

NORTHWESTERN UNIVERSITY  
PROJECT NAME \_\_\_\_\_  
JOB # \_\_\_\_\_

FOR: \_\_\_\_\_  
ISSUED: 03/29/2017

SECTION 23 7313 " PAC A! ED \$MODU#AR% AIR HAND#IN! UNITS

PART 1 " ! ENERA#

1&1 SECTION INC#UDES

A& O'()\*\*\*+ , -)/\*+ .-)\*\*\*+ / \*)'0,+ ,.+ 1, -)0.-2 ' -(3 , -) 4\* / 5\* -6-(3 ,3 3416)'06) , -) 31\*7- \*-  
)+, 7.-23&

1&2 RE#ATED DOCUMENTS

A& D+, 7.-23 , -) 26-6+, 0 5+\*8.3.\*-3 \*9 (16 C\* -(+, 4(



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F& T+, 5 16.21( +6A'.+6 / 6-(3

B& T16 M641, -.4, 0 C\* -(+, 4(\*+ 31, 00 >6 +635\*-3.>06 9\*+ 4\*3(3 .-4'+6) >; (16 !6-6+, 0  
C\* -(+, 4(\*+: S'>4\* -(+, 4(\*+3: , -) C\* -3'0(-.2 E-2.-66+3 (\* , 44\* / / \*), (6 ' -(3 9'+-.316) >; ,  
/ , - '9, 4('+6+ \*(16+ (1, - / , - '9, 4('+6+ - , / 6) , 3 >, 3.3 \*9) 63.2-&

1&@ RATINGS AND CERTIFICATIONS

A& A.+ H, -) 0.-2 U-( 3, 96(;: ET# \*+ U# 199?

B& A.+ H, -) 0.-2 U-( 6-6+2; '36: ASHRAE 90&1

C& F, -3: AMCA 210

D& A.+ C\*.03: AHRI B10

E& A.+ H, -) 0.-2 U-( 46+(.9.4, (. \* - 5+\*2+, / : ANSI/AHRI B30

F& F.0(6+ / 6) ., : ANSI/U# 900 0.3(6) C0, 33 I \*+ C0, 33 II

! & C\* -(+\*0 7.+.-2: NEC 4\*) 63 J ET# +6A'.+6 / 6-(3

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- 1& D63.2- C,04'0,(\*-3: C,04'0,(6 +6A'+6/6-(3 9\*+ 36064(-2 8.>+,(.\*- .3\*0,(+3 , -) 9\*+ )63.2--2 8.>+,(.\*- .3\*0,(.\*- >,363&
- 2& 19 \*'() \*\*+: +\*\*9 / \*'-(6) '-(: )6(,0 / \*'-(.-2: 364'+.-2: , -) 90,31.-2 \*9 +\*\*9 4'+> (\* +\*\*9 3(+ '4(+6& l-).4,(6 4\*\*+).-,(.-2+6A'+6/6-(3 7.(1 +\*\*9 / 6 / >+,-6 3;3(6 / &
- 3& W.-)"R63(+,-( D6(,03 \$9 '-( 3'>H64( (\* 7.-)%: D6(,0 9,>+.4,(.\*- , -) ,((,41 / 6-( \*9 7.-) +63(+,-(3 , -) 3-'>>6+3& S1\*7 , -41\*+,26 )6(,03 , -) .-).4,(6 A' ,-(.: ) ., / 6(6+: , -) )65(1 \*9 56-6(+,(.\*- \*9 , -41\*+3&

C& C\*\*+).-,(.\*- D+, 7.-23: P0, -3 , -) \*(16+ )6(,03: )+, 7 - (\* 34,06: \* - 71.41 (16 9\*00\*7.-2 .(6 / 3 ,+6 31\*7- , -) 4\*\*+).-,(6) 7.(1 6,41 \*(16+: '3.-2.-5'( 9+\* / -.3(,006+3 \*9 (16 .(6 / 3.-8\*086):

- 1& S(+ '4(+ , 0 / 6 / >6+3 (\* 71.41 5,4<,26) ,+ 1, -)0.-2 '-(.3 7.00 >6 ,((,416)&
- 2& R\*\*9 \*56--23
- 3& R\*\*9 4'+>3 , -) 90,31.-2&

.) 71(&)0.35637(188. D1\*+) -5.0032018225(19)8763247(7)0.7132078(7)15(,) -11.3583(-)0.713583(>)0.71320365807( #) -7(')0.713207(+)-5.0,2..



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I& W+,5 6A'.5 / 6-( : .-40' ).-2 6064(+.4, 0 4\* / 5\*-6-(3: 9\*+ 5+\*(64(. \* - ,2,.-3( +,.-: 3- \* 7: 7.-): ).+(:  
3' - 9, ).-2: +\* , ) 3,0(416 / .4, 03: + ' 3( , -) 4\*++\*3. \* -& 665 6A'.5 / 6-( 416, - , -) );&

J& T,+5 \* ' ( ) \*\*+ ' -(3 (\* 5+\*(64( ,2,.-3( +,.- , -) +\* , ) )6>+.3 ) '+.-2 31.55.-2&

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D& U-( 7.00 31.5 .- \*-6 \$1% 5.646 716-686+ 5\*33.>0

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1& S(,.-0633 3(660 1.-263 56+ / .( , 1F0° ) \*\*+ 37.-2&

2& A44633 ) \*\*+ 7.00 >6 \*9 (16 3, / 6 / , (6+, 0 (;56 , 3 6E(6+. \*+/- (6+. \*+ 4, 3.-2&

3& A44633 ) \*\*+ 0, (4163 7.00 '36 , +\*006+ 4, / 0, (41.-2 / 641, -.3 / &

M& V.67 5\*+(3 7.00 >6 3.-206 5, -6 P06E.20, 3&

N



E& D.34\* --64(3 7.00 >6 5+\*8.)6) 7.(1 , - .-(62+,0 2+\*' - ) 0' 2&

1& 1@A (\* 100A ).34\* --64(3 7.00 1,86 (7\* \$2% #1B 2+\*' - ) 7.+63&

2& 200A (\* B00A ).34\* --64(3 7.00 1,86 \*-6 \$1% #@"2?0 2+\*' - ) 7.+6&

2&7 ACROSS"THE"#INE FAN MOTOR STARTERS

A& C\*-3(- (3566) / \*(+ 3(+6+3 7.00 >6 9'+-.316) \$31.556) 0\*\*36% \*+ 5+\*8.)6) \$9,4(\*+; / \*' -(6) , -) 7.+6) (\* / \*(+\*% 7.(1 ' -(3: ,3 31\*7- .- 3'> / .((,0) \*4' / 6-(3&

B& F\*+ \*' ) \*\*+ ' -(3: / \*(+ 3(+6+3 7.00 >6 1\* '36) .- , )6).4,(6): 76,(16+ +63.3(- (4\* / 5,+ / 6-(&

1& S1.556) 0\*\*36 3(+6+3 , -) 3(+6+3 5+\*8.)6) \*- ' -(3 7.(1 \*' ( 3.-206 5\* -( 5\*76+ 7.00 >6 1\* '36) .- , NEMA 3R 6-40\*3'+6&

2& W6,(16+5+\*9 4\* / 5,+ / 6-(3 7.00 >6 5+\*8.)6) \*- ' -(3 7.(1 3.-206 5\* -( 5\*76+&

C& M\*(+ 3(+6+ 5, -603 7.00 .-40') 6:

1& M,.- 5\*76+ >0\*4<

2& M\*(+ 4\* -(, 4(\*+\$3%

3& I-).8.) ' ,0 31\*+( 4.4' .( , -) \*86+0\* , ) 5+\*(64(. \*-

B& 120 8\*0( 4\* -(+\*0 5\*76+ (+, -39\*+ / 6+ 7.(1 5+ / ,+; , -) 364\*- ) ,+; 5+\*(64(. \*-

?& ? 5\* -( (6+ / .- ,0 3(+5 9\*+ 9.60) 4\* --64(. \*- 3

@& M,.- 5\*76+ ) .34\* --64(

7& H, -)"O99"A' (\* 37.(41

2&F FAN VARIAB#E FREDUENCY DRIVES

A& R696+ (\* S64(. \*- 23 0?1B 0V ,+ , >06 F+6A '6-4; D+.863 \$VFD%&G

B& V,+ , >06 9+6A '6-4; )+.863 7.00 >6 9'+-.316) \$31.556) 0\*\*36% \*+ 5+\*8.)6) \$9,4(\*+; / \*' -(6) , -) 7.+6) (\* / \*(+\*% 7.(1 ' -(3: ,3 31\*7- .- 3'> / .((,0) \*4' / 6-(3&

C& F\*+ \*' ) \*\*+ ' -(3: VFD3 7.00 >6 1\* '36) .- , )6).4,(6): 76,(16+ +63.3(- (4\* / 5,+ / 6-(&

1& S1.556) 0\*\*36 VFD3 , -) VFD3 5+\*8.)6) \*- ' -(3 7.(1 \*' ( 3.-206 5\* -( 5\*76+ 7.00 >6 1\* '36) .- , NEMA 3R 6-40\*3'+6&

2& W6,(16+5+\*9 4\* / 5,+ / 6-(3 7.00 >6 5+\*8.)6) \*- ' -(3 7.(1 3.-206 5\* -( 5\*76+&

D& VFD3 9'+-.316) \*+ 5+\*8.)6) 7.(1 ' -(3 7.00 >6 5+\*2+, / / 6) , -) 3(+6) >; , )+.86 9,4(\*+; , '(1\*+.06) , -) (+, .-6) (641-.4. , -&

2&9 HEATIN ! AND COO#IN ! COI#S

A& R696+ (\* S64(. \*- 23 F21@ GC\*.03&G

B& C\*\*0.-2 4\*.0 362 / 6-(3 7.00 1,86 , 9'00"7.) (1 IAD )+, .- 5, - (1,( 6E(6-)3 ,( 06,3( @K ) \*7-3(+6, / \*9 (16 0,3( 4\*.0 .- (16 364(. \*- &

C& C\*.03 7.00 >6 +6 / \*8, >06 9+\* / (16 3.)6 \*9 ' -( : 8, +6 / \*8, >06 AHU 5, -603& N\* / \*+6 (1, - \* -6 5, -60 / '3(>6 +6 / \*86) (\* +6 / \*86 , 4\*.0&

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D& C\*.03 7.00 1,86 9+, / 63 4\*-3(+ ' 4(6) \*9 2,08, -.C6) 3(66& C,3.-2 41, --603 7.00 >6 9+66")+,.-.-2 , -) )\* -\*( >0\*4< 9.- ,+6,&

E& C\*\*0.-2 4\*.03 7.(1 9.--6) 16.21( 2+6,(6+ (1,- BFK 7.00 1,86 , - .-(6+/6)..(6 )+,.- 5,- 7.(1 )\*7-35\*' ( (\* )+,.- 4\*-)6-3,(6 (\* / ,.- )+,.- 5,- & 1-(6+/6)..(6 )+,.- 5,- / ,(6+,0 7.00 / ,(41 4\*.0 9+, / 6 / ,(6+,&

F& C\*.0 362 / 6-( ) \*\*+ 406,+ , -463 7.00 ,00\*7 9\*+ ,( 06,3( 2".-4163 \*9 9.60) .-3(,006) 5.5.-2 .-3'0,(.\* -&

! & C\*.0 >'0<16,)3 , -) >0,-<"\*993 7.00 5+686-( ,.+ 9+\* / >;5,33.-2 4\*.03&

H& C\*.0 362 / 6-( 4,3.-2 (\* ,44\* / / \*),(6 9'00"9,46 \*+

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B& F\*+ / 6) 3(660 >, 36 +, .03 3' .(, >06 9\*+ +.22.-2 , -) 0.9(-2 7.00 >6 5+\*8.)6): , 3  
31\*7 - \* - 5+\*) '4( )+, 7.-23&

C& #.9(-2 0' 23 7.00 >6 5+\*8.)6) 716+6 +6A' .+6) 9\*+ 5+\*56+ 0.9(-.2&

PART 3 " EOECUTION

3&1 INSTA##ATION

- A& I-3(,00 6A' .5 / 6-( 56+ .- ) '3(+; 3(, - ) ,+): ,550.4 ,>06 4\* )63: , - ) / , - '9,4('+6+P3 .-3(+ '4(. \* -3&
- B& D\* -\*( '36 AHUI3 9\*+ (6 / 5\*+, +; 16, (-2: 4\*\*0.-2 \*+ 86-(,0, (. \* - 5+. \*+ (\* 4\* / 506(6 .-3564(. \* - , - ) 3(+, ('5 56+9\*+ / 6) 56+ (1.3 3564.9.4, (. \* -&
- C& I-3(,00 AHUI3 \* - , 4\* -4+6(6 5, ) : +\*\*9 4' +>: \*+ 3(+ '4('+, 0 3(660 >, 36: , 3 31\* 7 - \* - )+, 7.-23&
- D& I-3(,00 AHUI3 7.(1 / , - '9,4('+6+P3 +64\* / / 6-)6) 406,+ , -463 9\*+ , 44633: 4\*.0 5'00: , - ) 9, - +6 / \*8, 0&
- E& P+\*8.)6 \* -6 4\* / 506(6 36( \*9 9.0(6+3 9\*+ (63(-2: >, 0, -4.-2: , - ) 4\* / / .33.\* -.-2& P+\*8.)6 364\* - ) 4\* / 506(6 36( \*9 9.0(6+3 , ( . / 6 \*9 (+, -396+ (\* \*7 -6&
- F& I-3(,00 AHUI3 50' / > , - ) 06860& C\* - -64( 5.5.-2 , - ) )'4(7\*+< , 44\*+).-2 (\* / , - '9,4('+6+P3 .-3(+ '4(. \* -3&
- I & I-3(,00 5.56 41 , 363 56+ / , - '9,4('+6+P3 .-3(+ '4(. \* -3&
- H& I-3'0, (6 50' / >.-2 , 33\*4., (6) 7.(1 )+, .- 5, - )+, .-3 , - ) 4\* - -64(. \* -3&
- I& I-3(,00 .-3'0, (. \* - \* - , 00 3(, 226+6) 4\*.0 5.5.-2 4\* - -64(. \* -3: >\*(1 .-(6+-, 0 , - ) 6E(6+-, 0 (\* (16 ' -.( &

3&2 FIE#D DUA#ITY CONTRO#

- A& S(\*+6 56+ AHU / , - '9,4('+6+P3 7+((6- +64\* / / 6-), (. \* -3& S(\*+6 AHU3 .-) \*\*+3 .- , 7, + / : 406, - : )+; 50, 46 716+6 ' -.(3 7.00 >6 5+\*(64(6) 9\*+ / 76, (16+: 4\*-3(+ '4(. \* - (+, 99.4: ).+(: ) '3(: 7, (6+ , - ) / \*.3('+6& 19 ' -.(3 7.00 >6 3(\*+6) 9\*+ / \*+6 (1, - @ / \*-(13: 9\*00\*7 / , - '9,4('+6+P3 .-3(+ '4(. \* - 9\*+ 0\* -2"(6+ / 3(\*+, 26&
- B& R.2 , - ) 0.9( ' -.(3 , 44\*+).-2 / , - '9,4('+6+P3 .-3(+ '4(. \* -3&

3&3 AHU INSPECTION

- A& H.+6 / , - '9,4('+6+P3 9,4(\*+;"(+, -6) , - ) 9,4(\*+;"6 / 50\*; 6) 36+8.46 (641-.4., - (\* 56+9\*+ / , - .-3564(. \* - \*9 ' -.( , - ) .-3(,00, (. \* - 5+. \*+ (\* 3(+, ('5 T641-.4., - 31,00 .-3564( , - ) 86+.9; (16 9\*00\*7.-2 , 3 , / .- / ' / :
- 1& D, / , 26 \*9 , - ; <.-)
- 2& #6860 .-3(,00, (. \* - \*9 ' -.(
- 3& P+\*56+ +6, 336 / >0; , - ) 36, 0.-2 \*9 ' -.( 362 / 6-(3 , ( 31.55.-2 350.(3&
- B& T.21( 36, 0 , +\* ' - ) 56+ / 6(6+ \*9 ' -.( , ( (16 +\*\*9 4' +>
- ?& I-3(,00, (. \* - \*9 31.556)"0\*\*36 5, +(3: .-40' ) .-2 9.0(6+3: , + 1\*\* )3: >.) 34+66-3 , - ) / .3( 60. / .- , (\*+3&
- @& C\* / 506(. \* - , - ) .21(-633 \*9 6064(+.4, 0: ) '4(7\*+< , - ) 5.5.-2
- 7& T.21( 36, 03 , +\* ' - ) 7.+.-2: 4\* - ) ' .( , - ) 5.5.-2 56-6(+, (. \* -3 (1+\* '21 AHU 4, 3.-2&
- F& S'550; \*9 6064(+.4.(; 9\*+ / (16 >' .0) .-2P3 56+ / , -6-( 3\* ' +46
- 9& I-(62+.(; \*9 4\* - )6-3, (6 (+, 5 9\*+ 5\*3.(.86 \*+ -62, (.86 5+633' +6 \*56+, (. \* -
- 10& C\* -)6-3, (6 (+, 53 41, +26) 7.(1 7, (6+

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11& R6 / \*8,0 \*9 31.55.-2 >\*0(3 , -) 31.55.-2 +63(+, .-(3  
12& S6,0.-2 \*9 5.56 41,36 90\*\*+\$3% ,( 56-6(+,(.\* - 0\*4,(.\* -3&  
13& T.21(-633 , -) 9'00 / \*(.\* - +, -26 \*9 ) , / 56+ 0.-<,263 \$\*56+,(6 / , - ' ,00;%  
1B& C\* / 506(6 .-3(,00,(.\* - \*9 4\* -(+\*0 3;3(6 / .-40' ).-2 6-) )68.463 , -) 7.+.-2

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E& S'>/.( , 3(+('5 +65\*(3' / / ,+C.-2 , - ; 5+\*>06 / 3 9\*' - ) , - ) +6 / 6).63 56+9\*+ / 6)&

3&@ FIE#D PERFORMANCE VERIFICATION

A& #6,<,26: P+633'+.C6 4,3.-2 (\* / ,E./ ' / \*56+,(.-2 3(,(.4 5+633'+6 \$'5 (\* M/"FK 7&2&% , - ) / 6,3'+6 06,<,26& 19 06,<,26 6E466)3 1R \*9 )63.2- ,.+90\*7: 36,0 06,<,26 5\*.- (3 7.(1 , 56+ / , -6-( 3\*0'(\*-& R656,( (63& 19 (16 AHU 3(.00 ) \*63 - \*( 5,33: 4\*-(,4( (16 / , - '9,4('+6+ (\* 36,0 ' -.(&

B& S'>/.( , 9.60) (63( +65\*( 7.(1 (63(-.2 ) , ( , +64\*+)6)& I-40' )6 )634+.5(\*- \*9 4\*++64(.86 , 4(\*-3 ( , <6-&

3&7 C#EANIN !

A& C06 , - ' -.( -(6+. \*+ 5+. \*+ (\* \*56+,(.-2& R6 / \*86 (\*03: )6>+.3: ) ' 3( , - ) .+(&

B& C06 , - 6E(6+. \*+ 5+. \*+ (\* (+ , -396+ (\* \*7 -6+&

3&F DOCUMENTATION

A& P+\*8.)6 I-3(,00,(.\* - I-3(+ ' 4(\*- M, - ' ,0: J S(+('5 4164<0.3( .- (16 3' 550; 9 , - 364(\*- \*9 6,41 ' -.(&

B& P+\*8.)6 3.E 4\*5.63 \*9 S5 ,+6 P ,+(3 M, - ' ,0 9\*+ \*7 -6+P3 5+\*H64( 3;3(6 / / , - ' ,0&

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