SECTION 2 0!"# $ VARIABLE$FREQUENCY DRIVES (VFD&)

PART 1 - ' ENERAL

"." RELATED DOCUMENTS

A. D() *+,-&),. -/,/()0 1(23+&+2,& 24 56/ C2,5()758 +,709.+,- '/,/()0),. S9110/:/,5)(; C2,.+5+2,&),. S1/7+4+7)5+2, B22< D+3+&+2, 0" S1/7+4+7)5+2, S/75+2,&8)110; 52 56+& S/75+2,.

".2 SUMMARY

A. S/75+2,+,709./& &/1)()5/0; /,702&/.8 1(/$)&&/:=0/.8 72:=+,)5+2, VFD&8 ()5/. >00 V),.0/&&8 42(&1//. 72,5(20 24 56(//$16)&/8 &?9+(((/0$7)-/+,.975+2, :252(&.

B. H)(:2,+7),)0;&+&.

". DEFINITIONS

A. AO $ A,)02- O95195.

B. BAS: B9+0.+,-)952:)5+2, &;&5/:.

C. BI $ B+,)(; I,195.

D. BO $ B+,)(; O95195.

E713207(5)0.356603(.)-11.7152( )3T6603(.)-11.7150 3((5)0.35;713207(0)4.71211.7149(+)4.713()O0TLUT * [(E7.99392( )0

P. OCPD: O3/(79(((/,5 1(25/75+3/ ./3+7/.

Q. PCC: P2+,5 24 72 : :2, 72910+,-.

R. PID: C2,5(20)75+2,8 1(212(5+2,)0 109&+,5/-()0 109& ./(+3)5+3/.

S. PWM: P90&/$*+.56 :2.90)5/..

T. RFI: R).+2$4(/?9/,7;+,5/(4/(/,7/.

U. TDD: T25)0 ./:),.(6)(:2,+7 79(((/,5) .+&52(5+2,.

V. THD(V): T25)0 6)(:2,+7 3205)-/ ./:),.

W. VFD: V)(+)=0/$4(/?9/,7; :252(72,5(200/(.

".# ACTION SUBMITTALS

A. P(2.975 D)5): F2(/)76 5;1/),.()5+,-24 VFD+,.+7)5/.. I,709./4/)59(/&8 215+2,&8 1/(42(:),7/8 /0/75(+7)0 ()5+,-&8 21/()5+,- 76)()75/(+&5+7&8 &6+11+,-),. 21/()5+,- */+-65&8),. 49(,+&6/. &1/7+)05+/&),.)77/&&2(+/&.

".! INFORMATIONAL SUBMITTALS

A. S621 D()*+,-&: F2(/)76 VFD+,.+7)5/.. I,709./ .+:/,&+2,/. 10),&8 /0/3)5+2,&8),. &/75+2,&8),. 72,.9+5 /,5(; 027)5+2,&),. &+C/&8 :29,5+,-)(()),-/:/,5&8),. ./5)+0&8 +,709.+,- (/?9+(/. 70/)(),7/&),. &/(3+7/ &1)7/)(29,. /?9+1:/,5.

C. Q9)0+4+7)5+2, D)5): F2(?9)0+4+/. 5/&5+,-)-/,7;.

D. P(2.975 C/(5+4+7)5/&: F2(/)76 VFD8 4(2: :),94)759(/(.

E. S29(7/ ?9)0+5;$72,5(20(/12(5&.

F. F+/0. ?9)0+5;$72,5(20(/12(5&.

'. R/&905& 24 6)(:2,+7),)0;&+&.

H. L2).$C9((/,5),. O3/(02).$R/0); H/)5/(L+&5: C2:1+0/)45/(:252(& 6)3/=//, +,&5)00/.8),.)(()),-/52./:2,&5()5/56)5&/0/75+2, 24 6/)5/(&&9+5&)759)0 :252(,):/10)5/8 4900$02). 79((/,5&.

I. L2).$C9((/,5),. L+&5 24 S/55+,-& 24 A.A9&5)=0/ O3/(02). R/0);&: C2:1+0/)45/(:252(& 6)3/=//, +,&5)00/.),.)(()),-/52./:2,&5()5/56)5&*+576 &/55+,-& 42(:252($(9,,+,- 23/(02). 1(25/75+2, &9+5)759)0 :252(&52=/1(25/75/..

".> CLOSEOUT SUBMITTALS

A. O1/()5+2,),. M)+,5/,),7/ D)5): F2(VFD& 52 +,709./ +, /:/(-/,7;8 21/()5+2,8),. :)+,5/,),7/ :),9)0&. I,).. +5+2, 52 +5/:& &1/7+4+/. +, Section 01 7000 "Execution and Closeout Requirements," +,709./56/ 42002*+,-:

". M),94)759(/(%& *(+55/, +,&5(975+2,& 42(5/&5+,-),.).A9&5+,- 56/(:)0$:)-,/5+7 7+(79+5 =(/)</(),. MCP 5(+1 &/55+,-&.
2. M),94)759(/(%& *(+55/, +,&5(975+2,& 42(&/55+,- 4+/0.$).A9&5)=0/ 23/(02). (/0);&.
. M),94)759(/(%& *(+55/, +,&5(975+2,& 42(5/&5+,-8).A9&5+,-8),. (/1(2-():: +,- :+7(21(27/&&2(72,5(20 :2.90/&.

B. T/&5+,- A-/,7; Q9)0+4+7)5+2,&: M/ :=/(72:1),; 24 NETA 2(),NRTL.

". T/&5+,- A-/,7;%& F+/0. S91/(3+&2(: C9((/,50; 7/(5+4+/. =; NETA 52 &91/(3+&/ 2,$&+5/ 5/&5+,-.

C. E0/75(+7)0 C2:12,/,5&8 D/3+7/&8),. A77/&&2(+/&: L+&5/.),.0)=/0/.)&./4+,/.+, NFPA D08=;)?9)0+4+/.5/&5+,-)-/,7;8),. :)(</.42(+,5/,./.027)5+2,),.)110+7)5+2,.

D. C2:10; *+56 NFPA D0.

E. IEC ()5/. 72:12,/,5&)(/ ,25)77/15)=0/.

F. R/4/(/,7/. S5),.)(.&),. '9+./0+,/&:

". I,&5+595/ 24 E0/75(+7)0),. E0/75(2,+7 E,-+,//(& (IEEE)

). IEEE !"G$"GG28 '9+./42(H)(:2,+7 C2,5/,5),. C2,5(20.

2. U,./(*(+5/(& L)=2()52(+/&()&)11(21(+)5/)

). UL!0F
=. UL!0FA
7. UL!0FC

". VFD&) , . 215+2 , & &6)00 =/ UL!0F 0+&5/ .)&) 72 : 10/5/)&&/ : =0; . T6/ =)&/ VFD &6)00 =/ UL 0+&5/ . 42("00 <A SCCR *+56295 56/ , / / . 42(+, 1955 49&/&. B)&/ VFD& *+56 (/ . 0)=/0 UL &5+7</(& (/?9+(+, -) . .+5+2 ,)0 =() , 76 7+(79+5 1(25/75+2 ,)(/ , 25)77/15)=0/.

2. CE M)(< L T6/ =)&/ VFD &6)00 72 , 42(: 52 56/ E9(21/) , U , +2 , E0/75(2 :) - , /5+7 C2 : 1)5+=+0+5; .+(/75+3/8) (/?9+(/ : / , 5 42(CE :)(<+, -. T6/ VFD &6)00 : / /5 1(2.975 &5) , .)(. EN >"F00$ 42(56/ F+(&5 E , 3+(2 , : / , 5 (/&5(+75/ . 0/3/0 (C)5/-2(; C2). B)&/ .(+3/& 56)5 2 , 0; : / /5 56/ S/72 , . E , 3+(2 , : / , 5 (C)5/-2(; C 8 C#) &6)00 =/ &9110+/ . *+56 /E5/(,)0 4+05/(& 52 =(+, - 56/ .(+3/ +, 72 : 10+) , 7/ *+56 56/ F+(&5 E , 3+(2 , : / , 5 0/3/0&.

J. C2 : 10; *+56 FM '02=)0 (/?9+(/ : / , 5& 42(VFD%&

".G DELIVERY8 STORA ' E8 AND HANDLIN '

A. S52(/ +, &1)7/ 56)5 +& 1/(:) , / , 50; / , 702&/ .) , .)+(72 , .+5+2 , / . .

"."0 PROJECT CONDITIONS

A. E , 3+(2 , : / , 5)0 L+ : +5)5+2 , &: R)5/ /?9+1 : / , 5 42(72 , 5+ , 929& 21/()5+2 , 8 7)1)=0/ 24 .(+3+, - 4900 02) . *+56295 . /()5+, -8 9 , . /(56/ 42002*+, - 72 , .+5+2 , & 9 , 0/&& 256/(*+&/ +, .+7)5/ . :

". A : =+/ , 5 T/ : 1/()59(/: N25 0/&& 56) , "# . / - F (: +, 9& "0 . / - C)) , . , 25 /E7/ / .+, - "0# . / - F (#0 . / - C).

2. A : =+/ , 5 S52() - / T/ : 1/()59(/: N25 0/&& 56) , : +, 9& # . / - F (: +, 9& 20 . / - C)) , . , 25 /E7/ / .+, - "#0 . / - F (>0 . / - C)

. H9 : +.+5; : L/&& 56) , G! 1/(7/ , 5 (, 2 , 72 , . / , &+, -).

#. A05+59 . /: N25 /E7/ / .+, - 00 4/ /5 ("00! :).

B. I , 5/((915+2 , 24 EE+&5+, - E0/75(+7)0 S;&5/ : &: D2 , 25 +, 5/((915 /0/75(+7)0 &;&5/ : & +, 4)7+0+5+/& 27791+/ . =; 56/ U , +3/(&+5; 2(256/(& 9 , 0/&& 1/(: +55/ . 9 , . /(56/ 42002*+, - 72 , .+5+2 , &) , . 56/ , 2 , 0;)45/( )(() , -+, - 52 1(23+. / 5/ : 12()(; /0/75(+7)0 &/(3+7/)772(.+, - 52 (/?9+(/ : / , 5& +, .+7)5/ . :

". N25+4; 56/ U , +3/(&+5; , 2 4/ * /(56) , &/3/ , .);& +,) . 3) , 7/ 24 1(212&/ . +, 5/((915+2 , 24 /0/75(+7)0 &;&5/ : &.

2. I , .+7)5/ : /562. 24 1(23+.+, - 5/ : 12()(; /0/75(+7)0 &/(3+7/.

. D2 , 25 1(27/ / . *+56 +, 5/((915+2 , 24 /0/75(+7)0 &;&5/ : & *+56295 56/ U , +3/(&+5;%& *(+55/ , 1/(: +&&+2 , .

#. C2 : 10; *+56 NFPA D0E.

C. P(2.975 S/0/75+2 , 42(R/&5(+75/ . S1)7/: D() *+, -& +, .+7)5/ :)E+ : 9 : .+ : / , &+2 , & 42(VFD&8 +, 709.+, - 70/)() , 7/& =/5* / / , VFD&8) , .) .A)7/ , 5 &9(4)7/&) , . 256/(+5/ : &.

"."" COORDINATION

A. C22(.+,)5/ 4/)59(/& 24 : 252(&8 02) . 76)()75/(+&5+7&8 +, &5)00/ . 9 , +5&8) , .)77/&&2(; ./3+7/& 52 =/ 72 : 1)5+=0/ *+56 56/ 42002*+, - :

". T2(?9/8 &1/ / .8) , . 62(&/12* /((/?9+(/ : / , 5& 24 56/ 02) . .

2. R)5+, -&) , . 76)()75/(+&5+7& 24 &9110; 7+(79+5) , . (/?9+(/ . 72 , 5(20 &/?9/ , 7/.

. A : =+/ , 5) , . / , 3+(2 , : / , 5)0 72 , .+5+2 , & 24 +, &5)00)5+2 , 027)5+2 , .

B. C22(.+,)5/ &+C/&) , . 027)5+2 , & 24 72 , 7(/5/ =)&/& *+56)759)0 /?9+1 : / , 5 1(23+./ . . C)&5) , 762($ =205 +, &/(5& +, 52 =)&/&.

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) , . + , 5 / (,) 0 762 < / &. VFD& 56) 5 . 2 , 25 + , 709 . / 722(. + ,) 5 / . AC 5() , &+ / , 5 &9(- / 1(25 / 75+2 , &6) 00 + , 709 . /) , /E5 / (,) 0 TVSS (T() , &+ / , 5 V205) - / S9(- / S911(/ &&2().

2#. T6 / VFD &6) 00 1(23+ . /) 1(2 - () : :) = 0 / 02&&$24$02) . (=(2< / , = / 05 I =(2< / , 72910+ , -) F2(: $ C (/0) ; 295195. T6 / .(+3 / &6) 00 = / 1(2 - () : :) = 0 / 52 &+ - ,) 0 56 / 02&&$24$02) . 72 , . +5+2 , 3+)) < / ; 1) . *) (, + , -8 F2(: $C (/0) ; 2951958) , . I 2(23 / (

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(((/&/55)=0/)8),. =;1)&& 02-+7 =2)(. 5/ :1/()59(/. T6/ BAS &6)00)0&2 =/ 7)1)=0/ 24 :2,+52(+,-56/ =;1)&&(/0); 295195 &5)59&8),.)00 .+-+5)0+,195 &5)59&. A00=;1)&& .+)-,2&5+7 *)(,+,-),. 4)905 +,42(:)5+2, &6)00 =/ 5(),&:+55/. 23/(56/ &/(+)0 72: :9,+7)5+2,& =9&. R/:25/ =;1)&& 4)905 (/&/5 &6)00 =/ 12&&+=0/.

>. T6/ VFD I =;1)&& &6)00)002* 56/ BAS 52 72,5(20 56/ .(+3/),. =;1)&& .+-+5)0),.),)02-295195& 3+)56/ &/(+)0+,5/(4)7/. T6+& 72,5(20 &6)00=/ +,./1/,./,5 24),; VFD 49,75+2,. T6/),)02- 295195& :); =/ 9&/. 42(:2.90)5+,-76+00/. *)5/(3)03/& 2(7220+,-52*/(=;1)&& 3)03/&8 +4)110+7)=0/. T6/ .(+3/),. =;1)&&H .+-+5)0 (F2(:$C (/0);) 295195& :); =/ 9&/. 52)759)5/) .):1/(8 21/,) 3)03/ 2(72,5(20),; 256/(./3+7/ 56)5 (/?9+(/&) :)+,5)+,/. 72,5)75 42(21/()5+2,. I,).. +5+2,8)00 24 56/ .(+3/),. =;1)&&H .+-+5)0+,195& &6)00=/ 7)1)=0/ 24 =/+,- :2,+52(/. =; 56/ BAS &;&5/:. T6+&)002*& 42((/:25/ :2,+52(+,- 24 *6+76 (24 91 52 #) &)4/5+/&)(/ 21/,.

D. T6/ VFD &6)00 +,709./), +,./1/,./,5 PID 0221 42(79&52:/(9&/. T6/ +,./1/,./,5 PID 0221 :); =/ 9&/. 42(7220+,-52*/(=;1)&& 3)09/ 72,

PART 3 - ESECUTION

." ESAMINATION

J. D(+3/&52 =/ 027)5/ . +,) ,2(:)0 U,+3/(&+5;)(/) 24 *2(<.

. IDENTIFICATION

'. I./,5+4; VFD&8 72:12,/,5&8),. 72,5(20 *+(+,-. C2:10; *+56 (/?9+(/:/,5& 42(+./,5+4+7)5+2, &1/7+4+/. +, Section **./ 0*005** "identification (or Electrical Systems."

". I./,5+4; 4+/0.$+,&5)00/. 72,.9752(&8 +,5/(72,,/75+,- *+(+,-8),. 72:12,/,5&8 1(23+./ *)(,+,- &+-,&.

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VARIABLE FREQUENCY DRIVES (VFD) 2 0!"#$">