City of Ann Arbor
PLANNING & DEVELOPMENT SERVICES
301 E. Huron St. | P.O. Box 8647 |
Ann Arbor, Michigan 48107-8647
p. 734.794.6263 | f. 734.994.8460 | building@a2gov.org

APPLICATION FOR BUILDING/CONSTRUCTION CODE APPEAL

Facility Information

Facility Name	County	
HOOVER + GREENE	WASHTENAW	
Facility Street Address	**City**	**Zip**
950 Greene St	Ann Arbor	48104

Permit Number: BLDG18-2038

Building Data

New Building ✓	Addition ☐	Alteration ☐	Repair ☐

Classification Per Building Code / Building Use	No. Of Floors	Construction Type	Area/Floor	No. Of Occupants
R-2, S-2, A-3, B, & M MIXED USE	4	TYPE 1A (LOWER LEVEL & 1ST FLOOR) TYPE 5A (FLOORS 2, 3 & 4)	140,930 SF/ 4	167 UNITS

Permit Holder

Name (Company or Individual)	Contact Name		
Hoover Greene Owner, LLC	PAUL STODULSKI		
Street Address	**City**	**State**	**Zip**
ONE TOWNE SQUARE, SUITE 1600	SOUTHFIELD	MI	48076
Phone	**Fax**	**Email**	
248.827.1700		PSTODULSKI@REDICO.COM	

Building Owner

Name (Company or Individual)	Contact Name		
Hoover Greene Owner, LLC	PAUL STODULSKI		
Street Address	**City**	**State**	**Zip**
ONE TOWNE SQUARE, SUITE 1600	SOUTHFIELD	MI	48076
Phone	**Fax**	**Email**	
248.827.1700		PSTODULSKI@REDICO.COM	

Summary Of Appeal

CODE SECTION(s)
NFPA 70, 2017, Article 695.3(A)

Provide copies of the following as appropriate:
Statement of Facts and Reasoning
Please see the attached
☐

DESIRED RELIEF (State Briefly)
Relief or alternate interpretation of the term "indefinitely" per NEC 695.3(A) with respect to the source (i.e. utility power). Please see the attached for further explanation.

BASIS OF APPEAL (State Briefly)
Documentation attached which outlines how all aspects of NEC 695.3 as well as NFPA 20 (2013) A.9.3.2 are met including interpretation of the intent of "indefinitely" by the NFPA technical Interpretations Division.

Supporting Material
Please see the attached
☐

Applicant (all correspondence will be sent to this address)

Name (company or individual)		Applicant Name	
Hoover Greene Owner, LLC		PAUL STODULSKI	
Street Address	**City**	**State**	**Zip**
ONE TOWNE SQUARE, SUITE 1600	SOUTHFIELD	MI	48076
Phone	**Fax**	**Email**	
248.827.1700		PSTODULSKI@REDICO.COM	

Application Fee (applicant is responsible for paying fee)

Residential $250.00 ☐ Commercial $500.00 ☑

Note: *You have the right to appeal the City of Ann Arbor's Building Boards of Appeals decision to the State of Michigan. If you choose to appeal this decision, then application must be made within 10 days of the decision to the address listed below, in accordance with Section 16 of 1972 PA 230. Michigan Department of Labor & Economic Growth, Bureau of Construction Codes, P.O. Box 30255, Lansing, MI 48909 517-241-9303, www.michigan.gov/bcc*

Note *: Reasons for Appeal (Per MRC, Section R112.2, MBC, Section 113.2) include:*

1. *The true intent of the code or the rules governing construction have been incorrectly interpreted.*
2. *The provisions of the code do not apply.*
3. *An equal or better form of construction is proposed.*

Applicant Signature [signature] Date 10/28/2020

BTR ENGINEERING

MECHANICAL | ELECTRICAL | PLUMBING | FIRE PROTECTION

October 26, 2020

City of Ann Arbor
Building Board of Appeals
301 E. Huron St.
P.O. Box 8647
Ann Arbor, Michigan, 48017-8647

Reference: 950 Green St.
"Hoover & Greene"
Construction Code Appeal

To whom it may concern,

Please use the following information in consideration of our appeal of the electrical inspection comment regarding the need for a standby generator to support the fire pump in the above referenced facility.

General Information:

Building Use:	Mixed use; R-2, A-3, B & M
No. Floors:	4-floors
No. Units:	167
Construction Type:	Type 1A and 5A
Total s.f.:	140,930 s.f.

Brief History:

This project was submitted for permit in September 2018 and received building permit on January 30, 2020. The electrical service, as designed and approved included (2) utility (DTE) service transformers, (1) at 120/208V to serve all the residential units, (1) at 277/480V to serve all house loads, retail tenant and the fire pump load. All services have shunt trip activated main breakers (except the fire pump) so that prior to entering the structure, the fire department can disengage all power to the building except for the power to the fire pump. This shunt trip operation is activated from the knox box (or other location as dictated by the AHJ). The transformer which serves the house loads, retail tenant and fire pump has been sized by DTE based on DTE's internal calculations.

During construction, electrical inspector John Lucht, informed the electrical sub-contractor that a standby generator would be required to support the fire pump as he interpreted the electrical utility as being "not reliable" as per the code sections outlined below. Attached please find the correspondence between our office, the inspector, NFPA's Technical Interpretation Division, DTE and Tornatech (the fire pump controller manufacturer).

Code Sections:

NFPA 70 National Electrical Code, 2017, Article 695.3 (A)
NFPA 20 Fire Pumps Standard, 2013, Article 9.3.2, A.9.3.2

Statement of Facts & Reasoning:

Per the sections cited by the inspector above, the dedicated electrical service to the fire pump meets the intent of a "reliable" power source as it:

1. The source power plant has not been shut down for more than (4) continuous hours in the last year.
2. Power outages have not been routinely experienced in the area of the protected premises caused by failure in generation or transmission.
3. The normal source of power is not supplied by overhead conductors outside of the protected premises.
4. Disconnection of the power to the fire pump can only occur at the fire pump controller. We have no additional disconnecting means in-line with the fire pump controller.

Per interpretation by Mr. Jeffrey Sargent of the NFPA, stating that:

"The term "indefinite" is defined as not being precise, vague and without exact limits. The performance bar that is set by 695.3(A) is that the power supply from any of the option provided by this section does not become a weak link in putting the fire pump into operation. If there was a condition where the motor did not start normally and was in a locked-rotor condition for an extended period of time, the power supply must be capable of delivering power for however long it takes to either overcome that abnormal condition or for other devices in the circuit, namely the fire pump controller, that along with the motor is required to be listed for fire pump operation, perform their intended function.

By reference, NFPA 20 as well as UL 218 & FM 1321-1323:

A fire pump motor shall be protected from damage during a locked rotor condition to shut down between 8-20 seconds at locked rotor, or three minutes at 300% full load current. A manual reset is required at that time.

By confirmation from DTE:

The utility transformer which powers the fire pump, can operate under load, including the locked rotor of the fire pump, for 1-hour, which is approximately 240 times longer than the automatic protective engagement of the fire pump motor safeties.

A reasonable summary:

1. The transformer can support the load and fire pump running load indefinitely.
2. The transformer can support the building load and the locked rotor of the fire pump significantly longer that the motor can even run at locked rotor before it self-protects.
3. The shunt trip operators present, provide the first responders a way to disengage all power except the fire pump during the event of a fire, therefore, the need to supports both the building load and the locked rotor of the fire pump is effectively a moot point.
4. The building is equipped with fire department connections for the connection of pumper trucks if the fire pump is disabled.

Desired Relief:

We request that the need for a standby generator to support the fire pump, as requested by the inspector be lifted due to:

1. We have provided adequate documentation that the current fire pump power design meets the NFPA intent of a reliable service.
2. The transformer operation time, under the loads required, can be accomplished before fire pump safeties take it automatically off-line
3. This is an AHJ interpretation and it was not requested during plan review.

Basis of Appeal:

1. Functional operation of the fire pump can be accomplished based on current design.
2. Confirmation of the intent of "indefinitely" as per NFPA above.
3. Options available i.e. shunt trip disconnection of other building loads and the fire department connections.

Supporting Material (attached):

1. Letters between BTR Engineering, LLC and Inspector Lucht. Contained within:
    a. NFPA Code Interpretation email
    b. DTE information confirming existing power reliability
    c. UL/FM/NFPA/Tortech fire pump controller protective information
    d. Locked rotor & thermal damage curve of the fire pump motor
    e. Code excerpts (NFPA 70, 2017 695.3(A) & NFPA 20 9.3.2 & A.9.3.2)

In summary, while we understand and appreciate the Inspectors concern for the safety of the building and its occupants, we believe, as designed, we meet the intent of the code for this type, size and occupancy class of structure. We thereby request that the need for a standby generator be waived.

Respectfully,

Erika L. Bolger, P.E, LEED AP
Principal
BTR ENGINEERING, LLC

NFPA 70, 695.3(A)

695.3 Power Source(s) for Electric Motor-Driven Fire Pumps. Electric motor-driven fire pumps shall have a reliable source of power.

Informational Note: See Sections 9.3.2 and A.9.3.2 from NFPA 20-2013, *Standard for the Installation of Stationary Pumps for Fire Protection*, for guidance on the determination of power source reliability.

(A) Individual Sources. Where reliable, and where capable of carrying indefinitely the sum of the locked-rotor current of the fire pump motor(s) and the pressure maintenance pump motor(s) and the full-load current of the associated fire pump accessory equipment when connected to this power supply, the power source for an electric motor driven fire pump shall be one or more of the following.

(1) Electric Utility Service Connection. A fire pump shall be permitted to be supplied by a separate service, or from a connection located ahead of and not within the same cabinet, enclosure, vertical switchgear section, or vertical switchboard section as the service disconnecting means. The connection shall be located and arranged so as to minimize the possibility of damage by fire from within the premises and from exposing hazards. A tap ahead of the service disconnecting means shall comply with 230.82(5). The service equipment shall comply with the labeling requirements in 230.2 and the location requirements in 230.72(B). [**20:**9.2.2(1)]

(2) On-Site Power Production Facility. A fire pump shall be permitted to be supplied by an on-site power production facility. The source facility shall be located and protected to minimize the possibility of damage by fire. [**20:**9.2.2(3)]

(3) Dedicated Feeder. A dedicated feeder shall be permitted where it is derived from a service connection as described in 695.3(A)(1). [**20:**9.2.2(3)]

NFPA 20 9.3.2 & A.9.3.2

9.3 Alternate Power.

9.3.1 Except for an arrangement described in 9.3.3, at least one alternate source of power shall be provided where the height of the structure is beyond the pumping capacity of the fire department apparatus.

9.3.2* Other Sources. Except for an arrangement described in 9.3.3, at least one alternate source of power shall be provided where the normal source is not reliable.

A.9.3.2 A reliable power source possesses the following characteristics:

(1) The source power plant has not experienced any shutdowns longer than 4 continuous hours in the year prior to plan submittal. NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, requires special undertakings (i.e., fire watches) when a water-based fire protection system is taken out of service for longer than 4 hours. If the normal source power plant has been intentionally shut down for longer than 4 hours in the past, it is reasonable to require a backup source of power.

(2) Power outages have not routinely been experienced in the area of the protected facility caused by failures in generation or transmission. The standard is not intended to require that the normal source of power be infallible to deem the power reliable. NFPA 20 does not intend to require a back-up source of power for every installation using an electric motor–driven fire pump. Note that should the normal source of power fail in a rare event, the impairment procedures of NFPA 25 could be followed to mitigate the fire risk. If a fire does occur during the power loss, the fire protection system could be supplied through the fire department connection.

(3) The normal source of power is not supplied by overhead conductors outside the protected facility. Fire departments responding to an incident at the protected facility will not operate aerial apparatus near live overhead power lines, without exception. A backup source of power is required in case this scenario occurs and the normal source of power must be shut off. Additionally, many utility providers will remove power to the protected facility by physically cutting the overhead conductors. If the normal source of power is provided by overhead conductors, which will not be identified, the utility provider could mistakenly cut the overhead conductor supplying the fire pump.

(4) Only the disconnect switches and overcurrent protection devices permitted by 9.2.3 are installed in the normal source of power. Power disconnection and activated overcurrent protection should only occur in the fire pump controller. The provisions of 9.2.2 for the disconnect switch and overcurrent protection essentially require disconnection and overcurrent protection to occur in the fire pump controller. If unanticipated disconnect switches or overcurrent protection devices are installed in the normal source of power that do not meet the requirements of 9.2.2, the normal source of power must be considered not reliable and a back-up source of power is necessary.

Typical methods of routing power from the source to the motor are shown in Figure A.9.2. Other configurations are also acceptable. The determination of the reliability of a service is left up to the discretion of the authority having jurisdiction.

BTR ENGINEERING

MECHANICAL | ELECTRICAL | PLUMBING | FIRE PROTECTION

July 27, 2020

Attn: Mr. Jeremiah Diamond
Associate
Myefski Architects

Reference: Hoover & Greene
950 Greene St.
Ann Arbor, MI, 48104
Fire Pump Power

Dear Jeremiah,

Per your request, I offer the following as it pertains to the Request for Information #107 regarding a second source of power to the fire pump.

As per the RFI, NFPA Articles NFPA 20-2013 A.9.3.2 and NEC 695.3 were referenced by the Inspector in the request for a second source of power to the fire pump. NEC 695.3 dictates the power requirements for the electrically driven pump, and NFPA 20 defines what is considered a "reliable" source of power.

NEC Article 695.3 indicates that a fire pump shall have a reliable source of power. If the power source is deemed unreliable, then a combination of more than one normal source can be provided (i.e. (2) dedicated utility feeders) or the primary source plus a backup source such as a generator.

The definition of what is considered "reliable" power for a fire pump is dictated by NFPA 20, and as referenced in the RFI, Appendix A.9.3.2 provide additional clarification. A reliable source of power is as follows:

a. The source power plant has not been shut down for more than (4) continuous hours in the last year.

b. Power outages have not been routinely experienced in the area of the protected premises caused by failure in generation or transmission. It goes on to say, the intent of the standard is not to make the normal power to the fire pump infallible to be deemed reliable. It also goes on to say that should a fire occur during an outage, the fire department could use the fire department connection to supply the fire protection system to the structure.

> (2) Power outages have not routinely been experienced in the area of the protected facility caused by failures in generation or transmission. The standard is not intended to require that the normal source of power be infallible to deem the power reliable. NFPA 20 does not intend to require a back-up source of power for every installation using an electric motor–driven fire pump. Note that should the normal source of power fail in a rare event, the impairment procedures of NFPA 25 could be followed to mitigate the fire risk. If a fire does occur during the power loss, the fire protection system could be supplied through the fire department connection.

c. The normal source of power is not supplied by overhead conductors outside of the protected premises. The building is being served by pad mount transformers. It goes on to say the fire department will not operate aerial apparatus near the overhead power lines and/or the fire department will not cut the power lines to discontinue power to the building in case of a fire. The building has been provided with shunt trips for the Fire Department to disconnect power to the building which does not disengage the fire pump.

d. Disconnection of the power to the fire pump can only occur at the fire pump controller. We have no additional disconnecting means in-line with the fire pump controller.

In addition to the requirements of NFPA 20, the plans indicate for the fire pump feeder to be concrete encased, further protecting the normal source of power.

With respect to power reliability, I received the attached information from DTE, which is measured at the circuit level. The average number of times a customer was out of power was 0.16 times and the average length of any outage duration was 64 minutes. Any additional detail other than what is provided in the attached, DTE will not provide for privacy reasons or does not have record of.

Lastly, no plan review comment was received requesting a second source of power to the fire pump.

Given the available information, it is our interpretation that the power as designed to the building fire pump is code compliant and with the Owners direction, we respectfully request the fire pump be allowed to be powered via a single source power supply in lieu of the secondary power supply as requested by the Inspector.

Respectfully,

Erika L. Bolger, PE, LEED AP
Principal
BTR Engineering, LLC

Erika Bolger

From: Keshon K Moorehead <keshon.moorehead@dteenergy.com>
Sent: Friday, July 24, 2020 1:44 PM
To: Erika Bolger
Subject: RE: Hoover & Green 950 Greene St.

I do not have that information.

Best Regards,
Keshon

From: Erika Bolger <ebolger@btrengineers.com>
Sent: Friday, July 24, 2020 2:29 PM
To: Keshon K Moorehead <keshon.moorehead@dteenergy.com>
Subject: [EXTERNAL] RE: Hoover & Green 950 Greene St.

Keshon,

Thank you. I looked these up as well. Do you have records which can tell me whether or not this specific address had an outage for longer than 4 hours in the past year?

Thanks much,

Erika L. Bolger, PE, LEED AP
Principal
o: (312) 635.6334 m: (847)373.8423
e: ebolger@btrengineers.com
w: btrengineers.com

BTR ENGINEERING
104 N. Oak Park Ave., Ste. 201
Oak Park, IL 60301
A Chicago MBE Certified Business

From: Keshon K Moorehead <keshon.moorehead@dteenergy.com>
Sent: Friday, July 24, 2020 1:10 PM
To: Erika Bolger <ebolger@btrengineers.com>
Subject: RE: Hoover & Green 950 Greene St.

Erika,

Please see below:

SAIFI, SAIDI, MAIFI are some of the indices used to measure distribution system reliability. Reliability is often measured by the outage indices defined in one international standard called IEEE 1366. These outage indices are based on the

duration of each power supply interruption & the frequency of interruption. It is clear that all three major functional components of the power system – generation, transmission & distribution contribute to reliability.

A power supply outage is an unplanned event & can be described in terms of the frequency, duration & amount of load (or consumers) affected. A momentary outage is defined as an outage lasting less than 5 minutes, corresponding to the time taken by automatic re-closure schemes to restore temporary faults; a sustained outage lasts longer than 5 minutes (NERC 1996). IEEE standard 1366 gives the definition for outage indices. These indices are calculated using details of consumer interruptions collected from past year's or several year's data. Definitions of few of the indices are given below:

System Average Interruption Frequency Index (SAIFI)
SAIFI is the average number of sustained interruptions per consumer during the year. It is the ratio of the annual number of interruptions to the number of consumers.
SAIFI = (Total number of sustained interruptions in a year) / (Total number of consumers)
System Average Interruption Duration Index (SAIDI)
SAIDI is the average duration of interruptions per consumers during the year. It is the ratio of the annual duration of interruptions (sustained) to the number of consumers. If duration is specified in minutes, SAIDI is given as consumer minutes.
SAIDI = Total duration of sustained interruptions in a year / total number of consumers
Consumer Average Interruption Frequency Index (CAIFI)
CAIFI is the average number of interruptions for consumers who experience interruptions during the year. It is the ratio of the annual number of interruptions to the number of consumers affected by interruptions during the year. Consumer is counted only once regardless of the number of interruptions.
CAIFI = Total number of sustained interruptions in a year/Total number of consumers affected.
Consumer Average Interruption Duration Index (CAIDI) – In Minutes
CAIDI is the average duration of an interruption, calculated based on the total number of sustained interruptions in a year. It is the ratio of the total duration of interruptions to the total number of interruptions during the year.
CAIDI = Total duration of sustained interruptions in a year/total number of interruptions.
It can also be seen that CAIDI = SAIDI/SAIFI
Momentary Average Interruption Frequency Index (MAIFI) – In minutes
MAIFI is the average number of momentary (less than 5 minutes) interruptions per consumer during the year. It is the ratio of the annual number of momentary interruptions to the number of consumers.
MAIFI = (Total number of momentary interruptions in a year) / (Total number of consumers)

Best Regards,

DTE
Keshon K. Moorehead
Engineer - Senior | DTE Energy | Distribution Operations
8001 Haggerty, Belleville, MI 48111
734.397.4120 (O)
734.661.9422 (C)

From: Erika Bolger <ebolger@btrengineers.com>
Sent: Friday, July 24, 2020 1:10 PM
To: Keshon K Moorehead <keshon.moorehead@dteenergy.com>
Subject: [EXTERNAL] RE: Hoover & Green 950 Greene St.

Keshon,

What dot the acronyms stand for and what units am I seeing?

Thanks!

Erika L. Bolger, PE, LEED AP
Principal
o: (312) 635.6334 m: (847)373.8423
e: ebolger@btrengineers.com
w: btrengineers.com

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Oak Park, IL 60301
A Chicago MBE Certified Business

From: Keshon K Moorehead <keshon.moorehead@dteenergy.com>
Sent: Friday, July 24, 2020 8:27 AM
To: Erika Bolger <ebolger@btrengineers.com>
Subject: RE: Hoover & Green 950 Greene St.

Erika,

Here is the information that was requested.

Outages	2018	2019	Last 12 Months
SAIFI – average # times a customer on this circuit was out during a year	.031	.102	.16
SAIDI – average duration of time customers on this circuit were out during a year	.682	8.4	10.2
CAIDI – average duration of time a customer was out, when they were out	22	83	64
MAIFI- average # times a customer on this circuit had a momentary during a year	.026	.949	.97

-
- Data is viewed at the circuit level, data for specific locations will vary

Please let me know if need anything else.

Best Regards,

Keshon K. Moorehead
Engineer - Senior | DTE Energy | Distribution Operations
8001 Haggerty, Belleville, MI 48111
734.397.4120 (O)
734.661.9422 (C)

From: Erika Bolger <ebolger@btrengineers.com>
Sent: Thursday, July 23, 2020 4:46 PM
To: Keshon K Moorehead <keshon.moorehead@dteenergy.com>
Subject: [EXTERNAL] RE: Hoover & Green 950 Greene St.

Hi.

Were you able to find a few minutes to look into this? I appreciate the help.

Thanks

Erika L. Bolger, PE, LEED AP
Principal
o: (312) 635.6334 m: (847)373.8423
e: ebolger@btrengineers.com
w: btrengineers.com

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104 N. Oak Park Ave., Ste. 201
Oak Park, IL 60301
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From: Erika Bolger
Sent: Tuesday, July 21, 2020 12:25 PM
To: Keshon K Moorehead <keshon.moorehead@dteenergy.com>
Subject: Hoover & Green 950 Greene St.

Hi Keshon,

Can you possibly look up something for me please? This is the original project we worked on in Ann Arbor.

Has the area the new building is located in experienced a significant number of utility outages in the past 2 years? If so, were they planned, how many and for what duration?

The inspector is requesting a second source of power for the fire pump and a second utility service is an option which will depend on recent utility outages.

Thanks!

Erika L. Bolger, PE, LEED AP
Principal
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A Chicago & CMS MBE Certified Business

Please note that BTR is currently following a modified Summer Hours schedule. The office will close at 12pm on Fridays through the end of August.

BTR ENGINEERING

MECHANICAL | ELECTRICAL | PLUMBING | FIRE PROTECTION

August 18, 2020

Attn: Mr. John Lucht, Electrical Inspector, Plan Reviewer
City of Ann Arbor
City Hall
301 E. Huron, Ann Arbor, MI 48104

Reference: Hoover & Greene
950 Greene St.
Ann Arbor, MI, 48104
Fire Pump Power

Dear Mr. Lucht,

I am responding to your email to Don Webb dated August 8, 2020 regarding the need for the utility to "indefinitely" carry the locked rotor current of the fire pump and associated loads. I am aware of this wording and offer the following for consideration.

Per confirmation with NFPA, we have confirmed that the intent of the term indefinitely has been left purposefully vague in Article 695.3 (A) of the NEC and relies on NFPA 20 "Standard for the Installation of Stationary Pumps for Fire Protection" for further guidance on the fire pump operation including the provisions of locked rotor protection.

I refer you to section 10.4.4(1) of NFPA 20 which refers to the requirement for locked rotor protection of the fire pump motor which is required to occur between 8-20 seconds of a locked rotor condition. This is also substantiated by UL 218 and FM 1321-1323. I have attached a letter from the fire pump controller manufacturer indicating as such. This range of duration is intended to protect the fire pump motor from thermal damage in the event of a prolonged locked rotor condition and is provided as a range as each motor has a different thermal damage threshold. This particular motor will sustain damage beyond approximately 15 seconds (hot) and 25 seconds (cold) at locked rotor.

Attached also is an email from NFPA which confirms my discussion and the intent being, both NFPA 70 and NFPA 20 should be applied together to obtain the true intent of the code as a whole.

As indicated by the code and fire pump controller information, the motor will be in an overload state should it operate beyond 20 seconds at locked rotor and will shut down to prevent further damage. The controller must be manually restarted at this point which leads us to the conclusion that the locked rotor condition will not occur for more than 20 seconds. As previously confirmed by DTE, the utility can support operation of the full building loads and the locked rotor current of the fire pump as well as its accessories for one hour which is approximately 240 times longer than the automatic engagement of the locked rotor protection of the motor.

Given this additional information, it is our interpretation that the power as designed to the building fire pump is code compliant and we respectfully request approval of the current design. Your review of this matter is greatly appreciated.

Respectfully,

Erika L. Bolger, PE, LEED AP
Principal
BTR Engineering, LLC

Cc: D. Webb, J. Roth, J. Diamond, T. McCafferty

Attachments: NFPA email interpretation; Fire pump controller manufacturer locked rotor protection info.;motor damage curve

TORNATECH

August 17th, 2020

Subject: Lock rotor requirement

To: Who it May Concern

Every full service UL/FM fire pump controller must have a protection of between 8 seconds and 20 seconds at locked rotor current, Three minutes at a minimum of 300 percent of motor full-load current and tripping shall be accomplished by opening the circuit breaker, which shall be of the external manual reset type.

NFPA 20 2019

10.4.4 Locked Rotor Overcurrent Protection. The only other overcurrent protective device that shall be required and permitted between the isolating switch and the fire pump motor shall be located within the fire pump controller and shall possess the following characteristics:
(1) For a squirrel-cage or wound-rotor induction motor, the device shall be of the time-delay type having tripping times as follows:
(a) Between 8 seconds and 20 seconds at locked rotor current
(b) Three minutes at a minimum of 300 percent of motor full-load current
(2) For a direct-current motor, the device shall be as follows:
(a) Of the instantaneous type
(b) Calibrated and set at a minimum of 400 percent of motor full-load current
(3) There shall be visual means or markings clearly indicated on the device that proper settings have been made.
(4)* It shall be possible to reset the device for operation immediately after tripping, with the tripping characteristics thereafter remaining unchanged.
(5) Tripping shall be accomplished by opening the circuit breaker, which shall be of the external manual reset type.

UL 218 2015

6.16 Locked rotor overcurrent protection
6.16.1 Locked rotor overcurrent protection sensing shall be located within the fire pump controller between the load side of the isolating switch and the controller output terminals and have the following characteristics:
a) Be of the non-thermal time delay type having a tripping time between 8 and 20 seconds at locked rotor current. (Unless otherwise specified, this is 600 percent of rated full-load current.);
b) Have a tripping characteristic such that tripping shall not occur within 3 min at a minimum of 300 percent of rated full-load current;
c) Be provided with visual means or markings that clearly indicate that proper settings have been made;
d) Be resettable for operation immediately after tripping, with the tripping characteristics unchanged;
e) Tripping shall be accomplished by opening the circuit breaker (disconnecting means). (See 6.15);
f) Calibration (trip and hold currents) shall apply to all poles of the locked rotor protection.

Tornatech Inc.
4100 Desserte Sud, (A-440 Ouest)
Laval, Québec, Canada H7T 0H3

Tel: +1 514 334 0523

FM 1321-1323 2015

4.2 Functional and performance requirements for components

4.2.1 General

All components required to start, run and protect the motor shall comply with their relevant IEC and
NFPA 70 (NEC) product standards.

4.2.4.4 Locked rotor overcurrent protection

A locked rotor protective device shall be provided between the load side of the disconnecting device and the contactor, and shall be located within the fire pump controller (see Figures B-1, B-2, B-3, B-4 and B-5). No other overcurrent protective device shall be provided. It shall have the following characteristics for a squirrel-cage induction motor:

a. It shall be of the non-thermal time delay type having a tripping time between 8 seconds and 20 seconds at 600 percent of rated motor full-load current; and for energy efficientmotors under 15 hp (10kW), between 8 seconds and 20 seconds at 720 percent of *I*e (rated operational current), or the inrush current of the motor as declared by the motor manufacturer;

b. It shall indefinitely carry 300 percent of *Ie*, or 300 percent of rated full-load current;
For the purpose of certification, it shall have a tripping characteristic such that tripping shall not occur in less than 30 minutes at 300 percent of *I*e, or 300 percent of rated fullload current;

c. It shall provide visual means or markings on the device which clearly indicate that proper settings are installed;

d. The overcurrent sensing elements shall be so constructed that it shall be possible to reset the device for operation immediately after tripping with the tripping characteristics thereafter remaining unchanged;
Note: Shunt-trip means, or some other direct acting means, are preferred (see Figures B-1, B-2, B-3, B-4 and B-5).

e. It shall be effective under all starting means;

f. If a circuit breaker is used as the disconnecting device, then tripping shall be accomplished by opening the circuit breaker, and the circuit breaker shall be of the external manual reset type;

g. If a common locked rotor protector is used in FPC's having more than one power source, the locked rotor protector shall reset its self before receiving power from the alternate source. The locked rotor protector trip signal is to be effective only to the circuit supplying the power;

h. Low or missing voltage on any conductor shall not prevent or interfere with the requirements of (a) through (g) above;

i. The locked rotor overcurrent protection shall be tested in accordance with this standard.

Sincerely,

Sebastien Desormeaux
Customer service Director
Office: +1.514.334.0523 / +1.800.363.8448
Mobile: +1.514.816.9898
Sebastiend@tornatech.com

Erika Bolger

From: Sargent, Jeffrey <jsargent@NFPA.org>
Sent: Tuesday, August 18, 2020 3:12 PM
To: Erika Bolger
Cc: McCabe, Michael
Subject: RE: [Ask NFPA Staff] - Re: Utility transformer as a reliable fire pump source

Erika,

Thank you for your follow-up questions on 695.3 in the 2017 edition of the National Electrical Code®, NFPA-70.

Your follow-up questions and the conversation you and I had earlier this month centered as to whether there is any context that can be associated with the use of the term "indefinitely" in 695.3(A) in respect to determining whether a single power source can be considered as "reliable". As my colleague Mr. McCabe accurately stated, the approval of any requirement, including whether an individual power source for an electric fire pump is reliable, is the responsibility of the *authority having jurisdiction.* However, I am happy to offer some insight that may provide some basis for approval of an individual power source.

The term "indefinite" is defined as not being precise, vague and without exact limits. The performance bar that is set by 695.3(A) is that the power supply from any of the option provided by this section does not become a weak link in putting the fire pump into operation. If there was a condition where the motor did not start normally and was in a locked-rotor condition for an extended period of time, the power supply must be capable of delivering power for however long it takes to either overcome that abnormal condition or for other devices in the circuit, namely the fire pump controller, that along with the motor is required to be listed for fire pump operation, perform their intended function. Chapter 10 of NFPA 20-2019, *Standard for the Installation of Stationary Pumps for Fire Protection* provides the performance requirements for fire pump controllers, including parameters on the controller performance if the motor is in a locked-rotor or overload condition. Additionally damage curves from the fire pump manufacturer provide some context as to how long a motor can remain in a locked-rotor condition without sustaining permanent damage.

From NFPA 20, A.9.3.2 is the following regarding evaluation of whether a power source is reliable:

> Only the disconnect switches and overcurrent protection devices permitted by 9.2.3 are installed in the normal source of power. Power disconnection and activated overcurrent protection should occur only in the fire pump controller. The provisions of 9.2.2 for the disconnect switch and overcurrent protection essentially require disconnection and overcurrent protection to occur in the fire pump controller. If unanticipated disconnect switches or overcurrent protection devices are installed in the normal source of power that do not meet the requirements of 9.2.2, the normal source of power must be considered not reliable and a backup source of power is necessary.

While the term "indefinitely" is left open for the AHJ to assess, the performance goal of this requirement is clearly identified in the Annex passage from NFPA 20. Using the information available from NFPA 20 and UL 218 Fire Pump Controllers on controller operation, the damage curves from the fire pump manufacturer, and the supplying utility engineering information on the performance of their system under the worst case scenario described in 695.3(A), an assessment can be made as to whether the power supply described in 695.3(A)(1) will meet the performance objectives specified in Article 695 of the NEC and Chapter 9 of NFPA 20 for reliable power sources.

Please note that this is the personal opinion of myself and not a formal interpretation of the National Electrical Code Committee. See the **Important Notice** below.

Jeff Sargent
Principal Specialist, Electrical | **NFPA**
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From: Erika Bolger <ebolger@btrengineers.com>
Sent: Monday, August 17, 2020 2:59 PM
To: Sargent, Jeffrey <jsargent@NFPA.org>
Subject: FW: [Ask NFPA Staff] - Re: Utility transformer as a reliable fire pump source

Erika L. Bolger, PE, LEED AP
Principal
o: (312) 635.6334 m: (847)373.8423
e: ebolger@btrengineers.com
w: btrengineers.com

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From: Erika Bolger
Sent: Friday, August 14, 2020 2:23 PM
To: jive-1975825947-192w-2-1sfu@mail.nfpa.jiveon.com
Subject: RE: [Ask NFPA Staff] - Re: Utility transformer as a reliable fire pump source

Mike,

Thank you for your response.

My inquiry is on NFPA 70 2017, not 2014 just as a point of reference.

Per my previous conversation with NFPA, the intent of "indefinite" was a duration of 20 seconds per a particular UL listing.

The fire pump for this project is fed directly from the utility transformer via a separate feed from any other service feed. My follow up questions are as follows:

1. Is the intent of 695.3(A) for the utility xformer to carry the LRC of the fire pump, pressure maintenance pumps, fire pump accessories as well as other building loads connected to the utility transformer? I make reference to section 695.5(B) where if a transformer is utilized due to a mis-match of building to fire pump voltage, only the transformer and transformer primary overcurrent protection are required to be sized for locked rotor current of the fire pump.

2. If the intent of question #1 above is yes, the utility transformer must be able to indefinitely carry the load of anything connected to it, including the LRC of the fire pump, etc., is there a specific duration or intent as to duration as previously mentioned? I refer to section 10.4.4(1) (a) of 2013 NFPA 20 which refers to required locked rotor protection of the fire pump motor not to exceed 20 seconds.

If NFPA 20 required locked rotor protection of the motor is not to exceed 20 seconds, is the intent of having the power source be able to carry the loads stated above "indefinitely" met if the utility can hold the loads stated above for 1 hour?

Thanks much,

Erika L. Bolger, PE, LEED AP
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From: mmccabe@nfpa.org <nfpa@jiveon.com>
Sent: Tuesday, August 11, 2020 8:02 AM
To: Erika Bolger <ebolger@btrengineers.com>
Subject: Re: [Ask NFPA Staff] - Re: Utility transformer as a reliable fire pump source

NFPA Xchange

Re: Utility transformer as a reliable fire pump source

reply from Mike McCabe in *Ask NFPA Staff* - View the full discussion

Thank you for your inquiry on the 2014 NEC®

The requirements in 695.3(A) are for reliability of the power source in addition to the capability to indefinitely carry the sum of the locked-rotor current of the fire pump motor(s), pressure maintenance pump motor(s) and the full-load current of any associated accessory equipment.

In accordance with 695.3(A)(1) a fire pump is permitted to be supplied by either a separate service, or from a connection located ahead of and not within the same cabinet, enclosure, vertical switchgear section, or vertical switchboard section as the service disconnecting means.

The 2014 NEC® Handbook (not the Code book) Exhibit 695.2 on page 922 shows both arrangements that are described in 695.3(A)(1) including configuration #1 where the fire pump service conductors are tapped from the service conductors supplying the building service equipment.

NFPA_20 Annex material A.9.3.2 goes into some detail involving the characteristics of a reliable source of power.

The determination of whether the serving electric utility is a reliable source of power is an issue for the authority having jurisdiction.

Mike McCabe

NFPA Staff

Reply to this message by replying to this email, or go to the message on NFPA Xchange

Start a new discussion in Ask NFPA Staff by email or at NFPA Xchange

Following Re: Utility transformer as a reliable fire pump source in these streams: Inbox

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DATA SHEET

Three Phase Induction Motor - Squirrel Cage

Customer	:

Product line	: W22 NEMA Premium Efficiency Three-Phase	Product code :	11567248
		Catalog # :	07518ET3E365TS-W22

Frame	: 364/5TS	Locked rotor time	: 25s (cold) 14s (hot)
Output	: 75 HP (55 kW)	Temperature rise	: 80 K
Poles	: 4	Duty cycle	: Cont.(S1)
Frequency	: 60 Hz	Ambient temperature	: -20°C to +40°C
Rated voltage	: 230/460 V	Altitude	: 1000 m.a.s.l.
Rated current	: 174/87.2 A	Protection degree	: IP55
L. R. Amperes	: 1116/558 A	Cooling method	: IC411 - TEFC
LRC	: 6.4x(Code G)	Mounting	: F-1
No load current	: 66.0/33.0 A	Rotation[1]	: Both (CW and CCW)
Rated speed	: 1780 rpm	Noise level[2]	: 67.0 dB(A)
Slip	: 1.11 %	Starting method	: Direct On Line
Rated torque	: 221 ft.lb	Approx. weight[3]	: 917 lb
Locked rotor torque	: 240 %		
Breakdown torque	: 260 %		
Insulation class	: F		
Service factor	: 1.25		
Moment of inertia (J)	: 23.3 sq.ft.lb		
Design	: B		

Output	25%	50%	75%	100%
Efficiency (%)	94.0	94.5	95.0	95.4
Power Factor	0.44	0.68	0.78	0.83

Foundation loads	
Max. traction	: 1728 lb
Max. compression	: 2645 lb

		Drive end	Non drive end
Bearing type	:	6314 C3	6314 C3
Sealing	:	WSeal	WSeal
Lubrication interval	:	12000 h	12000 h
Lubricant amount	:	27 g	27 g
Lubricant type	:	Mobil Polyrex EM	

Notes
USABLE @208V 186A SF 1.10 SFA 205A

This revision replaces and cancel the previous one, which must be eliminated.
(1) Looking the motor from the shaft end.
(2) Measured at 1m and with tolerance of +3dB(A).
(3) Approximate weight subject to changes after manufacturing process.
(4) At 100% of full load.

These are average values based on tests with sinusoidal power supply, subject to the tolerances stipulated in NEMA MG-1.

Rev.	Changes Summary	Performed	Checked	Date

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THERMAL LIMIT CURVE

Three Phase Induction Motor - Squirrel Cage

Customer	:

Product line	: W22 NEMA Premium Efficiency Three-Phase	Product code :	11567248
		Catalog # :	07518ET3E365TS-W22

Performance	: 230/460 V 60 Hz 4P

Rated current	: 174/87.2 A	Moment of inertia (J)	: 23.3 sq.ft.lb
LRC	: 6.4	Duty cycle	: Cont.(S1)
Rated torque	: 221 ft.lb	Insulation class	: F
Locked rotor torque	: 240 %	Service factor	: 1.25
Breakdown torque	: 260 %	Temperature rise	: 80 K
Rated speed	: 1780 rpm	Design	: B

Heating constant	
Cooling constant	

Rev.	Changes Summary	Performed	Checked	Date

Performed by				
Checked by			Page	Revision
Date	17/08/2020		2 / 3	

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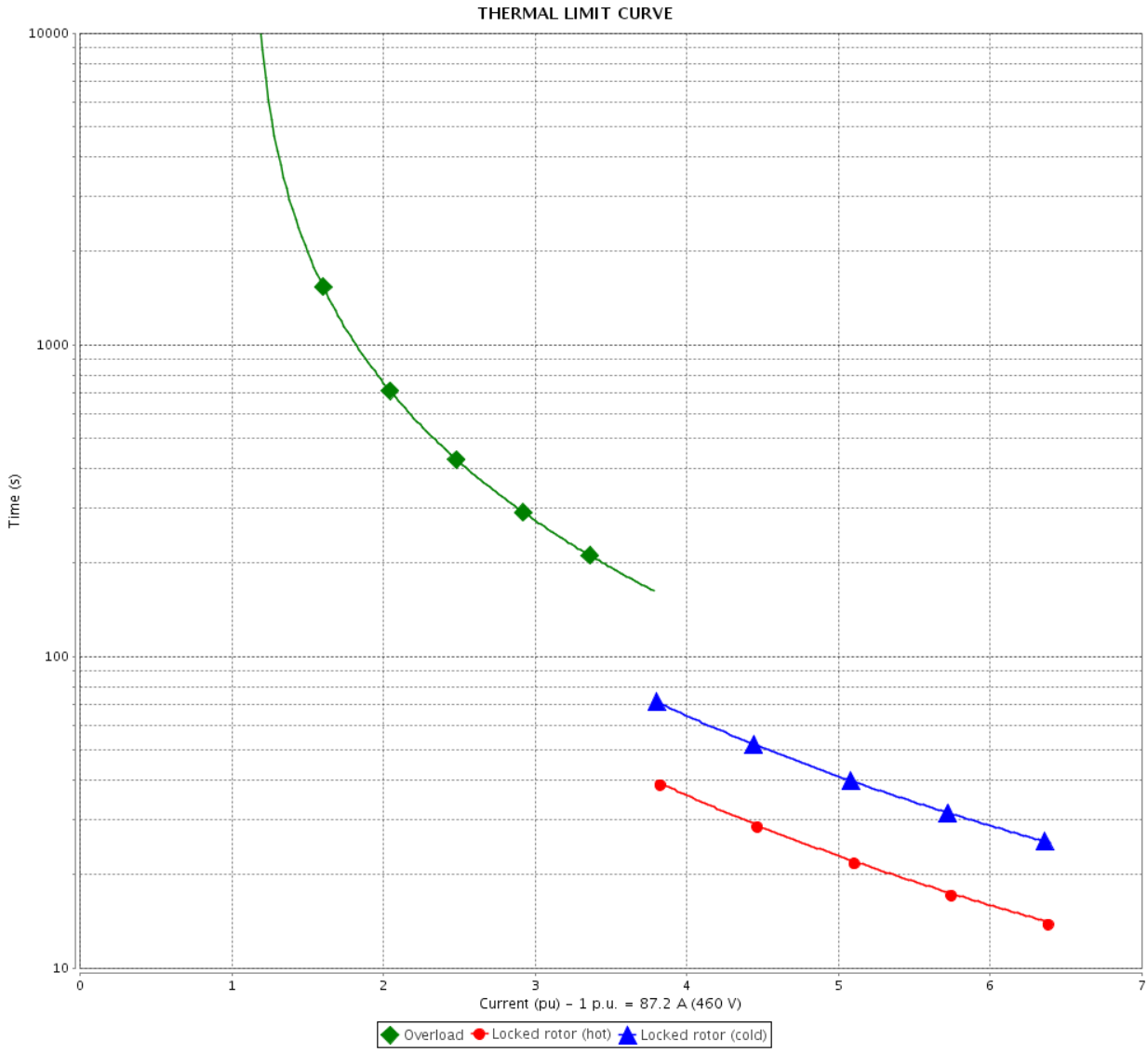
THERMAL LIMIT CURVE

Three Phase Induction Motor - Squirrel Cage

Customer :



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BTR ENGINEERING

MECHANICAL | ELECTRICAL | PLUMBING | FIRE PROTECTION

August 28, 2020

Attn: Mr. Tim McCafferty
Vice President of Construction
REDICO
One Towne Square, Suite 1600
Southfield, MI 48076

Reference: Hoover & Greene
950 Greene St.
Ann Arbor, MI, 48104
Fire Pump Power

Dear Mr. McCafferty,

Per your request, below please find a brief history of the request from Inspector Lucht for a standby generator to support the building fire pump.

Our original design which was permitted and approved included a dedicated service (below slab) from the DTE provided pad-mounted transformer to serve the fire pump and no standby generator. This feed is independent of the house, residential or retail services and shares a utility transformer, sized by DTE, for both the house and the fire pump loads.

The reliability of this configuration was called into question by the inspector, including reference to the National Electrical Code Article 695.3 as well as NFPA 20-2013 A9.3.2 to which we provided a response indicating the current design met all the required criteria for a reliable service.

Upon receipt of the letter, additional clarification was provided by the inspector, which highlighted the requirement of Article 695 of the National Electrical Code which indicates that not only the requirements of NFPA 20 be met, but that the source be able to carry the load of the building as well as the locked rotor current of the fire pump "indefinitely". The term "indefinitely" is being interpreted by the City as "infinitely", in that the utility transformer shall be able to carry the calculated load of the building as well as the locked rotor current of the fire pump forever. Upon receipt of this additional clarification, we researched the intent of the code as it pertains to the term "indefinitely" with both DTE as well as NFPA's Technical Questions Services department. The responses we received were the following.

NFPA indicated that: *The term "indefinite" is defined as not being precise, vague and without exact limits.* They further clarified that the intent of the code is *for the electrical service to not become a weak link in the performance of the fire pump and that the power supply should be capable of delivering power for however long it takes to either overcome that abnormal condition or for other devices in the circuit, namely the fire pump controller, that along with the motor is required to be listed for fire pump operation, perform their intended function.*

As per NFPA's interpretation, we provided a subsequent letter outlining the operation of the fire pumps safety components, as required specifically by UL 218 and FM 1321-1323 which requires automatic shutdown of the fire pump should it experience a locked rotor condition longer than 8-20 seconds to protect the motor. While the inspector has read the interpretation from NFPA, as it is just a learned opinion of the technical Interpreter, the inspector has requested that a formal NFPA Committee interpretation be provided; however, NFPA has said this will not be possible as the text is clear, they have offered their interpretation and ultimately final interpretation is up to the Authority Having Jurisdiction.

Per additional conversations with DTE, they too have questioned to necessity behind the need to provide utility power beyond the operational safeties required for the proper function of the fire pump. We have also inquired as to the possibility of providing a third, dedicated transformer, to serve the fire pump indefinitely, or upsizing the current

transformer selection to accommodate the infinite run time request, to which they have declined. They have indicated however, that based on their calculations, the current utility transformer could accommodate the requested loads for 1 hr.

Lastly I offer the following, should a fire indeed occur within the structure, and power not be available for operation of the fire pump, the building is equipped with a fire department connection which can be used by the fire department to supplement the sprinkler system.

Ultimately, it is completely within the purview of the AHJ to interpret and apply the provisions of the Building Codes as they see fit. Please advise as to how we are to proceed.

Respectfully submitted,

Erika L. Bolger, PE, LEED AP
Principal
BTR Engineering, LLC

Attachments: BTR memo's dated 07.27.2020 & 08.18.2020