



- I: S373-8 H07>: T60 =.0442.0 >20 3\* 360 50-?63 \*, 360 ,92-> 7<\*B0 360 =\*-+3 \*, / 0742.0 / 0+3: I+ 7 89\*40> 4;430 / 4373-8 607> -4 01279 \*+ <\*36 4->04 \*, 360 =2 / =:
- J: S283-\*+ H07>: T60 60-?63 \*, ,92-> 42.,780 7<\*B0 360 80+30.9+0 \*, 360 =2 / = \*+ 360 4283-\*+ 4->0:
- I: S;430 / E,,083: A =60+\* / 0+\*+ 3673 87+ 8.0730 2+>04.0> \*. 2+=.0>-830> 8\*+>-3-\*+4 3673 87240 .0>280> 87=78-3-04 +> 799 \*. =7.3 \*, 7 4;430 / :
- !: S;430 / E,,083 F783\*.4: A99\* 57+804 240> 3\* 879829730 7 .0>283-\*+ \*, 360 =0.,\* . / 7+80 .73+?4 \*, 7 ,7+ 560+ +>437990> 2+>0. 8\*+>-3-\*+4 >.,0.0+3 ,. \* / 36\*40 =.040+30> 560+ 360 ,7+ 574 =0.,\* . / 7+80 30430>:
- M: TAB: T043+? 7>|243+? 7+> <797+8+?:
- N: TAB S=08-79-43: A+ 0+3-3; 0+?7?0> 3\* =0.,\* . / TAB W\*.C:
- O: T043+? A>|243+? 7+> B797+8+? "TAB# A?0+3: T60 0+3-3; .04=\*+4-<90 ,\* . =0.,\* . / -+? 7+> .0=\* .3+? 360 TAB =.\*80>2.04:
- P: T0. / -+79: A =\*-+3 560.0 360 8\*+3. \*990> / 0>-2 / ",92-> \*. 0+0.?.;# 0+30.4 \*. 907B04 360 >43.-<23-\*+ 4;430 / :

1:\$ PREINSTA! !ATION MEETINGS

- A: TAB C\*+,0.0+80: I, .0120430> <; 360 O5+0. 8\*+>283 7 TAB 8\*+,0.0+80 73 =.\*!083 4-30 7,30. 7==.\*B79 \*, 360 TAB 43.730?-04 7+> =.\*80>2.04 =97+ 3\* >0B09\*= 7 / 23279 2+>0.437+>-+? \*, 360 >037-94: P.\*B->0 7 / -+ / 2 / \*, 1' >7;4| 7>B7+80 +\*3-80 \*, 4860>290> / 003+? 3- / 0 7+> 9\*873-\*+:
- 1: M+- / 2 / A?0+>7 I30 / 4:
  - 7: T60 C\*+3.783 D\*82 / 0+34 0E7 / -+73-\*+ .0=\* .3:
  - <: T60 TAB =97+:
  - 8: N00>4 ,\* . 8\*\* .->+73-\*+ 7+> 8\*\*=0.73-\*+ \*, 3.7>04 7+> 42<8\*+3.783\*.4:

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

FOR: \_\_\_\_\_  
ISSUED: 11/06/2017

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

FOR: \_\_\_\_\_  
ISSUED: 11/06/2017

1:7 FIELD CONDITIONS

A: F200 O5+0. O882=7+8;: O5+0. 5-00 \*882=; 360 4-30 7+> 0E-43+? <2-9>-+? >2.-+? 0+3-.0 TAB =0.-\*>:



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

FOR: \_\_\_\_\_  
ISSUED: 11/06/2017

D: W->\*54 7+> >\*.4 87+ <0 80\*40> 4\* -+>8730> 8\*+>3-\*+4 , \*. 4;430 / \*=0.73-\*+4 87+ <0 / 03:

\$\$ GENERAL PROCEDURES FOR TESTING AND BALANCING

A: PO., \*. / 3043+? 7+> <707+8+? =. \*80>2.04 \*+ 0786 4;430 / 788\* .>+? 3\* 360 =. \*80>2.04 8\*+37+0> + AABC;4 LN73-\*+70 S37+>7.>4 , \*. T\*370 S;430 / B707+80L \*. NEBB;4 LP.\*80>2.70 S37+>7.>4 , \*. T043+? A>1243+? 7+> B707+8+? \*, E+B.\*+ / 0+370 S;430 / 4L 7+> + 36-4 S083-\*+:

1: C\* / =0; 5-36 .012-.0 / 0+34 + ASHRAE 62:1(2007 S083-\*+ 7:2:2 LA-. B707+8+?:L

B: C23 +42073-\*+ >2834 =-04 7+> 012-=/ 0+3 87<-+034 , \*. +4370073-\*+ \*, 3043 6\*04 7+> =.\* <04 3\* 360 0E30+3 +080447.; , \*. TAB =.\*80>2.04 7+> >283 3043 6\*00 , -33+?4 46700 <0 =.\*B->0> 560.0

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

FOR: \_\_\_\_\_  
ISSUED: 11/06/2017

! : VO.-, ; 3673 7-. >283 4;430 / -4 40790> 74 4=08-,0-> -+ D-B-4-\*+ 2\$ S083-\*+ LD2835\*.C:L

\$.% PROCEDURES FOR CONSTANT(VOLUME AIR SYSTEMS

A: A>4243 ,7+4 3\* >09B0. 3\*379 -+>-8730> 7-.,9\* 54 5-36+ 360 / 7E- / 2 / 799\* 57<90 ,7+ 4=00> 9-430> <; ,7+ / 7+2,7832.0.:

1: M0742.0 3\*379 7-.,9\* 5:

7: W60.0 42,-8-0+3 4=780 -+>2834 -4 2+7B7-97<90 ,\* . P-3\*3(32<0 3.7B0.40 / 0742.0 / 0+34 / 0742.0 7-.,9\* 5 73 30. / -+79 \*299034 7+> -+9034 7+> 879829730 360 3\*379 7-.,9\* 5:

2: M0742.0 ,7+ 4373-8 =.0442.04 74 ,\*99\* 54 3\* >030. / -+0 783279 4373-8 =.0442.0:

7: M0742.0 \*29903 4373-8 =.0442.0 74 ,7. >\* 5+43.07 / ,.\* / 360 ,7+ 74 =.783-879 7+> 2=43.07 / ,.\* / .043-.83-\*+4 -+>2834 4286 74 09<\* 54 7+> 3.7+4-3-\*+4:

<: M0742.0 4373-8 =.0442.0 >-.0839; 73 360 ,7+ \*29903 \* . 36.\*2?6 360 ,90E-<90 8\*++083-\*+:

8: M0742.0 -+903 4373-8 =.0442.0 \* , 4+?90(-+903 ,7+4 + 360 -+903 >283 74 +07. 360 ,7+ 74 =\*44-<90 2=43.07 / ,.\* / 360 ,90E-<90 8\*++083-\*+ 7+> >\* 5+43.07 / ,.\* / >283 .043-.83-\*+4:

>: M0742.0 -+903 4373-8 =.0442.0 \* , >\*2<90(-+903 ,7+4 36.\*2?6 360 5799 \* , 360 =90+2 / 3673 6\*2404 360 ,7+:

\$. M0742.0 4373-8 =.0442.0 78.\*44 0786 8\* / =\*+0+3 3673 / 7C04 2= 7+ 7-.(67+>9+? 2+3 .\*\* ,3\*= 2+3 7+> \*360. 7-.(67+>9+? 7+> (3.073+? 012=- / 0+3:

7: R0=\* .3 360 8907+9+044 437324 \* , ,930.4 7+> 360 3- / 0 4373-8 =.0442.04 7.0 / 0742.0>:

' : M0742.0 4373-8 =.0442.04 0+30.-+? 7+> 907B+? \*360. >0B-804 4286 74 4\*2+> 3.7=4 6073(.08\*B0. ; 012=- / 0+3 7+> 7-. 57460.4 2+>0. ,+79 <797+80> 8\*+>-3-\*+4:

%: R0B-05 R08\* .> D\*82 / 0+34 3\* >030. / -+0 B7-.73-\*+4 -+>04-?+ 4373-8 =.0442.04 B0.424 783279 4373-8 =.0442.04: C79829730 783279 4;430 / (0,083 ,783\*.4: R08\* / / 0+> 7>4243 / 0+34 3\* 788\* / / \*>730 783279 8\*+>-3-\*+4:

6: O<37+ 7==.\*B79 ,.\* / E+?+00. ,\* . 7>4243 / 0+3 \* , ,7+ 4=00> 6-?60. \* .9\* 50. 367+ -+>-8730> 4=00>: C\* / =9; 5-36 .012-.0 / 0+34 + D-B-4-\*+ 2\$ S083-\*+4 ,\* . 7-.(67+>9+? 2+34 ,\* . 7>4243 / 0+3 \* , ,7+4 <0934 7+> =2990; 4-G04 3\* 786-0B0 -+>-8730> 7-.(67+>9+?(2+3 =0. ,.\* / 7+80:

7: D\* +\*3 / 7C0 ,7+(4=00> 7>4243 / 0+34 3673 .04293 + / \*3\* . \*B0.9\*7>: C\*+4293 012=- / 0+3 / 7+2,7832.0.4 7<\*23 ,7+(4=00> 47,03; ,783\*.4: M\*>29730 >7 / =0.4 7+> / 0742.0 ,7+( / \*3\* . 7 / =0.7?0 3\* 0+42.0 3673 +\* \*B0.9\*7> 5-99 \*882.: M0742.0 7 / =0.7?0 -+ ,299(8\* \*9+? ,299( 6073+? 08\*+\* / -G0. 7+> 7+; \*360. \*=0.73+? / \*>0 3

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

FOR: \_\_\_\_\_  
ISSUED: 11/06/2017



NORTHWESTERN UNIVERSITY

PROJECT NAME \_\_\_\_\_

JOB # \_\_\_\_\_

FOR: \_\_\_\_\_

ISSUED: 11/06/2017

7: A>h243 360 ,7+ 7+> <797+80 360 .032.+(7-. >2834 7+> -+9034 360 47 / 0 74 >048.-<0> , \* .  
8\*+437+3(B\*92 / 0 7-. 4;430 / 4:

7: M0742.0 4373-8 =.0442.0 73 360 / \*43 8.-3-879 30. / -+79 2+3 7+> 7>h243 360 4373-8(=.0442.0  
8\*+3.\*90. 73 360 / 7+ 42==9;(7-. 40+4+? 4373-\*+ 3\* 0+42.0 3673 7>012730 4373-8 =.0442.0 -4  
/ 7-+37+0> 73 360 / \*43 8.-3-879 2+3:

D: R08\* .> ,+79 ,7+(=0., \*. / 7+80 >737:

C: P.0442.0(D0=0+>0+3 V7.-7<90(A.(V\*92 / 0 S;430 / 4 5-36 D-B0.4-3;: A,30. 360 ,7+ 4;430 / 4 67B0  
<00+ 7>h2430> 7>h243 360 B7.-7<90(7-. (B\*92 / 0 4;430 / 4 74 , \*99\* 54:

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

FOR: \_\_\_\_\_  
ISSUED: 11/06/2017

\$.D PROCEDURES FOR CONSTANT FLOW HYDRONIC SYSTEMS

A:  $A = 2 / (4 \cdot B) \cdot C > 0.4 \cdot D + E / :$

1:  $M = 0.5730 \cdot C^5 :$

7:  $P = 4 \cdot B + 7 \cdot B^4 \cdot C^5 \cdot 36 \cdot 2 \cdot 6 \cdot 8 \cdot 94 :$

<:  $M = 0.5 < ; / 7 + C^5 / 0.30 \cdot D + 4370 > :$

8:  $I, / 7 + C^5 / 0.30 \cdot 4 + 3 \cdot 4370 > > 0.30 / + 0 \cdot C^5 < ; = 2 / = TDH \cdot 0.867 + ?0. = 0.442 \cdot 0 > \cdot = :$

2:  $M = 2 / = TDH \cdot 74 \cdot C^5 :$

7:  $M > 4867 \cdot ?0 = 0.442 \cdot 0 > 0.833 ; 73 \cdot 360 = 2 / = 2 \cdot 0.3 \cdot C^5 + ?0 \cdot D + > 4867 \cdot ?0 = 0$

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

FOR: \_\_\_\_\_  
ISSUED: 11/06/2017

- 1: R0( / 0742.0 7+> 8\*+,-. / 3673 3\*379 5730. ,9\* 5 -4 5-36+ >04-?+:
- 2: R0( / 0742.0 ,+79 =2 / =4J \*=0.73+? >737 TDH B\*934 7 / =4 7+> 4373-8 =. \*,90:
- \$: M7.C ,+79 4033+74:
- ': V0.-,; 3673 / 0 / \*. ; 43\*=4 67B0 <00+ 403:

PROCEDURES FOR VARIAB!E(F!OW HYDRONIC SYSTEMS

- A: B797+80 4;430 / 4 5-36 723\* / 73-8 35\*( 7+> 36.00(57; 8\*+3.\*9 B79B04 <; 4033+? 4;430 / 4 73 / 7E- / 2 / ,9\* 5 36.\*2?6 6073(0E867+?0 30. / -+794 7+> =.\*800> 74 4=08-,0> 7<\*B0 + 4083-\*+ \$:7 ,\*. 6;>.\*+8 4;430 / 4:

S;430 / 4 -+437990> 5-36 =.0442.0 -+>0=0+>0+3 8\*+3.\*9 B79B04 46799 +\*3 .012-.0 ,299 6;>.\*+8 4;430 / <797+8-+?: F9\* 5 46799 <0 B0.-,0> ,\*. 360 =.0442.0 -+>0=0+>0+3 B79B0 7440 / <9; "B79B0 7+> 783273\* . 8\* / <-+73-\*+## ,\*. ,09> 8\*+>-3-\*+4 24+? 360 =.0442.0 -+>0=0+>0+3 8\*+3.\*9 B79B0 / 7+2,7832.0.44 >\*82 / 0+30> =.\*80>2.0 ,\*. (063 7063 0063 \*, 360 3\*379 -+437990> =.\*>283: EE783 9\*873-\*+4 \*, 30430> =.\*>283 3\* <0 8\*\*.\*->+730> 5-36 360 >.75+?4:

PROCEDURES FOR PRIMARY(SECONDARY HYDRONIC SYSTEMS

- A: B797+80 360 =.- / 7. ; 8-.82-3 ,9\* 5 ,-.43:
- B: B797+80 360 408\*+>7. ; 8-.82-34 7,30. 360 =.- / 7. ; 8-.82-34 7.0 8\* / =9030:
- C: A>4243 =2 / =4 3\* >09B0. 3\*379 >04-?+ ?= / :

- 1: M0742.0 3\*379 5730. ,9\* 5:
  - 7: P\*4-3-\*+ B79B04 ,\*. ,299 ,9\* 5 36.\*2?6 8\*-94:
    - <: M0742.0 ,9\* 5 <; / 7+ ,9\* 5 / 030. -, -+437990>:
    - 8: I, / 7+ ,9\* 5 / 030. -4 +\*3 -+437990> >030. / +0 ,9\* 5 <; =2 / = TDH \*. 0E867+?0. =.0442.0 >.\*=:
  - 2: M0742.0 =2 / = TDH 74 ,\*99\* 54:
    - 7: \*200742+00-43DH+6686742-0=0.083  
=-.\*. 3 7#B-#F!#F> PpUq\_X9G\_ " ` pE\_ t pO9RVOM ^UaAME\_ p5cN#19 i %w q2Epq2EG q2EPN)N\_X

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

FOR: \_\_\_\_\_  
ISSUED: 11/06/2017

TESTING ADJUSTING /0STING /0ST\_

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

FOR: \_\_\_\_\_  
ISSUED: 11/06/2017

\$:1' PROCEDURES FOR MOTORS

A: M\*3\*.4 1/2 HP 7+> !7.?0.: T043 73 ,+79 <797+80> 8\*+>-3\*+4 7+> .08\* .> 360 , \*99\* 5-+? >737:

- 1: M7+2,7832.0.14 +7 / 0 / \*>09 +2 / <0. 7+> 40.-79 +2 / <0.:
- 2: M\*3\*. 6\*.40=\* 50. .73-+?:
- \$: M\*3\*. . = / :
- ': P6740 7+> 60.3G:
- 6: N7 / 0=9730 7+> / 0742.0> B\*937?0 0786 =6740:
- 7: S37.30. 4-G0 7+> 360. / 79(=. \*3083-\*+(090 / 0+3 .73-+?:
- D: S0.B-80 ,783\*. 7+> ,.7 / 0 4-G0:

B: M\*3\*.4 D.-B0+ <; V7.-7<90(F.0120+8; C\*+3. \*990.4: T043 / 7+279 <;=744 \*, 8\*+3. \*990. 3\* =. \*B0  
=. \* =0. \* =0.73-\*+:

\$:1% PROCEDURES FOR COOLING TOWERS

A: B797+80 3\*379 8\*+>0+40.(5730. ,9\* 54 3\* 3\* 50.4: M0742.0 7+> .08\* .> 360 , \*99\* 5-+? >737:

- 1: C\*+>0+40.(5730. ,9\* 5 3\* 0786 8099 \*, 360 8\*\*9-+? 3\* 50.:
- 2: E+30.-+?( 7+> 907B-+?(5730. 30 / =0.732.04:

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

FOR: \_\_\_\_\_  
ISSUED: 11/06/2017

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

FOR: \_\_\_\_\_  
ISSUED: 11/06/2017





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

FOR: \_\_\_\_\_  
ISSUED: 11/06/2017

NORTHWESTERN UNIVERSITY

PROJECT NAME \_\_\_\_\_

JOB # \_\_\_\_\_

FOR: \_\_\_\_\_

ISSUED: 11/06/2017

B: S074\*+7% P0.\*>4: I, -+3-7% TAB =.\*80>2.04 50.0 +\*3 =0., \* / 0> >2.-+? +07.(=07C 42 / / 0. 7+>  
5-+30. 8\*+>-3-\*+4 =0., \* / 7>>-3-\*+7% TAB >2.-+? +07.(=07C 42 / / 0. 7+> 5-+30. 8\*+>-3-\*+4:

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

FOR: \_\_\_\_\_  
ISSUED: 11/06/2017