NORTHERN ARIZONA UNIVERSITY

COLLEGE OF SOCIAL & BEHAVIORAL SCIENCES
BUILDING 65 - SBS
5 E. McCONNEL DRIVE
FLAGSTAFF, ARIZONA 86011

HEAT EXCHANGER REPLACEMENT
NAU PROJECT NO. 09.650.191 - C900092

PERMIT DRAWINGS 12/28/2018

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DESIGN CRITERIA

APPLICABLE CODES

ACCESSIBILITY (ADA)	2010
INTERNATIONAL EXISTING BUILDING CODE (IEBC)	2012
INTERNATIONAL BUILDING CODE (IBC)	2012
INTERNATIONAL MECHANICAL CODE (IMC)	2012
NATIONAL ELECTRICAL CODE (NEC) (NFPA 70)	2011
INTERNATIONAL PLUMBING CODE (IPC)	2012
INTERNATIONAL FUEL GAS CODE (IFGC)	2012
INTERNATIONAL FIRE CODE (IFC)	2012
NATIONAL FIRE ALARM CODE (NFPA 72)	2013
INSTALLATION OF SPRINKLER SYSTEMS (NFPA 13)	2013

OTHER CRITERIA

COMPLY WITH NAU DESIGN GUIDELINES AND TECHNICAL STANDARDS	2018
NAU FIRE CODE	2018

SCHEDULE OF DRAWINGS

GENERAL

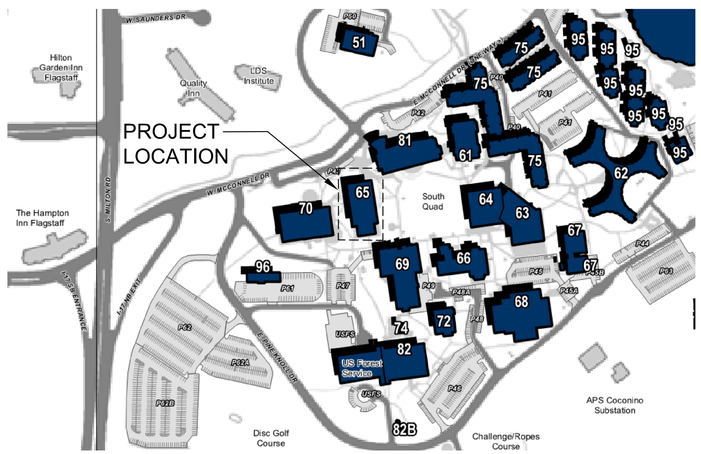
MECHANICAL

SCOPE OF WORK:

THE SCOPE OF THE PROJECT FOR SBS CASTRO HEAT EXCHANGER REPLACEMENT IS AS FOLLOWS:

1. HEATING WATER SYSTEM CAPACITY CALCULATIONS BASED UPON ORIGINAL CONSTRUCTION DOCUMENTS DATED 1969 AND RENOVATION CONSTRUCTION DOCUMENTS DATED 1989 TO ESTIMATE HEATING WATER SYSTEM DEMAND (GPM AND BTUH).
2. SIZING AND SELECTION OF HIGH TEMPERATURE HEATING WATER (HTHW) TO HEATING WATER (HW) SHELL AND TUBE HEAT EXCHANGER. ADD 20% CAPACITY FOR FUTURE GROWTH.
3. DEMOLITION OF EXISTING EQUIPMENT, PIPING AND SUPPORTS AS REQUIRED FOR NEW WORK.
4. HIGH TEMPERATURE SIDE OF HEAT EXCHANGER:
   - A. NEW ISOLATION VALVES WITH DOUBLE VALVE PROTECTION
   - B. NEW BY-PASS VALVE
   - C. NEW MODULATING CONTROL VALVE (LINEAR - GLOBE) (BELIMO ACTUATOR)
   - D. NEW STRAINER
   - E. NEW FLOW CONTROL VALVE
   - F. NEW DRAIN VALVE
   - G. NEW PRESSURE RELIEF VALVE ON HEAT EXCHANGER
5. LOW TEMPERATURE SIDE OF HEAT EXCHANGER:
   - A. NEW ISOLATION VALVES
   - B. NEW TEMPERATURE AND PRESSURE GAUGES
   - C. NEW DRAIN VALVE
6. DRAWINGS AND SHEET SPECIFICATIONS

LOCATION MAP:



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Project No. 20180782

CONSULTANTS

REGISTERED PROFESSIONAL ENGINEER
44759
KEVIN M. KOSOR
Date Signed 12/28/18
ARIZONA, U.S.A.
EXPIRES 06/30/21

NORTHERN ARIZONA UNIVERSITY

HEAT EXCHANGER REPLACEMENT

COLLEGE OF SOCIAL & BEHAVIORAL SCIENCES
BUILDING 65 - SBS
FLAGSTAFF CAMPUS

FLAGSTAFF, ARIZONA 86011

Mark	Date	Description

ISSUE:	PERMIT SET
DATE:	12/28/2018
SCALE:	NONE
NAU PROJ. NO:	09.650.191-C900092
SE PROJECT NO:	20180782
DRAWN BY:	RAB
CHECKED BY:	KMK
DESIGNED BY:	KMK
RECORD DRAWING DATE: SIGNATURE:	

SHEET TITLE

COVER SHEET

GE001

PERMIT SET

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MECHANICAL SPECIFICATIONS

230000 – HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

PART 1 – GENERAL

N/A

PART 2 - PRODUCTS

QUALITY ASSURANCE

THE SELECTION OF PRODUCTS OR SERVICE COMPANIES SHALL BE FROM THOSE FIRMS WHOSE PRODUCTS OR SERVICES HAVE PROVEN SATISFACTORY IN SIMILAR SERVICE FOR NOT LESS THAN THREE YEARS. REPAIR OR REPLACEMENT PARTS, OR REQUIRED SERVICE, SHALL BE READILY AVAILABLE, AND THE SUPPLIER OF PRODUCTS OR SERVICES SHALL HAVE A PROVEN TRACK RECORD OF RESPONSE TO COMPLAINTS OR PROBLEMS DURING, AND AFTER, THE WARRANTY PERIOD.

ALL PARTS OR PRODUCTS SHALL BE OF COMMERCIAL OR INDUSTRIAL QUALITY, AND SHALL BE SUITABLE FOR HEAVY-DUTY USE.

PART 3 – EXECUTION

QUALITY ASSURANCE

EXPERIENCED, QUALIFIED PERSONNEL SHALL BE ON THE JOB. EXPERIENCE AND QUALIFICATIONS ARE DEFINED BY THREE YEARS OF EXPERIENCE IN INSTALLATION OF SIMILAR EQUIPMENT ON SIMILAR PROJECTS. ALL SUBCONTRACTORS SHALL HAVE A PROVEN TRACK RECORD OF RESPONSE TO COMPLAINTS OR PROBLEMS DURING AND AFTER THE WARRANTY PERIOD. PROOF OF EXPERIENCE IS REQUIRED BEFORE THE START OF WORK.

1 COORDINATION

COORDINATE INSPECTIONS WITH NAU HVAC AND DOCUMENT INSPECTION APPROVAL'S ON FORM FS-15. CALL 928.523.4227 TO SCHEDULE INSPECTIONS 48 HOURS IN ADVANCE.

DESIGN DOCUMENT REQUIREMENTS

LOCATIONS AND SIZES OF MAJOR HVAC EQUIPMENT, INCLUDING FANS, AIR HANDLERS, PUMPS, HEAT EXCHANGERS AND STEAM CONTROL STATIONS WILL BE SHOWN ON THESE DRAWINGS ALONG WITH ELECTRICAL EQUIPMENT AND PANELS. MECHANICAL FLOOR LAYOUT DRAWINGS WILL DEMONSTRATE CODE CLEARANCES ALONG WITH MAINTENANCE AND SERVICE ACCESS.

THE DESIGN PROFESSIONAL SHALL PROVIDE A PROCESS AND INSTRUMENTATION DIAGRAM DRAWING AT CONSTRUCTION DOCUMENTS DEPICTING ALL PRESSURE GAUGES, THERMOMETERS AND FLOW METERS REQUIRED FOR THE PROJECT. INCLUDED ON THIS DRAWING SHALL BE ACTUAL DESIGN FLOWS PRESSURES AND TEMPERATURES FOR EACH AND EVERY SYSTEM.

SUBMITTAL INFORMATION AND CLOSEOUT MATERIALS

SEQUENCE OF CONTROL DIAGRAMS SHALL BE REQUIRED TO BE SUBMITTED WITHIN 21 DAYS OF NOTICE TO PROCEED.

PROVIDE SHOP DRAWINGS AND PRODUCT DATA PRIOR TO START OF CONSTRUCTION AS APPLICABLE FOR THE FOLLOWING:

- EQUIPMENT ROOM LAYOUTS, DRAWN TO SCALE, SHOWING ALL EQUIPMENT, PIPING AND ACCESSORIES AND CLEARANCES FOR OPERATION AND SERVICING.

PROVIDE SUBMITTAL INFORMATION INCLUDING EQUIPMENT CUT SHEETS FOR AT A MINIMUM, THE FOLLOWING COMPONENTS AND EQUIPMENT:

- ALL HVAC EQUIPMENT INCLUDING BOILERS, HEAT EXCHANGERS, PUMPS, TANKS, VALVES, HANGERS, AIR HANDLERS, FILTERS, LOUVERS AND DAMPERS, RELIEF VALVES, STRAINERS, TRAPS AND DRIP LEGS, ETC. ALL TERMINAL EQUIPMENT INCLUDING VOLUME CONTROL BOXES, REGISTERS, GRILLS, DIFFUSERS, ETC.
- DESIGN CURVES AND CHARACTERISTICS OF FANS, BLOWERS AND PUMPS.
- CONTROL DIAGRAMS AND SEQUENCE OF OPERATIONS FOR ALL HVAC EQUIPMENT.
- HVAC AND MOTOR CONTROL WIRING OR PNEUMATIC DIAGRAMS.
- EXPANSION LOOPS, JOINTS, GUIDES, AND ANCHORS.
- FOUNDATIONS, SUPPORTS, HANGERS AND INSERTS.
- INSULATION MATERIALS AND FINISHES, DUCT AND PIPING.
- MECHANICAL IDENTIFICATION.
- CONVERTERS WITH SADDLES AND RELIEF VALVES.
- GAUGES AND THERMOMETERS.
- FLOW FITTINGS.
- TEMPERATURE CONTROL EQUIPMENT, SCHEMATICS AND DIAGRAMS.
- PANEL BOARDS, GAUGES AND THERMOMETERS.
- PRESSURE TESTING PROCEDURE

PROVIDE ATTIC STOCK AS APPLICABLE FROM THE FOLLOWING:

- TWO (2) SETS KEYS/WRENCHES FOR ANY COVERS.
- CHEMICAL TEST KITS AS APPROPRIATE.
- ONE (1) EXTRA SET OF FILTERS.
- ONE (1) SET OF ANY PROPRIETARY TROUBLE SHOOTING, MAINTENANCE TOOLS, OR SPECIALTY TOOLS.
- TWO (2) COPIES ANY PROPRIETARY COMPUTER SOFTWARE FOR SYSTEMS CONTROL, PROGRAM BACK-UP, TROUBLESHOOTING OR MAINTENANCE.
- REFERENCE OWNER FORM FS #76 – ATTIC STOCK, WARRANTY, AS-BUILT LOG FOR ADDITIONAL REQUIREMENTS.

PROVIDE MANUFACTURER'S CERTIFICATES OR TEST RESULTS FOR THE FOLLOWING:

- AIR/WATER BALANCE REPORTS.
- HEAT EXCHANGERS.
- CHEMICAL TREATMENT PRODUCTS, APPLICATION LIMITS, TEST METHODS, AND APPARATUS.
- GLYCOL MIXING FORMULA.
- BACKFLOW PREVENTERS (PER R18-4-232).
- HYDRONICS BALANCING.

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OTHER CLOSEOUT REQUIREMENTS TO PROVIDE:

- 1 - 3 DAY START-UP TRAINING AS APPLICABLE (COORDINATED WITH FACILITY SERVICES.) TO BE VIDEOTAPED BY THE UNIVERSITY.
- VALVE TAG INDEX MOUNTED UNDER RIGID CLEAR PROTECTION IN THE MECHANICAL ROOM(S) AND DIAGRAM SUBMITTED WITH THE O & M MANUALS.
- HARD COPIES OF ALL CONTROL CODES AND SEQUENCE OF OPERATIONS.

WARRANTY

OWNER'S STANDARD 2-YEAR WARRANTY. REFERENCE OWNER FORM FS #76 – ATTIC STOCK, WARRANTY, AS-BUILT LOG FOR ADDITIONAL REQUIREMENTS.

MECHANICAL SPECIFICATIONS

SUBSTITUTIONS

SUBSTITUTIONS OF MATERIALS OR PRODUCTS SHOWN HEREIN SHALL BE AT THE OWNER'S, ARCHITECTS, OR ENGINEER'S WRITTEN APPROVAL ONLY WITH COPIES OF APPROVAL SENT TO THE PROJECT FILE. ANY DEVIATION FROM THESE DRAWINGS WILL NOT BE ALLOWED. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATION OF ANY SUBSTITUTIONS AND COSTS OF CHANGES INCURRED BY OTHER TRADES DUE TO THE SUBSTITUTIONS. OTHER TRADES INCLUDE: ELECTRICAL, PLUMBING, STRUCTURAL, ROOFING, OR ANY TRADE EFFECTED BY THE SUBSTITUTION.

GUARANTEE

THE CONTRACTOR SHALL GUARANTEE ALL MATERIALS, EQUIPMENT AND WORKMANSHIP FROM DEFECT OF WORKMANSHIP, AND SHALL REPLACE OR REPAIR WITHOUT ADDITIONAL COST TO THE OWNER ALL DEFECTIVE MATERIAL AND WORKMANSHIP, FOR A PERIOD OF (1) YEAR AFTER COMPLETION AND ACCEPTANCE.

DEFINITIONS

NOTE: ALL DEFINITIONS MAY NOT BE USED.

INDICATED: THE TERM "INDICATED" REFERS TO GRAPHIC REPRESENTATIONS, NOTES, OR SCHEDULES ON THE DRAWINGS, OTHER PARAGRAPHS OR SCHEDULES IN THE SPECIFICATIONS, AND SIMILAR REQUIREMENTS IN THE CONTRACT DOCUMENTS. WHERE TERMS SUCH AS "SHOWN", "NOTED", "SCHEDULED", AND "SPECIFIED" ARE USED, IT IS TO HELP THE READER LOCATE THE REFERENCE, NO LIMITATION ON LOCATION IS INTENDED.

DIRECTED: TERMS SUCH AS "DIRECTED", "REQUESTED", AUTHORIZED", "SELECTED", "APPROVED", "REQUIRED", AND "PERMITTED" MEAN "DIRECTED BY THE ENGINEER", "REQUESTED BY THE ENGINEER", AND SIMILAR PHRASES.

APPROVE: THE TERM "APPROVED", WHERE USED IN CONJUNCTION WITH THE ENGINEER'S ACTION ON THE CONTRACTOR'S SUBMITTALS, APPLICATIONS, AND REQUESTS, IS LIMITED TO THE ENGINEER'S DUTIES AND RESPONSIBILITIES AS STATED IN GENERAL AND SUPPLEMENTARY CONDITIONS.

FURNISH: THE TERM "FURNISH" IS USED TO MEAN "SUPPLY AND DELIVER TO THE PROJECT SITE, READY FOR UNLOADING, UNPACKING, ASSEMBLY, INSTALLATION, AND SIMILAR OPERATIONS."

INSTALL: THE TERM "INSTALL" IS USED TO DESCRIBE OPERATIONS AT PROJECT SITE INCLUDING THE ACTUAL "UNLOADING, UNPACKING, ASSEMBLY, ERECTION, PLACING, ANCHORING, APPLYING, WORKING TO DIMENSION, FINISHING, CURING, PROTECTING, CLEANING, AND SIMILAR OPERATIONS TO MAKE THE ITEM FULLY OPERATIONAL."

PROVIDE: THE TERM "PROVIDE" MEANS "TO FURNISH AND INSTALL, COMPLETE AND READY FOR THE INTENDED USE."

INSTALLER: AN "INSTALLER" IS THE CONTRACTOR OR AN ENTITY ENGAGED BY THE CONTRACTOR, EITHER AS AN EMPLOYEE, SUBCONTRACTOR, OR SUB-SUBCONTRACTOR, FOR PERFORMANCE OF A PARTICULAR CONSTRUCTION ACTIVITY, INCLUDING INSTALLATION, ERECTION, APPLICATION, AND SIMILAR OPERATIONS. INSTALLERS ARE REQUIRED TO BE EXPERIENCED IN THE OPERATIONS THEY ARE ENGAGED TO PERFORM.

ABBREVIATIONS

NOTE: ALL ABBREVIATIONS MAY NOT BE USED

AD	ACCESS DOOR	MCA	MINIMUM CIRCUIT AMPS
AIR	AIR CONDITION(-ING,-ED)	MFR	MANUFACTURER
COND		MIN	MINIMUM
APD	AIR PRESSURE DROP	N/A	NOT APPLICABLE
BD	BALANCING DAMPER	NC	NORMALLY CLOSED
BHP	BRAKE HORSE POWER	NC	NOISE CRITERIA
BTU	BRITISH THERMAL UNIT	NIC	NOT IN CONTRACT
BTUH	BTU/HOUR	NO	NORMALLY OPEN
CFH	CUBIC FEET PER HOUR	NPSH	NET POSITIVE SUCTION
CFM	CUBIC FEET PER MINUTE		HEAD
CLG	COOLING	NTS	NOT TO SCALE
COMP	COMPONENT	OA	OUTSIDE AIR
COND	CONDENS(-ER, -ING, -ATION)	OD	OUTSIDE DIAMETER
		OZ	OUNCE
CV	CONTROL VALVE	PCW	PROCESSED CHILLED WATER
CW	COLD WATER		
DIA	DIAMETER	PCWR	PROCESSED CHILLED WATER RETURN
DISCH	DISCHARGE		
DP	DEPTH OR DEEP	PH	PHASE
DB	DRY BULB TEMPERATURE	PPM	PARTS PER MILLION
(E)	EXISTING	PRESS	PRESSURE
ER	ENERGY EFFICIENCY RATIO	PSF	POUNDS PER SQUARE FOOT
EFF	EFFICIENCY		
EG	ETHYLENE GLYCOL	PSI	POUNDS PER SQUARE INCH
ELEC	ELECTRIC		
ELEV	ELEVATION	PSIA	PSI ABSOLUTE
ENT	ENTERING	PSIG	PSI GAUGE
EVAP	EVAPORAT(-E, -ING, -ED, -OR)	R	THERMAL RESISTANCE
		RA	RETURN AIR
EWT	ENTERING WATER TEMPERATURE	RECIRC	RECIRCULATE
		REFR	REFRIGERATION
EXT	EXTERNAL	REQD	REQUIRED
(F)	FUTURE	RLA	RATED --- AMPS
F	FAHRENHEIT	RPM	REVOLUTIONS PER MINUTE
FC	FLEXIBLE CONNECT(-OR, -ION)	RW	RAINWATER
		SA	SUPPLY AIR
FD	FIRE DAMPER	SC	SHADING COEFFICIENT
FLA	FULL LOAD AMPS	SCFM	STANDARD CUBIC FEET PER MINUTE
FPI	FINS PER INCH		
FPM	FEET PER MINUTE	SCW	SOFT COLD WATER
FPS	FEET PER SECOND	SF	SAFETY FACTOR
FSD	FIRE SMOKE DAMPER	SH	SENSIBLE HEAT
FT	FEET	SL	SEA LEVEL
GAL	GALLON(S)	SP	STATIC PRESSURE
GPH	GALLONS PER HOUR	SPECS(S)	SPECIFICATION(S)
GPM	GALLONS PER MINUTE	SQ	SQUARE
HD	HEAD	STD	STANDARD
HG	MERCURY	STM	STEAM
HR	HOUR	TEMP	TEMPERATURE
HT	HEIGHT	TD	TEMP. DROP OR DIFF.
HTG	HEATING	THERM	THERMAL
HP	HORSE POWER	TOT	TOTAL
HW	HOT WATER	TSTAT	THERMOSTAT
HTHW	HIGH TEMPERATURE HOT WATER	V	VOLT
		VAC	VACUUM
HZ	HERTZ(FREQUENCY)	VAV	VARIABLE AIR VOLUME
ID	INSIDE DIAMETER	VEL	VELOCITY
IN	INCH	VENT	VENT, VENTILATION
KW	KILOWATT	VERT	VERTICAL
LAT	LEAVING AIR TEMPERATURE	VFD	VARIABLE FREQUENCY DRIVE
LBS	POUNDS		
LG	LENGTH	VOL	VOLUME
LH	LATENT HEAT	WC	WATER COLUMN
LRA	LOCKED ROTOR AMPS	WG	WATER GAUGE
LVG	LEAVING	WPD	WATER PRESSURE DROP
LWT	LEAVING WATER TEMPERATURE	WTR	WATER
		WT	WEIGHT
MAX	MAXIMUM	WB	WET BULB TEMP
MBH	THOUSAND BTU PER HOUR	YR	YEAR

SYMBOL LEGEND

SYMBOL	DESCRIPTION
REFERENCE AND LINE SYMBOLS	
	DETAIL INDICATOR: # INDICATES DETAIL NUMBER, SHEET INDICATES DRAWING SHEET WHERE DETAIL IS SHOWN.
	ELEVATION OR SECTION INDICATOR, EXTERIOR: # INDICATES ELEVATION OR SECTION NUMBER, SHEET INDICATES DRAWING SHEET WHERE ELEVATION OR SECTION IS SHOWN.
	ELEVATION OR SECTION INDICATOR, INTERIOR: # INDICATES ELEVATION OR SECTION NUMBER, SHEET INDICATES DRAWING SHEET WHERE ELEVATION OR SECTION IS SHOWN.
100	ROOM OR SPACE NUMBER.
1	KEYNOTE INDICATOR.
	REVISION INDICATOR.
CU-1	EQUIPMENT INDICATOR.
P-	PLUMBING FIXTURE INDICATOR.
TYPE / CFM / SIZE	DIFFUSER/GRILLE INDICATOR.
TYPE / SIZE	DIFFUSER/GRILLE INDICATOR.
	BREAK, STRAIGHT
	BREAK, ROUND.
	HIDDEN FEATURES LINE: HIDDEN, THIN LINE.
	NEW CONNECTION POINT TO EXISTING
	EXTENT OF DEMOLITION

SYMBOL LEGEND

SYMBOL	DESCRIPTION
VALVES, METERS, AND GAUGES	
	SHUT OFF VALVE
	GATE VALVE
	CHECK VALVE
	AUTO 2-WAY VALVE
	AUTO 3-WAY VALVE
	GLOBE VALVE
	BALL VALVE
	RELIEF VALVE
	CHAIN OPERATED GATE VALVE
	PRESSURE REDUCING VALVE
	BUTTERFLY VALVE
	SOLENOID VALVE
	ANGLE VALVE
	VENTURI
	BALANCING OR PLUG COCK
	FLOW SETTER
	EXPANSION VALVE (REFRIG.)
MAV	MANUAL AIR VENT
	STRAINER
	GAUGE COCK
	FLEXIBLE CONNECTION
	PRESSURE GAUGE
	THERMOMETER
	REDUCER CONCENTRIC
	REDUCER ECCENTRIC
	REFRIGERANT SITE GLASS
	REFRIGERANT STAINER
	REFRIGERANT FILTER DRIER
	90° ELBOW UP
	90° ELBOW DOWN
	90° TEE UP
	90° TEE DOWN
	UNION
	CAPPED PIPE
	ANCHOR
	FLOAT AND THERMOSTATIC TRAP
HVAC SYMBOLS	
T	THERMOSTAT
S	TEMPERATURE SENSOR

SYMBOL LEGEND

SYMBOL	DESCRIPTION
HVAC PIPING	
A	COMPRESSED AIR
CS	CONDENSER WATER SUPPLY
CR	CONDENSER WATER RETURN
CWS	CHILLED WATER SUPPLY
CWR	CHILLED WATER RETURN
D	DRAIN LINE
HW	PROCESS HOT WATER
HTHW	HIGH TEMPERATURE HOT WATER

GENERAL MECHANICAL NOTES

1. DO NOT ROUTE DUCTS AND PIPES ABOVE ELECTRICAL PANELS. ALL ELECTRICAL PANELS MUST HAVE CLEAR ACCESS SPACE IN FRONT OF PANEL 4'-0" DEEP AND 6'-6" HIGH. DO NOT ROUTE DUCTS AND PIPES IN ELECTRICAL ROOMS, EXCEPT DUCTS AND PIPES SERVING THE ROOM.
2. COORDINATE EXACT LOCATIONS OF CEILING DIFFUSERS AND GRILLES WITH ARCHITECTURAL REFLECTED CEILING PLAN.
3. ALL DUCT DIMENSIONS ARE INSIDE FREE AREA DIMENSIONS. MAINTAIN FREE AREA WHERE PROFILE MUST CHANGE TO MATCH FIELD CONDITIONS.
4. IF CONTRACTOR ENCOUNTERS MATERIAL WHICH MAY CONTAIN ASBESTOS IMMEDIATELY STOP WORK IN THIS AREA AND NOTIFY THE OWNER.
5. ALL MECHANICAL INFORMATION IS NOT SHOWN ON THE MECHANICAL DRAWINGS. CONTRACTOR SHALL BE RESPONSIBLE FOR INFORMATION ON ALL OTHER CONSTRUCTION DOCUMENTS INCLUDING ARCHITECTURAL, STRUCTURAL, PLUMBING, ELECTRICAL, AND REFRIGERATION DRAWINGS AND PROJECT SPECIFICATIONS MANUAL.
6. THE DRAWINGS AND SPECIFICATIONS HAVE BEEN PREPARED TO SUPPLEMENT EACH OTHER AND THEY SHALL BE INTERPRETED AS AN INTEGRAL UNIT WITH ITEMS SHOWN ON ONE AND NOT THE OTHER BEING FURNISHED AND INSTALLED AS THOUGH SHOWN AND CALLED OUT IN BOTH.
7. ALL LOCATIONS FOR MECHANICAL EQUIPMENT SHALL BE CHECKED AND COORDINATED WITH THE ARCHITECTURAL, STRUCTURAL, AND ELECTRICAL DRAWINGS.
8. THE WORKING DRAWINGS ARE DIAGRAMMATIC. BECAUSE OF THE SMALL SCALE OF THE DRAWINGS, THEY DO NOT SHOW EVERY OFFSET, BEND OR ELBOW NECESSARY FOR THE COMPLETE INSTALLATION IN THE SPACE PROVIDED.
9. COORDINATE ALL DUCTWORK AND MECHANICAL EQUIPMENT WITH ALL OTHER TRADES PRIOR TO INSTALLATION. WHERE CONFLICTS MAY OCCUR, THEY SHALL BE RESOLVED PRIOR TO INSTALLATION.
10. ALL CAPACITIES ARE AT JOB SITE CONDITIONS AND ARE MINIMUM CAPACITY.

GENERAL MECHANICAL PIPING NOTES

1. CAULK AROUND ALL PIPING, INCLUDING PIPING THAT PASS THROUGH FIRE RATED PARTITIONS WITH A NON-HARDENING CAULKING SIMILAR TO 3M "FIRE BARRIER".
2. PROVIDE PROPER PROVISIONS FOR EXPANSION OR MOVEMENT OF ALL PIPING.
3. PROVIDE LARGE ENOUGH PIPE SLEEVES THROUGH WALLS OR FLOORS TO ALLOW FOR ANTICIPATED DEFERENTIAL MOVEMENTS.
4. ALL PIPING SHALL BE SUPPORTED WITH CLEVIS PIPE HANGERS. PERFORATED METAL STRAP OR PLASTIC STRAPPING (PLUMBERS TAPE) SHALL NOT BE USED TO HANG OR SUPPORT PIPING.
5. PROVIDE PIPE HANGERS WITHIN 18 INCHES OF ALL 90 DEGREE ELBOWS.
6. PROVIDE SWAY BRACING ON PIPING 4" AND LARGER AT CHANGES IN DIRECTION GREATER THAN 45 DEGREES.
7. STEEL PIPE HANGERS USED FOR HANGING PLASTIC PIPE SHALL BE PLASTIC COATED.
8. STEEL PIPE HANGERS USED FOR HANGING COPPER PIPE SHALL BE PLASTIC COATED.
9. ALL EXPOSED PIPING SHALL BE INSTALLED IN A NEAT ARRANGEMENT PARALLEL TO BUILDING STRUCTURE.
10. PATCH AND REPAIR ALL EXISTING SURFACES DAMAGED BY NEW CONSTRUCTION TO MATCH EXISTING. ENSURE ALL FLOOR/ROOF PIPE PENETRATIONS ARE SEALED WATER TIGHT.
11. FIELD DETERMINE EXACT SIZE, ELEVATION AND LOCATION OF EXISTING PIPING INSIDE THE BUILDING AT SPECIFIED CONNECTION POINTS PRIOR TO STARTING ANY WORK.

MECHANICAL SHEET INDEX

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Project No. 20180782

CONSULTANTS

REGISTERED PROFESSIONAL ENGINEER
44759
KEVIN M. KOSOR
Date Signed 01/30/19
ARIZONA, U.S.A.
EXPIRES 06/30/21

NORTHERN ARIZONA UNIVERSITY

HEAT EXCHANGER REPLACEMENT

COLLEGE OF SOCIAL & BEHAVIORAL SCIENCES
BUILDING 65 - SBS
FLAGSTAFF CAMPUS

FLAGSTAFF, ARIZONA 86011

Mark	Date	Description
1	01/30/19	OWNER REVIEW COMMENTS

ISSUE: PERMIT SET
DATE: 12/28/2018
SCALE:

NAU PROJ. NO: 09.650.191-C900092
SE PROJECT NO: 20180782
DRAWN BY: RAB
CHECKED BY: KMK
DESIGNED BY: KMK
RECORD DRAWING DATE:
SIGNATURE:

SHEET TITLE

MECHANICAL SYMBOL LEGEND, GENERAL NOTES, SPECIFICATIONS & DRAWING INDEX

ME001

PERMIT SET

MECHANICAL SPECIFICATIONS

230100 – BASIC MECHANICAL REQUIREMENTS

1. THE WORK INCLUDED UNDER THIS SECTION CONSISTS OF FURNISHING ALL MATERIALS, EQUIPMENT AND LABOR, AND THE PERFORMING OF ALL FUNCTIONS, EXCEPT AS OTHERWISE SPECIFIED HEREIN OR SHOWN ON THE DRAWINGS TO BE PERFORMED BY OTHERS, FOR THE INSTALLATION OF ALL HEATING AND COOLING EQUIPMENT, PIPING, DUCTWORK, GRILLES, REGISTERS, ETC., INCLUDING ALL CONNECTIONS TO EACH SYSTEM AS SPECIFIED HEREIN AND SHOWN ON THE DRAWINGS. IT SHALL FURTHER INCLUDE FURNISHING AND INSTALLING ALL MISCELLANEOUS ITEMS REQUIRED FOR THE OPERATION OF THE SYSTEM, WHETHER SPECIFICALLY CALLED OUT OR NOT.

2. ALL MATERIALS, EQUIPMENT AND INSTALLATION MUST COMPLY WITH NAU DESIGN GUIDELINES, NAU TECHNICAL STANDARDS AND ALL APPLICABLE LAWS, CODES, RULES AND REGULATIONS, REQUIRED BY CITY, COUNTY AND STATE, AS WELL AS FEDERAL REQUIREMENTS. PERMITS: OBTAIN AND PAY FOR ALL REQUIRED PERMITS, LICENSES AND FEES.

3. INSPECTIONS: FURNISH OWNER WITH CERTIFICATE OF INSPECTION AND APPROVAL BY LOCAL AUTHORITIES PRIOR TO FINAL ACCEPTANCE OF THE PROJECT BY THE OWNER. ALL WORK MUST BE INSPECTED.

230516 – EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 2 – PRODUCTS
HIGH TEMPERATURE HEATING WATER SYSTEMS:
OWNER HAS PRE-APPROVED THE FOLLOWING PRODUCT TO BE IN COMPLIANCE WITH THESE STANDARDS: BARCO BALL JOINT.

PART 3 – EXECUTION
ALL PRODUCTS TO BE INSTALLED PER MANUFACTURER'S RECOMMENDATION.

230519–METERS AND GAUGES FOR HVAC PIPING

PART 1 – GENERAL
N/A

1
PART 2 – PRODUCTS PRESSURE GAUGES
PROVIDE 6" MINIMUM DIAMETER, LIQUID FILLED GAUGES WITH SNUBBERS, STAND OFFS AND ISOLATION BALL VALVES. HHW SHALL BE BRASS. HTHW SHALL BE CARBON STEEL. PRESSURE GAUGES SHALL NORMALLY READ AT 60% OF TOTAL GAUGE PRESSURE CAPABILITY.

PRESSURE GAUGE, INDUSTRIAL PROCESS GAUGES, PGJ-60B, 6" DIAL SIZE, +/-0.5% ACCURACY, 316 STAINLESS STEEL WETTED PARTS. EQUIVALENT APPROVED BY OWNER.

PRESSURE GAUGES SHALL BE REQUIRED ON ALL INLET AND OUTLET LINES OF THE FOLLOWING:
• CONVERTERS

THERMOMETERS
THERMOMETER, TRERICE MODEL BX9, ADJUSTABLE ANGLE. EQUIVALENT APPROVED BY OWNER.

THERMOMETERS TO BE PROVIDED ON ALL OF THE FOLLOWING:
• CONVERTERS

PART 3 – EXECUTION
PROVIDE AIR VENT IN PIPE RISER. INSTALL AUTOMATIC AIR VENTS IN EQUIPMENT ROOMS AND MANUAL AIR VENTS ELSEWHERE, WITH ISOLATION VALVE AT ALL SYSTEM HIGH POINTS AND PIPED TO DRAIN. MINIMUM VENT PIPING SIZE IS 1/2".

230523 – GENERAL DUTY VALVES FOR HVAC PIPING

PART 1 – GENERAL
N/A

PART 2 – PRODUCTS
VALVE REQUIREMENTS:

SERVICE	SIZE	TYPE	MATERIAL	CONNECTIONS
NATURAL GAS (INSIDE BUILDING)	ALL	BALL VALVE	IRON OR BRONZE BODY	THREADED
HYDRONIC	THRU 2.5"	BALL	BRONZE BODY	THREADED
	2.5" & LARGER	BUTTERFLY	IRON BODY WITH BRONZE DISK	LUG TYPE FLANGE
STEAM	THRU 2"	BALL	BRONZE BODY	THREADED
STEAM	3-6"	GATE VALVE	BRONZE BODY	THREADED
STEAM	6" & ABOVE	HP BUTTERFLY	CARBON STL BODY	LUG TYPE FLANGE
CONDENSATE	ALL	BALL	BRONZE BODY	THREADED
HTHW	BUILDING SERVICE	GATE VALVE	STAINLESS STEEL	LUG TYPE THREADED
HTHW	ALL OTHERS	HP BUTTERFLY	STAINLESS STEEL	LUG TYPE THREADED

AUTOMATIC VALVES
ALL AUTOMATIC VALVES MUST BE ABLE TO COMMUNICATE WITH THE OWNER'S BUILDING MANAGEMENT SYSTEM (BMS). OWNER HAS PRE-APPROVED THE FOLLOWING MANUFACTURERS TO BE IN COMPLIANCE WITH THESE STANDARDS: BELIMO.

PART 3 – EXECUTION
INSTALL ALL VALVES FOR EASY ACCESS FOR OPERATION, REPAIR AND MAINTENANCE WITHOUT USE OF LADDERS. CHAINWHEELS ARE REQUIRED WHERE FLOOR ACCESS TO VALVE HANDLE IS NOT POSSIBLE AND VALVES ARE 4" AND OVER AND LOCATED 7'0" AFF.

ISOLATION VALVES SHALL BE AT ALL EQUIPMENT AND ON ALL MAIN BRANCH TAKE-OFFS.

1 AUTOMATICALLY CONTROLLED HEATING VALVES TO FAIL CLOSE. DOMESTIC STEAM AND HTHW VALVES SHALL FAIL CLOSED.

UNIONS SHALL BE INSTALLED ON THE DOWNSTREAM SIDE OF ALL NON-FLANGED VALVES FOR ACCESS AND REPAIR OF SYSTEMS.

PROVIDE ISOLATION VALVES ON EACH SIDE OF STRAINERS AND FULL PORT BALL VALVE ON BLOW DOWN.

PROVIDE BALL VALVES WITH HOSE END THREADS FOR SYSTEM DRAINS AND STRAINER BLOW DOWN.

WHEN AN EXISTING SYSTEM "HOT TAP" IS NECESSARY, SPECIFY A FULL PORT BALL VALVE TO ISOLATE THE NEW BRANCH LINE.

DO NOT USE CIRCUIT SETTER AS ISOLATION VALVE.

PROVIDE RELIEF VALVES ON PIPING AND EQUIPMENT AS NEEDED TO MEET CODE REQUIREMENTS.

PROVIDE PLUG COCK VALVES AT CONNECTIONS TO GAS-FIRED EQUIPMENT AND IN ALL BRANCH PIPING.

1" BYPASS REQUIRED ON BUTTERFLY VALVES FOR STEAM AND HTHW.

230523.16 – PLUG CONTROL VALVES

PART 1 – GENERAL

1.1 SUMMARY

A. SECTION INCLUDES:
1. PLUG VALVES.

1.2 ACTION SUBMITTALS
A. PRODUCT DATA: FOR EACH TYPE OF VALVE.

PART 2 – PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. SOURCE LIMITATIONS FOR VALVES: OBTAIN EACH TYPE OF VALVE FROM SINGLE SOURCE FROM SINGLE MANUFACTURER.
B. ASME COMPLIANCE:
1. ASME B16.1 FOR FLANGES ON IRON VALVES.
2. ASME B16.10 AND ASME B16.34 FOR FERROUS VALVE DIMENSIONS AND DESIGN CRITERIA.
3. ASME B31.1 FOR POWER PIPING VALVES.
4. ASME B31.9 FOR BUILDING SERVICES PIPING VALVES.
C. VALVE PRESSURE–TEMPERATURE RATINGS: NOT LESS THAN INDICATED AND AS REQUIRED FOR SYSTEM PRESSURES AND TEMPERATURES.
D. VALVE SIZES: SAME AS UPSTREAM PIPING UNLESS OTHERWISE INDICATED.
E. VALVE ACTUATOR TYPES:
1. HANDLEVER: FOR VALVES NPS 6 AND SMALLER.
2. CHAINWHEEL: DEVICE FOR ATTACHMENT TO GEAR, STEM, OR OTHER ACTUATOR OF SIZE AND WITH CHAIN FOR MOUNTING HEIGHT, ACCORDING TO "VALVE INSTALLATION" ARTICLE.
F. VALVES IN INSULATED PIPING: WITH 2–INCH STEM EXTENSIONS WITH EXTENDED NECKS.

2.2 PLUG CONTROL VALVES

A. CLASS 150, PLUG VALVES:

1. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY THE FOLLOWING:
A.A. MASONELIAN VALVE
A.B. ROTORK ACTUATOR

2. DESCRIPTION:
A.A. VALVE: MASONELIAN CAMFLEX ROTARY ECCENTRIC PLUG CONTROL VALVE, MODEL CMQ250–WT–2–35012
A.B. SIZE: 2"
A.C. FLOW RATE: MIN 25 GPM, MAX 100 GPM
A.D. DESIGN PRESSURE: 200 PSIG
A.E. DESIGN MAX TEMPERATURE: 300F
A.F. END CONNECTIONS: ASME 150# RF FLANGES
A.G. BODY MATERIAL: A216 gr WCC
A.H. PLUG: STELITE
A.I. SEAT: 316 SS w/HF
A.J. CV: 21.2
A.K. SHUTOFF CLASS: IV,
A.L.
3. DESCRIPTION:
A.A. ACTUATOR ROTORK CMQ ELECTRIC FAIL–SAFE QUARTER TURN ACTUATOR
A.B. POWER: 120 VAC
A.C. CONTROL: 4–20 Ma (EXT. POWERED)
A.D. FEEDBACK: 4–20Ma (EXT. POWERED)
A.E. DISPLAY WITH LOCAL CONTROLS

1

PART 3 – EXECUTION

3.1 VALVE INSTALLATION

A. INSTALL VALVES WITH FLANGES AT EACH PIECE OF EQUIPMENT ARRANGED TO ALLOW SERVICE, MAINTENANCE, AND EQUIPMENT REMOVAL WITHOUT SYSTEM SHUTDOWN.
B. LOCATE VALVES FOR EASY ACCESS AND PROVIDE SEPARATE SUPPORT WHERE NECESSARY.
C. INSTALL VALVES IN HORIZONTAL PIPING WITH STEM AT OR ABOVE CENTER OF PIPE.
D. INSTALL VALVES IN POSITION TO ALLOW FULL STEM MOVEMENT.
E. INSTALL CHAINWHEELS ON OPERATORS FOR BUTTERFLY VALVES NPS 4 AND LARGER AND MORE THAN 96 INCHES ABOVE FLOOR. EXTEND CHAINS TO 60 INCHES ABOVE FINISHED FLOOR.

3.2 ADJUSTING

A. ADJUST OR REPLACE VALVE PACKING AFTER PIPING SYSTEMS HAVE BEEN TESTED AND PUT INTO SERVICE BUT BEFORE FINAL ADJUSTING AND BALANCING. REPLACE VALVES IF PERSISTENT LEAKING OCCURS.

3.3 HIGH TEMPERATURE–WATER VALVE SCHEDULE

A. PIPE NPS 2–1/2 AND SMALLER:
1. PLUG CONTROL VALVES: CLASS 150, SINGLE FLANGE.

230548 – VIBRATION ISOLATION AND SEISMIC BRACING

1. ALL MECHANICAL EQUIPMENT, DUCTWORK, AND PIPING MUST BE VIBRATION ISOLATED AND SEISMICALLY BRACED FOR THE SITE SPECIFIC SEISMIC DESIGN CATEGORY AND SEISMIC USE GROUP, IN ACCORDANCE WITH THE LATEST ADOPTED EDITIONS OF THE IBC, UBC, ASHRAE, AND SMACNA. PROVIDE SEISMIC PRODUCTS BY AMBER–BOOTH OR MASON INDUSTRIES.

2. IN GENERAL, PROVIDE SPRING MOUNTS TO ATTENUATE LOW FREQUENCY SOUND AND VIBRATION AND NEOPRENE PADS TO ATTENUATE HIGH FREQUENCY SOUND AND VIBRATION. SEISMIC BRACING/MOUNTING CAN BE COMBINED WITH VIBRATION ISOLATION AS APPLICABLE.

3. CONTRACTOR MANUFACTURED SEISMIC BRACING/RESTRAINT METHODS ARE NOT ACCEPTABLE. PROVIDE A SIGNED AND STAMPED LETTER FROM A PROFESSIONAL ENGINEER CERTIFYING THAT THE SUPPLIED PRODUCTS ARE CORRECT FOR THE APPLICATION AND THAT THE INSTALLATION IS IN COMPLIANCE WITH ALL APPLICABLE CODES.

230553 – MECHANICAL IDENTIFICATION

1. PIPE MARKERS:
PLASTIC TAPE: PROVIDE MANUFACTURER'S STANDARD COLOR–CODED PRESSURE–SENSITIVE (SELF ADHESIVE) VINYL TAPE, NOT LESS THAN 3 MILS THICK. 1–1/2" WIDE TAPE MARKERS ON PIPES WITH OUTSIDE DIAMETERS LESS THAN 6" (INCLUDING INSULATION, IF ANY); 2–1/2" WIDE TAPE FOR LARGER PIPES.

2. COLOR:
COMPLY WITH ANSI A13.1

3. LETTERING:
MANUFACTURER'S STANDARD PRE–PRINTED NOMENCLATURE WHICH BEST DESCRIBES PIPING OR DUCT SYSTEM IN EACH INSTANCE OR AS SELECTED BY ARCHITECT OR ENGINEER IN CASES OF VARIANCE WITH NAMES AS SHOWN.

4. ARROWS:
PRINT EACH MARKER WITH ARROWS INDICATING DIRECTION OF FLOW.

5. VALVE TAGS:
PROVIDE PLASTIC LAMINATE VALVE TAGS: MANUFACTURER'S STANDARD 3/32" THICK ENGRAVED TAGS WITH PIPING SYSTEM ABBREVIATION IN 1/4" HIGH LETTERS AND SEQUENCED VALVE NUMBERS 1/2" HIGH, WITH 5/32" HOLE FOR FASTENER. PROVIDE 1–1/2" SQUARE BLACK TAGS WITH WHITE LETTERING.

6. VALVE TAG FASTENERS:
PROVIDE MANUFACTURER'S STANDARD SOLID BRASS CHAIN (WIRE LINK OR BEADED TYPE), OR SOLID BRASS S–HOOKS OF THE SIZED REQUIRED FOR PROPER ATTACHMENT OF TAGS TO VALVES, AND MANUFACTURED SPECIFICALLY FOR THAT PURPOSE.

230593 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 – GENERAL

TEST AND BALANCE FIRM CONSIDERATIONS
THE CONTRACTOR SHALL HIRE THE TEST AND BALANCE FIRM, BUT SHALL HAVE APPROVAL FROM OWNER ON WHO THEY RECEIVE BIDS FROM AND WHO THEY CONTRACT WITH.

THE AIR DISTRIBUTION SYSTEM SHALL BE TESTED AND BALANCED BY AN INDEPENDENT FIRM LICENSED, BONDED AND CERTIFIED TO PERFORM SUCH WORK IN THE STATE OF ARIZONA.

THE WATER FLOWS SHALL BE SPECIFIED TO BE SET WITHIN 3% OF THE DESIGN REQUIREMENTS.

THE FINAL AIR BALANCE WILL BE CONDUCTED AFTER ALL SYSTEMS ARE IN PLACE AND OPERATIONAL AND HAVE BEEN ACCEPTED.

ALL SYSTEMS START-UP, TESTING, BALANCING, FINAL OPERATIONS & MAINTENANCE MANUALS AND TRAINING SHALL BE COMPLETED ON OR BEFORE, AND IS A REQUIREMENT OF, SUBSTANTIAL COMPLETION.

TEST AND BALANCE SUBMITTAL REQUIREMENTS
CONTRACTOR SHALL SUBMIT TEST AND BALANCE FIRM'S CERTIFICATIONS ALONG WITH A TEST AND BALANCE PLAN INCLUDING BUT NOT LIMITED TO WHERE TEST POINTS SHALL BE TAKEN, ANY TRAVERSE TEST BEING PERFORMED, AND ANY POTENTIAL COMPLICATIONS.

THE TESTING AGENCY SHALL PROVIDE VERIFICATION THAT SYSTEMS OPERATE AT 50% TO 75% AND AT 100% CAPACITY AS DESIGNED. FINAL BALANCE REPORT SHALL INCLUDE COPIES OF PUMP AND FAN CURVES.

PART 2 – PRODUCTS
N/A

PART 3 – EXECUTION
N/A

230900 – INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 – GENERAL
EVERY BUILDING CONTROL SYSTEM SHALL INTEGRATE WITH OWNER'S HEAD END, LOCATED IN THE HVAC DEPARTMENT. EVERY CONTRACTOR IS REQUIRED TO FURNISH ALL LABOR, HARDWARE AND APPLICABLE SOFTWARE AND GRAPHICS NECESSARY TO INTEGRATE AND MAINTAIN THE SYSTEM.

ANY PROPOSED CHANGES TO THE SEQUENCE SHALL BE DONE THROUGH A RFI AND INCLUDED IN THE AS-BUILTS AND CONTROLS O&M'S.

CONTROLS CONTRACTOR TO PROVIDE:
• PIPING AND INSTRUMENTATION DIAGRAM, CONTROL SYSTEM
• CONTROL SYSTEM ARCHITECTURE DIAGRAM
• POINTS LIST
• CONTROL COMPONENT SPECIFICATION
• EMS SEQUENCE OF OPERATION

CONTROL SYSTEM ARCHITECTURE DIAGRAM SHALL DEPICT IN SINGLE LINE THE COMMUNICATION INTERFACES BETWEEN CAMPUS HEAD END, BUILDING ENERGY MANAGEMENT, AIR HANDLER AND PLANT CONTROLLERS AND ALL TERMINAL CONTROLLERS, ALONG WITH INTERFACE TO BUILDING METERING AND MONITORING DEVICES.

INSTALLATION OF CONTROL SYSTEMS SHALL NOT PROCEED WITHOUT SIGN OFF APPROVAL OF SEQUENCE OF OPERATIONS AND CONTROL DIAGRAMS AND SHOP DRAWINGS BY OWNER (HVAC INSPECTOR).

PART 2 – PRODUCTS
ALL DIRECT DIGITAL CONTROLS (DDC) SHALL BE NATIVE BACNET AND FULLY COMMUNICATE WITH OWNER'S EXISTING SYSTEM. THE CONTROL COMPONENT MANUFACTURER IS ALERTON.

WIRELESS ACCESS IS TO BE PROVIDED IN MECHANICAL AND ELECTRICAL ROOMS FOR TECHNICIAN ACCESS TO THE CAMPUS HEAD END.

MAJOR EQUIPMENT SUCH AS HEAT EXCHANGERS SYSTEMS SHALL BE FULLY INTEGRATED AND COMMUNICATE WITH THE BACNET DDC SYSTEM. HARDWIRE START/STOPS ARE REQUIRED.

FACTORY SET (PRE-PROGRAMMED) HVAC CONTROL MODULES ARE NOT ACCEPTABLE. PROPORTIONAL AUTHORITY PERCENTAGE (RE-SET) SHALL BE FIELD ADJUSTABLE.

SEQUENCE OF OPERATIONS AND CONTROL DIAGRAMS AND SHOP DRAWINGS REQUIRE SIGN OFF APPROVAL BY OWNER (HVAC DEPARTMENT) PRIOR TO INSTALLATION AND PROGRAMMING.

PART 3 – EXECUTION
THE CONTROLS CONTRACTOR SHALL BE A FIRST TIER SUB TO THE CONTRACTOR.

MAINTENANCE TRAINING SESSIONS SHALL BE PROVIDED ON ALL SYSTEMS. ALL SESSIONS SHALL BE SCHEDULED THROUGH OWNER (PROJECT MANAGER). SESSIONS SHALL BE VIDEO RECORDED BY THE CONTRACTOR AND GIVEN TO OWNER.
ALL REQUIRED CLOSE-OUT DIAGRAMS, SEQUENCE OF OPERATIONS AND O/M MANUALS SHALL BE ON-SITE AND AVAILABLE AT THE TIME OF THE SCHEDULED TRAINING SESSIONS. ALL TRAINING SHALL BE COMPLETED IN SUCH A MANNER TO ASSURE PROPER END-USER COMPETENCY.

TRAINING SHALL INCLUDE BOTH ON-SITE, IN-BUILDING EFFORTS AND REMOTE SITE TRAINING AT CONTROL CONTRACTOR'S FACILITY.

CONTROLS CONTRACTOR SHALL SET UP ALL TRENDS REQUIRED BY COMMISSIONING ON ENERGY MANAGEMENT COMPONENTS LISTED IN PART 1 OF THIS SECTION, METER INSTANTANEOUS DEMAND AND TOTALIZED USAGE, AND ALL SPACE TEMPERATURE SETPOINTS. THE DESIGN PROFESSIONAL OR COMMISSIONING AGENT MAY INDICATE ADDITIONAL TRENDS IN THE PROJECT SPECIFICATIONS.

232113 – HYDRONIC PIPING

PART 1 – GENERAL
THIS SECTION INCLUDES PIPE AND FITTING JOINING METHODS, SPECIALTY MATERIALS, VALVES, AND SPECIALTIES DUTY.

PART 2 – PRODUCTS
PIPE REQUIREMENTS - ABOVE GROUND

SIZE	PIPE	FITTINGS	JOINTS
UP TO 2"	COPPER TYPE "L" SEAMLESS HARD DRAWN	WROUGHT COPPER	LESS THAN 0.2% LEAD ALLOY SOLDER
2 1/2"	COPPER TYPE "L" HARD DRAWN	WROUGHT COPPER	15% SILVER BRAZED
	OR	OR	OR
SCHEDULE 40 BLACK PIPE		FORGED CARBON	BEVEL WELDED
1 80 SEAMLESS (HTHWS/R)		FORGED CARBON	BEVEL WELDED

PIPE REQUIREMENTS - BELOW GROUND

SIZE	PIPE	FITTINGS	JOINTS
UP TO 2"	COPPER TYPE "K" HARD DRAWN	WROUGHT COPPER	6% SILVER BRAZED
2-1/2"	COPPER TYPE "K" HARD DRAWN	WROUGHT COPPER	15% SILVER BRAZED

PRESS FIT COUPLING SYSTEMS SUCH AS PROPRESS ARE NOT ALLOWED WITHOUT EXPRESS WRITTEN PERMISSION OF OWNER (PROJECT MANAGER AND HVAC SUPERVISOR).

PIPE GASKETING – STEAM AND HIGH TEMPERATURE HOT WATER SERVICES
DIELECTRIC NIPPLES SHALL BE INSTALLED WHENEVER JOINING DISSIMILAR METALS. DIALECTRIC UNIONS ARE NOT TO BE USED. SPIRAL WOUND. OWNER HAS PRE-APPROVED THE FOLLOWING MANUFACTURER TO BE IN COMPLIANCE WITH THESE STANDARDS: FLEXITALLIC GASKETS.

EXPANSION TANKS
PROVIDE DIAPHRAGM-TYPE COMPRESSION TANK WITH REPLACEABLE DIAPHRAGM.

SIZE PIPE FITTINGS JOINTS
UP TO 2" COPPER TYPE "L" SEAMLESS HARD DRAWN WROUGHT COPPER LESS THAN 0.2% LEAD ALLOY SOLDER
2 1/2" LARGER COPPER TYPE "L" SEAMLESS HARD DRAWN WROUGHT COPPER 15% SILVER BRAZED
OR OR OR
SCHEDULE 40 BLACK STEEL FORGED CARBON STEEL BEVEL WELDED
PIPE SCHEDULE BELOWGROUND
UP TO 2"
SEAMLESS HARD DRAWN COPPER TYPE "K" WROUGHT COPPER 6% SILVER BRAZED
2 1/2"
SEAMLESS HARD DRAWN COPPER TYPE "K" WROUGHT COPPER 15% SILVER BRAZED

PART 3 – EXECUTION
COPPER: MAINTAIN A MINIMUM OF 50% PENETRATION OF BRAZED JOINTS.
STEEL:PERFORM A MINIMUM OF THREE PASSES ON WELD JOINTS (ROOT, FILLER, CAP).

ROUTE PIPING TO ALLOW SUFFICIENT ACCESS TO ALL EQUIPMENT, VALVES, CONTROLS, ETC., FOR MAINTENANCE. INSTALL ALL EQUIPMENT, VALVES, CONTROLS, ETC. IN A MANNER TO PERFORM MAINTENANCE FROM THE DECK.

IN GENERAL, PIPING SHALL BE INSTALLED BELOW ELECTRICAL CONDUITS NOT REQUIRING MAINTENANCE ACCESS.

ALL CHILLED WATER COILS AND DX COILS LOCATED IN A FAN COIL UNIT ABOVE THE CEILING SHALL HAVE A SECONDARY DRAIN PAN UNDER THE FAN COIL UNIT. THE SECONDARY DRAIN PAN SHALL DRAIN TO A CUSTODIAL SINK. SUCH PIPING SHALL BE DIRECTLY CONNECTED TO THE SECONDARY DRAIN PAN AND MAINTAIN A MINIMUM HORIZONTAL SLOPE IN DIRECTION OF DISCHARGE OF NOT LESS THAN ONE-EIGHTH UNIT VERTICAL IN 12 UNITS HORIZONTAL (1-PERCENT SLOPE).

PIPING SHALL BE SECURED AT EACH TRAPEZE HANGER OR SUPPORT.

ALL HYDRONIC PIPING, HEATING HOT WATER OR CHILLED WATER SHALL NOT BE EXPOSED TO THE WEATHER ELEMENTS; ALL PIPING SHALL BE WITHIN THE BUILDING STRUCTURE.

INSTALL PIPING SUFFICIENTLY BELOW STRUCTURE TO ALLOW TOP AIR VENTS.

PROVIDE ISOLATION VALVES ON EACH SIDE OF STRAINERS AND FULL PORT BALL VALVE ON BLOW DOWN. PROVIDE HOSE THREAD CONNECTION ON BLOW DOWN PORT 3/4" AND BELOW.

PROVIDE AIR VENT IN PIPE RISER. INSTALL AIR VENTS WITH ISOLATION VALVES AT ALL SYSTEM HIGH POINTS. AUTOMATIC AIR VENTS ARE TO BE PIPED TO DRAIN. MINIMUM VENT PIPING SIZE IS 1/2".

PIPING SYSTEMS FLUSHING AND TESTING
EACH SYSTEM (STEAM, WATER, CONDENSATE, ETC.) SHALL BE FLUSHED, CHECKED FOR LEAKS, CORROSION INHIBITORS ADDED WHERE APPLICABLE, AND OTHERWISE MADE READY FOR ACCEPTANCE.

TESTING ON ALL BACKFLOW PREVENTERS IS REQUIRED. TESTING SHALL BE PERFORMED BY A CERTIFIED TESTER AND RESULTS SHALL BE SUBMITTED IN WRITING TO OWNER ON THE NAU FACILITY SERVICES BACKFLOW TESTING FORM.

SOLUTION SHALL REMAIN IN SYSTEM (8) HOURS. SYSTEM SHALL THEN BE FLUSHED AND TEST RESULTS PROVIDED TO THE OWNER (INSPECTOR).

ALL PRESSURE TESTS SHALL BE PERFORMED USING A CERTIFIED GAUGE WHICH HAS BEEN APPROVED FOR USE BY OWNER (INSPECTOR).

PRESSURE TESTING NEEDS TO BE CONDUCTED ON THE NEW SYSTEM ONLY. THE NEW SYSTEM NEEDS TO BE ISOLATED FROM THE EXISTING SYSTEM DURING THE PRESSURE TESTING.

PRESSURE TEST THE NEW SYSTEM AT WHICHEVER IS HIGHER BETWEEN 1.5 TIMES THE OPERATING PRESSURE OR AS CODE REQUIRES FOR A PERIOD OF TWO HOURS. A TESTING PROCEDURE NEEDS TO BE SUBMITTED TO THE OWNER (HVAC SUPERVISOR) AND APPROVED PRIOR TO ANY TESTING.

235700 – HEAT EXCHANGERS FOR HVAC

PART 1 – GENERAL
HEAT EXCHANGERS ARE TO BE LOCATED NO MORE THAT 5' ABOVE FINISH FLOOR. HEAT EXCHANGERS ARE NOT TO BE MOUNTED TO CEILING.

IN DESIGN DEVELOPMENT DRAWINGS, DEMONSTRATE ADEQUACY OF MECHANICAL ROOM GEOMETRY FOR PURPOSE OF HEAT EXCHANGER SERVICE CLEARANCE FOR REMOVAL AND REPLACEMENT.

ISOLATION VALVES AND UNIONS ARE REQUIRED ON ALL HEAT TRANSFER UNITS ON BOTH SIDES OF HEAT EXCHANGER, BOTH SIDES OF PUMPS, AT STRAINERS AND AIR SEPARATORS. ALL ISOLATION VALVES SHALL BE BALL VALVES.

ALL GLYCOL TO BE PROPYLENE GLYCOL WITH INHIBITORS. OWNER USES DOWFROST IN THE GLYCOL SYSTEM.

DESIGN OUTSIDE AIR PREHEAT LOOPS WITH 40/60 GLYCOL MIXTURE FOR FREEZE PROTECTION, USE CLOSED LOOP WITH NO CITY FLAGSTAFF MAKE-UP WATER CONNECTION. THERE SHALL BE A MIXING TANK AND PRESSURIZATION PUMP FOR THIS APPLICATION.

FOR APPLICATIONS WITH EXTENSIVE OUTDOOR GLYCOL PIPING, PROVIDE 50/50 MIX FOR FREEZE PROTECTION.

GLYCOL RECOVERY TANK SHALL ALLOW COMPLETE

SYSTEM DRAIN BACK.

PART 2 – PRODUCTS
FACTORY ASSEMBLED HEAT TRANSFER SKIDS, INCLUDING HEAT EXCHANGERS, PUMPS, AIR SEPARATOR, PIPING AND CONTROLS IS ACCEPTABLE UPON WRITTEN APPROVAL BY OWNER (HVAC SUPERVISOR), PROVIDED A MINIMUM OF 36" OUTBOARD OF SKID IS PROVIDED AND MAINTENANCE ACCESS TO ALL COMPONENTS IS PROVIDED. A COMPLETE MANUFACTURER DIMENSIONAL SHOP DRAWINGS SHOWING ALL COMPONENTS AND SERVICE ACCESS, INCLUDING TUBE BUNDLE PULL SPACE TO BE SHOWN GRAPHICALLY.

HEATING WATER EXCHANGERS: FIELD ERECTED HEAT TRANSFER SYSTEMS ARE REQUIRED. DESIGN DRAWINGS TO PROVIDE SUFFICIENT DETAIL TO SHOW ALL COMPONENTS AND MINIMUM SERVICE ACCESS CLEARANCES. SERVICE ACCESS, INCLUDING TUBE BUNDLE PULL SPACE TO BE SHOWN GRAPHICALLY. CONTRACTOR SHALL SUBMIT COMPLETE SHOP DRAWINGS INCLUDING DIMENSION PLAN, ELEVATION AND ISOMETRIC FOR OWNER TO REVIEW AND APPROVE PRIOR TO CONSTRUCTION.

TUBE BUNDLE IN TANK HEAT EXCHANGERS ARE REQUIRED. HEAT EXCHANGERS SHALL BE STAINLESS STEEL OR CUPRO-NICKEL ALLOY.

PART 3 – EXECUTION
ALL HEAT EXCHANGERS USED FOR SPACE HEATING PURPOSES SHALL HAVE CONTROLS THAT FAIL CLOSED.

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CONSULTANTS

REGISTERED PROFESSIONAL ENGINEER 44759 KEVIN M. KOSOR Date Signed 01/30/19 ARIZONA, U.S.A. EXPIRES 06/30/21

NORTHERN ARIZONA UNIVERSITY

HEAT EXCHANGER REPLACEMENT

COLLEGE OF SOCIAL & BEHAVIORAL SCIENCES BUILDING 65 - SBS FLAGSTAFF CAMPUS

FLAGSTAFF, ARIZONA 86011

Mark	Date	Description
1	01/30/19	OWNER REVIEW COMMENTS

ISSUE: PERMIT SET
DATE: 12/28/2018
SCALE:

NAU PROJ. NO: 09.650.191-C900092
SE PROJECT NO: 20180782
DRAWN BY: RAB
CHECKED BY: KMK
DESIGNED BY: KMK
RECORD DRAWING DATE:
SIGNATURE:

SHEET TITLE
MECHANICAL SPECIFICATIONS

ME002

PERMIT SET

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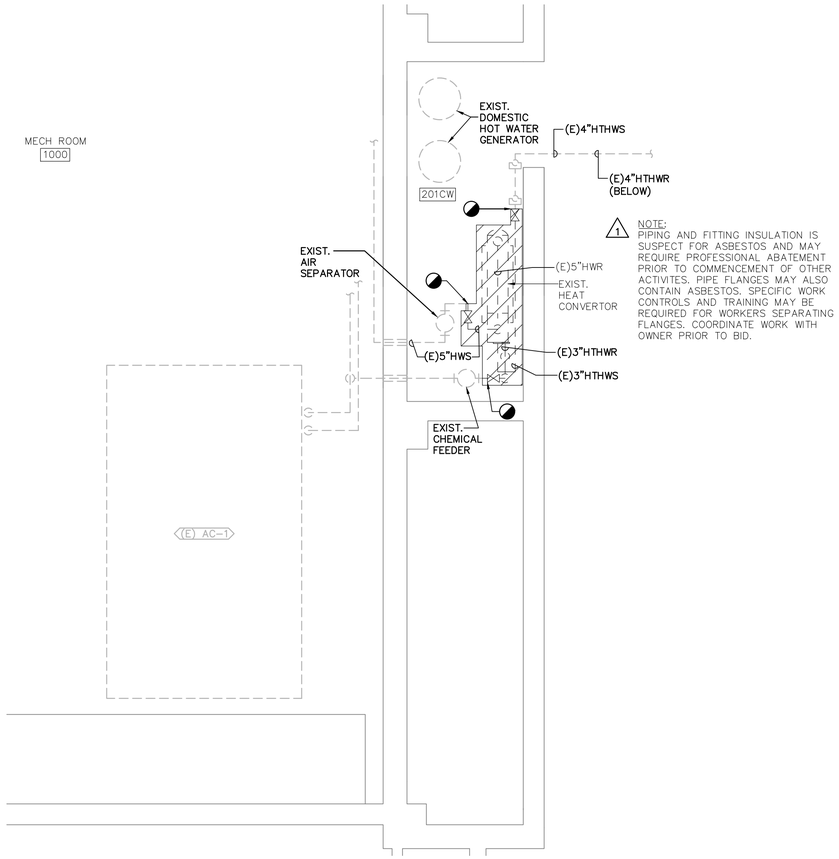
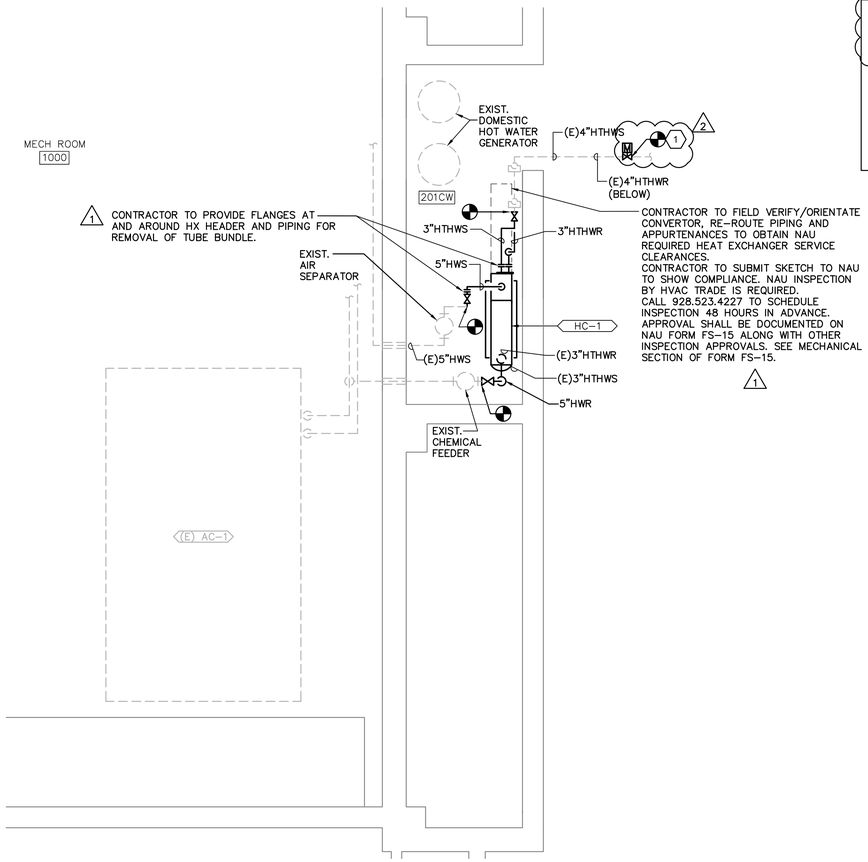


1 MECHANICAL PIPING PLAN – FIRST FLOOR – DEMOLITION
SCALE: 1/4"=1'-0"



2 MECHANICAL PIPING PLAN – FIRST FLOOR – NEW WORK
SCALE: 1/4"=1'-0"

SHEET KEYNOTES

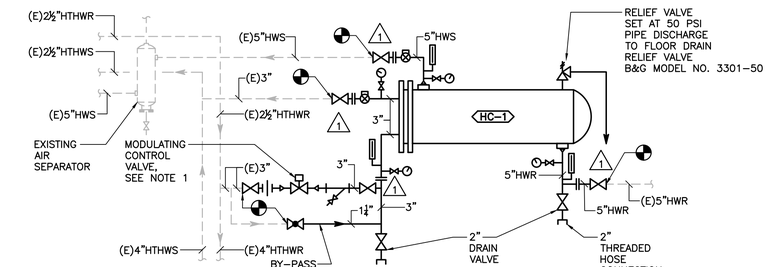
1. ADD ALTERNATE: ADD HTHW METER. ROSEMONT 8750W MAGNETIC FLOWMETER SYSTEM WITH FIELD MOUNT TRANSMITTER RATED FOR HIGH TEMPERATURE CAPABILITIES. CONNECT TO ALERTON DISPLAY WITH LOCAL CONTROLS. PROVIDE SOFTWARE, HARDWARE, PROGRAMMING AS REQUIRED TO PROVIDE A COMPLETE FUNCTIONING SYSTEM.

1

CONVERTER (HEAT EXCHANGER) SCHEDULE

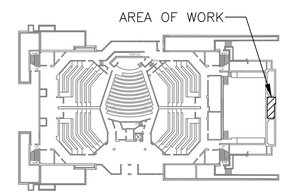
SYMBOL	MANUFACTURER & MODEL	TOTAL HEAT EXCHANGED MBH	HEATING SURFACE SQ. FT.	BAFFLE SPACING	LENGTH	DIA.	NUMBER OF PASSES	SHELL (2)				TUBE (FLUID)					FOULING FACTOR	COMMENTS
								FLOW GPM	IN °F	OUT °F	PD FT.	FLUID TYPE	FLOW GPM	IN °F	OUT °F	PD FT.		
HC-1	BELL & GOSSETT QWUS-1060-49	3,076	170	9"	60"	10"	4	340	140	160	6.5	WATER	80	250	170	3	0.00025	(1)

(1) PROVIDE FIELD FABRICATED HEAT EXCHANGER STRUCTURAL SUPPORT APPROX. 4 FEET HIGH.
(2) 45% PROPYLENE GLYCOL



NOTE 1.
MASONELIAN CAMFLEX ROTARY ECCENTRIC PLUG CONTROL VALVE
SIZE: 2"
FLOW RATE: MIN 25 GPM, MAX 100 GPM
DESIGN PRESSURE: 200 PSIG
DESIGN MAX TEMPERATURE: 300F
END CONNECTIONS: ASME 150# RF FLANGES
BODY MATERIAL: A216 gr WCC
PLUG: STELITE
SEAT: 316 SS w/HF
CV: 21.2
SHUTOFF CLASS: IV, ACTUATOR ROTORK CMQ ELECTRIC FAIL-SAFE
QUARTER TURN ACTUATOR
POWER: 120 VAC
CONTROL: 4-20 Ma (EXT. POWERED)
~~FEEDBACK: 4-20Mg (EXT. POWERED)~~
CONNECT TO ALERTON DISPLAY WITH LOCAL CONTROLS
~~FAILSAFE: SUPERCAPS; SET TO FAIL OPEN~~
OR EQUIVALENT APPROVED BY NAU OR ENGINEER.

3 HEATING HOT WATER CONVERTER PIPING SCHEMATIC
SCALE: NONE



KEY PLAN – BLDG. 65 SBS
SCALE: NONE

SPECTRUM ENGINEERS
1501 W. Fountainhead Parkway
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Project No. 20180782

CONSULTANTS

Registered Professional Engineer
44759
KEVIN M. KOSOR
Date Signed 04/19/19
ARIZONA, U.S.A.
EXPIRES 06/30/21

NORTHERN ARIZONA UNIVERSITY

HEAT EXCHANGER REPLACEMENT

COLLEGE OF SOCIAL & BEHAVIORAL SCIENCES
BUILDING 65 - SBS
FLAGSTAFF CAMPUS

FLAGSTAFF, ARIZONA 86011

Mark	Date	Description
2	04/17/19	OWNER REVIEW COMMENTS
1	01/30/19	OWNER REVIEW COMMENTS

ISSUE:	PERMIT SET
DATE:	12/28/2018
SCALE:	
NAU PROJ. NO:	09.650.191-C900092
SE PROJECT NO:	20180782
DRAWN BY:	RAB
CHECKED BY:	KMK
DESIGNED BY:	KMK
RECORD DRAWING DATE:	
SIGNATURE:	

SHEET TITLE

MECHANICAL PIPING PLAN FIRST FLOOR DEMOLITION AND NEW WORK, SCHEMATIC AND SCHEDULE

PERMIT SET

MP101

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