# SECTION 238318 – SNOW-MELTING SYSTEM

***Designer note: review highlighted paragraphs and edit or delete as necessary for specific project.***

1. GENERAL
	1. RELATED DOCUMENTS
		1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this section.
	2. SUMMARY
		1. Provide all labor, materials, and equipment as necessary to complete work as indicated on the Drawings and as specified herein.

***Designer note: Select one Paragraph B from below***

* + 1. Section includes: Slab preparation for snow-melting system
		2. Section includes: Snow-melting system
		3. Related sections:
			1. Division 23 Section “Common Work Results for HVAC.”
			2. Division 23 Section “Hydronic Pumps.”
			3. Division 23 Section “HVAC Water Treatment.”
			4. Division 23 Section “Testing, Adjusting and Balancing for HVAC.”
			5. Division 32 Exterior Improvements
	1. REFERENCES
		1. ASHRAE Handbook - 2003 HVAC Applications, Snow Melting and Freeze Protection
		2. Central Michigan University Design Standards:
			1. Sidewalk Concrete Delivery Standard
			2. General Design Requirements

***Designer note: Select one Paragraph 1.4 from below***

* 1. SYSTEM DESCRIPTION – SLAB PREPARATION
		1. Slab poured as part of this project in which a snow melting system will be installed in the future.
		2. Preparation shall include all slab insulation, snow melt tubing, manifold, snow/ice sensor sleeve and embedded conduit, outdoor access box and cover.
	2. SYSTEM DESCRIPTION – SNOW MELTING SYSTEM
		1. System shall be of hydronic type, field-assembled or packaged, skid mounted unit, except for distribution piping. System shall consist of glycol heater unit, circulating pump, expansion tank, air separator, temperature and pressure gauges, balancing valve, valves and fittings, chemical treatment, supply and return main, manifolds and fittings, distribution loops, and controls.
		2. If slab is existing and has been prepared with snow melt tubing and manifolds, a Tekmar D091 snow/ice sensor socket may be installed. Field verify and, if so, the Tekmar D090 snow/ice sensor is to be used as part of the snow melt system.
		3. If new slab is required, slab shall comply with Central Michigan University Design Standards.
		4. Field-mounted power devices including combination starters and wiring shall be furnished and installed by the electrical contractor. Control devices and wiring shall be furnished and installed by the control contractors.
	3. SNOW MELT SYSTEM DESIGN CRITERIA:
		1. Snow Melt System design criteria/parameters:
			1. Heat Output Min. 156 Btu/hr-sqft
			2. HWH Supply Temperature Max. 120-degree F, 30-degree temp. differential
			3. Glycol/Water Solution 40%
			4. Heat Source - Steam 10 psi
			5. Outdoor Design Temperature 0-degree F, 10 mph wind, 85% RH
			6. Surface Idling Temperature 29-degree F
			7. Melting Temperature 38-degree F
	4. SUBMITTALS

***Designer note: Select one paragraph A from below.***

* + 1. Shop Drawings for Slab preparation: Include outdoor access box, PEX tubing, manifold, and sensor socket.
		2. Shop Drawings for Snow Melt System: Include outdoor access box, PEX tubing, manifold, sensor socket and sensor, performance data, components, and accessories, wiring diagrams, dimensions, weights and loadings, field connections, and required clearances.
		3. Test Reports: Include operating test data submitted by the manufacturer's field service representative
		4. Operation and Maintenance Data: Include approved selection data, start-up instructions, maintenance data, part lists, accessories, control and wiring diagrams, and test reports.
	1. QUALITY ASSURANCE
		1. Codes and Standards
			1. MMC 2003
			2. ASHRAE 90.1-2004
			3. ASTM F876, “Standard Specification for Crosslinked Polyethylene (PEX) Tubing”.
	2. WARRANTY
		1. Manufacturer shall furnish, at the completion of installation, as described herein, a Certificate of Inspection signed by his authorized representative. The minimum five (5) year system warranty shall be provided to the Owner by the Contractor.

***Designer note: Select one PART 2 from below***

1. PRODUCTS FOR SLAB PREPARATION
	1. MANUFACTURERS
		1. Acceptable manufacturers of snow melting systems are
			1. HeatLink
			2. Wirsbo Co./Oponor
			3. Tekmar/Watts
	2. PIPES AND FITTINGS
		1. Underground distribution loop shall be cross-linked polyethylene, PEX-A, rated at minimum 180 deg. F. and 100 psi working pressure, conform to ASTM standards F876/F877, and marked "SNOW MELT SYSTEM". Minimum tubing size is 5/8" nominal ID. Tubing shall have a minimum bend radius of not more than six times the tubing OD at 68-degree F. Tubing shall be UV stabilized.
			1. Tubing shall carry a twenty-five (25) year warranty. Warranty to be included with submittals.
		2. Underground piping mains shall be pre-insulated PEX pipe. System shall consist of PEX pipe with an oxygen diffusion barrier, CFC free PEX closed cell foam insulation, and a corrugated twin wall HDPE protective sheath. Provide brass PEX compression x MPT adapters as necessary. Installer shall provide additional brass fittings as necessary for a complete system.
			1. Provide tracer wire on all underground piping. Tracer wire to be 12-gauge minimum solid copper with thermoplastic insulation recommended for direct burial. Wire connectors to be watertight and provide electrical continuity. Wire to be accessible at manifold location. Contractor shall perform a continuity test on all tracer wire in the presence of the CMU Project Manager and repair or replace failed segment of any tracer wire found to be not continuous after testing.
		3. Distribution manifolds shall be constructed of stainless or nickel-plated steel or approved equal. Provide isolation ball valves and thermometers in both the supply and return. Manifolds shall be compatible with tubing and shall have end caps tapped for manual air vents and a drain valve. Provide mini ball valves with PEX compression fittings for each loop for isolation and balancing. Installer shall provide a ball valve and circuit balancing valve with full shutoff capability for each manifold set.
	3. OUTDOOR ACCESS BOX
		1. Outdoor manifold access boxes shall be equal to a Quazite model PG box, constructed of polymer concrete, with a model CA bolted cover. A weather-resistant label reading “SNOWMELT SYSTEM” is to be mechanically attached to box cover. Box depth shall be 18”. Box width and length shall be suitable for actual manifold size, including space for manifold isolation and balancing valves. Additional access boxes shall be provided as necessary for access to any underground main piping joints.
	4. SNOW/ICE SENSOR SOCKET
		1. Sensor socket shall be Tekmar Model 091 socket designed to house a Tekmar Model 090/094 snow/ice sensor. Follow manufacturer’s recommendations for installation of socket. The socket is to be located a minimum of 36” away from buildings and the area where the PEX tubing enters/exits concrete slab. Utilize mounting plate and provide for adequate drainage under the socket.
		2. If only the socket will be installed, fabricate a disc of stainless steel, 3/18” thick, and install the disc in place of the plastic plug once the concrete has been poured and finished. Secure the disc to the socket using the existing screw holes in the socket and the o-ring.
		3. Embed a ¾” rigid PVC conduit running from the sensor socket to a point inside the building for future tie-in. Terminate and cap conduit inside outdoor access box, or inside building adjacent to manifold.
2. PRODUCTS FOR SNOW MELT SYSTEM
	1. MANUFACTURERS
		1. Acceptable manufacturers are
			1. HeatLink
			2. Wirsbo Co./Oponor
			3. Tekmar/Watts
	2. PIPES AND FITTINGS
		1. Underground distribution loop shall be cross-linked polyethylene, PEX-A, rated at minimum 180 deg. F. and 100 psi working pressure, conform to ASTM standards F876/F877, and marked "SNOW MELT SYSTEM". Minimum tubing size is 3/4" nominal ID. Tubing shall have a minimum bend radius of not more than six times the tubing OD at 68-degree F. Tubing shall be UV stabilized.
			1. Tubing shall carry a twenty-five (25) year warranty. Warranty to be included with submittals.
		2. Underground piping mains shall be pre-insulated PEX pipe. System shall consist of PEX pipe with an oxygen diffusion barrier, CFC free PEX closed cell foam insulation, and a corrugated twin wall HDPE protective sheath. Provide brass PEX compression x MPT adapters as necessary. Installer shall provide additional brass fittings as necessary for a complete system.
			1. Provide tracer wire on all underground piping. Tracer wire to be 12-gauge minimum solid copper with thermoplastic insulation recommended for direct burial. Wire connectors to be watertight and provide electrical continuity. Wire to be accessible at manifold location. Contractor shall perform a continuity test on all tracer wire in the presence of the CMU Project Manager and repair or replace failed segment of any tracer wire found to be not continuous after testing.
		3. Mains inside building shall be same as hot water heating piping. Refer to Division 23 Section “Common Work Results for HVAC.”
		4. Distribution manifolds shall be constructed of stainless or nickel-plated steel or approved equal. Provide isolation ball valves and thermometers in both the supply and return. Manifolds shall be compatible with tubing and shall have end caps tapped for manual air vents and a drain valve. Provide mini ball valves with PEX compression fittings for each loop for isolation and balancing. Installer shall provide a ball valve and circuit balancing valve with full shutoff capability for each manifold set.
	3. OUTDOOR ACCESS BOX
		1. Outdoor manifold access boxes shall be equal to a Quazite model PG box, constructed of polymer concrete, with a model CA bolted cover. A weather-resistant label reading “SNOWMELT SYSTEM” is to be mechanically attached to box cover. Box depth shall be 18” and buried level and flush to the grade. Box width and length shall be suitable for actual manifold size, including space for manifold isolation and balancing valves. Additional access boxes shall be provided as necessary for access to any underground main piping joints.
	4. GLYCOL HEATER UNITS
		1. Glycol heater unit shall consist of heat exchanger, temperature/pressure relief valve, strainer, float and thermostatic steam trap, vacuum breaker and air vent, pressure and temperature gauges, drain/flush valve, and controls.
		2. Heat exchanger shall be a steam to water, ASME approved, unaffected by thermal shock and designed for full standby shutdown.
		3. Heat exchanger shall be vertical shell and coil, or horizontal shell and tube type manufactured by Bell & Gossett, Armstrong, or approved equal.
	5. CIRCULATING PUMPS
		1. General requirements
			1. Pump motors shall be 1750 rpm maximum and sized for non-overloading service.
			2. Pumps shall have stainless steel shafts and sleeves, bronze wear rings, and cast-iron bases. Bases shall be designed for grouting in place.
			3. Mechanical seals shall be John Crane Type XP662D1, with Viton bellows, tungsten carbide and carbon seal faces.
			4. In special applications where packed pumps are used, packing shall be Chesterton 328 braided Teflon, Crane, Durametallic or equal.
			5. Pumps shall have Woods Dura-Flex or Rexnord Omega elastomeric couplings.
			6. Pumps, in general, shall have a grease lubricated, heavy duty, deep groove ball bearings with a certified rating design of 200,000 hours of average bearing life. Acceptable manufacturers are S.K.F., Fafnir, and New Departure.
		2. Close-coupled, in-line centrifugal pumps
			1. Manufacturers: Subject to compliance with the requirements, provide products by one of the following:
				1. Bell & Gossett; Div. of ITT Industries; Series 80.
				2. Armstrong Pumps, Inc.
			2. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally or vertically. Rate pump for 175-psig minimum working pressure and a continuous water temperature of 225 deg F.
			3. Pump Construction:
				1. Casing: Radially split, cast iron, with replaceable bronze wear rings, threaded gage tappings at inlet and outlet, and threaded companion-flange connections.
				2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
				3. Pump Shaft: Steel, with copper-alloy shaft sleeve.
			4. Motor: Single speed, with permanently lubricated ball bearings, unless otherwise indicated; and rigidly mounted to pump casing. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
		3. Separately coupled, base-mounted, end-suction centrifugal pumps
			1. Manufacturers: Subject to compliance with the requirements, provide products by one of the following:
				1. Bell & Gossett; Div. of ITT Industries; Series 1510.
				2. Armstrong Pumps, Inc.
			2. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, end-suction pump as defined in HI 1.1-1.2 and HI 1.3; designed for base mounting, with pump and motor shafts horizontal. Rate pump for 175-psig minimum working pressure and a continuous water temperature of 225 deg F.
			3. Pump Construction:
				1. Casing: Radially split, cast iron, with replaceable bronze wear rings, threaded gage tappings at inlet and outlet, drain plug at bottom and air vent at top of volute, and flanged connections. Provide integral mount on volute to support the casing and attached piping to allow removal and replacement of impeller without disconnecting piping or requiring the realignment of pump and motor shaft.
				2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
				3. Pump Shaft: Stainless steel.
			4. Coupling Guard: Dual rated; ANSI B15.1, Section 8; OSHA 1910.219 approved; steel; removable; attached to mounting frame.
			5. Mounting Frame: Welded-steel frame and cross members, factory fabricated from ASTM A 36/A 36M channels and angles. Fabricate to mount pump casing, coupling guard, and motor.
			6. Motor: Single speed, with grease-lubricated ball bearings, unless otherwise indicated; secured to mounting frame, with adjustable alignment. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
	6. PUMP SPECIALTY FITTINGS
		1. Suction Diffuser:

* + - 1. Manufacturers: Subject to compliance with the requirements, provide products by one of the following:
				1. ITT Bell & Gossett.
				2. Armstrong
			2. Cast iron, angle-type body with flow straightening device, removable strainer (bronze for start-up, stainless steel for permanent), tapped suction gage port, blow down connection, and adjustable support foot.
			3. Rated for maximum working pressure of 175 psi at 250-degree F.
		1. Y-Pattern Strainers:
			1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
			2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
			3. Strainer Screen: 40-mesh startup strainer and perforated stainless-steel basket with 50 percent free area.
	1. AIR CONTROL DEVICES
		1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
			1. Bell & Gossett Domestic Pump; a division of ITT Industries
			2. Armstrong Pumps, Inc.
			3. Spirotherm
		2. Manual Air Vents:
			1. Body: Bronze.
			2. Internal Parts: Nonferrous.
			3. Operator: Screwdriver or thumbscrew.
			4. Inlet Connection: NPS ½.
			5. Discharge Connection: NPS 1/8.
			6. CWP Rating: 150 psig.
			7. Maximum Operating Temperature: 225 deg F.
			8. Basis of Design: Bell & Gossett No. 4V.
		3. Expansion Tanks:
			1. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature, with taps in bottom of tank for tank fitting and taps in end of tank for gage glass. Tanks shall be factory tested with taps fabricated and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
			2. Air-Control Tank Fitting: Cast-iron body, copper-plated tube, brass vent tube plug, and stainless-steel ball check, 100-gal. unit only; sized for compression-tank diameter. Provide tank fittings for 125-psig working pressure and 250 deg F maximum operating temperature.
			3. Tank Drain Fitting: Brass body, nonferrous internal parts; 125-psig working pressure and 240 deg F maximum operating temperature; constructed to admit air to compression tank, drain water, and close off system.
			4. Gage Glass: Full height with dual manual shutoff valves, 3/4-inch-diameter gage glass, and slotted-metal glass guard.
		4. Diaphragm-Type Expansion Tanks:
			1. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature. Factory test with taps fabricated and supports installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
			2. Diaphragm: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
			3. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.
		5. Tangential-Type Air Separators:
			1. Furnish and install as shown on the drawings a Spirovent coalescing type air eliminator on the hot and chilled water systems. Pipe size is not a factor, and all units should be selected at the point of peak efficiency per the manufacturer’s recommendations. All eliminators shall be fabricated steel, rated for 150 psig working pressure with entering velocities not to exceed 4 feet per second at specified GPM. Units shall include an internal Spirotube® bundle filling the entire vessel to suppress turbulence and provide high efficiency. The bundle must consist of a copper core tube with continuous wound copper medium permanently affixed to the core. A separate copper medium is to be wound completely around and permanently affixed to each internal element. Each eliminator shall have a separate venting chamber to prevent system contaminants from harming the float and venting valve operation. At the top of the venting chamber shall be an integral full port float actuated brass venting mechanism. Units shall include a valved side tap to flush floating dirt or liquids and for quick bleeding of large amounts of air during system fill or refill. Eliminators shall include a bottom connection for use as a blow down connection for periodic cleaning. Air Eliminators shall be Spirovent Senior models manufactured by Spirotherm, Inc. and be capable of removing 100% of the free air, 100% of the entrained air, and up to 99.6% of the dissolved air in the system fluid.
	2. CONTROLS
		1. Control shall include snow/ice sensor, outdoor sensor, supply and return glycol temperature sensors, overheat protection, snow/ice detector, control valve. System shall be turned on and off automatically.
			1. If slab is existing and has been prepared with snow melt tubing and manifolds, a Tekmar D091 snow/ice sensor socket may be installed. Field verify and, if so, the Tekmar D090 snow/ice sensor is to be used as part of the snow melt system.
		2. Snow/ice melting control shall regulate the rate at which heat is transferred into a snow melting slab and determine the required supply glycol temperature from measurement of the slab temperature. Modulation of the heat delivery shall be accomplished by a modulating steam valve. Snow/ice detector shall activate the snow/ice melting control upon the detection of snow/ice formation on the snow melting slab.
		3. Microprocessor-based snow/ice melting controller shall be provided that will communicate an overall system fault:
			1. Flash a red light for local annunciation at the main snow melt panel
			2. Send a signal to the Building Management System
		4. Glycol temperature shall be limited to 120-degree F. A secondary high-limit manual reset shall be locked at 130-degree F.
	3. WATER TREATMENT
		1. Intercool P300 propylene glycol and corrosion inhibitor shall be provided by the Contractor Solution to be pre-mixed at 40% glycol.
1. EXECUTION
	1. INSTALLATION
		1. Slab Preparation and Snow Melt System
			1. A complete snow melt system including tubing loop, manifolds, fittings, and sensors shall be installed in accordance with the manufacturers' recommendations. The Contractor shall follow the Shop Drawings for tube layout, tube spacing, and manifold and sensor locations.
			2. Stamp “Snow Melt System” all along the edge of the heated surface. Review layout with Owner prior to stamping.
			3. Distribution manifolds, attached to supply and return mains, shall be located inside a yard box adjacent to the heated slab section. If heated slab is adjacent to a mechanical room or accessible tunnel, the manifold can be located there.
			4. A minimum of one supply and one return manifold is required for each 1,600 square foot area and for alternate expansion/construction joints. Locate main piping under the walk as much as possible. Main piping located outside the walk shall be at least 36" below ground and shall be protected by indicator warning tape. Provide flow balance for entire system.
			5. Reinforcing steel (6 x 6 – W2.9 x W2.9 minimum) shall be furnished by the Contractor and supported as required over entire heated area. 5/8”- inch pipe circuits shall be attached to reinforcing steel on 9" centers using 12-inch minimum return bends without fittings. All circuits shall be approximately 100 feet in length and form a continuous conduit without joints from supply to return manifolds. Maximum loop length shall not exceed 300 ft. All loops shall be of similar length with no more than +/- 10% variation from average loop length.
			6. No pipe shall extend through expansion, construction or working joints in concrete slab. Pipes and continuous steel may extend through contraction joints (surface tool marks). Pipe circuits shall be embedded in concrete at specified depth. All pipe connections, fittings and distribution manifolds shall be free of concrete and arranged so as to be easily serviced by removal of access box cover.
			7. Distribution loop shall be pressure tested with water or air in accordance with the Michigan Mechanical Code and manufacturer's recommendations prior to concrete cover. Pressure the system to 100 psi. If necessary, re-pressurize system to 100 psi until pressure stabilizes and hold for 2 hours. If pressure holds at 100 psi, the test passes. The system shall remain at this pressure during the concrete installation and for a minimum of 24 hours thereafter to ensure system integrity.
				1. Important Note: The pressure must not exceed 120 psi.
				2. Important Note: If using water to pressure test the system, purge all water from the system prior to the ambient air temperature falling to 32°F. Failing to remove the water from the system can result in damage to the piping and associated equipment.
			8. Outdoor sensor shall be installed on the north or west wall with shield unless otherwise approved by Owner.

***Designer note: Delete the following paragraphs for slab prep only project***

* + 1. Pumps
			1. Install all pumps in strict accordance with manufacturer’s instructions. Provide service space around pumps as recommended by the pump manufacturer.
			2. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
			3. Install continuous-thread hanger rods and spring hangers of sufficient size to support pump weight. Fabricate brackets or supports as required. Hanger and support materials are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
			4. Suspend vertically mounted, in-line centrifugal pumps independent of piping. Install pumps with motor and pump shafts vertical. Use continuous-thread hanger rods and spring hangers of sufficient size to support pump weight. Hanger and support materials are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Division 23 Section “Equipment/Hangers and Supports for HVAC Piping and Equipment."
			5. Set base-mounted pumps on concrete pad. Disconnect coupling before setting. Do not reconnect couplings until alignment procedure is complete.
			6. Do not mount pumps on walls that are common to critical areas such as offices, conference rooms, classrooms, etc. In-line pumps shall be installed directly in the piping system and supported independently from the piping.
			7. Alignment
				1. Align pump and motor shafts and piping connections after setting on foundation, grout has been set and foundation bolts have been tightened, and piping connections have been made.
				2. Comply with pump and coupling manufacturers' written instructions.
				3. Adjust pump and motor shafts for angular and offset alignment by methods specified in HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation."
				4. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.
				5. Grout pump mounting base full after piping is connected but before pump drive is aligned. After grouting, align pump drive shaft to 5 mils, even if pump is factory aligned, and conduct vibration test.
				6. Realignment after installation prior to start up will be performed by Owner.
			8. Connections
				1. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
				2. Install piping adjacent to machine to allow service and maintenance.
				3. Connect piping to pumps. Install valves that are same size as piping connected to pumps.
				4. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.
				5. Install check valve, balancing valve, and shutoff valve on discharge side of pumps. Triple duty valve is not acceptable.
				6. Install Y-type strainer and shutoff valve on suction side of pumps. Suction diffusers can be used in lieu of in-line strainers, long radius elbow and spool piece.
				7. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.
				8. Install pressure gages on pump suction and discharge, at integral pressure-gage tapping, or install single gage with multiple input selector valve.
				9. Install electrical connections for power, controls, and devices.
	1. FIELD QUALITY CONTROL
		1. Manufacturer shall provide inspection service and technical assistance for the installation:
			1. Site preparation
			2. Testing
			3. Start-up and balance
			4. Annual maintenance shall be available for inspection, adjustment, and lubrication of system equipment.

END OF SECTION 238318