high short-circuit closing operation	2	NA	
8	Check the main body of the switch blades and the arcing contacts for arc erosion ~~and each blade's arcing contact tip. If more than one-third of a blade tip is burned away, replace the switch pole assembly~~	~~NA~~ 2	2	Mild pitting and burning is ~~acceptable~~ permitted .
9	Inspect each arc chute for cracks or excessive erosion~~. If damaged, replace the switch pole assembly~~	NA	2	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_206_Table_17.3.1.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon May 02 17:06:31 EDT 2022

Committee Statement

Committee Statement: Added section title “Visual Inspection”.

Line 1 - Inspection may be performed as an online standard test or offline standard test.

Line 3 - The word ‘proper’ is ambiguous and has been removed.

Line 6 - All fuse styles are to be confirmed as secured for 1000V or less and greater than 1000V.

Line 8 - Wording modified to more clearly state that arcing contacts should be examined for arc erosion. Main contacts for low voltage should be checked and where applicable, arcing contacts. Replace “acceptable” with “permitted”.

Line 8 and Line 9 - Components of a switch may be replaceable rather than the entire assembly.

Response Message: SR-206-NFPA 70B-2022 RESPONSE TO PC 535: Line 2 not was not modified. Phase barriers and covers are insulating materials and are addressed by the existing content. Proposed Lines 10 and 11 were not added. Mechanical servicing addresses operating mechanisms and related contact assessment.

Public Comment No. 713-NFPA 70B-2022 [Chapter 17]

Public Comment No. 535-NFPA 70B-2022 [Section No. 17.3.1]

Public Comment No. 183-NFPA 70B-2022 [Section No. 17.3.1]

Public Comment No. 305-NFPA 70B-2022 [Section No. 17.3.1]

Public Comment No. 307-NFPA 70B-2022 [Section No. 17.3.1]

Second Revision No. 207-NFPA 70B-2022 [Section No. 17.3.2]

17.3.2 Cleaning.

~~Cleaning~~ If contamination is present, switches shall be ~~performed~~ cleaned in accordance with ~~5.8 and~~ Table 17.3.2 ~~if contamination is present~~ .

Table 17.3.2 Switch Cleaning

No.	Task	1000 Volts or Less Test Type*	Greater than 1000 Volts Test Type*	Notes
1	Clean the switch and barriers	2	2	
2	Clean exposed switch contacts with a multi-purpose precision lubricant before lubricating	2	NA	
3	Wipe contact surfaces with a lint-free cleaning cloth	2	NA	
4	Wipe contact surfaces with a noncorrosive cleaning agent	NA	2	
5	Clean insulators	NA	2	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon May 02 17:09:21 EDT 2022

Committee Statement

Committee Statement: Reference to Section 5.8 is not required. Section 5.8 applies generally within the document.

Response Message: SR-207-NFPA 70B-2022

Public Comment No. 156-NFPA 70B-2022 [Section No. 17.3.2]

Second Revision No. 208-NFPA 70B-2022 [Section No. 17.3.4]

17.3.4 Mechanical Servicing.

Switches shall be mechanically serviced in accordance with Table 17.3.4.

Table 17.3.4 Switch Mechanical Servicing

No.	Task	1000 Volts or Less Test Type*	Greater than 1000 Volts Test Type*	Notes
1	If accessible, verify main blade alignment, penetration, travel stops, and mechanical operation	2	2	
2	Check all accessible electrical hardware connections ~~for proper torque.~~	2	2	See Chapter 7.
~~3~~	~~Replace any barriers and parts that have been removed for maintenance.~~	~~2~~	~~NA~~	
4 3	Operate the switch ~~in a test fashion five~~ three times to work the lubricant between the contacts	2	NA	
~~5~~ 4	Verify operation and alignment of mechanical ~~safety~~ interlocks	2	2	
~~6~~ 5	Verify the contact pressure is within specification using a force gauge or other device that measures forces	NA	2	
~~7~~ 6	With the door closed and latched, close and open the switch ~~four~~ three times to confirm the switch and operator lever is operating ~~properly. View~~ ; view switch position through the window after each operation, where available~~. When~~ ; when open, verify that switch blades have cleared the arc chutes~~. When~~ ; when closed, verify that the switch blades are inside the arc chutes and vertical~~. If~~ ; if they are not, perform alignment adjustments per the manufacturer's instructions	NA	2	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_208_Table_17.3.4.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon May 02 17:10:36 EDT 2022

Committee Statement

Committee Statement: Line 2: Deleted ‘for proper torque’. The word ‘proper’ is ambiguous.

Line 3 - Line is deleted. This action should be a given understanding that anything removed or disconnected to allow testing or maintenance should be reinstalled.

Line 4 - Removed "in a test fashion" as this is not defined. Operating the switch three times is adequate.

Line 5 - The word "safety" is removed. There may be other mechanical interlocks that are not for safety.

Line 7- Operating the switch three times is adequate. Deleted The word ‘properly’ is ambiguous and has been removed.

Response Message: SR-208-NFPA 70B-2022

Public Comment No. 309-NFPA 70B-2022 [Section No. 17.3.4]

Second Revision No. 209-NFPA 70B-2022 [Section No. 17.3.5]

17.3.5* Electrical Testing.

Switches shall be electrically tested in accordance with Table 17.3.5.

Table 17.3.5 Switch Electrical Tests

No.	Task	1000 Volts or Less Test Type*	Greater than 1000 Volts Test Type*	Notes
1	Perform infrared thermography	1A	1	
2	Measure contact resistance of each switching pole	2A	2	
3	Perform insulation-resistance tests, phase-to-phase and phase-to-ground with switch closed and across each open pole	2A	2	
4	Functional tests only for switches with motor operators: Verify control power for close and trip functions	2	2	
	Verify the electrical operation of switch			
	Perform trip and close tests			
	Verify operation of the switch from local switches or terminal blocks			
5	Functional tests only for switches with shunt trip capabilities	2	2	
6	Measure the resistance between the line and load terminal pads on each phase	NA	2	
7	Verify ~~proper~~ operation of space heaters, if equipped	NA	2	
8	Perform overpotential test one pole at a time with the other poles and structure grounded	NA	2A	
9	Perform overpotential test on control wiring	NA	2A	**WARNING:** Do not perform this test on wiring connected to solid-state components.
10	Test arc reduction technology in accordance with the manufacturer's instructions	2	2	
11	Perform functional tests for automatic transfer switches, bypass switches, and other transfer switch equipment	1A or 2A	1A or 2A	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

A.17.3.5

See NFPA 110 and NFPA 111 for further information on Line 11 of Table 17.3.5 , performing functional tests for automatic transfer switches, bypass switches, and other transfer switch equipment.

Supplemental Information

File Name	Description	Approved
SR_209_Table_17.3.5.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon May 02 17:11:39 EDT 2022

Committee Statement

Committee Statement: Lines 1 and 2 - Requiring infrared inspection and contact resistance measurement on switches with extremely small loads may not provide beneficial data.

Line 3 - These should be enhanced tests and should be optional due to the issues created with the disconnection and reconnection of cables.

Line 4 - Removed space in front of ‘perform’.

Line 7 - The word ‘proper’ is ambiguous and has been removed.

New Line 11 – Transfer switches have been added to the scope of the standard.

Response Message: SR-209-NFPA 70B-2022

Public Comment No. 537-NFPA 70B-2022 [Section No. 17.3.5]

Public Comment No. 310-NFPA 70B-2022 [Section No. 17.3.5]

Public Comment No. 311-NFPA 70B-2022 [Section No. 17.3.5]

Second Revision No. 210-NFPA 70B-2022 [Section No. 17.3.6]

17.3.6 Special. (Reserved)

~~**17.3.6.1** Ground-Fault Protection.~~

~~The function of ground-fault type switches shall be verified in accordance with Chapter 21.~~

~~**17.3.6.2** Arc Reduction. (Reserved)~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon May 02 17:13:53 EDT 2022

Committee Statement

Committee Statement: Sections 17.3.6.1 and 17.3.6.2 are deleted. The requirements in Chapter 21 apply to GFP equipment without having to reference that chapter. The arc reduction section has no information and is not needed.

Response Message: SR-210-NFPA 70B-2022

Public Comment No. 153-NFPA 70B-2022 [Section No. 17.3.6]

Public Comment No. 306-NFPA 70B-2022 [Section No. 17.3.6]

Second Revision No. 211-NFPA 70B-2022 [Chapter 18 [Title Only]]

Power Cables and Conductors

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 08:34:24 EDT 2022

Committee Statement

Committee Statement: Changed Chapter 18 title to include conductors.

Response Message: SR-211-NFPA 70B-2022 RESPONSE TO PC 491: The frequencies in Chapter 10 are not recommended, they are required. Test types are retained for consistency across document.

Public Comment No. 491-NFPA 70B-2022 [Chapter 18]

Public Comment No. 677-NFPA 70B-2022 [Chapter 18 [Title Only]]

Second Revision No. 324-NFPA 70B-2022 [Section No. 18.1.1]

18.1.1

This chapter identifies electrical maintenance requirements for power cables and conductors operating at 1000 volts or less and those that are purpose-built, multilayered, and operating at over 1000 volts.

18.1.1.1

This chapter applies to circuit cables and conductors between the service point or other power supply source and the final branch-circuit overcurrent device.

18.1.1.2

This chapter does not apply to the ~~circuit~~ cables and conductors between the final overcurrent device protecting the circuit and the outlet(s).

Detail SR-3

~~18.1.1.3~~

~~This chapter is not intended to duplicate or supersede manufacturer's instructions or industry consensus standards.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon May 09 12:02:46 EDT 2022

Committee Statement

Committee Statement: Revised phrase to "cables and conductors" for consistency with the title change.

Response Message: SR-324-NFPA 70B-2022

Public Comment No. 679-NFPA 70B-2022 [Section No. 18.1.1 [Excluding any Sub-Sections]]

Second Revision No. 213-NFPA 70B-2022 [Section No. 18.3.1]

Detail SR-350

18.3.1* Visual Inspections ~~and Mechanical Testing~~ .

~~Power cables~~ Readily accessible and visible portions of power cables and conductors shall be visually inspected ~~and mechanically tested~~ in accordance with Table 18.3.1.

Table 18.3.1 Power Cable and Conductor Visual Inspections ~~and Mechanical Tests~~

No.	Task	Test Type*	Notes
1	Physical condition, including operating environment	1 or 2	Damage or deterioration, supports or restraints, bending radius, excessive tension, signs of overheating, corrosion, swelling or soft spots
2	Correct labeling or identification	1 or 2	Phasing, cable ID, multiple sources, hazard, ~~or~~ other warning labels
3	Grounding/bonding	1 or 2	Damage, missing or loose terminations, ~~proper~~ clearance from energized parts, protection from physical damage
4	Vaults containing cables	1 or 2	Damage, concrete deterioration, ~~proper~~ drainage ~~if equipped~~
~~5~~	~~Cables in vaults~~	~~1 or 2~~	~~Damage or deterioration, supports, bending radius, excessive tension, swelling or soft spots, proper grounding~~
~~6~~5	~~Pot heads~~Cable and conductor terminations	1 or 2	Oil or compound leaks, cracks or damaged bodies, cleanliness, terminations
~~7~~6	Aerial installations	1 or 2	Damage, deteriorating supports, suspension systems, pinched or damaged insulation at dead ends, animal~~,~~ or bird infestation
~~8~~7	Raceway~~/cable tray~~	1 or 2	Damage or deterioration, ~~cable jacket~~ abrasion or wear ~~when exposed~~, continuity, tight joints, missing or loose bonding jumpers, corrosion
~~9~~8	Barriers, guards, and assemblies	1 or 2	Damage or signs of deterioration, arcing, tracking, supports and mounting hardware

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 08:39:10 EDT 2022

Committee Statement

Committee Statement: Section 18.3.1 addresses visual inspections. Mechanical tests are not included. “Mechanically tested” is removed. These are visible inspections.

Revised phrase to “cables and conductors” for consistency with the title change.

‘Visible’ is added to clarify portions to cable to be inspected. This does not include cables that require manipulation or movement to gain visible access, nor does this include cables in conduit or other enclosed wiring methods.

Response Message: SR-213-NFPA 70B-2022

Public Comment No. 165-NFPA 70B-2022 [Section No. 18.3.1]

Public Comment No. 151-NFPA 70B-2022 [Section No. 18.3.1]

Second Revision No. 215-NFPA 70B-2022 [Section No. 18.3.2]

18.3.2 Cleaning.

Cable and conductor insulation, jackets, sheaths, terminals or terminations, ~~electrical equipment surfaces,~~ enclosures, and insulating materials shall be kept ~~in a clean and contaminant-free state~~ clean to prevent a buildup of contaminants that can negatively affect performance, reduce life expectancy, or create a safety hazard .

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 08:51:24 EDT 2022

Committee Statement

Committee Statement: Changed content to add ‘conductors’. Added jackets and sheaths as part of conductor components to inspect for conductors. Deleting ‘electrical equipment surfaces’. These are not part of cables and conductors. Clarity was added to recognize that some buildup of dust may have no negative impact on the equipment operation.

Response Message: SR-215-NFPA 70B-2022

Second Revision No. 216-NFPA 70B-2022 [Section No. 18.3.3]

18.3.3 Lubrication.

Terminating devices, elbows, or T-bodies shall be lubricated ~~as required~~ in accordance with the manufacturer's instructions .

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 08:53:11 EDT 2022

Committee Statement

Committee Statement: Added 'per manufacturer's instructions' to improve clarity and consistency between chapters.

Response Message: SR-216-NFPA 70B-2022

Public Comment No. 154-NFPA 70B-2022 [Section No. 18.3.3]

Second Revision No. 217-NFPA 70B-2022 [Section No. 18.3.5]

18.3.5* Electrical Testing.

Power cables and conductors shall be electrically tested in accordance with Table 18.3.5.

Table 18.3.5 Power Cable and Conductor Electrical Tests

No.	Task	1000 Volts or Less ~~Criteria~~ Test Type*	Over 1000 Volts ~~Criteria~~ Test Type*	Notes
~~1~~	~~Infrared thermography or equivalent thermal inspection~~	~~1~~	~~1~~	
~~2~~ 1	Airborne ultrasonic acoustic emissions	~~1A~~ NA	1A	
~~3~~ 2	Insulation resistance	2A	~~2~~ NA	For cables and conductors 1000 volts or less.
3	Insulation resistance:			For cables and conductors over 1000 volts.
4	Very low frequency (VLF <1 Hz)	NA	2	
~~5~~	Overpotential test (hi-pot)	NA	2	
~~6~~	Dissipation factor/tan delta	NA	2	
~~7~~	Partial discharge	NA	1 or 2	
~~8~~	Power frequency	NA	2	
~~9~~	Oscillating wave	NA	2	
~~10~~ 4	~~Bolted connection resistance~~ Connection quality	1 or 2	1 or 2	Millivolt drop, digital low-resistance ohmmeter, infrared thermography. Circuits tested are based on criticality of the circuit.

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_217_Table_18.3.5.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 08:56:50 EDT 2022

Committee Statement

Committee Statement: Revised phrase to “cables and conductors” for consistency with the chapter title change.

Line 1 – Removed since Line 10 addresses IR inspection.

Line 2 - Ultrasonic emission detection is typically performed at voltages above 1kV.

Line 3 – Changed to 2A for 1000V or less. Requirement to test all cables and conductors under 1000V is impractical and not necessary. The benefits do not outweigh the risks. Test type is changed to ‘NA’ for cables and conductors over 1000 volts.

Lines 4 through 9 - Changed to clarify that only one test is required, more than one is optional.

Line 10 – Test type ‘1 or 2’ is retained. Criticality of the circuit is added. Requirement to test all connections under 1000V is impractical. The benefits do not outweigh the risks.

Response Message: SR-217-NFPA 70B-2022

Public Comment No. 166-NFPA 70B-2022 [Section No. 18.3.5]

Public Comment No. 168-NFPA 70B-2022 [Section No. 18.3.5]

Public Comment No. 169-NFPA 70B-2022 [Section No. 18.3.5]

Public Comment No. 167-NFPA 70B-2022 [Section No. 18.3.5]

Second Revision No. 218-NFPA 70B-2022 [Section No. 19.3.1]

19.3.1 Visual Inspections ~~and Mechanical Testing~~ .

Cable tray shall be visually inspected ~~and mechanically tested~~ in accordance with Table 19.3.1.

Table 19.3.1 Cable Tray Visual Inspections

No.	Task	Test Type*	Notes
1	Verify equipment grounding and bonding for the following:	~~1~~	
	Cable tray	1 or 2	
	Transition raceways	1 or 2	
2	Check for overfilling	1 or 2	
3	Inspect for the following:	~~1~~	
	Incorrect cables (small, not TC listed)	1A or 2A	
	Cable damage	1A or 2A	
	Cables ~~improperly supported~~ support ~~(such as on edges)~~ damage	1 or 2	
	Intrusive items ~~such as~~ (e.g., pipes, hangers) ~~, etc.~~	1 or 2	
4	Inspect for the following:	~~1~~	
	~~Proper spacing~~ Spacing of cables, for cables that have minimum spacing requirements	1 or 2	
	~~Proper cable~~ Cable tie-downs	1 or 2	
	~~Proper supports~~ Supports of cable trays	1 or 2	
	Damaged tray or supports	1 or 2	
	~~Properly installed expansion~~ Expansion joints in sufficient distances	1 or 2	

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_218_Table_19.3.1.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 08:59:52 EDT 2022

Committee Statement

Committee Statement: Section 19.3.1 addresses visual inspections.

Changed inspection type to indicate inspection can be performed online or offline. ‘Improperly’, ‘proper’ and ‘properly’ are ambiguous and have been removed.

Line 3 - Altered to allow cable type and cable damage to be enhanced tests.

Line 4 - Second sentence, added 'for cables that have minimum spacing requirements' since all cables do not require spacing between them.

Response Message: SR-218-NFPA 70B-2022 RESPONSE TO PC 326: 'Expansion joints' were retained. They are an important part of the inspection.

Public Comment No. 318-NFPA 70B-2022 [Section No. 19.3.1]

Public Comment No. 317-NFPA 70B-2022 [Section No. 19.3.1]

Public Comment No. 666-NFPA 70B-2022 [Section No. 19.3.1]

Public Comment No. 320-NFPA 70B-2022 [Section No. 19.3.1]

Public Comment No. 319-NFPA 70B-2022 [Section No. 19.3.1]

Public Comment No. 326-NFPA 70B-2022 [Section No. 19.3.1]

Second Revision No. 220-NFPA 70B-2022 [Section No. 19.3.2]

19.3.2 Cleaning.

Cable trays and the cables within shall be ~~cleaned of dirt and debris~~ kept clean to prevent a buildup of contaminants that can negatively affect performance, reduce life expectancy, or create a safety hazard .

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 09:06:28 EDT 2022

Committee Statement

Committee Statement: Clarity was added to recognize that some buildup of dirt and debris may have no negative impact on the equipment operation.

Response Message: SR-220-NFPA 70B-2022

Public Comment No. 324-NFPA 70B-2022 [Section No. 19.3.2]

Second Revision No. 221-NFPA 70B-2022 [Section No. 19.3.5]

19.3.5 Electrical Testing.

Metal cable trays shall be electrically tested in accordance with Table 19.3.5.

Table 19.3.5 Metal Cable Tray Electrical Tests

No.	Task	Test Type*	Notes
1	Perform infrared thermography	1A	Check for inductive heating of the cable tray.
2	Test cable tray effective ground fault current path for continuity	1A	

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 09:08:31 EDT 2022

Committee Statement

Committee Statement: Line 1 - Changed to 1A as inductive heating of cable tray is not a common issue.

Response Message: SR-221-NFPA 70B-2022

Public Comment No. 325-NFPA 70B-2022 [Section No. 19.3.5]

Second Revision No. 222-NFPA 70B-2022 [Section No. 20.3.1]

20.3.1* Visual Inspections.

Grounding ~~methods~~ and bonding shall be visually inspected in accordance with Table 20.3.1.

Table 20.3.1 Grounding ~~Method~~ and Bonding Visual Inspections

No.	Task	Test Type*	Notes
1	Inspect physical and mechanical condition~~.~~ of accessible and visible components and connections	2	
~~2~~	~~Inspect bolted and mechanical connections.~~	~~2~~	
~~3~~ 2	Inspect anchorage	2	

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_222_Table_20.3.1.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 09:11:01 EDT 2022

Committee Statement

Committee Statement: Clarified that grounding and bonding is to be inspected, rather than methods.

Line 1 - Added ‘accessible and visible’ to distinguish between components and connections that cannot be accessed (e.g. buried).

Line 2 – Content moved to Line 1.

Response Message: SR-222-NFPA 70B-2022

Public Comment No. 124-NFPA 70B-2022 [Section No. 20.3.1]

Public Comment No. 120-NFPA 70B-2022 [Section No. 20.3.1]

Second Revision No. 224-NFPA 70B-2022 [Section No. 20.3.5]

20.3.5* Electrical Testing.

Grounding ~~methods~~ and bonding shall be electrically tested in accordance with Table 20.3.5.

Table 20.3.5 Grounding ~~Method~~ and Bonding Electrical Testing

No.	Task	Test Type*	Notes
1	Measure bolted or mechanical connection resistance	2A	
2	~~Perform fall-of-potential test~~ For ground rod electrode systems, perform fall-of-potential test to measure grounding rod to earth resistance	2A	~~Where the distance requirements cause this test to be impractical, employ an alternate method.~~
3	Perform ~~a~~ point-to-point test to verify equipment is bonded together	2A	
4	Perform ~~a~~ substation grounding electrode system and substation grid integrity test by injecting current in accordance with industry practices	2A	
5	Measure ~~the~~ voltage between the equipment grounding conductor and the grounded conductor	1A	
6	Measure ~~the~~ current magnitude on the equipment grounding conductor	1A	

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_224_Table_20.3.5.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 09:15:42 EDT 2022

Committee Statement

Committee Statement: Clarified that grounding and bonding is to be inspected, rather than methods.

Line 2 - Modified to clarify requirements for ground rods. Note was deleted. Note does not provide guidance on alternate methods.

Response Message: SR-224-NFPA 70B-2022 RESPONSE TO PC 123: Notes column is retained for consistency among chapter RESPONSE TO PC 507: Chapter 10 inspection frequencies are requirements, not recommendations. Test types in table notes are retained for consistency in the document.

Public Comment No. 507-NFPA 70B-2022 [Chapter 20]

Public Comment No. 121-NFPA 70B-2022 [Section No. 20.3.5]

Public Comment No. 123-NFPA 70B-2022 [Section No. 20.3.5]

Second Revision No. 227-NFPA 70B-2022 [Section No. 21.1.1]

21.1* Scope.

This chapter identifies electrical maintenance requirements for ground-fault circuit interrupter (GFCI) protection for personnel, special-purpose GFCI (SPGFCI), and ground-fault protection of equipment for solidly grounded systems.

Detail SR-3

~~**21.1.2**~~

~~This chapter is not intended to duplicate or supersede manufacturer's instructions or industry consensus standards.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 09:32:26 EDT 2022

Committee Statement

Committee Statement: Identified GFCI term before using it in the remainder of the chapter. Special-purpose GFCI was added as these units are recognized, required by the NEC, and used in commercial applications.

Response Message: SR-227-NFPA 70B-2022

Public Comment No. 329-NFPA 70B-2022 [Section No. 21.1.1]

Second Revision No. 229-NFPA 70B-2022 [Section No. 21.3.1.1]

21.3.1.1 Visual Inspections. (Reserved)

~~GFCI shall be visually inspected in accordance with Table 21.3.1.1 .~~

~~Table 21.3.1.1 GFCI Visual Inspections~~

~~No.~~	~~Task~~	~~Circuit Breaker with an Integrated GFCI~~	~~Receptacles with an Integrated GFCI~~	~~Portable Receptacles and Cords with Integrated GFCI~~	~~Notes~~
~~1~~	~~Visual inspection.~~	~~See Chapter 15 for circuit breaker maintenance.~~	~~See Section 24.3 for receptacle maintenance.~~	~~See Section 24.3 for receptacle maintenance, See Section 29.4 for cord maintenance.~~	-

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 09:45:15 EDT 2022

Committee Statement

Committee Statement: This table only refers to items in other chapters. Those chapters stand alone and don't need to be specifically listed. Therefore, the table is redundant.

Response Message: SR-229-NFPA 70B-2022

Public Comment No. 336-NFPA 70B-2022 [Section No. 21.3.1.1]

Second Revision No. 230-NFPA 70B-2022 [Section No. 21.3.1.2]

21.3.1.2 Cleaning. (Reserved)

~~Cleaning shall be performed in accordance with Section 5.8 and Table 21.3.1.2 if contamination is present.~~

~~Table 21.3.1.2 GFCI Cleaning~~

~~No.~~	~~Task~~	~~Circuit Breaker with an Integrated GFCI~~	~~Receptacles with an Integrated GFCI~~	~~Portable Receptacles and Cords with Integrated GFCI~~	~~Notes~~
~~1~~	~~Cleaning.~~	~~See Chapter 15 for circuit breaker maintenance.~~	~~See Section 24.3 for receptacle maintenance.~~	~~See Section 24.3 for receptacle maintenance, See Section 29.4 for cord maintenance.~~	~~-~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 09:47:42 EDT 2022

Committee Statement

Committee Statement: This table only refers to items in other chapters. Those chapters stand alone and don't need to be specifically listed. Therefore, the table is redundant.

Response Message: SR-230-NFPA 70B-2022

Public Comment No. 337-NFPA 70B-2022 [Section No. 21.3.1.2]

Second Revision No. 231-NFPA 70B-2022 [Section No. 21.3.1.4]

21.3.1.4 Mechanical Servicing. (Reserved)

~~GFCI shall be mechanically serviced in accordance with Table 21.3.1.4 .~~

~~Table 21.3.1.4 GFCI Mechanical Servicing~~

~~No.~~	~~Task~~	~~Circuit Breaker with an Integrated GFCI~~	~~Receptacles with an Integrated GFCI~~	~~Portable Receptacles and Cords with Integrated GFCI~~	~~Notes~~
~~1~~	~~Mechanical servicing.~~	~~See Chapter 15 for circuit breaker maintenance.~~	~~See Section 24.3 for receptacle maintenance.~~	~~See Section 24.3 for receptacle maintenance, See Section 29.4 for cord maintenance.~~	-

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 09:50:12 EDT 2022

Committee Statement

Committee Statement: This table only refers to items in other chapters. Those chapters stand alone and don't need to be specifically listed. Therefore, the table is redundant.

Response Message: SR-231-NFPA 70B-2022

Public Comment No. 334-NFPA 70B-2022 [Section No. 21.3.1.4]

Second Revision No. 232-NFPA 70B-2022 [Section No. 21.3.1.5]

21.3.1.5 Electrical Testing.

GFCIs shall be electrically tested in accordance with ~~Table 21.3.1.5~~ the manufacturer's instructions using either the integral push-to-test button or an external test set .

~~Table 21.3.1.5 GFCI Electrical Servicing~~

No.	Task	Circuit Breaker with an Integrated GFCI Test Type*	Receptacles with an Integrated GFCI Test Type*	Portable Receptacles and Cords with Integrated GFCI Test Type*	Notes
~~1~~	~~Test GFCI using integral push-to-test or external test set.~~	~~1~~	~~1~~	~~1~~	
~~2~~	~~Electrical servicing.~~	~~See Chapter 15 for circuit breaker maintenance.~~	~~See Section 24.3 for receptacle maintenance.~~	~~See Section 24.3 for receptacle maintenance See Section 29.4 for cord maintenance.~~	

~~*Types specified in accordance with Section 8.4, as follows: 1 = online standard test, 1A = online enhanced test, 2 = offline standard test, 2A = offline enhanced test.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 09:52:39 EDT 2022

Committee Statement

Committee Statement: Line 1 is moved into Section 21.3.1.5. The remainder of table only refers to items in other chapters. Those chapters stand alone and don't need to be specifically listed. Therefore, the table is redundant. The requirement was revised to address the use of external test sets or push-to-test button for testing these devices.

Response Message: SR-232-NFPA 70B-2022

Public Comment No. 335-NFPA 70B-2022 [Section No. 21.3.1.5]

Public Comment No. 330-NFPA 70B-2022 [Section No. 21.3.1.5]

Second Revision No. 233-NFPA 70B-2022 [Section No. 21.3.2.1]

21.3.2.1 Visual Inspections.

Low-voltage ground-fault protection systems shall be visually inspected in accordance with Table 21.3.2.1.

Table 21.3.2.1 Low-Voltage Ground-Fault Protection Systems Visual Inspections

No.	Task	Circuit Breaker Trip Units or Switches with Integral Ground-Fault Protection Test Type*	Circuit Breakers or Switches with External Ground-Fault Protection Test Type*	Notes
1	Verify ground connection is made on the source side of the neutral disconnect link and any ground fault sensors	2	2	
2	For zero-sequence systems, verify all phase and neutral conductors pass through the sensor in the same direction, and that grounding conductors do not pass through the sensor	NA	2	
3	Verify sensor, wiring, and ground-fault components are not damaged	NA	2	
4	~~Visual inspection~~	~~See Chapter 15 for circuit breaker maintenance.~~	~~See Chapter 15 for circuit breaker maintenance, Chapter 17 for switch maintenance, and Chapter 35 for protective relays.~~	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 10:05:00 EDT 2022

Committee Statement

Committee Statement: The phrase for covered equipment is corrected to ground-fault protection of equipment.

Line 4 - The requirements are already covered by the other chapters. There is no reason to refer to those chapters in this table.

Response Message: SR-233-NFPA 70B-2022

Public Comment No. 338-NFPA 70B-2022 [Section No. 21.3.2.1]

Second Revision No. 234-NFPA 70B-2022 [Section No. 21.3.2.2]

21.3.2.2 Cleaning.

~~Cleaning~~ If contamination is found, low-voltage ground-fault protection systems shall be ~~performed~~ cleaned in accordance with ~~Section~~ 5.8 ~~and~~ Table 21.3.2.2 ~~if contamination is present~~ .

Table 21.3.2.2 Low-Voltage Ground-Fault Protection System Cleaning

No.	Task	Circuit Breaker Trip Units or Switches with Integral Ground-Fault Protection	Circuit-Breakers or Switches with External Ground-Fault Protection	Notes
-	-	Test Type*	Test Type*	-
1	Clean the relay case and cover	NA	2	
2	Clean sensors and associated ground faults protection system components	NA	2	
~~3~~	~~Cleaning~~	~~See Chapter 15 for circuit breaker maintenance.~~	~~See Chapter 15 for circuit breaker maintenance, Chapter 17 for switch maintenance, and Chapter 35 for protective relays.~~	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 10:07:10 EDT 2022

Committee Statement

Committee Statement: The reference to Section 5.8 is not necessary since that section is already required. Modifying the text so the language appears consistently between the items in this portion of the chapter.

Line 3 - The requirements are already covered by the other chapters. There is no reason to refer to those chapters in this table

Response Message: SR-234-NFPA 70B-2022

Public Comment No. 158-NFPA 70B-2022 [Section No. 21.3.2.2]

Public Comment No. 339-NFPA 70B-2022 [Section No. 21.3.2.2]

Second Revision No. 235-NFPA 70B-2022 [Section No. 21.3.2.4]

21.3.2.4 Mechanical Servicing.

~~Ground-fault~~ Low-voltage ground-fault protection systems shall be mechanically serviced in accordance with Table 21.3.2.4.

Table 21.3.2.4 Low-Voltage Ground-Fault Protection System Mechanical Servicing

No.	Task	Circuit Breaker Trip Units or Switches with Integral Ground-Fault Protection	Circuit Breakers or Switches with External Ground-Fault Protection	Notes
		Test Type*	Test Type*	
1	Inspect bolted electrical connections	NA	2	
2	Verify correct operation of the self-test panel/trip unit functions	2	2	
~~3~~	~~Verify settings as per the coordination study.~~	~~2~~	~~2~~	
4	~~Mechanical servicing.~~	~~See Chapter 15 for circuit breaker maintenance.~~	~~See Chapter 15 for circuit breaker maintenance, Chapter 17 for switch maintenance, and Chapter 35 for protective relays.~~	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 10:09:33 EDT 2022

Committee Statement

Committee Statement: Modifying the text so the language appears consistently between the items in this portion of the chapter.

Line 3 - Checking settings is not a mechanical servicing item and should be removed from the table. The setting verifications are being done through the requirements in other chapters and do not need to be in this section.

Line 4 - The requirements are already covered by the other chapters. There is no reason to refer to those chapters in this table.

Response Message: SR-235-NFPA 70B-2022

Public Comment No. 353-NFPA 70B-2022 [Section No. 21.3.2.4]

Public Comment No. 340-NFPA 70B-2022 [Section No. 21.3.2.4]

Public Comment No. 346-NFPA 70B-2022 [Section No. 21.3.2]

Second Revision No. 236-NFPA 70B-2022 [Section No. 21.3.2.5]

21.3.2.5 Electrical Testing.

Low-voltage ground-fault protection systems shall be electrically tested in accordance with Table 21.3.2.5.

Table 21.3.2.5 Low-Voltage Ground-Fault Protection System Electrical ~~Servicing~~ Testing

No.	Task	Circuit Breaker Trip Units or Switches with Integral Ground-Fault Protection	Circuit Breakers or Switches with External Ground-Fault Protection	Notes
-	-	Test Type*	Test Type*	-
1	Measure system neutral-to-ground resistance with the neutral disconnect link removed~~. Verify~~ , and verify no downstream grounds exist on the neutral	2	2	
~~2~~	~~Perform ground fault pickup~~	~~2~~	~~2~~	
~~3~~	~~Test GFCI using integral push-to-test or external test set~~	~~NA~~	~~NA~~	
4	~~Measure ground fault device timing at two points above the pickup setting~~	~~2~~	~~2~~	
~~5~~	~~Verify correct ratio and polarity of each phase-neutral current transformer pair, if applicable~~	~~2~~	~~2~~	
~~6~~ 2	Verify reduced control voltage tripping ability at 55% for ac systems and 80% for dc systems	NA	2A	
~~7~~	~~Verify correct operation of zone-interlock systems~~	~~2~~	~~2~~	
~~8~~	~~Electrical servicing~~	~~See Chapter 15 for circuit breaker maintenance~~	~~See Chapter 15 for circuit breaker maintenance, Chapter 17 for switch maintenance, and Chapter 35 for protective relays.~~	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_236_Table_21.3.2.5.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 10:15:06 EDT 2022

Committee Statement

Committee Statement: The title of the table is changed to match the title of the section and other chapters.

Lines 2, 4, 5, 7 - Many items in the table are protection relay testing items or circuit breaker trip unit testing items. These are already covered in other chapters and they do not need to be duplicated here

Line 3 - Both requirements for this item are NA, so this item is not needed in the table.

Line 6 - A company may choose to do this test at different test values but would also have to test at these mandatory values per this table. There should not be a requirement to test at values which are not applicable.

Line 8 - The requirements are already covered by the other chapters. There is no reason to refer to those chapters in this table.

Response Message: SR-236-NFPA 70B-2022 RESPONSE TO PC 513: Chapter 10 frequencies are required, not recommended. Test types are retained for consistency in the document.

Public Comment No. 348-NFPA 70B-2022 [Section No. 21.3.2.5]

Public Comment No. 347-NFPA 70B-2022 [Section No. 21.3.2.5]

Public Comment No. 349-NFPA 70B-2022 [Section No. 21.3.2.5]

Public Comment No. 513-NFPA 70B-2022 [Chapter 21]

Public Comment No. 341-NFPA 70B-2022 [Section No. 21.3.2.5]

Public Comment No. 331-NFPA 70B-2022 [Section No. 21.3.2.5]

Second Revision No. 238-NFPA 70B-2022 [Section No. 21.3.3.1]

21.3.3.1 Visual Inspections.

Medium-voltage ground-fault protection systems shall be visually inspected in accordance with Table 21.3.3.1.

Table 21.3.3.1 Medium-Voltage Ground-Fault Protection Systems Visual Inspections

No.	Task	Circuit Breaker Trip Units or Switches with Integral Ground-Fault Protection	Circuit Breakers or Switches with External Ground-Fault Protection	Notes
-	-	Test Type*	Test Type*	-
1	Verify ground connection is made on the source side of the neutral disconnect link and any ground fault sensors	2	2	
2	For zero-sequence systems, verify all phase and neutral conductors pass through the sensor in the same direction, and that grounding conductors either do not pass through the sensor or pass back through the sensor	NA	2	
~~3~~	~~Verify sensor, wiring, and ground-fault components are not damaged.~~	~~NA~~	~~2~~	
4	~~Visual inspection~~	~~See Chapter 15 for circuit breaker maintenance.~~	~~See Chapter 15 for circuit breaker maintenance, Chapter 17 for switch maintenance, and Chapter 35 for protective relays.~~	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 10:23:44 EDT 2022

Committee Statement

Committee Statement: Added missing hyphen in the section.

Modifying the text so the language appears consistently between the items in this

portion of the chapter.

Line 3 – The line is redundant with Chapter 35.

Line 4 - The requirements are already covered by the other chapters. There is no reason to refer to those chapters in this table.

Response Message: SR-238-NFPA 70B-2022

Public Comment No. 342-NFPA 70B-2022 [Section No. 21.3.3.1]

Public Comment No. 350-NFPA 70B-2022 [Section No. 21.3.3.1]

Second Revision No. 239-NFPA 70B-2022 [Section No. 21.3.3.2]

21.3.3.2 Cleaning.

~~Cleaning~~ If contamination is present, medium-voltage ground-fault protection systems shall be ~~performed~~ cleaned in accordance with ~~Section 5.8 and~~ Table 21.3.3.2 ~~if contamination is present~~ .

Table 21.3.3.2 Medium-Voltage Ground-Fault Protection System Cleaning

No.	Task	Circuit Breaker Trip Units or Switches with Integral Ground-Fault Protection	Circuit-Breakers or Switches with External Ground-Fault Protection	Notes
-	-	Test Type*	Test Type*	-
1	Clean sensors and associated ground-faults protection system components	NA	2	
~~2~~	~~Cleaning~~	~~See Chapter 15 for circuit breaker maintenance.~~	~~See Chapter 15 for circuit breaker maintenance, Chapter 17 for switch maintenance, and Chapter 35 for protective relays.~~	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 10:25:59 EDT 2022

Committee Statement

Committee Statement: Modifying the text so the language appears consistently between the items in this portion of the chapter. The reference to Section 5.8 is not required since that section is already required per that section.

Line 2 - The requirements are already covered by the other chapters. There is no reason to refer to those chapters in this table.

Response Message: SR-239-NFPA 70B-2022

Public Comment No. 343-NFPA 70B-2022 [Section No. 21.3.3.2]

Second Revision No. 240-NFPA 70B-2022 [Section No. 21.3.3.4]

21.3.3.4 Mechanical Servicing.

~~Ground-fault~~ Medium-voltage ground-fault protection systems shall be mechanically serviced in accordance with Table 21.3.3.4.

Table 21.3.3.4 Medium-Voltage Ground-Fault Protection System Mechanical Servicing

No.	Task	Circuit Breaker Trip Units or Switches with Integral Ground-Fault Protection	Circuit Breakers or Switches with External Ground-Fault Protection	Notes
		Test Type*	Test Type*	
1	Inspect bolted electrical connections	NA	2	
2	Verify correct operation of the self-test panel/trip unit functions	2	2	
~~3~~	~~Verify settings as per the coordination study~~	~~2~~	~~2~~	
4	~~Mechanical servicing~~	~~See Chapter 15 for circuit breaker maintenance.~~	~~See Chapter 15 for circuit breaker maintenance, Chapter 17 for switch maintenance, and Chapter 35 for protective relays.~~	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 10:33:21 EDT 2022

Committee Statement

Committee Statement: Modifying the text so the language appears consistently between the items in this portion of the chapter.

Line 3: Deleted as this is not a mechanical test.

Line 4 - The requirements are already covered by the other chapters. There is no reason to refer to those chapters in this table.

Response Message: SR-240-NFPA 70B-2022

Public Comment No. 344-NFPA 70B-2022 [Section No. 21.3.3.4]

Second Revision No. 241-NFPA 70B-2022 [Section No. 21.3.3.5]

21.3.3.5 Electrical Testing.

Medium-voltage ground-fault protection systems shall be electrically tested in accordance with ~~Table 21.3.3.5~~ Chapter 35 .

~~Table 21.3.3.5 Medium-Voltage Ground-Fault Protection System Electrical Servicing~~

No.	Task	Circuit Breaker Trip Units or Switches with Integral Ground-Fault Protection	Circuit Breakers or Switches with External Ground-Fault Protection	Notes
-	-	Test Type*	Test Type*	-
1	Measure system neutral-to-ground resistance with the neutral disconnect link removed. Verify no downstream grounds exist on the neutral.	2	2	
2	Perform ground fault pickup.	2	2	
3	Measure ground fault device timing at two points above the pickup setting.	2	2	
4	Verify correct ratio and polarity of each phase-neutral current transformer pair, if applicable.	NA	2A	
5	Verify reduced control voltage tripping ability at 55% for ac systems and 80% for dc systems.	NA	2A	
6	Verify correct operation of zone-interlock systems.	2	2	
7	Electrical servicing	See Chapter 15 for circuit breaker maintenance.	See Chapter 15 for circuit breaker maintenance, Chapter 17 for switch maintenance, and Chapter 35 for protective relays.	

~~NA: Not applicable.~~

~~*Types specified in accordance with Section 8.4, as follows: 1 = online standard test, 1A = online enhanced test, 2 = offline standard test, 2A = offline enhanced test.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 10:42:59 EDT 2022

Committee Statement

Committee Statement: The table is deleted because medium-voltage GFPE is covered in Chapter 35.

Response Message: SR-241-NFPA 70B-2022

Public Comment No. 345-NFPA 70B-2022 [Section No. 21.3.3.5]

Public Comment No. 332-NFPA 70B-2022 [Section No. 21.3.3.5]

Public Comment No. 352-NFPA 70B-2022 [Section No. 21.3.3.5]

Second Revision No. 242-NFPA 70B-2022 [Section No. 22.3.2]

22.3.2 Cleaning.

Luminaires shall be ~~cleaned to remove all dirt, grime, and obstructions when lumen output is below acceptable levels in the following areas:~~ kept clean to prevent a buildup of contaminants that negatively affect performance, reduce life expectancy, or create a safety hazard.

~~Exterior lens, if applicable~~

~~Interior lens, if applicable~~

~~Photocell, if applicable~~

~~**A.22.3.2**~~

~~OSHA 1926.56 and *The Lighting Library* (Illuminating Engineering Society of North America) provide guidance on acceptable illumination levels.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 10:46:34 EDT 2022

Committee Statement

Committee Statement: Removed “acceptable” as this is ambiguous.

Deleted items 1 through 3. There is no need to provide specific components as these may not be the reason for luminaire output loss.

Clarity was added to recognize that some buildup of contaminates may have no negative impact on the equipment operation.

Removed related appendix material. The information in A.22.3.2 and A.22.3.3 is the exact same and both are not needed.

Response Message: SR-242-NFPA 70B-2022

Public Comment No. 236-NFPA 70B-2022 [Section No. 22.3.2]

Public Comment No. 237-NFPA 70B-2022 [Section No. A.22.3.2]

Public Comment No. 234-NFPA 70B-2022 [Section No. 22.3.2]

Second Revision No. 243-NFPA 70B-2022 [Section No. 22.3.3]

22.3.3* ~~Electrical~~ Maintenance Program.

~~An EMP~~ A maintenance program for any lighting system shall include the following elements:

(1) Periodic inspections

(2) Criteria for determining group or spot replacement options to maintain the ~~acceptable~~ required illuminance levels

(3) Repair and replacement strategy

(4) Assessment of illuminance levels

A.22.3.3

OSHA 29 CFR 1926.56, "Illumination," and *The Lighting Library* (Illuminating Engineering Society of North America) provide guidance on acceptable illumination levels.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 10:49:49 EDT 2022

Committee Statement

Committee Statement: Removing the reference to EMP for the lighting. Referring to a light system EMP could cause confusion. Removing unnecessary periods at the end of two lines.

Item (2) - Removed "acceptable" as this is ambiguous.

Response Message: SR-243-NFPA 70B-2022

Public Comment No. 235-NFPA 70B-2022 [Section No. 22.3.3]

Second Revision No. 244-NFPA 70B-2022 [Section No. 22.3.4]

22.3.4 Servicing.

Servicing shall include inspections of the luminaire system for the following conditions, where applicable:

(1) ~~Proper aiming~~ Aiming or orientation

(2) Pole and pole base condition

(3) Safety chains and/or supports

(4) Socket condition and luminaire mounting hardware when replacing lamps

(5) Compatibility of replacement lamps with existing luminaire

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 10:51:27 EDT 2022

Committee Statement

Committee Statement: Ambiguous term ‘proper’ has been deleted.

Response Message: SR-244-NFPA 70B-2022

Public Comment No. 667-NFPA 70B-2022 [Sections 22.3.2, 22.3.3, 22.3.4]

Second Revision No. 245-NFPA 70B-2022 [Chapter 23]

Chapter 23 Lighting Control Systems (Reserved)

~~**23.1** Scope.~~

~~**23.1.1**~~

~~This chapter identifies electrical maintenance requirements for lighting control systems.~~

~~**23.1.2**~~

~~This chapter is not intended to duplicate or supersede manufacturer's instructions or industry consensus standards.~~

~~**23.2** Frequency of Maintenance. (Reserved)~~

~~**23.3** Emergency Lighting. (Reserved~~

~~**23.4** Energy-Efficient Controls. (Reserved)~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 10:53:19 EDT 2022

Committee Statement

Committee Statement: There are no requirements in this chapter. The chapter is marked as 'reserved'

Response Message: SR-245-NFPA 70B-2022

Public Comment No. 578-NFPA 70B-2022 [Chapter 23]

Second Revision No. 247-NFPA 70B-2022 [Section No. 24.3.1]

24.3.1 Visual Inspections.

Wiring devices shall be visually inspected in accordance with Table 24.3.1.

Table 24.3.1 Wiring Device Visual Inspections

No.	Task	Test Type*	Notes
1	Check for worn, cracked, or distorted housing	~~2~~ 2A	Repair or replace as needed.
2	Pins or contacts are burned, bent, pitted, missing, or discolored	~~2~~ 2A	Repair or replace as needed.
3	Securement method for flexible wiring is intact	~~2~~ 2A	Repair or replace as needed.
4	Check for corrosion of housing, contacts, and pins	~~2~~ 2A	Repair or replace as needed.
5	Confirm gaskets are intact	~~2~~ 2A	Replace as needed.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 11:00:51 EDT 2022

Committee Statement

Committee Statement: This section is about visual inspections. All except Line 1 are changed to enhanced tests.

Line 1 remains as an offline standard test. It is not impractical to perform visual assessment for worn, cracked or distorted housings as part of pre-work steps.

Response Message: SR-247-NFPA 70B-2022

Public Comment No. 242-NFPA 70B-2022 [Section No. 24.3.1]

Second Revision No. 248-NFPA 70B-2022 [Section No. 24.3.2]

24.3.2 Cleaning.

~~Cleaning~~ Wiring devices shall be ~~performed~~ cleaned in accordance with ~~Section~~ 5.8 ~~and~~ Table 24.3.2.

Table 24.3.2 Wiring Device Cleaning

No.	Task	Plug Test Type*	Receptacle Test Type*	Notes
-	-			-
1	Clean current-carrying parts and housing faces of foreign material or corrosion	~~2~~ 2A	~~2~~ 2A	
2	Clean exterior surfaces to maintain visibility of nameplate ratings	~~2~~ 2A	~~2~~ 2A	

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 11:04:00 EDT 2022

Committee Statement

Committee Statement: The reference to Section 5.8 is not necessary since Section 5.8 is a required part of the document.

Lines 1 and 2 do not directly apply to those devices. It is not possible to clean the current carrying parts of receptacles. There is no need to clean the exterior surface to maintain visibility of a nameplate that is not visible on those devices after they are installed.

Response Message: SR-248-NFPA 70B-2022

Public Comment No. 243-NFPA 70B-2022 [Section No. 24.3.2]

Public Comment No. 159-NFPA 70B-2022 [Section No. 24.3.2]

Second Revision No. 249-NFPA 70B-2022 [Section No. 24.3.5]

24.3.5 Electrical Testing.

Wiring devices shall be electrically tested in accordance with Table 24.3.5.

Table 24.3.5 Wiring Device Electrical Servicing

No.	Task	Test Type*	Notes
1	Confirm grounding and bonding for correct installation and secure connection	~~2~~ 2A	
2	Confirm proper polarity of contacts	~~1~~ 1A or ~~2~~ 2A	

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 11:06:18 EDT 2022

Committee Statement

Committee Statement: Line 1 - The process of gaining access to the connection terminals for wiring devices can create more problems than will be found during the inspections. This is unnecessary and will create more problems than it finds. If performed, these tests should be offline enhanced tests.

Line 2 - Removed ambiguous word “proper”. Confirming polarity of an outlet is done at the time of original installation or when a device is replaced. Requiring the polarity test on all the devices is not necessary and burdensome.

Response Message: SR-249-NFPA 70B-2022

Public Comment No. 245-NFPA 70B-2022 [Section No. 24.3.5]

Public Comment No. 668-NFPA 70B-2022 [Section No. 24.3.5]

Public Comment No. 244-NFPA 70B-2022 [Section No. 24.3.5]

Second Revision No. 250-NFPA 70B-2022 [Section No. 25.3.1]

25.3.1 Visual Inspections.

UPS shall be visually inspected in accordance with Table 25.3.1 .

Table 25.3.1 UPS Visual Inspections

No.	Task	Static Test Type*	Rotary Test Type*	Notes
1	Inspect doors and latches for fit, dents, corrosion, and missing hardware	1	1	
2	Check fans for ~~proper~~ operation	1	1	~~Annual~~
3	Inspect wiring, bus, cables, and connections for damaged insulation, broken leads, tightness of connections, ~~proper~~ crimping, and overall general condition including corrosion	2	2	
4	Inspect capacitors for swelling and discoloration	2	NA	
5	Check visible current-carrying parts and control devices, if applicable, for signs of overheating or deterioration	2	2	
6	Inspect rectifier and inverter assembly	2	NA	Inspect for signs of overheating or deterioration.
7	Inspect static switch module	2	NA	Inspect for signs of overheating or deterioration.
8	Inspect interface, control, I/O boards, and dc capacitor boards	2	2	Inspect for signs of overheating or deterioration.
~~9~~	~~Perform visual inspections for system circuit breakers~~	~~2~~	~~2~~	~~See Chapter 15.~~
~~10~~	~~Perform visual inspections for system batteries~~	~~2~~	~~NA~~	~~See Chapter 36.~~
~~11~~	~~Perform visual inspections for. system fuses~~	~~2~~	~~2~~	~~See Chapter 16.~~
~~12~~	~~Perform visual inspections for transfer systems~~	~~2~~	~~2~~	
~~13~~	~~Perform visual inspections for rotating equipment~~	~~NA~~	~~2~~	~~See Chapter 27.~~
9	For individual components, refer to the appropriate chapter(s) of this standard	NA	NA	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_250_Table_25.3.1.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 11:09:37 EDT 2022

Committee Statement

Committee Statement: Remove extra space at end of sentence.

Lines 2 and 3 - The word ‘proper’ is ambiguous and has been removed.

Lines 9, 10, 11, 12, 13 - Many of the items in the table just point to different chapters in NFPA 70B. There is no need for those references as those chapters already apply to the equipment.

Item 14(New): Added for consistency with language found in other chapters. This new line item ensures that additional equipment is not missed.

Response Message: SR-250-NFPA 70B-2022 RESPONSE TO PC 360: Lubrication table is retained for rotary type UPS systems. See second revisions for other tables. Test types are retained for consistency in document

Public Comment No. 356-NFPA 70B-2022 [Section No. 25.3.1]

Public Comment No. 669-NFPA 70B-2022 [Section No. 25.3.1]

Public Comment No. 360-NFPA 70B-2022 [Chapter 25]

Second Revision No. 251-NFPA 70B-2022 [Section No. 25.3.2]

25.3.2 Cleaning.

~~Cleaning~~ If contamination is present, UPS shall be ~~performed~~ cleaned in accordance with ~~Section~~ 5.8 ~~and~~ Table 25.3.2 ~~if contamination is present~~ .

Table 25.3.2 ~~Uninterruptible Power Supplies~~ UPS Cleaning

No.	Task	Static Test Type*	Rotary Test Type*	Notes
1	Replace the air filters and verify the vents are clear	2	2	
2	Vacuum enclosure	2	2	
3	Clean exposed switch contacts with a multipurpose precision lubricant before lubricating	2	2	
4	Wipe contact surfaces with a lint-free cleaning cloth	2	2	
5	Wipe contact surfaces with a noncorrosive cleaning agent	2	2	
6	Clean insulators	2	NA	
~~7~~	~~Perform cleaning for rotating equipment~~	~~NA~~	~~2~~	~~See Chapter 27.~~

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 11:12:37 EDT 2022

Committee Statement

Committee Statement: The reference to Section 5.8 is not necessary since that section is already required.

The title for the table is changed to “UPS Cleaning” to match other portions of this chapter.

Line 7 - This just points to a different chapter in NFPA 70B. There is no need for the reference as that chapter already applies to the equipment.

Response Message: SR-251-NFPA 70B-2022

Public Comment No. 357-NFPA 70B-2022 [Section No. 25.3.2]

Public Comment No. 160-NFPA 70B-2022 [Section No. 25.3.2]

Second Revision No. 252-NFPA 70B-2022 [Section No. 25.3.3]

25.3.3 Lubrication.

~~Uninterruptible power supplies~~ Rotary-type UPS shall be lubricated in accordance with Table 25.3.3 ~~and the manufacturer's instructions~~ .

Table 25.3.3 UPS Lubrication

No.	Task	Static Test Type*	Rotary Test Type*	Notes
~~1~~	~~Lubricate system switches.~~	~~2~~	~~NA~~	~~See Chapter 17.~~
~~2~~ 1	Lubricate rotating equipment	NA	2	~~See Chapter 27.~~

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_252_Table_25.3.3.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 11:14:32 EDT 2022

Committee Statement

Committee Statement: Lubrication applies only to rotating UPS. Line 1 just points to a different chapter in NFPA 70B. There is no need for that reference as that chapter already applies to the equipment. The chapter reference in Line 2 is deleted.

Response Message: SR-252-NFPA 70B-2022

Second Revision No. 253-NFPA 70B-2022 [Section No. 25.3.4]

25.3.4 Mechanical Servicing.

~~Uninterruptible power supplies~~ UPS shall be mechanically serviced in accordance with Table 25.3.4.

Table 25.3.4 UPS Mechanical Servicing

No.	Task	Static Test Type*	Rotary Test Type*	Notes
1	Verify operation and alignment of mechanical safety interlocks	2	2	
2	Check electrical hardware connections	2	2	~~See Chapter 7.~~
3	Perform mechanical servicing for system circuit breakers	2	2	~~See Chapter 15.~~
4	~~Perform mechanical servicing for system switches~~	~~2~~	~~2~~	~~See Chapter 17.~~
~~5~~	~~Perform mechanical servicing for system batteries~~	~~2~~	~~NA~~	~~See Chapter 36.~~
~~6~~	~~Perform mechanical servicing for system fuses~~	~~2~~	~~2~~	~~See Chapter 16.~~
~~7~~ 4	~~Perform mechanical servicing for transfer~~ Transfer systems	2	2	
~~8~~	~~Lubricate rotating equipment~~	~~NA~~	~~2~~	~~See Chapter 27.~~
5	For individual components, refer to the appropriate chapter(s) of this standard	NA	NA	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_253_Table_25.3.4.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 11:15:33 EDT 2022

Committee Statement

Committee The lubrication requirement is in the lubrication section. It is not necessary to duplicate

Statement: the requirement. Many of the items in the table just point to different chapters in NFPA 70B. There is no need for those references as those chapters already apply to the equipment. The chapter reference in Lines 2 and 3 are also deleted.

Item 9(New): Added for consistency with language found in other chapters. This new line item ensures that additional equipment is not missed.

Response Message: SR-253-NFPA 70B-2022

Public Comment No. 358-NFPA 70B-2022 [Section No. 25.3.4]

Second Revision No. 254-NFPA 70B-2022 [Section No. 25.3.5]

25.3.5 Electrical Testing.

~~Uninterruptible power supplies~~ UPS shall be electrically tested in accordance with Table 25.3.5.

Table 25.3.5 UPS Electrical Tests

No. -	Task -	Static Test Type*	Rotary Test Type*	Notes -
1	Perform infrared thermography of lug terminals	1	1	~~Annual~~ Conduct on annual basis.
2	Measure the neutral output current during peak loads	1A	1A	~~Every~~ Conduct every 3 months or when new equipment is added to the system
3	Record all operating parameters, such as frequency, voltage, and current, at the bypass switch, input, output, batteries, and modules, where applicable	1	1	
4	Test static transfer from normal to bypass and back to normal	1	1	
~~5~~	~~Test grounding system.~~	~~2~~	~~2~~	~~See Chapter 20.~~
~~6~~ 5	~~Test electrical~~ Electrical interlock systems, alarms, and indicator circuits	2	2	
~~7~~	~~Perform electrical servicing for system circuit breakers.~~	~~2~~	~~2~~	~~See Chapter 15.~~
~~8~~	~~Perform electrical servicing for system switches.~~	~~2~~	~~2~~	~~See Chapter 17.~~
~~9~~	~~Perform electrical servicing for system batteries.~~	~~2~~	~~NA~~	~~See Chapter 36.~~
~~10~~	~~Perform electrical servicing for system fuses.~~	~~2~~	~~2~~	~~See Chapter 16.~~
~~11~~	~~Perform electrical servicing for transfer system.~~	~~2~~	~~2~~	
~~12~~	~~Perform electrical servicing for rotating equipment.~~	~~NA~~	~~2~~	~~See Chapter 27.~~
6	Perform operational test on all alarms and emergency shutdowns, where applicable	2	2	
7	For individual components, refer to the appropriate chapter(s) of this standard	NA	NA	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_254_Table_25.3.5.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 11:17:21 EDT 2022

Committee Statement

Committee Statement: Line 2 - There is already an item about recording measurements of system parameters. The measurement of neutral currents every three months should be an enhanced test.

Line 13: Content moved from 25.4.2.2.1. Testing of alarm and emergency shutdowns is an electrical test.

Many of the items in the table just point to different chapters in NFPA 70B. There is no need for those references as those chapters already apply to the equipment.

Item 14(New): Added for consistency with language found in other chapters. This new line item ensures that additional equipment is not missed.

Response Message: SR-254-NFPA 70B-2022 RESPONSE TO PC 366: The term ‘practical’ is ambiguous, using the term ‘applicable’.

Public Comment No. 367-NFPA 70B-2022 [Section No. 25.3.5]

Public Comment No. 359-NFPA 70B-2022 [Section No. 25.3.5]

Public Comment No. 366-NFPA 70B-2022 [Section No. 25.4.2.2.1]

Second Revision No. 255-NFPA 70B-2022 [Section No. 25.4.1]

25.4.1 Equipment Software Upgrades and ~~Software~~ Revisions.

~~The manufacturer shall be contacted at intervals not to exceed 2 years for information on equipment~~ Equipment software upgrades and ~~recommended~~ revisions shall be performed as needed .

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 11:19:58 EDT 2022

Committee Statement

Committee Statement: Clarified that equipment software is to be updated as needed. Removed the 2-year criteria.

Response Message: SR-255-NFPA 70B-2022

Public Comment No. 361-NFPA 70B-2022 [Section No. 25.4]

Second Revision No. 351-NFPA 70B-2022 [Sections 25.4.2.3.5, 25.4.2.3.6, 25.4.2.3.7, 25.4.2.3.8]

25.4.2.2 Output Stability.

25.4.2.2.1*

The load shall be ~~stepped~~ adjusted in steps to determine the performance of the UPS when significant load changes occur. ~~accordance with each of the following sequences, expressed as a percent of UPS system rating:~~

~~0 percent to 100 percent to 0 percent~~

~~25 percent to 75 percent to 25 percent~~

~~50 percent to 100 percent to 50 percent~~

~~0 percent to 100 percent to 0 percent~~

A.25.4.2.2.1

Recommended load steps for determining UPS output stability are expressed as a percentage of the UPS system rating, as follows:

(1) 0 percent to 100 percent to 0 percent

(2) 25 percent to 75 percent to 25 percent

(3) 50 percent to 100 percent to 50 percent

(4) 0 percent to 100 percent to 0 percent

25.4.2.2.2

The voltage regulation and frequency stability shall be within the manufacturer's specifications.

~~**25.4.2.4.6** Voltage Regulation.~~

~~In accordance with the manufacturer's specifications, the load bank shall be increased to greater than 100 percent system load to ascertain that the system is within the manufacturer's ratings for input and output current overload rating.~~

25.4.2.2.3 Low Battery Voltage Shutdown.

25.4.2.2.3.1

Where applicable, UPS ac input power shall be removed while the system is supplying 100 percent power to a load bank.

25.4.2.2.3.2

The elapsed time until low battery voltage shutdown occurs shall be recorded and compared with specifications.

25.4.2.2.3.3

Voltage, current, and frequency shall be recorded during tests.

25.4.2.2.3.4

~~On~~ Upon restoration of UPS input power, ~~it shall be verified that~~ the battery ~~is~~ shall be verified as recharging properly.

~~**25.4.2.4.6** Return to Service.~~

~~**25.4.2.4.6.1**~~

~~Any abnormalities shall be corrected prior to returning the system to service.~~

~~**25.4.2.4.6.2**~~

~~The battery shall be fully recharged prior to returning the system to service.~~

Supplemental Information

File Name	Description	Approved
SR_351_Section_25.4.2.3.5.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Fri May 13 15:58:49 EDT 2022

Committee Statement

Committee Statement: 25.4.2.3.5: The specified load steps are very restrictive and don't leave any flexibility concerning load application and removal. Some load banks may not have the ability to provide the exact percentage of load steps as described. The suggested steps for the loads have been moved to the annex.

25.4.2.3.6: The title for this section is voltage regulation but does not address voltage regulation. The section requires an intentional overload of the UPS. Intentionally overloading a system could cause a system failure and should not be required.

25.4.2.3.8: The need to correct abnormalities before returning the system to service is documented elsewhere in NFPA 70B and is not needed here. Also, the current language would require "all" abnormalities" to be corrected before returning the equipment to service, which may not be appropriate if something is a non-critical item. There are good reasons to have the UPS in service even if the batteries are not charged, such as having improved voltage stability with the UPS.

Response Message: SR-351-NFPA 70B-2022

Public Comment No. 375-NFPA 70B-2022 [Section No. 25.4.2.3.8]

Public Comment No. 374-NFPA 70B-2022 [Section No. 25.4.2.3.6]

Public Comment No. 371-NFPA 70B-2022 [Section No. 25.4.2.3.5.1]

Public Comment No. 372-NFPA 70B-2022 [New Section after A.25.4.2.1.2]

Public Comment No. 373-NFPA 70B-2022 [Section No. 25.4.2.3.6]

Second Revision No. 130-NFPA 70B-2022 [Chapter 27 [Title Only]]

Rotating Equipment ~~and Vibration~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 06:37:24 EDT 2022

Committee Statement

Committee Statement: The scope of this chapter is rotating equipment. Vibration does not need to be in the title of the chapter as it is a type of maintenance test and not equipment.

Response Message: SR-130-NFPA 70B-2022

Public Comment No. 427-NFPA 70B-2022 [Chapter 27]

Second Revision No. 131-NFPA 70B-2022 [Section No. 27.3.1]

27.3.1* Visual Inspections.

~~A visual inspection shall be conducted to check the condition of the following:~~ Rotating equipment shall be visually inspected in accordance with Table 27.3.1 .

~~Proper application~~

~~Physical condition~~

~~Indicating device status~~

~~Labeling~~

~~Grounding/bonding~~

~~Machinery alignment~~

Table 27.3.1 Rotating Equipment Visual Inspections

No.	Task	Test Type*					Notes
		Low-Voltage Machines			Medium-Voltage Machines		
		≤200 hp	>200 hp	dc Machines	Induction	Synchronous	
1	Application	1 or 2	1 or 2	1 or 2	1 or 2	1 or 2	Ensure the machinery is installed in accordance with the manufacturer's listing and labeling and applicable codes/standards.
2	Physical condition	1 or 2	1 or 2	1 or 2	1 or 2	1 or 2	
3	Indicating device status	1 or 2	1 or 2	1 or 2	1 or 2	1 or 2	
4	Labeling	1 or 2	1 or 2	1 or 2	1 or 2	1 or 2	
5	Grounding/bonding	1 or 2	1 or 2	1 or 2	1 or 2	1 or 2	
6	Machinery alignment	1 or 2	1 or 2	1 or 2	1 or 2	1 or 2	Intended where signs of misalignment exist.

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test; Type 1A = online enhanced test; Type 2 = offline standard test; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_131_Table_27.3.1.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 06:42:42 EDT 2022

Committee Statement

Committee Statement: Section changed to be consistent with other chapters, including making the section a table. Types 1 or 2 were chosen to allow for either selection for maintenance.

Response Message: SR-131-NFPA 70B-2022 Proposed wording was rejected to remain aligned with other chapters. “Application” was retained in the table to ensure the machinery was installed per manufacturer listing and labeling, and applicable codes/standards. Improper machinery alignment can be detected by visual inspection in some instances.

Public Comment No. 428-NFPA 70B-2022 [Section No. 27.3.1]

Public Comment No. 690-NFPA 70B-2022 [Section No. 27.3.1]

Second Revision No. 132-NFPA 70B-2022 [Section No. 27.3.2]

27.3.2* Cleaning.

27.3.2.1

Electrical equipment surfaces, enclosures, and insulating materials shall be kept ~~in~~ clean to prevent a ~~clean and contaminant-free state~~ buildup of contaminants that negatively affect performance, reduce life expectancy, or create a safety hazard .

~~**27.3.2.2**~~

~~Cleaning shall be in accordance with Section 5.8 and this section.~~

27.3.2.2*

After ~~being cleaned, stored, or shipped,~~ cleaning, apparatus shall be dried before being placed in operation if tests indicate that the insulation resistance is below ~~a safe minimum~~ the recommended level.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 06:56:19 EDT 2022

Committee Statement

Committee Statement: Section 27.3.2: Changes help define intent of clean, or cleaned, as part of maintenance.

Section 27.3.2.1: Deleted to align with other chapters.

Section 27.3.2.2: Changes provide clarity specific to maintenance and cleaning, as it relates to this chapter. Changed wording to better define the intent of the requirement without using ambiguous wording.

Response Message: SR-132-NFPA 70B-2022 Section 27.3.2.1 and Annex 27.3.2.2 were retained to increase document usability.

Public Comment No. 430-NFPA 70B-2022 [Sections A.27.3.2, A.27.3.2.2]

Public Comment No. 161-NFPA 70B-2022 [Section No. 27.3.2]

Public Comment No. 429-NFPA 70B-2022 [Section No. 27.3.2]

Public Comment No. 691-NFPA 70B-2022 [Chapter 27]

Second Revision No. 327-NFPA 70B-2022 [Section No. 27.3.4]

Detail SR-354

27.3.5* Electrical Testing.

Rotating equipment shall be electrically tested in accordance with Table 27.3.5.

Table 27.3.5 Rotating Equipment ~~Testing~~Electrical Tests

No.	Task	Low-Voltage Machines			Medium-Voltage Machines		Notes
		≤200 hp	>200 hp	dc Machines	Induction	Synchronous	
		Test Type*	Test Type*	Test Type*	Test Type*	Test Type*	
1	Bolted connection resistance	2A	~~2~~2A	~~2~~2A	2	2	
2	Stator/armature winding DAR	2A	2A	~~2~~2A	2	2	ac stator or dc armature
3	Wound rotor/field winding DAR	~~2~~2A	~~2~~2A	~~2~~2A	2	2	ac wound rotor, synchronous dc rotor, dc fields
4	Stator/armature winding polarization index (PI)	2A	2A	2A	2	2	
5	Wound rotor/field winding PI	2A	2A	2A	2A	NA	
6	Stator winding dc dielectric withstand (overpotential)	2A	2A	2A	2A	2A	
7	Wound rotor/field winding dc dielectric withstand (overpotential)	2A	2A	2A	2A	2A	
8	Stator/armature winding resistance	2A	2A	2A	2	2	
9	Wound rotor/field winding resistance	2A	2A	2A	2	2	
10	Stator winding insulation power factor	NA	NA	NA	2A	2A	Insulation power factor/dissipation factor
11	Stator winding insulation power factor tip-up	NA	NA	NA	2A	2A	Insulation power factor/dissipation factor
12	Stator winding surge comparison	2A	2A	2A	2A	2A	
13	Insulated bearing insulation resistance	2A	2A	2A	2	2	
14	Temperature detection device	2A	2A	2A	2	2	

No.	Task	Low-Voltage Machines			Medium-Voltage Machines		Notes
		≤≤200 hp	>200 hp	dc Machines	Induction	Synchronous	
		Test Type*	Test Type*	Test Type*	Test Type*	Test Type*	
15	Machine space heater	2	2	2	2	2	
16	Vibration analysis	1A	~~1~~1A	~~1~~1A	~~1~~1A	~~1~~1A	
17	Current signature analysis	1A	1A	1A	1A	1A	
18	Partial discharge	NA	NA	NA	1A	1A	
19	Surge protection device	2A	2A	NA	2	2	
20	Motor starter	2	2	2	2	2	
21	Current transformers	2A	2A	NA	2	2	
22	Potential transformers	2A	2A	NA	2	2	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~; Type 1A = online enhanced test~~,~~; Type 2 = offline standard test~~,~~; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_327_Table_27.3.5.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon May 09 14:26:02 EDT 2022

Committee Statement

Committee Statement: Section 27.3.4 Testing is moved under Section 27.3.5 Electrical Testing.

The title is changed to electrical tests to align with other chapters.

Added equal sign to the column for 200HP motors since it was unintentionally excluding 200HP motors.

Lines 1-5: Changes allow the user of the document to select what tests to perform and when to apply them.

Line 16: Change allows the user of the document to select when to perform vibrations analysis and clarifies that not all motors need the forementioned test

Response Message: SR-327-NFPA 70B-2022

Public Comment No. 440-NFPA 70B-2022 [Section No. 27.3.4]

Public Comment No. 439-NFPA 70B-2022 [Section No. 27.3.4]

Public Comment No. 437-NFPA 70B-2022 [Section No. 27.3.4]

Second Revision No. 328-NFPA 70B-2022 [Sections 27.3.5, 27.3.6]

27.3.4* Mechanical Servicing.

~~Mechanical servicing shall include verification of the following:~~ Rotating equipment shall be mechanically serviced in accordance with Table 27.3.4 .

~~Integrity of accessible bolted connections~~

~~Cooling system operation~~

~~Mechanical operations~~

~~Machinery guards and assemblies~~

~~Vibration levels~~

Table 27.3.4 Mechanical Servicing

No.	Task	Test Type*					Notes
		Low-Voltage Machines			Medium-Voltage Machines		
		<=200 hp	>200 hp	dc Machines	Induction	Synchronous	
1	Integrity of accessible bolted connections	2	2	2	2	2	
2	Cooling system operation, as applicable	2	2	2	2	2	
3	Mechanical operation	2	2	2	2	2	
4	Machine guards and assemblies	2	2	2	2	2	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test; Type 1A = online enhanced test; Type 2 = offline standard test; Type 2A = offline enhanced test.

Detail SR-355

~~**27.3.6***~~ ~~Electrical Testing.~~

~~Electrical tests shall include verification of the following:~~

~~Insulation integrity~~

~~Winding circuit resistance~~

Supplemental Information

File Name	Description	Approved
SR_328_Table_27.3.4.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon May 09 14:31:02 EDT 2022

Committee Statement

Committee Statement: Section 27.3.4 (existing 27.3.5) is changed to be consistent with other chapters, including making the section a table and renumbering sections.

Existing Section 27.3.5 is deleted and associated annex material is moved to new Section 27.3.5.

Response Message: SR-328-NFPA 70B-2022

Public Comment No. 432-NFPA 70B-2022 [Chapter 27]

Public Comment No. 433-NFPA 70B-2022 [Sections A.27.3.5, A.27.3.6, A.27.3.7.1]

Second Revision No. 135-NFPA 70B-2022 [Section No. 27.3.7]

27.3.6* Special. (Reserved)

~~**27.3.6.1***~~ ~~Vibration Analysis.~~

~~Vibration-analyzing equipment that is capable of distinguishing vibration displacement as a function of frequency shall be used to detect or predict bearing and mechanical failures by monitoring vibration velocity.~~

A.27.3.6.1

Vibration analysis equipment is useful in isolating the source of vibration that might appear to be the result of other malfunctions within a machine. It is also useful for ensuring proper installation of critical production equipment. Today there are computerized data collecting analyzers that store vibration spectrums, using fast fourier transform (FFT) methodology. In addition to detecting vibration due to unbalance, FFT analysis of the instruments can identify faults in stator windings, rotor bars and end rings, and bearings.

A formal vibration analysis program can reduce costly machine failures. The program can range from the use of simple hand-held analyzers to sophisticated multichannel recorders with permanently mounted sensors to provide data for comparison. Such a program makes it possible to keep track of the condition of rotating equipment, particularly high-speed types. Trend charts assist in establishing maintenance needs.

The most common methods of measuring vibration are in units of velocity. Velocity measurements are in millimeters per second or inches per second. Vibration is usually measured at the bearing housing.

Displacement is generally used as an indicator of vibration severity for both low-speed equipment operating at less than 1200 rpm and low-frequency vibration. When measured as displacement, the units are microns peak-to-peak or mils peak-to-peak. Velocity is independent of machine speed and therefore a better general indicator of overall vibration severity. Suggested vibration limits for machines are specified in Table A.27.3.6.1 .

Table A.27.3.6.1 Vibration Severity Chart

Velocity rms		-	-	-	-
mm/sec	in./sec	Class 1	Class 2	Class 3	Class 4
0.71	0.028	A	A	A	A
1.12	0.044	B	A	A	A
1.8	0.071	B	B	A	A
2.8	0.110	C	B	B	A
4.5	0.177	C	C	B	B
7.1	0.279	D	C	C	B
11.2	0.440	D	D	C	C
18.0	0.708	D	D	D	C
28.0	1.10	D	D	D	D

Notes

(1) Class 1: up to 20 hp on fabricated steel foundation; Class 2: 25 hp–100 hp on fabricated steel foundation, 100 hp–400 hp on heavy solid foundation; Class 3: above 400 hp on heavy solid foundation; Class 4: above 100 hp on fabricated steel foundation.

(2) Grade A: good; Grade B: usable; Grade C: just acceptable; Grade D: not acceptable.

27.3.6.2 Reserved.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 08:16:00 EDT 2022

Committee Statement

Committee Statement:	Section was changed to “reserved” to be consistent with other chapters. Annex A.27.3.7.1 is moved to A.27.3.4 for mechanical servicing.
Response Message:	SR-135-NFPA 70B-2022

Public Comment No. 435-NFPA 70B-2022 [Section No. 27.3.4]

Public Comment No. 434-NFPA 70B-2022 [Section No. 27.3.7]

Second Revision No. 153-NFPA 70B-2022 [Section No. 28.1.1]

28.1.1

This chapter identifies electrical maintenance requirements for low-voltage single- and three-phase ~~50/60 Hz,~~ ac and dc motor control equipment and medium-voltage single- and three-phase motor control equipment.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 13:04:29 EDT 2022

Committee Statement

Committee Statement: The change better aligns with the intent of the chapter.

Response Message: SR-153-NFPA 70B-2022

Public Comment No. 441-NFPA 70B-2022 [Section No. 28.1.1]

Second Revision No. 137-NFPA 70B-2022 [Section No. 28.3.1]

28.3.1 Visual Inspections ~~and Mechanical Testing~~ .

Motor control equipment shall be visually inspected ~~and tested~~ in accordance with Table 28.3.1.

Table 28.3.1 Motor Control Equipment Visual Inspections ~~and Mechanical Tests~~

No.	Task	Low-Voltage Test Type*	Medium-Voltage Test Type*	Notes
1	Inspect physical and mechanical condition	~~1~~ 1 or 2	~~1~~ 1 or 2	
2	Inspect anchorage and grounding	~~1~~ 1 or 2	~~1~~ 1 or 2	
3	~~Inspect~~ Physical integrity of contactors ~~— mechanical operation~~	~~2~~ 1	~~2~~ 1	
~~4~~	~~Inspect contactors — contact condition~~	~~2~~	~~2~~	~~Accessible contacts only~~
~~5~~ 4	Verify circuit breakers, fuses, and overload elements ~~is~~ are the correct sizes and types and correspond to the drawings	2	2	EMP determines when these inspections can be done energized.
~~6~~	~~Verify fuse sizes are correct~~	~~2~~	~~2~~	
~~7~~	~~Check bolted connection resistance~~	~~2~~	~~2~~	
~~8~~	~~Verify correct lubrication on moving current-carrying parts and sliding surfaces~~	~~2~~	~~2~~	
~~9~~	~~Verify mechanical interlock systems for correct sequencing~~	~~2~~	~~2~~	
~~10~~	~~Verify correct shutter operation~~	~~NA~~	~~2~~	
~~11~~ 5	Verify instrument transformer ratios are correct	2	2	
~~12~~	~~Verify mechanical indicating devices are functional~~	~~2~~	~~2~~	
~~13~~ 6	Inspect insulators for damage, tracking, or contaminated surfaces	2	2	
~~14~~ 7	Verify filters are clean and in place	2	2	
~~15~~	~~Verify switch blade alignment is correct~~	~~2~~	~~2~~	
~~16~~	~~Verify fuse holders provide adequate mechanical support and contact integrity~~	~~2~~	~~2~~	
~~17~~ 8	Ensure maintenance devices are available for servicing	NA	1	
~~18~~ 9	Verify switch phase barriers are in place	2	2	
~~19~~ 10	Verify fuse expulsion-limiting devices are in place	NA	2	
~~20~~	~~Operate switches and circuit breakers to ensure smooth operation~~	~~2~~	~~2~~	
~~21~~	~~Ensure correct alignment on drawout devices~~	~~NA~~	~~2~~	

No. -	Task -	Low-Voltage Test Type*	Medium-Voltage Test Type*	Notes -
~~22~~ 11	~~Inspect circuit breakers~~ For individual components and exposed conductors, refer to the appropriate chapter(s) of this standard	NA	NA	~~See Chapter 15.~~

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_137_Tabel_28.3.1.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 11:45:09 EDT 2022

Committee Statement

Committee Statement: Section changed to be consistent with other chapters. Mechanical servicing items from Table 28.3.1 have been incorporated into new Table 28.3.4.

Lines 1 and 2: Change allows flexibility in the EMP to determine when tests can be performed energized vs deenergized, based on appropriate risk analysis.

Response Message: SR-137-NFPA 70B-2022

Public Comment No. 692-NFPA 70B-2022 [Section No. 28.3.1]

Public Comment No. 230-NFPA 70B-2022 [Section No. 28.3.1]

Public Comment No. 443-NFPA 70B-2022 [Section No. 28.3.1]

Public Comment No. 447-NFPA 70B-2022 [Section No. 28.3.1]

Public Comment No. 445-NFPA 70B-2022 [Section No. 28.3.1]

Public Comment No. 444-NFPA 70B-2022 [Section No. 28.3.1]

Public Comment No. 446-NFPA 70B-2022 [Section No. 28.3.1]

Second Revision No. 138-NFPA 70B-2022 [Section No. 28.3.2]

28.3.2 Cleaning. ~~(Reserved)~~

Bus, cables, terminals or terminations, electrical equipment surfaces, enclosures, and insulating materials shall be cleaned to prevent a buildup of contaminants that negatively affect performance, reduce life expectancy, or create a hazard.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 11:57:40 EDT 2022

Committee Statement

Committee Statement: Section changed to be consistent with other chapters, including scope of work.

Response Message: SR-138-NFPA 70B-2022

Public Comment No. 217-NFPA 70B-2022 [Section No. 28.3.2]

Second Revision No. 139-NFPA 70B-2022 [Section No. 28.3.3]

28.3.3 Lubrication. ~~(Reserved)~~

Moving and sliding surfaces shall be lubricated in accordance with Table 28.3.3 .

Table 28.3.3 Moving and Sliding Surfaces Lubrication

No.	Task	Test Type*		Notes
		1000 Volts or Less	Greater than 1000 Volts	
1	Apply a thin coating of conductive lubricant to exposed contacts as specified by the manufacturer	2	2	
2	Apply nonconductive lubricant as needed to mechanism parts as specified by the manufacturer	2	2	
3	Apply conductive lubricant to pivot points, as well as moving and sliding surfaces, as specified by the manufacturer	2	2	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test; Type 1A = online enhanced test; Type 2 = offline standard test; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_139_Table_28.3.3.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Thu Apr 28 12:00:55 EDT 2022

Committee Statement

Committee Section changed to be consistent with other chapters, including making Section

Statement: 28.3.3 a table.

Response Message: SR-139-NFPA 70B-2022

Public Comment No. 218-NFPA 70B-2022 [Section No. 28.3.3]

Second Revision No. 140-NFPA 70B-2022 [Section No. 28.3.4]

28.3.4 Mechanical Servicing. ~~(Reserved)~~

Motor control equipment shall be mechanically serviced in accordance with Table 28.3.4 .

Table 28.3.4 Motor Control Equipment Mechanical Servicing

No.	Task	Test Type*					Notes
		Low-Voltage Machines			Medium-Voltage Machines		
		≤200 hp	>200 hp	dc Machines	Induction	Synchronous	
1	Integrity of accessible bolted connections	2	2	2	2	2	
2	Cooling system operation, as applicable	2	2	2	2	2	
3	Mechanical operation	2	2	2	2	2	
4	Machine guards and assemblies	2	2	2	2	2	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test; Type 1A = online enhanced test; Type 2 = offline standard test; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_328_Table_27.3.4.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 12:02:12 EDT 2022

Committee Statement

Committee Statement: Section changed to be consistent with other chapters, including making Section 28.3.4 a table. Mechanical servicing items from Table 28.3.1 have been incorporated into Table 28.3.4.

Response Message: SR-140-NFPA 70B-2022

Public Comment No. 215-NFPA 70B-2022 [Section No. 28.3.4]

Second Revision No. 141-NFPA 70B-2022 [Section No. 28.3.5]

28.3.5 Electrical Testing.

Motor control equipment shall be electrically tested in accordance with Table 28.3.5.

Table 28.3.5 Motor Control Equipment Electrical Tests

No.	Task	Low-Voltage Test Type*	Medium-Voltage Test Type*	Notes
1	~~Measure bolted connection~~ Inspect electrical connections for high resistance	~~2~~ 1 or 2	~~2~~ 1 or 2	See Section 7.2.
2	Measure insulation resistance ~~phase to phase and phase to ground with starter closed~~ of electrical power circuits	2	2	
3	Measure insulation resistance across each open starter pole	2	2	
4	Measure insulation resistance of control wiring with respect to ground	2A	2A	
5	Test motor protection devices	2	2	
~~6~~	~~Test circuit breakers~~	~~2~~	~~2~~	~~See Chapter 15.~~
~~7~~ 6	Perform control system operational tests	~~2~~ 1A	~~2~~ 1A	Include automatic throw-overs, paralleling controls, interlock and safety systems, or any other operational or maintenance-related control.
~~8~~ 7	Perform vacuum bottle integrity test or a magnetron atmospheric condition (MAC) test on vacuum bottles	NA	2A	
~~9~~	~~Perform vacuum bottle integrity test~~	~~NA~~	~~2~~	
~~10~~ 8	Perform dielectric withstand test	2A	2A	
~~11~~ 9	Measure contact resistance	2	2	
~~12~~	~~Measure power fuse resistance~~	~~2~~	~~2~~	
~~13~~	~~Test control power transformer~~	~~NA~~	~~2~~	~~See Chapter 11.~~
~~14~~	~~Test starting transformers~~	~~2A~~	~~2A~~	~~See Chapter 11.~~
~~15~~	~~Test protective relay parameters~~	~~2~~	~~2~~	
10	For individual components, refer to the appropriate chapter(s) of this standard	NA	NA	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved

SR_141_Table_28.3.5.docx For staff use only

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 12:05:19 EDT 2022

Committee Statement

Committee Statement: Section changed to be consistent with other chapters.

Changes to the testing wording and notes, and table deletions, provide clarity of scope and intent of the requirements of the table.

Response Message: SR-141-NFPA 70B-2022 RESPONSE TO PC 220: (Line 1) Declined to put 'See Chapter 7' as this would be inconsistent with other chapters and would have to be done with almost every other line in the table.

Public Comment No. 448-NFPA 70B-2022 [Section No. 28.3.5]

Public Comment No. 220-NFPA 70B-2022 [Section No. 28.3.5]

Public Comment No. 442-NFPA 70B-2022 [Section No. 28.3.5]

Public Comment No. 453-NFPA 70B-2022 [Section No. 28.3.5]

Second Revision No. 142-NFPA 70B-2022 [Section No. 29.1.2]

29.1.2

~~Mobile equipment is not included in this chapter.~~ This chapter does not apply to mobile equipment

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Thu Apr 28 12:14:26 EDT 2022

Committee Statement

Committee Statement: Changed to be consistent with other chapter language.
Response Message: SR-142-NFPA 70B-2022

Public Comment No. 380-NFPA 70B-2022 [Section No. 29.1.2]

Second Revision No. 155-NFPA 70B-2022 [Section No. 29.2]

29.2 Frequency of Maintenance.

The periodic maintenance procedures in Section 29.3 shall be performed in accordance with the frequencies in Chapter 9, unless otherwise specified in this chapter.

~~**A.29.2**~~

~~The key to safe maintenance is putting in place a maintenance program, integrating the safety aspects of maintenance and including inspection, reporting, and record-keeping procedures. Records must be kept to provide information for planning maintenance and replacement activities so that they occur at the proper time. Proper maintenance management of equipment requires a detailed inventory of all major items, including, among other things, information on manufacturer, model, year, and number and a list of the parts required for normal service and major repairs.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 13:16:09 EDT 2022

Committee Statement

Committee Statement: The annex language is not specific to frequency of maintenance.

Response Message: SR-155-NFPA 70B-2022

Public Comment No. 393-NFPA 70B-2022 [Section No. A.29.2]

Public Comment No. 392-NFPA 70B-2022 [Section No. 29.2]

Second Revision No. 143-NFPA 70B-2022 [Section No. 29.3.1.1]

29.3.1.1*

Portable electrical tools and equipment shall be visually inspected before each use for the following conditions:

(1) Pinched, crushed, nicked, or frayed cord jacket

(2) Damaged plug or missing pins

(3) Damage to grounding means, such as terminals, straps, or pins

(4) Signs of loosening, fraying, or overheating of the plug, cord, or tool

(5) External casing defects, such as cracks, damaged or loose components, or missing screws

(6) Damaged or missing guards

(7) Damaged wheels or blades

(8) Signs of leaking fluids

(9) Missing cover plates

(10) Loose or frayed conductors at termination points

(11) Damaged strain relief cord connectors

A.29.3.1.1

Visual inspections are aimed at detecting signs of ~~possible fault — for example, oil or coolant leaks, structural cracks, or cutting-edge wear. This also includes~~ damage. This could also include the mechanical adjusting and tune-up of equipment and the detection and correction of small problems before they become major problems. ~~Tools should be examined prior to each use to ensure that the necessary guards are present and secure, wheels and blades are not cracked or damaged, and electrical cords are not damaged, such as a missing ground pin or exposed conductors.~~ Items requiring attention should be reported, removed from use, and tagged “Do Not Use.”

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 12:16:48 EDT 2022

Committee Statement

Committee Statement: Annex material was edited to remove redundant requirements from Chapter 29.

Response Message: SR-143-NFPA 70B-2022

Public Comment No. 395-NFPA 70B-2022 [Section No. A.29.3.1.1]

Second Revision No. 144-NFPA 70B-2022 [Section No. 29.3.1.3]

~~29.3.1.3~~

~~Unless otherwise specified by the EMP, portable equipment and flexible cord sets that remain connected and are not exposed to damage shall be checked for buildup of debris around the equipment and cord connection.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 12:23:37 EDT 2022

Committee Statement

Committee Statement: Section was deleted as it was redundant with the requirements of Section 29.3.2 Cleaning.

Response Message: SR-144-NFPA 70B-2022

Public Comment No. 383-NFPA 70B-2022 [Section No. 29.3.1.3]

Second Revision No. 145-NFPA 70B-2022 [Section No. 29.3.4]

29.3.4 Mechanical Servicing.

Mechanical servicing of portable electrical tools and equipment shall be carried out according to the manufacturer's instructions ~~and applicable industry standards~~ .

~~**29.3.4.2**~~

~~Portable electrical tools and equipment shall be inspected for loose, frayed, or overheated conductors at termination points.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 12:24:20 EDT 2022

Committee Statement

Committee Statement: Section 29.3.4.1 was modified to align with other chapters. Section 29.3.4.2 was deleted to not be redundant with the requirements of 29.3.1.1.

Response Message: SR-145-NFPA 70B-2022

Public Comment No. 384-NFPA 70B-2022 [Section No. 29.3.4]

Second Revision No. 146-NFPA 70B-2022 [Section No. 29.3.5]

29.3.5* Electrical ~~Tests~~ Testing .

~~Electrical~~ When a GFCI or an assured equipment grounding conductor program is not implemented, electrical testing of portable electrical tools and equipment shall be conducted to verify the following, at a minimum:

(1) Equipment grounding from the tool or equipment to the plug ground pin

(2) Insulation resistance

(3) Correct polarity

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 12:25:12 EDT 2022

Committee Statement

Committee Statement: Section 29.3.5 was changed to align with the wording from other chapters. It also was changed to incorporate the use of GFCIs or the assured grounding conductor program as defined in OSHA language.

Response Message: SR-146-NFPA 70B-2022

Public Comment No. 70-NFPA 70B-2022 [Section No. 29.3.5]

Public Comment No. 389-NFPA 70B-2022 [Section No. 29.3.5]

Second Revision No. 147-NFPA 70B-2022 [Section No. 30.3.1]

30.3.1*

~~Maintenance personnel~~ The equipment owner shall ensure that supporting documentation, including the following, is available:

(1) System designer/installer, with installation and commissioning dates

(2) Emergency contacts for system owner

(3) Specifications

(4) Electrical schematics and as-built drawings

(5) ~~Proper signage~~ Signage , markings, and labels

(6) Mechanical drawings

(7) Commissioning manual, test plan, and appropriate test results

(8) Operations and maintenance manuals

(9) Materials list ~~to include~~ of expendable maintenance items, such as filters and fuses

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 12:26:36 EDT 2022

Committee Statement

Committee Statement: Line 5: Change was made to remove ambiguous wording

Response Message: SR-147-NFPA 70B-2022

Public Comment No. 696-NFPA 70B-2022 [Chapter 30]

Second Revision No. 148-NFPA 70B-2022 [Section No. 30.4.1]

30.4.1* Visual Inspections ~~and Mechanical Testing~~ .

PV systems and their associated equipment shall be visually inspected ~~and mechanically tested~~ in accordance with Table 30.4.1.

Table 30.4.1 PV System Visual Inspections ~~and Mechanical Tests~~

No.	Task	Test Type*	Notes
1	Front of PV modules	1 or 2	Damage, debris, soiling, discoloration, cracks, ~~or~~ and broken glass.
2	Backs of PV modules	1 or 2	Damage, debris, discoloration, cracks, and tears.
3	No unintentional shading of the array	1 or 2	Foliage, weeds, trees, or structures.
4	Conductors, connectors, and wiring harnesses are ~~properly~~ secured	1 or 2	Damaged insulation, melted plastic, broken or missing wiring and raceway supports.
5	~~Proper signage~~ Signage , markings, and labels	1 or 2	Arc flash, shock, mechanical hazards, means of isolation location.
6	String fuses ~~appropriately~~ are sized ~~per~~ in accordance with system design	~~1 or 2~~ 1A or 2A	Array fires can be caused by improperly sized string fuses. Replacement fuses should be matched to the design criteria.
7	Ensure all electrical equipment enclosures, raceways, structures, and mechanical apparatus are ~~properly~~ secured	1 or 2	Loose connections or connectors, broken raceways, and supports, missing hardware.
8	Electrical terminations, module interconnections	1	~~Infrared thermography~~ Damage, corrosion, discoloration .
9	Tracking and mechanical systems (e.g., gearbox, drivetrain~~, etc.~~)	1 or 2	~~Calibrated torque device, leaking~~ Leaking fluids, bent, broken or damaged drivetrains, array alignment.
10	Grounding and bonding	1 or 2	~~Proper~~ Secure attachment, missing, damaged or broken connections, protection from physical damage.
11	Battery cells and jumpers	1 or 2	Leaking, bulging, corrosion, fluid levels, damage, melted plastic, discoloration.
12	Roof or wall penetrations	1 or 2	Moisture, dust, and dirt ingress.
13	Site	1 or 2	Storm water runoff channels clear of debris, erosion around piers and pads, vegetation management, animal infestation/nesting /burrowing.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_148_Table_30.4.1.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 12:27:44 EDT 2022

Committee Statement

Committee Statement: Table and wording were changed to align with other chapters.

Line 1: Wording in notes were changed to be more consistent with other inspection criteria in the table.

Line 3: Change better defines intent of the visual inspection.

Lines 4, 5, 7, 10: Changed to not be ambiguous or vague.

Line 6: Changed to not be ambiguous or vague and to require this test to be an enhanced test.

Line 8: Changed to incorporate module interconnections, along with defining the notes to include the visual inspection criteria.

Line 9: Calibrated torque devices have been deleted from the note. The mechanical servicing of tracking and mechanical systems has been incorporated into new Table 30.4.4.

Response Message: SR-148-NFPA 70B-2022

Public Comment No. 291-NFPA 70B-2022 [Section No. 30.4.1]

Public Comment No. 294-NFPA 70B-2022 [Section No. 30.4.1]

Public Comment No. 293-NFPA 70B-2022 [Section No. 30.4.1]

Public Comment No. 290-NFPA 70B-2022 [Section No. 30.4.1]

Public Comment No. 295-NFPA 70B-2022 [Chapter 30]

Public Comment No. 292-NFPA 70B-2022 [Section No. 30.4.1]

Public Comment No. 695-NFPA 70B-2022 [Section No. 30.4.1]

Public Comment No. 694-NFPA 70B-2022 [Section No. 30.3.1]

Second Revision No. 149-NFPA 70B-2022 [Section No. 30.4.4]

30.4.4 Mechanical Servicing. ~~(Reserved)~~

PV systems and their associated equipment shall be mechanically serviced in accordance with Table 30.4.4 .

Table 30.4.4 PV System Mechanical Servicing

No.	Task	Test Type*	Notes
1	Tracking and mechanical systems (e.g., gearbox, drivetrain)	1 or 2	Torque of bolted mechanical systems, mechanical alignment.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test; Type 1A = online enhanced test; Type 2 = offline standard test; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_149_Table_30.4.4.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Thu Apr 28 12:28:38 EDT 2022

Committee Statement

Committee Statement: d
Response Message: SR-149-NFPA 70B-2022

Second Revision No. 150-NFPA 70B-2022 [Section No. 30.4.5]

30.4.5* Electrical Testing.

PV systems and their associated equipment shall be electrically tested in accordance with Table 30.4.5.

Table 30.4.5 PV System Electrical Tests

No.	Task	Test Type* [a]	Notes
1	Electrical terminations	1 or 2	Any or all the following could be utilized: infrared thermography[b] , contact resistance, millivolt drop, calibrated torque device.
2	Grounding and bonding	1 or 2	Any or all the following could be utilized: infrared thermography[b] , contact resistance, fall of potential, point to point, current reading, calibrated torque device.
3	PV strings and modules	1 or 2	IV curve trace[c] , insulation resistance, operating voltage, and current readings, electroluminescence[d] imaging , infrared thermography.[b]
4	Module interconnections	1	Infrared thermography[b] .

[a] * Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test, ; Type 1A = online enhanced test, ; Type 2 = offline standard test, ; Type 2A = offline enhanced test.

[b] Infrared thermography (IR): This noncontact electrical test can be performed on photovoltaic modules, strings, systems, and/or associated wiring connections. The modules or systems must have current flowing to acquire useful data. These images can help identify potential issues to include failed modules, high-resistance connections, cell hot spots, and interconnection issues.

[c] IV curve trace — current and voltage (IV) tracing: This electrical testing is used to determine output and electrical parameters of photovoltaic modules, strings, and systems. Tests are conducted on electrically isolated photovoltaic devices. Electrical parameters evaluated include open circuit voltage, short circuit current, maximum power, maximum power voltage, and maximum power current. This test can give an accurate snapshot of the health of the module, string, or system.

[d] Electroluminescence imaging (EL): This noncontact electrical test is a useful tool to find and identify cracked cells in deployed crystalline or wafer-based photovoltaic modules. Depending on equipment used, the modules or strings might or might not need to be isolated to acquire useful images. Cracks in cells can contribute to power loss.

A.30.4.5

Infrared thermography (IR): This noncontact electrical test can be performed on photovoltaic modules, strings, systems, and/or associated wiring connections. The modules or systems must have current flowing to acquire useful data. These images can ~~help~~ identify potential issues ~~to include~~ , including failed modules, high-resistance connections, cell hot spots, and interconnection issues.

IV curve trace — current and voltage (IV) tracing: This electrical testing is used to determine output and electrical parameters of photovoltaic modules, strings, and systems. Tests are conducted on electrically isolated photovoltaic devices. Electrical parameters are evaluated ~~include~~ , including open circuit voltage, short-circuit current, maximum power, maximum power voltage, and maximum power current. This test can give an accurate snapshot of the health of the module, string, or system.

Electroluminescence imaging (EL): This noncontact electrical test is a useful tool to find and identify cracked cells in deployed crystalline or wafer-based photovoltaic modules. Depending on the equipment used, the modules or strings might ~~or might not~~ need to be isolated to acquire useful images. Cracks in cells can contribute to power loss.

Supplemental Information

File Name	Description	Approved
SR_150_Table_30.4.5.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 12:29:48 EDT 2022

Committee Statement

Committee Statement: Line 3: Changed to include the word “imaging” to match the table note associated with it. Note b was moved to annex as information.

Response Message: SR-150-NFPA 70B-2022

Public Comment No. 296-NFPA 70B-2022 [Section No. 30.4.5]

Second Revision No. 151-NFPA 70B-2022 [Section No. 31.3.1]

31.3.1* Visual Inspection and Mechanical Testing.

Wind power electric systems and associated equipment shall be visually inspected and mechanically tested in accordance with Table 31.3.1.

Table 31.3.1 Wind Power Electric Systems and Associated Equipment Visual Inspections and Mechanical Tests

No.	Task	Test Type*	Notes
1	Check towers and foundations for:	~~1 or 2~~	
	~~Proper grounding~~ Grounding and bonding	1 or 2	
	Functional navigational warning lights	1 or 2	
	Weather measurement devices	1 or 2	
	Lightning protection	1 or 2	
2	Check yaw systems for damage, wear, and signs of overheating	1 or 2	
~~3~~	~~Generators~~	~~NA~~	~~See Chapter 27.~~
4 3	Check pitch systems for damage, wear, and signs of overheating	1 or 2	
~~5~~	~~Transformers~~	~~NA~~	~~See Chapter 11.~~
~~6~~	~~Circuit breakers~~	~~NA~~	~~See Chapter 15.~~
~~7~~ 4	Check cables, terminations, and cable support systems for:	~~1 or 2~~	
	Structural integrity	1 or 2	
	~~Proper support~~		
	Signs of vibration damage or abrasion	1 or 2	
	Overheating	1 or 2	
~~8~~	~~Collector substation and switchgear~~	~~NA~~	~~See Chapter 12.~~
~~9~~	~~Motor control equipment~~	~~NA~~	~~See Chapter 28.~~
~~10~~ 5	In-tower emergency lighting is functioning ~~properly~~	1	
6	For other individual components, refer to the appropriate chapter(s) of this standard or manufacturer's instructions	NA	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_151_Table_31.3.1.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 12:35:20 EDT 2022

Committee Statement

Committee Statement: Lines 1, 7, and 10: Changes were made to remove ambiguous wording.

Lines 3, 5, 6, 8, 9 and new 11: Table was modified to remove other specific chapter references and add one common statement referring to the pertinent chapters.

Response Message: SR-151-NFPA 70B-2022

Public Comment No. 697-NFPA 70B-2022 [Section No. 31.3]

Public Comment No. 284-NFPA 70B-2022 [Section No. 31.3.1]

Second Revision No. 152-NFPA 70B-2022 [Section No. 31.3.5]

31.3.5 Electrical Testing.

Wind power electric systems and associated equipment shall be electrically tested in accordance with Table 31.3.5.

Table 31.3.5 Wind Power Electric Systems and Associated Equipment Electrical Tests

No.	Task	Test Type*	Notes
1	Check grounding electrode system resistance	1 or 2	
2	Check emergency stops, safety shutdowns, controls, and warning indicators are functional	~~1~~ 1 or 2	
3	Verify supervisory control and data acquisition (SCADA) systems are functional	~~1~~ 1 or 2	
4	~~Check transformers.~~	~~NA~~	~~See Chapter 11.~~
~~5~~	~~Check circuit breakers.~~	~~NA~~	~~See Chapter 15.~~
~~6~~	~~Check collector substation and switchgear.~~	~~NA~~	~~See Chapter 12.~~
~~7~~	~~Check motor control equipment.~~	~~NA~~	~~See Chapter 28.~~
~~8~~	~~Check generators.~~	~~NA~~	~~See Chapter 27.~~
~~9~~ 4	Check functionality of blade heat trace systems, if installed	1 or 2	
5	For other individual components, refer to the appropriate chapter(s) of this standard or manufacturer's instructions	NA	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_151_Table_31.3.5.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 12:41:37 EDT 2022

Committee Statement

Committee Statement: Lines 2, 3 and 9: Changes made to Column 2 allow for flexibility to perform required tests online or offline.

Lines 4-8 and new 10: Table was modified to remove other specific chapter references and add one common statement referring to the pertinent chapters.

Response Message: SR-152-NFPA 70B-2022

Public Comment No. 285-NFPA 70B-2022 [Section No. 31.3.5]

Public Comment No. 286-NFPA 70B-2022 [Section No. 31.3.5]

Second Revision No. 163-NFPA 70B-2022 [Section No. 32.2]

32.2 Frequency of Maintenance.

The periodic maintenance procedures in Section 32.4 shall be performed in accordance with the frequencies in Chapter 9, unless otherwise specified in ~~this chapter~~ Table 32.2 .

Table 32.2 Maintenance Intervals

Test to be Performed	Equipment Condition Assessment			Notes
	Condition 1	Condition 2	Condition 3	
Visual	12 months	12 months	1 month	When batteries are accessible, see Section 36.2 for specific battery technology and maintenance test intervals.
Connection resistances	12 months	12 months	1 month	
Battery management system data and associated alarms	12 months	12 months	1 month	
Battery performance testing	36 months	36 months	12 months	

Supplemental Information

File Name	Description	Approved
SR_163_Table_32.2.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 14:32:10 EDT 2022

Committee Statement

Committee Statement: Table 32.2 was added to define maintenance intervals, separate from Chapter 10.

Response Message: SR-163-NFPA 70B-2022

Second Revision No. 159-NFPA 70B-2022 [Section No. 32.3]

32.3 Documentation.

An installed ESS shall include supporting documentation to include the following:

(1) System designer and installer with installation and commissioning dates
(2) Emergency contacts for system owner
(3) Specifications
(4) Electrical schematics and as-built drawings
(5) ~~Proper signage~~ Signage , markings, and labels
(6) Mechanical drawings
(7) Commissioning manual, test plan, and appropriate test results
(8) Operations and maintenance manuals
(9) Materials list ~~that includes~~ of expendable maintenance items, such as filters and fuses

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Thu Apr 28 14:03:52 EDT 2022

Committee Statement

Committee Statement: Line 5: Changed to remove ambiguous wording.

Line 9: Changed to clarify the intent of requirement.

Response Message: SR-159-NFPA 70B-2022

Public Comment No. 657-NFPA 70B-2022 [Section No. 32.3]
Public Comment No. 700-NFPA 70B-2022 [Section No. 32.3]

Second Revision No. 160-NFPA 70B-2022 [Section No. 32.4.1]

32.4.1 Visual Inspections ~~and Mechanical Testing~~ .

ESS shall be visually inspected ~~and mechanically tested~~ in accordance with Table 32.4.1.

Table 32.4.1 Battery ~~Energy Storage System~~ ESS Visual Inspections ~~and Mechanical Tests~~

No.	Task	Test Type*	Notes
1	Physical condition, including operating environment	1 or 2	Damage or deterioration, supports or restraints, bending radius, excessive tension, signs of overheating.
2	Correct labeling or identification	1 or 2	Phasing, cable ID, multiple sources, hazard, or other warning labels.
3	Grounding/bonding	1 or 2	Damage, missing or loose terminations, ~~proper~~ clearance from energized parts, protection from physical damage.
4	Batteries	1 or 2	Damage, leaking, swelling, discolored or melted plastic, terminal corrosion, electrolyte level, restraint systems. See Chapter 36 for stationary standby batteries.
5	Cables	1 or 2	Damage, deterioration, supports, bending radius, excessive tension, discoloration, or evidence of overheating.
6	Fire alarm notification, detection, and suppression systems	1 or 2	Damaged heads, physical obstruction to spray, leaking, corrosion, suppression agent is charged.
7	Raceway/cable tray	1 or 2	Damage or deterioration, cable jacket abrasion or wear when exposed, continuity, tight joints, missing or loose bonding jumpers, corrosion.
~~8~~	~~Ventilation system~~	~~1 or 2~~	~~Replace air filters as needed; verify the ventilation system is functional.~~
~~9~~ 8	Barriers, guards, and assemblies	1 or 2	Damage or signs of deterioration, arcing, tracking, supports, and mounting hardware.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_160_Table_32.4.1.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 14:10:59 EDT 2022

Committee Statement

Committee Statement: Wording was changed to align with other chapters.

Line 3: Change was made to remove ambiguous wording.

Line 6: Change was made to better describe the fire alarm system.

Line 8: Ventilation systems are covered in 32.4.4.

Response Message: SR-160-NFPA 70B-2022

Public Comment No. 378-NFPA 70B-2022 [Section No. 32.4.1]

Public Comment No. 698-NFPA 70B-2022 [Chapter 32]

Second Revision No. 162-NFPA 70B-2022 [Section No. 32.4.5]

32.4.5 Electrical Testing.

Energy storage systems shall be electrically tested in accordance with Table 32.4.5.

Table 32.4.5 Battery ~~Energy Storage System~~ ESS Electrical Tests

No.	Task	Test Type*	Notes
1	Infrared thermography or equivalent thermal inspection	1 or 2	Overall battery case(s) and terminations; should be performed under load.
2	Airborne ultrasonic acoustic emissions	1A	
3	Insulation resistance	2	Cables/conductors.
4	Bolted connection resistance	1 or 2	Includes intercell resistance, when accessible.
5	~~Load~~ Battery performance test	2	
6	~~Ph and specific gravity~~ Review of battery management system data and associated alarms	1 or 2	
~~7~~	~~Intercell resistance~~	~~1 or 2~~	
~~8~~	~~Voltage~~	~~1 or 2~~	~~Float, equalization~~
~~9~~	~~Current~~	~~1 or 2~~	~~Float, ripple, equalization~~
~~10~~	~~Temperature~~	~~1 or 2~~	~~Electrolyte~~

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_162_Table_32.4.5.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 14:21:11 EDT 2022

Committee Statement

Committee Statement: Table was modified to clarify the testing requirements. Items were deleted because they refer to traditional lead-acid and Ni-Cad batteries which covered in Chapter 36.

Lines 5 and 6: Added to be consistent with IEEE recommended (draft) practices and Chapter 10.

Response Message: SR-162-NFPA 70B-2022

Public Comment No. 664-NFPA 70B-2022 [Section No. 32.4.5]

Public Comment No. 651-NFPA 70B-2022 [Section No. 32.4.5]

Second Revision No. 164-NFPA 70B-2022 [Section No. 33.3.1]

33.3.1

The following electric vehicle transfer power system markings shall be maintained:

(1) Emergency contacts for system owner

(2) ~~Proper signage~~ Signage , markings, and labels

(3) Rating or adjusted rating

(4) Identification that load management is ~~utilized~~ used , if applicable

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 14:36:20 EDT 2022

Committee Statement

Committee Statement: Change removes ambiguous wording.

Response Message: SR-164-NFPA 70B-2022

Public Comment No. 701-NFPA 70B-2022 [Section No. 33.3.1]

Second Revision No. 165-NFPA 70B-2022 [Section No. 33.4.1.1]

33.4.1.1

Electric vehicle power transfer system equipment shall be visually inspected in accordance with Table 33.4.1.1.

Table 33.4.1.1 Electric Vehicle Power Transfer System Equipment Visual Inspections

No.	Task	Test Type*	Notes
1	Inspect doors and latches for fit, dents, corrosion, and missing hardware	1 or 2	Damage or deterioration, supports or restraints.
2	Inspect wiring, bus, ~~cables,~~ and connections for damaged insulation, broken leads, tightness of connections, ~~proper~~ crimping, and overall general condition including corrosion	1 or 2	~~Bending radius, excessive~~ Excessive tension, signs of overheating ~~phasing~~ , ~~cable ID,~~ multiple sources, hazard, or other warning labels.
3	Inspect grounding/bonding	1 or 2	Damage, missing or loose terminations, ~~proper~~ clearance from energized parts, protection from physical damage.
4	Inspect cables	1 or 2	Damage, deterioration, supports, bending radius, excessive tension, cable ID, discoloration, cable jacket abrasion or wear when exposed, or evidence of overheating.
5	Inspect raceway/cable tray	1 or 2	Damage or deterioration, cable jacket abrasion or wear when exposed, continuity, tight joints, missing or loose bonding jumpers, corrosion.
6	Inspect barriers, guards, and assemblies	1 or 2	Damage or signs of deterioration, arcing, tracking, supports and mounting hardware.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_165_Table_33.4.1.1.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Thu Apr 28 14:38:09 EDT 2022

Committee Statement

Committee Table was changed to remove ambiguous wording.

Statement: Table was changed to remove redundant wording and combine all required inspections into Line 4 for cables.

Response Message: SR-165-NFPA 70B-2022

Public Comment No. 702-NFPA 70B-2022 [Section No. 33.4.1.1]

Public Comment No. 704-NFPA 70B-2022 [Section No. 33.4.1.1]

Second Revision No. 330-NFPA 70B-2022 [Section No. 33.4.1.2]

33.4.1.2

The ~~electric vehicle power transfer system equipment in this section~~ following inspections shall be ~~inspected monthly~~ performed annually:

(1) The cord and cord connector shall be inspected to verify that the strain relief is intact, stress is not placed on the cord terminations, and the pins are not damaged.

(2) The equipment mounting shall be inspected to ensure the integrity of the mounting means.

(3) The physical protection for the equipment shall be inspected to ensure its integrity.

~~**33.4.1.2.1**~~

~~The cord and cord connector shall be inspected to verify that the strain relief is intact, stress is not placed on the cord terminations, and the pins are not damaged.~~

~~**33.4.1.2.2**~~

~~The equipment mounting shall be inspected to ensure the integrity of the mounting means.~~

~~**33.4.1.2.3**~~

~~The physical protection for the equipment shall be inspected to ensure its integrity.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 10 12:18:56 EDT 2022

Committee Statement

Committee Statement: The change clarifies the requirements of inspection. Monthly inspections are too prescriptive and the change to annual inspection relaxes the requirements.

Response Message: SR-330-NFPA 70B-2022

Public Comment No. 580-NFPA 70B-2022 [Section No. 33.4.1.2 [Excluding any Sub-Sections]]

Second Revision No. 167-NFPA 70B-2022 [Section No. 33.4.2]

33.4.2 Cleaning. (Reserved)

~~Cleaning shall be performed in accordance with manufacturer's instructions.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 14:52:43 EDT 2022

Committee Statement

Committee Statement: Change was made to align with other chapters.

Response Message: SR-167-NFPA 70B-2022

Public Comment No. 162-NFPA 70B-2022 [Section No. 33.4.2]

Public Comment No. 581-NFPA 70B-2022 [Section No. 33.4.2]

Second Revision No. 168-NFPA 70B-2022 [Section No. 33.4.4]

33.4.4 Electrical Testing. (Reserved)

~~A load management system that is used to manage the power supplied by the electric vehicle power transfer equipment shall comply with one of the following:~~

~~Test to verify operation of the energy management system at intervals not to exceed 5 years.~~

~~Utilize continuous energy monitoring to verify loads are being properly managed.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 14:54:12 EDT 2022

Committee Statement

Committee Statement: Change removes the requirements that were not electrical testing.

Response Message: SR-168-NFPA 70B-2022

Public Comment No. 174-NFPA 70B-2022 [Section No. 33.4.4]

Public Comment No. 705-NFPA 70B-2022 [Section No. 33.4.4]

Second Revision No. 169-NFPA 70B-2022 [Section No. 34.2]

~~**34.2** Maintenance.~~

~~**34.2.1**~~

~~Electrical equipment and equipotential bonding systems shall be maintained in proper operating condition.~~

~~**34.2.2**~~

~~Any change in equipment or purpose of the facility shall be performed in accordance with applicable installation codes and ordinances.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 15:07:53 EDT 2022

Committee Statement

Committee Statement: Wording was changed to align with other chapter outlines and to remove redundant and ambiguous text.

Response Message: SR-169-NFPA 70B-2022 RESPONSE TO PC 399: See other revisions for additional changes.

Public Comment No. 299-NFPA 70B-2022 [Chapter 34]

Public Comment No. 298-NFPA 70B-2022 [Section No. 34.2]

Public Comment No. 706-NFPA 70B-2022 [Chapter 34]

Second Revision No. 170-NFPA 70B-2022 [Section No. 34.3]

34.2 Frequency of Maintenance.

The periodic maintenance procedures in Section ~~34.2~~ 34.3 shall be performed in accordance with the frequencies in Chapter 9, unless otherwise specified in this chapter.

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Thu Apr 28 15:09:11 EDT 2022

Committee Statement

Committee Statement: The reference in 34.3 is corrected.
Response Message: SR-170-NFPA 70B-2022

Second Revision No. 173-NFPA 70B-2022 [Section No. 34.4.1]

34.3.1* Visual Inspections.

Public pools, fountains, and similar ~~Installations~~ installations shall be visually inspected in accordance with Table 34.3.1.

Table 34.3.1 Public Pools, Fountains, and Similar Installation Visual Inspections

No.	Task	Test Type*	Notes
1	Correct labeling or identification	1 or 2	Controls, emergency controls, shutoff indications, schematics, or other information that ~~the~~ requires public or operating personnel ~~need~~ access. ~~to~~
2	Physical condition of equipment, including corrosion and deterioration	1 or 2	Metal enclosures~~, grounding connections, bonding connections.~~ and other metal parts, including panel connections and busbars.
3	Physical condition of connections	1 or 2	Readily accessible bonding and grounding connections, for corrosion, electrical equipment associated with the pool. ~~or in close proximity to the pool and its water handling systems.~~
4	Corrosive environment inspection	1 or 2	Investigate areas that exhibit excessive corrosion for corrosive gas, liquid leaks, ~~or proper~~ and ventilation.
5	Electric motor labeling	1 or 2	
6	Overhead conductor clearance	2	

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

A.34.3.1

Any components found to be excessively corroded should be repaired or replaced. Leaks should be mitigated, or ventilation should be added or corrected as needed. Missing motor nameplates should be replaced. Electrically operated pool pumps should be listed and labeled. Overhead conductor clearances should be in accordance with ~~Section~~ 680.9(A) of ~~the National Electrical Code~~ *NFPA 70* . Any components found to be excessively corroded should be repaired or replaced. Leaks should be mitigated, or ventilation shall be added or corrected as needed. Missing motor nameplates should be replaced. Electrically operated pool pumps should be listed and labeled. Overhead conductor clearances should be in accordance with ~~Section~~ 680.9(A) of *NFPA 70*.

Supplemental Information

File Name	Description	Approved
SR_171_Table_34.4.1.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 15:18:46 EDT 2022

Committee Statement

Committee Statement: Change was made for proper grammar in the sentence.

Line 1: Change was made for grammar and clarification of the note.

Line 2: Change removes redundancy.

Lines 3: Change removes redundancy and ambiguous language regarding proximity to the pool.

Line 4: Change removes ambiguous language.

Response Message: SR-173-NFPA 70B-2022

Public Comment No. 708-NFPA 70B-2022 [Section No. 34.4.1]

Public Comment No. 301-NFPA 70B-2022 [Section No. 34.4.1]

Public Comment No. 707-NFPA 70B-2022 [Section No. 34.4.1]

Public Comment No. 302-NFPA 70B-2022 [Section No. 34.4.1]

Public Comment No. 711-NFPA 70B-2022 [Section No. 34.4.1]

Second Revision No. 175-NFPA 70B-2022 [Section No. 34.4.2]

34.3.2 Mechanical Inspections.

Public pools, fountains, and similar installations shall be mechanically inspected in accordance with Table 34.3.2.

Table 34.3.2 Public Pools, Fountains, and Similar Installation Mechanical Inspections

No.	Task	Test Type*	Notes
1	Verify operation	1 or 2	Verify accessible means for shutting off the suction and discharge piping for electrically operated pumps.
2	Wet niche pool luminaires	2	Inspect for water intrusion, ~~improper and/or~~ damaged attachment screws or sockets, insulating wedges or similar appliances, and visible cord damage and/or modification.
3	Operating pressures	1	Verify ~~proper~~ operating pressures after operating for minimum of 15 minutes.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

34.3.2.1

Luminaires with a discolored lens or evidencing water intrusion shall be replaced.

34.3.2.2*

Luminaires with cords exhibiting physical damage, repair, or splices or that are an inconsistent type for the luminaire shall be replaced.

34.3.2.3*

Luminaires or niches with ~~improper~~ incorrect, missing, or damaged attachment screws or sockets shall be repaired or replaced.

34.3.2.4

Insulating (nonconducting) wedges or similar appliances shall be replaced with conducting wedges or similar appliances.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 15:22:57 EDT 2022

Committee Statement

Committee Statement: Table 34.4.2 Lines 2 and 3: Change removes ambiguous language.

34.4.2.3: Change removes ambiguous language.

Response Message: SR-175-NFPA 70B-2022

Public Comment No. 709-NFPA 70B-2022 [Section No. 34.4.2]

Second Revision No. 176-NFPA 70B-2022 [Section No. 34.4.3]

34.3.3 Electrical ~~Tests~~ Testing .

Public pools, fountains, and similar installations shall be electrically tested in accordance with Table 34.3.3.

Table 34.3.3 Public Pools, Fountains, and Similar Installation Electrical Tests

No.	Task	GFCI Components Test Type*	Electric Motors and Valves Test Type*	System Grounding and Bonding Test Type*	Notes
~~1~~	~~Operational tests~~	~~1~~	~~1~~	~~2~~	~~See Chapter 21.~~
~~2~~	~~Test grounding system~~	~~2~~	~~2~~	~~2~~	~~See Chapter 20.~~
~~3~~	~~Test electric motors~~	~~NA~~	~~1 or 2~~	~~1 or 2~~	~~See Chapter 20 and Chapter 27.~~
4 1	Test electrically operated valves	NA	1	NA	Test for ~~proper~~ correct operation.
~~5~~	~~Test motor circuit protection~~	~~NA~~	~~1~~	~~NA~~	~~See Chapter 15 and Chapter 16.~~
2	For individual components, refer to the appropriate chapter(s) of this standard.	NA	NA	NA	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_176_Table_34.4.3.docx	For staff use onlly	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 15:25:46 EDT 2022

Committee Statement

Committee Statement: Change was made to align with other chapters.

Response Message: SR-176-NFPA 70B-2022

Public Comment No. 71-NFPA 70B-2022 [Section No. 34.4.3]

Second Revision No. 172-NFPA 70B-2022 [Section No. 34.5]

~~**34.5***~~ ~~Record Keeping.~~

~~A written report of maintenance activities and data shall be submitted to the responsible parties operating the public pool or facility.~~

~~**A.34.5**~~

~~A copy of the report should be retained for a minimum of 5 years.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 15:17:47 EDT 2022

Committee Statement

Committee Statement: Wording was changed to align with other chapter outlines and to remove redundant and ambiguous text.

Response Message: SR-172-NFPA 70B-2022

Second Revision No. 342-NFPA 70B-2022 [Section No. 34.6]

~~34.6*~~ ~~Maintenance Intervals.~~

~~Maintenance tasks required shall be reviewed at a minimum of once per year.~~

~~A.34.6~~

~~Maintenance tasks in this chapter should be performed annually unless conditions are determined, and so documented, to not require annual maintenance. Due to the potentially corrosive nature of pool water and the seasonality associated with pool usage, annual maintenance is considered a minimum maintenance requirement and conditions could indicate more frequent maintenance or partial maintenance is appropriate.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu May 12 15:38:41 EDT 2022

Committee Statement

Committee Statement: Section 34.6 and associate annex material is deleted as maintenance intervals are now covered in Chapter 10.

Response Message: SR-342-NFPA 70B-2022

Public Comment No. 303-NFPA 70B-2022 [Section No. 34.6]

Second Revision No. 343-NFPA 70B-2022 [Section No. 35.3.1]

35.3.1 Visual Inspections.

Protective relays shall be visually inspected in accordance with Table 35.3.1.

Table 35.3.1 Protective Relay Visual Inspections

No.	Task	Electromechanical	Solid-State	Microprocessor	Notes
-	-	Test Type*	Test Type*	Test Type*	-
1	Inspect case and windows for cracks and proper seal	2	2	2	
2	Inspect current transformer shorting blocks and voltage disconnects	2	2	2	
3	Check for proper operation of LEDs, targets, and visual displays	2	2	2	
4	Inspect wiring and connections for damaged insulation, broken leads, tightness of connections, proper crimping, and overall general condition including corrosion	2	2	2	
5	Inspect clearances, mechanical freedom, and condition of contacts and control springs	2	NA	NA	
6	Inspect contact bearing clearances, and freedom of movement	2	NA	NA	
7	Check that settings are in accordance with coordination study	2	2	2	

No.	Task	Electromechanical Test Type*	Solid-State Test Type*	Microprocessor Test Type*	Notes
8	Download or document events, oscillographs, and maintenance and statistical data	NA	NA	2A	
~~9~~	~~Download and save settings, logic, and other parameters. Document firmware version~~	~~NA~~	~~NA~~	~~2~~	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_343_Table_35.3.1.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu May 12 15:45:37 EDT 2022

Committee Statement

Committee Statement: Line 8: Change allows more flexibility within a maintenance program.

Line 9: Change removes line for redundancy with Table 35.3.5.

Response Message: SR-343-NFPA 70B-2022 RESPONSE TO PC 186: Proposed change to Line 9 was rejected because line was removed for redundancy.

Public Comment No. 186-NFPA 70B-2022 [Section No. 35.3.1]

Public Comment No. 189-NFPA 70B-2022 [Section No. 35.3.1]

Second Revision No. 179-NFPA 70B-2022 [Section No. 35.3.2]

35.3.2 Cleaning.

~~Cleaning~~ If contamination is present, protective relays shall be ~~performed~~ cleaned in accordance with ~~Section 5.8 and~~ Table 35.3.2 ~~if contamination is present~~ .

Table 35.3.2 Protective Relay Cleaning

No.	Task	Electromechanical Test Type*	Solid-State Test Type*	Microprocessor Test Type*	Notes
1	Clean the relay case and cover	2	2	2	
2	Clean relay contacts, disks, and magnets	2	NA	NA	
3	Burnish burned or pitted contacts	2	NA	NA	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 15:41:19 EDT 2022

Committee Statement

Committee Statement: Removed wording to align with other chapters.

Response Message: SR-179-NFPA 70B-2022

Public Comment No. 163-NFPA 70B-2022 [Section No. 35.3.2]

Second Revision No. 180-NFPA 70B-2022 [Section No. 35.3.5]

35.3.5 Electrical Testing.

Protective relays shall be electrically tested in accordance with Table 35.3.5.

Table 35.3.5 Protective Relay Electrical Tests

- No.	- Task	- Electromechanical Test Type*	Test Type* Solid-State Test Type*	- Microprocessor Test Type*	- Notes -
1	Perform an insulation resistance test on each branch circuit to frame	2	NA	NA	
2	Perform a pickup test to determine the minimum or maximum current, voltage, power, or frequency that causes closure of relay contacts for all active functions	2	2	2A	
3	Perform a timing at three points on the time dial curve to verify the timing characteristics of the relay	2	2	2A	
4	Perform tests as required to check operation of restraint, directional, and other protective elements	2	2	2A	
5	Perform a zero check test to determine proper time dial position when the relay is fixed and moving contacts are closed by the manual rotation of the time dial towards zero	2	NA	NA	
6	~~Using the front panel or computer connections, perform~~ Perform relay checks to verify relay status, meter readings (if applicable), and contact inputs/outputs	NA	NA	2	
7	Test arc energy reduction technology in accordance with the manufacturer's instructions	NA	NA	2	
8	Verify each input and output performs the intended function in accordance with control drawings	2A	2A	2A	
9	After testing is complete, clear trip counters, targets, events, and oscillographs from testing	2	2	2A	
10	Review maintenance and statistical data	NA	2	2	
11	Download ~~and save~~ or document settings, logic, and other parameters when changes are made	NA	2	2	

NA: Not applicable.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test~~,~~ ; Type 1A = online enhanced test~~,~~ ; Type 2 = offline standard test~~,~~ ; Type 2A = offline enhanced test.

Supplemental Information

File Name	Description	Approved
SR_180_Table_35.3.5.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 15:50:02 EDT 2022

Committee Statement

Committee Statement: Line 6: Change allows for flexibility in the performance of the tests and clarifies requirements between logic and physical inputs/outputs.

Line 7: Changed for clarity of intent.

Line 9: Change clarifies requirements between logic and physical inputs/outputs.

Line 11: Change clarifies when the information should be downloaded and stored.

Response Message: SR-180-NFPA 70B-2022 RESPONSE TO PC 190: Types of tests were not changed because the language was modified for Line 11.

Public Comment No. 190-NFPA 70B-2022 [Section No. 35.3.5]

Public Comment No. 194-NFPA 70B-2022 [Section No. 35.3.5]

Public Comment No. 195-NFPA 70B-2022 [Section No. 35.3.5]

Public Comment No. 193-NFPA 70B-2022 [Section No. 35.3.5]

Second Revision No. 183-NFPA 70B-2022 [Section No. 36.2]

36.2 Frequency of Maintenance.

The periodic maintenance procedures in Section 36.4 shall be performed in accordance with the frequencies in Chapter 9, unless otherwise specified in ~~this chapter~~ Table 36.2 .

Table 36.2 Maintenance Intervals

Battery Technology	Test to be Performed	Equipment Condition Assessment			Notes
		Condition 1	Condition 2	Condition 3	
Vented lead-acid	Overall float voltage	3 months	3 months	1 month	
	Visual inspections	12 months	12 months	1 month	
	Electrolyte levels	3 months	3 months	1 month	
	Ambient temperature	3 months	3 months	1 month	
	Float current	3 months	3 months	1 month	
	Individual cell/unit float voltages	12 months	12 months	1 month	
	Representative cell temperatures	3 months	3 months	1 month	
	Inspect electrical connection for high resistance	12 months	12 months	1 month	
	Performance testing	60 months	60 months	12 months	
Valve-regulated lead-acid	Overall float voltage	1 month	1 month	1 month	
	Visual inspections	12 months	12 months	1 month	
	Ambient temperature	3 months	3 months	1 month	
	Float current	1 month	1 month	1 month	
	Ohmic testing	3 months	3 months	1 month	
	Individual cell/unit float voltages	3 months	3 months	1 month	
	Representative cell temperatures	3 months	3 months	1 month	
	Inspect electrical connection for high resistance	12 months	12 months	1 month	
	Performance testing	24 months	24 months	12 months	
Ni-Cad	Overall float voltage	3 months	3 months	1 month	

Battery Technology	Test to be Performed	Equipment Condition Assessment			Notes
		Condition 1	Condition 2	Condition 3	
	Visual inspections	12 months	12 months	1 month	
	Electrolyte levels	3 months	3 months	1 month	
	Ambient temperature	3 months	3 months	1 month	
	Float current	3 months	3 months	1 month	
	Individual cell/unit float voltages	12 months	12 months	1 month	
	Representative cell temperatures	3 months	3 months	1 month	
	Inspect electrical connection for high resistance	12 months	12 months	1 month	
	Performance testing	60 months	60 months	12 months	

Supplemental Information

File Name	Description	Approved
SR_183_Table_36.2.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 16:06:40 EDT 2022

Committee Statement

Committee Statement: Table 36.2 was added with input from IEEE Energy Storage and Stationary Battery Committee and for consistency with industry standards to define maintenance intervals, separate from Chapter 10.

Response Message: SR-183-NFPA 70B-2022

Public Comment No. 622-NFPA 70B-2022 [Section No. 10.1.2.1]

Second Revision No. 181-NFPA 70B-2022 [Section No. 36.3.2]

36.3.2

A stationary standby battery installation shall include supporting documentation to include the following:

(1) ~~Move electrical~~ Electrical schematics and as-built drawings

(2) ~~Proper signage~~ Signage , markings, and labels

(3) Commissioning manual, test plan, and ~~appropriate~~ test results

(4) Operations and maintenance manuals

(5) Materials list ~~that includes~~ of expendable maintenance items, such as filters and fuses

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 15:54:47 EDT 2022

Committee Statement

Committee Statement: Changes were made to remove ambiguous wording.

Response Message: SR-181-NFPA 70B-2022

Second Revision No. 331-NFPA 70B-2022 [Section No. 36.4.1]

36.4.1* Visual Inspections .

Stationary standby batteries and their associated equipment shall be visually inspected in accordance with Table 36.4.1 .

Table 36.4.1 Stationary Standby Batteries Visual Inspections

No.	Task	Test Type*	Notes
1	Inspect containers, covers, and vent caps for cracks and structural damage	1	
2	Inspect plates and internal parts when visible	1	Document excessive positive plate growth, sulfate crystal formation, buckling, warping, scaling, swelling, cracking, hydration rings, excessive sedimentation, mossing, copper contamination, internal post seal cracks, and changes in color.
3	Inspect interconnection cables, cell connectors, and other conductors for wear, contamination, corrosion, and discoloration	1	
4	Inspect battery racks for corrosion, cleanliness, proper grounding, and structural integrity, seismic protection	1	
5	Inspect electrolyte for containment, leaking, spills, and levels	1	
6	Inspect ventilation equipment operation, dampers, filters, alarms, and other items that might restrict air movement	1	
7	Inspect heating and air conditioning equipment including filters that control ambient room temperature for restricted air movement	1	
8	Verify the functionality of lights, strobes, horns, and related alarm notifications	1	

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test; Type 1A = online enhanced test; Type 2 = offline standard test; Type 2A = offline enhanced

test.

A.36.4.1

Battery chargers play a critical role in maintaining batteries because they supply normal dc requirements and maintain batteries at appropriate levels of charge.

A solution of water and bicarbonate of soda (baking soda) can be used to neutralize lead-acid battery spills, and a solution of boric acid and water can be used for Ni-Cad spills. The battery manufacturer's instructions should be consulted for proper proportions. Information on prevention of and response to electrolyte spills can be found in IEEE 1578, *Recommended Practice for Stationary Battery Electrolyte Spill Containment and Management*.

Excessive water consumption can be a sign of overcharging or cell damage. For lead-antimony batteries, including low-antimony designs such as lead-selenium, water consumption increases gradually with age. Distilled or deionized water ~~shall~~ needs to be used unless otherwise recommended by the battery manufacturer.

CAUTION: Never add anything but water to a battery unless recommended to do so by the manufacturer.

Local sources of heating and cooling can create cell temperature differentials that cause battery damage.

If deionized water is used, it is important to check for proper operation of the deionizer (or if deionizing filters need replacement).

~~Vibration reduces battery life. Excessive vibration can be detected by observing vibration of plates and sediment in the jar. If this condition is observed, then steps should be taken to reduce the vibration source, isolate the batteries from the vibration, and/or plan for an earlier than normal scheduled replacement of the batteries.~~

Excess sedimentation and plate damage can be caused by any of the following:

(1) *Vibration caused by an external source.* Vibration reduces battery life. Excessive vibration can be detected by observing vibration of plates and sediment in the jar. If vibration is observed, then steps should be taken to reduce the vibration source, isolate the batteries from the vibration, and/or plan for an earlier-than-normal scheduled battery replacement.

(2) *Incorrect charging regimes.* The charger settings should be set to the battery manufacturer's recommended voltage range. If not, they should be adjusted as appropriate.

(3) *Excessive cycling.* The cause of excessive discharge/recharge cycles should be determined and corrected, if possible. Otherwise, it might be necessary to plan for an earlier-than-normal battery replacement.

(4) *Aging.* The battery date codes should be noted, and it should be determined if the observed condition is within the predicted condition for a battery of that age.

(5) *Manufacturing defect.* If the battery is relatively new, or if the condition is only observed in one or a few cells within the same manufacturing "batch number," the manufacturer should be contacted for possible warranty replacement.

(6) *AC ripple current from charger or connected load.* Readings should be taken to determine if the amount of ripple current exceeds the manufacturer's recommended limit.

~~**36.4.1.1** Containers and Covers.~~

~~**36.4.1.1.1**~~

~~Containers and covers shall be checked for cracks and structural damage.~~

36.4.1.1.2

Damaged units and damaged or missing removable vent caps shall be replaced.

36.4.1.2 Plates and Internal Parts.

36.4.1.2.1

Plates and internal parts within clear containers shall be checked for damage such as excessive positive plate growth, sulfate crystal formation on positive plates, buckling, warping, scaling, swelling, cracking, hydration rings, excessive sedimentation, mossing, copper contamination, internal post seal cracks, and changes in color.

36.4.1.2.2

Cells exhibiting any of these characteristics shall be documented and repaired or replaced.

36.4.1.3*

Charger output voltage shall be set and verified at least once per year, to be in accordance with the battery manufacturer's instructions.

A.36.4.1.3

Battery chargers play a critical role in maintaining batteries because they supply normal dc requirements and maintain batteries at appropriate levels of charge.

36.4.1.4

Interconnection cables, cell connectors, and other conductors shall be examined for wear, contamination, corrosion, and discoloration.

36.4.1.5

Racks shall be checked for corrosion, cleanliness, proper grounding, and structural integrity.

36.4.1.6*

A check shall be made for leaks or spilled electrolyte.

A.36.4.1.6

A solution of water and bicarbonate of soda (baking soda) can be used to neutralize lead-acid battery spills, and a solution of boric acid and water can be used for Ni-Cad spills. The battery manufacturer's instructions should be consulted for proper proportions. Information on prevention and response to electrolyte spills can be found in IEEE 1578, - *Recommended Practice for Stationary Battery Electrolyte Spill Containment and Management* .

36.4.1.7*

The electrolyte level shall be checked before water addition and corrective measures documented in accordance with the owner's maintenance program and the manufacturer's recommendations.

A.36.4.1.7

Excessive water consumption can be a sign of overcharging or cell damage. For lead-antimony batteries, including low-antimony designs such as lead-selenium, water consumption increases gradually with age. Distilled or deionized water shall be used unless otherwise recommended by the battery manufacturer.

CAUTION: Never add anything but water to a battery unless recommended to do so by the manufacturer.

36.4.1.8*

Ventilation, suitability, and condition of electrical equipment in the area shall be checked for its possible effect on the battery.

A.36.4.1.8

Local sources of heating and cooling can create cell temperature differentials that cause battery damage.

36.4.1.9

Where abnormal temperatures, temperature differentials, or restricted air movement are noted, sources of the condition shall be identified and corrective measures taken.

36.4.1.10

Battery room ventilation openings shall be checked to be sure they are clear of obstructions.

36.4.1.11*

Area heating, air conditioning, seismic protection, dc overcurrent protection, distilled or deionized water supply, grounding connections, cable clamps, and other installed protective systems and devices shall be checked for proper operation.

A.36.4.1.11

If deionized water is used, it is important to check for proper operation of the deionizer (or if deionizing filters need replacement).

36.4.1.12

Alarm relays, lights, horns, and emergency lighting shall be checked for proper operation.

36.4.1.13*

Batteries shall be visually inspected for excess sedimentation and other signs of plate damage.

~~**A.36.4.1.13**~~

~~Vibration reduces battery life. Excessive vibration can be detected by observing vibration of plates and sediment in the jar. If this condition is observed, then steps should be taken to reduce the vibration source, isolate the batteries from the vibration, and/or plan for an earlier than normal scheduled replacement of the batteries.~~

~~Excess sedimentation and plate damage can be caused by any of the following:~~

~~*Vibration caused by an external source.* If vibration is observed, then isolate the batteries from the vibration and/or plan for an earlier-than-normal scheduled battery replacement.~~

~~*Incorrect charging regimes.* The charger settings should be set to the battery manufacturer's recommended voltage range. If not, they should be adjusted as appropriate.~~

~~*Excessive cycling.* The cause of excessive discharge/recharge cycles should be determined and corrected, if possible. Otherwise, it might be necessary to plan for an earlier-than-normal battery replacement.~~

~~*Aging.* The battery date codes should be noted, and it should be determined if the observed condition is within the predicted condition for a battery of that age.~~

~~*Manufacturing defect.* If the battery is relatively new, or if the condition is only observed in one or a few cells within the same manufacturing "batch number," the manufacturer should be contacted for possible warranty replacement.~~

~~*AC ripple current from charger or connected load.* Readings should be taken to determine if the amount of ripple current exceeds the manufacturer's recommended limit.~~

Supplemental Information

File Name	Description	Approved
SR_331_Table_36.4.1.docx	For staff use only	

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Tue May 10 12:47:42 EDT 2022

Committee Statement

Committee Statement: Change clarifies the intent of required inspection and adds a table for format and consistency with other chapters.

Response Message: SR-331-NFPA 70B-2022 RESPONSE TO PCs 219 and 585: Some proposed wording was rejected as they are important areas to inspect on battery systems.

Public Comment No. 584-NFPA 70B-2022 [Section No. 36.4.1.3]

Public Comment No. 583-NFPA 70B-2022 [Section No. 36.4.1.2]

Public Comment No. 585-NFPA 70B-2022 [Section No. 36.4.1.11]

Public Comment No. 582-NFPA 70B-2022 [Section No. 36.4.1.1]

Public Comment No. 219-NFPA 70B-2022 [Section No. 36.4.1.11]

Second Revision No. 157-NFPA 70B-2022 [Section No. 36.4.2]

36.4.2* Cleaning.

Terminal connectors, battery posts, and cable ends shall be checked and be cleaned to remove all corrosion and dirt ~~removed~~ .

~~**36.4.2.1**~~

~~Battery posts shall be cleaned according to manufacturer's recommendations.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 13:32:35 EDT 2022

Committee Statement

Committee Statement: Change removes wording to be consistent with other chapters and moves the annex material under 36.4.2

Response Message: SR-157-NFPA 70B-2022

Public Comment No. 221-NFPA 70B-2022 [Section No. 36.4.2]

Public Comment No. 222-NFPA 70B-2022 [Section No. A.36.4.2.2]

Second Revision No. 182-NFPA 70B-2022 [Section No. 36.4.5]

36.4.5* Electrical Testing.

Stationary standby batteries and their associated equipment shall be electrically tested in accordance with Table 36.4.5 .

Table 36.4.5 Stationary Standby Battery Electrical Tests

No.	Task	Test Type*	Notes
1	Overall float voltage	1	Measured at the battery and verified annually to be in accordance with the battery manufacturer's instructions.
2	Measure cell temperature	1	
3	Specific gravity	1A	No less than 10% of the units in the string(s).
4	Ohmic testing	1A	Resistance, impedance, or conductance.
5	Inspect electrical connection for high resistance	1 or 1A	See Section 7.2.
6	Performance testing	1	
7	Thermal imaging	1	Under full load of performance testing.
8	Float current	1	
9	Individual cell/unit float voltage	1	Record voltage measurements on individual cells or units to two decimal places.

*Types specified in accordance with Section 8.4, as follows: Type 1 = online standard test; Type 1A = online enhanced test; Type 2 = offline standard test; Type 2A = offline enhanced test.

A.36.4.5

~~Inspections shall be performed and the~~ Inspection results should be recorded to establish trends that can be used in predicting state of health for a battery or batteries .

For VRLA batteries, cell temperature ~~shall~~ should be obtained by measuring at the negative post of the unit.

For vented batteries in which electrolyte samples are being collected, electrolyte temperature ~~shall~~ could be determined at the same time.

Use of ohmic measurements ~~shall~~ should be in accordance with the manufacturer's instructions and with an ~~established maintenance program~~ EMP to set baselines, ~~to~~ identify trends, and ~~to~~ identify anomalies.

Connections ~~shall~~ should only be tightened when the need is indicated by resistance readings or infrared scan.

Where a connection resistance ~~is~~ persists high, the connection ~~shall~~ should be cleaned and torqued in accordance with the manufacturer's procedures.

Where test sets to read intercell connection resistance are not available or cannot be ~~utilized~~ used due to inaccessible posts, an infrared scan ~~shall be used~~ should be performed while under load to indicate which connections need to be corrected to the battery manufacturer's specified values and repaired.

For batteries that require periodic water additions, the electrolyte levels should be checked on a periodic basis. If the level is approaching the low-level line, distilled or other approved-quality water should be added.

Float current can be measured with a calibrated amp clamp at any point in a series connected battery string. The amp clamp needs to be accurate to currents below one amp. An alternate method could be using a calibrated voltmeter with a calibrated shunt installed in-line with the battery strings, which would be accurate for currents below one amp.

~~**36.4.5.1***~~ ~~Battery Inspections.~~

~~Inspections shall be performed and the results recorded to establish trends that can be used in predicting state of health.~~

~~**36.4.5.2**~~

~~For trending state of health, a baseline shall be established approximately 6 months after the battery has been put into service or 2 weeks after the most recent discharge, whichever is later.~~

~~**36.4.5.3**~~ ~~Voltage.~~

~~Voltage potential between the battery's most positive and most negative terminals shall be verified to be within the manufacturer's recommended float voltage range for the observed ambient temperature.~~

~~**36.4.5.4***~~ ~~Temperature Testing.~~

~~Temperatures shall be collected for no less than 10 percent of the units in a string.~~

~~**36.4.5.4.1**~~

~~For VRLA batteries, cell temperature shall be obtained by measuring at the negative post of the unit.~~

~~**36.4.5.4.2**~~

~~For vented batteries in which electrolyte samples are being collected, electrolyte temperature shall be determined at the same time.~~

~~**36.4.5.4.3***~~

~~Ambient temperature shall be checked to be within the manufacturer's recommended range.~~

36.4.5.5 Specific Gravity.

Specific gravity measurements shall be taken during regular maintenance intervals only if recommended by the manufacturer.

36.4.5.6 Ohmic Testing.

36.4.5.6.1

When performing ohmic measurements for lead-acid batteries, resistance, impedance, and conductance shall be collected, recorded, and reviewed at regular intervals, but not less than quarterly.

36.4.5.6.2*

Use of ohmic measurements shall be in accordance with manufacturer's instructions and with an established maintenance program to set baselines, to identify trends, and to identify anomalies.

36.4.5.7 Connections.

All battery connections shall be checked on a routine basis with a micro-ohmmeter for high connection resistance.

36.4.5.7.1

Connections shall only be tightened when the need is indicated by resistance readings or infrared scan.

36.4.5.7.2

Where a connection resistance is high, the connection shall be cleaned and torqued in accordance with the manufacturer's procedures.

36.4.5.7.3

Where test sets to read intercell connection resistance are not available or cannot be utilized due to inaccessible posts, an infrared scan shall be used to indicate which connections need to be corrected to the battery manufacturer's specified values and repaired.

36.4.5.8 Battery Performance Testing.

36.4.5.8.1

A performance test shall be performed at intervals not greater than 25 percent of the expected service life as determined by the initial design, or as recommended by the manufacturer, depending on the load reliability requirements and environmental conditions of the installation.

36.4.5.8.2

The frequency of battery tests shall be increased to yearly when the battery reaches 85 percent of its service life or when it shows signs of deterioration.

36.4.5.8.3*

Batteries shall be examined under full load with an infrared scanning device whenever a performance test is conducted.

A.36.4.5.8.3

Infrared scanning can reveal problems such as abnormal temperature of a cell, a poor connection at a battery post, and a deteriorated link, strap, or conductor.

Supplemental Information

File Name	Description	Approved

SR_182_Table_36.4.5.docx For staff use only

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu Apr 28 15:57:27 EDT 2022

Committee Statement

Committee Statement: Section was revised into a table format for consistency with other chapters.

Some information that was descriptive was removed from the chapter and added as annex material for Table 36.4.5.

Section 36.4.5.2 is deleted as it didn't pertain to battery inspections.

Section 36.4.5.8.2 is deleted since intervals are in Chapter 10.

Response Message: SR-182-NFPA 70B-2022

Public Comment No. 632-NFPA 70B-2022 [Section No. 36.4.5.4]

Public Comment No. 645-NFPA 70B-2022 [Section No. 36.4.5.5]

Public Comment No. 637-NFPA 70B-2022 [Section No. 36.4.5.7.3]

Public Comment No. 634-NFPA 70B-2022 [Section No. 36.4.5.6]

Public Comment No. 590-NFPA 70B-2022 [Section No. 36.4.5.8.1]

Public Comment No. 213-NFPA 70B-2022 [Section No. 36.4.5.6.1]

Public Comment No. 587-NFPA 70B-2022 [Section No. 36.4.5.4]

Public Comment No. 588-NFPA 70B-2022 [Section No. 36.4.5.6.1]

Public Comment No. 630-NFPA 70B-2022 [Section No. 36.4.5.2]

Public Comment No. 642-NFPA 70B-2022 [New Section after 36.4.5.3]

Public Comment No. 649-NFPA 70B-2022 [New Section after 36.4.5.3]

Public Comment No. 223-NFPA 70B-2022 [Section No. 36.4.5.8.2]

Public Comment No. 631-NFPA 70B-2022 [Section No. 36.4.5.3]

Public Comment No. 589-NFPA 70B-2022 [Section No. 36.4.5.7]

Second Revision No. 258-NFPA 70B-2022 [Chapter A [Excluding any Sub-Sections]]

Annex A is not a part of the ~~recommendations~~ requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 12:21:20 EDT 2022

Committee Statement

Committee Statement: The change aligns with this document becoming a standard that includes mandatory language. All annexes are informative and not normative.

Response Message: SR-258-NFPA 70B-2022

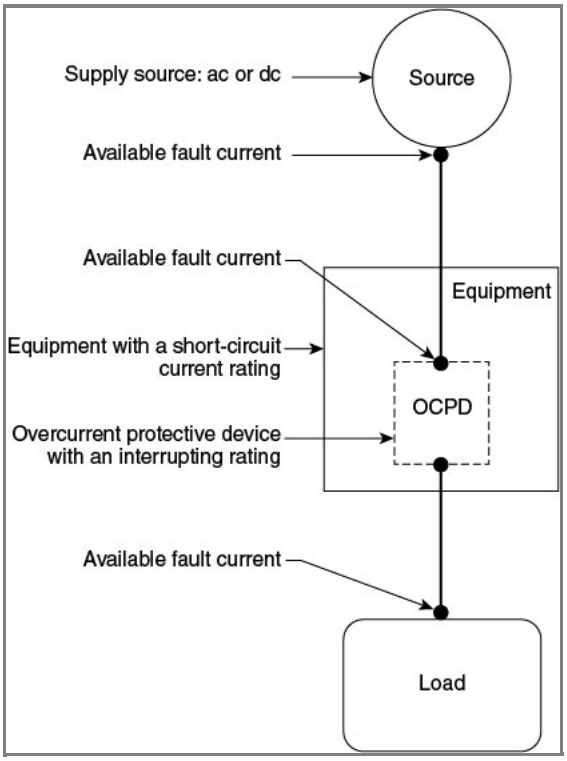
Public Comment No. 3-NFPA 70B-2021 [Chapter A [Excluding any Sub-Sections]]

Second Revision No. 16-NFPA 70B-2022 [Section No. A.3.3.21]

A.3.3.21 Fault Current, Available (Available Fault Current).

A short-circuit can occur during abnormal conditions such as a fault between circuit conductors or a ground fault. Available fault current can be different values at different points in the same circuit. See ~~Figure A.3.3.20~~ Figure A.3.3.21 .

Figure A.3.3.21 Available Fault Current. [70:Informational Note Figure 100.1]



Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon Apr 25 18:45:44 EDT 2022

Committee Statement

Committee Statement: The sentence was added to the Annex A material to explain that available fault current can be different at different points in the same circuit.

Response Message: SR-16-NFPA 70B-2022 The word "points" was used instead of "locations" to be consistent with the definition.

Public Comment No. 545-NFPA 70B-2022 [Section No. A.3.3.21]

Second Revision No. 362-NFPA 70B-2022 [Section No. A.3.3.26]

A.3.3.26 Ground-Fault Circuit Interrupter (GFCI).

See UL 943, *Standard for Ground-Fault Circuit Interrupters,* for further information. Class A ground-fault circuit interrupters trip when the ground-fault current ~~to ground~~ is 6 mA or higher and do not trip when the ground-fault current ~~to ground~~ is less than 4 mA. ~~For further information, see UL 943, *Standard for Ground-Fault Circuit Interrupters* .~~ [**70,**~~2020~~ 2023]

A GFCI does not eliminate the electric shock sensation since normal perception level is approximately 0.5 mA; nor does it protect from electric shock hazard from line-to-line contact.

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Wed Jun 29 09:07:29 EDT 2022

Committee Statement

Committee Statement: Updated to 2023 edition of NEC.
Response Message: SR-362-NFPA 70B-2022

Second Revision No. 63-NFPA 70B-2022 [Section No. A.6.1.1]

A.6.1.1

Engineering studies generally cover the following areas:

(1) Short-circuit studies

(2) Coordination studies

(3) Load-flow studies

(4) Reliability studies

(5) Incident energy analysis (arc-flash hazard calculations)

(6) Maintenance-related design studies

In order to conduct short-circuit, coordination, and arc flash studies, specific data should be collected. Data that should be included on a single-line diagram are utility company points of contact and data records for equipment such as~~, but not limited to,~~ transformers, cables, overhead lines, fuses, medium-voltage breakers, reclosers, capacitor banks, low-voltage breakers, disconnects, generators, and motors. This information should be developed for each type of operating conditions~~.~~ ~~Typical~~ Examples of data collection forms are included in ~~Figure~~ Annex E.~~47 through Figure E.49.~~

Utility information should at least include the minimum and maximum short circuit megavolt-amperes (MVA) and the X/R ratio at the service point; point of contact name, address, and telephone number; and facility point of contact, address, and telephone number.

Transformer data records should include location, rated kilovolt-amperes (kVA), maximum kVA, primary voltage, secondary voltage, impedance in percent, type of primary and secondary connection, ground impedance, and, if appropriate, the voltage tap.

Cable data should include “to” and “from,” rated volts, nominal volts, single-conductor or three-conductor cable, the number of conductors per phase, the neutral size, copper or aluminum, and length in feet.

Raceway material (i.e., magnetic or nonmagnetic) should be noted.

Overhead line information should include “to” and “from,” connection configuration, nominal volts, number of lines, lines per phase, ground size, type of cable (material), and length in feet.

Medium-voltage breaker information should include location ~~of the breaker~~ , manufacturer, type, rated volts, interrupting current, interrupting time (cycles), close/latch amps and for the associated relays the manufacturer/type, time delay range and existing tap, time dial, instantaneous range and existing tap, and CT ratio.

Recloser information should include location, CT ratio, nominal volts, manufacturer, type, BIL, continuous current rating, interrupting rating, minimum trip, operational sequence, reclosing times (if available), and tripping curves (if available).

Low-voltage information for the breaker should include location, manufacturer, type, rated volts, frame rating, and interrupting rating and for the trip device should include manufacturer, type, long time delay range and bands available, short time delay range and bands available, instantaneous range, and ground range and bands available.

Generator information should include location, type, kVA rating, generated volts, rated current, rpm, wiring connection (e.g., delta or wye), system ground, subtransient impedance, ground impedance, and power factor.

Motor information should include location, type, horsepower, rated volts, full load amps, rpm, code letter, locked rotor amps, power factor, and starter type.

Capacitor bank information should include ~~the~~ location, kVAR rating, rated volts, and wiring connection (e.g., delta or wye).

Fuse information should include ~~the~~ location, voltage rating, interruption rating, fuse type or class, manufacturer, and manufacturer’s part number.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue Apr 26 17:54:37 EDT 2022

Committee Statement

Committee Statement: The last sentence in the first paragraph is revised to reference Annex E rather than specific forms.

Response Message: SR-63-NFPA 70B-2022 Annex A is explanatory material, keeping the current text is necessary to provide context for the materials. Directing the user to Annex E is not necessary.

Public Comment No. 534-NFPA 70B-2022 [Section No. A.6.1.1]

Second Revision No. 339-NFPA 70B-2022 [Section No. A.14.3.5]

A.14.3.5

Insulation Resistance Testing for Busway Rated 600 Volts and Below. Insulation resistance testing should be performed ~~with a tester rated 1000 Volts~~ to ensure that the system is free from short circuits and grounds (phase-to-ground, phase-to-neutral, and phase-to-phase). Record and maintain records of the testing results.

Insulation resistance test readings vary inversely with the length of run and width or number of bars per phase. Readings will vary with humidity. ~~The recommended minimum insulation value is 1 megohm per 100 ft run. Readings less than that should be investigated to see if they can be improved. If the readings cannot be improved, contact the manufacturer.~~

Dielectric Withstand (High-Potential) Testing for Metal-Enclosed Busway Rated over 600 Volts. Dielectric withstand (high-potential) tests in accordance with IEEE C37.23, *Standard for Metal-Enclosed Bus*, should be conducted at 75 percent of the rated insulation withstand levels shown in Table A.14.3.5. Because this might be above the corona starting voltage of some busways, frequent testing is undesirable.

Table A.14.3.5 Metal-Enclosed Bus Dielectric Withstand Test Voltages

Metal-Enclosed Bus Nominal Voltage (kV, rms)	Insulation Withstand Level (kV, rms)*	High-Potential Field Test (kV, rms)†
4.16	19~~.0~~	14
13.8	36~~.0~~	27
23.0	60~~.0~~	45
34.5	80~~.0~~	60

*Test duration is 1 minute.

†Field test voltage is 75 percent of insulation withstand level.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu May 12 10:35:41 EDT 2022

Committee Statement

Committee Statement: Struck the text that required a specific tester and rating. The test should be performed to ensure the system is free from shorts and rounds. The methods used may vary as well as the equipment used. This annex material is merely stating the end goal.

Removed the sentence referencing insulation resistance testing and values. The important information here is the first sentence Insulation resistance test readings vary inversely with the length of run and width or number of bars per phase. Readings will vary with humidity.

Table A.14.3.5: Removed the decimal of zero as it is not necessary.

Response Message: SR-339-NFPA 70B-2022

Public Comment No. 96-NFPA 70B-2022 [Section No. A.14.3.5]

Public Comment No. 104-NFPA 70B-2022 [Section No. A.14.3.5]

Second Revision No. 340-NFPA 70B-2022 [Section No. A.16.3.1]

A.16.3.1

Evidence of corrosion and wear can include excessive erosion of the inside of the fuse tube~~,~~ ; physical damage to the outside of the fuse tube including cracks~~,~~ and cuts~~,~~ ; ~~and other,~~ discharge (tracking)~~,~~ ; dirt on the outside of the fuse tube~~,~~ ; or improper assembly and could prevent proper fuse operation.

Fuses Rated 1000 V or Less. Early detection of overheating is possible using infrared examination. If evidence of overheating exists, the cause should be determined. Fuses showing signs of deterioration, such as discolored or damaged casings or loose terminals, should be replaced.

Fuseholders should be deenergized before installing or removing fuses. Where it is not feasible or would result in a greater hazard to deenergize the fuseholder, installation or removal of fuses should be performed only with the load removed and in accordance with appropriate safety-related work practices for the task.

Many different types of fuses are used in power distribution systems and utilization equipment. Fuses differ by performance, characteristics, and physical size. Fuses, whether new or replacement, should be verified as the proper type and rating. When fuses are replaced, fuseholders should never be altered or forced to accept fuses that do not readily fit. An adequate supply of spare fuses with proper ratings, especially those that are uncommon, minimizes replacement problems.

The most common fuse classes for 0 ampere through 600 ampere applications on power systems are Class H, Class K, Class R, Class J, Class T, Class G, Class CC, and Class L. Class H, Class K, and Class R are the same physical size and are interchangeable in standard nonrejection-style fuseholders. Class H and Class K fuses are not current limiting whereas Class R fuses are current limiting. Special rejection-style fuseholders accept only Class R fuses. Note that Class R fuses are manufactured in two types: Class RK1 and Class RK5. Class RK1 fuses are more current limiting than Class RK5 fuses and are generally recommended to upgrade older distribution systems. Class L fuses are available in the range of 601 amperes through 6000 amperes. Class J, Class T, Class G, Class CC, and Class L are size rejection fuses. One type of fuse should never arbitrarily be replaced with a different type simply because it fits into the fuseholder.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Thu May 12 11:06:35 EDT 2022

Committee Statement

Committee Statement: Annex material was added from 2019 edition that provides additional guidance on fuse types, ratings, characteristics, and replacement considerations.

Response Message: SR-340-NFPA 70B-2022

Public Comment No. 84-NFPA 70B-2022 [Section No. A.16.3.1]

Second Revision No. 226-NFPA 70B-2022 [Section No. A.21.1]

A.21.1

The term *ground-fault circuit interrupter (GFCI)* is applied to describe a family of devices intended for shock protection of personnel.

Ground-Fault Circuit Interrupter (GFCI). A Class A GFCI is listed to UL 943, *Ground-Fault Circuit-Interrupters* , and is designed to protect a person from electrocution when contact between a live part of the protected circuit and ground causes current ~~to flow~~ through a person's body. A GFCI disconnects the circuit when a current equal to or higher than the calibration point (4 mA to 6 mA) flows through the protected circuit to ground. It does not eliminate the shock sensation since normal perception level is approximately 0.5 mA. ~~It does not protect from electrocution for line-to-line contact, because the nature of line-to-line loads cannot be distinguished.~~ Additional GFCI classes are available that offer protection under other conditions.

Special-Purpose GFCI (SPGFCI). A Class C, Class D, or Class E GFCI is listed to UL 943C, *Outline of Investigation for Special Purpose Ground-Fault Circuit-Interrupters* , and is designed to protect a person from electrocution when contact between a live part of the protected circuit and ground causes current through a person's body.

Ground-Fault Protection of Equipment. A system listed to UL 1053, *Ground-Fault Sensing and Relaying Equipment* , is intended to provide protection of equipment from damaging line-to-ground fault currents by causing a disconnecting means to open all ungrounded conductors of the faulted circuit. This protection is provided at current levels less than those required to protect conductors from damage through the operation of a supply circuit overcurrent device. ~~These types of protective equipment are typically used on ac, solidly grounded circuits rated 480 volts and higher, and cause the circuit to be disconnected when a current equal to or higher than its pickup threshold flows to ground.~~

~~Equipment ground-fault protective devices are intended to operate on a condition of excessive ground-fault current from equipment.~~

Circuit breakers with equipment ground-fault protection are a combination of a circuit breaker and ground-fault protective devices designed to serve the dual function of providing overcurrent protection and ground-fault protection for equipment. They are intended to be used in accordance with Articles 426 and 427 of *NFPA 70*.

Ground-fault sensing and relaying equipment is intended to provide ground-fault protection of equipment at services and feeders. They are rated for ground current pickup levels as high as 1200 amperes.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 09:30:11 EDT 2022

Committee Statement

Committee Statement: Revised the GFPE paragraph. The deleted existing information was contained in the last paragraph. A description of ground-fault protection of equipment was added to align with the paragraph on GFCIs.

Added information on special-purpose GFCI to distinguish what a SPGFCI is.

Response Message: SR-226-NFPA 70B-2022

Public Comment No. 354-NFPA 70B-2022 [Section No. A.21.1]

Second Revision No. 325-NFPA 70B-2022 [Section No. A.21.3.2]

A.21.3.2

Ground-Fault Sensing and Relaying Equipment. Ground-fault sensing and relaying equipment is used to prevent damage to conductors and equipment. The protective equipment consists of three main components: (1) sensors, (2) relay or control unit, and (3) a tripping means for the disconnect device controlling the protected circuit.

Sensing Methods. Detection of ground-fault current is done by either of two basic methods. With one method, ground-fault current flow is detected by sensing current in the ~~grounding~~ grounded conductor. With the other method, all phase conductor currents are monitored by either a single large sensor or several smaller ones.

Sensors. Sensors are generally a type of current transformer and are installed on the circuit conductors. The relay or control unit can be mounted remote from the sensors or can be integral with the sensor assembly.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Mon May 09 13:04:42 EDT 2022

Committee Statement

Committee Statement: Change "grounding" to "grounded" and adding the word "phase". Clarifying that the reference is to the phase conductors for this portion of the section.

Added ‘ground-fault’ for clarity.

Response Message: SR-325-NFPA 70B-2022

Public Comment No. 355-NFPA 70B-2022 [Section No. A.21.3.2]

Second Revision No. 246-NFPA 70B-2022 [Section No. A.24.1]

A.24.1

The use of ~~these~~ wiring devices for the connection of equipment provides for rapid removal and replacement and facilitates relocation of electrical equipment.

Devices used in hazardous (classified) locations require some additional inspections. Flame paths should be inspected to ensure that safe gaps are not exceeded and that no scratches are on the ground joints. All screws holding the receptacle to the body should be installed and tight. Covers and threaded openings should be properly tightened. These devices should be checked to make sure that the plug and receptacle marking agree with the present classification of the area ~~in regards to the~~ regarding class, group, and division.

The connection of equipment to supplies of incorrect electrical ratings of current, voltage, phase, or frequency can be dangerous or can cause damage to equipment. Therefore, attachment plugs, cord connectors, and equipment are provided with appropriate ratings and configurations to prevent interconnection that could create hazards. See ANSI/ NEMA WD 6, *Wiring Devices — Dimensional Specifications*, for configurations.

Use of some of these devices to disconnect some equipment under load conditions, such as welders, and running or stalled motors can be hazardous. Other load-interrupting means intended for this purpose should be used prior to disconnecting the wiring device.

If there is abnormal heating of the receptacle, plug, or connector insulation, ~~a check~~ the device should be ~~made~~ checked for loose terminations or insufficient pressure between contacts~~,~~ and ~~they~~ terminations should be corrected or the device replaced. If there is arc tracking or evidence of burning of the insulation or other damage, the insulation should be replaced.

Plugs should fit firmly when inserted into the mating connector or receptacle. Insufficient mating force can result in contact erosion caused by arcing of the contacts or accidental disengagement. The connector or receptacle should be checked to ensure that adequate contact pressure is present. The complete interior should be replaced if there is discoloration of the housing or severe erosion of the contact.

Receptacle contacts should retain inserted plugs firmly. Corroded, deformed, or mechanically damaged contacts should be replaced.

All mounting and assembly screws must be present and checked to ensure that they are tight to ensure proper grounding, prevent the entrance of adverse environmental products, and provide cable retention.

Proper wire connections on receptacles and proper polarity of power connection, including the integrity of the equipment grounding conductor, should be confirmed.

The equipment grounding conductor (green insulation) of the cord must be attached to the grounding terminal of the device, thereby ensuring grounding continuity.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 10:58:24 EDT 2022

Committee Statement

Committee Statement: Clarification of which devices are being referenced.

Response Message: SR-246-NFPA 70B-2022

Public Comment No. 681-NFPA 70B-2022 [Section No. A.24.1]

Second Revision No. 260-NFPA 70B-2022 [Section No. B.1.1]

B.1.1 Flexible Cords (Including Those on Appliances).

~~Heater-type cords are recommended for portable heating appliances, such as toasters, grills, and coffee makers.~~ An inspection should be made for badly worn or frayed spots, splices (not permitted), improper type, or current-carrying capacity that is too small.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 12:29:55 EDT 2022

Committee Statement

Committee Statement: The type of cord is not pertinent to this annex. The appliance would be provided with the proper cord based on the listing requirement for that appliance.

Response Message: SR-260-NFPA 70B-2022

Public Comment No. 591-NFPA 70B-2022 [Section No. B.1.1]

Second Revision No. 261-NFPA 70B-2022 [Section No. B.1.2]

B.1.2 Plugs and Connectors.

~~A check should be made for stray strands and loose terminals. They~~ Plugs and connectors should be grounding type where required for specific appliances. ~~The green conductor should be connected to the grounding terminal.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 12:31:30 EDT 2022

Committee Statement

Committee Statement: Since this chapter is about visual inspections, the inspection for stray strands, loose terminals, and conductor connections are not appropriate for this item as they cannot be seen or verified during a walk-through inspection.

Response Message: SR-261-NFPA 70B-2022

Public Comment No. 592-NFPA 70B-2022 [Section No. B.1.2]

Second Revision No. 262-NFPA 70B-2022 [Section No. B.1.5]

B.1.5 Appliances.

Grills, toasters, and similar equipment should be ~~permanently~~ spaced from combustible material.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 12:33:15 EDT 2022

Committee Statement

Committee Statement: Combustible materials can be brought near the equipment so "permanent" is not appropriate.

Response Message: SR-262-NFPA 70B-2022

Public Comment No. 593-NFPA 70B-2022 [Section No. B.1.5]

Second Revision No. 263-NFPA 70B-2022 [Section No. B.1.6]

~~**B.1.6** Heating Appliances.~~

~~Where used with combustible material, such appliances generally require a signal light to indicate when they are "on."~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 12:35:22 EDT 2022

Committee Statement

Committee Statement: The deleted section provides no suggestion for an inspection. It does not add any value to the section.

Response Message: SR-263-NFPA 70B-2022

Public Comment No. 197-NFPA 70B-2022 [Section No. B.1]

Second Revision No. 264-NFPA 70B-2022 [Section No. B.1.7]

~~**B.1.7** Hot-Water Heaters.~~

~~A check should be made for proper electrical protection. The combination temperature- and pressure-relief valve should be manually operated to be sure it is free and the drain line is clear. The setting should be visually checked.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 12:38:26 EDT 2022

Committee Statement

Committee Statement: The requirement to check the electrical protection is not something that can be readily checked during a walk-through inspection. The relief valve operation is not an electrical maintenance item. The last sentence refers to a "setting" with no setting defined.

Response Message: SR-264-NFPA 70B-2022

Public Comment No. 198-NFPA 70B-2022 [Section No. B.1]

Second Revision No. 265-NFPA 70B-2022 [Section No. B.1.9]

B.1.7 Receptacle Outlets.

Grounding-type receptacles are generally required. ~~Each receptacle should be checked for continuity of grounding connection, using a suitable test instrument.~~ Are special receptacle configurations used for those supplying unusual voltages, frequencies, and so on? Are they well marked or identified? In particular, missing faceplates, receptacles showing signs of severe arcing, loose mounting, and so on~~,~~ should be noted.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 12:40:31 EDT 2022

Committee Statement

Committee Statement: Testing of receptacles is an electrical test item and should not be required during a walk-through inspection, which is the topic of this chapter.

Response Message: SR-265-NFPA 70B-2022

Public Comment No. 200-NFPA 70B-2022 [Section No. B.1.9]

Second Revision No. 266-NFPA 70B-2022 [Section No. B.1.10]

B.1.8 Portable Equipment (Tools, Extension Lamps, and Extension Cords).

~~In the shop or tool room, a check should be made after each use for isolation between live parts and frame.~~ The condition of cords and plugs should be ~~noted~~ inspected, and any defective equipment should be removed from service . The condition of guards and shields on lamps should be checked. ~~Is continuity maintained between the frame and the grounding pin of the plug? The green conductor should connect only to the plug grounding pin. On lamps, the condition of guards, shields, and so on, should be checked. See *NFPA 70* for portable hand lamps; metal-shell and paper-lined lampholders for hand lamps are not permitted.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 12:42:17 EDT 2022

Committee Statement

Committee Statement: Removed electrical testing requirements as they are not part of a walk-through inspection. Remaining items were removed to improve clarity.

Response Message: SR-266-NFPA 70B-2022

Public Comment No. 199-NFPA 70B-2022 [Section No. B.1.10]

Second Revision No. 267-NFPA 70B-2022 [Section No. B.1.11]

B.1.9 ~~Lighting Fixtures~~ Luminaires .

~~All lighting fixtures should be labeled and grounded. See *NFPA 70* for connection of electric-discharge lighting fixtures. These are permitted to be connected by suitable, three-conductor flexible cord where visible for its entire length and terminated at outer end in a grounding-type attachment plug or busway plug.~~ No ~~fixtures~~ luminaire should be located close to highly combustible material. The location of ~~fixtures~~ luminaires with burned out bulbs or tubes; ~~fixtures~~ luminaires that are heavily coated with dust, dirt, or other material; and reflectors that ~~are in~~ need ~~of~~ cleaning should be noted.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 12:43:46 EDT 2022

Committee Statement

Committee Statement: Not all luminaires (like a desk lamp) are required to be grounded. The "labeled" requirement is ambiguous. Therefore, the first sentence is deleted. The second and third sentences are about electric discharge luminaires. Information on that specific luminaire type is not required.

Response Message: SR-267-NFPA 70B-2022

Public Comment No. 202-NFPA 70B-2022 [Section No. B.1.11]

Second Revision No. 268-NFPA 70B-2022 [Section No. B.1.12]

B.1.10 Equipment Grounding.

~~Where machinery or wiring enclosures are grounded through the conduit system, broken~~ Broken or loose connections at boxes and fittings, flexible connections, and exposed ground straps should be identified. Multiple bonding of conduit and other metallic enclosures to interior water piping systems, including sprinkler systems, is sometimes used as a precaution where building vibration is severe, even though a separate equipment grounding conductor is run with the circuit conductors inside the ~~conduit~~ raceway .

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 12:45:31 EDT 2022

Committee Statement

Committee Statement: This clarifies the visual inspection of raceways and their connections to boxes and enclosures. All damaged items listed should be fixed even if those items are not used for grounding.

Response Message: SR-268-NFPA 70B-2022

Public Comment No. 201-NFPA 70B-2022 [Section No. B.1.12]

Second Revision No. 269-NFPA 70B-2022 [Section No. B.1.13]

B.1.11 Yard Transformer Stations.

The condition of transformers, fence, gates, and locks should be noted. Yard and equipment should be free of storage of combustible material, weeds, grass, vines, ~~birds'~~ nests, and so on. Localized overheating, indicated by conductor discoloration, should be watched for. Indication of excessive transformer temperature, pressure, or oil leakage should be noted.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 12:47:12 EDT 2022

Committee Statement

Committee Statement: Clarification to not limit to only bird's nest, as other nests such as rodents and insects should also be identified.

Response Message: SR-269-NFPA 70B-2022

Public Comment No. 594-NFPA 70B-2022 [Section No. B.1.13]

Second Revision No. 270-NFPA 70B-2022 [Section No. B.1.14]

B.1.12 Services.

The condition of weatherheads and weatherhoods should be visually checked to determine that they remain in good condition. ~~Birds' nests, rats' nests, and so on, should be eliminated~~ Nests, such as rodent, insect, and bird nests, should be documented . At the same time, the apparent condition of lightning arresters, surge capacitors, grounding conductors, and grounds should be determined. Are switches safely and readily accessible?

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 12:48:46 EDT 2022

Committee Statement

Committee Statement: Clarification as to not limit to only bird's nest, as other nests such as rodents and insects should also be documented.

Response Message: SR-270-NFPA 70B-2022

Public Comment No. 595-NFPA 70B-2022 [Section No. B.1.14]

Second Revision No. 271-NFPA 70B-2022 [Section No. B.1.15]

B.1.13 ~~Switch~~ Electrical Equipment Rooms and Motor Control Centers.

~~Switch~~ Electrical equipment rooms and motor control centers should be clean, used for no other purpose, and free of storage of any kind, especially combustible material. Ventilation equipment should be in working condition and unobstructed. Any unusual noises or odors should be noticed and reported promptly. Metering equipment should be checked for high or low voltage and current and any indication of accidental grounding (ungrounded systems). Are switches, disconnects, and motor controllers properly identified as to function~~; are~~ ? Are fire extinguishers in place, of suitable type, and charged?

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 12:50:14 EDT 2022

Committee Statement

Committee Statement: Electrical equipment rooms can contain additional electrical equipment, not just switches and MCCs.

Response Message: SR-271-NFPA 70B-2022 “Rooms” was not added after MCCs as they are not always installed in a dedicated room.

Public Comment No. 596-NFPA 70B-2022 [Section No. B.1.15]

Second Revision No. 272-NFPA 70B-2022 [Section No. B.1.17]

B.1.15 Enclosures of Electrical Parts (e.g., Motor Control Equipment, Junction Boxes, Switches~~, etc.~~).

~~Are covers secured in place? The location of broken or loose conduit, wiring gutters, and so on, should be reported. Missing dust caps should be replaced.~~ All loose or missing covers and unused openings in enclosures should be documented.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 12:52:31 EDT 2022

Committee Statement

Committee Statement: Clarification to meet intent of this section in visual inspection and development of checklist. Raceways and wireways were deleted as they are not enclosures.

Response Message: SR-272-NFPA 70B-2022

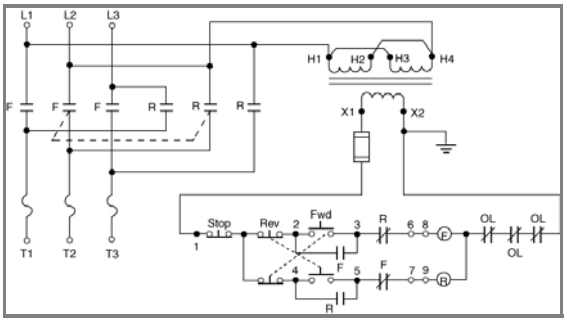
Public Comment No. 597-NFPA 70B-2022 [Section No. B.1.17]

Second Revision No. 273-NFPA 70B-2022 [Section No. D.3]

D.3

Figure D.3 shows a power and control schematic for a reversing starter with low-voltage remote pushbuttons. Forward, reverse, and stop connections are shown.

Figure D.3 Power and Control Schematic for Reversing Starter with Low-Voltage Remote Pushbuttons. ~~Forward, reverse, and stop connections are shown.~~



Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 12:54:37 EDT 2022

Committee Statement

Committee Statement: The last items in the title of the figure are repetitive and are removed.

Response Message: SR-273-NFPA 70B-2022

Public Comment No. 599-NFPA 70B-2022 [Section No. D.3]

Second Revision No. 274-NFPA 70B-2022 [Section No. H.1 [Excluding any Sub-Sections]]

Preferably, all types of electrical equipment should be stored in a clean, heated building affording good physical protection and providing controlled access to prevent unauthorized tampering with the equipment. However, equipment can be stored in other inside and outside environments with proper provisions to satisfy the ~~following~~ general recommendations of this section and the recommendations specified in the particular equipment sections. The manufacturer's instructions for the specific equipment and environment should be followed.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 12:56:39 EDT 2022

Committee Statement

Committee Statement: It is appropriate to recommend that manufacturer's instructions for the specific equipment and the specific environment be followed.

Response Message: SR-274-NFPA 70B-2022

Second Revision No. 357-NFPA 70B-2022 [Section No. H.1.2]

H.1.2

Covers are recommended unless storage conditions specified in Section ~~H.1.1~~ H.1 exist. Canvas tarpaulins or the equivalent are preferred over other coverings because they provide better humidity control and enclosure scuff protection.

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Fri May 20 14:33:53 EDT 2022

Committee Statement

Committee Statement: This clarifies that H.1 is the correct reference for storage conditions.
Response Message: SR-357-NFPA 70B-2022

Public Comment No. 126-NFPA 70B-2022 [Section No. H.1.2]

Second Revision No. 276-NFPA 70B-2022 [Section No. H.2.1.3]

H.2.1.3

Temporary heaters or lamp banks should be used where space heaters are not furnished to maintain temperature at a level approximately 12°C (~~10~~ 22 °F) above ambient.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 12:59:13 EDT 2022

Committee Statement

Committee Statement: The correct delta temperature rise is 21.6° F. 22°F is a hard conversion.

Response Message: SR-276-NFPA 70B-2022

Public Comment No. 87-NFPA 70B-2022 [Section No. H.2.1.3]

Second Revision No. 277-NFPA 70B-2022 [Section No. H.2.1.4]

H.2.1.4

In humid locations, ~~such as in the tropics,~~ it might be necessary to remove the equipment from shipping cases to permit adequate ventilation and to avoid mildew.

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Tue May 03 13:00:39 EDT 2022

Committee Statement

Committee Statement: Deleted extraneous language.
Response Message: SR-277-NFPA 70B-2022

Public Comment No. 601-NFPA 70B-2022 [Section No. H.2.1.4]

Second Revision No. 278-NFPA 70B-2022 [Section No. H.4.8]

H.4.8

Six weeks or less before start-up, insulation resistance values of each winding of all units should be measured and recorded. Temperature and weather conditions should be recorded at time of reading. If resistance is low, the recommendations of H.4.7 should be followed.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 13:02:02 EDT 2022

Committee Statement

Committee Statement: There is a need to ensure time frame between testing and start-up, but not to exceed six weeks prior to start-up.

Response Message: SR-278-NFPA 70B-2022

Public Comment No. 603-NFPA 70B-2022 [Section No. H.4.8]

Second Revision No. 279-NFPA 70B-2022 [Section No. H.5.4]

H.5.4 Transformers Filled with Insulating Liquid.

If a transformer is shipped with its main tank filled with insulating liquid (except for expansion space), the level of the liquid and the ambient temperature should be measured and recorded when the unit arrives on site ~~and every month thereafter. If the level falls, leaks should be repaired and insulating liquid added to keep the level within tolerances~~ . Levels should be within recommended tolerances. The transformer should be regularly inspected to verify the absence of leaks .

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 13:03:34 EDT 2022

Committee Statement

Committee Statement: Changes clarify that the correct fluid level should be maintained to manufacturer's tolerances and regular inspections should be made for any transformer leaks.

Response Message: SR-279-NFPA 70B-2022

Public Comment No. 604-NFPA 70B-2022 [Section No. H.5.4]

Second Revision No. 280-NFPA 70B-2022 [Section No. H.5.5]

H.5.5 Transformer Gas ~~Under Pressure~~ Blanket .

If a transformer is shipped with its main tank filled with insulating liquid and blanketed with gas under pressure or filled with gas under pressure, the gas pressure and the ambient temperature should be measured and recorded when the unit arrives on site and every month thereafter. ~~If the pressure falls, leaks should be repaired and gas added to keep the pressure within tolerances~~ Pressures should be kept within specified tolerances. If leaks are suspected, they should be found and repaired .

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 13:05:12 EDT 2022

Committee Statement

Committee Statement: Title change aligns with technical term for section subject. Clarification made to recognize gas pressure may fluctuate with temperature and not be related to leaks.

Response Message: SR-280-NFPA 70B-2022

Public Comment No. 607-NFPA 70B-2022 [Section No. H.5.5]

Second Revision No. 281-NFPA 70B-2022 [Section No. H.5.6]

H.5.6 Primary Disconnect Switches.

Primary disconnect switches should be handled ~~per~~ in accordance with the recommendations for switchgear, motor control, and control equipment.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 13:07:52 EDT 2022

Committee Statement

Committee Statement: Title added for better usability.

Response Message: SR-281-NFPA 70B-2022

Public Comment No. 609-NFPA 70B-2022 [Section No. H.5.6]

Second Revision No. 282-NFPA 70B-2022 [Section No. H.7.3]

H.7.3

Batteries that have been shipped wet should be handled in accordance with the manufacturer's instructions. Lead-acid batteries that have been shipped wet should be handled as follows:

(1) Electrolyte levels should be inspected when batteries are received at the site. Electrolyte should be added to the proper level, if any has been lost.

(2) Three months after the date of shipment from the factory, and every three months thereafter, batteries should be given a freshening charge to restore the voltage to 2.15 volts per cell and the specific gravity to 1.21 at 25°C (77°F). The charging rate should not exceed the manufacturer's recommended value; batteries should not be overcharged.

~~Other type batteries that have been shipped wet should be handled per the manufacturer's instructions.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 13:12:02 EDT 2022

Committee Statement

Committee Statement: Change clarifies that all batteries that are shipped wet should follow manufacturer's instructions.

Response Message: SR-282-NFPA 70B-2022

Public Comment No. 611-NFPA 70B-2022 [Section No. H.7.3]

Second Revision No. 283-NFPA 70B-2022 [Section No. I.1.1]

I.1.1 Availability.

The probability that a system or product will be available to perform its intended mission or function when called upon to do so at any point in time. It can be measured in one of several ways.

I.1.1.1 Function of Uptime.

Availability can be considered as the percent of total time that a system is available. It is measured using Equation ~~1~~ I.1.1.1 (note that the period of time over which this measure of availability is made must be defined). Downtime includes administrative time and delays, as well as time for maintenance and repair.

$$\text{Availability} = \frac{\text{Uptime}}{\text{Downtime} + \text{Uptime (Total time)}} \quad \textbf{[I.1.1.1]}$$

I.1.1.2 Operational Availability.

I.1.1.2.1

Another equation for availability directly uses parameters related to the reliability and maintainability characteristics of the item as well as the support system. Equation ~~2~~ I.1.1.2.1 reflects this measure.

$$\text{Operational Availability} = \frac{\text{Mean Time Between Maintenance (MTBM)}}{\text{Mean Downtime} + \text{MTBM}} \quad \textbf{[I.1.1.2.1]}$$

I.1.1.2.2

In Equation ~~2~~ I.1.1.2.1 , mean time between maintenance (MTBM) includes all maintenance required for any reason, including repairs of actual design failures, repairs of induced failures, cases where a failure cannot be confirmed, and preventive maintenance.

I.1.1.3 Inherent Availability.

When only maintenance required to correct design failures is counted and the effects of the support system are ignored, the result is inherent availability, which is given by Equation ~~3~~ I.1.1.3 .

$$\text{Inherent Availability} = \frac{\text{Mean Time Between Failures (MTBF)}}{\text{Mean Time to Repair} + \text{MTBF}} \quad \textbf{[I.1.1.3]}$$

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Tue May 03 13:14:18 EDT 2022

Committee Statement

Committee Statement: Equation references are changed to the bracketed reference number for each equation.
Response Message: SR-283-NFPA 70B-2022

Public Comment No. 613-NFPA 70B-2022 [Section No. I.1.1.3]

Public Comment No. 612-NFPA 70B-2022 [Section No. I.1.1.2.2]

Second Revision No. 284-NFPA 70B-2022 [Section No. J.3.3 [Excluding any Sub-Sections]]

Monitoring can be used to identify power anomalies including voltage transients. Oscilloscopes or power disturbance analyzers specifically designed for transients are useful monitoring tools. Monitoring might be ~~required~~ needed over an extended period of time to characterize the nature of the transients.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 13:17:35 EDT 2022

Committee Statement

Committee Statement: Adjusted the wording to remove “required” and replace it with “needed” in accordance with the NFPA Manual of Style for Technical Committee documents Section 1.9.5.

Response Message: SR-284-NFPA 70B-2022

Second Revision No. 285-NFPA 70B-2022 [Section No. J.3.4.1]

J.3.4.1

Devices intended to limit damage from transients ~~and~~ are typically rated in units of joules (watt-seconds).

Proper grounding of all circuits intended to be grounded is ~~required~~ needed for correct operation of these devices. The manufacturer's instructions should be followed when any of these devices is installed.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 13:18:54 EDT 2022

Committee Statement

Committee Statement: Adjusted the wording to remove "required" and replace it with "needed" in accordance with the NFPA Manual of Style for Technical Committee documents Section 1.9.5.

Response Message: SR-285-NFPA 70B-2022

Second Revision No. 286-NFPA 70B-2022 [Section No. K.1]

K.1 Introduction.

When electrical systems are faced with a natural or man-made disaster, a very specific and detailed sequence of events should occur prior to returning the electrical system to operation in a safe and expeditious manner. Actions can also be taken to reduce the damage to the system and to shorten the system recovery time frame. After a disaster event, it is especially critical to analyze and repair the electrical power system in a safe and logical sequence. This annex describes ~~the~~ recovery steps for an electrical power system~~,~~ and related equipment~~,~~ that should be followed before and after an electrical disaster event occurs.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 13:20:22 EDT 2022

Committee Statement

Committee Statement: The word “the” is deleted from K.1 to clarify that the methods mentioned in the text are not necessarily the only steps to be taken in recovery.

Response Message: SR-286-NFPA 70B-2022 The term “facility” remains in K.2.2 for consistency with the title and use in other sections of the document.

Public Comment No. 685-NFPA 70B-2022 [Chapter K]

Second Revision No. 288-NFPA 70B-2022 [Section No. K.2 [Excluding any Sub-Sections]]

The events surrounding a disaster can be detailed into the following specific event phases:

(1) ~~The initial~~ Initial event
(2) Securing the facility to limit damage
(3) Mobilization of recovery personnel
(4) Developing a safety plan
(5) Temporary and emergency power generation
(6) Initial damage assessment
(7) Documentation
(8) Equipment
(9) Re-energization of the facility
(10) System commissioning ~~during~~
(11) Project summary

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Tue May 03 13:24:10 EDT 2022

Committee Statement

Committee Statement: Item 1: Change made for consistency.

Item 10: The word “during” removed for clarity.

Response Message: SR-288-NFPA 70B-2022

Public Comment No. 614-NFPA 70B-2022 [Section No. K.2 [Excluding any Sub-Sections]]

Second Revision No. 287-NFPA 70B-2022 [Section No. K.2.8.7]

K.2.8.7 System Commissioning ~~During~~ .

~~Reenergization~~ During the re-energization of the facility, ~~the~~ equipment operation~~,~~ and performance should be verified. A period of monitoring should be established to verify and document that proper operation has been restored.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 13:22:32 EDT 2022

Committee Statement

Committee Statement: K.2.8.7 has been re-worded to delete “during” from the end of the title and insert it at the beginning of the first sentence for clarity. The first sentence has also been re-organized to clarify the recommendation.

Response Message: SR-287-NFPA 70B-2022

Second Revision No. 289-NFPA 70B-2022 [Chapter L [Excluding any Sub-Sections]]

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

The case histories in this annex ~~substantiate~~ support the need for qualified maintenance personnel and the implementation of an EMP . There are several types of case histories in this annex. These case histories illustrate that it is good business practice to devote the personnel and monetary resources to keep electrical equipment properly maintained. ~~Saving by not committing~~ Limiting resources committed to regular maintenance could result in significant monetary consequences, such as equipment replacement, lost production, personnel injuries, death settlements, OSHA fines, legal fees, and losses not covered by insurance ~~settlement nonpayment . Use these case histories to train personnel.~~ These case histories can be used as a tool to demonstrate the positive effects of routine maintenance and the potential consequences of not having an adequate preventative maintenance program.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 13:26:22 EDT 2022

Committee Statement

Committee Statement: Added reference to the implementation of an EMP as a reason for inclusion of the case histories. Adding the word “limiting” conveys consequences beyond solely monetary. Removed requirement language as annex material is informative and not normative. Last sentence already suggests using case histories for positive results of implementing an EMP.

Response Message: SR-289-NFPA 70B-2022

Public Comment No. 133-NFPA 70B-2022 [Chapter L [Excluding any Sub-Sections]]

Second Revision No. 290-NFPA 70B-2022 [Section No. L.1]

L.1 Oil Contamination Causes Transformer Failure.

~~In one industrial plant, the~~ The failure of a transformer caused a total plant shutdown at an industrial facility . Contamination of the transformer's insulating oil caused the failure. The contamination went undetected because the oil had not been tested for several years. Fire damage and equipment replacement costs amounted to $50,000 (US), exclusive of the cost of plant downtime. This amount would have paid for the cost of operating an ~~EPM program~~ EMP covering the entire plant's electrical distribution system for several years.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 13:29:45 EDT 2022

Committee Statement

Committee Statement: Changes made to improve readability. Correcting acronym for EMP. Eliminated redundancy of the word program.

Response Message: SR-290-NFPA 70B-2022

Public Comment No. 125-NFPA 70B-2022 [Section No. L.1]

Public Comment No. 134-NFPA 70B-2022 [Section No. L.1]

Second Revision No. 291-NFPA 70B-2022 [Section No. L.2]

L.2 Lack of Cleaning Program Causes Switchgear Damage.

~~In another industrial plant, damage~~ Damage amounting to $100,000 (US) was attributed to the failure of the main switchgear at an industrial facility . Fouling by dirt, gummy deposits, and iron filings caused the failure. The cost of this failure would have supported a comprehensive ~~EPM program~~ EMP covering all of the plant's electrical distribution system for several years.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 13:31:19 EDT 2022

Committee Statement

Committee Statement: Changes made to improve clarity. Correcting acronym for EMP. Eliminated redundancy of the word program.

Response Message: SR-291-NFPA 70B-2022

Public Comment No. 131-NFPA 70B-2022 [Section No. L.2]

Public Comment No. 135-NFPA 70B-2022 [Section No. L.2]

Second Revision No. 292-NFPA 70B-2022 [Section No. L.3]

L.3 Failure to Maintain Extension Cord Causes Fire.

A large exhibition hall in Chicago was destroyed by a fire believed to have been started because of a defective extension cord serving a display booth. Direct property loss was $60 million (US), and loss of the facility cost an additional $100 million (US) to the economy in the Chicago area. This fire might have been prevented if a program had been in effect to ~~ensure that worn cords were replaced, that only heavy-duty cords were used, and that cords and their supply circuits were not overloaded~~ manage the integrity of the cords .

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 13:33:05 EDT 2022

Committee Statement

Committee Statement: Changes were made to clean up unnecessary text.

Response Message: SR-292-NFPA 70B-2022

Public Comment No. 136-NFPA 70B-2022 [Section No. L.3]

Second Revision No. 293-NFPA 70B-2022 [Section No. L.4]

L.4 Clogged Cooling Ducts Cause Motor Failure.

The failure of a large motor shut down an entire industrial plant for 12 days. The cause of the failure was overheating resulting from dust-plugged cooling ducts. An ~~EPM~~ EMP inspection would likely have detected the clogged ducts and averted the failure and accompanying plant outage.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 13:34:26 EDT 2022

Committee Statement

Committee Statement: Correcting acronym for EMP. Change made to reflect that an EMP inspection is no guarantee that it would have detected the clog ducts.

Response Message: SR-293-NFPA 70B-2022

Public Comment No. 132-NFPA 70B-2022 [Section No. L.4]

Public Comment No. 137-NFPA 70B-2022 [Section No. L.4]

Second Revision No. 294-NFPA 70B-2022 [Section No. L.5]

L.5 ~~All Parts of the Protective System Must Be Tested and Maintained for It to Operate Adequately~~ Lack of Maintenance Causes Failure of Multiple Circuit Breakers .

A company had their protective relays on their 13.8 kV power system calibrated regularly each year, but did not have the circuit breakers tested or maintained. When a maintenance contractor pointed out that the circuit breakers as well as the protective relays needed maintenance, the company responded: “The circuit breakers are like brand new. We never operate them.” One year, several months after the relays were calibrated, an underground feeder cable failed and the fault cascaded through six circuit breakers before it was cleared.

The company was certain the root cause was improper calibration of the protective relays. Upon inspection, however, the company found that all of the operations indicators (flags) on all of the protective relays had dropped, showing that the relays operated correctly. The root cause was determined to be the circuit breaker operating mechanisms. The mechanisms were so dry from lack of lubricant that the opening coils burned up on all six of the circuit breakers that did not operate when the relays signaled the circuit breakers to open. *[See Figure L.5(a) through Figure L.5(f).]*

Figure L.5(a) A 20 cal/cm^2 Arc Flash Suit Hanging on the Wall was Reduced to Ashes. ***(Courtesy of Shermco Industries, Inc.)***

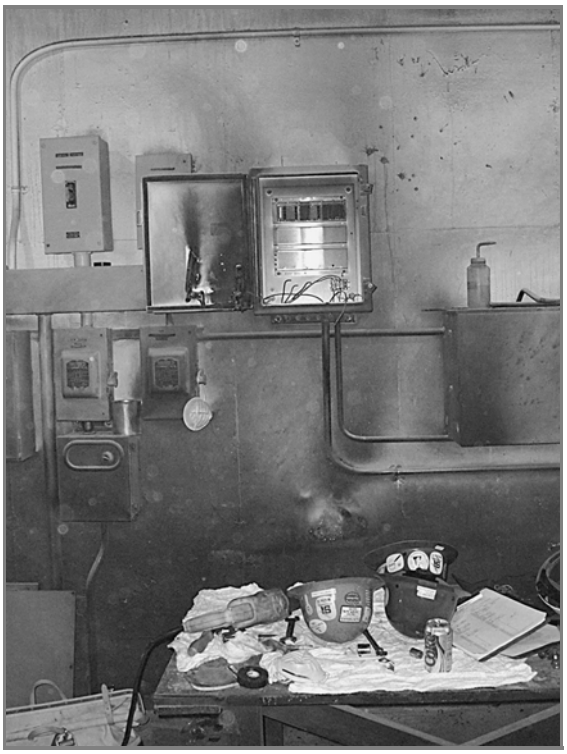


Figure L.5(b) All Six Circuit Breakers and Their Enclosures Were Destroyed. ***(Courtesy of Shermco Industries, Inc.)***

Figure L.5(c) Intense Heat Burned the Ceramic in the Arc Extinguishers. ***(Courtesy of Shermco Industries, Inc.)***

Figure L.5(d) All Bus Terminations and Insulation ~~Was~~ Were Destroyed. ***(Courtesy of Shermco Industries, Inc.)***

Figure L.5(e) All Metal Inside the Circuit Breaker Was Vaporized or Melted. ***(Courtesy of Shermco Industries, Inc.)***

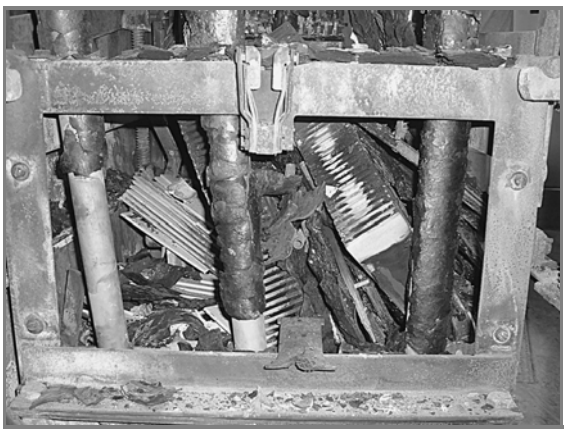


Figure L.5(f) Switchgear Could Not Be Repaired and Had to Be Replaced. ~~Costs included equipment replacement as well as lost production and revenue.~~ ***(Courtesy of Shermco Industries, Inc.)***

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Tue May 03 13:35:57 EDT 2022

Committee Statement

Committee Statement: Changes made for grammar. Cost statement not needed for figure title.
Response Message: SR-294-NFPA 70B-2022

Public Comment No. 138-NFPA 70B-2022 [Section No. L.5]

Second Revision No. 295-NFPA 70B-2022 [Section No. L.7]

L.7 Failure to Have Entire Critical System Acceptance Tested Results in $5.2 ~~M~~ Million (US) Loss. ~~*(Courtesy of Shermco Industries, Inc.)*~~

Critical devices must be acceptance tested as well as periodically tested on a regular basis, even if the costs associated with testing exceed the replacement cost of an item. It's not just the cost of testing that is important, but the criticality of the equipment to be tested as well.

A manufacturing company installed a new 13.8 kV transformer, switchgear, and battery bank with charging system to support expanded production. The electrical equipment manufacturer provided the acceptance testing in accordance with the manufacturing company's specifications in their contract. The molded-case circuit breakers that supplied the battery charging system in the outdoor substation were not included in the acceptance testing specifications, presumably because it would cost more to test them than to replace them.

A few months after start-up, one of the underground feeder cables failed and sent fault current through the transformer and reactor, destroying both. The brand-new 13.8 kV switchgear circuit breakers failed to operate and the upstream main circuit breaker had to clear the fault, causing a plant-wide outage. The root cause was traced back to a low-voltage, 100 A two-pole molded-case circuit breaker that when tested after the incident, tripped in 70 seconds with only 45 A of current flowing through it. This circuit breaker fed the battery bank charger that supplied the dc tripping power for the 13.8 kV protective system. With no dc power available, the 13.8 kV circuit breakers were unable to trip. The situation could have been identified and rectified before the fault, but because it was a new installation and just tested, no one at the manufacturing company checked the status of the battery bank. When the circuit breaker feeding the battery bank tripped, the batteries were depleted and could not be recharged. *[See Figure L.7(a) and Figure L.7(b).]*

This failure cost the manufacturing company over ~~$5,200,000~~ 5.2 million (US), not including legal fees. If the acceptance testing in the installation contract had included the circuit breaker supplying the battery charger, this incident and monetary loss would likely not have occurred.

Figure L.7(a) The Circuit Breaker Fed This Battery Bank, which Lost All Power. ***(Courtesy of Shermco Industries, Inc.)***

Figure L.7(b) Transformer (foreground) and Reactor Destroyed by Fault Current. ***(Courtesy of Shermco Industries, Inc.)***

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Tue May 03 13:37:16 EDT 2022

Committee Statement

Committee Statement: Change made to be consistent with title.
Response Message: SR-295-NFPA 70B-2022

Public Comment No. 139-NFPA 70B-2022 [Section No. L.7]

Second Revision No. 296-NFPA 70B-2022 [Section No. L.8]

L.8 Refrigeration Compressor Fails Unexpectedly as a Result of Improper Maintenance.

A 25-story office building located in a major metropolitan, warm-climate city was constructed in the early 1920s. The building's air-conditioning system (with one central compressor) was installed in the 1960s. During the hottest time of the year, the compressor motor failed due to a shorted coil winding~~. The windows of the building were sealed shut, so there was no conditioned air for the building. Internal~~ and the internal temperatures of the building reached over 32°C (90°F). The timeline for repairs to the air-conditioning system was three months. Tenants fled the building and revenue losses initially increased to over $250,000 (US). Long-term revenue losses could not be tracked. The repair costs of the air-conditioning system and compressor motor approached $200,000 (US) due to the emergency service.

The following is the preventative maintenance schedule that was used when the failure occurred:

Resistive measurements of the motor windings ~~was~~ were performed and recorded for ~~only~~ six years. Examples of resistive measurements recorded were: "good," "not performed," "0.5," and "3." Oil sampling was ~~only~~ performed for the past three years. The oil sampling revealed evidence of increasing metal wear, but under a predetermined action level.

Ignoring trending data from the oil sampling and not accurately documenting resistive measurements from testing allowed this failure to occur at an unscheduled downtime.

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Tue May 03 13:38:39 EDT 2022

Committee Statement

Committee Statement: Changes made to improve clarity and grammar.
Response Message: SR-296-NFPA 70B-2022

Public Comment No. 141-NFPA 70B-2022 [Section No. L.8]

Second Revision No. 297-NFPA 70B-2022 [Section No. L.9]

L.9 Explosion in an Electrical Room.

In a plant, two electricians were servicing programmable logic controller (PLC) equipment in the main motor control center (MCC). During the electricians' break, an explosion occurred in the main circuit breaker section of the MCC. One of the electricians had his back to the enclosure when the explosion occurred~~; his~~ . His clothes caught fire and he was severely burned and eventually died ~~as a result of~~ from his injuries. The second electrician suffered smoke inhalation, minor burns, and PTSD. The forensic investigation into this failure revealed the MCC's owner never maintained nor inspected the MCC during its over 25 years of service, despite requests from the plant's own maintenance staff. The failure occurred at the 1200 amperes main circuit breaker's load side lugs. Two lawsuits were initiated from this explosion. The first lawsuit resulted in an eight-figure settlement awarded to the deceased electrician's family. The second lawsuit resulted in a seven-figure settlement awarded to the injured electrician ~~injured in this explosion~~ . The second lawsuit also required the owner of the MCC to pay the repair costs for the damage to the local electric utility's facilities caused by this failure and the local utility's legal fees incurred for the second lawsuit. *[See Figure L.9(a) and Figure L.9(b).]*

Figure L.9(a) Overview of the MCC.

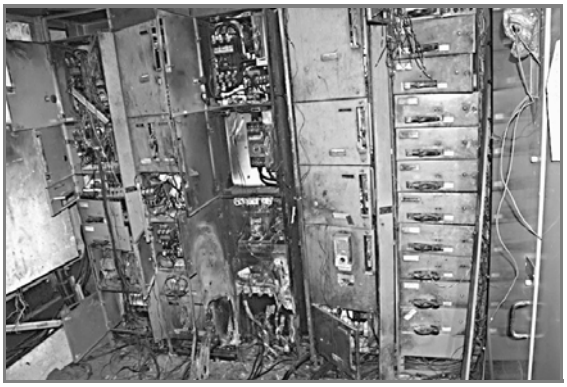
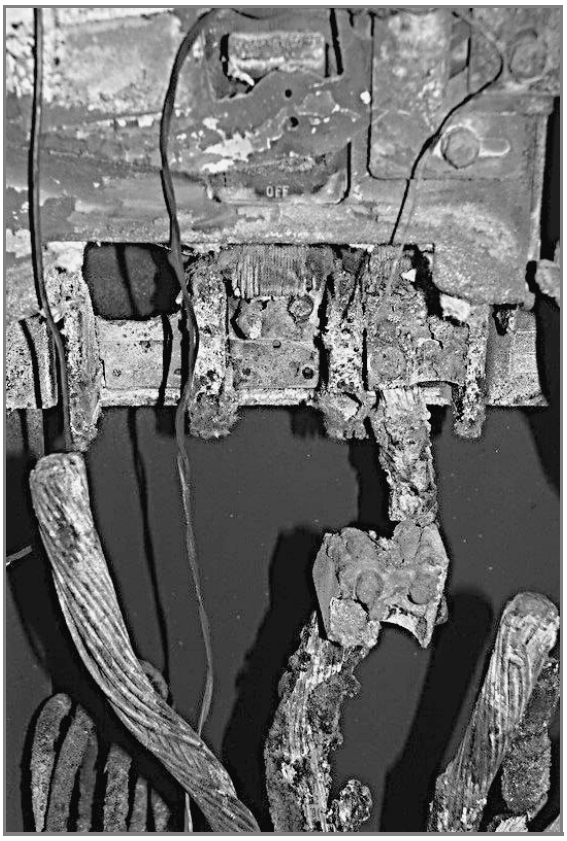


Figure L.9(b) Close-up View of Main Circuit Breaker Lug Failure.



Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 13:40:06 EDT 2022

Committee Statement

Committee Statement: Changes made for improved readability.

Response Message: SR-297-NFPA 70B-2022 “MCC” is the equipment that is the subject of this case history, appropriately specific for clarity.

Public Comment No. 142-NFPA 70B-2022 [Section No. L.9]

Second Revision No. 298-NFPA 70B-2022 [Section No. L.10]

L.10 Infrared Inspection Prevents Potential Failure and Outage of 20 ~~mVA~~ MVA Transformer.

The observation at the initial infrared survey indicated the transformer was not cooling properly. The infrared image showed an uneven heat pattern on the transformer cooling fins. This condition could result in the transformer overheating and a breakdown of the oil. Failure of this substation transformer would result in loss of power to businesses and homeowners.

After consultations between the owner and repair firms, it was determined that there could be several causes for this cooling problem: the transformer could be low on oil, the transformer could have shifted (tilted on an angle), or sludge could be causing a blockage in the cooling fins.

When the observation port at the top of the transformer was opened, inspectors noted that approximately half of the radiator tubes were covered with oil. The initial infrared image showed an uneven heat pattern. The cooling fins properly filled with oil showed a hotter surface temperature than those cooling fins that were not properly filled with oil. After adding the appropriate amount of oil to the transformer and recharging the nitrogen blanket, another infrared image was taken. The infrared image after the repair indicated an even heat pattern across the cooling fins. Detection of the abnormal condition and the corrective actions prevented potential failure and loss of power, and improved the reliability of the owner's operations.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 13:41:56 EDT 2022

Committee Statement

Committee Statement: Transformer ratings corrected. Added "cooling" and "radiator" to improve clarity.

Response Message: SR-298-NFPA 70B-2022

Public Comment No. 145-NFPA 70B-2022 [Section No. L.10]

Second Revision No. 299-NFPA 70B-2022 [Section No. L.11]

~~**L.11** Hospital Transformer Failure.~~

~~The main power transformer for a hospital failed, which resulted in fire damage to the transformer and the associated bus duct. Costs exceeded $130,000 (US). The transformer was less than five years old. After the initial installation, an electrical contractor added cooling fan kits to the transformer. It is unknown whether this attributed to the failure. To avoid any potential business interruption, a readily available replacement transformer was installed instead of the original specialty transformer due to several months lead time for a like-kind replacement.~~

~~What triggered the need to alter the manufacturer's design and install additional cooling fan kits? Did overloading, improper maintenance, or loose connections create an overheating condition? Insurance company case study reports indicate 52 percent of transformer failures are preventable. Failures for relatively new transformers could be due to localized damage, limitations in design/application, and improper maintenance that does not allow for detecting symptoms of developing faults. Site testing and commissioning provide a baseline for future maintenance. Defects of poor workmanship will usually cause a transformer to fail in very early stages of its life.~~

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 13:43:29 EDT 2022

Committee Statement

Committee Statement: Case history does not directly indicate how an EMP could have prevented the failure.

Response Message: SR-299-NFPA 70B-2022

Public Comment No. 146-NFPA 70B-2022 [Section No. L.11]

Second Revision No. 300-NFPA 70B-2022 [Section No. L.12]

L.11 Office Building Drive System Loose Connection Results in Arcing Fault.

A centrifugal chiller unit failed at a commercial real estate office building. The ~~chiller was used a few weeks prior due to warm weather, but was not used in the week prior to failure. After the~~ building engineer noted an odor, typical of electrical damage in the chiller room~~, it~~ . It was discovered that there was no power to the chiller panel and the 800 A breaker that powered the chiller had tripped. ~~Some basic electrical tests were performed on the transformer, with no obvious short circuits or ground faults found.~~ Basic troubleshooting did not reveal any faults. There was some spattering around the load side of the circuit breaker, but it was not determined if this was old or new and no tests were performed on the circuit breaker. No further investigation was conducted at the time because the chiller was not needed.

The chiller panel cabinet door was closed, and the circuit breaker reset. As soon as the circuit breaker was closed, a severe arcing fault occurred within the panel. A service company was then called in and determined that the unit could not be repaired. The 800 A circuit breaker for the ~~drive~~ chiller system suffered an arcing fault due to a loose connection. Costs exceeded $100,000 (US).

~~Proper safe work practices and maintenance procedures should always be followed. When an overcurrent protective device opens as a result of a fault, OSHA 1910.334(b)(2) and NFPA *70E* do not permit reclosing a circuit breaker or replacing fuses until it is safe to do so. The drive system should have been thoroughly checked out after the first circuit breaker trip to determine the cause, assess the action to remedy the failure, and ensure it is safe to reenergize the system.~~ It's possible that a regular preventive maintenance program that included visual inspection, cleaning, testing, and infrared inspection could have identified and corrected the root cause ~~before the first circuit breaker trip was necessary~~ for this event .

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 13:45:51 EDT 2022

Committee Statement

Committee Statement: Changes made to improve readability and reinforce the need for an EMP, and not purposes outside the scope of NFPA 70B.

Response Message: SR-300-NFPA 70B-2022

Public Comment No. 147-NFPA 70B-2022 [Section No. L.12]

Second Revision No. 303-NFPA 70B-2022 [Section No. M.1.2.1]

M.1.2.1 ASTM Publications.

ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

~~ASTM D92, *Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester* , 2016b.~~

ASTM D923, *Standard Practices for Sampling Electrical Insulating Liquids*, 2015.

ASTM D924, *Standard Test Method for Dissipation Factor (or Power Factor) and Relative Permittivity (Dielectric Constant) of Electrical Insulating Liquids*, 2015.

ASTM D971, *Standard Test Method for Interfacial Tension of Insulating Liquids Against Water by the Ring Method*, 2020.

ASTM D974, *Standard Test Method for Acid and Base Number by Color-Indicator Titration*, 2014e2.

ASTM D1298, *Standard Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method*, 2012b, reapproved 2017.

ASTM D1500, *Standard Test Method for ASTM Color of Petroleum Products (ASTM Color Scale)*, 2012, reapproved 2017.

ASTM D1524, *Standard Test Method for Visual Examination of Used Electrical Insulating Liquids in the Field*, 2015.

ASTM D1533, *Standard Test Method for Water in Insulating Liquids by Coulometric Karl Fischer Titration*, 2020.

ASTM D1816, *Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using VDE Electrodes*, 2012, reapproved 2019.

ASTM D1933, *Standard Specification for Nitrogen Gas as an Electrical ~~Insulation~~ Insulating Material,* 2003 ~~(revised~~ , reapproved 2017~~)~~ .

~~ASTM D3613, *Standard Practice for Sampling Insulating Liquids for Gas Analysis and Determination of Water Content* , 1998 (withdrawn 2007).~~

ASTM D5837, *Standard Test Method for Furanic Compounds in Electrical Insulating Liquids by High-Performance Liquid Chromatography (HPLC)*, 2015.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 13:50:05 EDT 2022

Committee Statement

Committee Statement: Change made for consistency. Withdrawn document reference deleted for accuracy.

Response Message: SR-303-NFPA 70B-2022

Public Comment No. 128-NFPA 70B-2022 [Section No. M.1.2.1]

Second Revision No. 306-NFPA 70B-2022 [Section No. M.1.2.6]

M.1.2.6 NEMA Publications.

National Electrical Manufacturers Association, 1300 North 17th Street, Suite 1847, Rosslyn, VA 22209.

NEMA AB-4, *Guidelines for Inspection and Preventive Maintenance of Molded-Case Circuit Breakers Used in Commercial and Industrial Applications*, 2017.

NEMA BU1.1, *General Instructions for Handling, Installation, Operation, and Maintenance of Busway Rated 600 ~~V~~ Volts or Less*, 2010.

ANSI/NEMA C84.1, *American National Standard for Electric Power Systems and Equipment — Voltage Ratings (60 Hz)*, 2020.

NEMA GD 1, *Evaluating Water-Damaged Electrical Equipment,* 2019.

NEMA GD 2, *Evaluating Fire- and Heat-Damaged Electrical Equipment*, 2016.

NEMA KS-3 , *Guidelines for Inspection and Preventive Maintenance of Switches Used in Commercial and Industrial Applications* , 2010.

ANSI/NEMA WD 6, *Wiring Devices — Dimensional Specifications*, 2016.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 13:55:19 EDT 2022

Committee Statement

Committee Statement: Reference document was added as it appears within the body of the standard.

Response Message: SR-306-NFPA 70B-2022

Second Revision No. 307-NFPA 70B-2022 [Section No. M.1.2.10]

M.1.2.10 Other Publications.

~~Leiter, David, *Distributed Energy Resources,* U.S. Department of Energy for Fuel Cell Summit IV, Washington, DC, May 10, 2000.~~

Flood Repair of Electrical Equipment, Pat Beisert, Shermco Industries, PowerTest Annual Technical Conference, March 12, 2009.

~~*International Swimming Pool and Spa Code (ISPSC)* , 2018.~~

The Lighting Library, Illuminating Engineering Society of North America (IESNA).

MIL-HNDK-508, *Wiring and Wiring Devices for Combat and Tactical Vehicles, Selection and Installation of*, April 21, 1998, available from DLA Document Services, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094. (Supersedes MIL-STD-339)

ISO 31000, *Risk Management — Principles and Guidelines* , 2009.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 03 13:56:04 EDT 2022

Committee Statement

Committee Statement: Reference document was added as it appears within the body of the standard.

Response Message: SR-307-NFPA 70B-2022

Second Revision No. 304-NFPA 70B-2022 [Section No. M.2.1]

~~**M.2.1** API Publications.~~

~~American Petroleum Institute, 1220 L Street, NW, Washington, DC 20005-4070.~~

~~*Guide for Inspection of Refinery Equipment* , Chapter XIV, Electrical Systems, third edition, 1982 (withdrawn).~~

Submitter Information Verification

Committee: EEM-AAA
Submittal Date: Tue May 03 13:52:03 EDT 2022

Committee Statement

Committee Statement: For technical accuracy, reference of the withdrawn document is deleted.
Response Message: SR-304-NFPA 70B-2022

Public Comment No. 129-NFPA 70B-2022 [Section No. M.2.1]

Second Revision No. 332-NFPA 70B-2022 [Section No. M.2.7]

M.2.6 NECA Publications.

National Electrical Contractors Association, ~~3 Bethesda Metro Center, Suite 1100~~ 1201 Pennsylvania Ave., NW, Suite 1200 , ~~Bethesda, MD 20814-5372~~ Washington, DC 20004 .

Total Energy Management — A Practical Handbook on Energy Conservation and Management, Index No. 2095.

Submitter Information Verification

Committee: EEM-AAA

Submittal Date: Tue May 10 14:45:38 EDT 2022

Committee Statement

Committee Statement: The address for NECA has been updated.

Response Message: SR-332-NFPA 70B-2022

Public Comment No. 687-NFPA 70B-2022 [Chapter M]

Second Revision No. 364-NFPA 70B-2022 [Section No. M.3]

M.3 References for Extracts in Informational Sections.

NFPA 70®, *National Electrical Code®*, 2020 edition.

NFPA 70®, *National Electrical Code®*, 2023 edition.

Submitter Information Verification

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Submittal Date: Thu Jul 28 10:44:06 EDT 2022

Committee Statement

Committee Statement: The 2023 edition of the NEC is reference in informative annexes.
Response Message: SR-364-NFPA 70B-2022