HOUSTON COMMUNITY COLLEGE
STAFFORD FINE ARTS BUILDING

9910 CASH ROAD, STAFFORD, TX 77477

CHILLER REPLACEMENT PROJECT

100% CONSTRUCTION DRAWINGS
JUNE 24, 2016

Table of Contents

Texas Registered Engineering Firm F-4882

1111 N IH 35, Suite 212
Round Rock, Texas 78664
Phone: 512-256-0547
www.esa-engineers.com

HOUSTON COMMUNITY COLLEGE
STAFFORD FINE ARTS CHILLER
REPLACEMENT

COVER SHEET

STATE OF TEXAS
BRIAN P. CLARK
111337
LICENSED
PROFESSIONAL ENGINEER
6-24-2016

DATE
June 24
2016

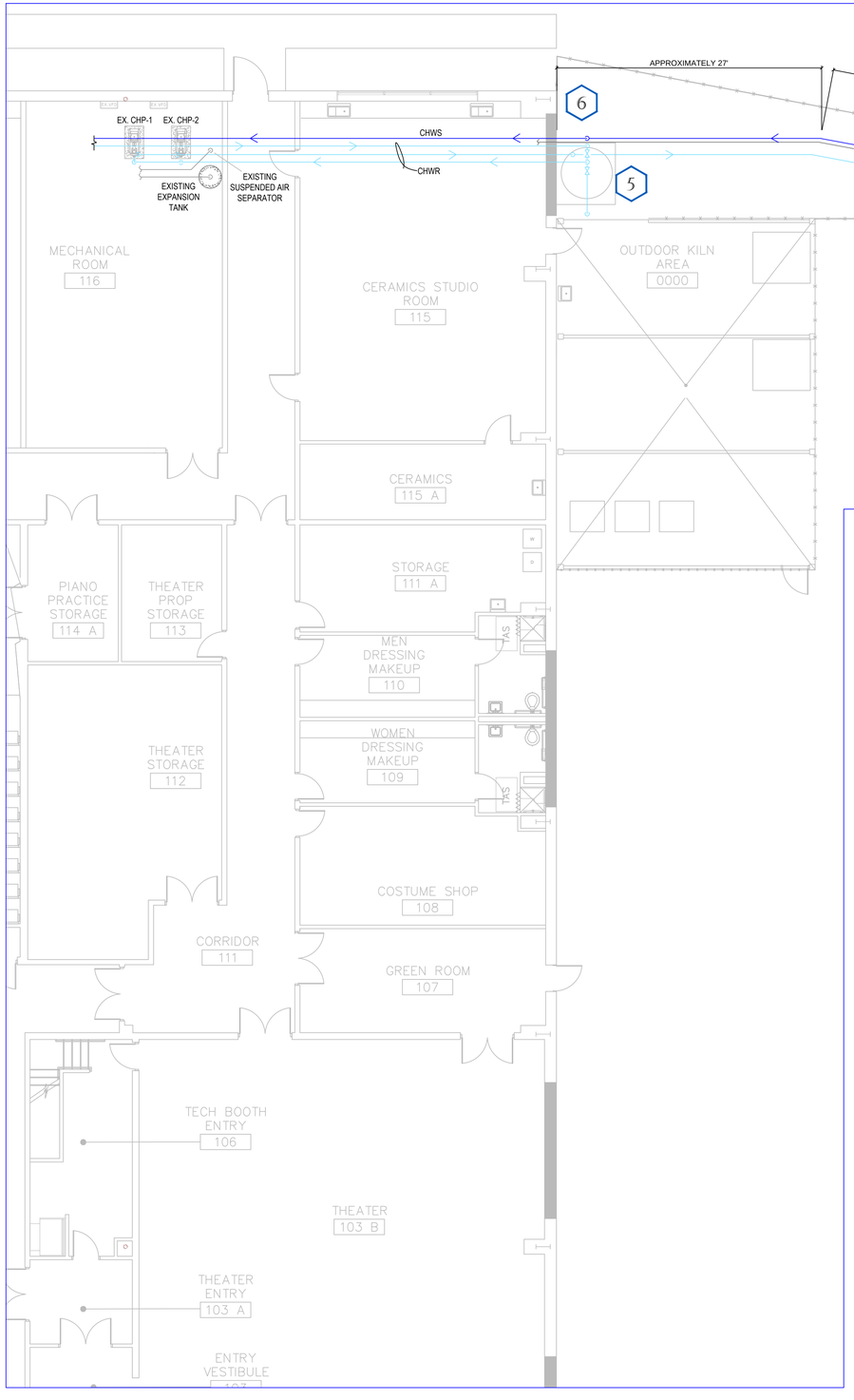
REVISIONS :

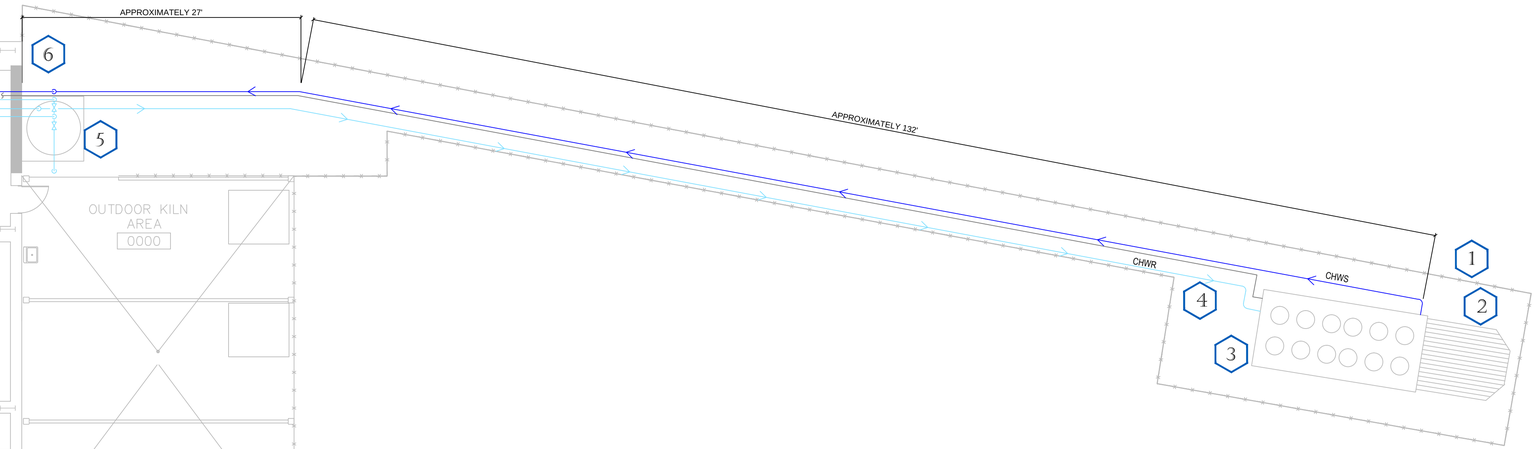
NO.	REV.	DATE
SD	CC	12-15
95% CD	CC	4.12.16
100% CD	CC / BC	6.24.16

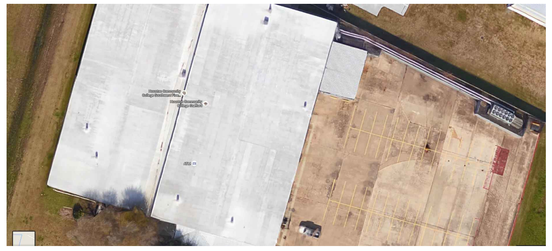
SCALE:
As noted.

SHEET INFO.

T-1







AERIAL PHOTO: EXISTING CHILLER ON TRAILER WITH CHILLED WATER SUPPLY AND RETURN PIPING

PLAN KEYED NOTES:

1. EXISTING CHAIN LINK FENCE
2. EXISTING TRACTOR TRAILER SUPPORT FOR EXISTING CHILLER
3. EXISTING TRANE CHILLER
4. EXISTING CHILLED WATER SUPPLY AND RETURN PIPING
5. EXISTING VOLUME BUFFER TANK AND PIPING
6. EXISTING CHILLED WATER SUPPLY AND RETURN PIPING PENETRATION INTO BUILDING

PHOTO: EXISTING CHILLER ON TRAILER

PHOTO: EXISTING VOLUME BUFFER TANK AND PIPING

PHOTO: EXISTING CHW PUMPS TO REMAIN

A EXISTING CHILLER PLAN

SCALE: $\frac{1}{8}$"=1'-0"

NOTE: PROJECT IS FUNDED THROUGH A PROGRAM SPONSORED BY THE AMERICAN RECOVERY AND REINVESTMENT ACT (ARRA). CONTRACTOR WILL BE REQUIRED TO CERTIFY THAT ALL EQUIPMENT SUPPLIED IN THIS PROJECT COMPLIES WITH THE REQUIREMENTS OF "BUY AMERICAN CERITIFICATION" AND WAS MANUFACTURED IN THE UNITED STATES. CONTRACTOR WILL ALSO BE RESPONSIBLE TO COMPLETE DEPARTMENT OF LABOR FORM WH347 AND WAGES PAID WILL BE FILED AS CERTIFIED PAYROLLS AND COMPLY WITH THE DAVIS BACON ACT.

1111 N IH 35, Suite 212
Round Rock, Texas 78664
Phone: 512-256-0547
www.esa-engineers.com
ESA
ENERGY SYSTEMS ASSOCIATES, INC.

HOUSTON COMMUNITY COLLEGE
STAFFORD FINE ARTS CHILLER REPLACEMENT

EXISTING CONDITIONS PLAN

STATE OF TEXAS
BRIAN P. CLARK
111337
LICENSED PROFESSIONAL ENGINEER
4/12/2016

DATE
June 24
2016

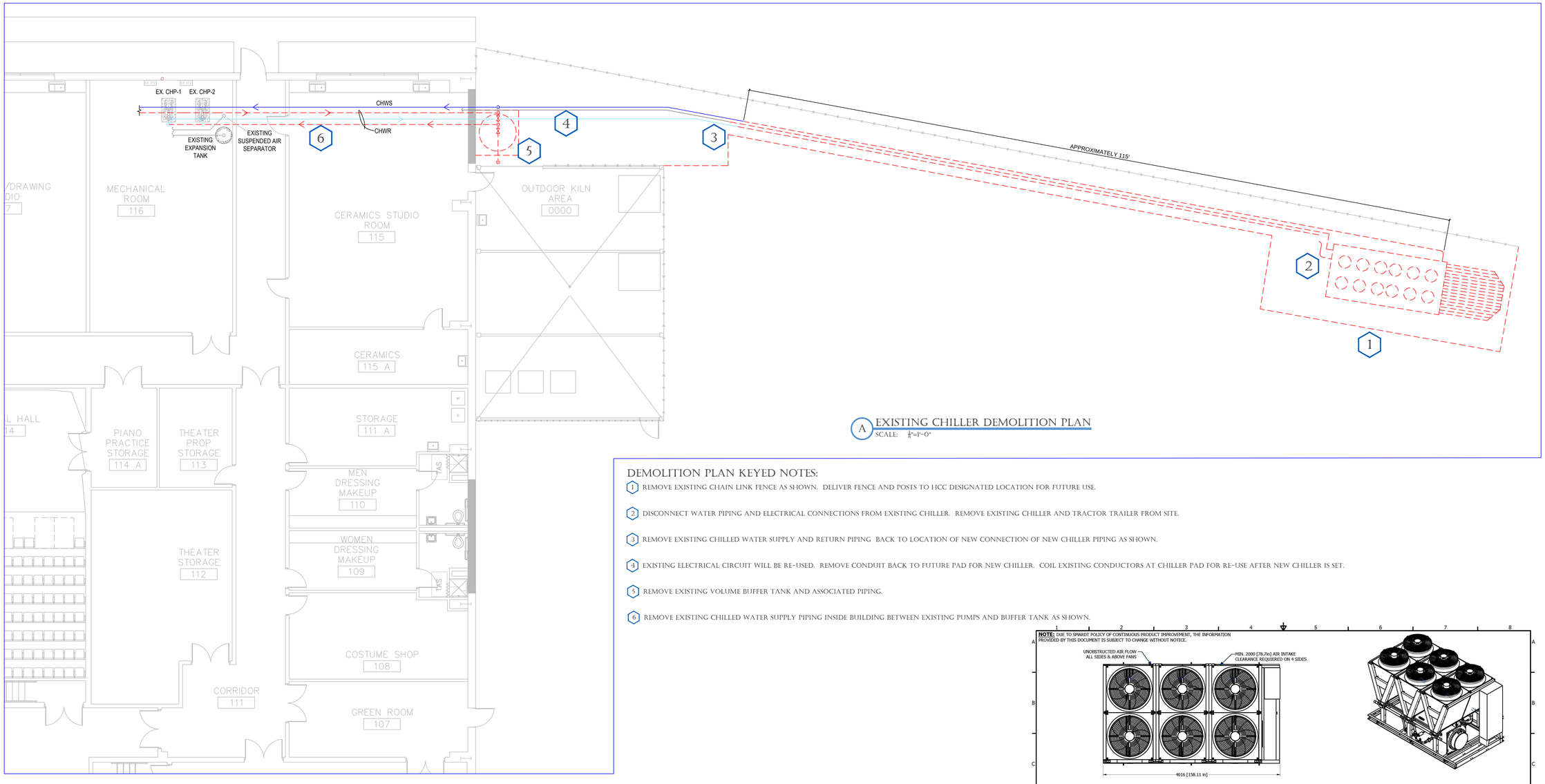
REVISIONS :

NO.	REV.	DATE
SD	CC	12-15
95% CD	CC	4.12.16
100% CD	CC / BC	6.24.16

SCALE:
As noted.

SHEET INFO.

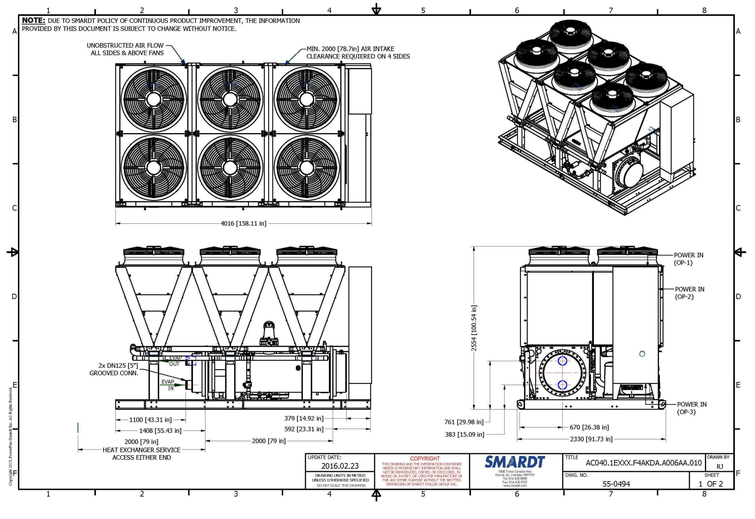
SFA-1



A EXISTING CHILLER DEMOLITION PLAN
SCALE: $\frac{1}{8}$"=1'-0"

DEMOLITION PLAN KEYED NOTES:

1. REMOVE EXISTING CHAIN LINK FENCE AS SHOWN. DELIVER FENCE AND POSTS TO HCC DESIGNATED LOCATION FOR FUTURE USE.
2. DISCONNECT WATER PIPING AND ELECTRICAL CONNECTIONS FROM EXISTING CHILLER. REMOVE EXISTING CHILLER AND TRACTOR TRAILER FROM SITE.
3. REMOVE EXISTING CHILLED WATER SUPPLY AND RETURN PIPING BACK TO LOCATION OF NEW CONNECTION OF NEW CHILLER PIPING AS SHOWN.
4. EXISTING ELECTRICAL CIRCUIT WILL BE RE-USED. REMOVE CONDUIT BACK TO FUTURE PAD FOR NEW CHILLER. COIL EXISTING CONDUCTORS AT CHILLER PAD FOR RE-USE AFTER NEW CHILLER IS SET.
5. REMOVE EXISTING VOLUME BUFFER TANK AND ASSOCIATED PIPING.
6. REMOVE EXISTING CHILLED WATER SUPPLY PIPING INSIDE BUILDING BETWEEN EXISTING PUMPS AND BUFFER TANK AS SHOWN.



A SCHEDULED CHILLER MANUFACTURER DIMENSION SCHEMATIC
SCALE: NONE

CHILLER SCHEDULE AND CHILLER SCHEDULE NOTES:

1. Chiller to be Smardt oil-free centrifugal chiller as scheduled or Engineer approved equal.
2. Chiller will conform with ANSI/UL 1995.
3. Electrical subcontractor will circuit new chiller using single-point power connection at power entry option #3 (bottom entry).
4. Control enclosures will be NEMA 3R rated for outdoor use.
5. Horizontal shell and tube heat exchangers will be ASME certified.
6. Evaporator thermal insulation will be standard $\frac{3}{4}$" thick.
7. Tubes will be high performance copper with aluminum fin condenser.
8. Fins will have 1000 hour salt spray test (ASTM B117) anti-corrosive paint coating.
9. Sheet metal and electrical panel coatings will be 1000 hour salt spray tested, compliant with ASTM B117.
10. Chiller controller will have 12" touch panel screen and internet capability.
11. Warranty to be 5 years parts and labor, including compressors and refrigerant.

EXISTING AND REPLACEMENT CHILLER SCHEDULES

Chiller	Make	Model	Serial #	Nominal Tonnage	MINIMUM LOAD (%)	REFRIGERANT	GPM MAX (gallons)	CONSTANT SPEED GPM MIN (gallons)	VARIABLE FLOW GPM MIN (gallons)	# OF FANS	FAN hp (EACH)	TOTAL AIRFLOW (CFM)	EAT (°F)	EWT (°F)	LWT (°F)	CHILLER PD (FT H2O)	# COMPRESSORS	FULL LOAD EFFICIENCY	IPLV (EER)	PPLV (EER)	ELECTRICAL	MCA	MOCP (AMPS)	UNIT LENGTH (')	UNIT WIDTH (')	UNIT HEIGHT (')	SOUND Lp dB (A) @ 3.3'
Existing	Trane	RTAC 2004 UDON UAFN NINX IDDC NN5E A10B NOEX N	U03A08128	200	15	R134A	767 MAX	215	NOT AVAILABLE	12	1.5	110,506	105	n/a	44.0	~ 11	2	1.5 kW/TON (NEW)	NOT AVAILABLE	12.9 EER (NEW)	460V / 3Ph / 60Hz	414	500	223.0	88.25	93.25	n/a
New	Smardt	AC040.1EG09.F4AKDA.A006AA.010	To Be Determined	100	NOT AVAILABLE	HFC 134a	270.00	146.8	96.3	6	1.5	85184	97	52.8	44.0	16.86	1	1.027 kW/TON	20.6	20.2	460V / 3 Ph / 60Hz	179	306	158.1	91.7	100.5	76.9

1111 N IH 35, Suite 212
Round Rock, Texas 78664
Phone: 512-256-0547
www.esa-engineers.com
ESA
ENERGY SYSTEMS ASSOCIATES, INC.

HOUSTON COMMUNITY COLLEGE
STAFFORD FINE ARTS CHILLER REPLACEMENT

EXISTING CHILLER DEMOLITION PLAN

STATE OF TEXAS
BRIAN P. CLARK
111337
LICENSED PROFESSIONAL ENGINEER
6/24/2016

DATE
June 24
2016

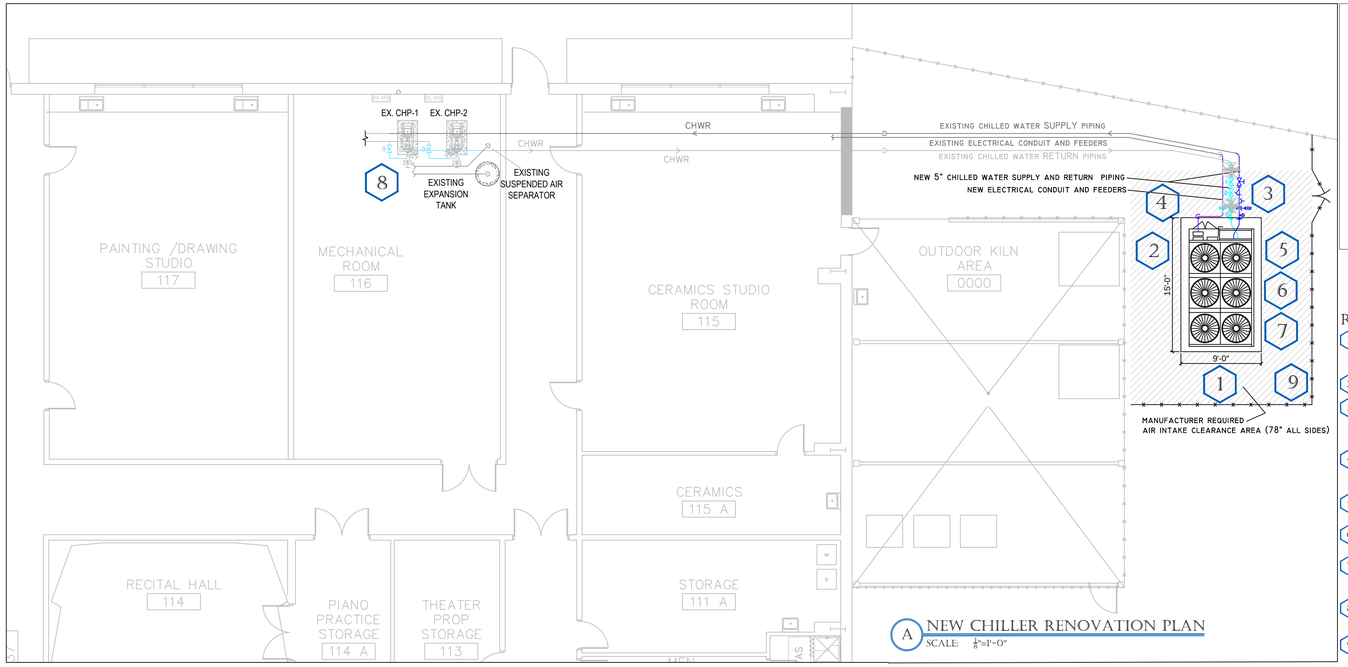
REVISIONS :

NO.	REV.	DATE
SD	CC	12-15
95% CD	CC	4.12.16
100% CD	CC / BC	6.24.16

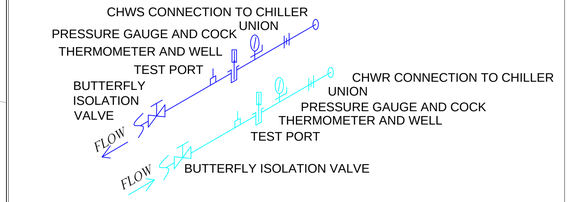
SCALE:
As noted.

SHEET INFO.

SFA-2



A NEW CHILLER RENOVATION PLAN
SCALE: 1/8"=1'-0"



B NEW CHILLER WATER PIPING CONNECTION DETAIL
NO SCALE

RENOVATION PLAN KEYED NOTES:

1. POUR NEW CHILLER MAINTENANCE PAD SO THAT FINAL DIMENSIONS ARE 9'-0" X 15'-0" X 8" PER CONCRETE MAINTENANCE PAD SPECIFICATIONS.
2. SUPPLY AND INSTALL NEW MAGNETIC BEARING CHILLER PER SCHEDULE THIS DRAWING.
3. SUPPLY AND INSTALL NEW 5" CHILLED WATER SUPPLY AND 5" RETURN PIPING (NEW CHILLER HAS 2X DN125 GROOVED CONNECTIONS), ISOLATION VALVES, TEMPERATURE AND PRESSURE GAUGES, TEST AND BALANCE TEST PORTS AS SHOWN IN DETAIL THIS DRAWING TO CONNECT NEW CHILLER TO EXISTING BUILDING SUPPLY AND RETURN PIPING. SUPPLY AND INSTALL PIPING/CONDUIT SUPPORTS (MIRO MODEL 24-BASE STRUT-18 OR ENGINEER APPROVED EQUAD WHERE INDICATED AND AS REQUIRED.
4. DETERMINE NEW REQUIRED LENGTH OF ELECTRICAL CIRCUIT FOR NEW CHILLER CONNECTION. SUPPLY AND INSTALL NEW CONDUIT TO COMPLETE TERMINATION WITH NEW CHILLER. DO NOT ALLOW NEW CONDUIT TO INTERFERE WITH CHILLER MAINTENANCE OR PANEL ACCESS.
5. PERFORM FACTORY REPRESENTATIVE CHILLER STARTUP.
6. SUPPLY AND INSTALL CONTROLLERS, CONTROL WIRING AND APPURTENANCES AS REQUIRED TO INTEGRATE NEW CHILLER INTO EXISTING ENERGY MANAGEMENT SYSTEM.
7. PERFORM HYDRONIC TEST AND BALANCE FOR NEW CHILLER. EXISTING PUMPS ARE DESIGNED FOR 324 GPM AT 70' HEAD. EXISTING PUMPS SHALL BE BALANCED DOWN TO 270 GPM MAXIMUM FLOW, 100 GPM MINIMUM FLOW BY THROTTLING ISOLATION VALVES AND SETTING MIN/MAX VFD SPEEDS.
8. CONNECT EXISTING CHILLED WATER PUMP PIPING AS SHOWN TO EXISTING RETURN PIPING AFTER REMOVING EXISTING VOLUME BUFFER TANK PIPING. CONTRACTOR TO INCORPORATE EXISTING PUMP CONTROL AS LEAD-LAG OPERATION PER SEQUENCE OF OPERATIONS THIS DRAWING.
9. CONTRACTOR TO SUPPLY AND INSTALL NEW 6 FOOT HIGH CHAIN LINK FENCE, AND DOUBLE 36 INCH WIDE CHAIN LINK GATE TO CLOSE OPENING AT FENCED STORAGE AREA AND CHILLER YARD AFTER INSTALLATION OF NEW CHILLER.

VARIABLE VOLUME CHILLED WATER PUMPS

1) Run Conditions:
   a. The chilled water pump shall be controlled to run anytime the chillers are called to run.
   b. The pump shall run for freeze protection anytime the outside air temperature is less than 38°F (adj.).
   c. Alarms shall be provided as follows:
      i. Pump Failure: The pump status is off 2 minutes (adj.) after being commanded on.
      ii. Pump Running in Hand: The pump status is on 2 minutes (adj.) after being commanded off.
      iii. Pump Runtime Exceeded: Status runtime exceeds a User-definable limit.
      iv. Pump VFD Fault: Pump VFD is reporting an error.
2) Chilled Water Pump Start / Stop Sequence
   a. When the chilled water system is activated, the BAS will start the chilled water pump.
   b. If the lead pump fails to start, the BAS shall activate the Pump Failure alarm and attempt to start the lag pump.
   b. The pump shall have a User-adjustable delay on stop. The pump shall continue to run for 5 minutes (adj.) after the chillers have been commanded off and the chiller status is proven off.
3) Chilled Water Pump Lead/Lag Operation:
   a. The designated lead pump shall rotate upon one of the following conditions (User-selectable):
      i. Manually through a software switch.
      ii. If pump runtime (adj.) is exceeded.
      iii. Daily, weekly, or monthly.
4) Chilled Water Pump Speed Control
   a. The BAS shall monitor the chilled water system differential pressure sensor, mounted on the building chilled water supply and return lines, 2/3 the distance of the longest piping run. The BAS shall adjust the chilled water pump VFD speed to maintain the chilled water system differential pressure at 12 psi (adj.). The pump VFD shall be controlled to operate between a maximum speed of 60 Hz (adj.) and a minimum speed of 20 Hz (adj.). The differential pressure setpoints and pump speed shall be field-adjusted during the commissioning period to meet the requirements of actual field conditions.
   b. The differential pressure setpoint shall be reset using a trim and respond algorithm based on cooling coil valve positions throughout the facility as follows.
      i. If 2 (adj.) or more chilled water coil valves are at a position of 100%, the differential pressure setpoint shall incrementally increase until all valves are at a position of 90% open (adj.) or less, up to a maximum differential pressure of 12 psi (adj.)
      ii. If all chilled water coil valves are at a position of 80% open (adj.) or less, the differential pressure setpoint shall incrementally decrease until one or more valves reach a position of 90% open (adj.), down to a minimum differential pressure of 5 psi (adj.).
   c. Alarms shall be provided as follows:
      i. High System Differential Pressure: The chilled water system differential pressure is 25% (adj.) greater than setpoint.
      ii. Low System Differential Pressure: The chilled water system differential pressure is 25% (adj.) less than setpoint.
5) Pump Differential Pressure Monitoring:
   a. The BAS shall monitor the differential pressure between the pump suction and discharge.
   b. Alarms shall be provided as follows:
      i. High Pump Differential Pressure: The pump differential pressure is greater than a User-definable amount.

Variable Volume CHW Pump Points Summary
Typical of Each CHW Plant

Point Name	Point Type AI	DI	AO	DO	Show on Graphic
System Differential Pressure	X				X
Pump 1 Differential Pressure	X				X
Pump 2 Differential Pressure	X				X
Lead Pump Selection				X	X
Pump Start/Stop				X	X
Pump VFD Speed			X		X
Pump Amps / Run Status	X				X
Pump VFD Fault		X			X
Totals	4	1	1	2	
	8				

Additional Settings and Statuses to Show on Graphic
Current Differential Pressure Setpoint
Current Schedule Status (Enabled or Disabled)
Active Program Overrides
Active Alarms

Alarms
High System Differential Pressure
Low System Differential Pressure
High Pump Differential Pressure
Pump Failure
Pump Running in Hand
Pump VFD Fault
Pump Runtime Exceeded
Site Emergency
Network Emergency

Adjustable Control Settings (At Minimum)	Initial Setting
Disabled/Disabled Scheduling	Chiller Interlock
System Differential Pressure Setpoint	12 PSI
Differential Pressure Setpoint Reset Settings	SEE SEQUENCE
Maximum Pump VFD Speed	60 Hz
Minimum Pump VFD Speed	20 Hz
Start Delay Time	2 minutes
Stop Delay Time	5 minutes
Maximum Run Time / Off-Time	Not set
Lead Pump Selection Settings	Daily Rotation
Freeze Protection Enable	Below 38°F
Pump Enable/Disable Override	AUTO

C CHILLED WATER PUMP NEW SEQUENCE OF OPERATIONS
NO SCALE

AIR-COOLED CHILLERS

1) Run Conditions:
   a. The chillers shall be enabled to run by a User-defined enable/disable time schedule.
   b. After being enabled by the time schedule, the chillers and chilled water pump shall stop if no chilled water coils have requested cooling for a period of 1 hour (adj.). The chillers and chilled water pump shall re-start if 1 (adj.) or more chilled water coils request cooling AND the chillers are still enabled by the time schedule.
   c. To prevent short cycling, the chillers shall run for and be off for a minimum period of 15 minutes each (adj.), unless shutdown on safeties.
   d. Each chiller shall run subject to its own internal safeties and controls. A BACNET control interface shall be provided by the chiller manufacturer to allow the BAS to monitor and/or control chiller status and functions remotely. When a chiller is in alarm, a chiller alarm shall be displayed at the HMI.
   e. Alarms shall be provided as follows:
      i. Chiller Failure: The chiller status is off 2 minutes (adj.) after being commanded on.
      ii. Chiller Running in Hand: The chiller status is on 2 minutes (adj.) after being commanded off.
      iii. Chiller Runtime Exceeded: Status runtime exceeds a User definable limit.
      iv. Manual Reset / Auto Reset Chiller Alarm: Chiller is reporting an internal alarm.
2) Chiller Start / Stop Sequence
   a. When the chilled water system is activated, the BAS will start the chilled water pump. Once chilled water flow has been proven by the chiller flow switch, the chiller will start and maintain the leaving water temperature at setpoint by its own internal controls.
   b. The chillers shall have a User-adjustable delay on start. The delay shall prevent the chillers from starting until 5 minutes (adj.) after the pump has been commanded to start.
   c. When the chilled water system is deactivated, the BAS will stop the chillers. After the chillers have been commanded off for 5 minutes (adj.) and the chiller status is proven off, the BAS will stop the chilled water pump.
   d. Alarms shall be provided as follows:
      i. Chilled Water Flow Failure: No flow is detected 30 seconds (adj.) after the chillers are commanded to run.
3) Chiller Monitoring: The BAS shall monitor the loading of the chillers including the current percent of full-load capacity and amperage. The BAS shall also monitor the on/off status of each compressor.
4) Chilled Water Temperature Monitoring:
   a. The entering water temperature and leaving water temperature of each chiller shall be monitored.
   b. The building chilled water supply and return temperatures shall be monitored.
   c. Alarms shall be provided as follows:
      i. Low Chiller Leaving Water Temp: The chiller leaving water temperature is less than 38°F (adj.) while the chiller is running. Disable the chiller until the alarm is manually reset. The chilled water pump shall continue to run until the leaving water temperature rises above 40°F (adj.).
      ii. High Chiller Leaving Water Temp: The chiller leaving water temperature is greater than 55°F (adj.) for 15 minutes (adj.) while the chiller is running.
      iii. Low Chilled Water Supply Temp: The temperature of the chilled water supply to the building is less than 38°F (adj.) while the chiller is running. Disable the chiller until the alarm is manually reset. The chilled water pump shall continue to run until the leaving water temperature rises above 40°F (adj.).
      iv. High Chilled Water Supply Temp: The temperature of the chilled water supply to the building is greater than 55°F (adj.) for 15 minutes (adj.) while the chiller is running.
5) Chilled Water Supply Temperature Setpoint Reset: The chilled water supply temperature setpoint shall be allowed to reset based on a correlation to the outside ambient temperature. The chilled water supply temperature setpoint shall incrementally increase from a minimum setpoint of 42°F (adj.) at 80°F (adj.) OAT, up to a maximum of 48°F (adj.) at 40°F (adj.) OAT.

Air-Cooled Chiller Points Summary
Typical of Each Chiller

Point Name	Point Type AI	DI	AO	DO	Show on Graphic
Chiller Leaving Water Temp.	X				X
Chiller Entering Water Temp.	X				X
CHW Supply Temp Setpoint			X		X
Building CHWS Temperature	X				X
Building CHWR Temperature	X				X
Chilled Water Flow Status		X			X
Chiller Enable/Disable				X	X
Chiller % Full Load	X				X
Chiller Amps	X				X
Compressor Status		X			X
Manual Reset Alarm		X			
Auto Reset Alarm		X			
Totals	6	4	1	1	
	12				

Additional Settings and Statuses to Show on Graphic
Current Schedule Status (Enabled or Disabled)
Active Program Overrides
Active Alarms

Alarms
High Chiller Leaving Water Temperature
Low Chiller Leaving Water Temperature
High Chilled Water Supply Temperature (Building)
Low Chilled Water Supply Temperature (Building)
Chiller Failure
Chiller Running in Hand
Chiller Runtime Exceeded
Chilled Water Flow Failure
Chiller Manual Reset Internal Alarm
Chiller Auto Reset Internal Alarm

Adjustable Control Settings (At Minimum)	Initial Setting
Enabled/Disabled Scheduling	SEE SCHEDULES
Chilled Water Supply Temperature Setpoint	44°F
CHW Supply Temperature Setpoint Reset Settings	SEE SEQUENCE
Chiller Start Delay Time	5 minutes
Chiller Stop Delay Time	6 minutes
Maximum Chiller Run Time / Off-Time	15 minutes
No. of Cig Requests Required to Maintain Operation	1
Chiller Plant Stop Delay Upon Zero Cooling Requests	1 hour
OFF Lockout	Not set
Chiller Enable/Disable Override	AUTO

D NEW AIR-COOLED CHILLER SEQUENCE OF OPERATIONS
NO SCALE

1111 N IH 35, Suite 212
Round Rock, Texas 78664
Phone: 512-256-0547
www.esa-engineers.com
ESA ENERGY SYSTEMS ASSOCIATES, INC.

HOUSTON COMMUNITY COLLEGE
STAFFORD FINE ARTS CHILLER REPLACEMENT

NEW CHILLER RENOVATION PLAN

STATE OF TEXAS
BRIAN P. CLARK
111337
LICENSED PROFESSIONAL ENGINEER
6/24/2016

DATE
June 24
2016

REVISIONS :

NO.	REV.	DATE
SD	CC	12-15
95% CD	CC	4.12.16
100% CD	CC / BC	6.24.16

SCALE:
As noted.

SHEET INFO.

SFA-3