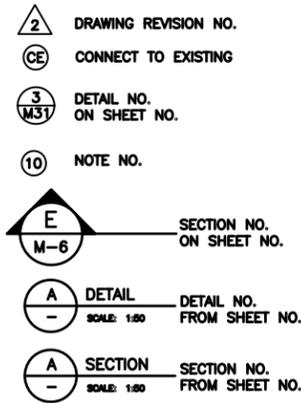


STANDARD ABBREVIATIONS

ABBREVIATIONS

AD ACCESS DOOR
 AFF ABOVE FINISHED FLOOR
 A/P ACCESS PANEL
 AHU AIR HANDLING UNIT
 APD AIR PRESSURE DROP
 BHP BRAKE HORSE POWER
 CD CONTROL DAMPER
 CE CONNECT TO EXISTING
 C/W COMPLETE WITH
 BD BALANCE DAMPER
 BDD BACKDRAFT DAMPER
 DN DOWN
 DSP EXTERNAL STATIC PRESSURE
 EF EXHAUST FAN
 E/A EXHAUST AIR
 EH EXHAUST HOOD
 EXH. EXHAUST
 O/A OUTDOOR AIR
 RE/RE REMOVE AND RE-INSTALL
 RH RE-HEAT COIL
 R/A RETURN AIR
 SP STATIC PRESSURE
 S/A SUPPLY AIR
 SF SUPPLY FAN
 PD PRESSURE DROP
 UH UNIT HEATER
 VEL VELOCITY
 VSD VARIABLE SPEED DRIVE
 VFD VARIABLE FREQUENCY DRIVE
 WMS WIRE MESH SCREEN
 WPD WATER (LIQUID) PRESSURE DROP

GENERAL - H.V.A.C.



DRAWING LIST

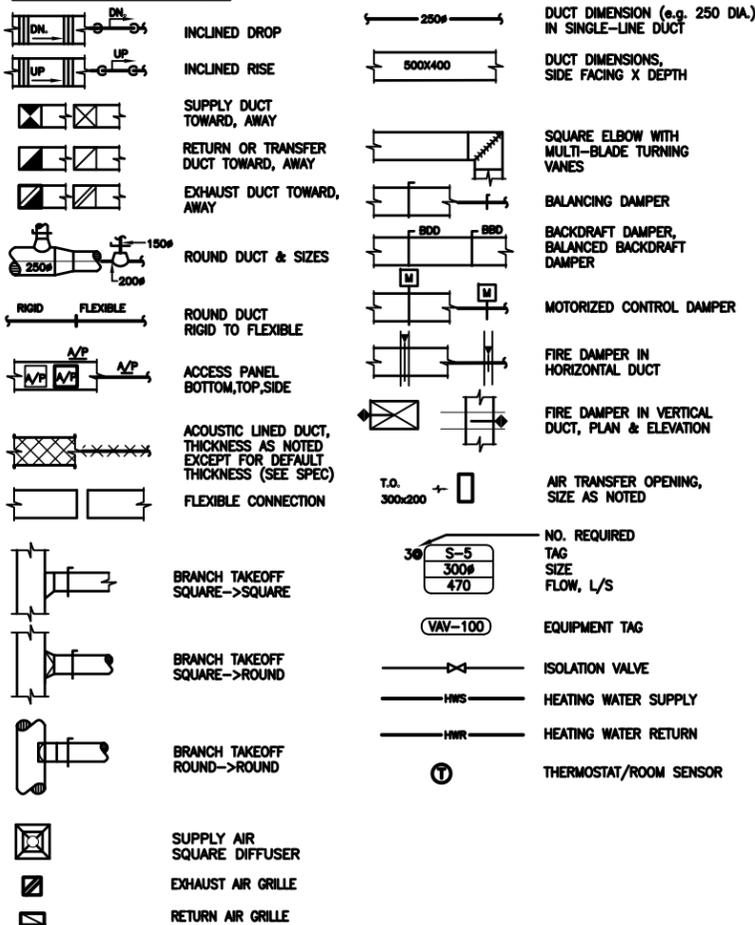
- M-001 MECHANICAL LEGEND, DRAWING LIST AND EQUIPMENT SCHEDULES
- M-002 MAIN FLOOR & SECOND FLOOR PLANS AND ELEVATION
- M-003 MECHANICAL ROOM, ELEVATION AND SCHEMATIC
- M-004 MECHANICAL SPECIFICATIONS SHEET 1
- M-005 MECHANICAL SPECIFICATIONS SHEET 2

EXHAUST FAN SCHEDULE

TAG	DESCRIPTION	LOCATION	FLOW	ESP	AVG SOUND	FAN RPM	MOTOR	ELECT. POWER	TYPE	MAKE	MODEL	REMARKS
			L/S	Pa	LEVEL (dBA)		HP	V/PH/Hz				
EF-1403	EXHAUST FAN	WALL PLATFORM	285	1245	82	4374	3	575/3/60	BACKWARD INCLINED CENTRIFUGAL	GREENHECK	IPA	W/VFD
FHEF-21	FUME HOOD EXHAUST FAN	MECHANICAL ROOM	1180	435	70	1891	1.5	575/3/60	BACKWARD INCLINED CENTRIFUGAL	GREENHECK	SWB-115-15	W/VFD

LEGEND

HVAC - DUCTWORK



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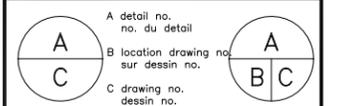
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DO NOT SCALE THE DRAWINGS.

THESE DRAWINGS ARE INTENDED FOR ARCHITECTURAL INFORMATION ONLY. THE CONTRACTOR AND ANY PERSONS USING THESE DRAWINGS ARE ADVISED TO REFER TO THE ENGINEER FOR INFORMATION RELATING TO SPECIFIC DISCIPLINES.

revisions	date
0	Issued for Tender
	31 Oct 14



project **NRC · CRC** project
NATIONAL RESEARCH COUNCIL CANADA

Westbrook Mall, Vancouver, BC

drawing **MINING WEAR LAB 1403 RENOVATION** dessin

MECHANICAL LEGEND, DRAWING LIST AND EQUIPMENT SCHEDULES

designed **KM** concu

date

drawn **DL** dessine

date **AUG. 2014**

approved - approuve

date -

Tender - Soumission

PWGC Project Manager Administrateur de projets TPSGC

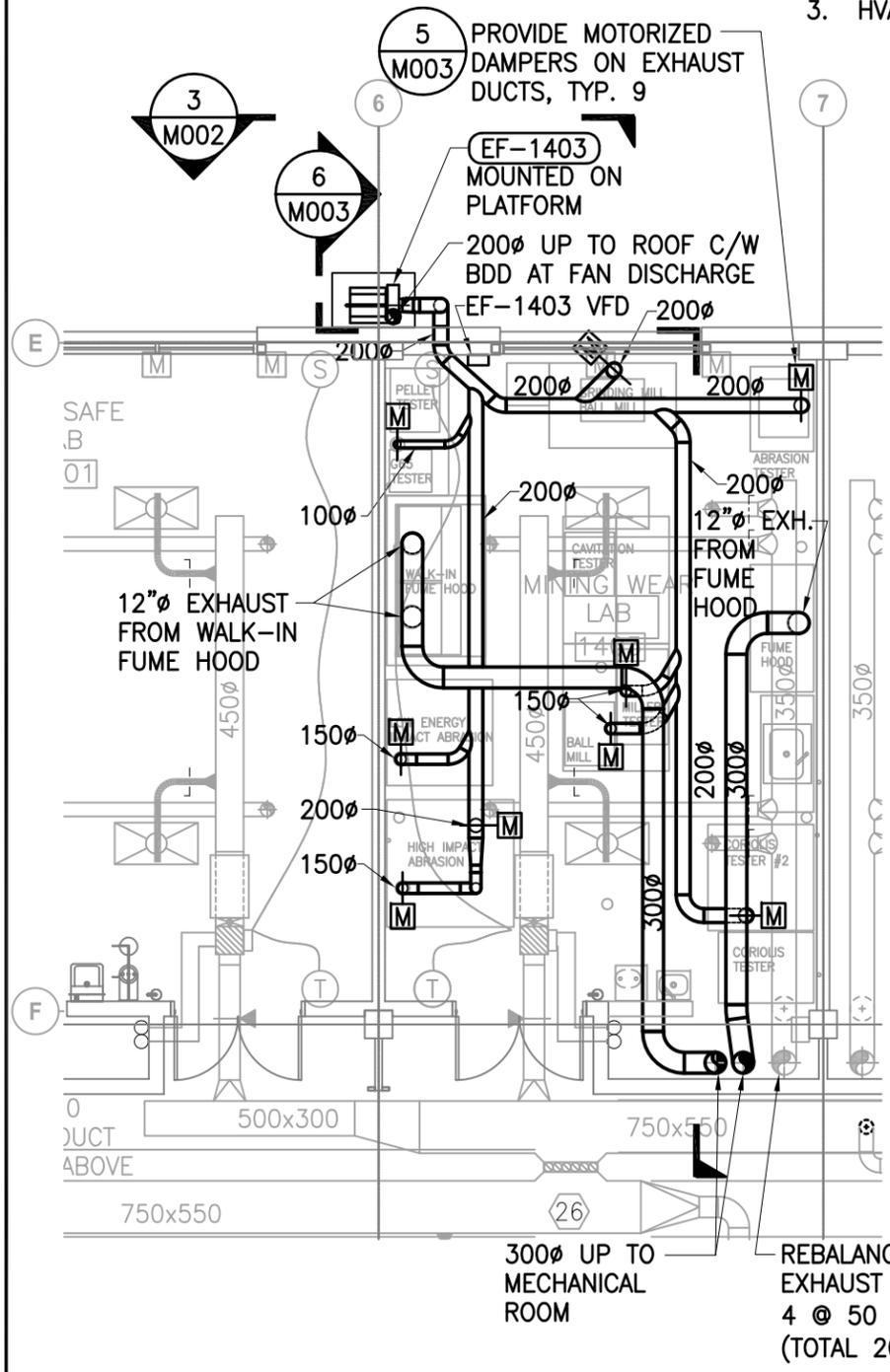
project number **1407** no. du projet

drawing no. **M-001** no. du dessin

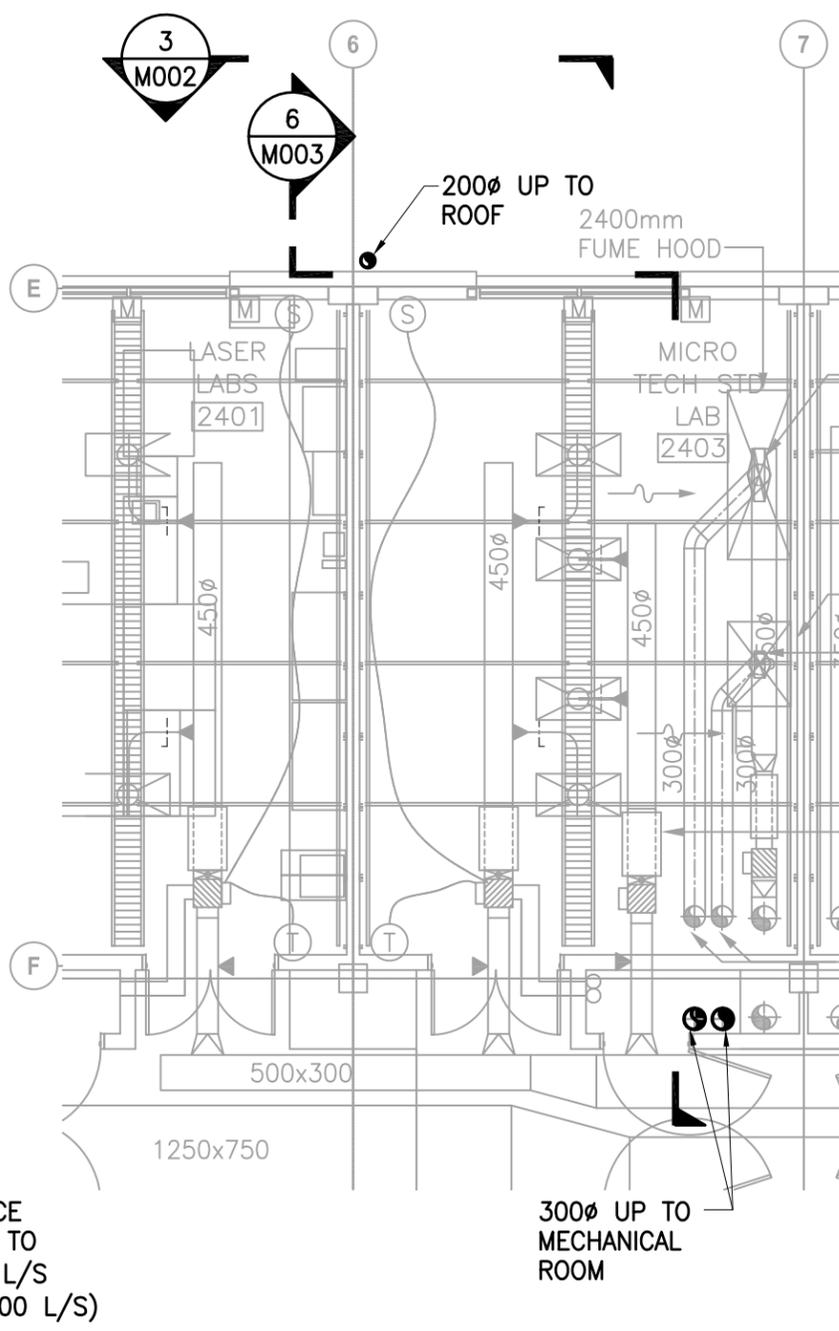


GENERAL NOTES:

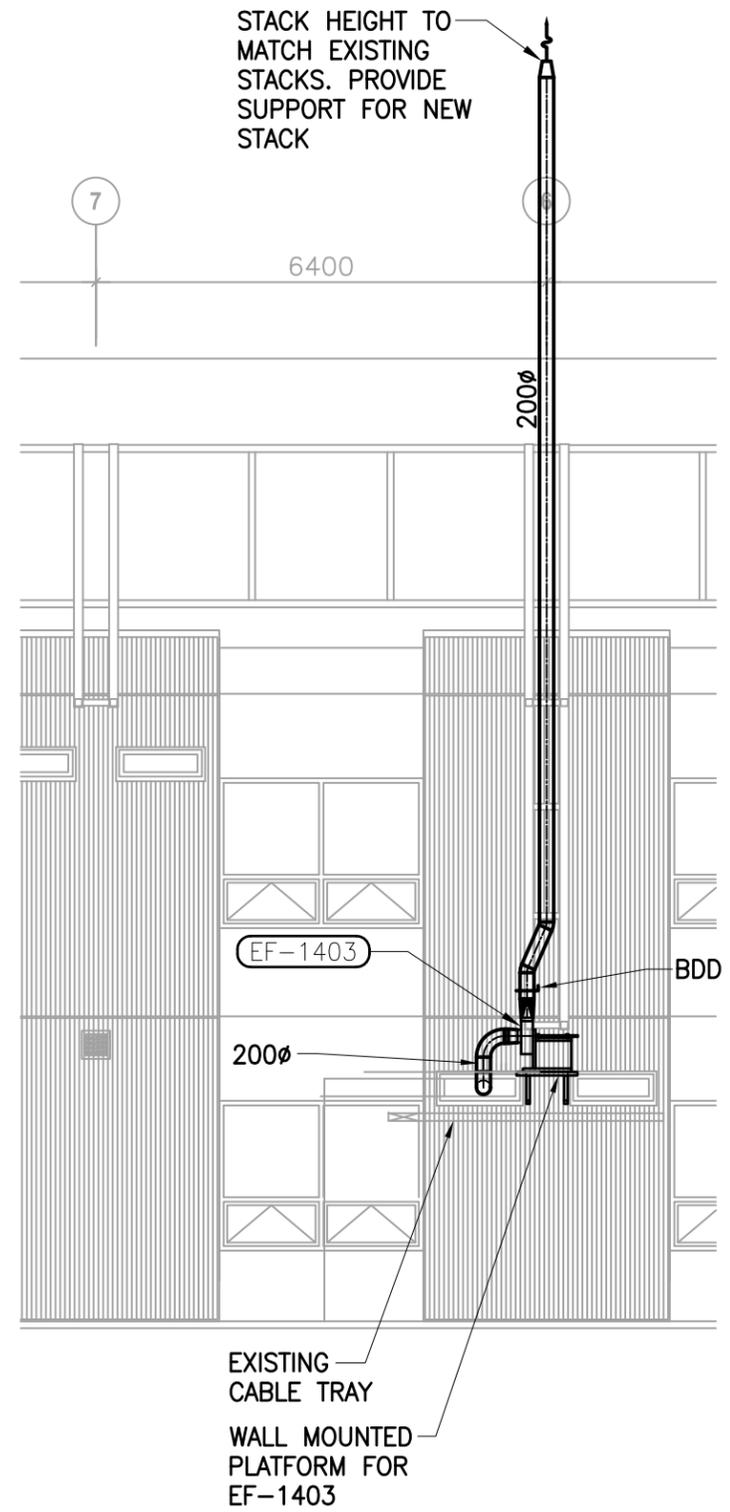
1. COORDINATE LOCATION OF EXHAUST DUCTING WITH CV-103A AND ASSOCIATED DUCTWORK AND DIFFUSERS TO AVOID INTERFERENCES. REFERENCE PROJECT 1409.
2. INSTALL EXHAUST DUCTING AWAY FROM EXISTING SPRINKLERS. NOTIFY ENGINEER OF ANY INTERFERENCES IMMEDIATELY.
3. HVAC CONTROLS BY OTHERS (NRC).



01 HVAC - MAIN FLOOR
M002



02 HVAC - SECOND FLOOR
M002



03 HVAC - ELEVATION
M002



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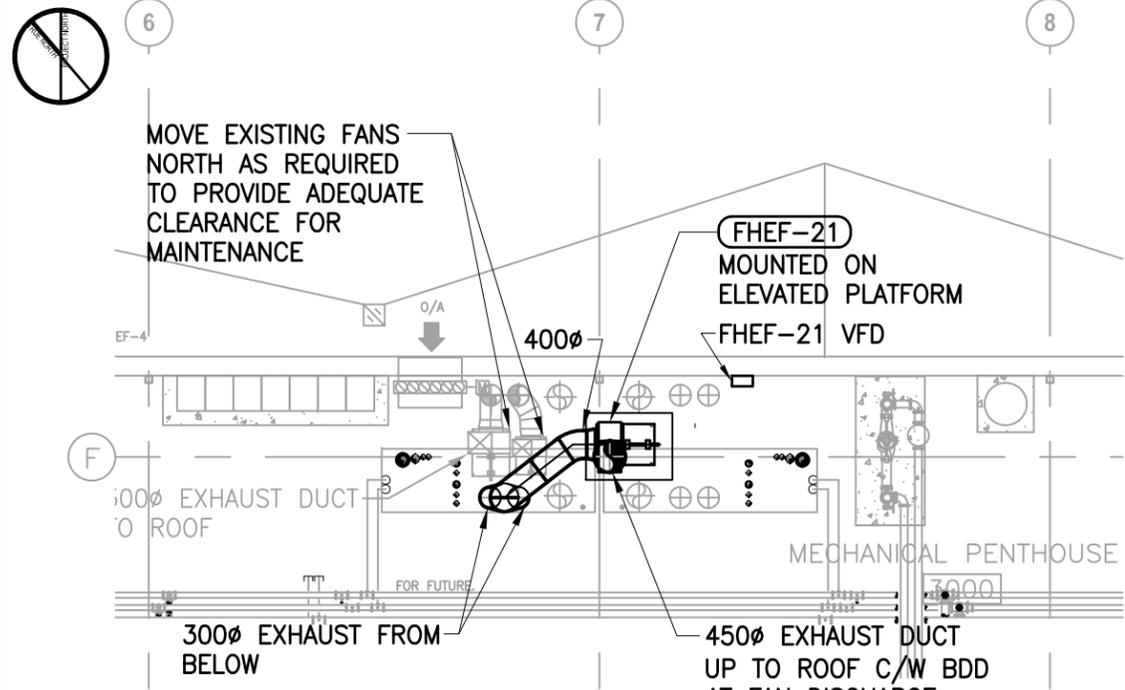
0	Issued for Tender	31 Oct 14
revisions		date

A	A detail no. no. du detail	A
B	B location drawing no. sur dessin no.	B
C	C drawing no. dessin no.	C

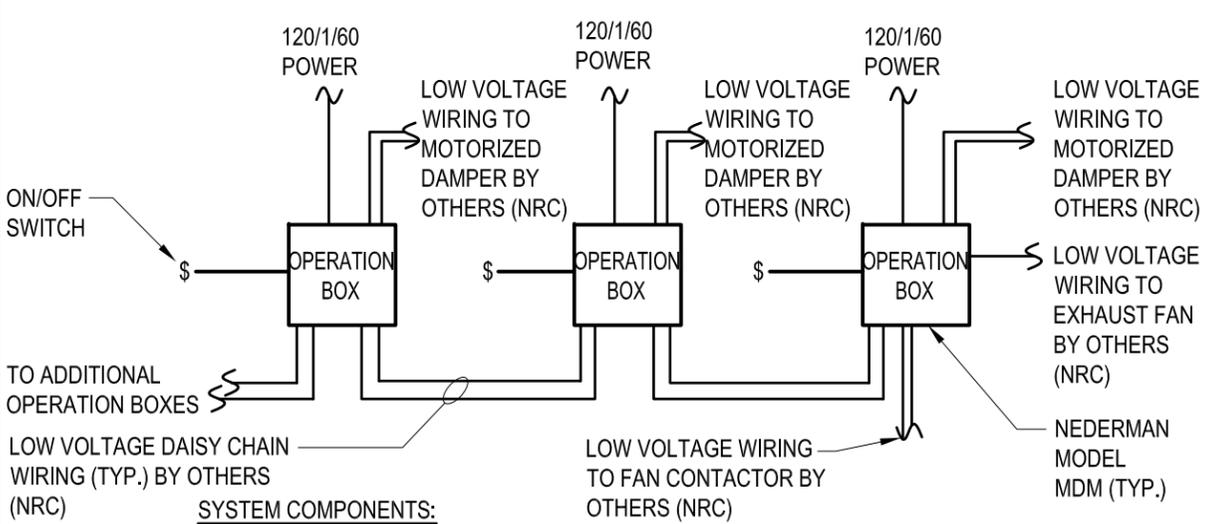
project **NRC · CMRC** project
NATIONAL RESEARCH COUNCIL CANADA
Wesbrook Mall, Vancouver, BC

drawing **MINING WEAR LAB 1403 RENOVATION** dessin
MAIN FLOOR & SECOND FLOOR PLANS AND ELEVATION

designed	KM	concu
date		
drawn	DL	dessine
date	AUG. 2014	
approved		approuve
date		
Tender		Soumission
PWGSC Project Manager	Administrateur de projets TPSGC	
project number	1407	no. du projet
drawing no.	M-002	no. du dessin



04 HVAC - MECHANICAL ROOM
MO03



SYSTEM COMPONENTS:

1. MOTORIZED DAMPER AND OPERATION BOX WITH SWITCH. ALL COMPONENTS PROVIDED BY CONTRACTOR.

NOTES:

1. EACH PIECE OF EQUIPMENT REQUIRING EXHAUST IS ASSIGNED AN OPERATION BOX AND MOTORIZED DAMPER.
2. THE OPERATION BOXES ARE WIRED IN A DAISY CHAIN.
3. EXHAUST FAN EF-1403 IS CONTROLLED ON A FIRST-ON/LAST-OFF BASIS.

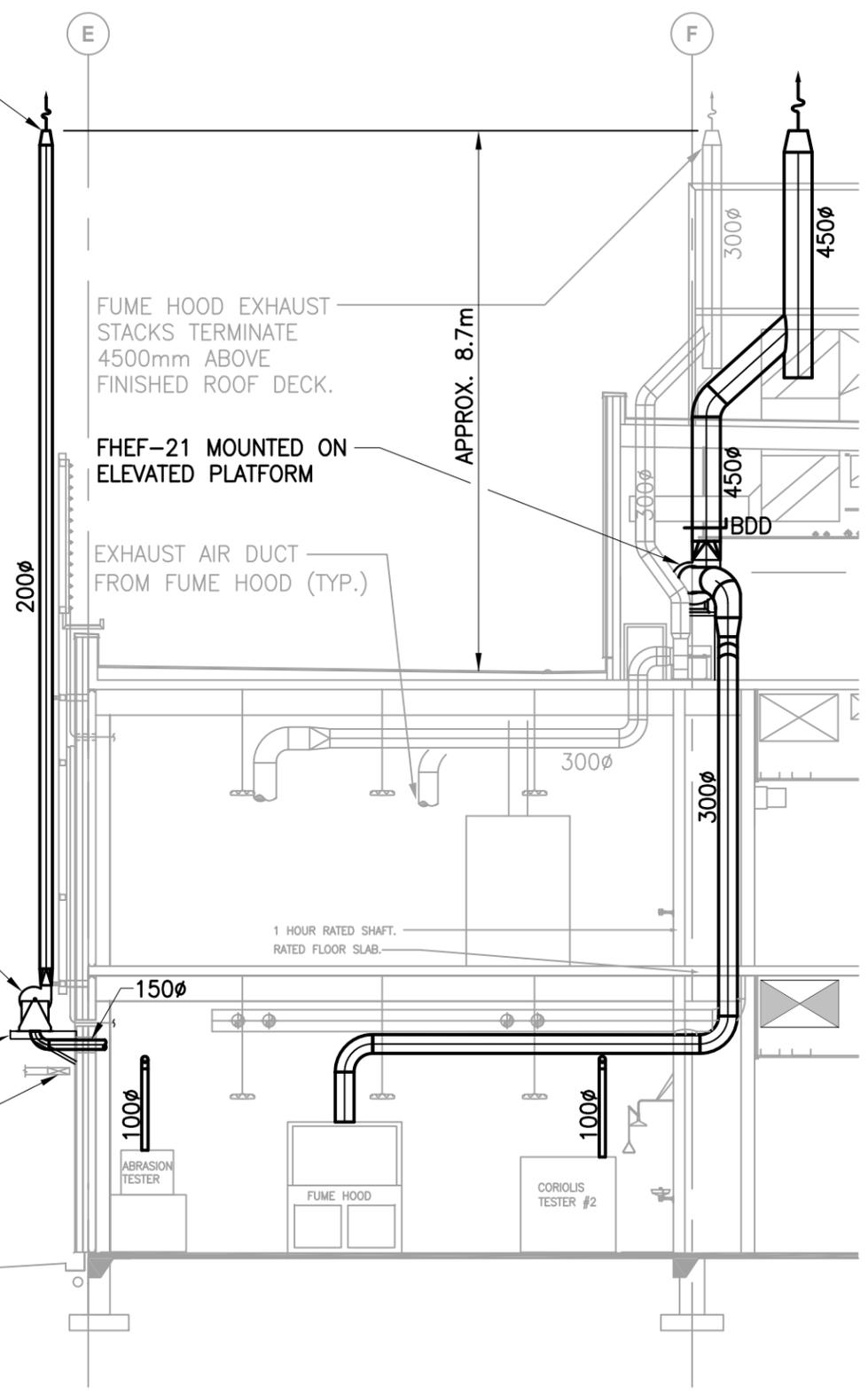
SEQUENCE OF OPERATION:

1. THE OPERATOR TURNS ON THE EQUIPMENT AND FAN SWITCH.
2. A SIGNAL IS SENT TO OPERATION BOX.
3. THE OPERATION BOX ACTIVATES THE MOTORIZED DAMPER TO "OPEN" POSITION.
4. THE OPERATION BOX SENDS A SIGNAL TO THE FAN CONTACTOR TO START EXHAUST FAN.

05 WIRING SCHEMATIC FOR MOTORIZED DAMPER CONTROL (EF-1403)
MO03

STACK HEIGHT TO MATCH EXISTING STACKS. PROVIDE SUPPORT FOR NEW STACK

EF-1403
WALL MOUNTED PLATFORM
EXISTING CABLE TRAY



06 HVAC - ELEVATION
MO03



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revisions		date

A	A detail no.	A
C	no. du detail	B
	B location drawing no.	C
	sur dessin no.	
	C drawing no.	
	dessin no.	

project **NRC · CRC** project
NATIONAL RESEARCH COUNCIL CANADA
Wesbrook Mall, Vancouver, BC

drawing **MINING WEAR LAB 1403 RENOVATION** dessin
MECHANICAL ROOM, ELEVATION AND SCHEMATIC

designed	KM	concu
date		
drawn	DL	dessine
date	AUG. 2014	
approved		approuve
date		
Tender		Submission
PWGC Project Manager		Administrateur de projets TPSGC
project number	1407	no. du projet
drawing no.	M-003	no. du dessin

1. GENERAL MECHANICAL PROVISIONS (15010)

- 1.1 CONFORMANCE
- 1.1 CONFORM TO TERMS AND CONDITIONS OF THE GENERAL CONTRACT DOCUMENT.
- 1.2 SCOPE
- 1 PROVIDE COMPLETE, FULLY TESTED AND OPERATIONAL MECHANICAL SYSTEMS TO MEET THE REQUIREMENTS DESCRIBED HEREIN AND IN COMPLETE ACCORDANCE WITH APPLICABLE CODES AND ORDINANCES.
 - 2 CONTRACT DOCUMENTS OF THIS DIVISION AND DRAWINGS ARE DIAGRAMMATIC AND APPROXIMATELY TO SCALE UNLESS DETAILED OTHERWISE. THEY ESTABLISH SCOPE, MATERIAL AND INSTALLATION QUALITY AND ARE NOT DETAILED INSTALLATION INSTRUCTIONS.
 - 3 FOLLOW MANUFACTURER'S RECOMMENDED INSTALLATION DETAILS AND PROCEDURES FOR EQUIPMENT, SUPPLEMENTED BY REQUIREMENTS OF CONTRACT DOCUMENTS.
 - 4 INSTALL EQUIPMENT GENERALLY IN LOCATIONS AND ROUTES SHOWN CLOSE TO BUILDING STRUCTURE WITH MINIMUM INTERFERENCE WITH OTHER SERVICES OR FREE SPACE. REMOVE AND REPLACE IMPROPERLY INSTALLED EQUIPMENT TO SATISFACTION OF THE CONSULTANT AT NO EXTRA COST.
 - 5 THE DRAWINGS INDICATE THE GENERAL LOCATION AND ROUTE TO BE FOLLOWED BY THE PIPING AND DUCTWORK. WHERE DETAILS ARE NOT SHOWN ON THE DRAWINGS OR ONLY SHOWN DIAGRAMMATICALLY, THE PIPES AND DUCTWORK SHALL BE INSTALLED IN SUCH A WAY AS TO CONSERVE HEAD ROOM AND INTERFERE AS LITTLE AS POSSIBLE WITH THE FREE USE OF SPACE THROUGH WHICH THEY PASS. SERVICE LINES SHALL RUN PARALLEL TO BUILDING LINES. ALL DUCT AND PIPES AT CEILING SHALL BE KEPT AS TIGHT AS POSSIBLE TO BEAMS OR OTHER LIMITING MEMBERS AT HIGH END. ALL PIPES AND DUCTS SHALL BE COORDINATED IN ELEVATION TO ENSURE THAT THEY ARE CONCEALED IN THE CEILING SPACE PROVIDED UNLESS DETAILED AND DIMENSIONED OTHERWISE ON DRAWINGS AND PERMITTED OTHERWISE BY THE CONSULTANT.
 - 6 CONNECT TO EQUIPMENT SPECIFIED IN OTHER SECTIONS AND TO EQUIPMENT SUPPLIED AND INSTALLED BY OTHER CONTRACTORS OR BY THE OWNER UNDER CONTRACT. SUCH IDENTIFICATION SHALL BE VIA MARKED UP DRAWINGS SHOWING OPENING LOCATIONS, SIZES, AND LEVELS. IF REQUIRED, THE CONTRACTOR IS TO CLEARLY MARK ON SITE THE INTENDED OPENINGS FOR REVIEW BY THE STRUCTURAL ENGINEER.
 - 12 COORDINATE WITH ALL SUB-TRADES AT THE START AND THROUGHOUT THE PROJECT TO PREVENT AVOIDABLE CONFLICTS. COSTS ASSOCIATED WITH REDOING SERVICE DUE TO LACKING OF COORDINATION ON SITE WILL BE RESOLVED AT THE CONTRACTORS' COST.
 - 13 ENSURE ALL WHIMS AND OTHER CONSTRUCTION AND SITE SAFETY PROCEDURES ARE FOLLOWED BY ALL TRADES.
 - 14 THE WORK SHALL INCLUDE BUT NOT LIMIT TO THE FOLLOWING:
 - 1 COMPLETE HVAC AND CONTROLS INSTALLATION.
 - 2 COMMISSIONING AND BALANCING.
- 1.3 MATERIALS
- 1 MATERIALS AND EQUIPMENT INSTALLED SHALL BE NEW, FULL WEIGHT AND OF QUALITY SPECIFIED. USE SAME BRAND OR MANUFACTURER FOR EACH SPECIFIED APPLICATION.
 - 2 EACH MAJOR COMPONENT OF EQUIPMENT SHALL BEAR MANUFACTURER'S NAME, ADDRESS, CATALOG AND SERIAL NUMBER.
- 1.4 CUTTING AND PATCHING
- 1 PROVIDE HOLES AND SLEEVES, CUTTING AND FITTING REQUIRED FOR MECHANICAL WORK. RELOCATE IMPROPERLY LOCATED HOLES AND SLEEVES.
 - 2 ALL WORK SHALL BE COORDINATED WITH OTHER TRADES ESPECIALLY THAT RELATED TO CUTTING AND PATCHING OF REQUIRED OPENINGS AND LOCATIONS AND INSTALLATION OF SLEEVES, INSERTS, SUPPORT, CURBS, FRAMES AND ACCESS DOORS.
 - 3 OBTAIN APPROVAL FROM STRUCTURAL AND ELECTRICAL ENGINEERS BEFORE DRILLING AND CORING OF EXISTING STRUCTURE.
 - 4 PROVIDE X-RAY OF ALL REQUIRED PENETRATIONS OF THE FLOOR. X-RAY USE FOR LOCATING IN FLOOR REBAR AND CONDUIT TO BE DONE AFTER NORMAL WORKING HOURS. TAKE NECESSARY PRECAUTIONS TO PROTECT COMPUTER EQUIPMENT WHEN X-RAYING FLOORS. COORDINATE WITH OWNER.
 - 5 DRILL FOR EXPANSION BOLTS, HANGER RODS, BRACKETS, AND SUPPORTS.
 - 6 OBTAIN WRITTEN APPROVAL FROM STRUCTURAL CONSULTANT BEFORE CUTTING OR BURNING STRUCTURAL MEMBERS. THIS WORK SHALL BE CARRIED OUT BY THE SPECIALIST TRADE ONLY.
 - 7 PROVIDE OPENINGS AND HOLES REQUIRED IN PRECAST MEMBERS FOR MECHANICAL WORK. CAST HOLES LARGER THAN 100MM Ø (4") TIGHT TO COLUMNS SHALL NOT EXCEED 200MM Ø (8"), CAST OR FIELD CUT HOLES SMALLER THAN 100MM Ø (4") CAULK GAPS BETWEEN WALL FINISHES AND PIPES WHERE THE GAP APPROX. 13MM (1/2"). GAPS GREATER THAN 13MM (1/2"), INSTALL AN ESCUTCHEON PLATE. IN FIRE RATED WALLS, WHERE THE TOTAL SIZE OF A HOLE EXCEEDS 20 SQ. IN, THE CONDITION IS UNACCEPTABLE AND MUST BE PATCHED WITH FIRE RATED DRYWALL OR SIMILAR TO MAINTAIN THE REQUIRED FIRE RESISTANCE RATING.
 - 8 REPAIR BUILDING WHERE DAMAGED FROM EQUIPMENT INSTALLATION, IMPROPERLY LOCATED HOLES, ETC., BY THIS SECTION OF THE WORK. THIS REPAIR WORK SHALL BE CARRIED OUT BY THE SPECIALIST TRADE AT THE EXPENSE OF THIS SECTION OF WORK. USE MATCHING MATERIALS AS SPECIFIED IN THE RESPECTIVE SECTIONS.
- 1.5 SHOP DRAWINGS
- 1 PROVIDE SHOP DRAWINGS FOR SPECIFIED EQUIPMENT.
 - 2 IDENTIFY MATERIALS AND EQUIPMENT BY MANUFACTURER, TRADE NAME AND MODEL NUMBER. INCLUDE COPIES OF APPLICABLE BROCHURE OR CATALOG MATERIAL.
 - 3 CLEARLY MARK SUBMITTAL MATERIAL USING ARROWS, UNDERLINING OR CIRCLING TO SHOW DIFFERENCES FROM SPECIFIED, E.G. RATINGS, CAPABILITIES AND OPTIONS BEING PROPOSED. CROSS OUT NON-APPLICABLE MATERIAL. SPECIFICALLY NOTE ON THE SUBMITTAL SPECIFIED FEATURES SUCH AS SPECIAL TANK LININGS, PUMPS, SEALS, MATERIAL, OR PAINTING.

- 4 INCLUDE DIMENSIONAL AND TECHNICAL DATA SUFFICIENT TO CHECK IF EQUIPMENT MEETS REQUIREMENTS. INCLUDE WIRING, PIPING, AND SERVICE CONNECTION DATA AND MOTOR SIZES.
 - 5 INSTALLED MATERIALS AND EQUIPMENT SHALL MEET SPECIFIED REQUIREMENTS REGARDLESS OF WHETHER OR NOT SHOP DRAWINGS ARE REVIEWED BY THE CONSULTANT.
 - 6 DO NOT ORDER EQUIPMENT OR MATERIAL UNTIL THE CONSULTANT HAS REVIEWED AND RETURNED APPROVED SHOP DRAWINGS.
 - 7 SHOP DRAWINGS SHALL BE ENDORSED BY THE GENERAL CONTRACTOR AND MECHANICAL SUB-CONTRACTOR INDICATING THAT THE SHOP DRAWINGS HAVE BEEN REVIEWED AND SUBMITTED WITHOUT QUALIFICATIONS.
 - 8 SUBMIT A MINIMUM OF (4) COPIES OF SHOP DRAWINGS PRIOR TO ORDERING EQUIPMENT.
 - 9 SUBMIT WEIGHTS OF ALL MAJOR EQUIPMENT FOR REVIEW SUCH THAT THE LOADS CAN BE REVIEWED BY THE APPROPRIATE CONSULTANT.
 - 10 SUBMIT LIST OF ALL ELECTRICAL MOTORS AND POWER REQUIREMENTS TO ELECTRICAL CONSULTANT AND CONTRACTOR.
 - 11 SUBMIT SHOP DRAWINGS TO SUIT CONSTRUCTION SCHEDULE - ALLOWING ADEQUATE TIME FOR CONSULTANT APPROVAL.
- 1.6 STANDARDS OF MATERIALS, EQUIPMENT AND INSTALLATION
- 1 EQUIPMENT USED SHALL NOT EXCEED SPACE LIMITATIONS IN ANY DIMENSION. REPLACE ANY EQUIPMENT OR APPARATUS WHICH DOES NOT MEET THIS SPECIFICATION AT NO COST. ASSUME FULL RESPONSIBILITY FOR THE EXPENSE OF REDESIGN AND ADJUSTMENT TO OTHER PARTS OF THE BUILDING WHEN PROPOSING THE USE OF APPROVED EQUAL OR ALTERNATE EQUIPMENT.
 - 2 SUBMIT SAMPLES, IN ADDITION TO DRAWINGS, OF ALL ITEMS WHICH IN THE CONSULTANT'S JUDGMENT, CAN BE BETTER EXAMINED FOR CAPACITY, QUALITY, FINISH OR DETAIL BY SAMPLE RATHER THAN BY DRAWINGS. SAMPLES SHALL BE SUBMITTED BEFORE EQUIPMENT IS ORDERED.
 - 3 PROVIDE EQUIPMENT FROM THE SPECIFIED MANUFACTURERS. ALL MECHANICAL EQUIPMENT SHALL HAVE THE APPROVED MANUFACTURERS NAME PERMANENTLY AFFIXED TO IT.
 - 4 EQUIPMENT ON ALTERNATE & APPROVED MANUFACTURERS LIST MUST BE EQUAL IN QUALITY AND PERFORMANCE TO THE MODEL SPECIFIED. EQUIPMENT WHICH IS NOT EQUAL WILL BE REPLACED WITH THE SPECIFIED EQUIPMENT AT NO COST TO THE OWNER.
 - 5 IF SHOP DRAWINGS ARE REJECTED TECHNICALLY AFTER 3 SUBMISSIONS, THE CONTRACTOR, AT NO ADDITIONAL EXPENSE TO THE OWNER, SHALL REVERT TO SPECIFIED PRODUCT AND MANUFACTURER FOR THIS PROJECT.
 - 6 THE EQUIPMENT MANUFACTURER SHALL ENSURE THAT THE STRENGTH AND ANCHORAGE OF THE INTERNAL COMPONENTS OF THE EQUIPMENT EXCEEDS THE FORCE LEVEL USED TO RESTRAIN AND ANCHOR THE EQUIPMENT UNIT ITSELF TO THE SUPPORTING STRUCTURE.
 - 7 ACCEPTABLE PRODUCTS/SUPPLIERS/MANUFACTURERS:
- | ITEM | ACCEPTABLE PRODUCTS/SUPPLIERS/MANUFACTURERS |
|----------------------------------|--|
| GRILLES, DIFFUSERS AND REGISTERS | DDK, TUTTLE & BAILEY, PRICE |
| INSULATION - DUCT/PIPING | FIBERGLAS, KNAUF, JOHNS-MANVILLE, ATLAS, PPG, MANSION, ARMSTRONG, ARMAFLEX |
| JACKETING MATERIAL | CHILDERS, FIBERGLAS, JOHNS-MANVILLE |
| PIPE FITTINGS AND FLANGES | CRANE, GRINNELL, JENKINS, VICTAULIC |
| PIPE SUPPORTS AND HANGERS | CRANE, UNISTRUT, MYATT, GRINNELL, SARCO |
| TESTING & BALANCING AGENTS | KD ENGINEERING, WESTERN MECHANICAL |
| VIBRATION CONTROL EQUIPMENT | VIBRO-ACOUSTICS, LO-REZ, VIBRON, KORFUND, MASON |
| EXHAUST FANS | GREENHECK, COOK |
- 1.7 PERFORMANCE VERIFICATION OF INSTALLED EQUIPMENT
- 1 INSTALLED MECHANICAL EQUIPMENT WHOSE PERFORMANCE IS QUESTIONED BY THE CONSULTANT, MAY BE SUBJECT TO PERFORMANCE VERIFICATION AS SPECIFIED HEREIN.
 - 2 WHEN PERFORMANCE VERIFICATION IS REQUESTED, EQUIPMENT SHALL BE TESTED TO DETERMINE COMPLIANCE WITH SPECIFIED PERFORMANCE REQUIREMENTS.
 - 3 THE CONSULTANT WILL DETERMINE BY WHOM TESTING SHALL BE CARRIED OUT. WHEN REQUESTED, THE CONTRACTOR SHALL ARRANGE FOR SERVICES OF AN INDEPENDENT TESTING AGENCY.
 - 4 TESTING PROCEDURES SHALL BE APPROVED BY THE CONSULTANT.
 - 5 MAINTAIN BUILDING COMFORT CONDITIONS WHEN EQUIPMENT IS REMOVED FROM SERVICE FOR TESTING PURPOSES.
 - 6 PROMPTLY PROVIDE THE CONSULTANT WITH ALL TEST REPORTS.
 - 7 SHOULD TEST RESULTS REVEAL THAT ORIGINALLY INSTALLED EQUIPMENT MEETS SPECIFIED PERFORMANCE REQUIREMENTS, OWNER WILL PAY ALL COSTS RESULTING FROM PERFORMANCE VERIFICATION PROCEDURE.
 - 8 SHOULD TEST RESULTS REVEAL THAT EQUIPMENT DOES NOT MEET SPECIFIED PERFORMANCE REQUIREMENTS, EQUIPMENT WILL BE REJECTED AND THE FOLLOWING SHALL APPLY:
 - 1 REMOVE REJECTED EQUIPMENT, REPLACE WITH EQUIPMENT WHICH MEETS REQUIREMENTS OF CONTRACT DOCUMENTS INCLUDING SPECIFIED PERFORMANCE REQUIREMENTS.
 - 2 REPLACEMENT EQUIPMENT WILL BE SUBJECT TO PERFORMANCE VERIFICATION AS WELL, USING SAME TESTING PROCEDURES ON ORIGINALLY INSTALLED EQUIPMENT.
 - 3 CONTRACTOR SHALL PAY ALL COSTS RESULTING FROM PERFORMANCE VERIFICATION PROCEDURE.
- 1.8 OPERATING AND MAINTENANCE DATA
- 1 INSTRUCT THE BUILDING OPERATORS IN THE OPERATION AND PREVENTATIVE MAINTENANCE OF EACH PIECE OF EQUIPMENT AND SYSTEM SUPPLIED AND INSTALLED. COMPLETE AND TURN OVER DOCUMENTATION PRIOR TO SUBSTANTIAL PERFORMANCE.
 - 2 SUBMIT 2 SETS 0 & M MANUALS IN 3-RING BINDERS AND TRANSFER ALL DATA ONTO A CD, TO INCLUDE THE FOLLOWING:
 - * NAME OF ENGINEER AND MECHANICAL CONTRACTOR AND PHONE NUMBER.
 - * DESCRIPTION OF OPERATION OF ALL MECHANICAL SYSTEMS.
 - * SHOP DRAWINGS OF ALL EQUIPMENT.
 - * LIST OF TAGGED VALVES.
 - * EXTENDED WARRANTIES.
 - * MAINTENANCE AND OPERATION INSTRUCTIONS.
 - * LIST OF MANUFACTURERS SOURCE AND TRADE NAMES.
 - * BALANCE REPORT OF AIR & WATER SYSTEMS.
 - * COPY OF RECORD DRAWING.
 - * LIST OF INSPECTION AND TEST CERTIFICATES.
 - * CONTRACTOR'S WARRANTY CERTIFICATE
 - * SEISMIC ENGINEER'S CERTIFICATE (WHEN REQUIRED BY CODE)

1.9 RECORD DRAWINGS

- 1 SUBMIT RECORD DRAWINGS IDENTIFYING LOCATION OF FIRE DAMPERS, ACCESS DOORS, TAGGED VALVES AND ACTUAL ROOM NAMES.
 - 2 THE CONTRACTOR SHALL BE RESPONSIBLE FOR AND KEEP ONE SET OF WHITE PRINTS. INCLUDING REVISION DRAWINGS, IN JOB SITE OFFICE. SET OF WHITE PRINTS SHALL BE MAINTAINED IN CONSTANT UP-TO-DATE CONDITION BY EACH TRADE (AS-BUILT CONDITIONS MARKED IN RED PENCIL). THE 1 WHITE SET OF PRINTS WILL BE PROVIDED TO THE CONTRACTOR BY THE CONSULTANT AT THE CONTRACTORS COST.
 - 3 THE RECORD DRAWINGS SHALL INCLUDE, BUT NOT BE LIMITED TO, THE FOLLOWING CHANGES AND SHALL BE RECORDED DAILY:
 - 1 SIZE, LOCATION, ARRANGEMENT, ROUTE AND EXTENT OF DUCTWORK, PIPING, CONDUIT, TERMINAL UNITS, EQUIPMENT, FIXTURES, CLEANOUTS, VALVES, ROUGH-IN, ETC., ABOVE AND BELOW GRADE INSIDE THE BUILDING, INCLUDING LOCATIONS OF BURIED PIPING.
 - 2 LOCATION, TAGGING AND NUMBERING OF ALL VALVES EXCEPT INDIVIDUAL PLUMBING FIXTURES OR EQUIPMENT ISOLATION VALVES.
 - 3 THE AS-BUILT DAILY MARKED-UP PRINTS SHALL CONFORM TO THE STANDARDS OF THE CONTRACT DRAWINGS AND SHALL INCLUDE ALL DETAILS FROM REVISION DRAWINGS, SUPPLEMENTARY DRAWINGS, CHANGE ORDERS, ADDENDA AND SITE REVISIONS, ETC.
 - 4 AT THE END OF CONSTRUCTION, ALL OF THE ABOVE CHANGES SHALL BE TRANSFERRED BY THE CONSULTANT, AT CONTRACTORS COST. THE CONTRACTOR SHALL ALLOW \$300 PER DRAWING.
- 1.10 PAINTING AND IDENTIFICATION
- 1 CLEAN ALL EXPOSED BARE METAL SURFACES SUPPLIED BY THE MECHANICAL AND PLUMBING TRADE BY REMOVING ALL DIRT, DUST, GREASE AND MILLSCALE.
 - 2 REPAINT ALL MARRED FACTORY FINISHED EQUIPMENT, WHICH IS NOT SCHEDULED TO BE REPAINTED, TO MATCH THE ORIGINAL FACTORY FINISH.
 - 3 PIPE MARKERS AND DIRECTION ARROWS - IN ALL EXPOSED AREAS.
 - 4 PROVIDE COMMERCIALY AVAILABLE PIPE MARKERS HAVING STANDARD SIZES OF LETTERING AND COLOURS. STANDARD COLOURS DESIGNATE CLASSES OF MATERIALS FOLLOWS, AND ARE CONSISTENT WITH THOSE SPECIFIED BY THE CSA AND THE USAS. PROVIDE MARKERS TO ALL PIPES PROVIDED UNDER THIS CONTRACT.
 - 5 LOCATION OF PIPE MARKERS AND DIRECTION ARROWS
 - 1 PIPE MARKER AND DIRECTION ARROW SHALL BE PLACED SIDE BY SIDE IN THE BOTTOM QUARTER OF THE PIPE TO BE IDENTIFIED.
 - 2 ADJACENT TO ALL MAJOR CHANGES IN DIRECTION AND AT CONNECTIONS TO EACH PIECE OF EQUIPMENT.
 - 3 AT LEAST ONCE IN EACH ROOM THAT THE PIPE PASSES THROUGH.
 - 4 WHERE PIPING PASSES THROUGH WALLS, PARTITIONS, OR FLOORS, IDENTIFY PIPING ON BOTH SIDES OF THE SECTION AND AT ENTRY AND EXITS TO SHAFTS.
- 1.11 EQUIPMENT PROTECTION AND CLEAN-UP
- 1 PROTECT EQUIPMENT AND MATERIAL UNTIL FINAL ACCEPTANCE. TAKE SPECIAL PRECAUTIONS TO PREVENT ENTRY OF FOREIGN MATERIAL INTO WORKING PARTS OF PIPING AND DUCT SYSTEMS.
 - 2 THOROUGHLY CLEAN ALL NEW AND EXISTING PIPING, DUCTS AND EQUIPMENT OF DIRT, CUTTINGS, AND OTHER FOREIGN MATERIAL.
 - 3 ENSURE THAT EXISTING EQUIPMENT TO BE REMOVED IS CAREFULLY DISMANTLED AND NOT DAMAGED OR LOST. DO NOT REUSE EXISTING MATERIALS AND EQUIPMENT UNLESS SPECIFICALLY INDICATED.
 - 4 UPON COMPLETION OF TENANT'S IMPROVEMENTS AND BEFORE OCCUPANCY, THE CONTRACTOR SHALL THOROUGHLY VACUUM AND THOROUGHLY CLEAN THE LEASED PREMISES INCLUDING BUT NOT LIMITED TO WINDOWS (INTERIORS ONLY), VERTICAL BLINDS, LIGHT FIXTURES AND LENSES AND THE FACE OF THE DIFFUSERS.
 - 5 DAMAGED CEILING TILES AND ANY OTHER PARTS OF THE BUILDING AFFECTED BY THE TENANT'S WORK SHALL BE REPAIRED. THE LANDLORD RECOMMENDS THE USE OF THE BUILDING CLEANING CONTRACTOR TO ENSURE PHYSICAL COMPATIBILITY OF CLEANING MATERIALS AND STANDARDS.
- 1.12 CONNECTION AND INTERRUPTION TO EXISTING SYSTEMS
- 1 COORDINATE INTERRUPTION OF EXISTING BUILDING SYSTEMS WITH THE OWNER.
 - 2 INCLUDE PREMIUM TIME FOR CONNECTION TO EXISTING SYSTEM SO THAT NORMAL USE OF THE EXISTING SYSTEM WILL NOT BE AFFECTED. THERE SHALL BE NO SYSTEM SHUT-DOWN UNLESS ACCEPTED BY THE OWNER.
- 1.13 ACCESS OF EQUIPMENT
- 1 MAKE ALL ARRANGEMENTS TO ENSURE THAT ADEQUATE ACCESS IS AVAILABLE FOR ALL MECHANICAL EQUIPMENT. DO ALL HOISTING AND RIGGING INTO PLACE OF ALL SPECIFIED EQUIPMENT AND BE RESPONSIBLE FOR ANY DAMAGES INCURRED THEREFROM.
 - 2 CONTRACTOR TO DEMONSTRATE REASONABLE ACCESS TO ALL EQUIPMENT SERVICE LOCATIONS.
 - 3 CO-ORDINATE AND ACCESS PANELS TO DRAINS/CLEAN OUTS ETC. FOR APPROVAL WITH INTERIOR DESIGNER.
 - 4 ADEQUATE ACCESS TO BE PROVIDED TO ALL FILTERS, DAMPERS ETC. OF ALL NEW AND EXISTING EQUIPMENT.
 - 5 ADEQUATE ACCESS TO BE PROVIDED TO ALL EQUIPMENT, FILTERS, DAMPERS, WHERE LOCATED OVER DRYWALL CEILING.
- 1.14 LIABILITY
- 1 ASSUME FULL RESPONSIBILITY FOR LAYING OUT THE WORK AND FOR ANY DAMAGE CAUSED TO THE OWNER OR OTHER TRADES BY IMPROPER LOCATION, OR CARRYING OUT OF THE WORK.
 - 2 BE RESPONSIBLE FOR PROMPT INSTALLATION OF THIS WORK IN ADVANCE OF CONCRETE POURING OR SIMILAR WORK. PROVIDE AND SET SLEEVES WHERE REQUIRED. SHOULD ANY CUTTING OR REPAIRING OF EITHER UNFINISHED OR FINISHED WORK BE REQUIRED, THIS CONTRACTOR SHALL DIRECT THE PARTICULAR SUB-CONTRACTOR WHOSE WORK IS INVOLVED TO DO SUCH CUTTING AND REPAIRING WITHOUT EXPENSE TO THE OWNER, BEFORE BEING UNDERTAKEN, SUCH WORK SHALL BE LAID OUT FOR THE CONSULTANT'S REVIEW.

- 3 EXAMINE THE SITE AND THE LOCAL CONDITIONS AFFECTING WORK UNDER THIS CONTRACT PRIOR TO SUBMITTING BID. EXAMINE CAREFULLY THE MECHANICAL, ELECTRICAL, STRUCTURAL AND ARCHITECTURAL DRAWINGS AND CONFIRM THAT THE WORK UNDER THIS CONTRACT CAN BE SATISFACTORILY CARRIED OUT WITHOUT CHANGES TO THE BUILDING AS SHOWN ON THESE PLANS. BEFORE COMMENCING THE WORK, EXAMINE THE WORK OF THE OTHER TRADES AND REPORT AT ONCE ANY DETECT OF INTERFERENCE AFFECTING THE WORK OF THIS SECTION, OF THE GUARANTEE OF SAME. NO EXTRAS WILL BE SUBSEQUENTLY ALLOWED TO COVER ANY SUCH ERROR, OMISSION OR OVERSIGHT ON THE THOROUGH INSPECTION OF THE GROUNDS, BUILDING, CONDITIONS, ETC.
 - 4 ARRANGE WORK IN CO-OPERATION WITH OTHER TRADES IN THE BUILDING IN SUCH A MANNER AS NOT TO INTERFERE WITH OTHER WORK BEING CARRIED ON IN THE BUILDING AND PLACES WHERE OTHER PIPES AND EQUIPMENT BE INSTALLED ALONG WITH THE PIPES AND DUCTS PERTAINING TO THIS TRADE. CO-OPERATE WITH THE OTHER TRADES TO GET ALL THE PIPES, DUCTS, CONDUIT, ETC., INSTALLED TO THE BEST ADVANTAGE. WHEN OPEN WEB STRUCTURAL JOISTS ARE USED, MUST OBTAIN STRUCTURAL SHOP DRAWINGS TO ENSURE SPACE AVAILABLE FOR INSTALLATION OF PIPES AND DUCTWORK.
 - 5 WHERE ANY PIPES, DUCTS AND EQUIPMENT MUST BE BUILT INTO THE WORK OF OTHER TRADES SUCH AS MASONRY, STRUCTURAL, OR PLASTERING, BE RESPONSIBLE FOR SUPPLYING THE EQUIPMENT TO BE BUILT IN OR MEASUREMENTS TO ALLOW THE NECESSARY OPENINGS TO BE LEFT. ALL PIPES AND DUCTS WHICH ARE TO BE CONCEALED SHALL BE INSTALLED NEATLY AND CLOSELY TO THE BUILDING STRUCTURE SO THAT THE NECESSARY FURRING CAN BE KEPT AS SMALL AS POSSIBLE. ANY PIPES, DUCTS, OR OTHER WORK WHICH ARE NOT, IN THE OPINION OF THE CONSULTANT, INSTALLED AS THEY SHOULD BE, SHALL BE TAKEN OUT AND REPLACED WITHOUT COST TO THE OWNER.
 - 6 PROTECT FINISHED AND UNFINISHED WORK FROM DAMAGE DUE TO THE CARRYING OUT OF THIS WORK, GIVING SPECIAL ATTENTION TO THE PROTECTION OF BUILDING VAPOUR BARRIERS, WATERPROOF MEMBRANES, ETC. COVER FLOORS AND OTHER PARTS OF THE BUILDING WITH TARPULINS, ETC., AND REPAIR ALL DAMAGE TO THE SATISFACTION OF THE OWNER AND THE CONSULTANT. DURING FREEZING WEATHER, PROTECT ALL MATERIALS IN SUCH A MANNER THAT NO HARM CAN BE DONE TO THE INSTALLATION ALREADY MADE AND/OR TO MATERIALS AND EQUIPMENT ON THE JOB.
 - 7 BE RESPONSIBLE FOR THE CONDITION OF ALL MATERIALS AND EQUIPMENT SUPPLIED AND PROVIDE ALL NECESSARY PROTECTION FOR SAME.
 - 8 BE RESPONSIBLE FOR THE PROTECTION AND MAINTENANCE OF THE WORK OF THIS SECTION UNTIL THE BUILDING HAS BEEN COMPLETED AND ACCEPTED BY THE OWNER, AND BE RESPONSIBLE FOR THE SORTING OF MATERIAL INSIDE AND OUT OF THE WAY, AND TO CLEAN UP ALL REFUSE CAUSED BY THIS WORK TO MEET CONSULTANT'S REVIEW.
 - 9 ON COMPLETION OF THE WORK, ALL TOOLS AND SURPLUS AND WASTE MATERIALS SHALL BE REMOVED AND THE WORK LEFT IN A CLEAN AND PERFECT CONDITION.
- 1.15 GUARANTEE WARRANTY
- 1 THIS CONTRACTOR SHALL FURNISH A WRITTEN WARRANTY STATING THAT ALL WORK EXECUTED UNDER THIS DIVISION WILL BE FREE FROM DEFECTS OF MATERIAL AND WORKMANSHIP FOR A PERIOD OF ONE (1) YEAR FROM THE DATE OF SUBSTANTIAL PERFORMANCE, WHICH SHALL INCLUDE ONE (1) COMPLETE SUMMER AND ONE (1) COMPLETE WINTER OF UNINTERRUPTED OPERATION. WARRANTY SHALL INCLUDE ANY PART OF EQUIPMENT, UNITS OR STRUCTURES FURNISHED HEREUNDER THAT SHOW DEFECTS IN THE WORKS UNDER NORMAL OPERATING CONDITIONS AND/OR FOR THE PURPOSE OF WHICH THEY WERE INTENDED.
 - 2 THE CONTRACTOR SHALL AT HIS OWN EXPENSE PROMPTLY INVESTIGATE ANY MECHANICAL OR CONTROL MALFUNCTION, AND REPAIR OR REPLACE ALL SUCH DEFECTIVE WORK, AND ALL OTHER DAMAGES THEREBY WHICH BECOMES DEFECTIVE DURING THE TIME OF THE GUARANTEE-WARRANTY.
- 1.16 HOISTS AND SCAFFOLDS
- 1 PROVIDE INTERIOR MOVABLE OR ROLLER SCAFFOLDS FOR THE INSTALLATION OF THE MECHANICAL WORK. ALL OTHER HOISTS, SCAFFOLDS, TEMPORARY ELEVATORS, LADDERS, RUNWAYS, ETC., SHALL BE REQUESTED BY THIS CONTRACTOR AND ARRANGED WITH THE GENERAL CONTRACTOR.
- 1.17 SITE REVIEW
- 1 THE CONSULTANT OR HIS REPRESENTATIVE MAY CHOOSE TO INSPECT ALL WORK PRIOR TO IT BEING CONCEALED.
 - 2 THE CONTRACTOR SHALL NOTIFY THE CONSULTANT IN WRITING FOR THE FOLLOWING MINIMUM, BUT NOT LIMITED TO, INSPECTIONS: (REQUIRED TO PROVIDE A SCHEDULE 'C' FOR OCCUPANCY)
 - 1 ALL HVAC AND PLUMBING ROUGH-IN PRIOR TO WALL AND CEILING FINISH INSTALLATION.
 - 2 FIRE STOPPING OF ALL OPENINGS.
 - 3 DROP TEST ALL FIRE DAMPERS AND DEMONSTRATE ACCESS.
 - 4 FINAL OCCUPANCY INSPECTION AND VERIFICATION OF ALL EQUIPMENT BEING FULLY OPERATIONAL.
 - 3 ALL WORK SHALL BE APPROVED BY ANY OTHER REGULATORY BODY HAVING JURISDICTION WHERE REQUIRED.
 - 4 THE CONTRACTOR IS TO PROVIDE COPIES OF ALL PERMITS, INSPECTION REPORTS AND CERTIFICATES TO THE CONSULTANT.
 - 5 THE CONTRACTOR IS TO PROVIDE THE CONSULTANT REASONABLE NOTICE PRIOR TO CALLING AN INSPECTION.
 - 6 AFTER THE PRE-OCCUPANCY INSPECTION FOR SUBSTANTIAL PERFORMANCE ALL DEFICIENCIES SHALL BE COMPLETED FOR THE FINAL INSPECTION. THE CONTRACTOR WILL BE PERMITTED ONE ADDITIONAL FINAL INSPECTION TO FINISH ALL REMAINING DEFICIENCIES. ANY ADDITIONAL INSPECTIONS AFTER FINAL OCCUPANCY WILL BE AT THE CONTRACTORS' COST AND PAID TO THE CONSULTANT, IN ADVANCE, AT \$500.00 PER SITE VISIT.
- 1.18 SUBSTANTIAL PERFORMANCE INSPECTION
- 1 PRIOR TO THE CONTRACTOR REQUESTING AN INSPECTION FOR SUBSTANTIAL PERFORMANCE ALL THE FOLLOWING ITEMS MUST BE PROVIDED TO PERMIT BENEFICIAL USE BY THE OWNER:
 - 1 COMPLY WITH REQUIREMENTS IN GENERAL CONTRACT CONDITIONS.
 - 2 AS-BUILT DRAWINGS SUBMITTED.
 - 3 BALANCING REPORTS (AIR AND WATER,) IF REQUIRED.
 - 4 ALL SYSTEMS SHALL BE CERTIFIED IN WRITING BY THE CONTRACTOR AS COMPLETE AND FULLY OPERATIONAL.
 - 5 A COMPLETE LIST OF ITEMS WHICH THE CONTRACTOR HAS NOT FINISHED, OR ARE DEFICIENT SHALL BE PROVIDED, IF, IN THE OPINION OF THE CONSULTANT, THIS LIST INDICATES THE PROJECT IS EXCESSIVELY INCOMPLETE, A SUBSTANTIAL COMPLETION INSPECTION WILL NOT BE PERFORMED.
 - 6 THE CONTRACTOR SHALL BE FULLY RESPONSIBLE TO ACCUMULATE ALL NECESSARY DATA FROM HIS SUB-TRADES AND SUPPLIERS AND PRESENT SAME IN THE SPECIFIED FORMAT FOR THE APPROVAL BY THE CONSULTANT.



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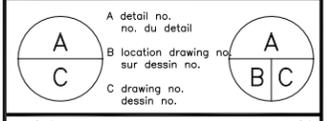
ALL RIGHTS RESERVED, USE OR REPRODUCTION PROHIBITED WITHOUT PRIOR WRITTEN PERMISSION FROM THE ENGINEER.

THE GENERAL CONTRACTOR SHALL REVIEW THE DOCUMENTS FOR CONFORMANCE TO CODES AND BY-LAWS AND SHALL ADVISE THE ENGINEER OF ANY DISCREPANCIES HE MAY NOTE. THE GENERAL CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ALL ERRORS AND OMISSIONS TO THE ENGINEER.

DO NOT SCALE THE DRAWINGS.

THESE DRAWINGS ARE INTENDED FOR ARCHITECTURAL INFORMATION ONLY. THE CONTRACTOR AND ANY PERSONS USING THESE DRAWINGS ARE ADVISED TO REFER TO THE ENGINEER FOR INFORMATION RELATING TO SPECIFIC DISCIPLINES.

0	Issued for Tender	31 Oct 14
revisions		date



project **NRC · CRC** project
NATIONAL RESEARCH COUNCIL CANADA
Wesbrook Mall, Vancouver, BC

drawing **MINING WEAR LAB 1403 RENOVATION** dessin
MECHANICAL SPECIFICATIONS SHEET 1

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1.19 LAWS, NOTICES, PERMITS AND FEES

- .1 GIVE ALL NECESSARY NOTICES, OBTAIN ALL NECESSARY PERMITS AND PAY ALL FEES IN ORDER THAT THE WORK SPECIFIED MAY BE CARRIED OUT, AND FURNISH ANY CERTIFICATES NECESSARY AS EVIDENCE THAT THE WORK INSTALLED CONFORMS WITH THE LAW AND REGULATIONS OF ALL AUTHORITIES HAVING JURISDICTION.
- .2 ALL WORK SHALL BE IN ACCORDANCE WITH THE REGULATIONS OF THE FOLLOWING AUTHORITATIVE BODIES, THE CODES IN EFFECT AT THE TIME OF TENDER, AND ANY OTHERS HAVING JURISDICTION:
 - .1 FIRE MARSHALL
 - .2 CANADIAN ELECTRICAL CODE
 - .3 ASSOCIATED/RELATED BUILDING CODE IN THIS PROVINCE AND LOCAL BUILDING BY-LAWS
 - .4 WORKER'S COMPENSATION BOARD
 - .5 CANADIAN STANDARDS ASSOCIATION
 - .6 POLLUTION CONTROL BOARD
 - .7 NATIONAL BUILDING CODE OF CANADA
 - .8 UNDERWRITERS' LABORATORIES OF CANADA

1.20 FIRE-STOPPING

- .1 FIRE-STOP ALL PIPE AND DUCT PENETRATIONS THROUGH FLOORS AND WALLS, DESIGNATED AS FIRE AND/OR SMOKE SEPARATIONS.
- .2 FIRE-STOPPING MATERIALS TO MEET ULC CAN 25115. ACCEPTABLE MATERIALS: BY "TREMCO" OR "NATIONAL FIRESTOPPING".
- .3 PREPARATION OF SURFACES AND INSTALLATION OF FIRE-STOPPING MATERIALS SHALL BE CARRIED OUT AS PER MANUFACTURER'S INSTRUCTIONS.

1.21 FLASHING AND ROOF CURBS

- .1 PROVIDE CURBS, FLASH AND COUNTER FLASH WHERE MECHANICAL EQUIPMENT PASSES THROUGH WEATHER OR WATERPROOFED WALLS, FLOORS AND ROOFS.
- .2 ALL ROOFING WORKS SHALL BE PERFORMED BY THE LANDLORD DESIGNATED ROOFING CONTRACTOR.

2. TESTING (15042)

- .1 PERFORM ALL TESTING REQUIRED BY THE AUTHORITY HAVING JURISDICTION.
- .2 PRESSURE TEST PIPING AT 1.5 TIMES MAXIMUM WORKING PRESSURE OR 125 PSI. PRESSURE TEST ALL BURIED SYSTEMS BEFORE BACKFILLING. DRAINAGE PIPING SHALL BE TESTED WITH 5' TO 25' OF HYDROSTATIC PRESSURE. PRESSURE TESTS SHALL BE LEFT ON FOR A MINIMUM OF 4 HOURS AND HYDROSTATIC TESTS FOR A MINIMUM OF 8 HOURS.
- .3 OBTAIN TEST CERTIFICATES FOR ALL TESTS PERFORMED AND PROVIDE TO CONSULTANT.
- .4 ALL TEST SHALL BE DOCUMENTED AND WITNESSED BY THE CONSULTANT OR GENERAL

3. BALANCING (15043)

- .1 CONTRACTOR IS TO PROVIDE THE SERVICES OF THE BASE BUILDING APPROVED PROFESSIONAL TESTING & BALANCING FIRM.
- .2 PROVIDE A BALANCE REPORT OF ALL AIR & WATER BALANCE POINTS AND PERFORMANCE TESTING & BALANCING OF ALL EQUIPMENT AS PER THE AABC.
- .3 BALANCE ALL AIR AND WATER QUANTITIES TO - 5% OR + 10% OF THE DESIGN REQUIREMENT, EXCEPT IN AIR SYSTEMS PART OF LIFE SAFETY WHERE DEVIATION SHALL BE 0 TO + 5%.
- .4 MEASURE AND BALANCE THE FOLLOWING (WHERE APPLICABLE):
 - .1 SUPPLY, EXHAUST AND RETURN FAN VOLUMES AND SPEEDS.
 - .2 AIRFLOW AT EACH AIR OUTLET, VAV, AND BRANCH CONNECTION.
 - .3 ADJUST PATTERN CONTROL ON SUPPLY DIFFUSERS.
 - .4 MOTOR AMPERAGE DRAW ON ALL MOTORS AND COMPARE WITH MOTOR RATING.
- .5 AFTER INSTALLATION AND BALANCING OF ALL THE FUME HOODS, THE CONTRACTOR SHALL COMMISSION A REGISTERED P.Eng TO CONDUCT A COMPLETE CERTIFICATION FOR ALL FUME HOODS IN COMPLIANCE WITH WORKSAFE BC REGULATION 30.8 (2.5) AND SUBMIT CERTIFICATION REPORTS FOR OWNER'S RECORD.
- .6 ADDITIONAL TESTING OF THE SYSTEM MAY BE REQUESTED BY THE CONSULTANT TO SPOT CHECK AIR AND WATER FLOW QUANTITIES. (10% OF THE SYSTEM WILL BE RE-CHECKED AT THE DISCRETION OF THE CONSULTANT) AT THE CONTRACTOR' COST.
- .7 UPON COMPLETION OF WORK, SUBMIT 2 COPIES OF AIR BALANCING REPORT TO PROPERTY MANAGER.

4. PIPE & PIPE FITTINGS (15060)

- .1 ENSURE ALL PIPE MATERIALS AND FITTINGS ARE ACCEPTABLE TO THE AUTHORITY HAVING JURISDICTION.
- .2 ALL TYPE 'L' COPPER MUST BE CERTIFIED TO ASTM B88, PROVIDE WRITTEN GUARANTEE THAT LEAD FREE SOLDER WAS USED ON ALL DOMESTIC WATER SYSTEMS.
- .3 APPROVED PIPE & FITTINGS: (NON-COMBUSTIBLE CONSTRUCTION).

SERVICE	PIPE	FITTINGS
.1 HOT WATER (ALTERNATE)	TYPE 'L' HARD COPPER	WROUGHT COPPER OR BRASS TO ANSI/ASME B16.22

- .2 HOT WATER SCHEDULE 40 BLACK STEEL OR ASTM A53 GRADE B MALLEABLE IRON OR STEEL, THREADED OR WELDED
- .4 CONTRACTOR TO PROVIDE DRAINS AT ALL LOW POINTS IN THE PIPING SYSTEM.

5. SUPPORT, ANCHORS, SEALS & FIRESTOPPING (15090)

- .1 PROVIDE ALL NECESSARY SUPPORTS, AND HANGERS TO SECURE MECHANICAL SYSTEMS AND EQUIPMENT.
- .2 PROVIDE FIRESTOPPING AT ALL DUCT AND PIPING PENETRATIONS THROUGH RATED FLOORS/WALLS AND SHAFTS. PROVIDE SHOP DRAWINGS SHOWING APPLICABLE ASSEMBLIES. ALL PRODUCTS TO BE ULC LISTED.
- .3 PROVIDE OVERSIZE HANGERS ON ALL COLD PIPES TO FIT OVER PIPE INSULATION WHERE REQUIRED.

- .4 PROVIDE ISOLATION AND PREVENT CONTACT WITH DISSIMILAR METALS.
- .5 ALL SLEEVES FOR MECHANICAL PIPING TO EXTEND 1" (25MM) ABOVE THE FLOOR IN ALL MECHANICAL ROOMS, SHAFTS AND WET AREAS.
- .6 ALL DUCTWORK TO BE SUPPORTED AS PER SMACNA.
- .7 ALL EXPOSED PIPING PENETRATIONS SHALL BE PROVIDED WITH ESCUTCHEONS.

7. INSULATION (15250)

- 7.1 INSULATION SHALL CONFORM TO INSULATION "AGENCY" THAT GOVERNS IN BC.
- 7.2 PIPING INSULATION:
 - .1 PROVIDE VAPOUR BARRIER FOR ALL COLD PIPES.
 - .2 ALL EXPOSED PIPING TO BE COMPLETE WITH PF-3 ECONOMY FINISH, NO FINISH REQUIRED ON CONCEALED PIPING.
 - .3 PROVIDE INSULATION THICKNESS AND TYPE AS FOLLOWS: (WHERE APPLICABLE)

SERVICE	PIPE THICKNESS	PIPE SIZE	INSULATION	TYPE
HOT WATER HEATING	ALL		1.5" (40MM)	MINERAL FIBRE

7.3 DUCT AND BREECHING INSULATION

- .1 EXPOSED RECTANGULAR DUCTS: RIGID FIBROUS GLASS INSULATION, 'K' VALUE AT 75°F (24°C) MAXIMUM 0.24 BTU.IN/FT HRF (0.035 W/M°C) WITH FACTORY APPLIED REINFORCED ALUMINUM FOIL VAPOUR BARRIER.
- .2 ROUND DUCTS AND CONCEALED RECTANGULAR DUCTS: FLEXIBLE FIBROUS GLASS INSULATION, 'K' VALUE 75°F (24°C) MAXIMUM 0.24 BTU.IN/FT HRF (0.035 W/M°C) WITH FACTORY APPLIED REINFORCED ALUMINUM FOIL VAPOUR BARRIER.
- .3 PROVIDE 1"ACOUSTIC INSULATION IN ALL DUCTS OFF EQUIPMENT SUPPLY AND RETURN OR EXHAUST INLETS AND OUTLETS. MAINTAIN INSIDE SIZES OF DUCTS SHOWN ON DRAWINGS
- .4 ACOUSTIC LINING: FIBROUS INSULATION WITH 'K' VALUE AT 75°F (24°C) MAXIMUM 0.24 BTU.IN/FT HRF (0.035 W/M°C) ABSOLUTE ROUGHNESS OF EXPOSED SURFACE NOT TO EXCEED 0.023 IN (0.58 000) COATED TO PREVENT FIBRE EROSION AT AIR VELOCITIES UP TO 5000 FPM (254 M/S), 1.5 LB/FT (24 KG/M) MINIMUM DENSITY FOR DUCTWORK AND 4.7 LB/FT (75 KG/M) PLENUMS.
- .5 RECOVER ALL INSULATION EXCEPT IN CEILING SPACES, CRAWL SPACES, AND MECHANICAL SHAFTS.
- .6 RECOVERY JACKETS: ULC LABELED THERMOCANVAS.
- .7 ENSURE SURFACE AND INSULATION IS CLEAN AND DRY PRIOR TO AND DURING INSTALLATION.
- .8 ENSURE INSULATION IS CONTINUOUS THROUGH INSIDE PARTITIONS.
- .9 FINISH AND SEAL INSULATION NEATLY AT HANGERS, SUPPORTS, ACCESS DOORS, FIRE DAMPERS AND OTHER PROTRUSIONS.

8.0 DUCTWORK AND ACCESSORIES

8.1 GENERAL

- .1 FABRICATE DUCTWORK IN ACCORDANCE WITH SMACNA DUCT MANUAL AND ASHRAE HANDBOOKS. DUCTWORK SHALL MEET THE REQUIREMENTS OF NFPA 90A AND 90B AND CONFORM TO APPLICABLE CODES. KITCHEN EXHAUST DUCTWORK SHALL CONFORM TO NFPA 96.
- .2 PRIOR TO FABRICATION OF DUCTWORK, CHECK ALL CEILING SPACES AND HEIGHTS AND CONFLICTS WITH OTHER TRADES.
- .3 DUCT SIZES INDICATED ARE INSIDE CLEAR DIMENSIONS.FOR ACOUSTICALLY LINED OR INTERNALLY INSULATED DUCTS MAINTAINS SIZE INSIDE DUCTS.
- .4 FLEXIBLE DUCTWORK SHALL MEET SMACNA STANDARD. USE THERMAFLEX 1"INSULATED FLEX DUCT. FLEXIBLE DUCTS SHALL NOT EXCEED 6 FEET IN LENGTH UNLESS NOTED OTHERWISE ON DRAWINGS. SUPPORT FLEXIBLE DUCT TO MAINTAIN 12"VERTICAL DROP WITH NO KINKS IN FLEX DUCT. WHERE THIS CANNOT BE PROVIDED, INSTALL A 12"VERTICAL SLEEVE OFF DIFFUSER NECK.
- .5 PROVIDE FIRE DAMPERS WHERE DUCTS CROSS FIRE SEPARATIONS. FIRE DAMPERS SHALL BE ULC LISTED AND CONSTRUCTED IN ACCORDANCE WITH ULC STANDARD S112 "FIRE DAMPERS". FUSIBLE LINKS SHALL BE CONSTRUCTED TO ULC STANDARD S505.
- .6 PROVIDE BALANCING DAMPERS WHERE INDICATED ON DRAWINGS AND AT POINTS ON LOW PRESSURE SUPPLY, RETURN AND EXHAUST DUCTS WHERE BRANCHES ARE TAKEN FROM LARGER DUCTS.
- .7 PROVIDE ADEQUATELY SIZED ACCESS PANELS FOR DAMPERS, EQUIPMENT, FIRE DAMPERS, VALVES, RADIATION VALVES, AND ANY OTHER EQUIPMENT REQUIRING SERVICING.
- .8 PROVIDE RETURN AIR OPENINGS AND/OR INSULATED SOUND TRAPS WHERE INDICATED.
- .9 PROVIDE ACOUSTICAL SEAL AROUND DUCTS AND SOUND TRAPS AT PENETRATION THROUGH SOUND Baffles.
- .10 MODIFY CEILING SYSTEM WHERE REQUIRED TO ACCOMMODATE GRILLES AND DIFFUSERS.
- .11 SIZE ROUND DUCTS, INSTALLED IN PLACE OF RECTANGULAR DUCTS, FROM ASHRAE TABLE OF EQUIVALENT RECTANGULAR AND ROUND DUCTS. NO VARIATION OF DUCT CONFIGURATION OR SIZES PERMITTED EXCEPT BY PERMISSION FROM ENGINEER.
- .12 EXPOSED ROUND DUCTWORK TO BE SPIRAL LOCK SEAM TYPE ONLY.
- .13 PROVIDE DUCT HANGERS AND SUPPORTS IN ACCORDANCE WITH SMACNA MANUALS.
- .14 IDENTIFY DUCTWORK AS PER THE BASE BUILDING STANDARDS. CONFIRM THESE PRIOR TO SUBMITTING TENDER.

8.2 LOW VELOCITY DUCTWORK

- .1 DUCTWORK SHALL BE GALVANIZED STEEL. THE MINIMUM SHEET METAL THICKNESS FOR DUCTS INCLUDING FITTINGS, ACCESS DOORS, AND OTHER ACCESSORIES SHALL BE AS PER SMACNA DUCT MANUAL FOR LOW VELOCITY DUCTWORK.
- .2 LOW VELOCITY INSULATED FLEXIBLE DUCTWORK SHALL BE EQUAL TO THERMAFLEX TYPE M-KC.
- .3 CONNECT DIFFUSERS OR TROFFER BOOTS TO LOW PRESSURE DUCTS WITH 36" (900 mm) MAXIMUM LENGTH OF STRETCHED FLEXIBLE DUCT. HOLD IN PLACE WITH CAULKING COMPOUND AND STRAP OR CLAMP. DO NOT USE FLEXIBLE DUCT TO CHANGE DIRECTIONS.
- .4 WHERE LOW PRESSURE DUCTS ARE CONNECTED TO FAN EQUIPMENT, TERMINAL BOXES OR ANY OTHER APPARATUS, A SCREWED OR BOLTED FLEXIBLE GASKETED JOINT SHALL BE PROVIDED BETWEEN THE DUCTWORK AND THE EQUIPMENT.

8.3 MEDIUM AND HIGH VELOCITY DUCTWORK

- .1 DUCTWORK SHALL BE GALVANIZED STEEL. THE MINIMUM SHEET METAL THICKNESS FOR MEDIUM AND HIGH PRESSURE DUCTS INCLUDING FITTINGS, ACCESS DOORS AND OTHER ACCESSORIES SHALL BE AS PER SMACNA MANUAL FOR MEDIUM AND HIGH VELOCITY DUCTWORK.
 - .2 CONTINUOUSLY WELDED ROUND DUCTS SHALL HAVE 4" (100 mm) CEMENTED SLIP JOINTS. BRAZED OR ELECTRIC WELDED.
 - .3 WHERE FLEXIBLE AIR DUCTS ARE USED TO CONNECT TERMINAL UNITS TO METAL DUCTS, THE FLEXIBLE AIR DUCTS SHALL BE RATED FOR 6000 FPM (30.5 M/S) VELOCITY AND 16" W.G. (3.98 KPA). MAXIMUM STRETCHED LENGTH OF FLEXIBLE AIR DUCT SHALL BE 12' (300 mm). DO NOT USE FLEXIBLE DUCT TO CHANGE DIRECTION. WHERE FLEXIBLE AIR DUCTS ARE ATTACHED TO METAL INSULATED DUCT, FURNISH FLEXIBLE AIR DUCTS WITH FIBERGLASS WOOL INSULATION AND METALIZED JACKET SUCH AS THERMAFLEX M-KC.
- 8.4 FUME HOOD EXHAUST DUCTS
- .1 STAINLESS STEEL TO ASTM A480/A480M, TYPE 316, WELD SEAM, JOINTS, CONNECTIONS, ETC. CONTINUOUSLY, IN FINISHED AREAS ALL SEAMS AND JOINTS SHALL BE GROUND SMOOTH, BUFFED AND POLISHED TO MATCH STAINLESS STEEL FINISH.
 - .2 ELBOWS SHALL BE MITRED AND JOINT WELDED. CONSTRUCT ELBOWS OF MINIMUM 5 SECTIONS.
 - .3 SUPPORT EXPOSED DUCTWORK WITH 50mm x 1.8mm STAINLESS STEEL "U" STRAP AT 2.0m CENTRES. STRAP TO MATCH FINISH OF DUCT.
 - .4 SUPPORT VERTICAL DUCTWORK AT EACH FLOOR LEVEL WITH INTERMEDIATE ADDITIONAL SUPPORTS AND SUPPORT HORIZONTAL CONCEALED DUCTWORK WITH 50mm x 1.8mm THICK GALVANIZED HANGERS AT 2.0m CENTRES MAXIMUM.
 - .5 DUCTWORK SHALL HAVE CONTINUOUSLY INERT GAS WELDED STAINLESS STEEL ANGLE IRON FLANGES WITH SILICONE GASKETS AND STAINLESS STEEL BOLTS AT ENTRY AND EXIT FROM SHAFTS.
 - .6 PROVIDE A COMPANION FLANGE AND ANY REQUIRED TRANSITIONS FOR FUME HOOD DUCT CONNECTIONS CONTINUOUSLY WELDED TO DUCT.
 - .7 PROVIDE GASKETTED ACCESS DOORS 450mm x 300mm AT 7m INTERVALS, CHANGES OF DIRECTION AND BASE OF RISERS AND AT FAN INLET AND DISCHARGE.
 - .8 PROVIDE STAINLESS STEEL DRAINS TO ALL EXHAUST HOODS WITH STAINLESS STEEL SCREWED CONNECTION. PIPE TO DRAIN.
 - .9 FOR FUME HOOD AND LAB EQUIPMENT EXHAUST SYSTEMS PROVIDE:
 - .1 BACKDRAFT DAMPER 316 C/W 2B FINISH STAINLESS STEEL, EPDM SEAL AT EACH FUME HOOD.
 - .2 STACK HEAD DISCHARGE CONE AT ROOF OUTLET TO PROVIDE 10 m/s OUTLET VELOCITY.
 - .3 2mm DIAMETER STAINLESS STEEL SCREEN AT DISCHARGE AT 75mm CENTRES.
 - .10 INSTALL DUCT SEAM AT TOP OF DUCT.

8.5 DUCT SEALING

- .1 ALL SUPPLY, RETURN AND EXHAUST DUCT JOINTS, LONGITUDINAL AS WELL AS TRANSVERSE, SHALL BE SEALED USING,
 - .1 LOW PRESSURE DUCTWORK:
 - * SLIP JOINTS: APPLY HEAVY BRUSH-ON HIGH PRESSURE DUCT SEALANT. APPLY SECOND APPLICATION AFTER THE FIRST APPLICATION HAS COMPLETELY DRIED OUT. WHERE METAL CLEARANCE EXCEEDS 1/16" (1.5 mm) USE HEAVY MASTIC TYPE SEALANT.
 - * FLANGED JOINTS: SOFT ELASTOMER BUTYL OR EXTRUDED FORM OF SEALANT BETWEEN FLANGES FOLLOWED BY AN APPLICATION OF HEAVY BRUSH-ON HIGH PRESSURE DUCT SEALANT.
 - * OTHER JOINTS: HEAVY MASTIC TYPE SEALANT.
 - .2 MEDIUM AND HIGH PRESSURE DUCTWORK: COMBINATION OF WOVEN FABRICS AND SEALING COMPOUND FOLLOWED BY AN APPLICATION OF HIGH PRESSURE DUCT SEALANT.
- .2 DUCT TAPES AS SEALING METHOD ARE NOT PERMITTED.
- .3 SURFACES TO RECEIVE SEALANT SHOULD BE FREE FROM OIL, DUST, DIRT, MOISTURE, RUST AND OTHER SUBSTANCES THAT INHIBIT OR PREVENT BONDING.
- .4 DO NOT INSULATE ANY SECTION OF THE DUCTWORK UNTIL IT HAS BEEN INSPECTED AND APPROVED OF DUCT SEALANT APPLICATION, BY THE ENGINEER.

9. CONTROLS (15900)

- .1 DIVISION 16 (ELECTRICAL) TO PROVIDE WIRING TO 120V/1 PHASE MOTOR AND ALSO THE WIRING BETWEEN SUCH MOTOR AND ITS CONTROL DEVICE SUCH AS THERMOSTAT AND TIME CLOCK. ALL OTHER WIRING ARE GENERALLY BY DIVISION 15. THE MOTOR LIST SCOPE OF WORK SHALL BE FOLLOWS.
- .2 ALL DIVISION 15 (MECHANICAL) WIRING AND CONDUIT REQUIREMENTS TO FOLLOW DIVISION 16 (ELECTRICAL) SPECIFICATIONS FOR THIS PROJECT. THIS SHALL INCLUDE LOW-VOLTAGE WIRING. MOUNT OF CONTROL DEVICES.
 - .1 BY ELECTRICAL CONTRACTOR - MOUNTING AND WIRING THERMOSTATS CONTROLLING SINGLE PHASE MOTOR. WIRING OF AQUASTATS AND TIMERS CONTROLLING SINGLE PHASE MOTORS.
 - .2 BY MECHANICAL CONTRACTOR - MOUNTING OF ALL IN-LINE PIPING DEVICES (WELL, VALVES, PRESSURE SWITCHES, ORIFICES, ETC.), MOUNTING OF AQUASTATS AND ALL CONTROL DEVICES.
 - .3 BY SHEET METAL CONTRACTOR - MOUNTING OF DAMPERS, BAFFLING IN MIXED AIR PLENUM TO CONTROL CONTRACTOR REQUIREMENTS, ACCESS DOOR FOR DUCT OR UNIT MOUNTED CONTROLS.
- .3 PROVIDE NEW THERMOSTATS AS INDICATED ON THE DRAWINGS. MOUNT ON WALL OR COLUMN AT 60" ABOVE FLOOR. THERMOSTATS ON EXTERIOR WALL SHALL BE COMPLETE WITH INSULATED BASE PLATE.
- .4 RELOCATE EXISTING THERMOSTATS AS INDICATED.
- .5 WORKING WITH THE AIR BALANCING AGENT, RE-CALIBRATE VAV BOX MAX. AND MIN. VOLUMES IF REQUIRED TO ACHIEVE AIR FLOWS.
- .6 RECALIBRATE ALL NEW AND EXISTING THERMOSTATS IN RENOVATED AREA.
- .7 CONTRACTOR TO PROVIDE NEW DDC CONNECTIONS TO ALL NEW MECHANICAL EQUIPMENT AS PER BASE BUILDING BMS STANDARD & TO PROVIDE GRAPHICS UPDATE AS PER THE MECHANICAL DRAWINGS.

10. HVAC CONTROL SEQUENCE

- 1.1 HVAC CONTROL SEQUENCE
 - .1 HVAC SYSTEMS:
 - .1 PROGRAM THE SYSTEM TO MEET THE FOLLOWING OBJECTIVES:
 - .1 TEMPERATURE:
 - .1 CONTROL THE TEMPERATURE IN EACH OCCUPIED SPACE.
- 1.2 HOURS OF OPERATION
 - .1 GENERALLY THE HOURS OF OPERATION ARE 0700 TO 1800 MONDAY TO FRIDAY.
- 1.3 CONTROL SEQUENCING
 - .1 HVAC SYSTEM CONSISTS OF THE FOLLOWING COMPONENTS:
 - .1 VAVS-103: EXISTING VAV BOX WITH HOT WATER REHEAT COIL
 - .2 CV-103A: VAV BOX WITH HOT WATER REHEAT COIL
 - .3 FHEF-21: FUME HOOD EXHAUST FAN WITH VFD
 - .1 INTERLOCKED WITH VAVS-103 AND CV-103A
 - .2 EMCS TO MONITOR FAN OPERATION
 - .4 EF-1403: EXHAUST FAN WITH VFD
 - .1 EMCS TO MONITOR FAN OPERATION
 - .2 HVAC SYSTEM STOPPED:
 - .1 EF-1403 AND FHEF-21 STOPPED
 - .2 HIGH LEVEL EXHAUST RUNS CONTINUOUSLY (4 @ 50 L/S)
 - .3 SYSTEM OPERATION:
 - .1 GENERAL
 - .1 DURING NORMAL OPERATION WHEN FHEF-21 AND HIGH LEVEL EXHAUST ARE OPERATING, VAVS-103 AND CV-103A WILL OPERATE TO PROVIDE THE MAKE-UP AIR REQUIRED FOR THE FUME HOODS AND GENERAL HIGH LEVEL EXHAUST.
 - .2 VAVS-103 AND CV-103A SHALL MODULATE TO MAINTAIN A NET NEGATIVE PRESSURE IN THE MINING WEAR LAB (NET -100 L/S) RELATIVE TO THE CORRIDOR AT ALL TIMES.
 - .3 EF-1403 SHALL OPERATE AS NEEDED BY PERSONNEL. SEE SCHEMATIC 05 ON DRAWING M-003.
 - .4 EMCS SHALL MONITOR OPERATION OF VAVS-103, CV-103A AND FHEF-21. THIS WILL REQUIRE CLOSE COORDINATION WITH BALANCING CONTRACTOR DURING THE COMMISSIONING STAGE.
 - .5 EMCS TO MONITOR AND CONTROL ROOM SPACE CONDITIONS AS FOLLOWS:
 - ROOM TEMPERATURE: 21°C±2°C (70°F±4°F)
 - .2 SEISMIC PROTECTION
 - .1 ALL MECHANICAL EQUIPMENT, DUCTING, DIFFUSERS ARE TO BE SEISMICALLY SUPPORTED AND BRACED WITH STRUTS OR WIRES AS REQUIRED TO RESIST SEISMIC FORCES AND AVOID INJURY TO OCCUPANTS.
 - .2 ALL FREE-STANDING MECHANICAL EQUIPMENT SHALL BE SUPPORTED AND BRACED TO COMPLY WITH BCBC CODE AND APPROVED BY A PROFESSIONAL SEISMIC ENGINEER.
 - .3 HIRE A PROFESSIONAL SEISMIC ENGINEER THAT IS REGISTERED WITH APEGBC AND PROVIDE A LETTER OF SEISMIC ASSURANCE. PAY FOR ALL ASSOCIATED FEES AS REQUIRED.



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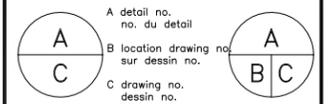
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project **ARC · CRC** project
NATIONAL RESEARCH COUNCIL CANADA
 Wesbrook Mall, Vancouver, BC

drawing **MINING WEAR LAB 1403 RENOVATION** dessin

MECHANICAL SPECIFICATIONS SHEET 2

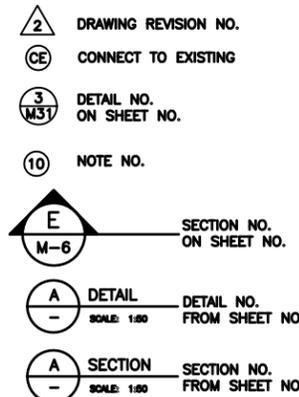
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date	AUG. 2014	
approved -		approuve
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PWGSC Project Manager	Administrateur de projets TPSGC	
project number	1407	no. du projet
drawing no.	M-005	no. du dessin

STANDARD ABBREVIATIONS

ABBREVIATIONS

AD ACCESS DOOR
 AFF ABOVE FINISHED FLOOR
 A/P ACCESS PANEL
 AHU AIR HANDLING UNIT
 APD AIR PRESSURE DROP
 BHP BRAKE HORSE POWER
 CD CONTROL DAMPER
 CE CONNECT TO EXISTING
 C/W COMPLETE WITH
 BD BALANCE DAMPER
 BDD BACKDRAFT DAMPER
 DN DOWN
 ESP EXTERNAL STATIC PRESSURE
 EF EXHAUST FAN
 E/A EXHAUST AIR
 EH EXHAUST HOOD
 EXH. EXHAUST
 O/A OUTDOOR AIR
 RE/RE REMOVE AND RE-INSTALL
 RH RE-HEAT COIL
 R/A RETURN AIR
 SP STATIC PRESSURE
 S/A SUPPLY AIR
 SF SUPPLY FAN
 PD PRESSURE DROP
 UH UNIT HEATER
 VEL VELOCITY
 VSD VARIABLE SPEED DRIVE
 VFD VARIABLE FREQUENCY DRIVE
 WMS WIRE MESH SCREEN
 WPD WATER (LIQUID) PRESSURE DROP

GENERAL - H.V.A.C.



DRAWING LIST

M-001	MECHANICAL LEGEND, DRAWING LIST AND EQUIPMENT SCHEDULES
M-002	MAIN FLOOR HVAC PLAN
M-003	MECHANICAL DETAILS
M-004	MECHANICAL SPECIFICATIONS SHEET 1
M-005	MECHANICAL SPECIFICATIONS SHEET 2

AIR TERMINAL SCHEDULE

TAG	TYPE	SIZE	CORESTYLE	BORDER STYLE	FINISH	MAKE	MODEL	REMARKS
		MM x MM / Ø MM.						
S-5	SUPPLY DIFFUSER	1200 x 600 / 300"Ø	FLUSH FACE RADIAL FLOW DIFFUSER-PERFORATED FACE	EXPOSED MOUNTING	B12	EH PRICE	AFRFD	1, 2, 3

NOTES:
 1. COORDINATE WITH ARCHITECT THE REQUIRED BORDER TYPE, END CAP AND FINISH PRIOR TO ORDERING.
 2. 2 WAY RADIAL AIR PATTERN
 3. ALUMINUM CONSTRUCTION

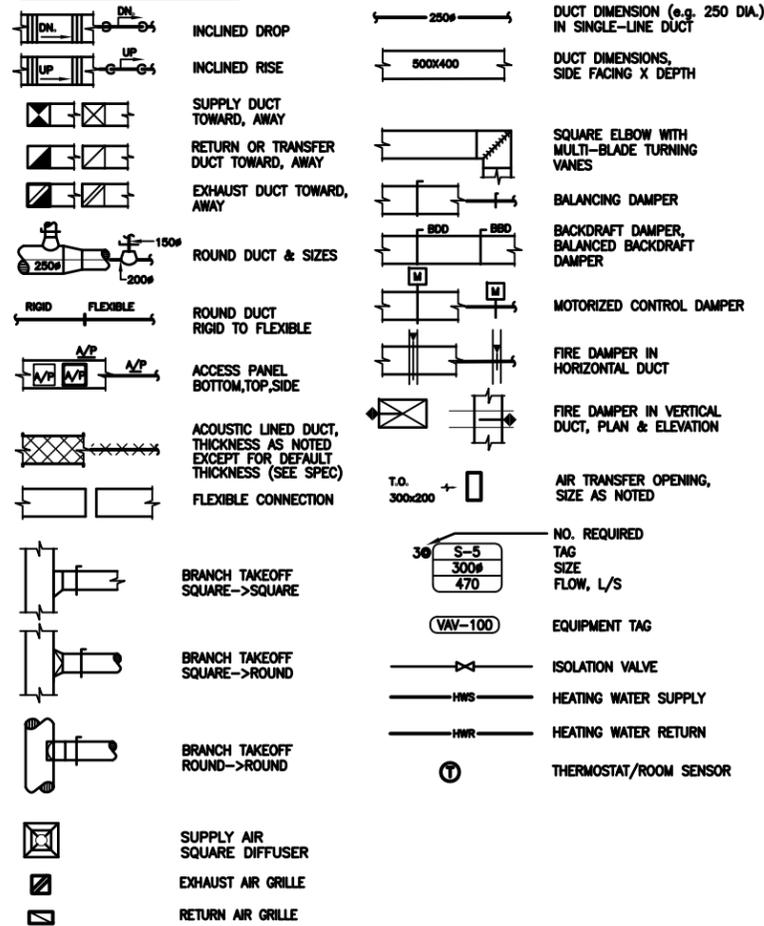
CV BOX SCHEDULE

TAG	LOCATION	BOX LOCATION	SET VOLUME			MODEL	HOT WATER HEATING COIL			SIZE MM	MODEL	REMARKS
			MIN.	MAX.	MAX. PD		KW	EAT	LAT			
			L/S	L/S	Pa			°C	°C			
CV-103A	1403	MINING WEAR LAB	630	630	62	SDV SIZE 12	11.0	16	25	3000	EH PRICE	1, 2, 3
CV-114	1422	MAINTENANCE SHOP	1500	1500	62	SDV SIZE 16	20.3	16	25	4000	EH PRICE	1, 2, 3

NOTES:
 1. MAXIMUM PRESSURE DROP AND STATIC PRESSURE REQUIRED AT MAXIMUM FLOW
 2. ALL CV BOXES ARE TO HAVE 30" ATTENUATORS.
 3. COORDINATE WITH ELECTRICAL AND CONTROLS SUBTRADES TO ENSURE ALL SUPPORTING EQUIPMENT AND DEVICES ASSOCIATED WITH CV BOXES ARE INCLUDED

LEGEND

HVAC - DUCTWORK



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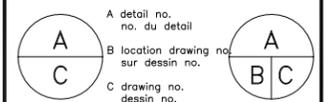
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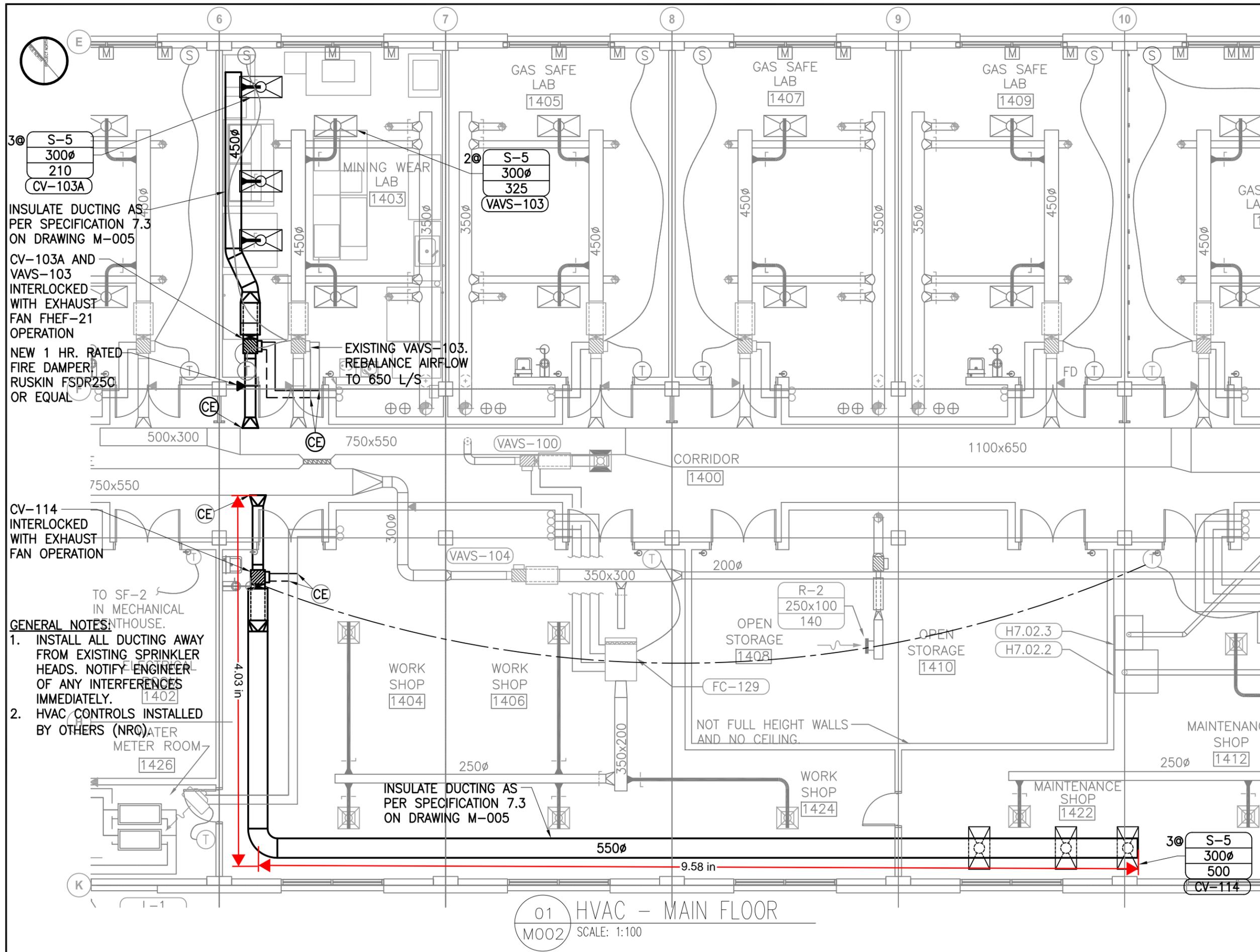
Westbrook Mall, Vancouver, BC

drawing dessin

MINING WEAR LAB AND MAINTENANCE SHOP RENOVATION

MECHANICAL LEGEND, DRAWING LIST AND EQUIPMENT SCHEDULES

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date		
drawn	DL	dessine
date	SEP. 2014	
approved	-	approuve
date	-	
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PWGC Project Manager	Administrateur de projets TPSGC	
project number	1409	no. du projet
drawing no.	M-001	no. du dessin



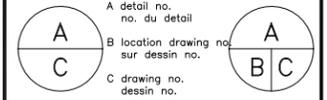
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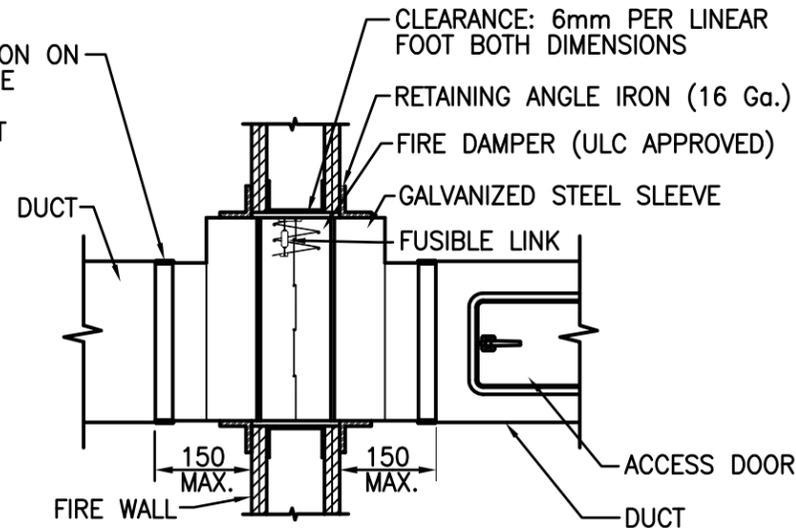


project **NRC · CNRC** project
NATIONAL RESEARCH COUNCIL CANADA
Wesbrook Mall, Vancouver, BC

drawing **MINING WEAR LAB AND MAINTENANCE SHOP RENOVATION** dessin
MAIN FLOOR HVAC PLAN

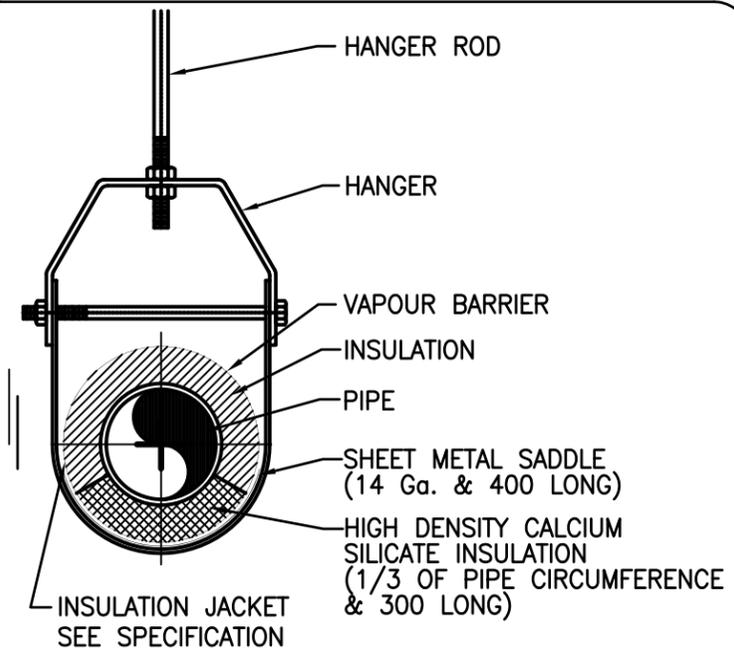
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PWGSC Project Manager	Administrateur de projets TPSGC	
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drawing no.	M-002	no. du dessin

BREAKAWAY JOINT: S SLIP CONNECTION ON TOP & BOTTOM. DRIVE SLIPS ON THE SIDES OR AS PER MANUFACTURER'S RECOMMENDATIONS (CAULK AIR TIGHT 4 PLS)



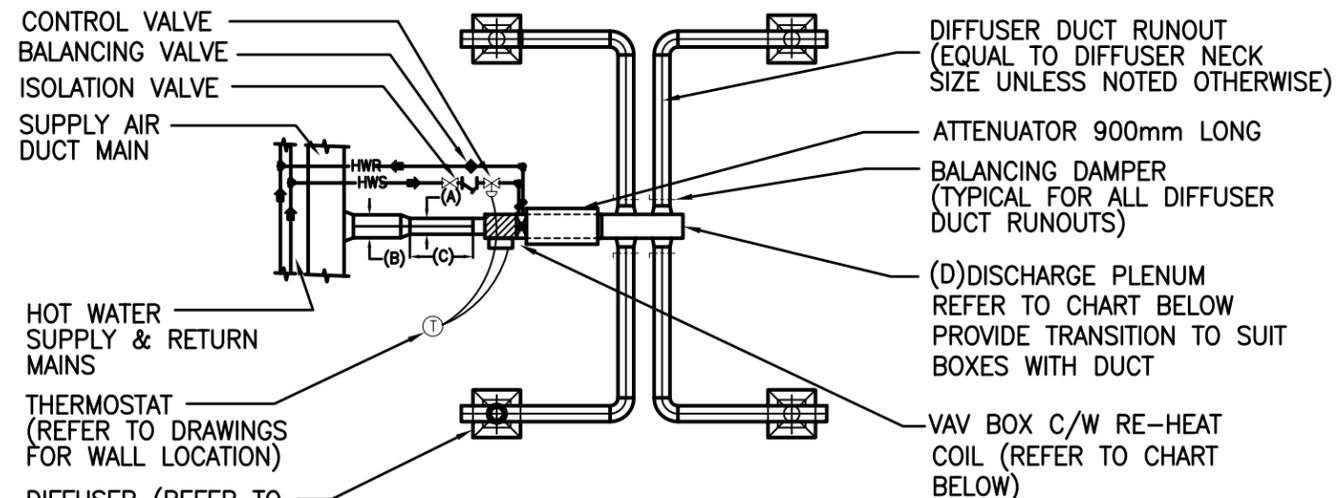
FIRE DAMPER DETAIL

SCALE: N.T.S



INSULATED PIPE HANGER DETAIL

SCALE: N.T.S



BOX SIZE	(A) mm	(B) mm	(C) mm	(D) mm
12	300 ϕ	350 ϕ	1200	400X400
14	350 ϕ	400 ϕ	1400	500X450
16	400 ϕ	450 ϕ	1600	600X450

NOTES

(C) IS THE STRAIGHT LENGTH (Min.) OF DUCT EQUAL TO 4 TIMES THE INLET DIAMETER OF THE BOX.

ONE THERMOSTAT PER VAV BOX UNLESS NOTED OTHERWISE. EXACT LOCATION TO BE CONFIRMED WITH ARCHITECT PRIOR TO INSTALLATION, REFER TO DRAWINGS.

SUPPLY VAV BOX DETAIL (RE-HEAT COIL)

SCALE: N.T.S



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A	A detail no. no. du detail	A
B	B location drawing no. sur dessin no.	B
C	C drawing no. dessin no.	C

project

NRC · CRC

NATIONAL RESEARCH
COUNCIL CANADA

Wesbrook Mall, Vancouver, BC

drawing

**MINING WEAR LAB
AND MAINTENANCE
SHOP RENOVATION**

**MECHANICAL
DETAILS**

designed **KM** concu

date

drawn **DL** dessine

date **SEP. 2014**

approved - approuve

date -

Tender - Soumission

PWGC Project Manager Administrateur de projets TPSGC

project number **1409** no. du projet

drawing no. **M-003** no. du dessin

1. GENERAL MECHANICAL PROVISIONS (15010)

- 1.1 CONFORMANCE
- 1.1 CONFORM TO TERMS AND CONDITIONS OF THE GENERAL CONTRACT DOCUMENT.
- 1.2 SCOPE
1. PROVIDE COMPLETE, FULLY TESTED AND OPERATIONAL MECHANICAL SYSTEMS TO MEET THE REQUIREMENTS DESCRIBED HEREIN AND IN COMPLETE ACCORDANCE WITH APPLICABLE CODES AND ORDINANCES.
 2. CONTRACT DOCUMENTS OF THIS DIVISION AND DRAWINGS ARE DIAGRAMMATIC AND APPROXIMATELY TO SCALE UNLESS DETAILED OTHERWISE. THEY ESTABLISH SCOPE, MATERIAL AND INSTALLATION QUALITY AND ARE NOT DETAILED INSTALLATION INSTRUCTIONS.
 3. FOLLOW MANUFACTURER'S RECOMMENDED INSTALLATION DETAILS AND PROCEDURES FOR EQUIPMENT, SUPPLEMENTED BY REQUIREMENTS OF CONTRACT DOCUMENTS.
 4. INSTALL EQUIPMENT GENERALLY IN LOCATIONS AND ROUTES SHOWN CLOSE TO BUILDING STRUCTURE WITH MINIMUM INTERFERENCE WITH OTHER SERVICES OR FREE SPACE. REMOVE AND REPLACE IMPROPERLY INSTALLED EQUIPMENT TO SATISFACTION OF THE CONSULTANT AT NO EXTRA COST.
 5. THE DRAWINGS INDICATE THE GENERAL LOCATION AND ROUTE TO BE FOLLOWED BY THE PIPING AND DUCTWORK. WHERE DETAILS ARE NOT SHOWN ON THE DRAWINGS OR ONLY SHOWN DIAGRAMMATICALLY, THE PIPES AND DUCTWORK SHALL BE INSTALLED IN SUCH A WAY AS TO CONSERVE HEAD ROOM AND INTERFERE AS LITTLE AS POSSIBLE WITH THE FREE USE OF SPACE THROUGH WHICH THEY PASS. SERVICE LINES SHALL RUN PARALLEL TO BUILDING LINES. ALL DUCT AND PIPES AT CEILING SHALL BE KEPT AS TIGHT AS POSSIBLE TO BEAMS OR OTHER LIMITING MEMBERS AT HIGH END. ALL PIPES AND DUCTS SHALL BE COORDINATED IN ELEVATION TO ENSURE THAT THEY ARE CONCEALED IN THE CEILING SPACE PROVIDED UNLESS DETAILED AND DIMENSIONED OTHERWISE ON DRAWINGS AND PERMITTED OTHERWISE BY THE CONSULTANT.
 6. CONNECT TO EQUIPMENT SPECIFIED IN OTHER SECTIONS AND TO EQUIPMENT SUPPLIED AND INSTALLED BY OTHER CONTRACTORS OR BY THE OWNER UNDER CONTRACT. SUCH IDENTIFICATION SHALL BE VIA MARKED UP DRAWINGS SHOWING OPENING LOCATIONS, SIZES, AND LEVELS. IF REQUIRED, THE CONTRACTOR IS TO CLEARLY MARK ON SITE THE INTENDED OPENINGS FOR REVIEW BY THE STRUCTURAL ENGINEER.
 12. COORDINATE WITH ALL SUB-TRADES AT THE START AND THROUGHOUT THE PROJECT TO PREVENT AVOIDABLE CONFLICTS. COSTS ASSOCIATED WITH REDOING SERVICE DUE TO LACKING OF COORDINATION ON SITE WILL BE RESOLVED AT THE CONTRACTORS' COST.
 13. ENSURE ALL WHIMS AND OTHER CONSTRUCTION AND SITE SAFETY PROCEDURES ARE FOLLOWED BY ALL TRADES.
 14. THE WORK SHALL INCLUDE BUT NOT LIMIT TO THE FOLLOWING:
 1. COMPLETE HVAC AND CONTROLS INSTALLATION.
 2. COMMISSIONING AND BALANCING.
- 1.3 MATERIALS
1. MATERIALS AND EQUIPMENT INSTALLED SHALL BE NEW, FULL WEIGHT AND OF QUALITY SPECIFIED. USE SAME BRAND OR MANUFACTURER FOR EACH SPECIFIED APPLICATION.
 2. EACH MAJOR COMPONENT OF EQUIPMENT SHALL BEAR MANUFACTURER'S NAME, ADDRESS, CATALOG AND SERIAL NUMBER.
- 1.4 CUTTING AND PATCHING
1. PROVIDE HOLES AND SLEEVES, CUTTING AND FITTING REQUIRED FOR MECHANICAL WORK. RELOCATE IMPROPERLY LOCATED HOLES AND SLEEVES.
 2. ALL WORK SHALL BE COORDINATED WITH OTHER TRADES ESPECIALLY THAT RELATED TO CUTTING AND PATCHING OF REQUIRED OPENINGS AND LOCATIONS AND INSTALLATION OF SLEEVES, INSERTS, SUPPORT, CURBS, FRAMES AND ACCESS DOORS.
 3. OBTAIN APPROVAL FROM STRUCTURAL AND ELECTRICAL ENGINEERS BEFORE DRILLING AND CORING OF EXISTING STRUCTURE.
 4. PROVIDE X-RAY OF ALL REQUIRED PENETRATIONS OF THE FLOOR. X-RAY USE FOR LOCATING IN FLOOR REBAR AND CONDUIT TO BE DONE AFTER NORMAL WORKING HOURS. TAKE NECESSARY PRECAUTIONS TO PROTECT COMPUTER EQUIPMENT WHEN X-RAYING FLOORS. COORDINATE WITH OWNER.
 5. DRILL FOR EXPANSION BOLTS, HANGER RODS, BRACKETS, AND SUPPORTS.
 6. OBTAIN WRITTEN APPROVAL FROM STRUCTURAL CONSULTANT BEFORE CUTTING OR BURNING STRUCTURAL MEMBERS. THIS WORK SHALL BE CARRIED OUT BY THE SPECIALIST TRADE ONLY.
 7. PROVIDE OPENINGS AND HOLES REQUIRED IN PRECAST MEMBERS FOR MECHANICAL WORK. CAST HOLES LARGER THAN 100MM Ø (4") TIGHT TO COLUMNS SHALL NOT EXCEED 200MM Ø (8"), CAST OR FIELD CUT HOLES SMALLER THAN 100MM Ø (4") CAULK GAPS BETWEEN WALL FINISHES AND PIPES WHERE THE GAP APPROX. 13MM (1/2"). GAPS GREATER THAN 13MM (1/2"), INSTALL AN ESCUTCHEON PLATE. IN FIRE RATED WALLS, WHERE THE TOTAL SIZE OF A HOLE EXCEEDS 20 SQ. IN. THE CONDITION IS UNACCEPTABLE AND MUST BE PATCHED WITH FIRE RATED DRYWALL OR SIMILAR TO MAINTAIN THE REQUIRED FIRE RESISTANCE RATING.
 8. REPAIR BUILDING WHERE DAMAGED FROM EQUIPMENT INSTALLATION, IMPROPERLY LOCATED HOLES, ETC., BY THIS SECTION OF THE WORK. THIS REPAIR WORK SHALL BE CARRIED OUT BY THE SPECIALIST TRADE AT THE EXPENSE OF THIS SECTION OF WORK. USE MATCHING MATERIALS AS SPECIFIED IN THE RESPECTIVE SECTIONS.
- 1.5 SHOP DRAWINGS
1. PROVIDE SHOP DRAWINGS FOR SPECIFIED EQUIPMENT.
 2. IDENTIFY MATERIALS AND EQUIPMENT BY MANUFACTURER, TRADE NAME AND MODEL NUMBER. INCLUDE COPIES OF APPLICABLE BROCHURE OR CATALOG MATERIAL.
 3. CLEARLY MARK SUBMITTAL MATERIAL USING ARROWS, UNDERLINING OR CIRCLING TO SHOW DIFFERENCES FROM SPECIFIED, E.G. RATINGS, CAPABILITIES AND OPTIONS BEING PROPOSED. CROSS OUT NON-APPLICABLE MATERIAL. SPECIFICALLY NOTE ON THE SUBMITTAL SPECIFIED FEATURES SUCH AS SPECIAL TANK LININGS, PUMPS, SEALS, MATERIAL, OR PAINTING.

4. INCLUDE DIMENSIONAL AND TECHNICAL DATA SUFFICIENT TO CHECK IF EQUIPMENT MEETS REQUIREMENTS. INCLUDE WIRING, PIPING, AND SERVICE CONNECTION DATA AND MOTOR SIZES.
 5. INSTALLED MATERIALS AND EQUIPMENT SHALL MEET SPECIFIED REQUIREMENTS REGARDLESS OF WHETHER OR NOT SHOP DRAWINGS ARE REVIEWED BY THE CONSULTANT.
 6. DO NOT ORDER EQUIPMENT OR MATERIAL UNTIL THE CONSULTANT HAS REVIEWED AND RETURNED APPROVED SHOP DRAWINGS.
 7. SHOP DRAWINGS SHALL BE ENDORSED BY THE GENERAL CONTRACTOR AND MECHANICAL SUB-CONTRACTOR INDICATING THAT THE SHOP DRAWINGS HAVE BEEN REVIEWED AND SUBMITTED WITHOUT QUALIFICATIONS.
 8. SUBMIT A MINIMUM OF (4) COPIES OF SHOP DRAWINGS PRIOR TO ORDERING EQUIPMENT.
 9. SUBMIT WEIGHTS OF ALL MAJOR EQUIPMENT FOR REVIEW SUCH THAT THE LOADS CAN BE REVIEWED BY THE APPROPRIATE CONSULTANT.
 10. SUBMIT LIST OF ALL ELECTRICAL MOTORS AND POWER REQUIREMENTS TO ELECTRICAL CONSULTANT AND CONTRACTOR.
 11. SUBMIT SHOP DRAWINGS TO SUIT CONSTRUCTION SCHEDULE - ALLOWING ADEQUATE TIME FOR CONSULTANT APPROVAL.
- 1.6 STANDARDS OF MATERIALS, EQUIPMENT AND INSTALLATION
1. EQUIPMENT USED SHALL NOT EXCEED SPACE LIMITATIONS IN ANY DIMENSION. REPLACE ANY EQUIPMENT OR APPARATUS WHICH DOES NOT MEET THIS SPECIFICATION AT NO COST. ASSUME FULL RESPONSIBILITY FOR THE EXPENSE OF REDESIGN AND ADJUSTMENT TO OTHER PARTS OF THE BUILDING WHEN PROPOSING THE USE OF APPROVED EQUAL OR ALTERNATE EQUIPMENT.
 2. SUBMIT SAMPLES, IN ADDITION TO DRAWINGS, OF ALL ITEMS WHICH IN THE CONSULTANT'S JUDGMENT, CAN BE BETTER EXAMINED FOR CAPACITY, QUALITY, FINISH OR DETAIL BY SAMPLE RATHER THAN BY DRAWINGS. SAMPLES SHALL BE SUBMITTED BEFORE EQUIPMENT IS ORDERED.
 3. PROVIDE EQUIPMENT FROM THE SPECIFIED MANUFACTURERS. ALL MECHANICAL EQUIPMENT SHALL HAVE THE APPROVED MANUFACTURERS NAME PERMANENTLY AFFIXED TO IT.
 4. EQUIPMENT ON ALTERNATE & APPROVED MANUFACTURERS LIST MUST BE EQUAL IN QUALITY AND PERFORMANCE TO THE MODEL SPECIFIED. EQUIPMENT WHICH IS NOT EQUAL WILL BE REPLACED WITH THE SPECIFIED EQUIPMENT AT NO COST TO THE OWNER.
 5. IF SHOP DRAWINGS ARE REJECTED TECHNICALLY AFTER 3 SUBMISSIONS, THE CONTRACTOR, AT NO ADDITIONAL EXPENSE TO THE OWNER, SHALL REVERT TO SPECIFIED PRODUCT AND MANUFACTURER FOR THIS PROJECT.
 6. THE EQUIPMENT MANUFACTURER SHALL ENSURE THAT THE STRENGTH AND ANCHORAGE OF THE INTERNAL COMPONENTS OF THE EQUIPMENT EXCEEDS THE FORCE LEVEL USED TO RESTRAIN AND ANCHOR THE EQUIPMENT UNIT ITSELF TO THE SUPPORTING STRUCTURE.
 7. ACCEPTABLE PRODUCTS/SUPPLIERS/MANUFACTURERS:
- | ITEM | ACCEPTABLE PRODUCTS/SUPPLIERS/MANUFACTURERS |
|----------------------------------|--|
| GRILLES, DIFFUSERS AND REGISTERS | DDK, TUTTLE & BAILEY, PRICE |
| INSULATION - DUCT/PIPING | FIBERGLAS, KNAUF, JOHNS-MANVILLE, ATLAS, PPG, MANSION, ARMSTRONG, ARMAFLEX |
| JACKETING MATERIAL | CHILDERS, FIBERGLAS, JOHNS-MANVILLE |
| PIPE FITTINGS AND FLANGES | CRANE, GRINNELL, JENKINS, VICTAULIC |
| PIPE SUPPORTS AND HANGERS | CRANE, UNISTRUT, MYATT, GRINNELL, SARCO |
| TESTING & BALANCING AGENTS | KD ENGINEERING, WESTERN MECHANICAL |
| VIBRATION CONTROL EQUIPMENT | VIBRO-ACOUSTICS, LO-REZ, VIBRON, KORFUND, MASON |
| EXHAUST FANS | GREENHECK, COOK |
- 1.7 PERFORMANCE VERIFICATION OF INSTALLED EQUIPMENT
1. INSTALLED MECHANICAL EQUIPMENT WHOSE PERFORMANCE IS QUESTIONED BY THE CONSULTANT, MAY BE SUBJECT TO PERFORMANCE VERIFICATION AS SPECIFIED HEREIN.
 2. WHEN PERFORMANCE VERIFICATION IS REQUESTED, EQUIPMENT SHALL BE TESTED TO DETERMINE COMPLIANCE WITH SPECIFIED PERFORMANCE REQUIREMENTS.
 3. THE CONSULTANT WILL DETERMINE BY WHOM TESTING SHALL BE CARRIED OUT. WHEN REQUESTED, THE CONTRACTOR SHALL ARRANGE FOR SERVICES OF AN INDEPENDENT TESTING AGENCY.
 4. TESTING PROCEDURES SHALL BE APPROVED BY THE CONSULTANT.
 5. MAINTAIN BUILDING COMFORT CONDITIONS WHEN EQUIPMENT IS REMOVED FROM SERVICE FOR TESTING PURPOSES.
 6. PROMPTLY PROVIDE THE CONSULTANT WITH ALL TEST REPORTS.
 7. SHOULD TEST RESULTS REVEAL THAT ORIGINALLY INSTALLED EQUIPMENT MEETS SPECIFIED PERFORMANCE REQUIREMENTS, OWNER WILL PAY ALL COSTS RESULTING FROM PERFORMANCE VERIFICATION PROCEDURE.
 8. SHOULD TEST RESULTS REVEAL THAT EQUIPMENT DOES NOT MEET SPECIFIED PERFORMANCE REQUIREMENTS, EQUIPMENT WILL BE REJECTED AND THE FOLLOWING SHALL APPLY:
 1. REMOVE REJECTED EQUIPMENT, REPLACE WITH EQUIPMENT WHICH MEETS REQUIREMENTS OF CONTRACT DOCUMENTS INCLUDING SPECIFIED PERFORMANCE REQUIREMENTS.
 2. REPLACEMENT EQUIPMENT WILL BE SUBJECT TO PERFORMANCE VERIFICATION AS WELL, USING SAME TESTING PROCEDURES ON ORIGINALLY INSTALLED EQUIPMENT.
 3. CONTRACTOR SHALL PAY ALL COSTS RESULTING FROM PERFORMANCE VERIFICATION PROCEDURE.
- 1.8 OPERATING AND MAINTENANCE DATA
1. INSTRUCT THE BUILDING OPERATORS IN THE OPERATION AND PREVENTATIVE MAINTENANCE OF EACH PIECE OF EQUIPMENT AND SYSTEM SUPPLIED AND INSTALLED. COMPLETE AND TURN OVER DOCUMENTATION PRIOR TO SUBSTANTIAL PERFORMANCE.
 2. SUBMIT 2 SETS 0 & M MANUALS IN 3-RING BINDERS AND TRANSFER ALL DATA ONTO A CD, TO INCLUDE THE FOLLOWING:
 - * NAME OF ENGINEER AND MECHANICAL CONTRACTOR AND PHONE NUMBER.
 - * DESCRIPTION OF OPERATION OF ALL MECHANICAL SYSTEMS.
 - * SHOP DRAWINGS OF ALL EQUIPMENT.
 - * LIST OF TAGGED VALVES.
 - * EXTENDED WARRANTIES.
 - * MAINTENANCE AND OPERATION INSTRUCTIONS.
 - * LIST OF MANUFACTURERS SOURCE AND TRADE NAMES.
 - * BALANCE REPORT OF AIR & WATER SYSTEMS.
 - * COPY OF RECORD DRAWING.
 - * LIST OF INSPECTION AND TEST CERTIFICATES.
 - * CONTRACTOR'S WARRANTY CERTIFICATE
 - * SEISMIC ENGINEER'S CERTIFICATE (WHEN REQUIRED BY CODE)

1.9 RECORD DRAWINGS

1. SUBMIT RECORD DRAWINGS IDENTIFYING LOCATION OF FIRE DAMPERS, ACCESS DOORS, TAGGED VALVES AND ACTUAL ROOM NAMES.
 2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR AND KEEP ONE SET OF WHITE PRINTS THAT BE MAINTAINED IN CONSTANT UP-TO-DATE CONDITION BY EACH TRADE (AS-BUILT CONDITIONS MARKED IN RED PENCIL). THE 1 WHITE SET OF PRINTS WILL BE PROVIDED TO THE CONTRACTOR BY THE CONSULTANT AT THE CONTRACTORS COST.
 3. THE RECORD DRAWINGS SHALL INCLUDE, BUT NOT BE LIMITED TO, THE FOLLOWING CHANGES AND SHALL BE RECORDED DAILY:
 1. SIZE, LOCATION, ARRANGEMENT, ROUTE AND EXTENT OF DUCTWORK, PIPING, CONDUIT, TERMINAL UNITS, EQUIPMENT, FIXTURES, CLEANOUTS, VALVES, ROUGH-IN, ETC., ABOVE AND BELOW GRADE INSIDE THE BUILDING, INCLUDING LOCATIONS OF BURIED PIPING.
 2. LOCATION, TAGGING AND NUMBERING OF ALL VALVES EXCEPT INDIVIDUAL PLUMBING FIXTURES OR EQUIPMENT ISOLATION VALVES.
 3. THE AS-BUILT DAILY MARKED-UP PRINTS SHALL CONFORM TO THE STANDARDS OF THE CONTRACT DRAWINGS AND SHALL INCLUDE ALL DETAILS FROM REVISION DRAWINGS, SUPPLEMENTARY DRAWINGS, CHANGE ORDERS, ADDENDA AND SITE REVISIONS, ETC.
 4. AT THE END OF CONSTRUCTION, ALL OF THE ABOVE CHANGES SHALL BE TRANSFERRED BY THE CONSULTANT, AT CONTRACTORS COST. THE CONTRACTOR SHALL ALLOW \$300 PER DRAWING.
- 1.10 PAINTING AND IDENTIFICATION
1. CLEAN ALL EXPOSED BARE METAL SURFACES SUPPLIED BY THE MECHANICAL AND PLUMBING TRADE BY REMOVING ALL DIRT, DUST, GREASE AND MILLSCALE.
 2. REPAINT ALL MARRED FACTORY FINISHED EQUIPMENT, WHICH IS NOT SCHEDULED TO BE REPAINTED, TO MATCH THE ORIGINAL FACTORY FINISH.
 3. PIPE MARKERS AND DIRECTION ARROWS - IN ALL EXPOSED AREAS.
 4. PROVIDE COMMERCIALY AVAILABLE PIPE MARKERS HAVING STANDARD SIZES OF LETTERING AND COLOURS. STANDARD COLOURS DESIGNATE CLASSES OF MATERIALS FOLLOWS, AND ARE CONSISTENT WITH THOSE SPECIFIED BY THE CSA AND THE USAS. PROVIDE MARKERS TO ALL PIPES PROVIDED UNDER THIS CONTRACT.
 5. LOCATION OF PIPE MARKERS AND DIRECTION ARROWS
 1. PIPE MARKER AND DIRECTION ARROW SHALL BE PLACED SIDE BY SIDE IN THE BOTTOM QUARTER OF THE PIPE TO BE IDENTIFIED.
 2. ADJACENT TO ALL MAJOR CHANGES IN DIRECTION AND AT CONNECTIONS TO EACH PIECE OF EQUIPMENT.
 3. AT LEAST ONCE IN EACH ROOM THAT THE PIPE PASSES THROUGH.
 4. WHERE PIPING PASSES THROUGH WALLS, PARTITIONS, OR FLOORS, IDENTIFY PIPING ON BOTH SIDES OF THE SECTION AND AT ENTRY AND EXITS TO SHAFTS.
- 1.11 EQUIPMENT PROTECTION AND CLEAN-UP
1. PROTECT EQUIPMENT AND MATERIAL UNTIL FINAL ACCEPTANCE. TAKE SPECIAL PRECAUTIONS TO PREVENT ENTRY OF FOREIGN MATERIAL INTO WORKING PARTS OF PIPING AND DUCT SYSTEMS.
 2. THOROUGHLY CLEAN ALL NEW AND EXISTING PIPING, DUCTS AND EQUIPMENT OF DIRT, CUTTINGS, AND OTHER FOREIGN MATERIAL.
 3. ENSURE THAT EXISTING EQUIPMENT TO BE REMOVED IS CAREFULLY DISMANTLED AND NOT DAMAGED OR LOST. DO NOT REUSE EXISTING MATERIALS AND EQUIPMENT UNLESS SPECIFICALLY INDICATED.
 4. UPON COMPLETION OF TENANT'S IMPROVEMENTS AND BEFORE OCCUPANCY, THE CONTRACTOR SHALL THOROUGHLY VACUUM AND THOROUGHLY CLEAN THE LEASED PREMISES INCLUDING BUT NOT LIMITED TO WINDOWS (INTERIORS ONLY), VERTICAL BLINDS, LIGHT FIXTURES AND LENSES AND THE FACE OF THE DIFFUSERS.
 5. DAMAGED CEILING TILES AND ANY OTHER PARTS OF THE BUILDING AFFECTED BY THE TENANT'S WORK SHALL BE REPAIRED. THE LANDLORD RECOMMENDS THE USE OF THE BUILDING CLEANING CONTRACTOR TO ENSURE PHYSICAL COMPATIBILITY OF CLEANING MATERIALS AND STANDARDS.
- 1.12 CONNECTION AND INTERRUPTION TO EXISTING SYSTEMS
1. COORDINATE INTERRUPTION OF EXISTING BUILDING SYSTEMS WITH THE OWNER.
 2. INCLUDE PREMIUM TIME FOR CONNECTION TO EXISTING SYSTEM SO THAT NORMAL USE OF THE EXISTING SYSTEM WILL NOT BE AFFECTED. THERE SHALL BE NO SYSTEM SHUT-DOWN UNLESS ACCEPTED BY THE OWNER.
- 1.13 ACCESS OF EQUIPMENT
1. MAKE ALL ARRANGEMENTS TO ENSURE THAT ADEQUATE ACCESS IS AVAILABLE FOR ALL MECHANICAL EQUIPMENT. DO ALL HOISTING AND RIGGING INTO PLACE OF ALL SPECIFIED EQUIPMENT AND BE RESPONSIBLE FOR ANY DAMAGES INCURRED THEREFROM.
 2. CONTRACTOR TO DEMONSTRATE REASONABLE ACCESS TO ALL EQUIPMENT SERVICE LOCATIONS.
 3. CO-ORDINATE AND ACCESS PANELS TO DRAINS/CLEAN OUTS ETC. FOR APPROVAL WITH INTERIOR DESIGNER.
 4. ADEQUATE ACCESS TO BE PROVIDED TO ALL FILTERS, DAMPERS ETC. OF ALL NEW AND EXISTING EQUIPMENT.
 5. ADEQUATE ACCESS TO BE PROVIDED TO ALL EQUIPMENT, FILTERS, DAMPERS, WHERE LOCATED OVER DRYWALL CEILING.
- 1.14 LIABILITY
1. ASSUME FULL RESPONSIBILITY FOR LAYING OUT THE WORK AND FOR ANY DAMAGE CAUSED TO THE OWNER OR OTHER TRADES BY IMPROPER LOCATION, OR CARRYING OUT OF THE WORK.
 2. BE RESPONSIBLE FOR PROMPT INSTALLATION OF THIS WORK IN ADVANCE OF CONCRETE POURING OR SIMILAR WORK. PROVIDE AND SET SLEEVES WHERE REQUIRED. SHOULD ANY CUTTING OR REPAIRING OF EITHER UNFINISHED OR FINISHED WORK BE REQUIRED, THIS CONTRACTOR SHALL DIRECT THE PARTICULAR SUB-CONTRACTOR WHOSE WORK IS INVOLVED TO DO SUCH CUTTING AND REPAIRING WITHOUT EXPENSE TO THE OWNER, BEFORE BEING UNDERTAKEN, SUCH WORK SHALL BE LAID OUT FOR THE CONSULTANT'S REVIEW.

3. EXAMINE THE SITE AND THE LOCAL CONDITIONS AFFECTING WORK UNDER THIS CONTRACT PRIOR TO SUBMITTING BID. EXAMINE CAREFULLY THE MECHANICAL, ELECTRICAL, STRUCTURAL AND ARCHITECTURAL DRAWINGS AND CONFIRM THAT THE WORK UNDER THIS CONTRACT CAN BE SATISFACTORILY CARRIED OUT WITHOUT CHANGES TO THE BUILDING AS SHOWN ON THESE PLANS. BEFORE COMMENCING THE WORK, EXAMINE THE WORK OF THE OTHER TRADES AND REPORT AT ONCE ANY DETECT OF INTERFERENCE AFFECTING THE WORK OF THIS SECTION, OF THE GUARANTEE OF SAME. NO EXTRAS WILL BE SUBSEQUENTLY ALLOWED TO COVER ANY SUCH ERROR, OMISSION OR OVERSIGHT ON THE THOROUGH INSPECTION OF THE GROUNDS, BUILDING, CONDITIONS, ETC.
 4. ARRANGE WORK IN CO-OPERATION WITH OTHER TRADES IN THE BUILDING IN SUCH A MANNER AS NOT TO INTERFERE WITH OTHER WORK BEING CARRIED ON IN THE BUILDING AND PLACES WHERE OTHER PIPES AND EQUIPMENT BE INSTALLED ALONG WITH THE PIPES AND DUCTS PERTAINING TO THIS TRADE. CO-OPERATE WITH THE OTHER TRADES TO GET ALL THE PIPES, DUCTS, CONDUIT, ETC., INSTALLED TO THE BEST ADVANTAGE. WHEN OPEN WEB STRUCTURAL JOISTS ARE USED, MUST OBTAIN STRUCTURAL SHOP DRAWINGS TO ENSURE SPACE AVAILABLE FOR INSTALLATION OF PIPES AND DUCTWORK.
 5. WHERE ANY PIPES, DUCTS AND EQUIPMENT MUST BE BUILT INTO THE WORK OF OTHER TRADES SUCH AS MASONRY, STRUCTURAL, OR PLASTERING, BE RESPONSIBLE FOR SUPPLYING THE EQUIPMENT TO BE BUILT IN OR MEASUREMENTS TO ALLOW THE NECESSARY OPENINGS TO BE LEFT. ALL PIPES AND DUCTS WHICH ARE TO BE CONCEALED SHALL BE INSTALLED NEATLY AND CLOSELY TO THE BUILDING STRUCTURE SO THAT THE NECESSARY FURRING CAN BE KEPT AS SMALL AS POSSIBLE. ANY PIPES, DUCTS, OR OTHER WORK WHICH ARE NOT, IN THE OPINION OF THE CONSULTANT, INSTALLED AS THEY SHOULD BE, SHALL BE TAKEN OUT AND REPLACED WITHOUT COST TO THE OWNER.
 6. PROTECT FINISHED AND UNFINISHED WORK FROM DAMAGE DUE TO THE CARRYING OUT OF THIS WORK, GIVING SPECIAL ATTENTION TO THE PROTECTION OF BUILDING VAPOUR BARRIERS, WATERPROOF MEMBRANES, ETC. COVER FLOORS AND OTHER PARTS OF THE BUILDING WITH TARPULINS, ETC., AND REPAIR ALL DAMAGE TO THE SATISFACTION OF THE OWNER AND THE CONSULTANT. DURING FREEZING WEATHER, PROTECT ALL MATERIALS IN SUCH A MANNER THAT NO HARM CAN BE DONE TO THE INSTALLATION ALREADY MADE AND/OR TO MATERIALS AND EQUIPMENT ON THE JOB.
 7. BE RESPONSIBLE FOR THE CONDITION OF ALL MATERIALS AND EQUIPMENT SUPPLIED AND PROVIDE ALL NECESSARY PROTECTION FOR SAME.
 8. BE RESPONSIBLE FOR THE PROTECTION AND MAINTENANCE OF THE WORK OF THIS SECTION UNTIL THE BUILDING HAS BEEN COMPLETED AND ACCEPTED BY THE OWNER, AND BE RESPONSIBLE FOR THE SORTING OF MATERIAL INSIDE AND OUT OF THE WAY, AND TO CLEAN UP ALL REFUSE CAUSED BY THIS WORK TO MEET CONSULTANT'S REVIEW.
 9. ON COMPLETION OF THE WORK, ALL TOOLS AND SURPLUS AND WASTE MATERIALS SHALL BE REMOVED AND THE WORK LEFT IN A CLEAN AND PERFECT CONDITION.
- 1.15 GUARANTEE WARRANTY
1. THIS CONTRACTOR SHALL FURNISH A WRITTEN WARRANTY STATING THAT ALL WORK EXECUTED UNDER THIS DIVISION WILL BE FREE FROM DEFECTS OF MATERIAL AND WORKMANSHIP FOR A PERIOD OF ONE (1) YEAR FROM THE DATE OF SUBSTANTIAL PERFORMANCE, WHICH SHALL INCLUDE ONE (1) COMPLETE SUMMER AND ONE (1) COMPLETE WINTER OF UNINTERRUPTED OPERATION. WARRANTY SHALL INCLUDE ANY PART OF EQUIPMENT, UNITS OR STRUCTURES FURNISHED HEREUNDER THAT SHOW DEFECTS IN THE WORKS UNDER NORMAL OPERATING CONDITIONS AND/OR FOR THE PURPOSE OF WHICH THEY WERE INTENDED.
 2. THE CONTRACTOR SHALL AT HIS OWN EXPENSE PROMPTLY INVESTIGATE ANY MECHANICAL OR CONTROL MALFUNCTION, AND REPAIR OR REPLACE ALL SUCH DEFECTIVE WORK, AND ALL OTHER DAMAGES THEREBY WHICH BECOMES DEFECTIVE DURING THE TIME OF THE GUARANTEE-WARRANTY.
- 1.16 HOISTS AND SCAFFOLDS
1. PROVIDE INTERIOR MOVABLE OR ROLLER SCAFFOLDS FOR THE INSTALLATION OF THE MECHANICAL WORK AND ALL OTHER HOISTS, SCAFFOLDS, TEMPORARY ELEVATORS, LADDERS, RUNWAYS, ETC., SHALL BE REQUESTED BY THIS CONTRACTOR AND ARRANGED WITH THE GENERAL CONTRACTOR.
- 1.17 SITE REVIEW
1. THE CONSULTANT OR HIS REPRESENTATIVE MAY CHOOSE TO INSPECT ALL WORK PRIOR TO IT BEING CONCEALED.
 2. THE CONTRACTOR SHALL NOTIFY THE CONSULTANT IN WRITING FOR THE FOLLOWING MINIMUM, BUT NOT LIMITED TO, INSPECTIONS: (REQUIRED TO PROVIDE A SCHEDULE 'C' FOR OCCUPANCY)
 1. ALL HVAC AND PLUMBING ROUGH-IN PRIOR TO WALL AND CEILING FINISH INSTALLATION.
 2. FIRE STOPPING OF ALL OPENINGS.
 3. DROP TEST ALL FIRE DAMPERS AND DEMONSTRATE ACCESS.
 4. FINAL OCCUPANCY INSPECTION AND VERIFICATION OF ALL EQUIPMENT BEING FULLY OPERATIONAL.
 3. ALL WORK SHALL BE APPROVED BY ANY OTHER REGULATORY BODY HAVING JURISDICTION WHERE REQUIRED.
 4. THE CONTRACTOR IS TO PROVIDE COPIES OF ALL PERMITS, INSPECTION REPORTS AND CERTIFICATES TO THE CONSULTANT.
 5. THE CONTRACTOR IS TO PROVIDE THE CONSULTANT REASONABLE NOTICE PRIOR TO CALLING AN INSPECTION.
 6. AFTER THE PRE-OCCUPANCY INSPECTION FOR SUBSTANTIAL PERFORMANCE ALL DEFICIENCIES SHALL BE COMPLETED FOR THE FINAL INSPECTION. THE CONTRACTOR WILL BE PERMITTED ONE ADDITIONAL FINAL INSPECTION TO FINISH ALL REMAINING DEFICIENCIES. ANY ADDITIONAL INSPECTIONS AFTER FINAL OCCUPANCY WILL BE AT THE CONTRACTORS' COST AND PAID TO THE CONSULTANT, IN ADVANCE, AT \$500.00 PER SITE VISIT.
- 1.18 SUBSTANTIAL PERFORMANCE INSPECTION
1. PRIOR TO THE CONTRACTOR REQUESTING AN INSPECTION FOR SUBSTANTIAL PERFORMANCE ALL THE FOLLOWING ITEMS MUST BE PROVIDED TO PERMIT BENEFICIAL USE BY THE OWNER:
 1. COMPLY WITH REQUIREMENTS IN GENERAL CONTRACT CONDITIONS.
 2. AS-BUILT DRAWINGS SUBMITTED.
 3. BALANCING REPORTS (AIR AND WATER,) IF REQUIRED.
 4. ALL SYSTEMS SHALL BE CERTIFIED IN WRITING BY THE CONTRACTOR AS COMPLETE AND FULLY OPERATIONAL.
 5. A COMPLETE LIST OF ITEMS WHICH THE CONTRACTOR HAS NOT FINISHED, OR ARE DEFICIENT SHALL BE PROVIDED, IF, IN THE OPINION OF THE CONSULTANT, THIS LIST INDICATES THE PROJECT IS EXCESSIVELY INCOMPLETE, A SUBSTANTIAL COMPLETION INSPECTION WILL NOT BE PERFORMED.
 6. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE TO ACCUMULATE ALL NECESSARY DATA FROM HIS SUB-TRADES AND SUPPLIERS AND PRESENT SAME IN THE SPECIFIED FORMAT FOR THE APPROVAL BY THE CONSULTANT.



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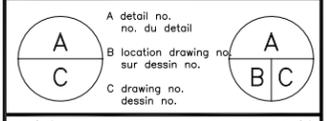
ALL RIGHTS RESERVED, USE OR REPRODUCTION PROHIBITED WITHOUT PRIOR WRITTEN PERMISSION FROM THE ENGINEER.

THE GENERAL CONTRACTOR SHALL REVIEW THE DOCUMENTS FOR CONFORMANCE TO CODES AND BY-LAWS AND SHALL ADVISE THE ENGINEER OF ANY DISCREPANCIES HE MAY NOTE. THE GENERAL CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ALL ERRORS AND OMISSIONS TO THE ENGINEER.

DO NOT SCALE THE DRAWINGS.

THESE DRAWINGS ARE INTENDED FOR ARCHITECTURAL INFORMATION ONLY. THE CONTRACTOR AND ANY PERSONS USING THESE DRAWINGS ARE ADVISED TO REFER TO THE ENGINEER FOR INFORMATION RELATING TO SPECIFIC DISCIPLINES.

0	Issued for Tender	31 Oct 14
revisions		date



project **NRC · CRC** project

NATIONAL RESEARCH COUNCIL CANADA

Wesbrook Mall, Vancouver, BC

drawing **MINING WEAR LAB AND MAINTENANCE SHOP RENOVATION** dessin

MECHANICAL SPECIFICATIONS SHEET 1

designed	KM	concu
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drawn	DL	dessine
date	SEP. 2014	
approved -		approuve
date -		
Tender -		Soumission
PWQSC Project Manager	Administrateur de projets TPQSC	
project number	1409	no. du projet
drawing no.	M-004	no. du dessin

1.19 LAWS, NOTICES, PERMITS AND FEES

- .1 GIVE ALL NECESSARY NOTICES, OBTAIN ALL NECESSARY PERMITS AND PAY ALL FEES IN ORDER THAT THE WORK SPECIFIED MAY BE CARRIED OUT, AND FURNISH ANY CERTIFICATES NECESSARY AS EVIDENCE THAT THE WORK INSTALLED CONFORMS WITH THE LAW AND REGULATIONS OF ALL AUTHORITIES HAVING JURISDICTION.
- .2 ALL WORK SHALL BE IN ACCORDANCE WITH THE REGULATIONS OF THE FOLLOWING AUTHORITATIVE BODIES, THE CODES IN EFFECT AT THE TIME OF TENDER, AND ANY OTHERS HAVING JURISDICTION:
 - .1 FIRE MARSHALL
 - .2 CANADIAN ELECTRICAL CODE
 - .3 ASSOCIATED/RELATED BUILDING CODE IN THIS PROVINCE AND LOCAL BUILDING BY-LAWS
 - .4 WORKER'S COMPENSATION BOARD
 - .5 CANADIAN STANDARDS ASSOCIATION
 - .6 POLLUTION CONTROL BOARD
 - .7 NATIONAL BUILDING CODE OF CANADA
 - .8 UNDERWRITERS' LABORATORIES OF CANADA

1.20 FIRE-STOPPING

- .1 FIRE-STOP ALL PIPE AND DUCT PENETRATIONS THROUGH FLOORS AND WALLS, DESIGNATED AS FIRE AND/OR SMOKE SEPARATIONS.
- .2 FIRE-STOPPING MATERIALS TO MEET ULC CAN 25115. ACCEPTABLE MATERIALS: BY "TREMCO" OR "NATIONAL FIRESTOPPING".
- .3 PREPARATION OF SURFACES AND INSTALLATION OF FIRE-STOPPING MATERIALS SHALL BE CARRIED OUT AS PER MANUFACTURER'S INSTRUCTIONS.

2. TESTING (15042)

- .1 PERFORM ALL TESTING REQUIRED BY THE AUTHORITY HAVING JURISDICTION.
- .2 PRESSURE TEST PIPING AT 1.5 TIMES MAXIMUM WORKING PRESSURE OR 125 PSI. PRESSURE TEST ALL BURIED SYSTEMS BEFORE BACKFILLING. DRAINAGE PIPING SHALL BE TESTED WITH 5' TO 25' OF HYDROSTATIC PRESSURE. PRESSURE TESTS SHALL BE LEFT ON FOR A MINIMUM OF 4 HOURS AND HYDROSTATIC TESTS FOR A MINIMUM OF 8 HOURS.
- .3 OBTAIN TEST CERTIFICATES FOR ALL TESTS PERFORMED AND PROVIDE TO CONSULTANT.
- .4 ALL TEST SHALL BE DOCUMENTED AND WITNESSED BY THE CONSULTANT OR GENERAL

3. BALANCING (15043)

- .1 CONTRACTOR IS TO PROVIDE THE SERVICES OF THE BASE BUILDING APPROVED PROFESSIONAL TESTING & BALANCING FIRM.
- .2 PROVIDE A BALANCE REPORT OF ALL AIR & WATER BALANCE POINTS AND PERFORMANCE TESTING & BALANCING OF ALL EQUIPMENT AS PER THE AABC.
- .3 BALANCE ALL AIR AND WATER QUANTITIES TO - 5% OR + 10% OF THE DESIGN REQUIREMENT, EXCEPT IN AIR SYSTEMS PART OF LIFE SAFETY WHERE DEVIATION SHALL BE 0 TO + 5%.
- .4 MEASURE AND BALANCE THE FOLLOWING (WHERE APPLICABLE):
 - .1 SUPPLY, EXHAUST AND RETURN FAN VOLUMES AND SPEEDS.
 - .2 AIRFLOW AT EACH AIR OUTLET, VAV, AND BRANCH CONNECTION.
 - .3 ADJUST PATTERN CONTROL ON SUPPLY DIFFUSERS.
 - .4 MOTOR AMPERAGE DRAW ON ALL MOTORS AND COMPARE WITH MOTOR RATING.
- .5 AFTER INSTALLATION AND BALANCING OF ALL THE FUME HOODS, THE CONTRACTOR SHALL COMMISSION A REGISTERED P.Eng TO CONDUCT A COMPLETE CERTIFICATION FOR ALL FUME HOODS IN COMPLIANCE WITH WORKSAFE BC REGULATION 30.8 (2.5) AND SUBMIT CERTIFICATION REPORTS FOR OWNER'S RECORD.
- .6 ADDITIONAL TESTING OF THE SYSTEM MAY BE REQUESTED BY THE CONSULTANT TO SPOT CHECK AIR AND WATER FLOW QUANTITIES. (10% OF THE SYSTEM WILL BE RE-CHECKED AT THE DISCRETION OF THE CONSULTANT) AT THE CONTRACTOR'S COST.
- .7 UPON COMPLETION OF WORK, SUBMIT 2 COPIES OF AIR BALANCING REPORT TO PROPERTY MANAGER.

4. PIPE & PIPE FITTINGS (15060)

- .1 ENSURE ALL PIPE MATERIALS AND FITTINGS ARE ACCEPTABLE TO THE AUTHORITY HAVING JURISDICTION.
- .2 ALL TYPE 'L' COPPER MUST BE CERTIFIED TO ASTM B88. PROVIDE WRITTEN GUARANTEE THAT LEAD FREE SOLDER WAS USED ON ALL DOMESTIC WATER SYSTEMS.
- .3 APPROVED PIPE & FITTINGS: (NON-COMBUSTIBLE CONSTRUCTION).

SERVICE	PIPE	FITTINGS
.1 HOT WATER (ALTERNATE)	TYPE 'L' HARD COPPER	WROUGHT COPPER OR BRASS TO ANSI/ASME B16.22
.2 HOT WATER	SCHEDULE 40 BLACK STEEL ASTM A53 GRADE B	MALLEABLE IRON OR STEEL, THREADED OR WELDED
- .4 CONTRACTOR TO PROVIDE DRAINS AT ALL LOW POINTS IN THE PIPING SYSTEM.

5. SUPPORT, ANCHORS, SEALS & FIRESTOPPING (15090)

- .1 PROVIDE ALL NECESSARY SUPPORTS, AND HANGERS TO SECURE MECHANICAL SYSTEMS AND EQUIPMENT.
- .2 PROVIDE FIRESTOPPING AT ALL DUCT AND PIPING PENETRATIONS THROUGH RATED FLOORS/WALLS AND SHAFTS. PROVIDE SHOP DRAWINGS SHOWING APPLICABLE ASSEMBLIES. ALL PRODUCTS TO BE ULC LISTED.
- .3 PROVIDE OVERSIZE HANGERS ON ALL COLD PIPES TO FIT OVER PIPE INSULATION WHERE REQUIRED.

- .4 PROVIDE ISOLATION AND PREVENT CONTACT WITH DISSIMILAR METALS.
- .5 ALL SLEEVES FOR MECHANICAL PIPING TO EXTEND 1" (25MM) ABOVE THE FLOOR IN ALL MECHANICAL ROOMS, SHAFTS AND WET AREAS.
- .6 ALL DUCTWORK TO BE SUPPORTED AS PER SMACNA.
- .7 ALL EXPOSED PIPING PENETRATIONS SHALL BE PROVIDED WITH ESCUTCHEONS.

7. INSULATION (15250)

- 7.1 INSULATION SHALL CONFORM TO INSULATION "AGENCY" THAT GOVERNS IN BC.
- 7.2 PIPING INSULATION:
 - .1 PROVIDE VAPOUR BARRIER FOR ALL COLD PIPES.
 - .2 ALL EXPOSED PIPING TO BE COMPLETE WITH PF-3 ECONOMY FINISH. NO FINISH REQUIRED ON CONCEALED PIPING.
 - .3 PROVIDE INSULATION THICKNESS AND TYPE AS FOLLOWS: (WHERE APPLICABLE)

SERVICE	PIPE THICKNESS	PIPE SIZE	INSULATION	TYPE
HOT WATER HEATING	ALL	ALL	1.5" (40MM)	MINERAL FIBRE

7.3 DUCT AND BREECHING INSULATION

- .1 EXPOSED RECTANGULAR DUCTS: RIGID FIBROUS GLASS INSULATION, 'K' VALUE AT 75°F (24°C) MAXIMUM 0.24 BTU.IN/FT HRF (0.035 W/M°C) WITH FACTORY APPLIED REINFORCED ALUMINUM FOIL VAPOUR BARRIER.
- .2 ROUND DUCTS AND CONCEALED RECTANGULAR DUCTS: FLEXIBLE FIBROUS GLASS INSULATION, 'K' VALUE 75°F (24°C) MAXIMUM 0.24 BTU.IN/FT HRF (0.035 W/M°C) WITH FACTORY APPLIED REINFORCED ALUMINUM FOIL VAPOUR BARRIER.
- .3 PROVIDE 1"ACOUSTIC INSULATION IN ALL DUCTS OFF EQUIPMENT SUPPLY AND RETURN OR EXHAUST INLETS AND OUTLETS. MAINTAIN INSIDE SIZES OF DUCTS SHOWN ON DRAWINGS
- .4 ACOUSTIC LINING: FIBROUS INSULATION WITH 'K' VALUE AT 75°F (24°C) MAXIMUM 0.24 BTU.IN/FT HRF (0.035 W/M°C) ABSOLUTE ROUGHNESS OF EXPOSED SURFACE NOT TO EXCEED 0.023 IN (0.58 mm) COATED TO PREVENT FIBRE EROSION AT AIR VELOCITIES UP TO 5000 FPM (254 M/S). 1.5 LB/FT (24 KG/M) MINIMUM DENSITY FOR DUCTWORK AND 4.7 LB/FT (75 KG/M) FOR PLENUMS.
- .5 RECOVER ALL INSULATION EXCEPT IN CEILING SPACES, CRAWL SPACES, AND MECHANICAL SHAFTS.
- .6 RECOVERY JACKETS: ULC LABELLED THERMOCANVAS.
- .7 ENSURE SURFACE AND INSULATION IS CLEAN AND DRY PRIOR TO AND DURING INSTALLATION.
- .8 ENSURE INSULATION IS CONTINUOUS THROUGH INSIDE PARTITIONS.
- .9 FINISH AND SEAL INSULATION NEATLY AT HANGERS, SUPPORTS, ACCESS DOORS, FIRE DAMPERS AND OTHER PROTRUSIONS.

8.0 DUCTWORK AND ACCESSORIES

8.1 GENERAL

- .1 FABRICATE DUCTWORK IN ACCORDANCE WITH SMACNA DUCT MANUAL AND ASHRAE HANDBOOKS. DUCTWORK SHALL MEET THE REQUIREMENTS OF NFPA 90A AND 90B AND CONFORM TO APPLICABLE CODES. KITCHEN EXHAUST DUCTWORK SHALL CONFORM TO NFPA 96.
- .2 PRIOR TO FABRICATION OF DUCTWORK, CHECK ALL CEILING SPACES AND HEIGHTS AND CONFLICTS WITH OTHER TRADES.
- .3 DUCT SIZES INDICATED ARE INSIDE CLEAR DIMENSIONS.FOR ACOUSTICALLY LINED OR INTERNALLY INSULATED DUCTS MAINTAINS SIZE INSIDE DUCTS.
- .4 FLEXIBLE DUCTWORK SHALL MEET SMACNA STANDARD. USE THERMAFLEX 1"INSULATED FLEX DUCT. FLEXIBLE DUCTS SHALL NOT EXCEED 6 FEET IN LENGTH UNLESS NOTED OTHERWISE ON DRAWINGS. SUPPORT FLEXIBLE DUCT TO MAINTAIN 12"VERTICAL DROP WITH NO KINKS IN FLEX DUCT. WHERE THIS CANNOT BE PROVIDED, INSTALL A 12"VERTICAL SLEEVE OFF DIFFUSER NECK.
- .5 PROVIDE FIRE DAMPERS WHERE DUCTS CROSS FIRE SEPARATIONS. FIRE DAMPERS SHALL BE ULC LISTED AND CONSTRUCTED IN ACCORDANCE WITH ULC STANDARD S112 "FIRE DAMPERS". FUSIBLE LINKS SHALL BE CONSTRUCTED TO ULC STANDARD S505.
- .6 PROVIDE BALANCING DAMPERS WHERE INDICATED ON DRAWINGS AND AT POINTS ON LOW PRESSURE SUPPLY, RETURN AND EXHAUST DUCTS WHERE BRANCHES ARE TAKEN FROM LARGER DUCTS.
- .7 PROVIDE ADEQUATELY SIZED ACCESS PANELS FOR DAMPERS, EQUIPMENT, FIRE DAMPERS, VALVES, RADIATION VALVES, AND ANY OTHER EQUIPMENT REQUIRING SERVICING.
- .8 PROVIDE RETURN AIR OPENINGS AND/OR INSULATED SOUND TRAPS WHERE INDICATED.
- .9 PROVIDE ACOUSTICAL SEAL AROUND DUCTS AND SOUND TRAPS AT PENETRATION THROUGH SOUND BAFFLES.
- .10 MODIFY CEILING SYSTEM WHERE REQUIRED TO ACCOMMODATE GRILLES AND DIFFUSERS.
- .11 SIZE ROUND DUCTS, INSTALLED IN PLACE OF RECTANGULAR DUCTS, FROM ASHRAE TABLE OF EQUIVALENT RECTANGULAR AND ROUND DUCTS. NO VARIATION OF DUCT CONFIGURATION OR SIZES PERMITTED EXCEPT BY PERMISSION FROM ENGINEER.
- .12 EXPOSED ROUND DUCTWORK TO BE SPIRAL LOCK SEAM TYPE ONLY.
- .13 PROVIDE DUCT HANGERS AND SUPPORTS IN ACCORDANCE WITH SMACNA MANUALS.
- .14 IDENTIFY DUCTWORK AS PER THE BASE BUILDING STANDARDS. CONFIRM THESE PRIOR TO SUBMITTING TENDER.

8.2 LOW VELOCITY DUCTWORK

- .1 DUCTWORK SHALL BE GALVANIZED STEEL. THE MINIMUM SHEET METAL THICKNESS FOR DUCTS INCLUDING FITTINGS, ACCESS DOORS, AND OTHER ACCESSORIES SHALL BE AS PER SMACNA DUCT MANUAL FOR LOW VELOCITY DUCTWORK.
- .2 LOW VELOCITY INSULATED FLEXIBLE DUCTWORK SHALL BE EQUAL TO THERMAFLEX TYPE M-KC.
- .3 CONNECT DIFFUSERS OR TROFFER BOOTS TO LOW PRESSURE DUCTS WITH 36" (900 mm) MAXIMUM LENGTH OF STRETCHED FLEXIBLE DUCT. HOLD IN PLACE WITH CAULKING COMPOUND AND STRAP OR CLAMP. DO NOT USE FLEXIBLE DUCT TO CHANGE DIRECTIONS.
- .4 WHERE LOW PRESSURE DUCTS ARE CONNECTED TO FAN EQUIPMENT, TERMINAL BOXES OR ANY OTHER APPARATUS, A SCREWED OR BOLTED FLEXIBLE GASKETED JOINT SHALL BE PROVIDED BETWEEN THE DUCTWORK AND THE EQUIPMENT.

8.3 MEDIUM AND HIGH VELOCITY DUCTWORK

- .1 DUCTWORK SHALL BE GALVANIZED STEEL. THE MINIMUM SHEET METAL THICKNESS FOR MEDIUM AND HIGH PRESSURE DUCTS INCLUDING FITTINGS, ACCESS DOORS AND OTHER ACCESSORIES SHALL BE AS PER SMACNA MANUAL FOR MEDIUM AND HIGH VELOCITY DUCTWORK.
- .2 CONTINUOUSLY WELDED ROUND DUCTS SHALL HAVE 4" (100 mm) CEMENTED SLIP JOINTS, BRAZED OR ELECTRIC WELDED.
- .3 WHERE FLEXIBLE AIR DUCTS ARE USED TO CONNECT TERMINAL UNITS TO METAL DUCTS, THE FLEXIBLE AIR DUCTS SHALL BE RATED FOR 6000 FPM (30.5 M/S) VELOCITY AND 16" W.G. (3.98 KPA). MAXIMUM STRETCHED LENGTH OF FLEXIBLE AIR DUCT SHALL BE 12' (300 mm). DO NOT USE FLEXIBLE DUCT TO CHANGE DIRECTION. WHERE FLEXIBLE AIR DUCTS ARE ATTACHED TO METAL INSULATED DUCT, FURNISH FLEXIBLE AIR DUCTS WITH FIBERGLASS WOOL INSULATION AND METALIZED JACKET SUCH AS THERMAFLEX M-KC.

8.4 DUCT SEALING

- .1 ALL SUPPLY, RETURN AND EXHAUST DUCT JOINTS, LONGITUDINAL AS WELL AS TRANSVERSE, SHALL BE SEALED USING.
 - .1 LOW PRESSURE DUCTWORK:
 - * SLIP JOINTS: APPLY HEAVY BRUSH-ON HIGH PRESSURE DUCT SEALANT. APPLY SECOND APPLICATION AFTER THE FIRST APPLICATION HAS COMPLETELY DRIED OUT. WHERE METAL CLEARANCE EXCEEDS 1/16" (1.5 mm) USE HEAVY MASTIC TYPE SEALANT.
 - * FLANGED JOINTS: SOFT ELASTOMER BUTYL OR EXTRUDED FORM OF SEALANT BETWEEN FLANGES FOLLOWED BY AN APPLICATION OF HEAVY BRUSH-ON HIGH PRESSURE DUCT SEALANT.
 - * OTHER JOINTS: HEAVY MASTIC TYPE SEALANT.
 - .2 MEDIUM AND HIGH PRESSURE DUCTWORK: COMBINATION OF WOVEN FABRICS AND SEALING COMPOUND FOLLOWED BY AN APPLICATION OF HIGH PRESSURE DUCT SEALANT.
 - .2 DUCT TAPES AS SEALING METHOD ARE NOT PERMITTED.
 - .3 SURFACES TO RECEIVE SEALANT SHOULD BE FREE FROM OIL, DUST, DIRT, MOISTURE, RUST AND OTHER SUBSTANCES THAT INHIBIT OR PREVENT BONDING.
 - .4 DO NOT INSULATE ANY SECTION OF THE DUCTWORK UNTIL IT HAS BEEN INSPECTED AND APPROVED OF DUCT SEALANT APPLICATION, BY THE ENGINEER.

9. CONTROLS (15900)

- .1 DIVISION 16 (ELECTRICAL) TO PROVIDE WIRING TO 120V/1 PHASE MOTOR AND ALSO THE WIRING BETWEEN SUCH MOTOR AND ITS CONTROL DEVICE SUCH AS THERMOSTAT AND TIME CLOCK. ALL OTHER WIRING ARE GENERALLY BY DIVISION 15. THE MOTOR LIST SCOPE OF WORK SHALL BE FOLLOWS.
 - .1 BY ELECTRICAL CONTRACTOR - MOUNTING AND WIRING THERMOSTATS CONTROLLING SINGLE PHASE MOTOR. WIRING OF AQUASTATS AND TIMERS CONTROLLING SINGLE PHASE MOTORS.
 - .2 BY MECHANICAL CONTRACTOR - MOUNTING OF ALL IN-LINE PIPING DEVICES (WELL, VALVES, PRESSURE SWITCHES, ORIFICES, ETC.). MOUNTING OF AQUASTATS AND ALL CONTROL DEVICES.
 - .3 BY SHEET METAL CONTRACTOR - MOUNTING OF DAMPERS, BAFFLING IN MIXED AIR PLENUM TO CONTROL CONTRACTOR REQUIREMENTS, ACCESS DOOR FOR DUCT OR UNIT MOUNTED CONTROLS.
- .3 PROVIDE NEW THERMOSTATS AS INDICATED ON THE DRAWINGS. MOUNT ON WALL OR COLUMN AT 60" ABOVE FLOOR. THERMOSTATS ON EXTERIOR WALL SHALL BE COMPLETE WITH INSULATED BASE PLATE.
- .4 RELOCATE EXISTING THERMOSTATS AS INDICATED.
- .5 WORKING WITH THE AIR BALANCING AGENT, RE-CALIBRATE VAV BOX MAX. AND MIN. VOLUMES IF REQUIRED TO ACHIEVE AIR FLOWS.
- .6 RECALIBRATE ALL NEW AND EXISTING THERMOSTATS IN RENOVATED AREA.
- .7 CONTRACTOR TO PROVIDE NEW DDC CONNECTIONS TO ALL NEW MECHANICAL EQUIPMENT AS PER BASE BUILDING BMS STANDARD & TO PROVIDE GRAPHICS UPDATE AS PER THE MECHANICAL DRAWINGS.

10. HVAC CONTROL SEQUENCE FOR MINING WEAR LAB 1403

- 1.1 HVAC CONTROL SEQUENCE
 - .1 HVAC SYSTEMS:
 - .1 PROGRAM THE SYSTEM TO MEET THE FOLLOWING OBJECTIVES:
 - .1 TEMPERATURE:
 - .1 CONTROL THE TEMPERATURE IN EACH OCCUPIED SPACE.
- 1.2 HOURS OF OPERATION
 - .1 GENERALLY THE HOURS OF OPERATION ARE 0700 TO 1800 MONDAY TO FRIDAY.
- 1.3 CONTROL SEQUENCING
 - .1 HVAC SYSTEM CONSISTS OF THE FOLLOWING COMPONENTS:
 - .1 VAVS-103: EXISTING VAV BOX WITH HOT WATER REHEAT COIL
 - .2 CV-103A: VAV BOX WITH HOT WATER REHEAT COIL
 - .3 FHEF-21: FUME HOOD EXHAUST FAN WITH VFD
 - .1 INTERLOCKED WITH VAVS-103 AND CV-103A
 - .2 EMCS TO MONITOR FAN OPERATION
 - .4 EF-1403: EXHAUST FAN WITH VFD
 - .1 EMCS TO MONITOR FAN OPERATION
 - .2 HVAC SYSTEM STOPPED:
 - .1 EF-1403 AND FHEF-21 STOPPED
 - .2 HIGH LEVEL EXHAUST RUNS CONTINUOUSLY (4 @ 50 L/S)
 - .3 SYSTEM OPERATION:
 - .1 GENERAL
 - .1 DURING NORMAL OPERATION WHEN FHEF-21 AND HIGH LEVEL EXHAUST ARE OPERATING, VAVS-103 AND CV-103A WILL OPERATE TO PROVIDE THE MAKE-UP AIR REQUIRED FOR THE FUME HOODS AND GENERAL HIGH LEVEL EXHAUST.

- .2 VAVS-103 AND CV-103A SHALL MODULATE TO MAINTAIN A NET NEGATIVE PRESSURE IN THE MINING WEAR LAB (NET -100 L/S) RELATIVE TO THE CORRIDOR AT ALL TIMES.
- .3 EF-1403 SHALL OPERATE AS NEEDED BY PERSONNEL. SEE SCHEMATIC 05 ON DRAWING M-003.
- .4 EMCS SHALL MONITOR OPERATION OF VAVS-103, CV-103A AND FHEF-21. THIS WILL REQUIRE CLOSE COORDINATION WITH BALANCING CONTRACTOR DURING THE COMMISSIONING STAGE.
- .5 EMCS TO MONITOR AND CONTROL ROOM SPACE CONDITIONS AS FOLLOWS:
 - ROOM TEMPERATURE: 21°C±2°C (70°F±4°F)

11. SEISMIC PROTECTION

- .1 ALL MECHANICAL EQUIPMENT, DUCTING, DIFFUSERS ARE TO BE SEISMICALLY SUPPORTED AND BRACED WITH STRUTS OR WIRES AS REQUIRED TO RESIST SEISMIC FORCES AND AVOID INJURY TO OCCUPANTS.
- .2 ALL FREE-STANDING MECHANICAL EQUIPMENT SHALL BE SUPPORTED AND BRACED TO COMPLY WITH BCBC CODE AND APPROVED BY A PROFESSIONAL SEISMIC ENGINEER.
- .3 HIRE A PROFESSIONAL SEISMIC ENGINEER THAT IS REGISTERED WITH APEGBC AND PROVIDE A LETTER OF SEISMIC ASSURANCE. PAY FOR ALL ASSOCIATED FEES AS REQUIRED.



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THE GENERAL CONTRACTOR SHALL REVIEW THE DOCUMENTS FOR CONFORMANCE TO CODES AND BY-LAWS AND SHALL ADVISE THE ENGINEER OF ANY DISCREPANCIES HE MAY NOTE. THE GENERAL CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ALL ERRORS AND OMISSIONS TO THE ENGINEER.

DO NOT SCALE THE DRAWINGS.

THESE DRAWINGS ARE INTENDED FOR ARCHITECTURAL INFORMATION ONLY. THE CONTRACTOR AND ANY PERSONS USING THESE DRAWINGS ARE ADVISED TO REFER TO THE ENGINEER FOR INFORMATION RELATING TO SPECIFIC DISCIPLINES.

0	Issued for Tender	31 Oct 14
revisions		date



project **NRC · CRC** project
NATIONAL RESEARCH COUNCIL CANADA

Wesbrook Mall, Vancouver, BC

drawing **MINING WEAR LAB AND MAINTENANCE SHOP RENOVATION** dessin

MECHANICAL SPECIFICATIONS SHEET 2

designed	KM	concu
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date	SEP. 2014	
approved	-	approuve
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Tender	-	Soumission
PWGSC Project Manager	Administrateur de projets TPSGC	
project number	1409	no. du projet
drawing no.	M-005	no. du dessin