LIMBACH

Since 1901 Consistently Exceeding Expectations

Date: January 8, 2015.

Project: Jackson Home Office Expansion.

Phase: 3 – Office Building / Connector.

Product: Snow Melt System.

Document: Warranty.

Notes: No Notes.

Date of substantial completion or 18 months from date of shipment.

LIMITED WARRANTY

Products manufactured by (GRUNDFOS) GRUNDFOS PUMPS CORPORATION are warranted to the original user only to be free of defects in material and workmanship for a period of 24 months from date of installation, but not more than 30 months from date of manufacture. GRUNDFOS' liability under this warranty shall be limited to repairing or replacing at GRUNDFOS' option, without charge, F.O.B. GRUNDFOS' factory or authorized service station, any product of GRUNDFOS' manufacture. GRUNDFOS will not be liable for any costs of removal, installation, transportation, or any other charges which may arise in connection with a warranty claim. Products which are sold but not manufactured by GRUNDFOS are subject to the warranty provided by the manufacturer of said products and not by GRUNDFOS' warranty. GRUNDFOS will not be liable for damage or wear to products caused by abnormal operating conditions, accident, abuse, misuse, unauthorized alteration or repair, or if the product was not installed in accordance with GRUNDFOS' printed installation and operating instructions.

To obtain service under this warranty, the defective product must be returned to the distributor or dealer of GRUNDFOS' products from which it was purchased together with proof of purchase and installation date, failure date, and supporting installation data. Unless otherwise provided, the distributor or dealer will contact GRUNDFOS or an authorized service station for instructions. Any defective product to be returned to GRUNDFOS or a service station must be sent freight prepaid; documentation supporting the warranty claim and/or a Return Material Authorization must be included if so instructed.

GRUNDFOS WILL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSSES, OR EXPENSES ARISING FROM INSTALLATION, USE, OR ANY OTHER CAUSES. THERE ARE NO EXPRESS OR IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHICH EXTEND BEYOND THOSE WARRANTIES DESCRIBED OR REFERRED TO ABOVE.

Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages and some jurisdictions do not allow limitations on how long implied warranties may last. Therefore, the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction.

ISO 9001 CERTIFIED

L-CP-TL-003 12/05 (US)
Subject to alterations

GRUNDFOS Pumps Corporation
17100 West 118th Terrace
Olathe, Kansas 66061
Telephone: 913 227 3400
Fax: 913 227 3500

www.grundfos.com

GRUNDFOS Canada Inc.
2941 Brighton Road
Oakville, Ontario L6H 6C9 Canada
Telephone: 905 829 9533
Fax: 905 829 9512

Bombas GRUNDFOS de Mexico S.A. de C.V.
Boulevard TLC #15, Parque Stiva Aeropuerto
Apodaca, N.L. 66600 Mexico
Telephone: 52 81 8144 4000
Fax: 52 81 8144 4010

GRUNDFOS

ProRadiant Warranty

VIEGA LLC LIMITED WARRANTY PRORADIANT HYDRONIC RADIANT HEATING/COOLING AND SNOW MELT

Subject to the conditions and limitations in this Limited Warranty, VIEGA LLC (VIEGA) warrants to property owners in the United States with hydronic radiant heating/cooling and/or snow melt systems properly installed by Viega trained contractors that its VIEGAPEX™ BARRIER and FOSTAPEX® tubing, under normal conditions of use and properly maintained, will be free from failure caused by manufacturing defect for a period of thirty (30) years from date of installation.

In addition, Viega warrants that properly installed and protected Viega PEX Press couplings used as repair fittings in slab or in Climate Panels with the above listed tubing in hydronic radiant heating/cooling and snow melt systems will be free from failure caused by manufacturing defect for a period of thirty (30) years from date of initial installation; warrants that properly installed Viega PEX Press and PEX Crimp fittings used with the above listed tubing in hydronic radiant heating/cooling and snow melt systems and not in slab, to include PEX Press fittings used as connections to manifolds sold by Viega, will be free from failure caused by manufacturing defect for a period of ten (10) years from date of original installation; and warrants that any controls, manifolds, manifold stations, valves, or panels sold by Viega and used in those systems will be free from failure caused by manufacturing defect for a period of two (2) years from date of initial installation.

Power tools and jaws used with Press fittings are warranted by the manufacturer and Viega extends no separate warranty on those tools or jaws. Viega warrants that PEX Press hand and Pneumatic PEX Hammer tools sold by Viega, under normal conditions of use, shall be free from failure caused by manufacturing defects for a period of two (2) years from date of sale.

Under this limited warranty, you only have a right to reimbursement if the failure or leak resulted from a manufacturing defect in the products covered by this warranty and the failure or leak occurred during the warranty period. You do not have a remedy or right of reimbursement under this warranty and the warranty does not apply if the failure or any resulting damage is caused by (1) components in the systems other than those manufactured or sold by Viega or components not recommended for use in the systems with the particular tubing used; (2) not installing, inspecting, or testing the tubing in accordance with Viega's installation instructions at the time of the installation, applicable code requirements and accepted industry practices (for example, guidelines of the Radiant Panel Association); (3) improper design, including determining proper heat-load, of the system or improper maintenance of the system; (4) exposure to unauthorized solvents or chemicals, antifreeze, rust inhibitor or other treatment fluids; freezing; or by failure to appropriately limit recommended water temperature levels or other misuse or abuse of the tubing in the handling of the tubing prior to or during installation or by other construction activity on the property; (5) acts of nature such as earthquakes, fire, flood, wind, or lightning.

In the event of a leak or other failure in the system, it is the responsibility of the property owner to obtain and pay for the repairs. Only if the warranty applies will Viega be responsible for reimbursement under this warranty. The part or parts which you claim failed should be kept and Viega contacted by writing to the address below or telephoning 1-877-843-4262 within thirty (30) days after the leak or other failure and identifying yourself as having a warranty claim. You should be prepared to ship, at your expense, the product which you claim failed due to a manufacturing defect, document the date of installation, and the amount of any claimed bills for which you claim reimbursement. Within a reasonable time after notification, Viega will investigate the reasons for the failure, which includes the right to inspect the product at Viega and reasonable access to the site of the damage in order to determine whether the warranty applies. Viega will notify you in writing of the results of its review.

In the event that Viega determines that the failure or leak and any resulting damages were the result of a manufacturing defect in the products covered by this warranty and occurred during the first ten years of the time period covered by this warranty, Viega will reimburse the property owner for reasonable repair or replacement charges resulting from the failure or leak and, additionally will reimburse damages to personal property resulting from the failure or leak. After the first ten years of the time period covered by this warranty, the EXCLUSIVE and ONLY remedy will be reimbursement for repair and replacement of the product covered by this warranty. VIEGA SHALL NOT BE LIABLE FOR CONSEQUENTIAL ECONOMIC LOSS DAMAGES UNDER ANY LEGAL THEORY AND WHETHER ASSERTED BY DIRECT ACTION, FOR CONTRIBUTION OR INDEMNITY OR OTHERWISE.

THE ABOVE LIMITED WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. IF FOUND APPLICABLE, ANY IMPLIED WARRANTIES ARE LIMITED TO THE DURATION OF ANY TIME LIMITS SET OUT IN THIS WRITTEN WARRANTY. Other than this limited warranty, Viega does not authorize any person or firm to create for it any other obligation or liability in connection with its products. This written warranty applies for the full term of the applicable warranty regardless of any change of ownership of the property.

In the event that the tubing or fittings covered by this warranty is used in potable water plumbing systems, the Viega Limited Warranty for PureFlow® potable water plumbing systems will apply.

Some states do not allow the exclusion or limitation of incidental or consequential damages or limitations on the duration of implied warranties in certain types of transactions, so the above exclusion or limitations may not apply to you. This limited warranty gives you specific legal rights and you also may have other rights which vary from state to state. This warranty shall be interpreted and applied under the law of the state in which the product is installed.

HRH WARR 06/01/10 rev.

Viega…The global leader in plumbing and heating systems.
301 N. Main, 9th Floor • Wichita, KS 67202 • Ph: 800-976-9819 • Fax: 1-800-976-9817 • Email: service @viega.com • www.viega.com

LIMBACH

Since 1901 Consistently Exceeding Expectations

Date: January 8, 2015.

Project: Jackson Home Office Expansion.

Phase: 3 – Office Building / Connector.

Product: Snow Melt System.

Document: Installation, Operation, and Maintenance Manuals.

Notes: No notes.

Performance Engineering Group, Inc.
32995 Industrial Road
Livonia, MI 48150-1617
Phone: 734.266.5300
Fax: 734.266.5310

SUBMITTAL PACKAGE
WARRANTIES AND O & M MANUALS

Job: **Jackson National Life Phase 3.1**
Architect: **Gresham Smith and Partners**
Engineer: **Edwards & Zuck**
Construction Manager: **The Christman Company**
Mechanical Contractor: **Limbach Company LLC**

SUBMITTED BY:	ATTACHMENT INCLUDES	REF #
	Grundfos Magna3 Pump O + M Manual	984594080-0614
	Alfa- Laval Heat exchangers T5-BFG - Plate Heat Exchanger	1644725-01 01/10
	Viega PRO Radiant warranty	HRH WARR 6/10/10
	Tekmar TE664 manual	D 664

MAGNA3

Installation and operating instructions

Original installation and operating instructions.

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Warning

Prior to installation, read these installation and operating instructions. Installation and operation must comply with local regulations and accepted codes of good practice.

Warning

The use of this product requires experience with and knowledge of the product.
Persons with reduced physical, sensory or mental capabilities must not use this product, unless they are under supervision or have been instructed in the use of the product by a person responsible for their safety.
Children must not use or play with this product.

1. Limited warranty

Products manufactured by GRUNDFOS PUMPS CORPORATION (Grundfos) are warranted to the original user only to be free of defects in material and workmanship for a period of 24 months from date of installation, but not more than 30 months from date of manufacture. Grundfos' liability under this warranty shall be limited to repairing or replacing at Grundfos' option, without charge, F.O.B. Grundfos' factory or authorized service station, any product of Grundfos' manufacture. Grundfos will not be liable for any costs of removal, installation, transportation, or any other charges which may arise in connection with a warranty claim. Products which are sold but not manufactured by Grundfos are subject to the warranty provided by the manufacturer of said products and not by Grundfos' warranty. Grundfos will not be liable for damage or wear to products caused by abnormal operating conditions, accident, abuse, misuse, unauthorized alteration or repair, or if the product was not installed in accordance with Grundfos' printed installation and operating instructions.

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Any defective product to be returned to Grundfos or a service station must be sent freight prepaid; documentation supporting the warranty claim and/or a Return Material Authorization must be included if so instructed.

GRUNDFOS WILL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSSES, OR EXPENSES ARISING FROM INSTALLATION, USE, OR ANY OTHER CAUSES. THERE ARE NO EXPRESS OR IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHICH EXTEND BEYOND THOSE WARRANTIES DESCRIBED OR REFERRED TO ABOVE.

Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages and some jurisdictions do not allow limit actions on how long implied warranties may last. Therefore, the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction.

2. Symbols used in this document

Warning

If these safety instructions are not observed, it may result in personal injury.

Warning

If these instructions are not observed, it may lead to electric shock with consequent risk of serious personal injury or death.

Warning

The surface of the product may be so hot that it may cause burns or personal injury.

Warning

Risk of dropping objects which may cause personal injury.

Warning

Escaping vapor involves the risk of personal injury.

Caution ***If these safety instructions are not observed, it may result in malfunction or damage to the equipment.***

Note ***Notes or instructions that make the job easier and ensure safe operation.***

3. General information

The Grundfos MAGNA3 is a complete range of circulator pumps with integrated controller enabling adjustment of pump performance to the actual system requirements. In many systems, this will reduce the power consumption considerably, reduce noise from thermostatic radiator valves and similar fittings and improve the control of the system.

The desired head can be set on the pump control panel.

3.1 Applications

The Grundfos MAGNA3 is designed for circulating liquids in the following systems:

- heating systems
- domestic hot-water systems
- air-conditioning and cooling systems.

The pump can also be used in the following systems:

- ground source heat pump systems
- solar-heating systems.

3.2 Pumped liquids

The pump is suitable for thin, clean, non-aggressive and non-explosive liquids, not containing solid particles or fibers that may attack the pump mechanically or chemically.

In heating systems, the water should meet the requirements of accepted standards on water quality in heating systems.

In domestic hot-water systems, we recommend to use MAGNA3 pumps only for water with a degree of hardness lower than approx. 14 °dH.

In domestic hot-water systems, we recommend to keep the liquid temperature below 150 °F (+65 °C) to eliminate the risk of lime precipitation.

Warning

Do not use the pump for flammable liquids, such as diesel oil and gasoline.

Warning

Do not use the pump for aggressive liquids, such as acids and sea water.

Fig. 1 Pumped liquids

3.2.1 Glycol

The pump can be used for pumping water/glycol mixtures up to 50 %.

Example of a water/ethylene glycol mixture:

Maximum viscosity: 50 cSt ~ 50 % water / 50 % ethylene glycol mixture at +14 °F (-10 °C).

The pump has a power-limiting function that protects against overload.

The pumping of glycol mixtures will affect the max. curve and reduce the performance, depending on the water/ethylene glycol mixture and the liquid temperature.

To prevent the ethylene glycol mixture from degrading, avoid temperatures exceeding the rated liquid temperature and minimize the operating time at high temperatures.

It is important to clean and flush the system before the ethylene glycol mixture is added.

To prevent corrosion or lime precipitation, check and maintain the ethylene glycol mixture regularly. If further dilution of the supplied ethylene glycol is required, follow the glycol supplier's instructions.

Note ***Additives with a density and/or kinematic viscosity higher than those/that of water will reduce the hydraulic performance.***

3.3 Operating conditions

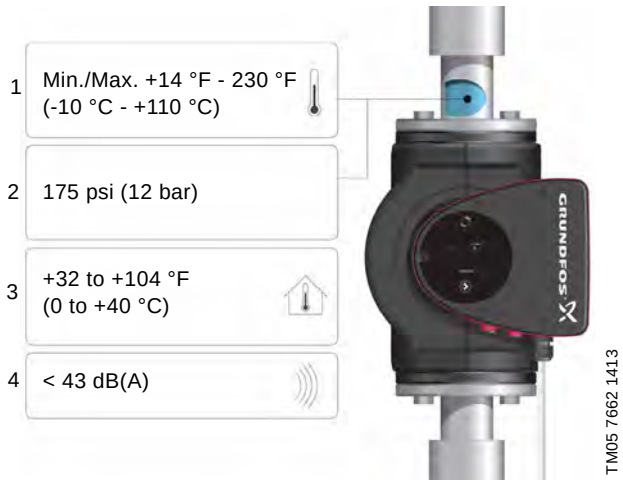


Fig. 2 Operating conditions

3.3.1 Liquid temperature

See fig. 2, pos. 1.

Continuously: +14 °F to +230 °F (-10 °C to +110 °C).

Domestic hot-water systems:

- Up to +150 °F (+65 °C).

3.3.2 System pressure

See fig. 2, pos. 2.

The maximum permissible system pressure is stated on the pump nameplate.

3.3.3 Ambient temperature

See fig. 2, pos. 3.

+32 °F to +104 °F (0 °C to +40 °C).

The control box is air-cooled. Therefore, it is important that the maximum permissible ambient temperature is not exceeded during operation.

During transport: -40 °F to +158 °F (-40 °C to +70 °C).

3.3.4 Sound pressure level

See fig. 2, pos. 4.

The sound pressure level of the pump is lower than 43 dB(A).

3.3.5 Approvals

- Conforms to ANSI/UL Standard 778.
- Certified to CAN/CSA Standard C22.2 No. 108.
- The protective earth (ground) symbol ⏚ identifies any terminal which is intended for connection to an external conductor for protection against electric shock in case of a fault, or the terminal of a protective earth (ground) electrode.

3.4 Frost protection

Caution ***If the pump is not used during periods of frost, necessary steps must be taken to prevent frost bursts.***

Note ***Additives with a density and/or kinematic viscosity higher than those/that of water will reduce the hydraulic performance.***

3.5 Insulating shells

Insulating shells are available for single-head pumps only.

Note ***Limit the heat loss from the pump housing and pipework.***

The heat loss from the pump and pipework can be reduced by insulating the pump housing and the pipework. See fig. 3 and fig. 13.

- Insulating shells for pumps in heating systems are supplied with the pump; see fig. 3.
- For pumps in air-conditioning and cooling systems (down to +14 ° (-10 °C)) it is required to apply a silicon sealant to the internal contours of the shell in order to eliminate any air gaps and prevent condensation between the insulation shell and pump housing. Alternatively, the pump can also be insulated manually in accordance with standard insulating requirements for heating and cooling systems (fig. 13).

The fitting of insulating shells will increase the pump dimensions.

Fig. 3 Fitting insulating shells to the pump

Caution ***Do not insulate the control box or cover the control panel.***

3.6 Non-return valve

If a non-return valve is fitted in the pipe system (fig. 4), it must be ensured that the set minimum discharge pressure of the pump is always higher than the closing pressure of the valve. This is especially important in proportional-pressure control mode (reduced head at low flow). The closing pressure of a single non-return valve is accounted for in the pump settings as the minimum head delivered is 5 ft (1.5 m).

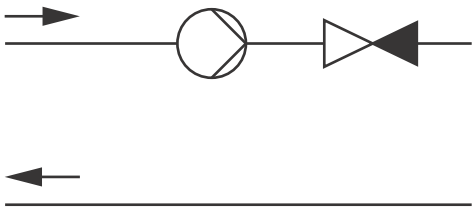


Fig. 4 Non-return valve

3.7 Nameplate

The pump nameplate provides the following information:

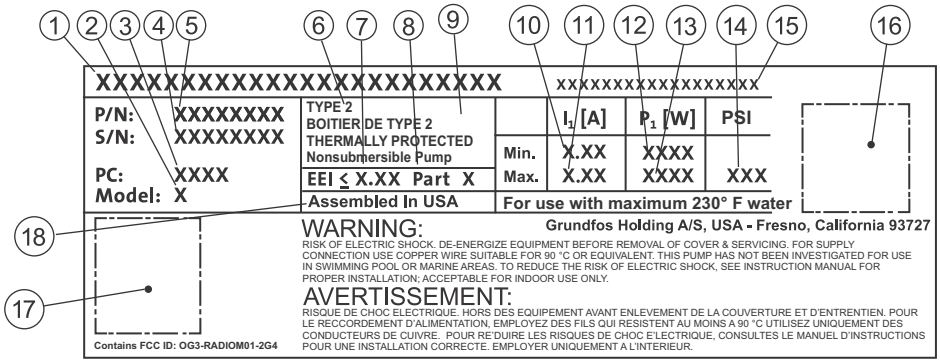


Fig. 5 Example of nameplate

Pos.	Description
1	Product name
2	Model
3	Production code (year and week)
4	Serial number
5	Product number
6	Enclosure type
7	Energy Efficiency Index (EEI)
8	Part (according to EEI)
9	TF-class
10	Minimum current [A]
11	Maximum current [A]
12	Minimum power [W]
13	Maximum power [W]
14	Maximum pressure
15	Voltage [V] and frequency [Hz]
16	QR (Quick Response) code
17	Approvals (nameplate)
18	Assembled in USA

TM05 6381 4612

3.8 Radio communication

The wireless radio in this product is class B.

Intended use

This product incorporates a radio for remote control.

The product can communicate with Grundfos Go Remote and with other MAGNA3 pumps of the same type via the built-in radio.

Only Grundfos-approved external antennae may be connected to this product, and only by a Grundfos-approved installer.

3.9 Tools

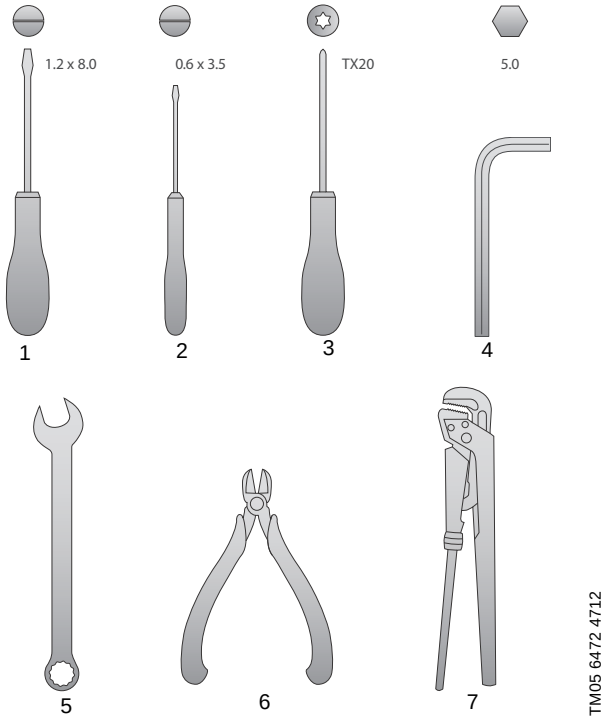


Fig. 6 Recommended tools

Pos.	Tool	Size
1	Screwdriver, straight slot	1.2 x 8.0 mm
2	Screwdriver, straight slot	0.6 x 3.5 mm
3	Screwdriver, torx bit	TX20
4	Hexagon key	5.0 mm
5	Open-end wrench	Depending on flange bolt size
6	Wire cutter	
7	Pipe wrench	

4. Mechanical installation

4.1 Installing the pump

MAGNA3 is designed for indoor installation.

The pump must be installed in such a way that it is not stressed by the pipework.

The pump may be suspended direct in the pipes, provided that the pipework can support the pump.

Twin-head pumps are prepared for installation on a mounting bracket or base plate.

To ensure adequate cooling of motor and electronics, the following must be observed:

- Position the pump in such a way that sufficient cooling is ensured.
- The temperature of the ambient air must not exceed +104 °F (+40 °C).

Warning

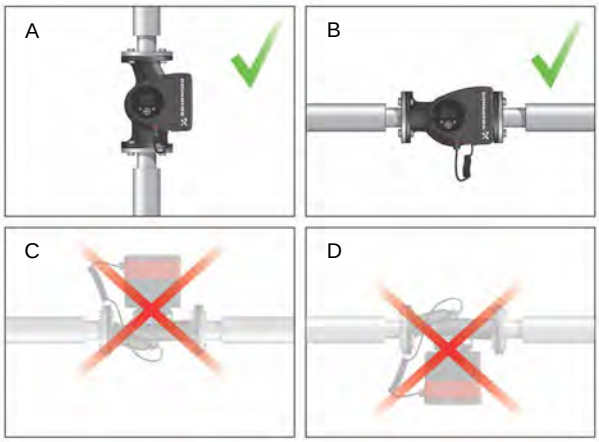
Observe local regulations setting limits for manual lifting or handling.

Step	Action	Illustration
1	Arrows on the pump housing indicate the liquid flow direction through the pump. The liquid flow direction can be horizontal or vertical, depending on the control box position.	 TM05 2862 0612
2	Close the isolating valves and make sure that the system is not pressurized during the installation of the pump.	 TM05 2863 0612
3	Mount the pump with gaskets in the pipework.	 TM05 2864 0612
4	Fit bolts and nuts. Use the right size of bolts according to system pressure.	 TM05 2865 0612

4.2 Positioning

Always install the pump with horizontal motor shaft.

- Pump installed correctly in a vertical pipe. See fig. 7, pos. A.
- Pump installed correctly in a horizontal pipe. See fig. 7, pos. B.
- Do not install the pump with vertical motor shaft. See fig. 7, pos. C and D.

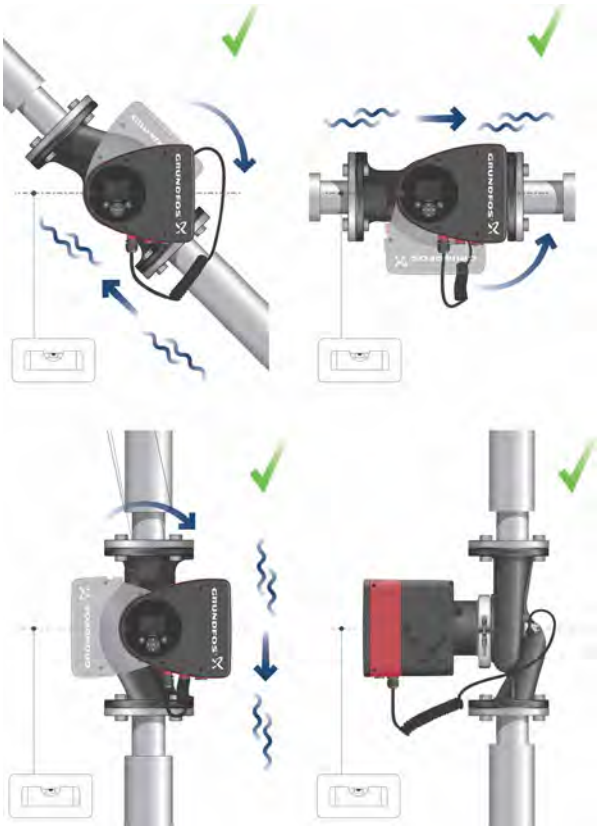


TM05 2866 0712

Fig. 7 Pump installed with horizontal motor shaft

4.3 Control box positions

To ensure adequate cooling, the control box must be in horizontal position with the Grundfos logo in vertical position. See fig. 8.

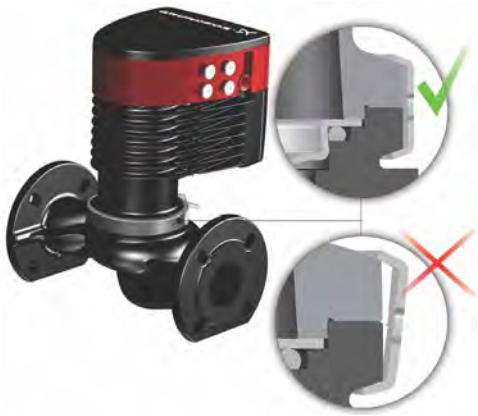


TM05 2915 0612

Fig. 8 Pump with control box in horizontal position

If the pump head is removed before the pump is installed in the pipework, pay special attention when fitting the pump head to the pump housing:

1. Gently lower the pump head with rotor shaft and impeller into the pump housing.
2. Make sure that the contact face of the pump housing and that of the pump head are in contact before the clamp is tightened. See fig. 9.



TM05 5837 4112

Fig. 9 Fitting the pump head to the pump housing

4.4 Pump head position

If the pump head is removed before the pump is installed in the pipework, pay special attention when fitting the pump head to the pump housing:

3. Visually check that the floating ring in the sealing system is centered. See figs. 10 and 11.
4. Gently lower the pump head with rotor shaft and impeller into the pump housing.
5. Make sure that the contact face of the pump housing and that of the pump head are in contact before the clamp is tightened. See fig. 12.

TM05 6650 5012

Fig. 10 Correctly centered sealing system

TM05 6651 5012

Fig. 11 Incorrectly centered sealing system

Caution

Observe the position of the clamp before the clamp is tightened. Incorrect position of the clamp will cause leakage from the pump and damage the hydraulic parts in the pump head. See fig. 12.

TM05 5837 4112

Fig. 12 Fitting the pump head to the pump housing

4.5 Changing the control box position

Warning

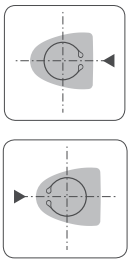
The warning symbol on the clamp holding the pump head and pump housing together indicates that there is a risk of personal injury. See specific warnings below.

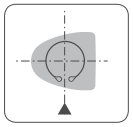
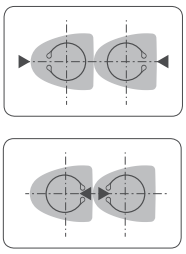
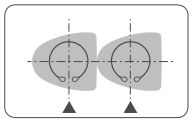
Warning

When loosening the clamp, do not drop the pump head.

Warning

Risk of escaping vapor.

Step	Action	Illustration
1	Loosen the screw in the clamp holding the pump head and pump housing together. **Warning:** If the screw is loosened too much, the pump head will be completely disconnected from the pump housing.	 TM05 2867 0612
2	Carefully rotate the pump head to the desired position. If the pump head is stuck, loosen it with a light blow of a rubber mallet.	 TM05 2868 0612
3	Position the control box in horizontal position so that the Grundfos logo is in vertical position. The motor shaft must be horizontal.	 TM05 2869 0612
4	Due to the drain hole in the stator housing, position the gap of the clamp as shown in step 4a, 4b, 4c or 4d.	 TM05 2870 0612
4a	Single-head pump. Position the clamp so that the gap points towards the arrow. It can be in position 3 or 9 o'clock.	 TM05 2918 0612 - TM05 2871 0612

Step	Action	Illustration
4b	Single-head pump. **Note:** The gap of the clamp can also be in position 6 o'clock for the following pump sizes: • MAGNA3 65-XX • MAGNA3 80-XX • MAGNA3 100-XX.	 TM05 2899 1912
4c	Twin-head pump. Position the clamps so that the gaps point towards the arrows. They can be in position 3 or 9 o'clock.	 TM05 2917 0612 - TM05 2873 0612
4d	Twin-head pump. **Note:** The gap of the clamp can also be in position 6 o'clock for the following pump sizes: • MAGNA3 65-XX • MAGNA3 80-XX • MAGNA3 100-XX.	 TM05 2897 1912
6	Fit and tighten the screw holding the clamp to minimum 6 ± 0.7 ft-lbs (8 ± 1 Nm).	 TM05 2872 0612
7	Fit the insulating shells. **Note:** For air conditioning and cooling systems a silicone sealant must be applied inside the insulation shell to eliminate all air gaps and prevent condensation between the pump housing and insulation shell. Alternatively, the pump may be insulated manually in accordance with standard insulation practices for cooling applications.	 TM05 2874 0412

Caution ***If insulating the pump manually, do not insulate the control box or cover the control panel.***

TM05 5549 3812

Fig. 13 Insulation of pump housing and pipework

5. Electrical installation

Carry out the electrical connection and protection according to local regulations.

Check that the supply voltage and frequency correspond to the values stated on the nameplate.

Warning

Never make any connections in the pump control box unless the power supply has been switched off for at least 5 minutes.

Warning

The pump must be connected to an external mains switch with a contact separation of at least 1/8 inch (3 mm) in each pole.

The ground terminal of the pump must be connected to ground. Grounding or neutralization can be used for protection against indirect contact.

If the pump is connected to an electric installation where a Ground Fault Circuit Interrupter (GFCI) is used as additional protection, this circuit interrupter must trip out when ground fault currents with DC content (pulsating DC) occur.

- If rigid conduit is to be used, the hub must be connected to the conduit system before it is connected to the terminal box of the pump.
- The pump must be connected to an external mains switch.
- The pump requires no external motor protection.
- The motor incorporates thermal protection against slow overloading and blocking.
- When switched on via the power supply, the pump will start pumping after approx. 5 seconds.

Note ***The number of starts and stops via the power supply must not exceed four times per hour.***

5.1 Supply voltage

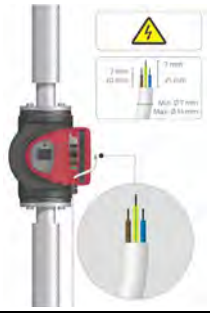
1 x 115 V ± 10 %, 50/60 Hz, PE.

1 x 208-230 V ± 10 %, 50/60 Hz, PE.

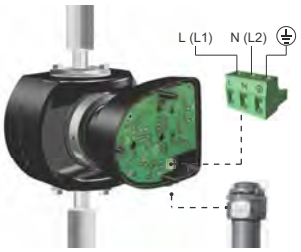
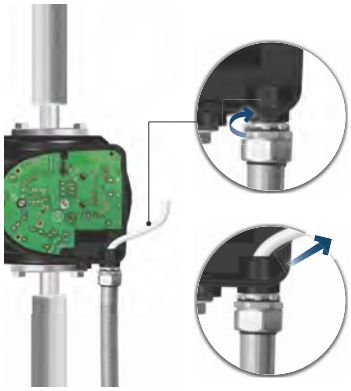
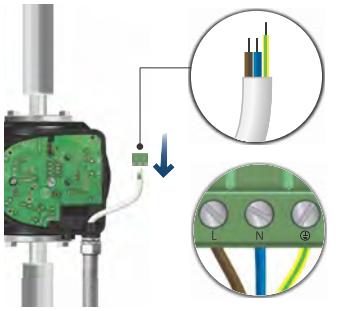
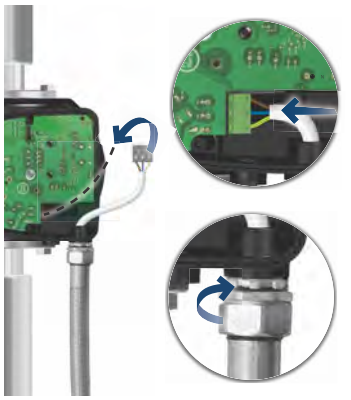
See pump nameplate for rated supply voltage

The voltage tolerances are intended for mains voltage variations. They should not be used for running pumps at other voltages than those stated on the nameplate.

5.2 Connection to the power supply (models 40-XX, 50-XX, 65-XX, 80-XX, 100-XX)

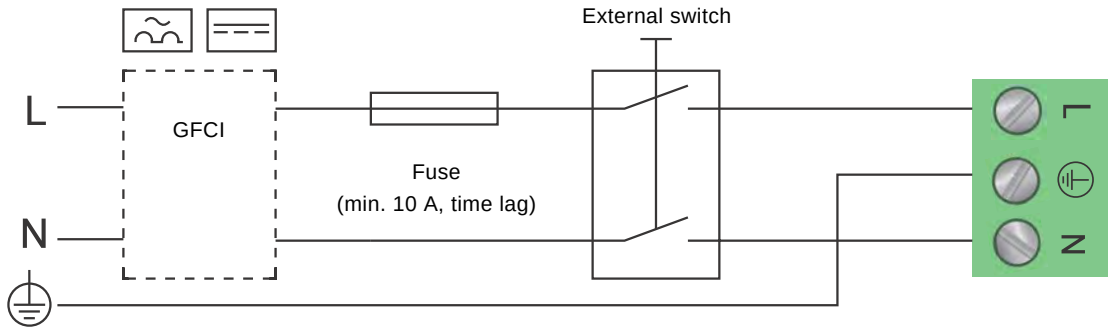
Step	Action	Illustration
1	Remove the front cover from the control box.	 TM05 2875 0612
2	Locate the power supply plug and conduit adapter in the box supplied with the pump.	 TM05 2876 0612
3	Connect the conduit adapter to the control box.	 TM05 2877 0612
4	Pull the power supply cable through the conduit adapter.	 TM05 2878 0612
5	Strip the cable conductors as illustrated.	 TM05 5534 3812
6	Connect the cable conductors to the power supply plug. L - L or L1 Ground - Ground N - N or L2	 TM05 2880 0612
7	Insert the power supply plug into the male plug in the pump control box.	 TM05 2881 0612
8	Tighten the conduit adapter. Refit the front cover.	 TM05 2882 0612

5.3 Connection to the power supply (models 32-XX)

Step	Action	Illustration
1	Remove two screws. Remove the front cover from the control box and access the power connection.	 TM06 1102 1614
2	Locate the power plug inside.	 TM06 1103 1614
3	Connect the conduit to the control box. Pull the power supply cable through the conduit.	 TM06 1104 1614
5	Strip the cable as illustrated. Connect the cable conductors to the power supply plug. L - L or L1 Ground - Ground N - N or L2	 TM06 1105 1614
6	Insert the power plug into its mating connector. Tighten the conduit.	 TM06 1106 1614

Step	Action	Illustration
7	Refit the front cover.	 TM06 1107 1614

5.4 Connection diagram

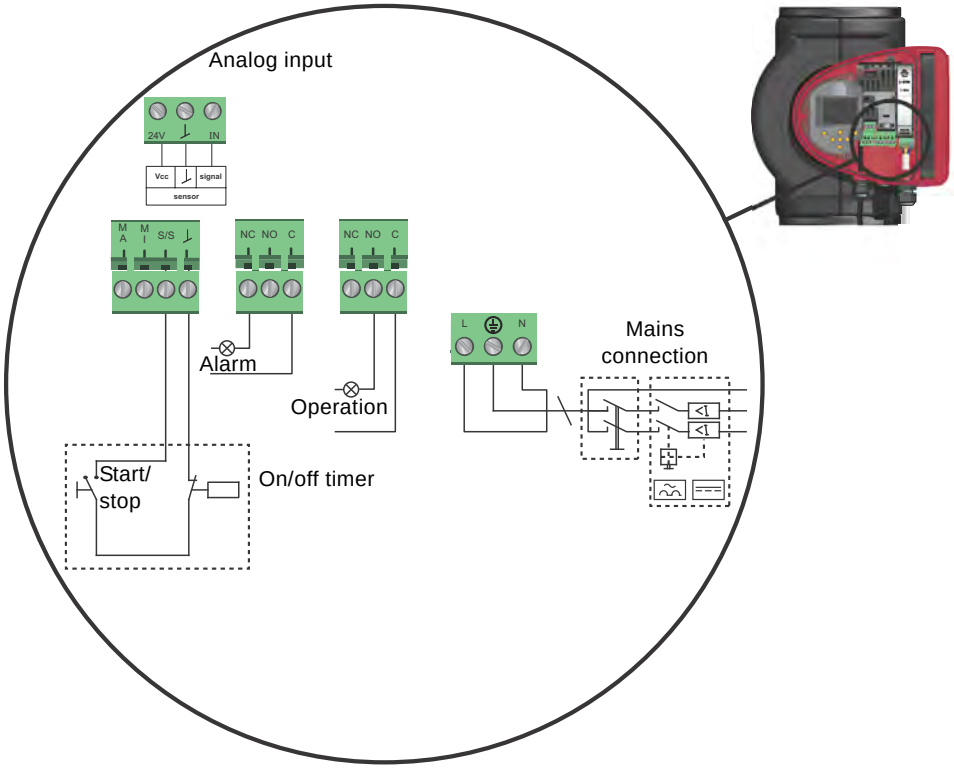


TM03 2397 0312

Fig. 14 Example of typical connection, 1 x 230 V ± 10 %, 50/60 Hz

Note ***All cables used must be connected in accordance with local regulations.***

5.4.1 Connection to external controllers



TM05 2673 3812

Fig. 15 Example of connections in the control box

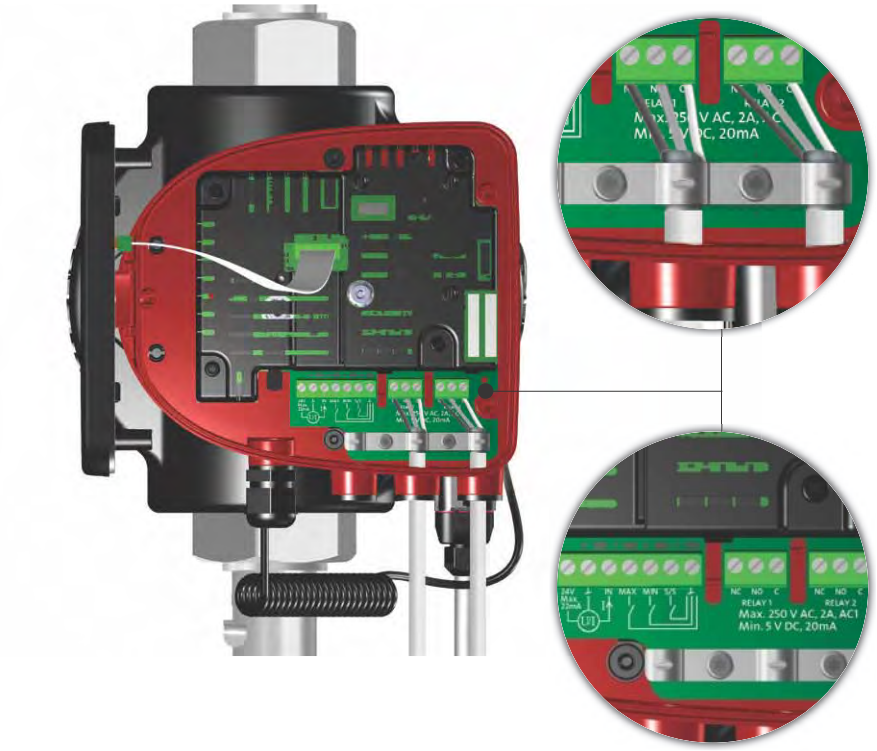
Warning

Wires connected to supply terminals, outputs NC, NO, C and start/stop input must be separated from each other and from the supply by reinforced insulation.

Concerning demands on signal wires and signal transmitters, see section *19. Technical data*.

Use screened cables for external on/off switch, digital input, sensor and setpoint signals.

Note ***All cables used must be heat-resistant up to +185 °F (+85 °C).***



TM05 8539 2413

Fig. 16 Wiring diagram, 32-XX versions

The connection terminals of 32-XX versions differ from those of terminal-connected versions, but they have the same function and connection options.

Use screened cables for external on/off switch, digital input, sensor and setpoint signals.

Connect screened cables to the ground connection as follows:

- Terminal-connected versions:
  Connect the cable screen to ground via the digital-input terminal (earth).
- Plug-connected versions:
  Connect the cable screen to ground via cable clamp.

Warning

Wires connected to supply terminals, outputs NC, NO, C and start/stop input must be separated from each other and from the supply by reinforced insulation.

Note

All cables used must be heat-resistant up to +85 °C.

All cables used must be installed in accordance with EN 60204-1 and EN 50174-2:2000.

5.5 Input/output communication

- Relay outputs
  Alarm, ready and operating indication via signal relay.
- Digital input
  – Start/Stop (S/S)
  – Min. curve (MI)
  – Max. curve (MA).
- Analog input
  0-10 V or 4-20 mA control signal.
  To be used for external control of the pump or as sensor input for the control of the external setpoint.
  The 24 V supply from pump to sensor is optional and is normally used when an external supply is not available.

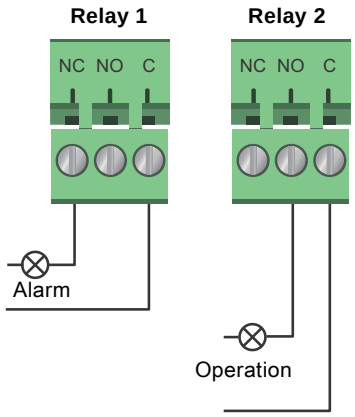
5.5.1 Relay outputs

See fig. 15, pos. 1.

The pump incorporates two signal relays with a potential-free changeover contact for external fault indication.

The function of the signal relay can be set to "Alarm", "Ready" or "Operation" on the pump control panel or with Grundfos GO Remote.

The relays can be used for outputs up to 250 V and 2 A.



TM05 3338 1212

Fig. 17 Relay output

Contact symbol	Function
NC	Normally closed
NO	Normally open
C	Common

The functions of the signal relays appear from the table below:

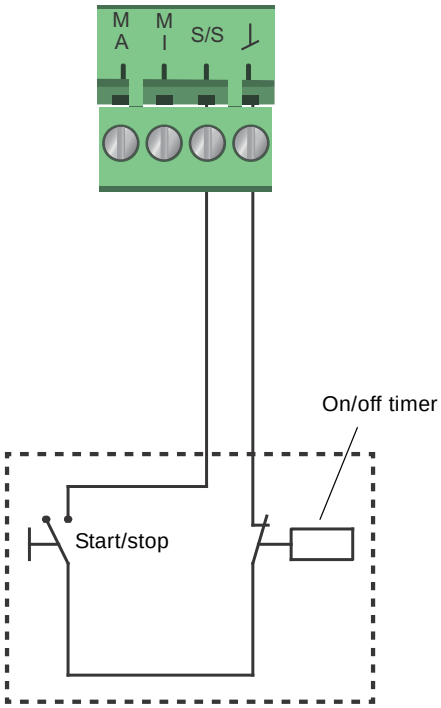
Signal relay	Alarm signal
	Not activated: • The power supply has been switched off. • The pump has not registered a fault.
	Activated: • The pump has registered a fault.
Signal relay	**Ready signal**
	Not activated: • The pump has registered a fault and is unable to run.
	Activated: • The pump has been set to stop, but is ready to run. • The pump is running.
Signal relay	**Operating signal**
	Not activated: • The pump is not running.
	Activated: • The pump is running.

5.5.2 Digital inputs

See fig. 15, pos. 2.

The digital input can be used for external control of start/stop or forced max. or min. curve.

If no external on/off switch is connected, the jumper between terminals Start/Stop (S/S) and frame (⊥) should be maintained. This connection is the factory setting.



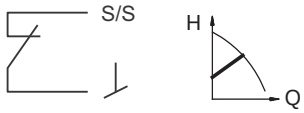
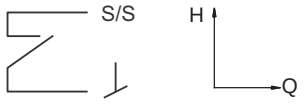
TM05 3339 1212

Fig. 18 Digital input

Contact symbol	Function
M A	Max. curve 100 % speed
M I	Min. curve 25 % speed
S/S	Start/Stop
⊥	Frame connection

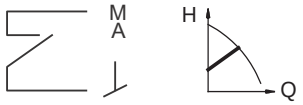
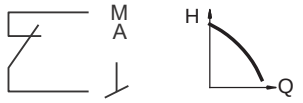
External start/stop

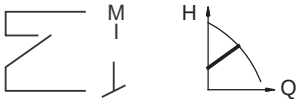
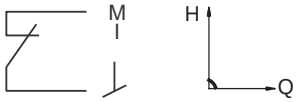
The pump can be started or stopped via the digital input.

Start/stop	
	Normal duty **Note:** Factory setting with jumper between S/S and ⊥.
	Stop

External forced max. or min. curve

The pump can be forced to operate on the max. or min. curve via the digital input.

Max. curve	
	Normal duty
	Max. curve

Min. curve	
	Normal duty
	Min. curve

Select the function of the digital input on the pump control panel or with Grundfos GO Remote.

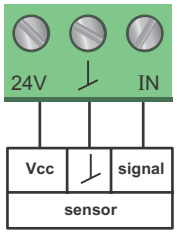
5.6 Analog input for external sensor

The analog input can be used for the connection of an external sensor for measuring temperature or pressure.

The analog input can also be used for an external signal for the control from a BMS system or similar control system.

The electrical signal for the input can be 0-10 VDC or 4-20 mA.

The selection of electrical signal (0-10 V or 4-20 mA) can be changed on the control panel or with Grundfos GO Remote.

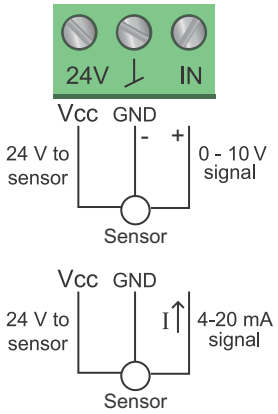


TM05 3221 1112

Fig. 19 Analog input for external sensor or control

In order to optimize the pump performance, external sensors can advantageously be used in the following cases:

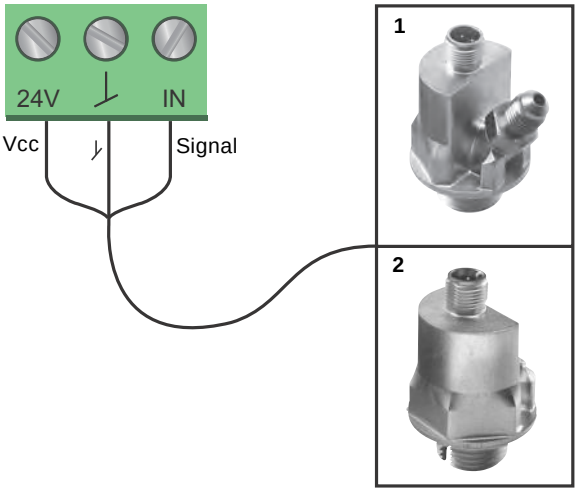
Function/control mode	Sensor type
Heat energy meter	Temperature sensor
Constant temperature	Temperature sensor
Differential pressure	Pressure sensor



TM06 0882 1114

Fig. 20 Wiring, analog input

PIN	Description	Load
IN	Analog input	150 Ω (4-20 mA signal) 78 kΩ (0-10 V signal)
24 V	24 V supply to external sensor	Max. 22 mA
⏚	Ground for external sensor	

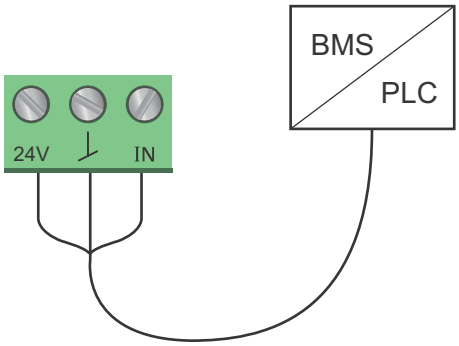


TM05 2947 1212

Fig. 21 Examples of external sensors

Pos.	Sensor type
1	Differential pressure transmitter, Grundfos type DPI V.2 1/2" connection and 4-20 mA signal.
2	Relative pressure transmitter, combined pressure and temperature sensor, Grundfos type RPI/T G 1/2" connection and 4-20 mA signal.

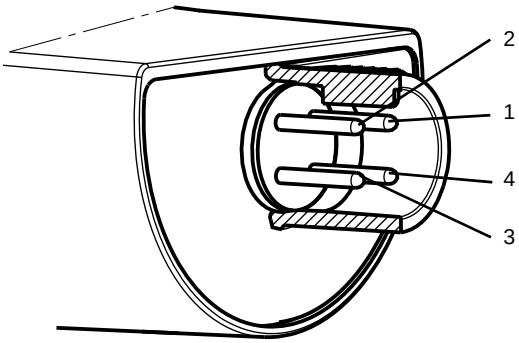
For further details, visit WebCAPS and reference Magna3 Data booklet 98439208.



TM05 2888 0612

Fig. 22 Example of external signal for the control via BMS or PLC

5.7 Electrical connection for external sensor



TM04 7156 1610

Fig. 23 Example electrical connections for external sensor

PIN	1	2	3	4
Wire color	Brown	Grey	Blue	Black
Output 4 to 20 mA	+	not used	-	not used
Output 2 x 0 to 10 V	+	Pressure signal	-*	Temperature signal

* Common ground for both pressure and temperature signal.

* Power supply (screened cable): SELV or PELV.

5.8 Priority of settings

The external forced-control signals will influence the settings available on the pump control panel or with Grundfos GO Remote. However, the pump can always be set to max. curve duty or to stop on the pump control panel or with Grundfos GO Remote.

If two or more functions are enabled at the same time, the pump will operate according to the setting with the highest priority.

The priority of the settings is as shown in the table below.

Example: If the pump has been forced to stop via an external signal, the pump control panel or Grundfos GO Remote can only set the pump to max. curve.

Priority	Possible settings		
	Pump control panel or Grundfos GO Remote	**External signals**	**Bus signal**
1	Stop		
2	Max. curve		
3		Stop	
4			Stop
5			Max. curve
6			Min. curve
7			Start
8		Max. curve	
9	Min. curve		
10		Min. curve	
11	Start		

As illustrated in the table, the pump does not react to external signals (max. curve and min. curve) when it is controlled via bus.

For further details, please contact Grundfos.

6. First start-up

Do not start the pump until the system has been filled with liquid and vented. Furthermore, the required minimum inlet pressure must be available at the pump inlet. See section *19. Technical data*.

The system cannot be vented through the pump. The pump is self-venting.

Step	Action	Illustration
1	Switch on the power supply to the pump. **Note:** When switched on, the pump will start in $AUTO_{ADAPT}$ after approx. 5 seconds.	 TM05 2884 0612
2	Pump display at first start-up. After a few seconds, the pump display will change to the start-up guide.	 TM05 2885 0612
3	The start-up guide will guide you through the general settings of the pump, such as language, date and time. If the buttons on the pump control panel are not touched for 15 minutes, the display will go into sleep mode. When a button is touched, the "Home" display will appear.	 TM05 2886 0612
4	When the general settings have been made, select the desired control mode or let the pump run in $AUTO_{ADAPT}$. For additional settings, see section *7. Settings*.	 TM05 2887 0612

7. Settings

7.1 Overview of settings

All settings can be made on the pump control panel or with Grundfos GO Remote.

Menu	Submenu	Further information
Setpoint		See section *13.1 Setpoint*.
Operating mode		See section *13.2 Operating mode*.
	• Normal	
	• Stop	
	• Min.	
	• Max.	
Control mode		See section *13.3 Control mode*.
	• $AUTO_{ADAPT}$	See section *13.3.1 AUTOADAPT*.
	• $FLOW_{ADAPT}$	See section *13.3.2 FLOWADAPT*.
	• Prop. press.	See section *13.3.3 Proportional pressure*.
	• Const. press.	See section *13.3.4 Constant pressure*.
	• Const. temp.	See section *13.3.5 Constant temperature*.
	• Differential temperature	See section *13.3.6 Differential temperature*.
	• Constant curve	See section *13.3.7 Constant curve*.
$FLOW_{LIMIT}$		See section *13.4 FLOWLIMIT*.
	• Set FLOWLIMIT	
Automatic Night Setback		See section *13.5 Automatic Night Setback*.
	• Not active	
	• Active	
Relay outputs		See section *13.6 Relay outputs*.
	• Relay output 1	
	• Relay output 2	
Setpoint influence		See section *13.7 Setpoint influence*.
	• External setpoint function	See section *13.7.1 External setpoint function*.
	• Temperature influence	See section *13.7.2 Temperature influence*.
Bus communication		See section *13.8 Bus communication*.
	• Pump number	See section *13.8.1 Pump number*.
General settings		See section *13.9 General settings*.
	• Language	See section *13.9.1 Language*.
	• Set date and time	See section *13.9.2 Set date and time*.
	• Units	See section *13.9.3 Units*.
	• Enable/disable settings	See section *13.9.4 Enable/disable settings*.
	• Delete history	See section *13.9.5 Delete history*.
	• Define Home display	See section *13.9.6 Define Home display*.
	• Display brightness	See section *13.9.7 Display brightness*.
	• Return to factory settings	See section *13.9.8 Return to factory settings*.
	• Run start-up guide	See section *13.9.9 Run start-up guide*.

8. Menu overview

Status

- Operating status
  - Operating mode, from
  - Control mode
- Pump performance
  - Max. curve and duty point
  - Resulting setpoint
  - Liquid temperature
  - Speed
  - Operating hours
- Power and energy consumption
  - Power consumption
  - Energy consumption
- Warning and alarm
  - Actual warning or alarm
  - Warning log
    - Warning log 1 to 5
  - Alarm log
    - Alarm log 1 to 5
- Heat energy meter
  - Heat power
  - Heat energy
  - Flow rate
  - Volume
  - Hours counter
  - Temperature 1
  - Temperature 2
  - Differential temp.
- Work log
  - Operating hours
  - Trend data
    - Duty point over time
    - 3D showing (Q, H, t)
    - 3D showing (Q, T, t)
    - 3D showing (Q, P, t)
    - 3D showing (T, P, t)
- Fitted modules
- Date and time
  - Date
  - Time
- Pump identification
- Multi-pump system
  - Operating status
    - Operating mode, from
    - Control mode
  - System performance
    - Duty point
    - Resulting setpoint
    - System identification
  - Power and energy consumption
    - Power consumption
    - Energy consumption
  - Other pump 1, multi-pump sys.

Settings

- Setpoint
- Operating mode
- Control mode
- $FLOW_{LIMIT}$
  - Enable FLOWLIMIT function
  - Set FLOWLIMIT
- Automatic Night Setback
- Relay outputs
  - Relay output 1
  - Relay output 2
    - Not active
    - Ready
    - Alarm
    - Operation
- Setpoint influence
  - External setpoint function
  - Temperature influence
- Bus communication
  - Pump number
- General settings
  - Language
  - Set date and time
    - Select date format
    - Set date
    - Select time format
    - Set time
  - Units
    - SI or US units
    - Customized units
      - Pressure
      - Differential pressure
      - Head
      - Level
      - Flow rate
      - Volume
      - Temperature
      - Differential temp.
      - Power
      - Energy
  - Enable/disable settings
  - Delete history
    - Delete work log
    - Delete heat energy data
    - Delete energy consumption
  - Define Home display
    - Select Home display type
      - List of data
      - Graphical illustration
    - Define Home display contents
      - List of data
      - Graphical illustration
  - Display brightness
    - Brightness
  - Return to factory settings
  - Run start-up guide

Assist

- Assisted pump setup
  - Setting of pump
- Setting of date and time
  - Date format, date and time
  - Date only
  - Time only
- Multi-pump setup
- Setup, analog input
- Description of control mode
  - $AUTO_{ADAPT}$
  - $FLOW_{ADAPT}$
  - Prop. press.
  - Const. press.
  - Const. temp.
  - Differential temperature
  - Constant curve
- Assisted fault advice
  - Blocked pump
  - Pump communication fault
  - Internal fault
  - Internal sensor fault
  - Dry running
  - Forced pumping
  - Undervoltage
  - Overvoltage
  - External sensor fault

9. Control panel

Warning

At high liquid temperatures, the pump housing may be very hot. In that case, only touch the control panel.

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Fig. 24 Control panel

Button	Function
⌂	Goes to the "Home" menu.
↩	Returns to the previous action.
‹ ›	Navigates between main menus, displays and digits. When the menu is changed, the display will always show the top display of the new menu.
˄ ˅	Navigates between submenus.
OK	Saves changed values, resets alarms and expands the value field.

10. Menu structure

The pump incorporates a start-up guide which is started at the first start-up. After the start-up guide, the four main menus will appear in the display. See section *6. First start-up*.

1. Home

This menu shows up to four user-defined parameters with shortcuts or a graphical illustration of a Q/H performance curve. See section *11. "Home" menu*.

2. Status

This menu shows the status of the pump and system as well as warnings and alarms. See section *12. "Status" menu*.

Note ***No settings can be made in this menu.***

3. Settings

This menu gives access to all setting parameters. A detailed setting of the pump can be made in this menu.

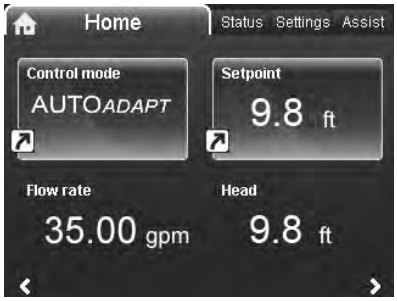
See section *13. "Settings" menu*.

4. Assist

This menu enables assisted pump setup, provides a short description of the control modes and offers fault advice.

See section *14. "Assist" menu*.

11. "Home" menu



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Navigation

Home

Press ⌂ to go to the "Home" menu.

"Home" menu (factory setting)

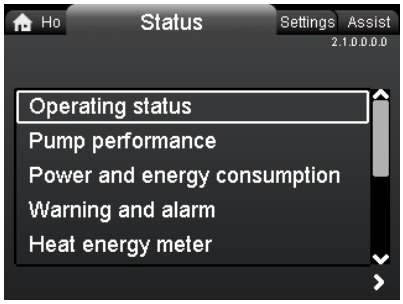
- Shortcut to control mode settings
- Shortcut to setpoint settings
- Flow rate
- Head.

Navigate in the display with ˅ or ˄ and change between the two shortcuts with › or ‹.

The "Home" display can be defined by the user.

See section *13.9.6 Define Home display*.

12. "Status" menu



2.1.0.0.0.0 Status

Navigation

Home > Status

Press ⌂ and go to the "Status" menu with ›.

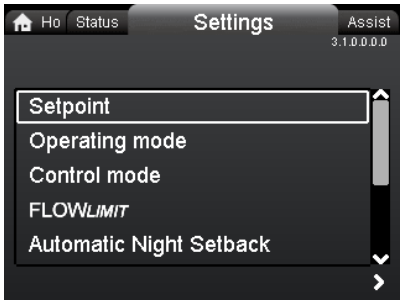
"Status" menu

This menu offers the following status information:

- Operating status
- Pump performance
- Power and energy consumption
- Warning and alarm
- Heat energy meter
- Work log
- Fitted modules
- Date and time
- Pump identification
- Multi-pump system.

Navigate between submenus with ⌄ or ⌃.

13. "Settings" menu



3.1.0.0.0.0 Settings

Navigation

Home > Settings

Press ⌂ and go to the "Settings" menu with ›.

"Settings" menu

This menu offers the following setting options:

- Setpoint
- Operating mode
- Control mode
- $FLOW_{LIMIT}$
- Automatic Night Setback
- Relay outputs
- Setpoint influence
- Bus communication
- General settings.

Navigate between submenus with ⌄ or ⌃.

13.1 Setpoint

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Navigation

Home > Settings > Setpoint

Setpoint

Set the setpoint so that it matches the system.

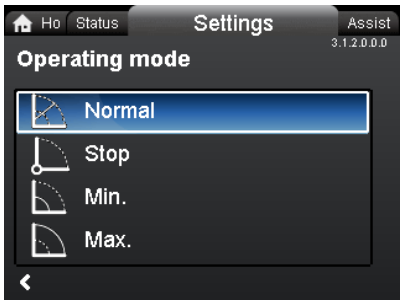
Setting:

1. Press [OK] to start the setting.
2. Select digit with ‹ and › and adjust with ⌄ or ⌃.
3. Press [OK] to save.

A too high setting may result in noise in the system whereas a too low setting may result in insufficient heating or cooling in the system.

Control mode	Measuring unit
Proportional pressure	m, ft
Constant pressure	m, ft
Constant temperature	°C, °F, K
Constant curve	%

13.2 Operating mode



3.1.2.0.0.0 Operating mode

Navigation

Home > Settings > Operating mode

Operating mode

- Normal (control mode)
- Stop
- Min. (min. curve)
- Max. (max. curve).

Setting:

1. Select operating mode with ⌄ or ⌃.
2. Press [OK] to save.

The pump can be set to operate according to the max. or min. curve, like an uncontrolled pump. See fig. 25.

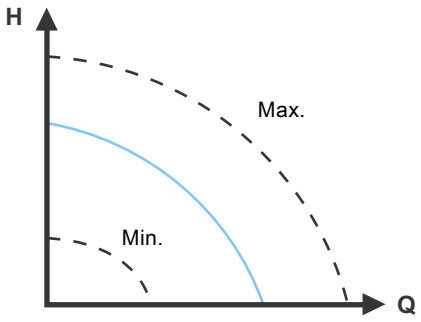


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Fig. 25 Max. and min. curves

- **Normal:** The pump runs according to the selected control mode.
- **Stop:** The pump stops.
- **Min.:** The min. curve mode can be used in periods in which a minimum flow is required.
  This operating mode is for instance suitable for manual night setback if Automatic Night Setback is not desired.
- **Max.:** The max. curve mode can be used in periods in which a maximum flow is required.
  This operating mode is for instance suitable for hot-water priority.

13.3 Control mode

3.1.3.0.0.0 Control mode

Navigation

Home > Settings > Control mode

Control mode

- $AUTO_{ADAPT}$
- $FLOW_{ADAPT}$
- Prop. press. (proportional pressure)
- Const. press. (constant pressure)
- Const. temp.(constant temperature)
- Constant curve.

Note ***The operating mode must be set to "Normal" before a control mode can be enabled.***

Setting:

1. Select control mode with ⌄ or ⌃.
2. Press [OK] to enable.

The setpoint for all control modes, except $AUTO_{ADAPT}$ and $FLOW_{ADAPT}$, can be changed in the "Setpoint" submenu under "Settings" when the desired control mode has been selected.

All control modes, except "Constant curve", can be combined with Automatic Night Setback. See section *13.5 Automatic Night Setback*.

The $FLOW_{LIMIT}$ function can also be combined with the last five control modes mentioned above. See section *13.4 FLOWLIMIT*.

13.3.1 AUTO$_{ADAPT}$

The AUTO$_{ADAPT}$ control mode continuously adapts the pump performance according to the actual system characteristic.

Note ***Manual setting of the setpoint is not possible.***

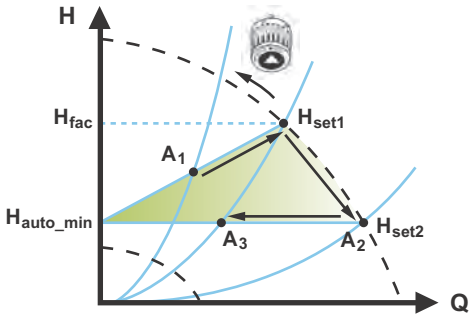

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Fig. 26 AUTO$_{ADAPT}$

When the AUTO$_{ADAPT}$ control mode has been enabled, the pump will start with the factory setting, H_{fac} = H_{set1}, corresponding to approx. 55 % of its maximum head, and then adjust its performance to A_1. See fig. 26.

When the pump registers a lower head on the max. curve, A_2, the AUTO$_{ADAPT}$ function will automatically select a correspondingly lower control curve, H_{set2}. If the valves in the system close, the pump will adjust its performance to A_3.

A_1:	Original duty point.
A_2:	Lower registered head on the max. curve.
A_3:	New duty point after AUTO$_{ADAPT}$ control.
H_{set1}:	Original setpoint setting.
H_{set2}:	New setpoint after AUTO$_{ADAPT}$ control.
$H_{fac.}$:	MAGNA3 xx-60: 11.4 ft (3.5 m) MAGNA3 xx-80: 14.7 ft (4.5 m) MAGNA3 xx-100: 18 ft (5.5 m) MAGNA3 xx-120: 21.3 ft (6.5 m) MAGNA3 xx-150: 26.2 ft (8.0 m) MAGNA3 xx-180: 31.1 ft (9.5 m).
H_{auto_min}:	A fixed value of 4.9 ft (1.5 m).

The AUTO$_{ADAPT}$ control mode is a form of proportional-pressure control where the control curves have a fixed origin, H_{auto_min}.

The AUTO$_{ADAPT}$ control mode has been developed specifically for heating systems and is not recommended for air-conditioning and cooling systems.

To reset AUTO$_{ADAPT}$, see section *13.9.8 Return to factory settings*.

13.3.2 FLOW$_{ADAPT}$

When FLOW$_{ADAPT}$ is selected, the pump will run AUTO$_{ADAPT}$ and ensure that the flow never exceeds the entered FLOW$_{LIMIT}$ value.

The setting range for the FLOW$_{LIMIT}$ is 25 to 90 % of the Q_{max} of the pump.

The factory setting of the FLOW$_{LIMIT}$ is the flow where the AUTO$_{ADAPT}$ factory setting meets the max. curve. See fig. 27.

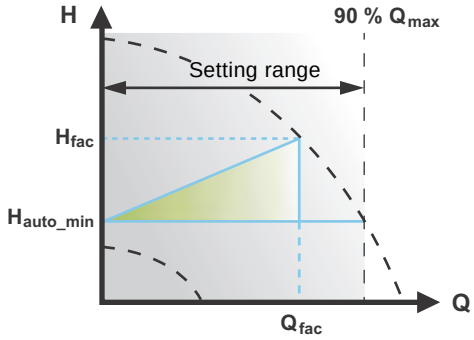

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Fig. 27 FLOW$_{ADAPT}$

13.3.3 Proportional pressure

The pump head is reduced at decreasing water demand and increased at rising water demand. See fig. 28.

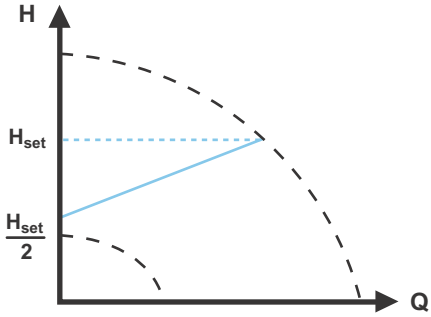

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Fig. 28 Proportional pressure

13.3.4 Constant pressure

The pump maintains a constant pressure, irrespective of water demand. See fig. 29.

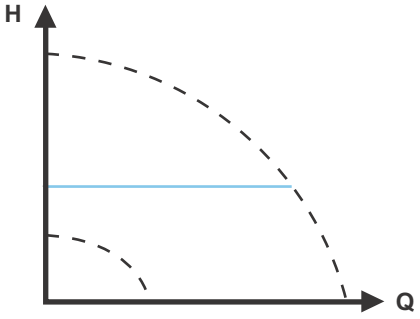

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Fig. 29 Constant pressure

13.3.5 Constant temperature

This control mode ensures a constant temperature. Constant temperature is a comfort control mode that can be used in domestic hot-water systems to control the flow to maintain a fixed temperature in the system. See fig. 30. When this control mode is used, no balancing valves must be installed in the system.

If the pump is installed in the return pipe of the system, the internal temperature sensor can be used. In this case, the pump must be installed as close as possible to the consumer (radiator, heat exchanger, etc.).

If the pump is installed in the flow pipe, an external temperature sensor must be installed in the return pipe of the system. The sensor must be installed as close as possible to the consumer (radiator, heat exchanger, etc.).

The constant-temperature control mode also reduces the risk of bacterial growth (for example Legionella) in the system.

It is possible to set the sensor range:

- min. +14 °F (-10 °C)
- max. +266 °F (+130 °C).

Note ***To ensure that the pump is able to control, we recommend to set the sensor range between +3 °F and +257 °F (-5 and +125 °C).***

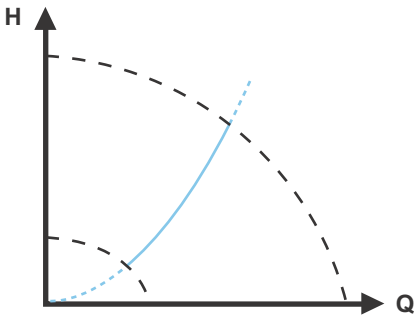

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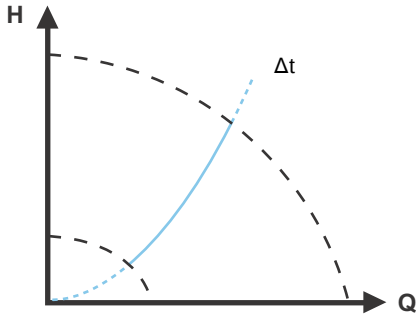
Fig. 30 Constant temperature

13.3.6 Differential temperature

This control mode ensures a constant differential temperature drop across a heating system.

The pump should be installed in the flow pipe so the built-in sensor measures the liquid temperature going out to the load. An external temperature sensor must be installed in the system to measure the liquid temperature returning from the heating load. In this mode, the pump will maintain a constant temperature. See figs 31 and 32, differential between the pump and the external sensor.



TM05 2451 5111

Fig. 31 Differential temperature

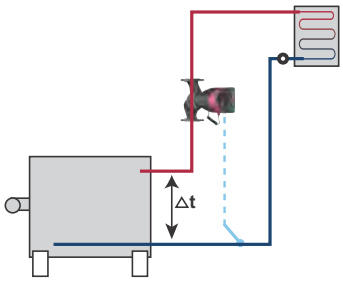


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Fig. 32 Differential temperature

Note ***Changing K_p and T_i values are only possible with Grundfos GO.***

Note ***Changing the K_p and T_i values will affect all control modes. If the control mode is to be changed back to another mode you must set the K_p and T_i values back to default values. For all other modes the default values are K_p = 0.5, T_i = 0.5.***

See table, fig. 33.

The table shows the suggested controller settings:

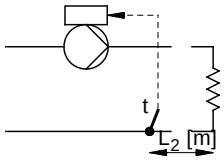
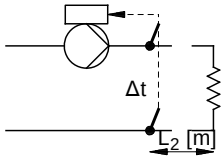
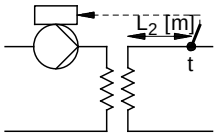
System/application	K_p		T_i
	Heating system[1)]	Cooling system[2)]	
	**0.5**	- 0.5	$10 + 5L_2$
	**-0.5**		$10 + 5L_2$
	**0.5**	- 0.5	$30 + 5L_2$

Fig. 33 Suggested controller settings

1) Heating systems are systems in which an increase in pump performance will result in a **rise** in temperature at the sensor.

2) Cooling systems are systems in which an increase in pump performance will result in a **drop** in temperature at the sensor.

L_2 = Distance in [m] between heat exchanger and sensor.

Proceed as follows:

1. Increase the gain (K_p) until the motor becomes unstable. Instability can be seen by observing if the measured value starts to fluctuate. Furthermore, instability is audible as the motor starts hunting up and down.
   Some systems, such as temperature controls, are slow-reacting, meaning that it may be several minutes before the motor becomes unstable.
2. Set the gain (K_p) to half the value of the value which made the motor unstable. This is the correct setting of the gain.
3. Reduce the integral time (T_i) until the motor becomes unstable.
4. Set the integral time (T_i) to twice the value which made the motor unstable. This is the correct setting of the integral time.

General rules of thumb:

- If the controller is too slow-reacting, increase K_p.
- If the controller is hunting or unstable, dampen the system by reducing K_p or increasing T_i.

13.3.7 Constant curve

The pump can be set to operate according to a constant curve, like an uncontrolled pump. See fig. 34.

The desired speed can be set in % of maximum speed in the range from 25 to 100 %.

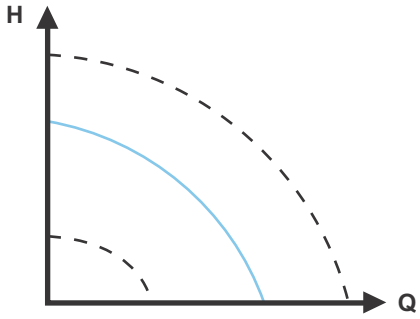


Fig. 34 Constant curve

Note

Depending on the system characteristic and the duty point, the 100 % setting may be slightly smaller than the pump's actual max. curve even though the display shows 100 %. This is due to power and pressure limitations built into the pump. The deviation varies according to pump type and pressure loss in the pipes.

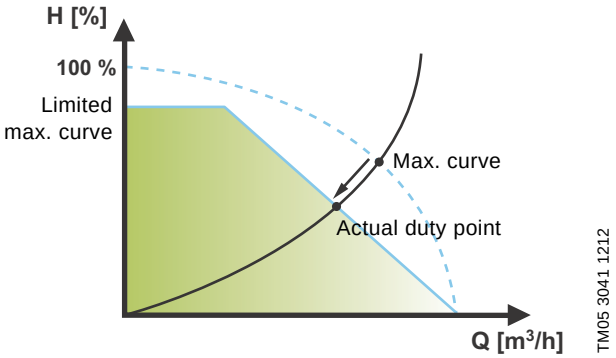
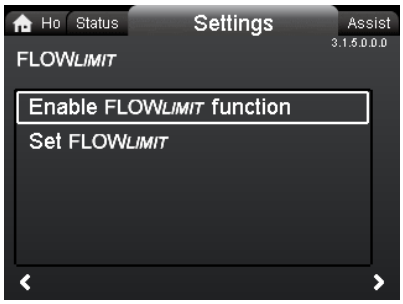


Fig. 35 Power and pressure limitations influencing the max. curve

13.4 FLOW$_{LIMIT}$



3.1.5.0.0.0 FLOW$_{LIMIT}$

Navigation

Home > Settings > FLOW$_{LIMIT}$

FLOW$_{LIMIT}$

- Enable FLOWLIMIT function
- Set FLOWLIMIT.

Setting:

1. To enable the function, select "Active" with ⌄ or ⌃ and press [OK].
2. To set the FLOW$_{LIMIT}$, press [OK] to start the setting.
3. Select digit with ‹ and › and adjust with ⌄ or ⌃.
4. Press [OK] to save.

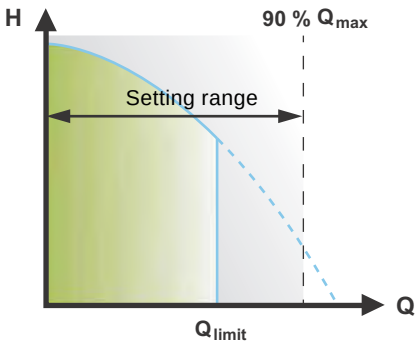


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Fig. 36 FLOW$_{LIMIT}$

The FLOW$_{LIMIT}$ function can be combined with the following control modes:

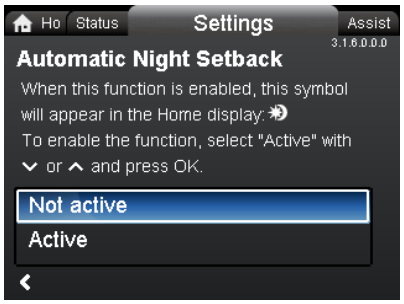
- Prop. press.
- Const. press.
- Const. temp.
- Constant curve.

A flow-limiting function ensures that the flow never exceeds the entered FLOW$_{LIMIT}$ value.

The setting range for FLOW$_{LIMIT}$ is 25 to 90 % of the Q_{max} of the pump.

The factory setting of the FLOW$_{LIMIT}$ is the flow where the AUTO$_{ADAPT}$ factory setting meets the max. curve. See fig. 27.

13.5 Automatic Night Setback



3.1.6.0.0.0 Automatic Night Setback

Navigation

Home > Settings > Automatic Night Setback

Automatic Night Setback

To enable the function, select "Active" with ⌄ or ⌃ and press [OK].

Once Automatic Night Setback has been enabled, the pump automatically changes between normal duty and night setback (duty at low performance).

Changeover between normal duty and night setback depends on the flow-pipe temperature.

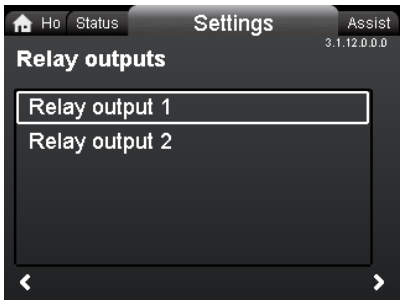
The pump automatically changes over to night setback when the built-in sensor registers a flow-pipe temperature drop of more than +18 to +27 °F (-8 to -3 °C) within approx. two hours.
The temperature drop must be at least 0.18 °F/min (0.1 °C/min).

Changeover to normal duty takes place without a time lag when the temperature has increased by approx. +18 °F (-8 °C).

Note

Automatic Night Setback cannot be enabled when the pump is in constant-curve mode.

13.6 Relay outputs



3.1.12.0.0.0 Relay outputs

Navigation

Home > Settings > Relay outputs

Relay outputs

- Relay output 1
- Relay output 2.

The relay outputs can be set to the following:

- Not active
- Ready
- Alarm
- Operation.

The pump incorporates two signal relays, terminals 1, 2 and 3, for a potential-free alarm signal, ready signal and operating signal. For further information, see section *5.5.1 Relay outputs*.

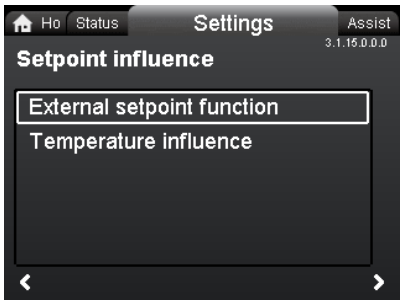
Set the function of the signal relays, alarm signal (factory setting), ready signal and operating signal, on the pump control panel.

The output, terminals 1, 2 and 3, is electrically separated from the rest of the controller.

The signal relay is operated as follows:

- Not active
  The signal relay is deactivated.
- Ready
  The signal relay is active when the pump is running or has been set to stop, but is ready to run.
- Alarm
  The signal relay is activated together with the red indicator light on the pump.
- Operation
  The signal relay is activated together with the green indicator light on the pump.

13.7 Setpoint influence



3.1.15.0.0.0 Setpoint influence

Navigation

Home > Settings > Setpoint influence

Setpoint influence

- External setpoint function
- Temperature influence.

13.7.1 External setpoint function

Range		
4-20 mA	[0-100 %]	
0-10 V	[0-100 %]	
Control		
0-20 %	(e.g. 0-2 V)	Setpoint = Min.
20-100 %	(e.g. 2-10 V)	Setpoint = Min. ↔ setpoint

The external setpoint function is an external 0-10 V or 4-20 mA signal that will control the pump speed in a range from 0 to 100 % in a linear function. See fig. 37.

Note

Before the "External setpoint function" can be enabled, the analog input must be set to "External setpoint influence" via the "Assist" menu.

See section 5.6 Analog input for external sensor.

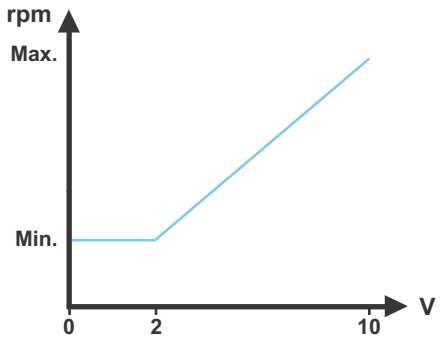


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Fig. 37 External setpoint function, 0-10 V

13.7.2 Temperature influence

When this function is enabled in proportional- or constant-pressure control mode, the setpoint for head will be reduced according to the liquid temperature.

Temperature influence can be set to function at liquid temperatures below +176 °F or +122 °F (80 °C or 50 °C). These temperature limits are called $T_{max.}$. The setpoint is reduced in relation to the head set (= 100 %) according to the characteristics below.

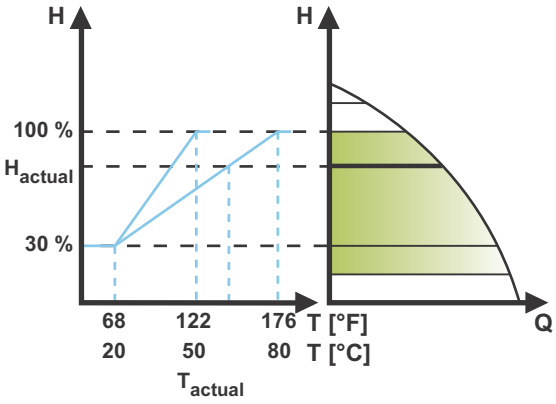

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Fig. 38 Temperature influence

In the above example, $T_{max.}$ = +176 °F (+80 °C) has been selected.

The actual liquid temperature T_{actual} causes the setpoint for head to be reduced from 100 % to H_{actual}.

The temperature influence function requires the following:

- Proportional-pressure, constant-pressure or constant-curve control mode.
- Pump installed in flow pipe.
- System with flow-pipe temperature control.

Temperature influence is suitable for the following systems:

- Systems with variable flows (for example two-pipe heating systems) in which the enabling of the temperature influence function will ensure a further reduction of the pump performance in periods with small heating demands and consequently a reduced flow-pipe temperature.
- Systems with almost constant flows (for example one-pipe heating systems and underfloor heating systems), in which variable heating demands cannot be registered as changes in the head as is the case with two-pipe heating systems. In such systems, the pump performance can only be adjusted by enabling the temperature influence function.

Selection of $T_{max.}$

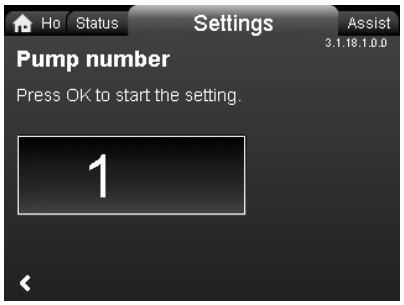
In systems with a dimensioned flow-pipe temperature of:

- up to and including +131 °F (+55 °C), select $T_{max.}$ = +122 °F (+50 °C)
- above +131 °F (+55 °C), select $T_{max.}$ = +176 °F (80 °C).

Note ***The temperature influence function cannot be used in air-conditioning and cooling systems.***

13.8 Bus communication

13.8.1 Pump number



3.1.18.1.0.0 Pump number

Navigation

Home > Settings > Bus communication > Pump number

Pump number

A unique number can be allocated to the pump. This makes it possible to distinguish between pumps in connection with bus communication.

13.9 General settings

13.9.1 Language

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Navigation

Home > Settings > General settings > Language

Language

The display can be shown in any of the following languages:

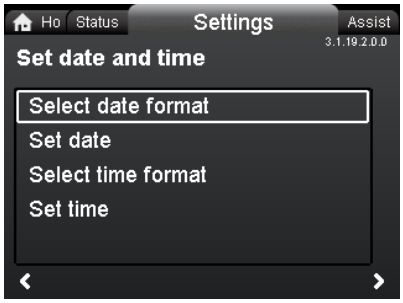
GB, BG, CZ, DK, DE, EE, GR, ES, FR, HR, IT, LV, LT, HU, NL, UA, PL, PT, RU, RO, SK, SI, RS, FI, SE, TR, CN, JP or KO.

Measuring units are automatically changed according to selected language.

Setting:

1. Select language with and .
2. Press [OK] to enable.

13.9.2 Set date and time



3.1.19.2.0.0 Set date and time

Navigation

Home > Settings > General settings > Set date and time

Set date and time

- Select date format
- Set date
- Select time format
- Set time.

Set the real-time clock in this menu.

Select date format

- YYYY-MM-DD
- DD-MM-YYYY
- MM-DD-YYYY.

Setting:

1. Select "Set date".
2. Press [OK] to start the setting.
3. Select digit with ‹ and › and adjust with ⌄ or ⌃.
4. Press [OK] to save.

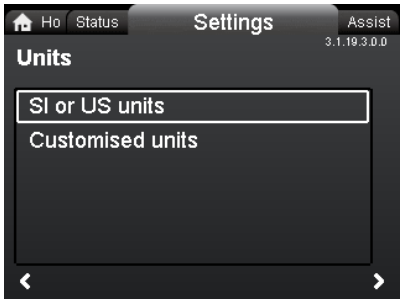
Select time format

- HH:MM 24-hour clock
- HH:MM am/pm 12-hour clock.

Setting:

1. Select "Set time".
2. Press [OK] to start the setting.
3. Select digit with ‹ and › and adjust with ⌄ or ⌃.
4. Press [OK] to save.

13.9.3 Units



3.1.19.3.0.0 Units

Navigation

Home > Settings > General settings > Units

Units

- SI or US units
- Customized units.

Select whether the display should shows SI or US units or select the desired units for the parameters below.

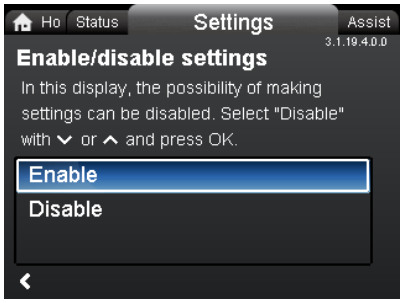
- Pressure
- Differential pressure
- Head
- Level
- Flow rate
- Volume
- Temperature
- Differential temp.
- Power
- Energy.

Setting:

1. Select parameter and press [OK].
2. Select unit with ⌄ or ⌃.
3. Press [OK] to enable.

If "SI or US units" is selected, the customized units will be reset.

13.9.4 Enable/disable settings



3.1.19.4.0.0 Enable/disable settings

Navigation

Home > Settings > General settings > Enable/disable settings

Enable/disable settings

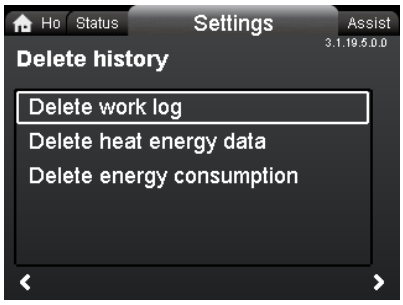
In this display, the possibility of making settings can be disabled for protective reasons.

Select "Disable" with ⌄ or ⌃ and press [OK].

The pump will now be locked for settings. Only the "Home" display will be available.

To unlock the pump and allow settings, press ⌄ and ⌃ simultaneously for at least 5 seconds.

13.9.5 Delete history



3.1.19.5.0.0 Delete history

Navigation

Home > Settings > General settings > Delete history

Delete history

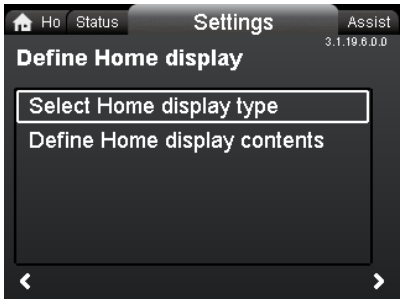
- Delete work log
- Delete heat energy data
- Delete energy consumption.

It is possible to delete data from the pump, for example if the pump is moved to another system or if new data are required due to changes to the system.

Setting:

1. Select the relevant submenu and press [OK].
2. Select "Yes" with ⌄ or ⌃ and press [OK] or press ⎋ to cancel.

13.9.6 Define Home display



3.1.19.6.0.0 Define Home display

Navigation

Home > Settings > General settings > Define Home display

Define Home display

- Select Home display type
- Define Home display contents.

The "Home" display can be set to show up to four user-defined parameters or a graphical illustration of a performance curve.

Select Home display type

1. Select "List of data" or "Graphical illustration" with ⌄ or ⌃.
2. Press [OK] to save.

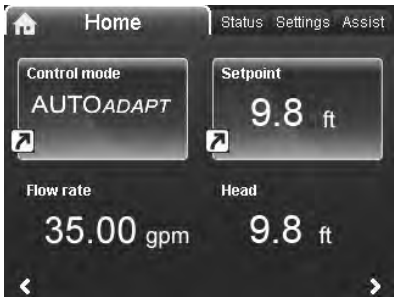
To specify the contents, go to "Define Home display contents".

Define Home display contents

1. To set "List of data", press [OK] to start the setting.
   A list of parameters will appear in the display.
2. Select or deselect with [OK].
   Up to four parameters can be selected.

The selected parameters will be shown as illustrated below.

The arrow icon indicates that the parameter links to the "Settings" menu and works as a shortcut for quick settings.



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1. To set "Graphical illustration", press [OK] to start the setting.
2. Select the desired curve and press [OK] to save.

13.9.7 Display brightness

3.1.19.7.1.0 Brightness

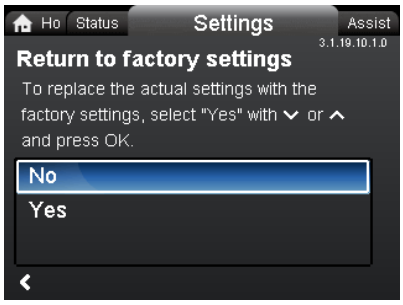
Navigation

Home > Settings > General settings > Display brightness

Brightness

1. Press [OK] to start the setting.
2. Set brightness with ‹ and ›.
3. Press [OK] to save.

13.9.8 Return to factory settings



3.1.19.10.1.0 Return to factory settings

Navigation

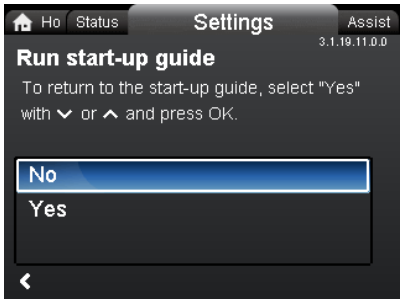
Home > Settings > General settings > Return to factory settings

Return to factory settings

It is possible to recall the factory settings and overwrite the current settings. All user settings in the "Settings" and "Assist" menus will be set back to the factory settings. This also includes language, units, possible setup of analog input, multi-pump function, etc.

To overwrite the current settings with the factory settings, select "Yes" with ⌄ or ⌃ and press [OK].

13.9.9 Run start-up guide



3.1.19.11.0.0 Run start-up guide

Navigation

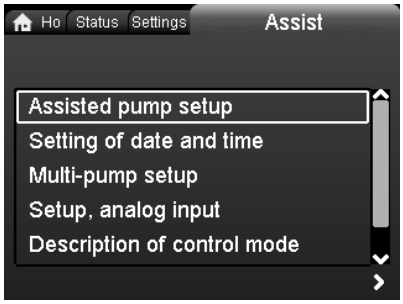
Home > Settings > General settings > Run start-up guide

Run start-up guide

It is possible to run the start-up guide again. The start-up guide will guide the user through the general settings of the pump, such as language, date and time.

To run the start-up guide, select "Yes" with ⌄ or ⌃ and press [OK].

14. "Assist" menu



Assist

Navigation

Home > Assist

Press ⌂ and go to the "Assist" menu with ›.

"Assist" menu

This menu offers the following:

- Assisted pump setup
- Setting of date and time
- Multi-pump setup
- Setup, analog input
- Description of control mode
- Assisted fault advice.

The "Assist" menu guides the user through the setting of the pump. In each submenu, the user is presented with a guide that helps throughout the setting.

14.1 Assisted pump setup

This submenu is a step-by-step guide to complete pump setup, starting with a presentation of the control modes and ending with the setpoint setting.

14.2 Setting of date and time

See section *13.9.2 Set date and time*.

14.3 Multi-pump setup

This submenu assists the user in setting up a multi-pump system. See section *14.8 Multi-pump function*.

14.4 Setup, analog input

This submenu assists the user in setting up the analog input.

14.5 Description of control mode

This submenu gives a short description of each control mode.

14.6 Assisted fault advice

This submenu provides information about faults and corrective actions.

14.7 Wireless GENIair

The pump is designed for multi-pump connection via the wireless GENIair connection or wired via a bus system (Building Management System).

The built-in wireless GENIair module enables communication between pumps and with Grundfos Go Remote without the use of add-on modules:

- Multi-pump function.
  See section *14.8 Multi-pump function*.
- Grundfos GO Remote.
  See section *18.1 Grundfos GO Remote*.

14.8 Multi-pump function

The multi-pump function enables the control of single-head pumps connected in parallel and twin-head pumps without the use of external controllers. The pumps in a multi-pump system communicate with each other via the wireless GENIair connection.

A multi-pump system is set up via a selected pump, i.e. the master pump (first selected pump). All Grundfos pumps with a wireless GENIair connection can be connected to the multi-pump system.

The multi-pump functions are described in the following sections.

14.8.1 Alternating operation

Only one pump is operating at a time. The change from one pump to the other depends on time or energy. If a pump fails, the other pump will take over automatically.

Pump system:

- Twin-head pump.
- Two single-head pumps connected in parallel. The pumps must be of same type and size. Each pump requires a non-return valve in series with the pump.

14.8.2 Back-up operation

One pump is operating continuously. The back-up pump is operated at intervals to prevent seizing up. If the duty pump stops due to a fault, the back-up pump will start automatically.

Pump system:

- Twin-head pump.
- Two single-head pumps connected in parallel. The pumps must be of same type and size. Each pump requires a non-return valve in series with the pump.

14.8.3 Cascade operation

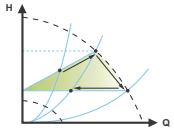
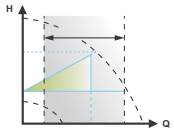
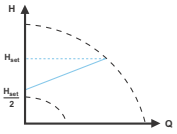
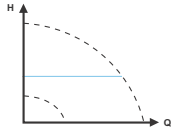
Cascade operation ensures that the pump performance is automatically adapted to the consumption by switching pumps on or off. The system thus runs as energy-efficiently as possible with a constant pressure and a limited number of pumps.

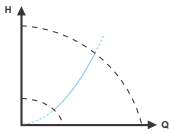
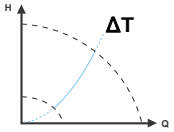
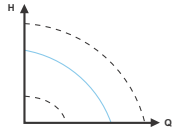
All pumps in operation will run at equal speed. Pump changeover is automatic and depends on energy, operating hours and fault.

Pump system:

- Twin-head pump.
- Two single-head pumps connected in parallel. The pumps must be of same type and size. Each pump requires a non-return valve in series with the pump.
- The control mode must be set to "Const. press." or "Constant curve".

15. Selection of control mode

System application	Select this control mode
Recommended for most heating systems, especially in systems with relatively large pressure losses in the distribution pipes. See description under proportional pressure. In replacement situations where the proportional-pressure duty point is unknown. The duty point has to be within the $AUTO_{ADAPT}$ operating range. During operation, the pump automatically makes the necessary adjustment to the actual system characteristic. This setting ensures minimum energy consumption and noise level from valves, which reduces operating costs and increases comfort.	$AUTO_{ADAPT}$ 
The $FLOW_{ADAPT}$ control mode is a combination of $AUTO_{ADAPT}$ and $FLOW_{LIMIT}$. This control mode is suitable for systems where a maximum flow limit, $FLOW_{LIMIT}$, is desired. The pump continuously monitors and adjusts the flow, thus ensuring that the selected $FLOW_{LIMIT}$ is not exceeded. Main pumps in boiler applications where a steady flow through the boiler is required. No extra energy is used for pumping too much liquid into the system. In systems with mixing loops, the control mode can be used to control the flow in each loop. Benefits: • Enough water for all loops at peak load conditions if each loop has been set to the right maximum flow. • The dimensioned flow for each zone (required heat energy) is determined by the flow from the pump. This value can be set precisely in the $FLOW_{ADAPT}$ control mode without the use of pump throttling valves. • When the flow is set lower than the balancing valve setting, the pump will ramp down instead of losing energy by pumping against a balancing valve. • Cooling surfaces in air-conditioning systems can operate at high pressure and low flow.	$FLOW_{ADAPT}$ 
In systems with relatively large pressure losses in the distribution pipes and in air-conditioning and cooling systems. • Two-pipe heating systems with thermostatic valves and – a dimensioned pump head higher than 13 ft (4 meters) – very long distribution pipes – strongly throttled pipe balancing valves – differential-pressure regulators – large pressure losses in those parts of the system through which the total quantity of water flows (for example boiler, heat exchanger and distribution pipe up to the first branching). • Primary circuit pumps in systems with large pressure losses in the primary circuit. • Air-conditioning systems with – heat exchangers (fan coils) – cooling ceilings – cooling surfaces.	Proportional pressure 
In systems with relatively small pressure losses in the distribution pipes. • Two-pipe heating systems with thermostatic valves and – a dimensioned pump head lower than 6.5 ft (2 meters) – dimensioned for natural circulation – small pressure losses in those parts of the system through which the total quantity of water flows (for example boiler, heat exchanger and distribution pipe up to the first branching) or – modified to a high differential temperature between flow pipe and return pipe (for example district heating). • Underfloor heating systems with thermostatic valves. • One-pipe heating systems with thermostatic valves or pipe balancing valves. • Primary circuit pumps in systems with small pressure losses in the primary circuit.	Constant pressure 

System application	Select this control mode
In heating systems with a fixed system characteristic, for example domestic hot-water systems, the control of the pump according to a constant return-pipe temperature may be relevant. $FLOW_{LIMIT}$ can be used with advantage to control the maximum circulation flow.	Constant temperature 
In a heating system where a constant temperature drop across the system is desired, constant differential temperature can be used. This mode requires an external temperature sensor for the second temperature measurement.	Differential temperature 
If an external controller is installed, the pump is able to change from one constant curve to another, depending on the value of the external signal. The pump can also be set to operate according to the max. or min. curve, like an uncontrolled pump: • The max. curve mode can be used in periods in which a maximum flow is required. This operating mode is for instance suitable for hot-water priority. • The min. curve mode can be used in periods in which a minimum flow is required. This operating mode is for instance suitable for manual night setback if Automatic Night Setback is not desired.	Constant curve 
In systems with pumps operating in parallel. The multi-pump function enables the control of single-head pumps connected in parallel (two pumps) and twin-head pumps without the use of external controllers. The pumps in a multi-pump system communicate with each other via the wireless GENIair connection.	"Assist" menu "Multi-pump setup"

16. Fault finding

Warning

Before dismantling the pump, drain the system or close the isolating valve on either side of the pump. The pumped liquid may be scalding hot and under high pressure.

16.1 Grundfos Eye operating indications

Grundfos Eye	Indication	Cause
	No lights on.	Power off. Pump not running.
	Two opposite green indicator lights running in the direction of rotation of the pump.	Power on. Pump running.
	Two opposite green indicator lights permanently on.	Power on. Pump not running.
	One yellow indicator light running in the direction of rotation of the pump.	Warning. Pump running.
	One yellow indicator light permanently on.	Warning. Pump stopped.
	Two opposite red indicator lights flashing simultaneously.	Alarm. Pump stopped.
	One green indicator light in the middle permanently on (in addition to another indication).	Remote-controlled. The pump is currently being accessed by Grundfos GO Remote.

16.2 Signalling communication with remote control

The center indicator light in the Grundfos Eye will indicate communication with Grundfos GO Remote.

The table below describes the desired function of the center indicator light.

Case	Description	Signalling by the center indicator light
Wink	The pump in question is highlighted in the Grundfos GO Remote display. To inform the user of the location of the highlighted pump, the center indicator light will flash four or five times once to signal "I am here".	Four or five quick flashes once to signal "I am here". 
Push me	The pump in question is selected/opened in the Grundfos GO Remote menu. The pump will signal "Push me" to ask the user to select the pump/allow the pump to exchange data with Grundfos GO Remote. The indicator light will flash continuously until a pop-up window asks the user to press [OK] to allow communication with Grundfos GO Remote.	Flashing continuously with 50 % duty cycle. 
I am connected	The indicator light is signalling that the pump is connected to Grundfos GO Remote. The indicator light is permanently on as long as the pump is selected in Grundfos GO Remote.	Indicator light permanently on. 

16.3 Fault finding

A fault indication can be reset in one of the following ways:

- When the fault cause has been eliminated, the pump will revert to normal duty.
- If the fault disappears by itself, the fault indication will automatically be reset.
- The fault cause will be stored in the pump alarm log.

Warning and alarm codes	Fault	Automatic reset and restart?	Corrective actions
Pump communication fault (10) Alarm	Communication fault between different parts of the electronics.	Yes	Replace the pump, or call GRUNDFOS SERVICE for assistance. Check if the pump is running in turbine operation. See code (29) Forced pumping.
Forced pumping (29) Alarm	Other pumps or sources force flow through the pump even if the pump is stopped and switched off.	Yes	Switch off the pump on the main switch. If the light in the Grundfos Eye is on, the pump is running in forced-pumping mode. Check the system for defective non-return valves and replace, if necessary. Check the system for correct position of non-return valves, etc.
Undervoltage (40, 75) Alarm	Supply voltage to the pump too low.	Yes	Check that the power supply is within the specified range.
Blocked pump (51) Alarm	The pump is blocked.	No	Dismantle the pump, and remove any foreign matter or impurities preventing the pump from rotating.
Dry running (57) Alarm	No water at the pump inlet or the water contains too much air.	No	Prime and vent the pump before a new start-up. Check that the pump is operating correctly. If not, replace the pump, or call GRUNDFOS SERVICE for assistance.
High motor temperature (64) Alarm	Temperature in stator windings too high.	No	Check the winding resistance according to the *MAGNA3 service instructions.*
Internal fault (72, 84, 155, 157) Warning/alarm	Internal fault in the pump electronics.	Yes	Replace the pump, or call GRUNDFOS SERVICE for assistance.
Overvoltage (74) Alarm	Supply voltage to the pump too high.	Yes	Check that the power supply is within the specified range.
Communication fault, twin-head pump (77) Warning	Communication between pump heads disturbed or broken.	Yes	Check that the second pump head is powered or connected to the power supply.
Internal sensor fault (88) Warning	The pump is receiving a signal from the internal sensor which is outside the normal range.	Yes	Check that the plug and cable are connected correctly in the sensor. The sensor is located on the back of the pump housing. Replace the sensor, or call GRUNDFOS SERVICE for assistance.
External sensor fault (93) Warning	The pump is receiving a signal from the external sensor which is outside the normal range.	Yes	Does the electrical signal set (0-10 V or 4-20 mA) match the sensor output signal? If not, change the setting of the analog input, or replace the sensor with one that matches the setup. Check the sensor cable for damage. Check the cable connection at the pump and at the sensor. Correct the connection, if required. The sensor has been removed, but the analog input has not been disabled. Replace the sensor, or call GRUNDFOS SERVICE for assistance.

Caution ***If the power supply cable is damaged, it must be replaced by the manufacturer, the manufacturer's service partner or a similarly qualified person.***

17. Sensor

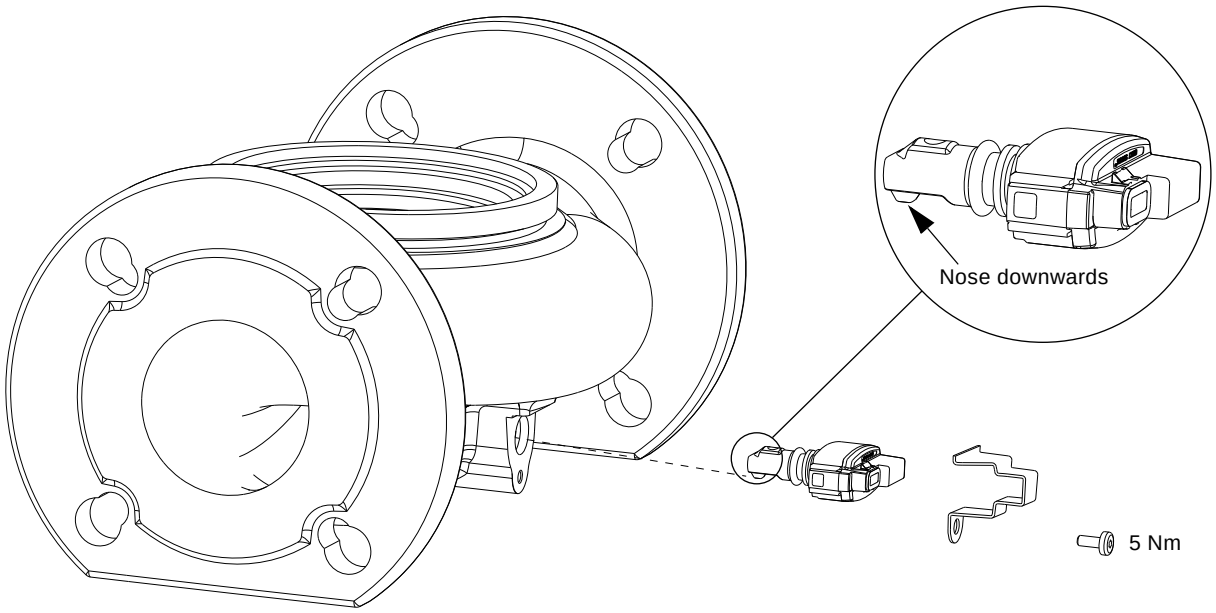


Fig. 39 Correct position of sensor

During maintenance and replacement of the sensor, it is important that the sealing cap is fitted correctly on the sensor housing.

Tighten the screw holding the clamp to 3.7 ft-lbs (5 Nm).

Warning

Before replacing the sensor, make sure that the pump is stopped and that the system is not pressurized.

17.1 Sensor specifications

17.1.1 Pressure

Maximum differential pressure during operation	29 psi / 2 bar / 0.2 MPa
Accuracy +32 to +185 °F (0 to +85 °C)	2 %*
Accuracy +14 to +32 °F and +185 to +266 °F (-10 to 0 °C and +85 to +130 °C)	3 %*

* Full scale.

17.1.2 Temperature

Temperature range during operation	+14 to +266 °F (-10 to +130 °C)
Accuracy	± 3.6 °F (± 2 °C)

18. Accessories

18.1 Grundfos GO Remote

MAGNA3 is designed for wireless communication with the Grundfos GO Remote app. The Grundfos GO Remote app communicates with the pump via radio communication (wireless GENIair).

Note ***The radio communication between the pump and Grundfos GO Remote is encrypted to protect against misuse.***

The Grundfos GO Remote app is available from Apple AppStore and Android market.

The Grundfos GO Remote concept replaces the Grundfos R100 remote control. This means that all products supported by the R100 are supported by Grundfos GO Remote.

Grundfos GO Remote can be used for the following:

- Reading of operating data.
- Reading of warning and alarm indications.
- Setting of control mode.
- Setting of setpoint.
- Selection of external setpoint signal.
- Allocation of pump number making it possible to distinguish between pumps that are connected via Grundfos GENIbus.
- Selection of function for digital input.
- Generation of reports (PDF).
- Assist function.
- Multi-pump setup.
- Display of relevant documentation.

For function and connection to the pump, see separate installation and operating instructions for the desired type of Grundfos GO Remote setup.

18.2 Communication

The pump can communicate via the wireless GENIair connection or a CIM module.

This enables the pump to communicate with other pumps and with different types of network solutions.

The Grundfos CIM modules (CIM = Communication Interface Module) enable the pump to connect to standard fieldbus networks.

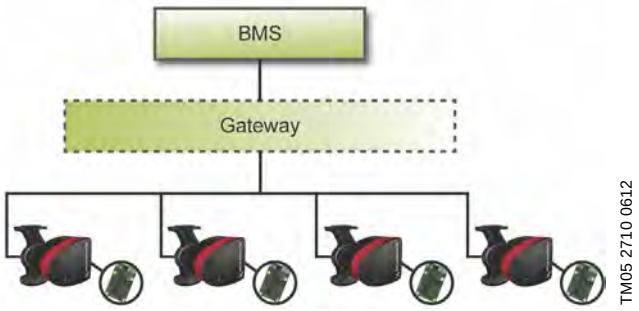


Fig. 40 Building management system (BMS) with four pumps connected in parallel

A CIM module is an add-on communication interface module.

The CIM module enables data transmission between the pump and an external system, for example a BMS or SCADA system.

The CIM module communicates via fieldbus protocols.

Note ***A gateway is a device that facilitates the transfer of data between two different networks based on different communication protocols.***

The following CIM modules are available:

Module	Fieldbus protocol	Product number
CIM 050	GENIbus	96824631
CIM 100	LonWorks	96824797
CIM 150	PROFIBUS DP	96824793
CIM 200	Modbus RTU	96824796
CIM 250	GSM/GPRS	96824795
CIM 270	GRM	96898815
CIM 300	BACnet MS/TP	96893770
CIM 500	Ethernet	98301408

18.2.1 Description of CIM modules

Module	Fieldbus protocol	Description	Functions
CIM 050  TM05 3812 1612	GENIbus	CIM 050 is a Grundfos communication interface module used for communication with a GENIbus network.	CIM 050 has terminals for the GENIbus connection.
CIM 100  TM05 3813 1612	LonWorks	CIM 100 is a Grundfos communication interface module used for communication with a LonWorks network.	CIM 100 has terminals for the LonWorks connection. Two LEDs are used to indicate the actual status of the CIM 100 communication. One LED is used for indication of correct connection to the pump, and the other is used to indicate LonWorks communication status.
CIM 150  TM05 3814 1612	PROFIBUS DP	CIM 150 is a Grundfos communication interface module used for communication with a PROFIBUS network.	CIM 150 has terminals for the PROFIBUS DP connection. DIP switches are used to set line termination. Two hexadecimal rotary switches are used to set the PROFIBUS DP address. Two LEDs are used to indicate the actual status of the CIM 150 communication. One LED is used for indication of correct connection to the pump, and the other is used to indicate PROFIBUS communication status.
CIM 200  TM05 3815 1612	Modbus RTU	CIM 200 is a Grundfos communication interface module used for communication with a Modbus RTU network.	CIM 200 has terminals for the Modbus connection. DIP switches are used to select parity and stop bits, to select transmission speed and to set line termination. Two hexadecimal rotary switches are used to set the Modbus address. Two LEDs are used to indicate the actual status of the CIM 200 communication. One LED is used for indication of correct connection to the pump, and the other is used to indicate Modbus communication status.
CIM 250  TM05 4432 2212	GSM/GPRS	CIM 250 is a Grundfos communication interface module used for GSM/GPRS communication. CIM 250 is used to communicate via a GSM network.	CIM 250 has a SIM-card slot and an SMA connection to the GSM antenna. CIM 250 also has an internal backup battery. Two LEDs are used to indicate the actual status of the CIM 250 communication. One LED is used for indication of correct connection to the pump, and the other is used to indicate GSM/GPRS communication status. **Note:** The SIM card is not supplied with CIM 250. The SIM card from the service provider must support data/fax service to use call service from PC Tool or SCADA. The SIM card from the service provider must support GPRS service to use Ethernet service from PC Tool or SCADA.

Module	Fieldbus protocol	Description	Functions
CIM 270  TM05 4432 2212	Grundfos Remote Management	CIM 270 is a Grundfos GSM/GPRS modem used for communication with a Grundfos Remote Management system. It requires a GSM antenna, a SIM card and a contract with Grundfos.	With CIM 270 you have wireless access to your account anywhere, anytime when you have an internet connection, for example via a smartphone, tablet PC, laptop or computer. Warnings and alarms can be sent by e-mail or SMS to your mobile phone or computer. You will get a complete status overview of the entire GRM system. It allows you to plan maintenance and service based on actual operating data.
CIM 300  TM05 3815 1612	BACnet MS/TP	CIM 300 is a Grundfos communication interface module used for communication with a BACnet MS/TP network.	CIM 300 has terminals for the BACnet MS/TP connection. DIP switches are used to set transmission speed and line termination and to select the custom Device Object Instance Number. Two hexadecimal rotary switches are used to set the BACnet address. Two LEDs are used to indicate the actual status of the CIM 300 communication. One LED is used for indication of correct connection to the pump, and the other is used to indicate BACnet communication status.
CIM 500  TM05 8825 2713	Ethernet	CIM 500 is a Grundfos communication interface module used for data transmission between an industrial Ethernet network and a Grundfos product.	CIM 500 supports various industrial Ethernet protocols. CIM 500 is configured via the built-in web server, using a standard web browser on a PC. See the specific functional profile on the DVD-ROM supplied with the Grundfos CIM module.

18.2.2 Grundfos Remote Management

Grundfos Remote Management is an easy-to-install, low-cost solution for wireless monitoring and management of Grundfos products. It is based on a centrally hosted database and a web server with wireless data collection via GSM/GPRS modem. The system only requires an internet connection, a web browser, a GRM modem and an antenna as well as a contract with Grundfos allowing you to monitor and manage Grundfos pump systems.

You have wireless access to your account anywhere, anytime when you have an internet connection, for example via a smartphone, tablet PC, laptop or computer. Warnings and alarms can be sent by e-mail or SMS to your mobile phone or computer.

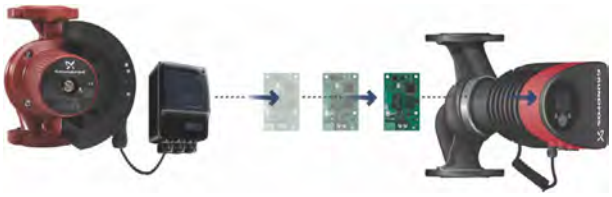
Application	Description	Product number
CIM 270	Grundfos Remote Management (requires a contract with Grundfos and a SIM card).	96898815
GSM antenna for roof-mounting	Antenna for use on top of metal cabinets. Vandal-proof. 2-metre cable. Quad band (global use).	97631956
GSM antenna for desk-mounting	Antenna for general-purpose application, for example inside plastic cabinets. To be fixed with the double-adhesive tape supplied. 4-metre cable. Quad band (global use).	97631957

For GRM contract, contact your local Grundfos company.

18.2.3 Reuse of CIM modules

A CIM module in a CIU unit used together with GRUNDFOS MAGNA can be reused in MAGNA3.

The CIM module has to be re-configured before it is used in a MAGNA3 pump. Contact your nearest Grundfos company.



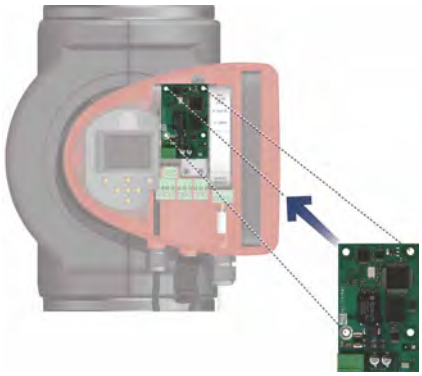
TM05 2911 1312

Fig. 41 Reuse of CIM module

18.3 Fitting the CIM module

Warning

Before fitting the module, switch off the power supply. Make sure that the power supply cannot be accidentally switched on.

Step	Action	Illustration
1	Remove the front cover from the control box.	 TM05 2875 0912
2	Fit the CIM module as illustrated and click it on.	 TM05 2914 1112
3	Fit and tighten the screw holding the CIM module and secure the earth connection.	 TM05 2912 1112
4	For connection to fieldbus networks, see separate installation and operating instructions for the desired CIM module.	 TM05 2913 1112

19. Technical data

Supply voltage

See Pump Nameplate for Rated Supply Voltage:

1 x 115 V ± 10 %, 50/60 Hz, PE.

1 x 208-230 V ± 10 %, 50/60 Hz, PE.

Motor protection

The pump requires no external motor protection.

Enclosure class

Enclosure Type 2.

Insulation class

F.

Relative air humidity

Maximum 95 %.

Ambient temperature

+32 °F to +104 °F (0 °C to +40 °C).

During transport: -40 °F to +158 °F (-40 °C to +70 °C).

Temperature class

TF110 (EN 60335-2-51).

Liquid temperature

Continuously: +14 °F to +230 °F (-10 °C to +110 °C).

Stainless-steel pumps in domestic hot-water systems:

In domestic hot-water systems, we recommend to keep the liquid temperature below +150 °F (+65 °C) to eliminate the risk of lime precipitation.

System pressure

The maximum permissible system pressure is stated on the pump nameplate:

175 psi (12 bar).

Inlet pressure

Recommended inlet pressures:

Single-head pumps:

- Min. 1.5 psi / 0.10 bar / 0.01 MPa at +167 °F (+75 °C)
- Min. 5 psi / 0.35 bar / 0.035 MPa at +203 °F (+95 °C)
- Min. 9.5 psi / 0.65 bar / 0.065 MPa at +230 °F (+110 °C).

Twin-head pumps:

- Min. 13 psi / 0.90 bar / 0.09 MPa at +167 °F (+75 °C)
- Min. 17.5 psi / 1.20 bar / 0.12 MPa at +203 °F (+95 °C)
- Min. 22 psi / 1.50 bar / 0.15 MPa at +230 °F (+110 °C).

EMC (electromagnetic compatibility)

EN 55014-1:2006, EN 55014-2:1998, EN 61800-3-3:2008 and EN 61000-3-2:2006.

Sound pressure level

The sound pressure level of the pump is lower than 43 dB(A).

Leakage current

The pump mains filter will cause a discharge current to earth during operation. $I_{leakage}$ < 3.5 mA.

Consumption when the pump is stopped

1 to 10 W, depending on activity, i.e. reading the display, use of Grundfos GO Remote, interaction with modules, etc.

Input/output communication

Two digital inputs	External potential-free contact. Contact load: 5 V, 10 mA. Screened cable. Loop resistance: Maximum 130 Ω.
Analog input	4-20 mA (load: 150 Ω). 0-10 VDC (load: 78 kΩ).
Two relay outputs	Internal potential-free changeover contact. Maximum load: 250 V, 2 A, AC1. Minimum load: 5 VDC, 20 mA. Screened cable, depending on signal level.

cos φ

MAGNA3 has a built-in active PFC (Power Factor Correction) which gives a cos φ from 0.98 to 0.99, i.e. very close to 1.

20. Disposal

This product has been designed with focus on the disposal and recycling of materials. The following disposal values apply to all variants of Grundfos MAGNA3 pumps:

- minimum 85 % recycling
- maximum 10 % incineration
- maximum 5 % depositing.

Values in percent of total weight.

This product or parts of it must be disposed of in an environmentally sound way according to local regulations.

Subject to alterations.

GRUNDFOS Kansas City
17100 West 118th Terrace
Olathe, Kansas 66061
Phone: (913) 227-3400
Fax: (913) 227-3500

www.grundfos.us

GRUNDFOS Canada
2941 Brighton Road
Oakville, Ontario L6H 6C9 Canada
Phone: +1-905 829 9533
Telefax: +1-905 829 9512

www.grundfos.ca

GRUNDFOS México
Boulevard TLC No. 15
Parque Industrial Stiva Aeropuerto
C.P. 66600 Apodaca, N.L. México
Phone: 011-52-81-8144 4000
Fax: 011-52-81-8144 4010

www.grundfos.mx

L-MAG-TL-09

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ECM: 1133339

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Instruction Manual
Plate Heat Exchangers

M3 M6 M10 TS6
T2 T5 TL3 TL6

Part number 1644725-01
0810

EN

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How to contact Alfa Laval:

Contact details for all countries are continually updated on our website.

Please visit **www.alfalaval.com** and contact your local Alfa Laval Representative.

Except for this Instruction Manual, the following documents are also included in this shipment:

– Plate Heat Exchanger (PHE) drawing

– Plate hanging list

– Parts list with exploded view drawing.

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Environmental compliance

AlfaLaval endeavours to perform its own operations as cleanly and efficiently as possible, and to take environmental aspects into considerattion when developing, designing, manufacturing, servicing and marketing its products.

Unpacking

Packing material consists of wood, plastics, cardboard boxes and in some cases metal straps.

- Wood and cardboard boxes can be reused, recycled or used for energy recovery.
- Plastics should be recycled or burnt at a licensed waste incineration plant.
- Metal straps should be sent for material recycling.

Maintenance

- During maintenance oil and wear parts in the machine are replaced.
- All metal parts should be sent for material recycling.
- Worn out or defective electronic parts should be sent to a licensed handler for material recycling.
- Oil and all non metal wear parts must be taken care of in agreement with local regulations.

Scrapping

At end of use, the equipment shall be recycleed according to relevant, local regulations. Beside the equipmnet itself, any hazardous residues from the process liquid must be considered and dealt with in a proper manner. When i doubt, or in absence of local regulations, please contact the local AlfaLaval sales company.

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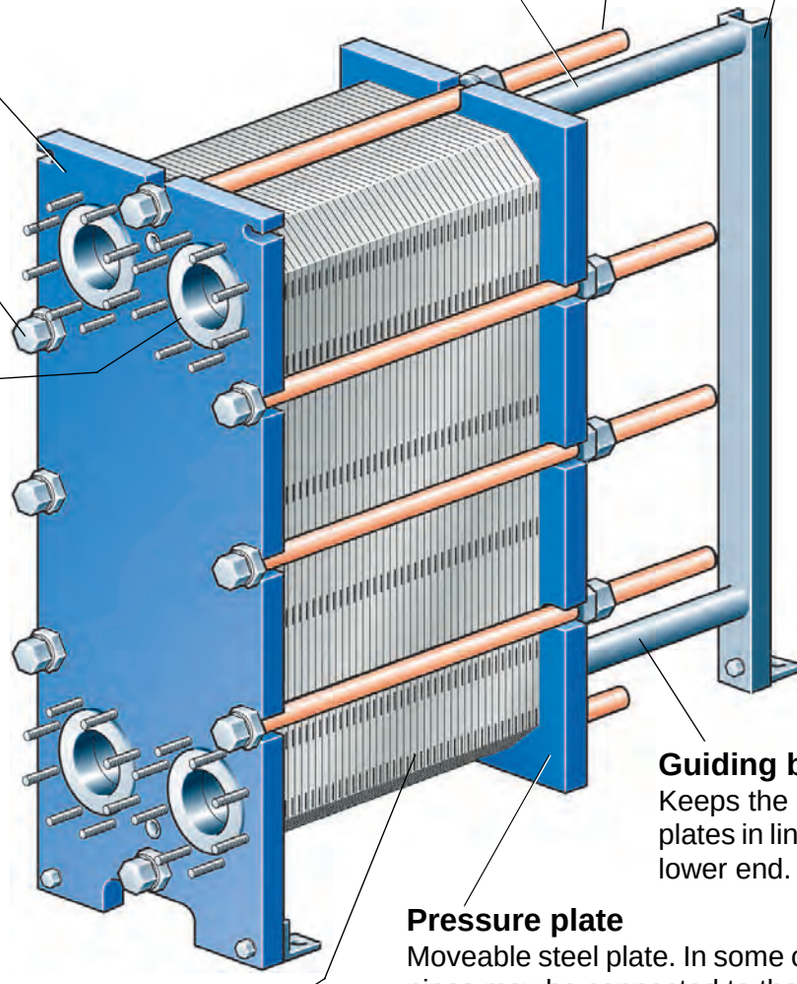
Description

Main components



Frame plate

Carrying bar
Carries the channel plates and the pressure plate.

Bolt protection

Support column

Tightening bolts
Press the channel plates together.

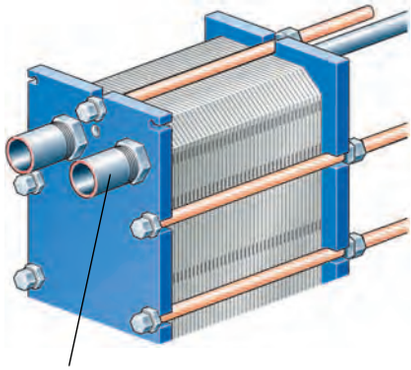
Connections
Holes through the frame plate, permitting the media to enter into the heat exchanger.

Threaded studs around the holes secure the pipes to the apparatus. Metallic or rubber-type linings may be used to protect the holes against corrosion.

Connections can also be pipes for welding or threaded.

Guiding bar
Keeps the channel plates in line at their lower end.

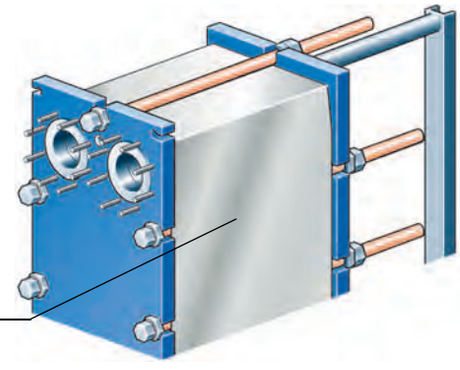
Pressure plate
Moveable steel plate. In some cases pipes may be connected to the pressure plate.



Pipe connections

Channel plates
Heat is transferred from one medium to the other through the thin channel plates.

The number of plates determines the total heat transfer surface.



Protective sheets
In the USA mandatory, in other countries optional.

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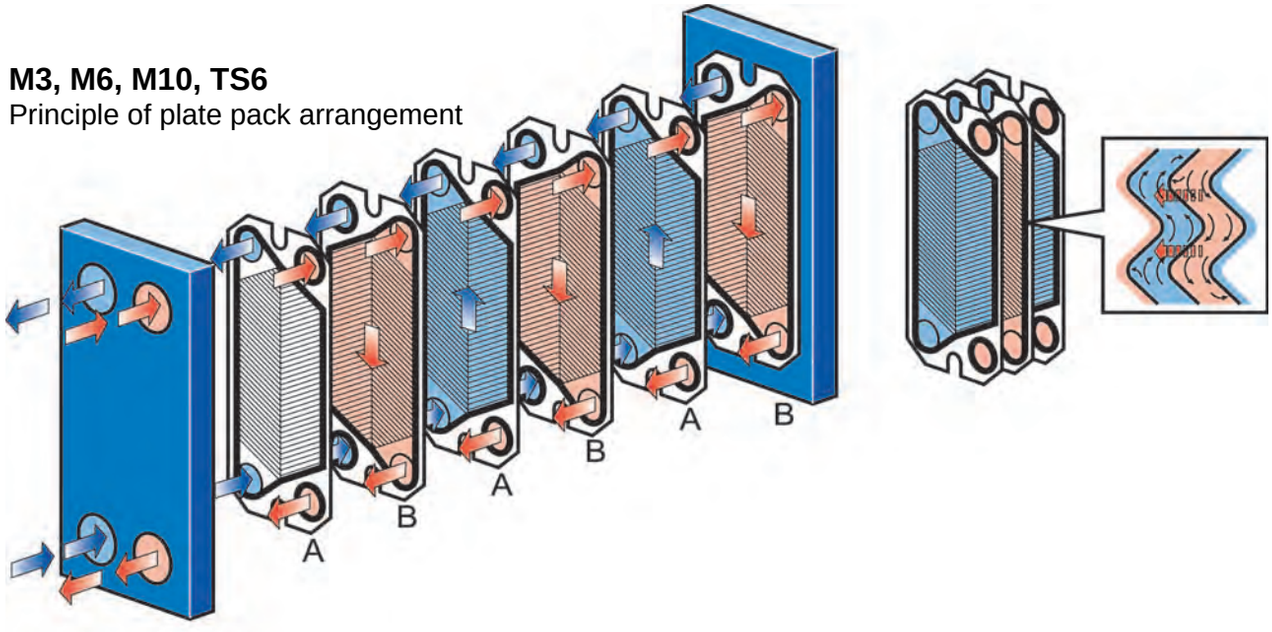
Function

The plate heat exchanger consists of a pack of corrugated metal plates with portholes for the passage of the two fluids between which heat transfer will take place.

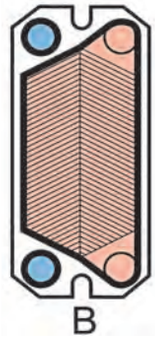
The plate pack is assembled between a frame plate and a pressure plate and compressed by tightening bolts. The plates are fitted with a gasket which seals the channel and directs the fluids into alternate channels. The plate corrugation promotes fluid turbulence and supports the plates against differential pressure.

M3, M6, M10, TS6
Principle of plate pack arrangement



M3, M6, M10, TS6

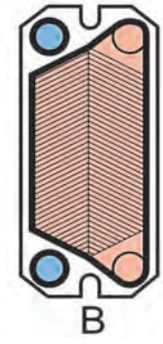
The A-plate is a plate hanging with the chevron pointing downwards.



The A-plate is a plate hanging with the chevron pointing upwards.

T2, T5

The B-plate is a plate hanging with the chevron pointing upwards.



The B-plate is a plate hanging with the chevron pointing downwards.

Semi-welded PHE

For certain plate sizes there are semi-welded plates (Cassettes) available. The function of the semi-welded PHE is the same as that of the conventional PHE. Chapters Installation and Operation of this manual are applicable to full extent. Chapter Maintenance is fully applicable when it comes to the parts Cleaning-in-Place and Pressure test after maintenance and partially applicable for the remaining part. To cover the specific requirements of the semi-welded PHE a separate additional manual has been made.

EN

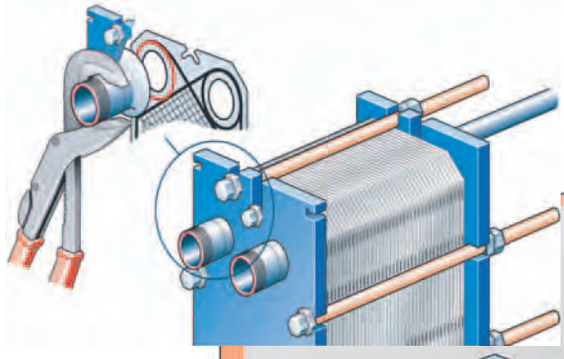
Installation

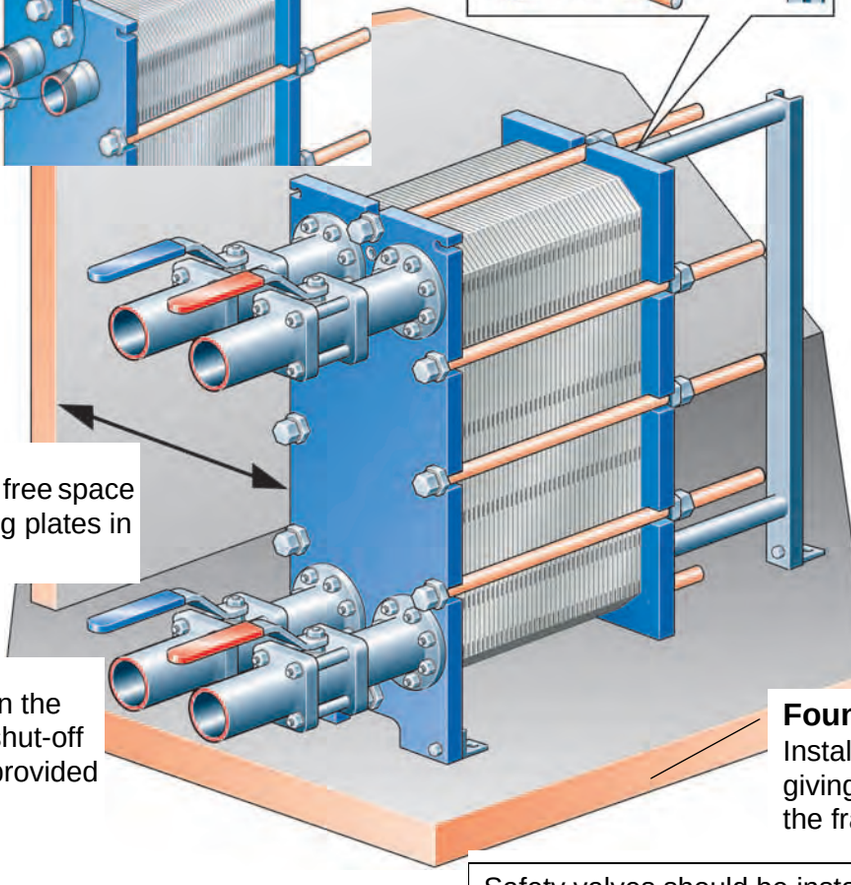
Requirements

Pipes

Caution!

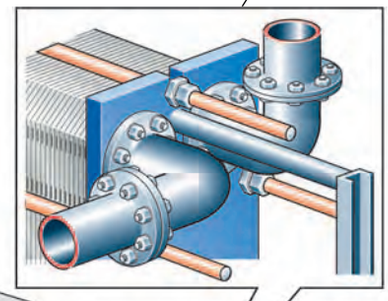
Make sure the pipe connections are locked when working on the piping. Turning of the connections will damage the gaskets on the end plate and cause leakage.





Multi-pass units: Connections on the pressure plate

It is important that the plate pack has been tightened to the correct measurement (check against drawing) before the pipe is connected.



Elbow

To make it easier to disconnect the plate heat exchanger, an elbow should be flanged to the connection in the pressure plate, directed upwards or sideways, and with another flange located just outside the contour of the heat exchanger.

Drip tray

Depending on the type of fluid in the PHE and the type of installation, a drip tray (drainage box) may be nesessary to avoid damages on personnel and equipment.

Space

600 mm minimum free space is needed for lifting plates in and out.

Shut-off valves

To be able to open the heat exchanger, shut-off valves should be provided in all connections.

Foundation

Install on a flat foundation giving enough support to the frame.

Note!

- Before connecting any piping, make sure all foreign objects have been flushed out of the system.
- When connecting the pipe system make sure the pipes do not subject the plate heat exchanger to stress or strain.
- To avoid water hammer, do not use fast-closing valves.

Safety valves should be installed according to current pressure vessel regulations.

If PHE surface temperature is expected to be hot or cold, the PHE should be isolated.

It is recommended that protective sheets are used to cover the PHE.

For each model, design pressures and temperatures are marked on the identification plate. These must not be exceeded.

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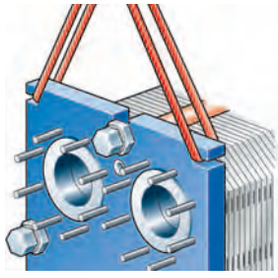
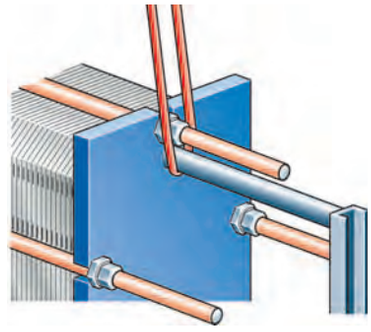
Lifting

Warning!
Never lift by the connections or the studs around them.

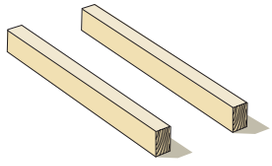




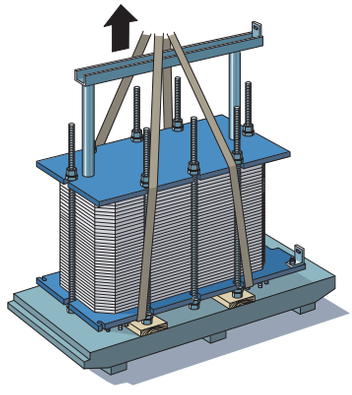
Straps should be used when lifting. Place straps according to picture.

Raising

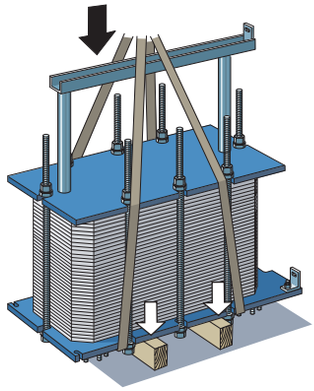
1. Place two timber beams on the floor.



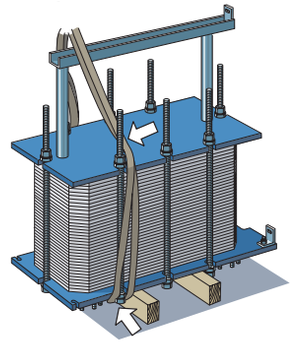
2. Lift the heat exchanger off pallet using e.g. straps.



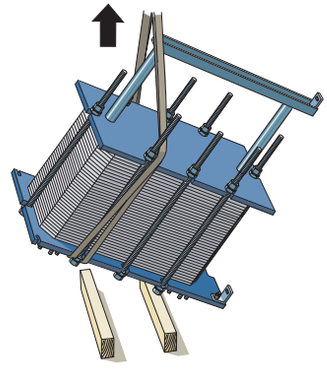
3. Place the heat exchanger on the timber beams.



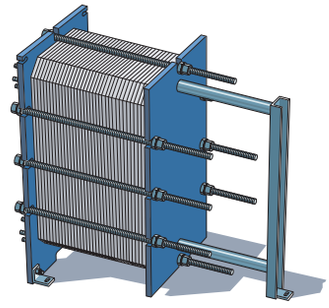
4. Place straps around one bolt on each side.



5. Lift the heat exchanger off the timber beams.



6. Lower the heat exchanger to horizontal position and place it on the floor.



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Operation

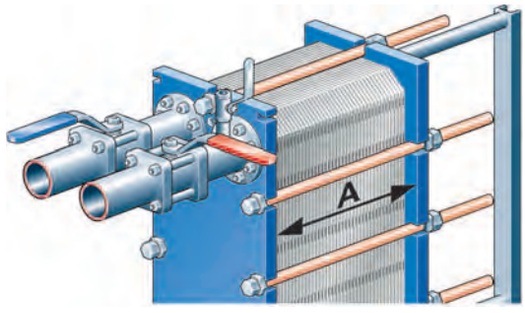
Start-up

Note!
If several pumps are included in the system, make sure you know which one should be activated first.

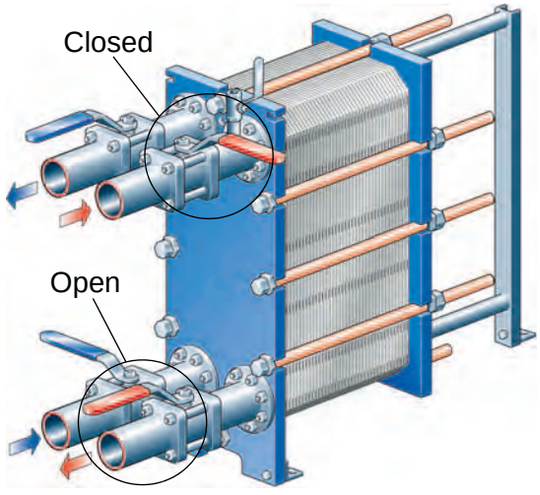
Note!
Adjustments of flowrates should be made slowly in order to avoid the risk of **water hammer**.

Water hammer is a shortlasting pressure peak that can appear during start-up or shut-down of a system, causing liquids to travel along a pipe as a wave at the speed of sound. This can cause considerable damage to the equipment.

1 Check that measurement A is correct. For A, see enclosed PHE-drawing.

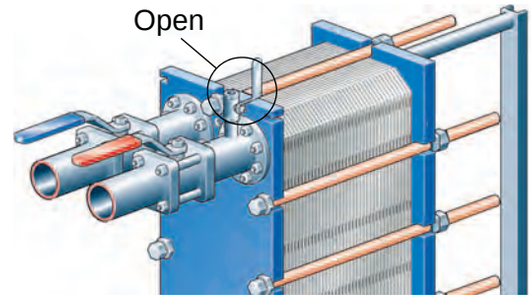


2 Check that the valve is closed between the pump and the unit controlling the system flowrate.

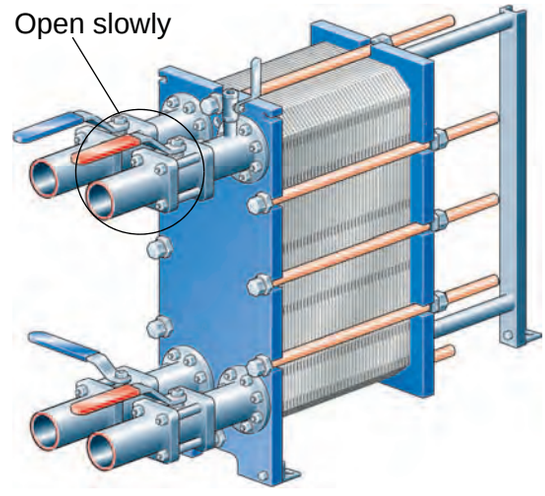


3 If there is a valve at the exit, make sure it is fully open.

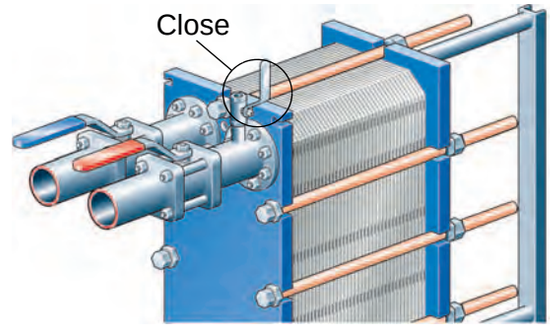
4 Open the vent and start the pump.



5 Open the valve slowly.



6 When all air is expelled, close the vent.



7 Repeat steps 1– 6 for the second media.

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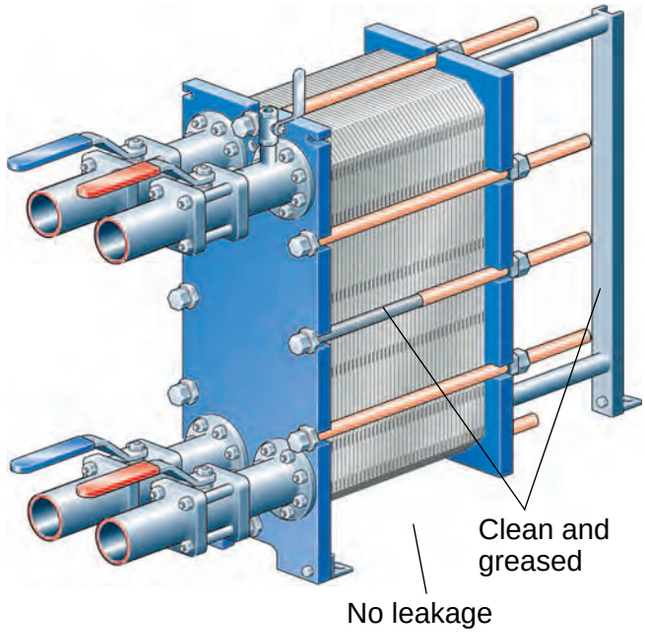
Unit in operation

Note!
Adjustments of flowrates should be made slowly in order to protect the system against sudden and extreme variations of temperature and pressure.

During operation, check that

- ☑ media temperatures and pressures are within the limits stated on the PHE-drawing
- ☑ no leakages appear due to faulty tightening of the plate pack or to defective or damaged gaskets
- ☑ support column, carrying bar and guiding bar are kept clean and greased
- ☑ the bolts are kept clean and greased.



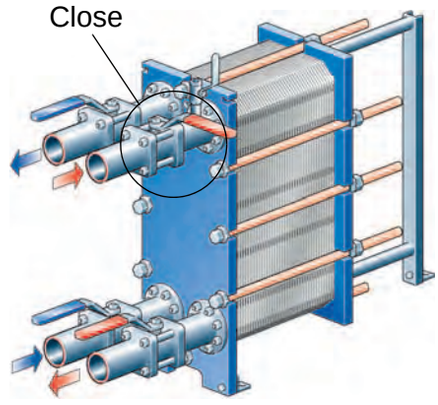
Always consult your local Alfa Laval Representative for advice on

- new plate pack dimensions if you intend to change number of plates
- selection of gasket material if operating temperatures and pressures are permanently changed, or if another medium is to be processed in the PHE.

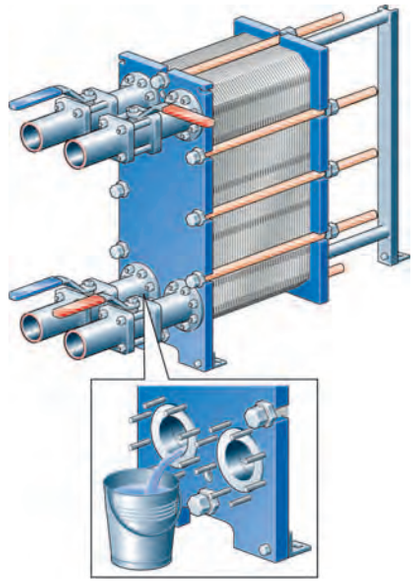
Shut-down

Note!
If several pumps are included in the system, make sure you know which one should be stopped first.

1. Slowly close the valve controlling the flowrate of the pump you are about to stop.



2. When the valve is closed, stop the pump.
3. Repeat steps 1–2 for the other side.
4. If the heat exchanger is shut down for several days or longer, it should be drained. Draining should also be done if the process is shut down and the ambient temperature is below freezing temperature of the media. Depending on the media processed, it is also recommended to rinse and dry the heat exchanger plates and connections.



EN

Maintenance

Cleaning-In-Place (CIP)

The Cleaning-In-Place (CIP) equipment permits cleaning of the plate heat exchanger without opening it.

If CIP cannot be done, cleaning must be performed manually, see section “Manual cleaning”.

CIP performs

- cleaning of fouling and descaling of lime deposits
- passivation of cleaned surfaces to reduce susceptibility to corrosion
- neutralization of cleaning liquids before draining.

Follow the instructions of the CIP equipment.

CIP equipment

CIP model		Maximum number of plates					
		M3	M6	M6-M	M10-B	M10-M	TS6-M
	CIP 20	90	89	62	40	27	56
	CIP 40	–	178	124	81	53	110

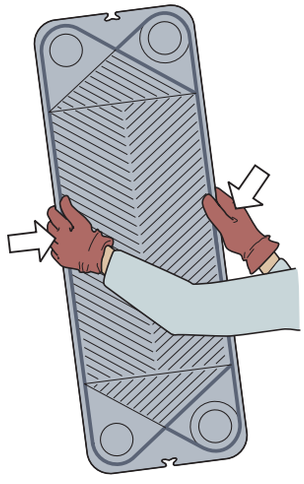
Cleaning liquids

Cleaning liquid	Description
AlfaCaus	A strong alkaline liquid, for removing paint, fat, oil and biological deposits.
AlfaPhos	An acid cleaning liquid for removing metallic oxides, rust, lime and other inorganic scale.
AlfaPass	An alkaline liquid for passivation (inhibition of corrosion).
AlfaNeutra	A strong alkaline liquid for neutralization of AlfaCarbon or AlfaPhos before drainage.

EN

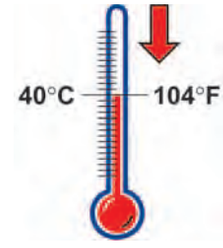
Manual cleaning

Warning!
To avoid hand injuries owing to sharp edges, protective gloves should always be worn when handling plates and protective sheets.

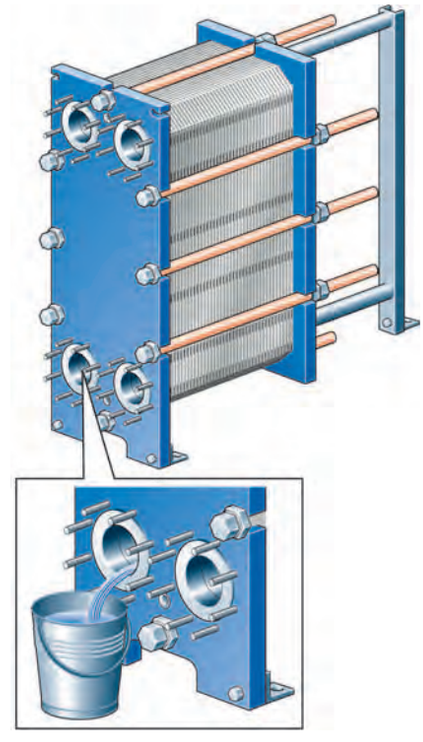


Opening

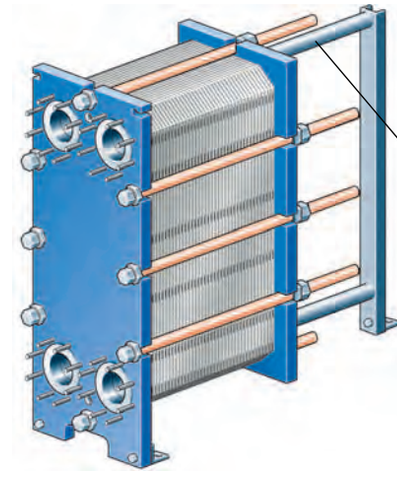
Warning!
If the heat exchanger is hot, wait until it has cooled down to about 40 °C (104 °F).



1 Drain the plate heat exchanger.



2 Inspect the sliding surfaces of the carrying bar and wipe clean.



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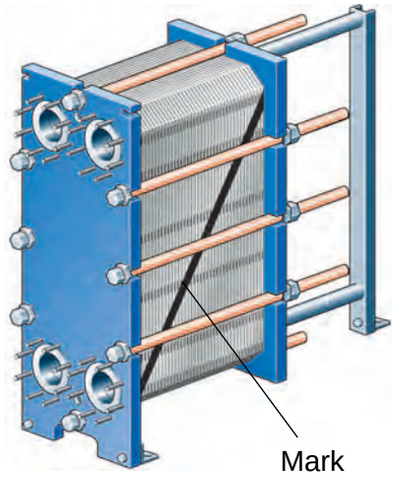
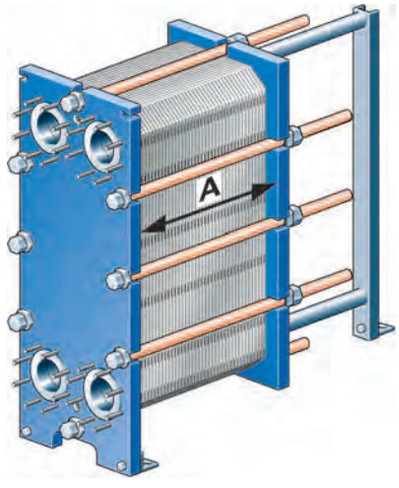
3 Mark the plate assembly on the outside by a diagonal line.



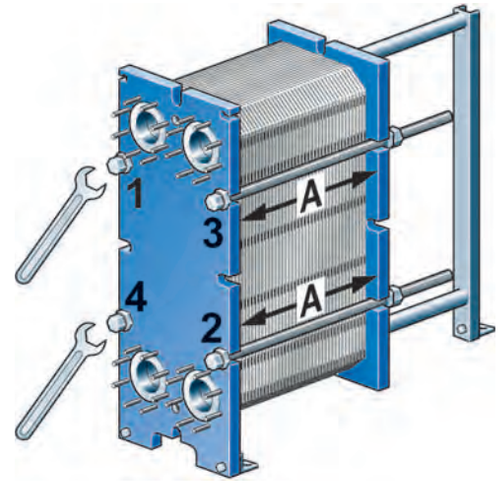
4 Measure and note down the dimension A.



5 Loosen and remove all bolts except the 4 at the positions indicated below. Use these remaining 4 bolts to open the plate pack according to the following scheme.

Step	Bolt No.	To dimension
1	1–2–3–4	1,05A
2	1–2 or 3–4	Opening

Be careful so that the plate and pressure plate are always in parallel. Skewing of the pressure plate during opening must not exceed 10 mm (2 turns per bolt) across the with and 25 mm (5 turns per bolt) vertically.

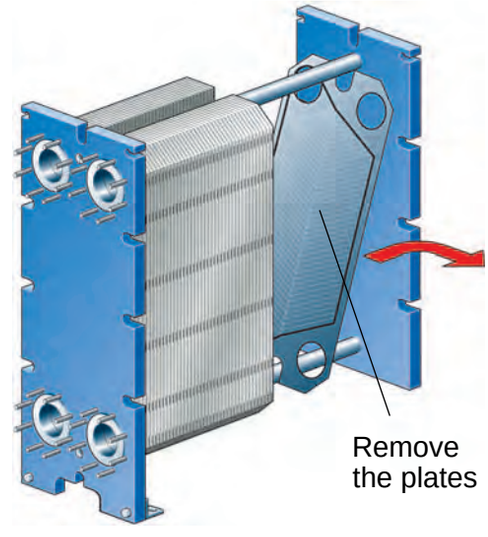


See also point 5 under part “Closing”.

6 Open the plate pack by letting the pressure plate glide on the carrying bar.

If plates are to be numbered, do this before removing the plates.

Plates need not to be removed if cleaning is done using only water, i.e. without cleaning agent.



Warning!

The plate pack may still contain a small residual amount of liquid after draining. Depending on the type of product and type of installation special arrangments, e.g. drainage box, may be necessary to avoid damages on personnel and equipment.

EN

Manual cleaning of opened units

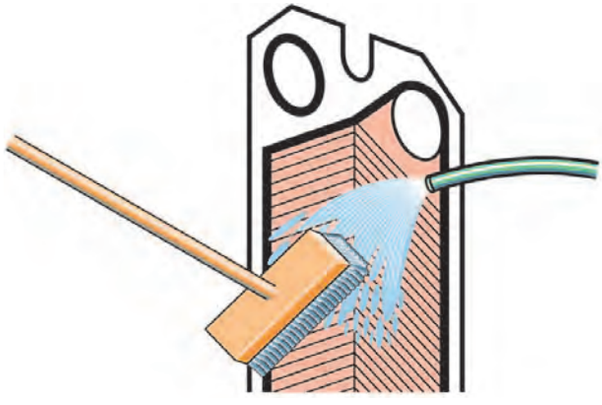
Caution!
Never use hydrochloric acid with stainless steel plates. Water of more than 330 ppm Cl may not be used for the preparation of cleaning solutions. It is very important that carrying bars and support columns in aluminium are protected against chemicals.

Note!
Be careful not to damage the gasket during manual cleaning.

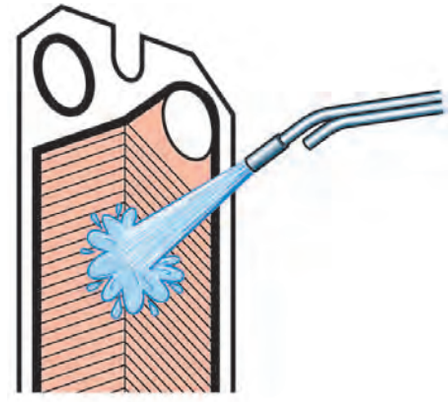
Deposits removable with water and brush

Plates need not to be removed from the plate heat exchanger during cleaning.

1. Remove deposits using a soft brush and running water.



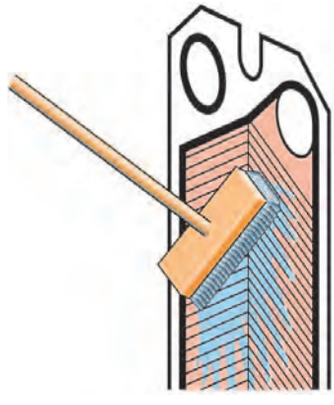
2. Rinse with water using a high pressure hose.



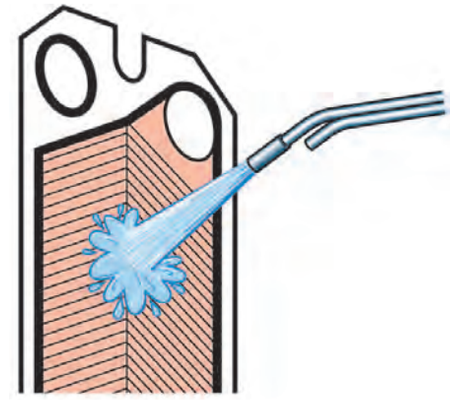
Deposits not removable with water and brush

Plates must be removed from the plate heat exchanger during cleaning.

1. Brush with cleaning agent.



2. Rinse with water.



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Cleaning agents – Incrustation, scaling
Concentration max 4 %
Temperature max 60 °C (140 °F)

Incrustation – Scaling	Sediment	Cleaning agent
Calcium carbonate	Corrosion products	Nitric acid
Calcium sulphate	Metal oxides	Sulfamic acid
Silicates	Silt	Citric acid
	Alumina	Phosphoric acid
	Diatomic organisms and their excrement of various colours	Complexing agents (EDTA, NTA) Sodium polyphosphates

Cleaning agents – Biological growth, slime
Concentration max 4 %
Temperature max 80 °C (176 °F)

Biological growth – Slime	Cleaning agent
Bacteria	Sodium hydroxide
Nematodes	Sodium carbonate
Protozoa	Cleaning effect can be considerably increased by the addition of small quantities of hypochlorite or agents for the formation of complexes and surfactants.

Cleaning agents – Oil residues, asphalt, fats

Deposit	Cleaning agent
Oil residues Asphalt Fats	Paraffinic naphta-based solvent (e.g. kerosine). **Note**! Gaskets in EPDM rubber qualities swell in these media. Contact time should be limited to 30 minutes.

Caution!

The following solutions should not be used:

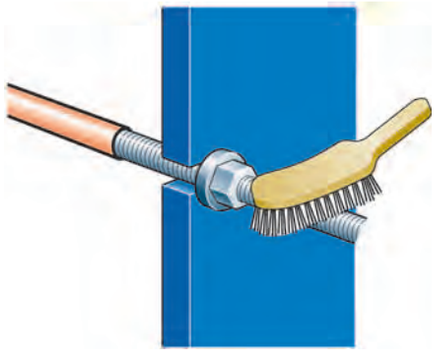
- Ketones (e.g. Acetone, Methyletylketone, Methylisobutylketone
- Esters (e.g. Ethylacetate, Butylacetate)
- Halogenated hydrocarbons (e.g. Chloro-thene, Carbon tetrachloride, Freons)
- Aromatics (e.g. Benzene, Toluene).

EN

Closing

1 Check that all the sealing surfaces are clean.

2 Brush the threads of the bolts clean, using a steel wire brush. Lubricate the threads with a thin layer of grease, e.g. Gleitmo 800 or equivalent.

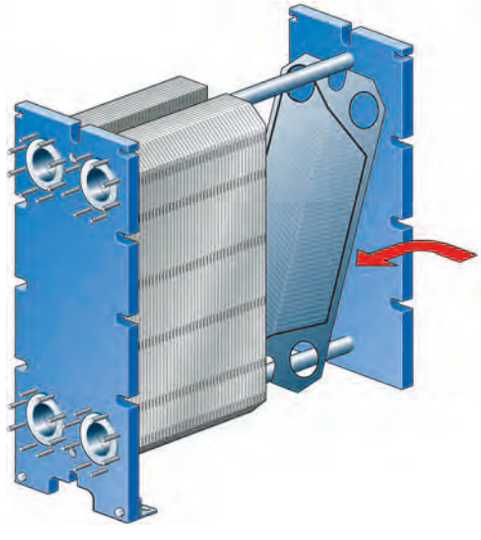


3 Attach gaskets to the plates or check that all the gaskets are properly attached.

Note!

If the gasket is wrongly positioned, it will show by the fact that it rises out of the gasket groove or that it is positioned outside the groove.

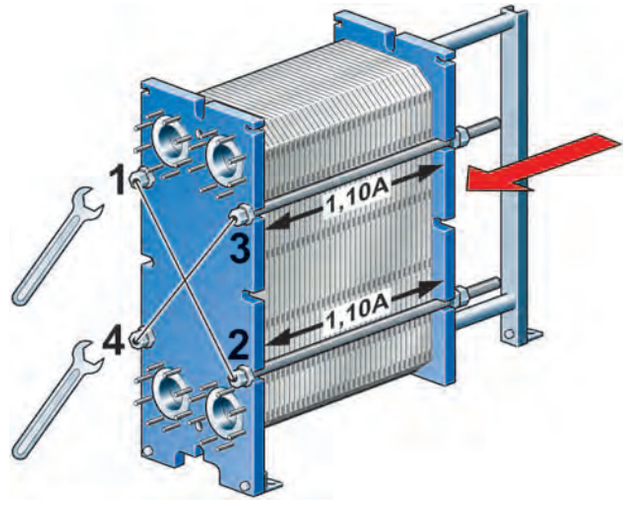
4 Insert the plates with the herring bone pattern positioned in alternate directions and with the gaskets turned towards the frame plate.



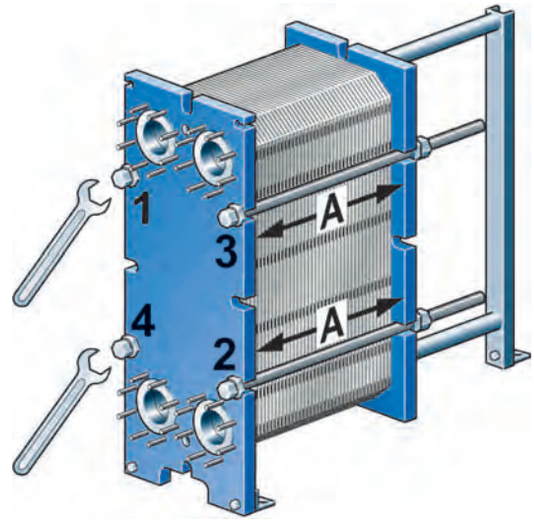
5 Press the plate assembly together. Tightening is done in two steps, see figures below. Be careful so that the frame plate and the pressure plate are always in parallel.

Step	Bolt No.	To dimension
1	1–2 or 3–4	1,10A
2	1–2–3–4	A

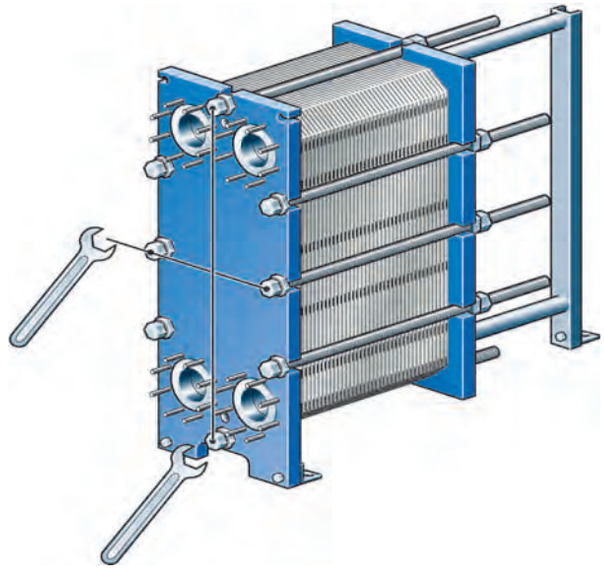
Tighten the two diagonal pair of bolts alternately until the plate package measures 1,10A.



After that bolts are tightened alternately and diagonally, as shown in the figure below.

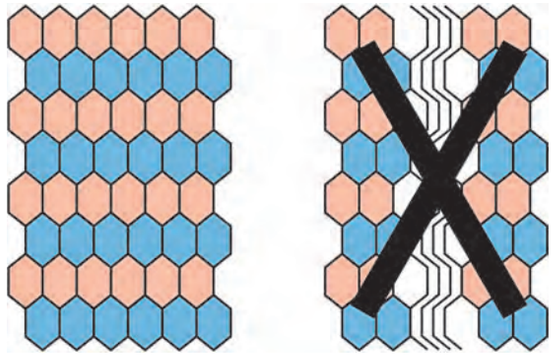


Finally the middle pair of bolts, and upper and lower bolts are tightened.



Note!
The actual measurement must never be less than the A-dimension.

6 If the plates are correctly assembled, the edges form a “honeycomb” pattern, see picture below.



Pressure test after maintenance

Before start-up of production, whenever plates or gaskets have been removed, inserted or exchanged, it is strongly recommended to perform a pressure test to confirm the internal and external sealing function of the PHE. At this test, one media side at the time must be tested with the other side open to the atmosphere.

The pressure testing shall be performed at a pressure equal to the operating pressure of the actual unit but never above the design pressure as stated on the nameplate.

The recommended test time is 10 minutes.

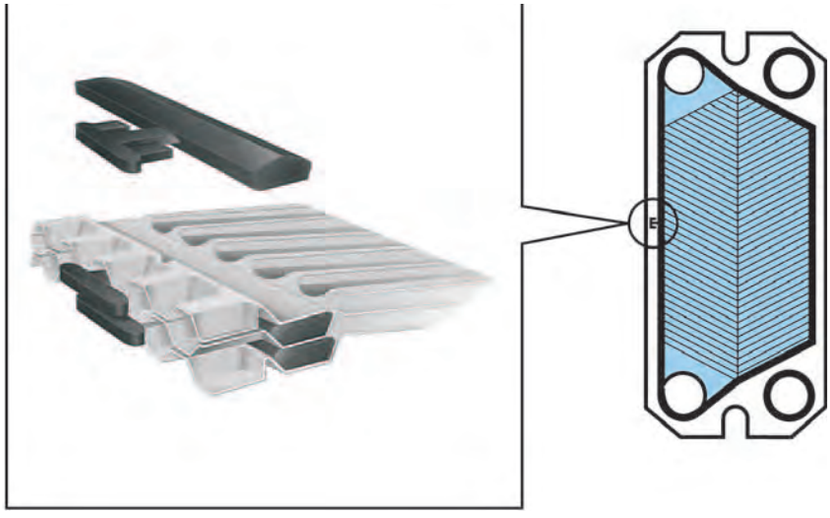
Please note that PHE units for refrigeration applications and units with media not mixable with water must be dried after hydrostatic pressure testing.

Please consult the local office/representative of the supplier for advice on the pressure testing procedure.

EN

Regasketing

1. Open the plate heat exchanger according to page 8, and remove the plate that is to have a new gasket.
2. Remove the old gasket.
3. Assure that all sealing surfaces are dry, clean and free of foreign matter.
4. Attach the clip-on gasket to the plate. Slip the gasket prongs under the edge of the plate.



Glued gaskets
Separate gluing instructions will be delivered together with the glue.

Note!
Make sure the two gasket prongs are in correct position.

5. Proceed with the next plate to be regasketed until all plates in need of regasketing are done with.
6. Close the plate heat exchanger according to page 12.

tekmar® - Data Brochure

Snow Detector & Melting Control 664

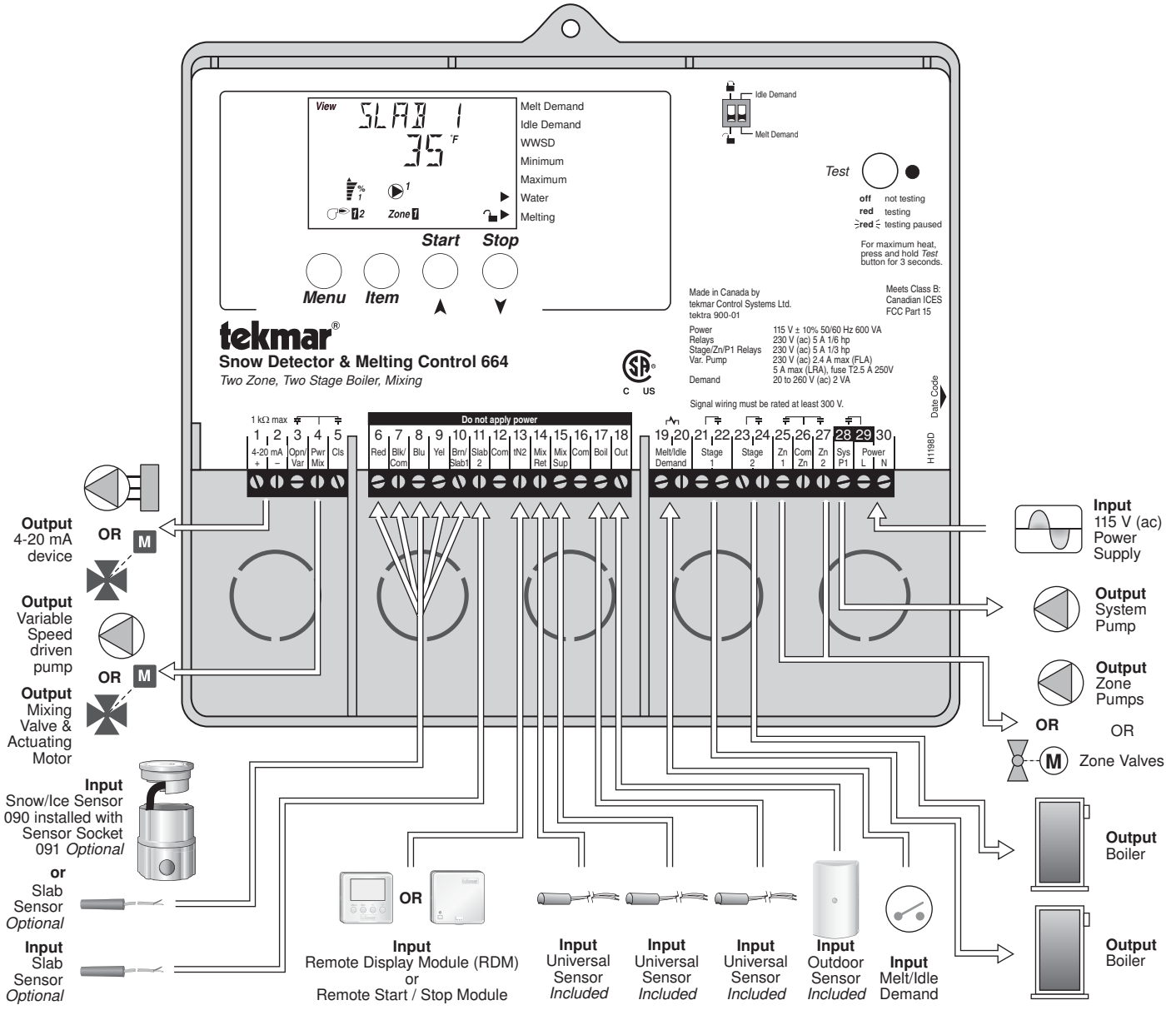
D 664

07/09

The Snow Detector and Melting Control 664 is designed to control up to two zones in a snow melting system. The control automatically adjusts the mixed supply water to the snow melting system by controlling up to two boilers and a single mixing device. For mixing, the 664 can use a variable speed injection pump, a floating action mixing valve or a 4-20 mA device. The snow melting system may be started manually or automatically through the use of a Snow / Ice Sensor 090. The 664 control includes a large Liquid Crystal Display (LCD) in order to view system status and operating information.

Additional features include:

- Temporary Idle
- Optional priority zoning operation
- Slab protection for the snow melting system
- Boiler protection
- Manual Override
- Adjustable Warm Weather Shut Down (WWSD)
- Cold Weather Cut Out (CWCO)
- Remote display and adjustment capabilities
- Test sequence to ensure proper component operation
- Pump and valve exercising
- CSA C US Certified (approved to applicable UL standards)



How To Use The Data Brochure

This brochure is organized into four main sections. They are: 1) *Sequence of Operation*, 2) *Installation*, 3) *Control Settings*, and 4) *Troubleshooting*. The Sequence of Operation section has 6 sub-sections. We recommend reading Section A: General of the *Sequence of Operation*, as this contains important information on the overall operation of the control. Then read to the sub-sections that apply to your installation.

The *Control Settings* section (starting at DIP Switch Settings) of this brochure describes the various items that are adjusted and displayed by the control. The control functions of each adjustable item are described in the *Sequence of Operation*.

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- ***Section B: Snow Melting*** ..... **Pg 6**
- ***Section C: Boiler Operation*** ..... **Pg 8**
- ***Section D: Melting Enable / Disable*** ..... **Pg 9**
- ***Section E: Melting Operation*** ..... **Pg 12**
- ***Section F: Idling Operation*** ..... **Pg 14**

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- ***Testing The Wiring*** ..... **Pg 18**

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- ***Adjust Menu*** ..... **Pg 23**
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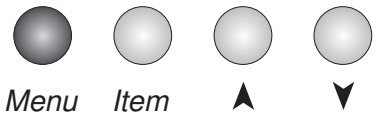
User Interface

The 664 uses a Liquid Crystal Display (LCD) as the method of supplying information. You use the LCD in order to setup and monitor the operation of your system. The 664 has four push buttons (***Menu***, ***Item***, ▲, ▼) for selecting and adjusting settings. As you program your control, record your settings in the ADJUST Menu table which is found in the second half of this brochure.

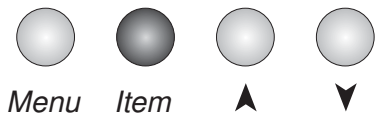
Menu

All of the items displayed by the control are organized into various menus. These menus are listed on the left hand side of the display (Menu Field). To select a menu, use the ***Menu*** button. By pressing and releasing the ***Menu*** button, the display will advance to the next available menu. Once a menu is selected, there will be a group of items that can be viewed within the menu.



Item

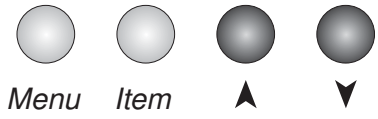
The abbreviated name of the selected item will be displayed in the item field of the display. To view the next available item, press and release the ***Item*** button. Once you have reached the last available item in a menu, pressing and releasing the ***Item*** button will return the display to the first item in the selected menu.



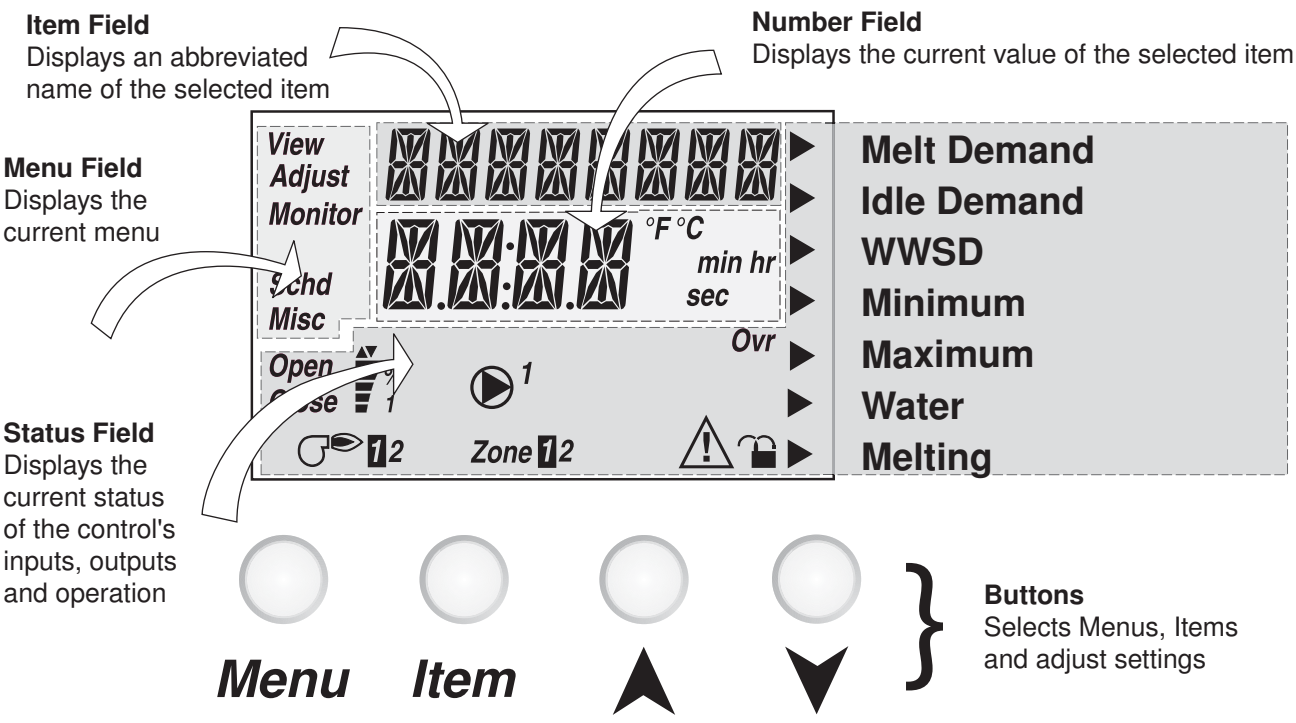
Adjust

To make an adjustment to a setting in the control, begin by selecting the appropriate menu using the ***Menu*** button. Then select the desired item using the ***Item*** button. Finally, use the ▲ and / or ▼ button to make the adjustment.

Additional information can be gained by observing the Status field of the LCD. The status field will indicate which of the control's outputs are currently active. Most symbols in the status field are only visible when the VIEW Menu is selected.



Display



Symbol Description

Open Close	**Open / Close** Displays when the actuator is opening or closing the mixing valve.		**Lock / Unlock** Displays when the access levels are locked or unlocked.
% 1	**Mixing Device Output Scale** Shows output of injection pump, mixing valve or 4-20 mA device. Arrows show whether the output is increasing or decreasing.	1 2	**Burner** Displays when the Stage 1 and / or Stage 2 relay is turned on.
1	**Pump** Displays when the system pump is operating.	▶	**Pointer** Displays the control operation as indicated by the text.
Ovr	**Override** Displays when the control is in override mode.	°F °C min hr sec	**°F, °C, min, hr, sec** Units of measurement.
⚠	**Warning** Displays when an error exists or when a limit has been reached.	Zone 1 2	**Zone** Displays when a zone is in operation.

Definitions

The following defined terms and symbols are used throughout this manual to bring attention to the presence of hazards of various risk levels, or to important information concerning the life of the product.

⚠ - Warning Symbol: Indicates presence of hazards which can cause severe personal injury, death or substantial property damage if ignored.

⧈ - Double insulated

INSTALLATION CATEGORY II - Local level, appliances

Sequence of Operation

Section A General Operation Page 4 - 5

Section B Snow Melting Page 5 - 7

Section C Boiler Operation Page 7 - 9

Section D Melting Enable / Disable Page 9 - 11

Section E Melting Operation Page 12 - 13

Section F Idling Operation Page 14

Section A: General Operation

POWERING UP THE CONTROL

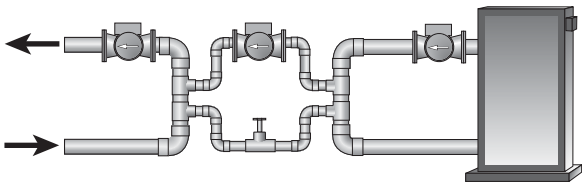
When the Snow Detector and Melting Control 664 is powered up, the control displays all LCD segments for 2 seconds, then the control type number in the LCD for 2 seconds. Next, the software version is displayed for 2 seconds. Finally, the control enters into the normal Operating mode and the LCD defaults to displaying the current outdoor air temperature.

MIXING DEVICE SELECTION (MIXING)

The 664 can supply a lower fluid temperature to the snow melting system by using a variable speed injection pump, a floating action mixing valve or a modulating 4-20 mA device. The selection is made under the Mixing item in the ADJUST menu.

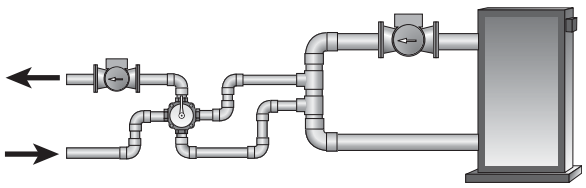
Variable Speed Injection (VAR)

A standard wet rotor circulator is connected to the 664 on the *Pwr Mix* and *Opn / Var* terminals (4 and 3). The 664 increases or decreases the power output to the circulator based on the system requirements. For correct sizing and piping of the variable speed injection pump, refer to Essay E 021. A visual indication of the current variable speed output is displayed in the LCD in the form of a segmented bar graph.



Floating Action (FLOT)

A floating action motor is connected to the 664 on the *Pwr Mix*, *Opn* / *Var and Cls* terminals (4, 3 and 5). The 664 pulses the actuator motor open or close based on the system requirements. The mixing valve that the actuator is connected to can be either a 2-way, 3-way or 4-way valve. A visual indication of the current position of the valve is displayed in the LCD in the form of a segmented bar graph.



4-20 mA Output (4-20)

A 4-20 mA device is connected to the 664 on the *4-20 mA +* and *4-20 mA –* terminals (1 and 2). The 664 increases or decreases the modulating output to the 4-20 mA device based on the system requirements. The 4-20 mA output can be used to operate a variety of actuating motors for mixing valves and motor drives for larger pumps. A visual indication of the current output of the 4-20 mA device is displayed in the LCD in the form of a segmented bar graph.

MIXING TARGET (MIX TRG)

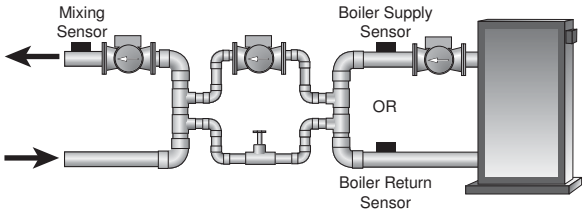
The mixing target temperature is the supply fluid temperature calculated by the control. The control will operate the snow melt system so that the mix supply temperature reaches the mixing target except while providing boiler return protection for the boiler.

MIXING MAXIMUM (MIX MAX)

The *Mix Max* sets the highest fluid temperature that the control is allowed to calculate as the mixing target temperature. If the control does target the *Mix Max* setting, and the mix supply temperature is near the MIX MAX, the Maximum pointer is displayed in the LCD while the MIX SUP temperature is being viewed.

BOILER PROTECTION (Boil MIN)

The 664 is capable of providing boiler protection from cold mixing system return fluid temperatures. If the boiler sensor temperature is cooler than the *Boil Min* setting while the boiler(s) is firing, the 664 reduces the output from the mixing device. This limits the amount of cool return water to the boiler(s) and allows the boiler temperature to recover. This feature can only be used if the Boil Sens item is set to *Sup* or *Ret*. The 664 can not provide boiler protection if the Boil Sens item is set to *None*.



EXERCISING (EXERCISE)

The 664 has a built in pump and valve exercising function. The exercising period is adjustable and is factory set at 70 hours. If a pump or valve output has not been operated at least once during every exercising period, the control turns on the output for 10 seconds. This minimizes the possibility of a pump or valve seizing during a long period of inactivity. In the case where a mixing valve is being used as the mixing device, the 664 ensures that the valve operates over its entire range at least once each exercising period.

Note: The exercising function does not work if power to the control, valves or pumps is disconnected.

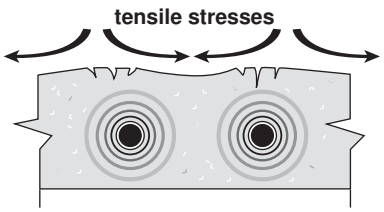
Section B: Snow Melting

Section B1
General
Snow Melting

Section B1: General Snow Melting

SLAB PROTECTION (ΔT MAX)

The control can limit the rate at which heat is applied to the currently operating zone through the Δ*T Max* setting. The ΔT (delta T) is the temperature difference between the snow melting supply temperature and the snow melting return temperature. By limiting this temperature difference, the rate at which heat is applied to the currently operating zone can be controlled and thermal stresses in the slab can be minimized. When the control is operating at the ΔT MAX, the *Maximum* pointer can be seen when viewing the ΔT item in the VIEW menu. The control provides slab protection differently based on boiler sensor placement.



Note: The ΔT MAX function is only available if the PRIORITY item is set to *COND* or *FULL*.

VISCOSITY COMPENSATION (EXCEEDING ΔT MAX)

At low temperatures, the glycol solutions used in snow melting systems become very viscous and difficult to pump. In order to overcome this condition during a cold start of a snow melting system, the 664 is allowed to exceed the Δ*T Max* setting for a period of time in order to warm the glycol solution. This allows the control to compensate for the high viscosity of the glycol solution and is used when the mixing return temperature is below 30°F (-1°C). When the control exceeds the Δ*T Max* setting, the *Maximum* pointer will flash when viewing the ΔT item in the VIEW menu.

Note: This operation only occurs if the PRIORITY item is set to *COND* or *FULL*.

SOFT START

When the control starts applying heat to the slab, the supply temperature to the snow melting system is ramped up over a period of time until it reaches the target mixed supply temperature. This feature helps reduce thermal stresses in the slab.

Note: This operation only occurs if the Boil SENS item is set to *RET* or *NONE*.

RUNNING TIME (RUN TIME)

The running time is the length of time that a zone operates once it has reached its slab target temperature. During the time that a zone is approaching its slab target temperature, the Run Time does not decrease. Once a zone reaches its slab target temperature the Run Time begins counting down. When the Run Time reaches 0:00 as displayed in the Status item of the appropriate zone in the VIEW menu, the zone has finished melting.

Note: The running time is only applicable when a manual melting enable signal starts the snow melting system. Refer to Section D1 for a description of a manual melting enable.

WARM WEATHER SHUT DOWN (WWSD)

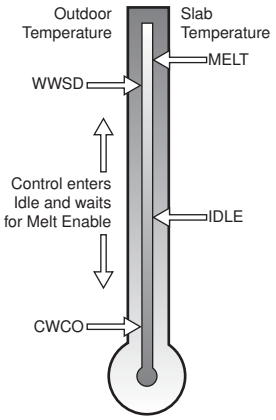
The control has a warm weather shut down for each zone that prevents the control from entering the Melt or Idle modes in order to conserve energy. While a zone is in WWSD, the word WWSD is displayed in the STATUS 1 or STATUS 2 items in the VIEW menu. When both zones enter WWSD, the 664 turns on the WWSD pointer in the display.

Automatic (Auto)

There is a warm weather shut down for each zone. When both the slab temperature of a zone and the outdoor temperature exceed the zone's *Melt Temperature* setting by more than 2°F (1°C), the zone enters into WWSD. While a zone is in WWSD, the word WWSD is displayed in the STATUS item of the appropriate zone in the VIEW menu. When both zones enter WWSD, the 664 turns on the WWSD pointer in the display.

Adjustable WWSD

When the WWSD is set to a temperature, the WWSD occurs when the outdoor air temperature exceeds the *WWSD* setting by 1°F (0.5°C) and when the slab temperature of a zone exceeds 34°F (1°C). The zone exits WWSD when the outdoor air temperature falls 1°F (0.5°C) below the *WWSD* setting or if the slab temperature of the zone falls below 34°F (1°C). This allows the *Melting Temperature* setting to be set higher than the WWSD. This is useful where high slab temperatures are required to melt the snow or ice. A good example of this is installations using paving bricks on top of sand and concrete layers.



COLD WEATHER CUT OUT (CWCO)

Maintaining the zone(s) at either the melting or idling temperature during extremely cold temperatures can be expensive or impossible. The control turns the snow melting system off when the outdoor air temperature drops below the Cold Weather Cut Out (CWCO) temperature. While the control is in CWCO, the word CWCO is displayed in the STATUS 1 and STATUS 2 item in the VIEW menu. If a Snow / Ice Sensor 090 is used, the heater in the sensor is kept on during CWCO until the control detects moisture. If water is detected, the heater is turned off but the control retains the moisture detected information. When the outdoor temperature rises above the CWCO temperature, the control exits CWCO and if the Snow / Ice Sensor 090 detected moisture during CWCO, the control initiates Melting mode. If the control has been started prior to the CWCO, it resumes the Melting mode once the outdoor air temperature rises above the CWCO temperature.

STATUS 1 and 2 (STATUS)

While in the VIEW menu there are a number of items available to determine the current status of zone 1 and zone 2. To view the current status of zone 1, select the STATUS 1 item in the VIEW menu. To view the current status of zone 2, select the STATUS 2 item in the VIEW menu.

- **STRT** — The word STRT is displayed after the snow melting system has been manually enabled. It is displayed until the zone reaches its slab target temperature. If the zone is at its slab target temperature, STRT is displayed for five seconds after the snow melting system has started operation. This is to verify that the control has entered into the Melting mode.
- **STOP** — The word STOP is displayed for five seconds after the snow melting system has been manually disabled. The word STOP is also displayed if either a Remote Start / Stop Module 039, Remote Display Module 040 or the ***Stop*** on the control stops the snow melting system and an external melt demand is still present.
- **IDLE** — The word IDLE is displayed as long as the zone is operating at its idling temperature.
- **"IDLE"** — The word IDLE is flashed on the display as long as the zone is operating in temporary idle.
- **EXT** — The word EXT is displayed when the RUN TIME has reached 0:00 and the control still has an external melt demand. In this situation, the zone continues melting until the melt demand is removed or the control is stopped.

- **DET** The word DET is displayed after the snow melting system has been automatically enabled by the Snow / Ice Sensor 090 and the zone is at its slab target temperature. DET is also displayed once the control is manually enabled after automatic detection by the 090 and the running time has counted down to 0:00.
- **0:00 to 23:59 hr** While the zone is up to temperature and melting, the remaining RUN TIME is displayed.
- **INF** If an infinite RUN TIME is selected and the zone is melting, INF is displayed.
- **WWSD** When the zone is in Warm Weather Shut Down, WWSD is displayed.
- **CWCO** When the control is in Cold Weather Cut Out, CWCO is displayed.

BOILER PROTECTION

Refer to Section A for a description of boiler protection.

BOILER OPERATION

Refer to Section C for a description of boiler operation.

SNOW MELTING OVERRIDE

If the *Away* setting is selected in the SCHEDULE menu, the snow melting system is shut down. Both the Melting and Idling temperatures are ignored as long as the control remains in the Away mode.

SYSTEM PUMP OPERATION (Sys P1)

The *System Pump* (*Sys P1*) contact closes and remains closed as long as at least one of the zones is either in the Melting or Idling mode. The *System Pump* contact shuts off if the control is in CWCO, if both zones are in WWSD, or if there is no call for Melting or Idling.

ZONE OUTPUTS (Zn 1 and Zn 2)

The *Zone 1* (*Zn 1)* contact and the *Zone 2* (*Zn 2*) contact operate based on the Melting and / or Idling operation. Refer to Melting Section E and / or Idling Section F for a description of how the zone contact(s) operate. The *Zone Pump* contact(s) shuts off if the control is in CWCO, if the corresponding zone(s) is in WWSD, or if there is no call for Melting or Idling.

PURGE

The system pump (Sys P1) and zoning device(s) (Zn 1 and Zn 2) continue to operate for up to 2 minutes after the last demand is removed. This purges the residual heat from the boiler(s) into the snow melting slab. If the boiler temperature drops below the *Boil Min* setting after 20 seconds, the purge is aborted and the system pump and zoning device(s) are turned off.

Section C: Boiler Operation

Section C1
Boiler Supply Sensor

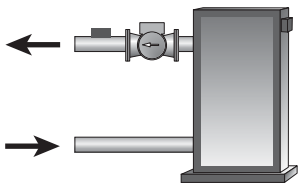
Section C2
Boiler Return Sensor

Section C3
No Boiler Sensor

Section C1: Boiler Supply Sensor

BOILER SENSOR ON THE SUPPLY (Boil SENS = SUP)

When operating a boiler or boiler plant that is dedicated to a snow melting system, the 664 is designed to operate the boiler(s) as efficiently as possible. The boiler(s) are cycled based on the mixing supply fluid temperature. This is to provide longer and more efficient boiler cycles. This mode of operation only works if the Boil SENS item is set to *SUP*.



BOILER MINIMUM (Boil MIN)

The Boil MIN is the lowest water temperature that the control is allowed to use as a boiler target temperature. If the boiler(s) is operating, and the boiler supply temperature is near the *Boil Min* setting, the Minimum pointer turns on in the LCD while the *Boil SUP* temperature is being viewed. If the installed boiler(s) is designed for condensing or low temperature operation, set the *Boil MIN* adjustment to *OFF*.

STAGING

The 664 controls up to two stages in order to supply the required temperature. After the first stage is turned on in the firing sequence, the control waits a minimum amount of time before turning on the next stage. After the minimum time delay between stages has expired, the 664 examines the control error to determine when the next stage is to fire. The control error is determined using Proportional, Integral and Derivative (PID) logic.

Proportional – compares the actual temperature to the target temperature. The colder the temperature, the sooner the next stage is turned on.

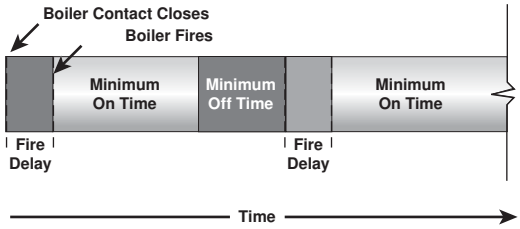
Integral – compares the actual temperature to the target temperature over a period of time.

Derivative – determines how fast or slow the actual temperature is changing. If the temperature is increasing slowly, the next stage is turned on sooner. If the temperature is increasing quickly, the next stage is turned on later, if at all.

– Each stage has a minimum on time, and a minimum off time.

FIRE DELAY (FIRE DLY)

The FIRE DLY is the delay time that may occur between the time that the 664 closes a stage contact and the burner fires for that stage. This delay is usually the result of burner pre-purge or other forms of time delay built into the burner's safety circuits.



BOILER MASS (Boil MASS)

The *Boil MASS* setting allows the 664 to adjust to different types of heat sources depending on their thermal mass.

Light (LITE)

The *LITE* setting is selected if the boiler(s) that is used has a low thermal mass. This means that the boiler(s) has a very small water content and has very little metal in the heat exchanger. A boiler that has a low thermal mass comes up to temperature quite rapidly when fired. This is typical of many copper fin-tube boilers.

Medium (MED)

The *MED* setting is selected if the boiler(s) that is used has a medium thermal mass. This means that the boiler(s) either has a large water content and a low metal content or a low water content and a high metal content. This is typical of many modern residential cast iron boilers or steel tube boilers.

Heavy (HEVY)

The *HEVY* setting is selected if the boiler(s) that is used has a high thermal mass. This means that the boiler(s) has both a large water content and a large metal content. A boiler that has a high thermal mass is relatively slow in coming up to temperature. This is typical of many commercial cast iron and steel tube boilers.

DIFFERENTIAL (DIFF)

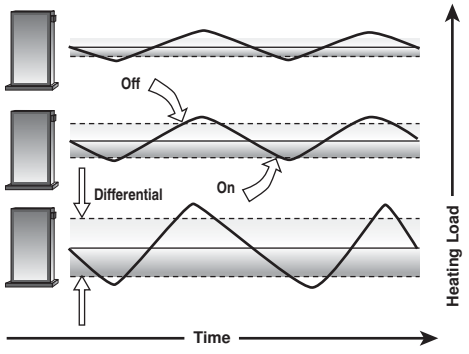
An on / off heat source such as a boiler must be operated with a differential in order to prevent short cycling. With the 664, either a fixed or an automatic differential may be selected.

Fixed Differential

The differential is centered around the target temperature. If the temperature drops 1/2 the differential below the target temperature, the 664 closes the *Boiler* contact(s) to fire the boiler(s). If the temperature rises 1/2 of the differential above the target temperature, the 664 opens the *Boiler* contact(s) to turn off the boiler(s).

Auto Differential (AUTO)

If the *AUTO Differential* is selected, the 664 automatically adjusts the *Differential* setting under the current load conditions to avoid short cycling.



STAGE 1 AND 2 (STAGE)

The *Stage 1* and *2* setting may be selected to AUTO or OFF. When AUTO is selected, the stage is activated and the control operates the appropriate boiler. When OFF is selected, the control does not fire the stage.

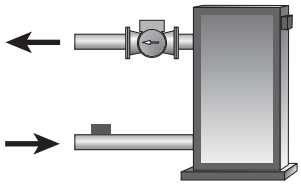
ROTATION (ROTATE)

The ROTATE item is an adjustable setting that is factory set at 48 hours. The firing order of the boiler changes whenever one stage's accumulated running time exceeds the other stage's accumulated running time by more than the *ROTATE* setting. After each rotation, the stage with the least running hours is the first to fire and the stage with the most running hours is the last to fire. This function ensures that both stages receive equal amounts of use. When this item is set to the *OFF* setting, Stage 1 is always the first to fire.

Section C2: Boiler Return Sensor

BOILER SENSOR ON THE RETURN (Boil SENS = RET)

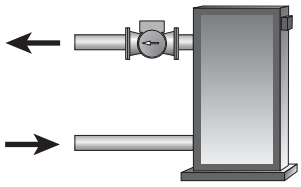
The boiler sensor should be located on the boiler return if the 664 is one of many controls that can call for boiler operation. When in the Return mode, the 664 provides a boiler enable through the *Stage 1* contact. The 664 no longer tries to control the boiler supply water temperature directly, but allows the boiler to operate at its operating aquastat setting when required. If this mode of operation is selected, the boiler pump should either operate continuously, or be operated in parallel with the *System Pump* contact (*Sys P1*). When the mixing device begins to ramp up, the *Stage 1* contact closes on the 664. The *Stage 1* contact remains closed until the mixing device no longer requires heat. With the sensor on the boiler return, the 664 is still capable of providing boiler protection as described in Section A.



Section C3: No Boiler Sensor

NO BOILER SENSOR (Boil SENS = NONE)

The 664 is capable of operating without a boiler sensor if desired. Without a boiler sensor, the 664 is unable to provide boiler protection. In this mode of operation, the *Stage 1* contact is used to provide a boiler enable. When the mixing device begins to ramp up, the *Stage 1* contact on the 664 closes. The *Stage 1* contact remains closed until the mixing device no longer requires heat. This type of application is typical if the 664 is drawing heat from a source that already incorporates some form of boiler protection.



Section D: Melting Enable / Disable

Section D1
Snow Melting Enable

Section D2
Snow Melting Disable

Section D1: Snow Melting Enable

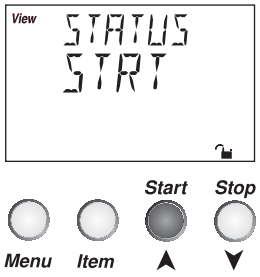
The snow melting system can be enabled manually or automatically. A melting enable signal applied to the control places both zones into the Melting mode. If a melting enable signal is applied once the system is already in the Melting mode, the control responds to the last command received.

MANUAL MELTING ENABLE

A manual melting enable signal requires the user to manually start the snow melting system and can be provided from the Start button on the control, Remote Start / Stop Module 039, Remote Display Module 040, or an external melt demand.

Start Button on the Control

The snow melting system is enabled by pressing the ***Start*** button on the control while in the VIEW menu. The control then displays the *RUN TIME* setting to allow the user to adjust it. Once the snow melting system is enabled, the word STRT is displayed for at least 5 seconds in the STATUS item of the appropriate zone while in the VIEW menu. If the ***Start*** button on the control is pressed while the zone(s) is already melting and up to temperature, the running time counter is reset to the *RUN TIME* setting.

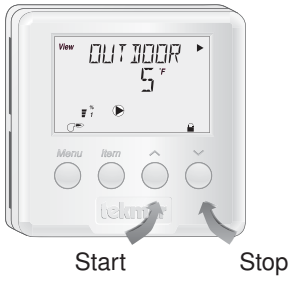


Remote Start / Stop Module 039

The snow melting system is enabled by pressing the button on the front of the 039. While the zone(s) is coming up to temperature, a green indicator light flashes on the front of the 039. Once the zone(s) is up to temperature and the RUN TIME is counting down, the green indicator light on the front of the 039 is on solid.

Remote Display Module 040

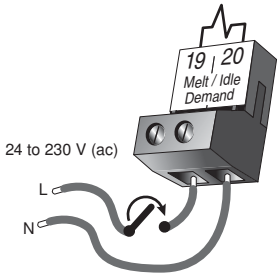
The snow melting system is enabled by pressing the ▲ button on the 040 while in the VIEW menu. The 040 then displays the *RUN TIME* setting to allow the user to adjust it. Once the snow melting system is enabled, the word STRT is displayed for at least 5 seconds in the Status item of the appropriate zone while in the VIEW menu.

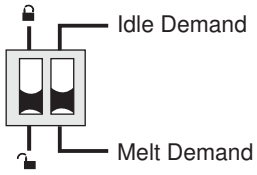


External Melt Demand (DIP switch set to Melt Demand)

The snow melting system is enabled when a voltage between 24 and 240 V (ac) is applied across the *Melt / Idle Demand* terminals (19 and 20). An external melt demand must be present for at least 4 seconds in order to start the snow melting system. If the RUN TIME reaches 0:00 and the external melt demand is still present, the control continues melting until the external melt demand is removed or the system is otherwise stopped.

Note: This operation only occurs if the Idle Demand / Melt Demand DIP switch is set to the Melt Demand position.

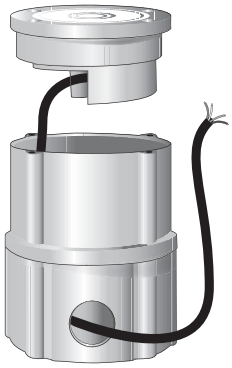




AUTOMATIC MELTING ENABLE (Snow / Ice Sensor 090)

The 664 can use the Snow / Ice Sensor 090 to provide an automatic melting enable signal to start the snow melting system. The control continually monitors the 090 for the presence of moisture. Once moisture is detected, the *Water* pointer is displayed in the LCD and the snow melting system is enabled.

Note: In addition to the Snow / Ice Sensor 090 connected to the 664, the Zone 1 item in the ADJUST menu must be set to *AUTO* in order for the automatic melting enable function to work. Therefore, if zone 1 is turned off, the 090 can not provide a melting enable signal to start the Melting mode for zone 2.



Water Detection Sensitivity (SENSTVTY)

The 664 has a *Sensitivity* setting which compensates for varying outdoor conditions which could affect how the moisture detector in the 090 interprets the presence of moisture. This adjustable setting is available through the SENSTVTY item in the ADJUST menu of the control. As snow becomes contaminated with dirt, and as the sensor itself becomes dirty, the control may incorrectly indicate the presence of water. If this condition occurs, clean the surface of the sensor and / or turn down the *SENSTVTY* setting. If the snow in your area is very clean, the *SENSTVTY* setting may need to be increased before snow is detected. If AUTO is selected, the control automatically adjusts the sensitivity level used to detect moisture.

Section D2: Snow Melting Disable

The snow melting system can be disabled manually or automatically. A melting disable signal applied to the control takes both zones out of the Melting mode. Once the snow melting system is disabled, the zone(s) operates in the Idling mode. The Idling mode allows the zone(s) to be either operated at a lower temperature or turned off.

MANUAL MELTING DISABLE

A manual melting disable signal requires the user to manually stop the snow melting system and can be provided from the ***Stop*** button on the control, Remote Start / Stop Module 039, Remote Display Module 040, or an external idle demand.

Stop Button on the Control

The ***Stop*** button on the control can be used to stop the snow melting system. The snow melting system is disabled by pressing the ***Stop*** button on the control while in the VIEW menu. Once the snow melting system is disabled, the word STOP is displayed for 5 seconds in the STATUS item of the appropriate zone while in the VIEW menu.

Remote Start / Stop Module 039

A Remote Start / Stop Module 039 can be used to stop the snow melting system. The snow melting system is disabled by pressing the button on the face of the 039. When the system is stopped, a solid red indicator light is displayed on the face of the 039 for five seconds. If the snow melting system is disabled while there is still an external melt demand for snow melting, the 039 displays a solid red indicator light until the external demand is removed.

Remote Display Module 040

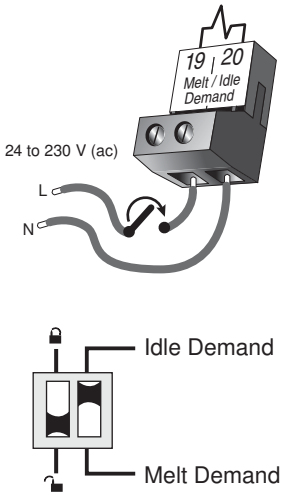
A Remote Display Module 040 can be used to stop the snow melting system. The snow melting system is disabled by pressing the ▼ button on the 040 while in the VIEW menu. Once the snow melting system is disabled, the word STOP is displayed for 5 seconds in the STATUS item of the appropriate zone while in the VIEW menu.

External Idle Demand (DIP switch set to Idle Demand)

The snow melting system is disabled when a voltage between 24 and 230 V (ac) is applied across the *Melt / Idle Demand* terminals (19 and 20). An external idle demand must be present for at least 4 seconds in order to stop the snow melting system.

Note: This operation only occurs if the Idle Demand / Melt Demand DIP switch is set to the *Idle Demand* position.

If the snow melting system is placed into Idling mode by an external idle demand, then a manual melting enable signal is applied, the idle demand is overridden until either the running time has expired, a stop signal is given, or the external idle demand is removed and reapplied.



AUTOMATIC MELTING DISABLE (Snow / Ice Sensor 090)

The Snow / Ice Sensor 090 can be used to automatically disable the snow melting system. Once the 090 is dry, the *Water* pointer turns off in the LCD. The zone 1 slab temperature has to be at least the zone 1 slab target temperature for a minimum of thirty minutes in order for zone 1 to turn off. If a manual melting disable signal is applied and the 090 is dry, the snow melting system turns off immediately.

Section E: Melting Operation

Section E1
General Melting Operation

Section E1: General Melting Operation

The Snow Detector and Melting Control 664 provides up to two zones of snow melting. In order for the snow melting system to be started, one of the methods described in Section D1 must be used. Once a melting enable signal is applied and the zone(s) is not in WWSD or the system is not in CWCO, the Melting mode begins. When the control is in the Melting mode, the *Melting* pointer is visible in the VIEW menu. The *MELT 1* and the *MELT 2* settings in the ADJUST menu sets the slab surface temperatures of zone 1 and zone 2 respectively. When the zone(s) is melting and its slab temperature is warming up to its slab target temperature, STRT is displayed in the STATUS item of the appropriate zone while in the VIEW menu. The zone(s) finishes melting when its slab temperature has been at least its slab target temperature for a period of time. This period of time is based on whether an automatic or manual melting enable signal starts the snow melting system.

If an automatic melting enable signal starts the snow melting system, DET is displayed in the STATUS item of the appropriate zone while in the VIEW menu once the slab temperature of the currently operating zone(s) reaches its slab target temperature. The currently operating zone(s) continues to melt either until the 090 becomes dry, or any additional running time has expired. Once the Melting mode is complete, the zone(s) operates in the Idling mode.

If a manual melting enable signal starts the snow melting system, the running time is displayed in the STATUS item of the appropriate zone while in the VIEW menu and begins counting down once the slab temperature of the currently operating zone(s) reaches its slab target temperature. The currently operating zone(s) continues to melt until the running time counts down to 0:00. Once the Melting mode is complete, the zone(s) operates in the Idling mode. The table on page 14 describes how the control responds to enable and disable signals.

ZONE 1 and 2 (ZONE)

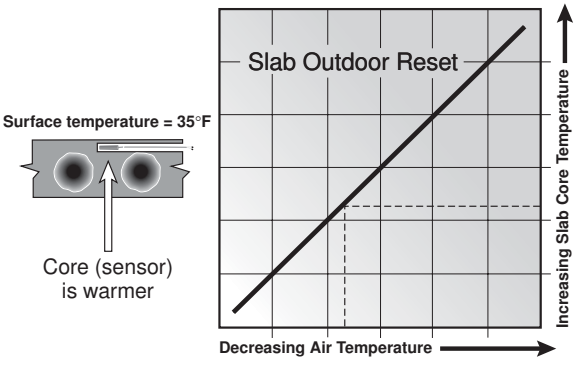
The *Zone 1* and *2* setting may be selected to AUTO or OFF. When AUTO is selected, the zone is activated and the control operates the appropriate zone. When OFF is selected, the control does not operate the zone.

SLAB TEMPERATURE CONTROL

The 664 uses a sensor in zone 1 and zone 2 to provide slab temperature control. Zone 1 has the option to use either the Snow / Ice Sensor 090 or the Slab Sensor. Zone 2 can only use the Slab Sensor.

Slab Sensor

If a Slab Sensor is used, the control assumes that the sensor is approximately 1 inch below the surface of the snow melting slab. Since this point is closer to the source of the heat, this point is warmer than the surface of the slab. Therefore, the sensor must be maintained at a higher temperature in order to ensure that the surface of the slab is maintained at the correct temperature. The amount of temperature difference between the surface of the slab and the slab sensor changes with the outdoor temperature. Therefore, the slab core temperature is increased as the outdoor air temperature drops. The temperature displayed as the slab temperature (SLAB 1 and / or SLAB 2) is the temperature of the slab sensor.



Slab Surface Temperature is Constant

Snow / Ice Sensor 090

The temperature displayed as the slab temperature (SLAB 1) is the slab temperature of zone 1. This temperature is calculated from the edge sensor and the center sensor built into the 090.

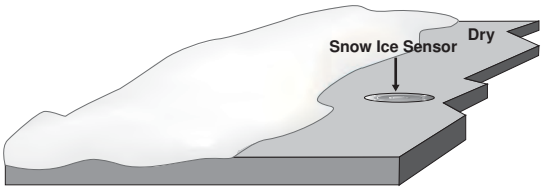
SLAB TARGET TEMPERATURE (SLB TRG)

The SLB1 TRG and the SLB2 TRG temperatures are determined from the *Melting* settings (MELT 1 and MELT 2 respectively), or *Idle* settings (IDLE 1 and IDLE 2 respectively) and the outdoor air temperature. The control displays the temperature(s) that it is currently trying to maintain at the slab sensors of zone 1 and zone 2. If the control does not presently have a requirement for heat, it displays "– – –" in the STATUS item of the appropriate zone while in the VIEW menu.

ADDITIONAL MELTING TIME (ADD MELT)

In cases where areas of the snow melting system haven't completely melted after the Melting mode has finished and the 090 is dry, the 664 has a function in which additional time can be added to melt the zone(s). This is an adjustable time through the ADD MELT item in the ADJUST menu of the control. The ADD MELT time is calculated into a running time and is displayed in the STATUS item of the appropriate zone while in the VIEW menu. Once the 090 becomes dry and the currently operating zone(s) slab temperature is at least its slab target temperature, the running time starts counting down.

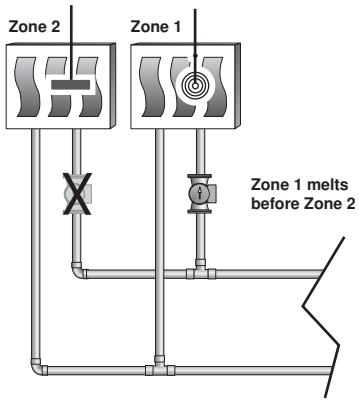
Note: This function is only available if the Snow / Ice Sensor 090 is used in zone 1.



PRIORITY OPERATION

In a multiple zone system where the zones have different heat requirements, or the total combined heat requirement of the snow melting system exceeds that of the heat source, the 664 has a function which can provide priority of zone 1 over zone 2. The 664 allows for full priority, conditional priority or no priority. This is a selectable item through the PRIORITY item in the ADJUST menu.

Note: If either *Full Priority* or *Conditional Priority* is selected, there is the potential for the non-priority zone to freeze over.



Full Priority (PRIORITY = FULL)

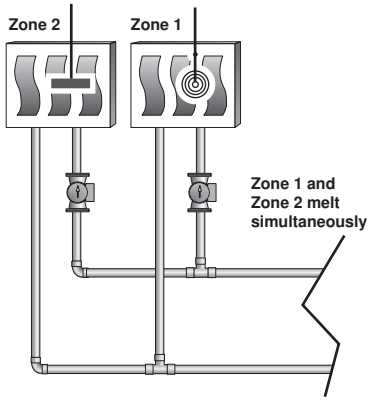
It can be selected that zone 1 has full priority over zone 2. Zone 1 begins melting first when the Melting mode is initiated. While zone 1 is melting, the control keeps track of how long zone 1 operates at its melting temperature. Once zone 1 finishes melting, the control turns off zone 1 and starts melting zone 2. Zone 2 then operates at its melting temperature for the same amount of melting time as zone 1. If at any time while zone 2 is melting and the system is restarted either manually or automatically, the control turns off zone 2 and begins melting zone 1. If the slab temperature of zone 2 is warm enough when the system is restarted, the control provides any extra heat to zone 2 that zone 1 is not using. If the slab temperature of zone 2 is not warm enough when the system is restarted, the control only provides heat to zone 1. Zone 2 then only receives heat when zone 1 finishes melting.

Conditional Priority (PRIORITY = COND)

It can be selected that zone 1 has conditional priority over zone 2. Zone 1 begins melting first when the Melting mode is initiated. While zone 1 is melting and up to temperature, the control provides any extra heat to zone 2 that zone 1 is not using. While zone 1 is melting, the control keeps track of how long zone 1 operates at its melting temperature. Once zone 1 finishes melting, the control turns off zone 1 and provides all available heat to zone 2. Zone 2 then operates at its melting temperature for the same amount of melting time as zone 1. If at any time while zone 2 is melting and the system is restarted either automatically or manually, the control turns off zone 2 and begins melting zone 1 again. The control then operates zone 1 and zone 2 as described above.

NON-PRIORITY OPERATION (PRIORITY = NONE)

If the PRIORITY item is set to *NONE*, zone 1 and zone 2 begin melting simultaneously when the Melting mode is initiated. The 664 operates based on the mixing fluid temperature requirement of each zone. The mixing target temperature is calculated for the zone with the highest heat requirement, and that zone output runs continuously. The zone output with the lower heat requirement is cycled using Pulse Width Modulation (PWM) with a 20 minute cycle length.



Section F: Idling Operation

Section F1
General Idling Operation

Section F2
Temporary Idle

Section F1: General Idling Operation

When the snow melting system starts from a cold temperature, the time required for the zone(s) to reach its melting temperature may be excessive. To decrease this start up time, the 664 has an idling feature which can maintain the zone(s) at a lower temperature. This feature is also useful for preventing frost and light ice formation. The *IDLE 1* and the *IDLE 2* settings in the ADJUST menu sets the slab surface temperatures of zone 1 and zone 2 respectively while the control is in the Idling mode. When in the Idling mode, IDLE 1 and / or IDLE 2 is displayed in the STATUS item of the appropriate zone while in the VIEW menu. If idling is not desirable, the *IDLE 1* and / or *IDLE 2* settings may be set to *OFF*.

IDLING WITHOUT PRIORITY

If the PRIORITY item is set to *NONE*, both zone 1 and zone 2 can utilize the idling feature.

IDLING WITH PRIORITY

If the PRIORITY item is set to *COND* or *FULL*, only zone 1 can utilize the idling feature. Therefore, the IDLE 2 item in the ADJUST menu is not available.

Section F2: Temporary Idle (TMPY IDL)

The temporary idle allows the control to enter the idle state for a set amount of time. If the snow ice detector does not detect snow during the temporary idle period, the control then leaves the idle state and returns to the OFF state. This is useful in applications where there is the possibility of snow and the slab can be pre-heated in order to have a short heat up time if snow is detected.

To enable a temporary idle, the *Temporary Idle* setting in the ADJUST menu must be set from OFF to the length of the temporary idle. The DIP Switch must be set to IDLE DEMAND and the IDLE 1 or IDLE 2 settings must be set to a temperature. To activate a temporary idle, a voltage between 24 and 240 V (ac) must be applied across the *Melt/Idle Demand* terminals for at least 4 seconds.

When a *Temporary Idle time* is selected, the control has three available states: OFF, Temporary Idle, and Melting. The table below describes the action of the control:

Control State	Action	Result
OFF	External Idle Demand	Temporary Idle
OFF	Manual or Auto Melt Start	Melting
Melting	External Idle Demand	Melting
Melting	Manual or Auto Melt Start	Melting
Melting	Manual or Auto Melt Stop	OFF
Temporary Idle	Temporary Idle Expires	OFF
Temporary Idle	Manual or Auto Melt Start	Melting
Temporary Idle	Manual Melt Stop	OFF

Installation

CAUTION

Improper installation and operation of this control could result in damage to the equipment and possibly even personal injury. It is your responsibility to ensure that this control is safely installed to all applicable codes and standards. This electronic control is not intended for use as a primary limit control. Other controls that are intended and certified as safety limits must be placed into the control circuit. Do not open the control. Refer to qualified personnel for servicing. Opening voids warranty and can result in damage to the equipment and possibly even personal injury.

STEP ONE — GETTING READY

Check the contents of this package. If any of the contents listed are missing or damaged, please contact your wholesaler or tekmar sales representative for assistance.

Type 664 includes: One Snow Detector and Melting Control 664, One Outdoor Sensor 070, Three Universal Sensors 082, Data Brochures D 664, D 070, D 001, User Brochure U 664, Application Brochure A 664, Essay E 021.

Note: Carefully read the details of the Sequence of Operation to ensure that you have chosen the proper control for your application.

STEP TWO — MOUNTING THE BASE

Remove the control from its base by pressing down on the release clip in the wiring chamber and sliding the control away from it. The base is then mounted in accordance with the instructions in the Data Brochure D 001.

STEP THREE — ROUGH-IN WIRING

All electrical wiring terminates in the control base wiring chamber. The base has standard 7/8" (22 mm) knockouts which accept common wiring hardware and conduit fittings. Before removing the knockouts, check the wiring diagram and select those sections of the chamber with common voltages. Do not allow the wiring to cross between sections as the wires will interfere with safety dividers which should be installed at a later time.

- Power must not be applied to any of the wires during the rough-in wiring stage.
- All wires are to be stripped to a length of 3/8" (9mm) to ensure proper connection to the control.
- Install the Outdoor Sensor 070, Boiler Sensor 082 and Mixing Sensor(s) 082 according to the installation instructions in the Data Brochure D 070 and run the wiring back to the control.
- Install the Snow / Ice Sensor 090 according to the installation instructions in the Data Brochure D 090 and run the wiring back to the control. See Data Brochure D 090 for very important details on sensor location and installation.
- If a Slab Sensor is used, install the slab sensor according to the installation instructions in the Data Brochure D 079 and run the wiring back to the control. See page 12 for very important details on sensor location and installation.
- If a Remote Display Module (RDM) 040 is used, install the RDM according to the installation instructions in the Data Brochure D 040 and run the wiring back to the control.
- If a Remote Start / Stop Module 039 is used, install the module according to the installation instructions in the Data Brochure D 039 and run the wiring back to the control.
- Run wire from other system components (pumps, boiler, etc.) to the control.
- Run wires from the 115 V (ac) power to the control. Use a clean power source with a minimum 15 A circuit to ensure proper operation. Multi-strand 16 AWG wire is recommended for all 115 V (ac) wiring due to its superior flexibility and ease of installation into the terminals.

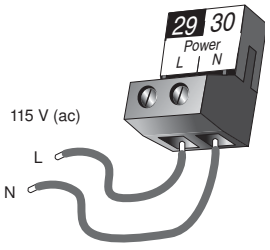
STEP FOUR — ELECTRICAL CONNECTIONS TO THE CONTROL

The installer should test to confirm that no voltage is present at any of the wires. Push the control into the base and slide it down until it snaps firmly into place.

⚠ *Powered Input Connections*

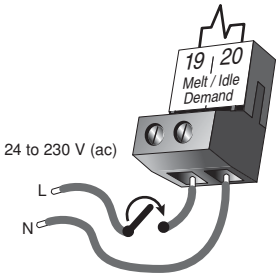
115 V (ac) Power

Connect the 115 V (ac) power supply to the *Power L* and *Power N* terminals (29 and 30). This connection provides power to the microprocessor and display of the control. As well, this connection provides power to the *Sys P1* terminal (28) from the *Power L* terminal (29).



Melt / Idle Demand

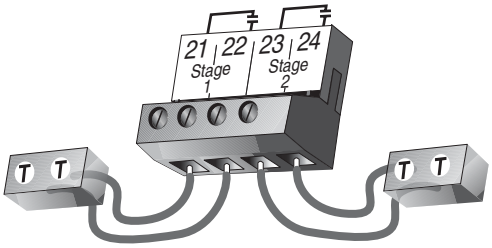
To generate a melt demand or idle demand, a voltage between 24 V (ac) and 230 V (ac) must be applied across the *Melt / Idle Demand* terminals (19 and 20).



⚠ *Output Connections*

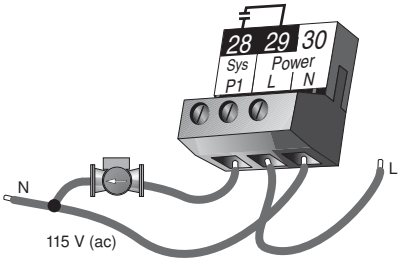
Boiler Contacts

The *Stage 1* and *Stage 2* terminals (21, 22 and 23, 24) are isolated outputs in the 664. There is no power available on these terminals from the control. These terminals are used as a switch to either make or break the boiler circuit. When the 664 requires the boiler(s) to fire, it closes the contact between terminals 21 and 22 and / or 23 and 24.



System Pump Contact (Sys P1)

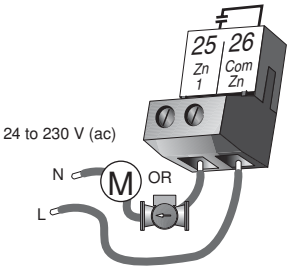
The *Sys P1* output terminal (28) on the 664 is a powered output. When the relay in the 664 closes, 115 V (ac) is provided to the *Sys P1* terminal (28) from the *Power L* terminal (29). To operate the system pump, connect one side of the system pump circuit to terminal 28 and the second side of the pump circuit to the neutral (N) side of the 115 V (ac) power supply.



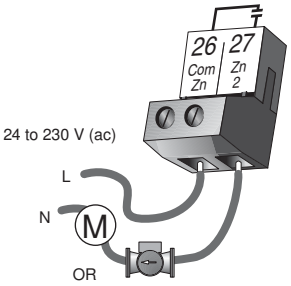
Zone Pumps and Zone Valves

The zoning outputs are isolated terminals in the 664. There is no power available on these terminals from the control.

If zone 1 is used, connect the zone pump or zone valve circuit to the *Com Zn* and *Zn 1* terminals (26 and 25).



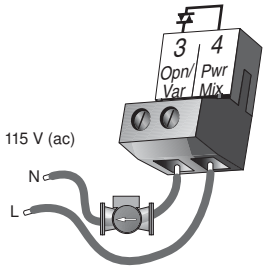
If zone 2 is used, connect the zone pump or zone valve circuit to the *Com Zn* and *Zn 2* terminals (26 and 27).



Variable Speed Injection Pump

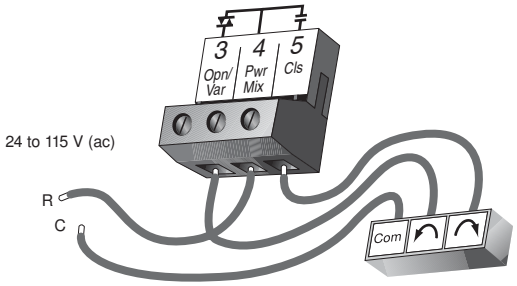
The 664 can vary the speed of a permanent capacitor, impedance protected or equivalent pump motor that has a locked rotor current of less than 2.4 A. Most small wet rotor circulators are suitable as described in Essay E 021. The 664 has an internal overload fuse which is rated at 2.5 A 250 V (ac). Contact your tekmar sales representative for details on the repair procedures if the fuse is blown.

If a variable speed injection pump is used, connect one of the wires from the variable speed injection pump to the *Opn / Var* terminal (3) on the 664. Connect the *Pwr Mix* terminal (4) to the live (L) side of the 115 V (ac) power source. The other wire on the variable speed injection pump must be connected to the neutral (N) side of the 115 V (ac) power supply.



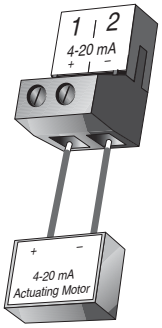
Mixing Valve Actuator

If a mixing valve is used, connect one side of the 24 V (ac) power to the *Pwr Mix* terminal (4) on the control. The output relay *Opn / Var* (3) is then connected to the open terminal of the actuating motor and the output relay Cls (5) is connected to the close terminal of the actuating motor. Connect the second side of the 24 V (ac) circuit to the common terminal of the actuating motor.

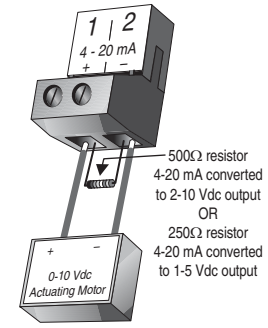


4-20 mA Device

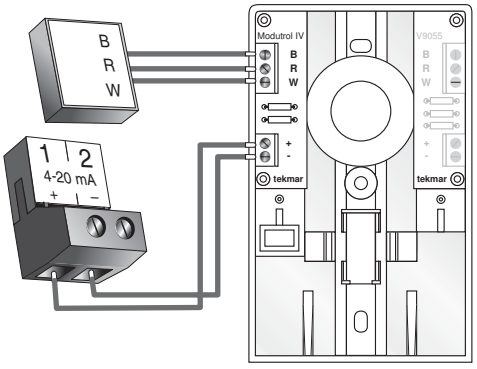
If a 4-20 mA device is used, connect the positive 4-20 mA lead to the *4-20 mA +* terminal (1) and the negative 4–20 mA lead to the *4-20 mA –* terminal (2). Maximum resistance allowed in the 4-20 mA circuit is 1000 Ω. The 4-20 mA output can be converted to either a 2-10 V (dc) or 1-5 V (dc) output by connecting resistor(s). A 0-135 Ω Converter 005 can be used to convert the 4-20 mA signal to 0-135 Ω.



Connection to Operate a 4 - 20 mA Device



Converting the 4-20 mA Output to Operate a 1-5 Vdc or 2-10 Vdc Device



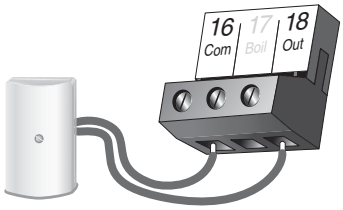
Converting the 4-20 mA Output to Operate a 0-135 Ω Actuating Motor

⚠ *Sensor and Unpowered Input Connections*

Do not apply power to these terminals as this will damage the control.

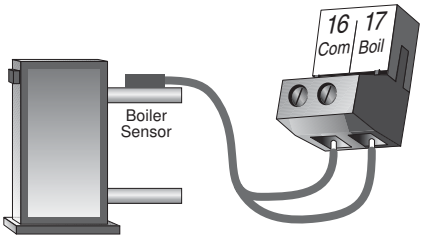
Outdoor Sensor

Connect the two wires from the Outdoor Sensor 070 to the *Com* and *Out* terminals (16 and 18). The outdoor sensor is used by the 664 to measure the outdoor air temperature.



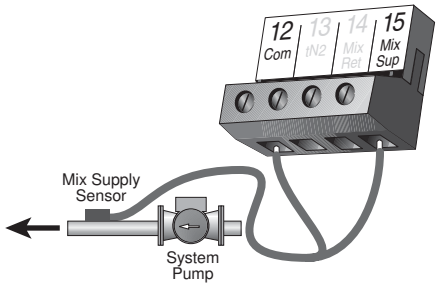
Boiler Sensor

Connect the two wires from the Boiler Sensor 082 to the *Com* and *Boil* terminals (16 and 17). The boiler sensor is used by the 664 to measure the water temperature of the boiler.



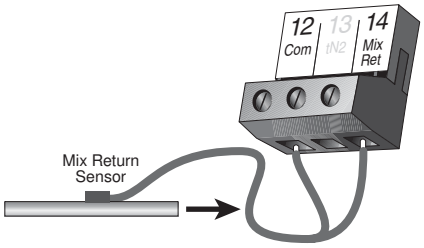
Mixing Supply Sensor

Connect the two wires from the Mixing Supply Sensor 082 to the *Com* and *Mix Sup* terminals (12 and 15). The mixing supply sensor is used by the 664 to measure the fluid supply temperature after the mixing device. Normally the sensor is attached downstream of the mixing pump.



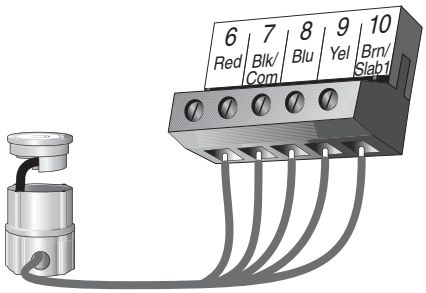
Mixing Return Sensor

Connect the two wires from the Mixing Return Sensor 082 to the *Com* and *Mix Ret* terminals (12 and 14). The mixing return sensor is used by the 664 to measure the fluid return temperature from the snow melting slab.



EITHER: Snow / Ice Sensor 090 (Zone 1)

If a Snow / Ice Sensor 090 is used, connect the red wire from the sensor cable to the *Red* terminal (6), connect the black wire from the sensor cable to the *Blk / Com* terminal (7), connect the blue wire from the sensor cable to the *Blu* terminal (8), connect the yellow wire from the sensor cable to the *Yel* terminal (9) and connect the brown wire from the sensor cable to the *Brn / Slab1* terminal (10). The snow / ice sensor is used by the 664 to measure the slab surface temperature of zone 1. This sensor must be installed flush with the slab surface and 1/2 way between the heating pipes. See Data Brochure D 090 for installation instructions regarding the Snow / Ice Sensor 090 and Sensor Socket 091.

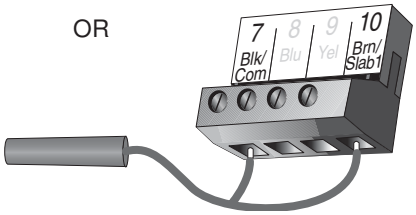


OR: Slab Sensor (Zone 1)

If a Snow / Ice Sensor 090 is not used for zone 1, a slab sensor can be used. If a slab sensor is used, connect the two wires from the slab sensor to the *Blk / Com and Brn / SLAB 1* terminals (7 and 10). The slab sensor is used by the 664 to measure the slab temperature of zone 1.

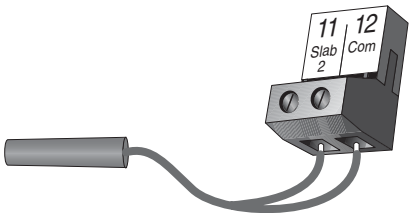
Note: Proper sensor placement is critical for correct operation of the 664 control. The slab sensor must be installed 1/2 way between the heating pipes and 1'' (25 mm) below the surface of the slab. Although the sensor can be installed directly into the slab, we recommend that the sensor be installed in tubing or conduit in such a manner that the sensor can be removed and replaced in case of failure.

OR



Slab Sensor *(Zone 2)*

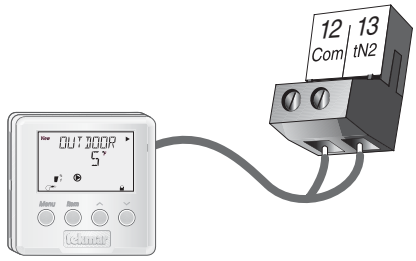
If a slab sensor is used, connect the two wires from the slab sensor to the *Slab 2* and *Com* terminals (11 and 12). The slab sensor is used by the 664 to measure the slab temperature of zone 2.



tekmar Net™ (tN2) Device

A Remote Display Module (RDM) 040 or Remote Start / Stop Module 039 can be connected to the tekmar Net™ (tN2) input. Connect the *Com* terminal from the appropriate tN2 device to the *Com* terminal (12) on the 664. Connect the *tN2* terminal from the appropriate tN2 device to the *tN2* terminal (13) on the 664.

Note: The wires from the RDM and Remote Start / Stop Module are polarity sensitive. The tN2 device does not operate correctly if the wires are reversed.



STEP FIVE — TESTING THE WIRING

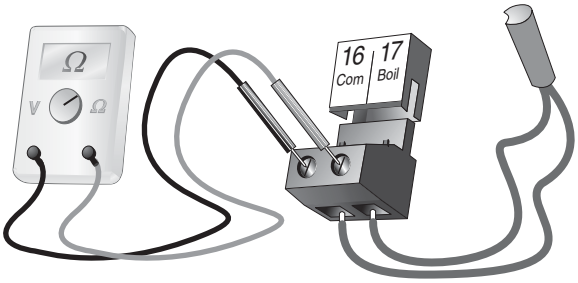
Each terminal block must be unplugged from its header on the control before power is applied for testing. To remove the terminal block, pull straight down from the control.

The following tests are to be performed using standard testing practices and procedures and should only be carried out by properly trained and experienced persons.

A good quality electrical test meter, capable of reading from at least 0 – 300 V (ac) and at least 0 – 2,000,000 Ω, is essential to properly test the wiring and sensors.

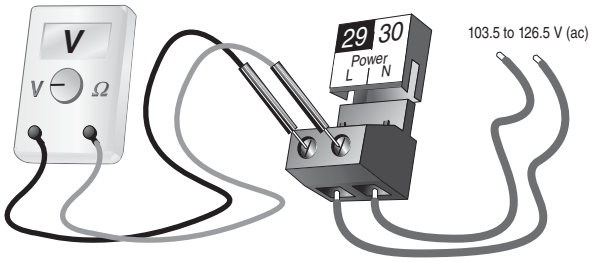
⚠ *Test The Sensors*

In order to test the sensors, the actual temperature at each sensor location must be measured. A good quality digital thermometer with a surface temperature probe is recommended for ease of use and accuracy. Where a digital thermometer is not available, a spare sensor can be strapped alongside the one to be tested and the readings compared. Test the sensors according to the instructions in the Data Brochure D 070.



⚠ *Test The Power Supply*

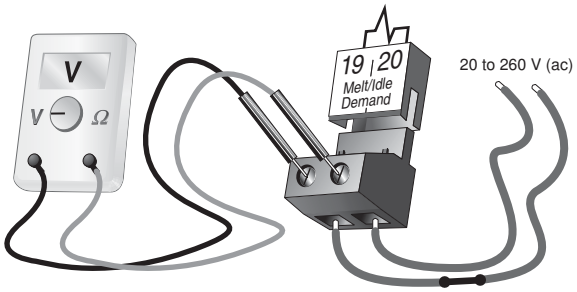
Make sure exposed wires and bare terminals are not in contact with other wires or grounded surfaces. Turn on the power and measure the voltage between the *Power L* and *Power N* terminals (29 and 30) using an AC voltmeter, the reading should be between 103.5 and 126.5 V (ac).



⚠ *Test The Powered Inputs*

Melt / Idle Demand

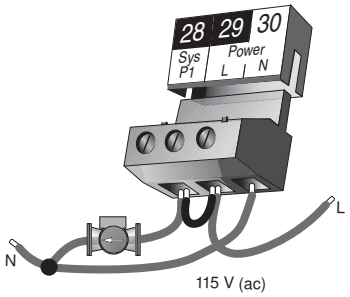
If a melt / idle demand is used, measure the voltage between the *Melt / Idle Demand* terminals (19 and 20). When the melting or idling device calls for heat, you should measure between 20 and 260 V (ac) at the terminals. When the melting or idling device is off, you should measure less than 5 V (ac).



⚠ *Test The Outputs*

System Pump (Sys P1)

If a system pump is connected to the *Sys P1* terminal (28), make sure that power to the terminal block is off and install a jumper between the *Sys P1* and *Power L* terminals (28 and 29). When power is applied to the *Power L* and *Power N* terminals (29 and 30), the system pump should start. If the pump does not turn on, check the wiring between the terminal block and pump and refer to any installation or troubleshooting information supplied with the pump. If the pump operates properly, disconnect the power and remove the jumper.



Zone Pump or Zone Valve

If a zone pump or zone valve is connected to the *Com Zn* and *Zn 1* terminals (26 and 25), make sure power to the pump or valve circuit is off and install a jumper between the *Com Zn* and *Zn 1* terminals (26 and 25). When the circuit is powered up, the zone pump should turn on or the valve should open completely. If no response occurs, check the wiring between the terminal and the pump or valve and refer to any installation or troubleshooting information supplied with these devices. If a zone pump or zone valve is connected to the *Com Zn* and *Zn 2* terminals (26 and 27), follow a similar procedure as described for the zone 1 relay.

Stage 1 and 2

If the boiler circuit is connected to the *Stage 1* terminals (21 and 22) and / or *Stage 2* terminals (23 and 24), make sure power to the boiler circuit is off, and install a jumper between the terminals. When the boiler circuit is powered up, the boiler should fire. If the boiler does not turn on, refer to any installation or troubleshooting information supplied with the boiler. (The boiler may have a flow switch that prevents firing until the boiler pump is running). If the boiler operates properly, disconnect the power and remove the jumper.

Variable Speed Injection Pump

If a variable speed injection pump circuit is connected to the *Pwr Mix* and *Opn / Var* terminals (4 and 3), make sure the power to the terminal block is off and install a jumper between the *Pwr Mix* and *Opn / Var* terminals (4 and 3). When the variable speed pump circuit is powered up, the variable speed pump should operate at full speed. If the pump does not operate, check the wiring between the terminal block and the pump and refer to any installation or troubleshooting information supplied with the pump. If the pump operates properly, disconnect the power and remove the jumper.

Mixing Valve Actuator

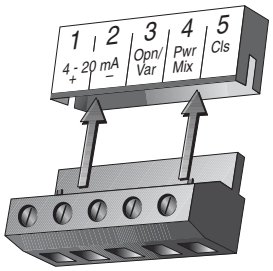
If a floating action actuating motor circuit is connected to the *Pwr Mix, Opn / Var* and *Cls* terminals (4, 3 and 5), make sure power to the motor circuit is off and install a jumper between the *Pwr Mix* and *Opn / Var* terminals (4 and 3). When the circuit is powered up, the actuator should move in the opening direction. If it does not, check the wiring between the terminals and the actuating motor. Refer to any installation or troubleshooting information supplied with the motor. If the motor closes instead of opening, the wiring of the actuating motor must be reversed. If the valve opens correctly, turn off the power to the circuit and remove the jumper. Install a jumper between the *Pwr Mix* and *Cls* terminals (4 and 5). When the circuit is powered up, the actuator should move in the closing direction. If it does not, check the wiring between the terminals and the actuating motor. Refer to any installation or troubleshooting information supplied with the motor. If the motor closes correctly, turn off the power to the circuit and remove the jumper.

4–20 mA Device

The *4–20 mA* output terminals (1 and 2) can not be tested without power applied to the control. Since no power is supplied to the control at this point, the 4–20 mA output cannot be tested. Please refer to the operation test below.

⚠ *Connecting The Control*

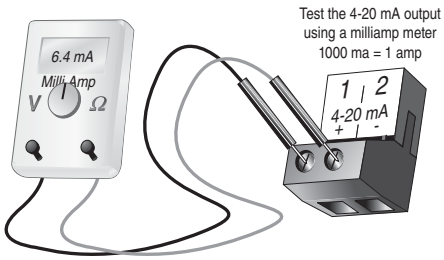
Make sure all power to the devices and terminal blocks is off, and remove any remaining jumpers from the terminals. Reconnect the terminal blocks to the control by carefully aligning them with their respective headers on the control, and then pushing the terminal blocks into the headers. The terminal blocks should snap firmly into place. Install the supplied safety dividers between the unpowered sensor inputs and the powered wiring chambers. Apply power to the control. The operation of the control on power up is described in the Sequence of Operation section of the brochure.



⚠ *Test the 4-20 mA Output*

If a 4-20 mA device is used, connect an ammeter to the *4-20 mA* output terminals (1 and 2) and observe the current reading during operation. When the 4-20 mA modulation increases, the initial percentage output is zero and the meter should read 4 mA. As the % Output increases, the meter reading should increase until 100% Output is reached at which point the meter should read 20 mA. When the 4-20 mA modulation decreases, the meter should start at 20 mA and eventually reach 4 mA when the display shows 0% Output.

Note: The 4-20 mA output can only be tested if 4-20 is selected in the Mixing item of the ADJUST menu.



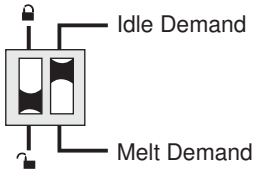
Cleaning

The control's exterior can be cleaned using a damp cloth. Moisten cloth with water and wring out prior to wiping control. Do no use solvents or cleaning solutions.

DIP Switch Settings

The DIP switch settings on the control are very important and should be set to the appropriate settings prior to making an adjustments to the control through the User Interface. The DIP switch settings change the items that are available to be viewed and / or adjusted in the User Interface.

If a DIP switch is changed while the control is powered up, the control responds to the change in setting by returning the display to the VIEW menu. This is true for all the DIP switches except for the Lock / Unlock DIP switch.



LOCK / UNLOCK (FACTORY SETTING IS UNLOCK)

The Lock / Unlock DIP switch is used to lock and unlock the access level of the control and tekmar Net™ tN2 device. Once locked, access levels can not be changed. To determine if the control is currently locked or unlocked, a small segment representing a padlock is viewed in the bottom right hand corner of the display. When the padlock is closed, the access level cannot be changed.

To change the access level, set the DIP switch to the unlocked, or down position. The current access level of the control or tekmar Net™ tN2 device is viewed in its Miscellaneous (*Misc*) menu. While viewing the access level, use the ▲ and ▼ keys to select between the Limited (LTD), User (USER), Installer (INST) or Advanced (ADV) access levels.

To lock the access level, select the appropriate access level in the Miscellaneous (Misc) and move the DIP switch from the unlocked position to the locked position. As long as the DIP switch is in the locked position, the access level of the control or tekmar Net™ tN2 device can no longer be viewed or adjusted in its Miscellaneous (*Misc*) menu.

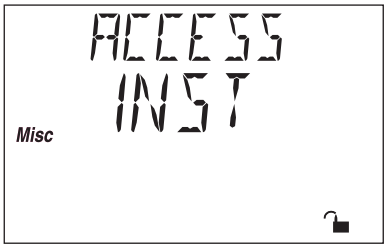
IDLE DEMAND / MELT DEMAND (FACTORY SETTING IS MELT DEMAND)

The Idle Demand / Melt Demand DIP switch is used for melting and idling operation. The position of the DIP switch determines what the *Melt / Idle Demand* terminals (19 and 20) are used for. When the DIP switch is set to the *Melt Demand* position, the *Melt / Idle Demand* terminals (19 and 20) are used to place the snow melting system into Melting mode. When the DIP switch is set to the Idle Demand position, the *Melt / Idle Demand* terminals (19 and 20) are used to force the snow melting system into Idling mode.

Access Levels

The tekmar Snow Detector and Melting Control 664 comes with four *Access Level* settings. These Access Levels restrict the number of Menus, Items and Adjustments that can be accessed by the user. The four access levels are Limited (LTD), User (USER), Installer (INST) and Advanced (ADV).

The access level of the control is found in the Miscellaneous (*Misc*) menu when the Lock / Unlock DIP switch is set to the *Unlocked* position. In the Advanced access level, all of the control settings are available to the user. In the User access level, only a few of the menus and items are available. The Limited access level is the most restricted of them all. The control's factory setting is *Installer* (INST). This access level is sufficient for the normal set up of the control. Once the control is set up, the appropriate access level should be selected for the people that deal with the control on a regular basis.



Item Field	Section	Access Level: LTD	USER	INST	ADV	Description	Range
OUTDOOR		●	●	●	●	**Outdoor** Current outdoor air temperature as measured by the outdoor sensor.	-67 to 149°F (-55 to 65°C)
SLB1 TRG	E1			●	●	**Slab 1 Target** Slab sensor target temperature of zone 1. **ZONE 1 = AUTO**	– – –, -58 to 167°F (– – –, -50 to 75°C)
SLAB 1	E1		●	●	●	**Slab 1** Current slab sensor temperature of zone 1. **ZONE 1 = AUTO**	-58 to 167°F (-50 to 75°C)
STATUS 1	B1	●	●	●	●	**Status 1** Operating status of Zone 1.	STRT, STOP, IDLE, EXT, 0:00 to 23:59 hr, – – –, INF, WWSD, CWCO, DET, IDLE
SLB2 TRG	E1			●	●	**Slab 2 Target** Slab sensor target temperature of zone 2. **ZONE 2 = AUTO**	– – –, -58 to 167°F (– – –, -50 to 75°C)
SLAB 2	E1		●	●	●	**Slab 2** Current slab sensor temperature of zone 2. **ZONE 2 = AUTO**	-58 to 167°F (-50 to 75°C)
STATUS 2	B1	●	●	●	●	**Status 2** Operating status of zone 2.	STRT, STOP, IDLE, EXT, 0:00 to 23:59 hr, – – –, INF, WWSD, CWCO, DET, IDLE
MIX TRG	A				●	**Mix Target** The current mix target temperature as calculated by the control.	– – –, -25 to 248°F (– – –, -32 to 120°C)
MIX SUP	B1		●	●	●	**Mix Supply** Current mixed supply water temperature as measured by the mixing supply sensor.	-31 to 266°F (-35 to 130°C)
MIX RET	B1		●	●	●	**Mix Return** Current mixed return water temperature as measured by the mixing return sensor. **Mix Ret Sensor present**	-31 to 266°F (-35 to 130°C)
ΔT	B1			●	●	**ΔT** Current mixed ΔT difference between the mixed supply sensor and the mixed return sensor. **ΔT MAX ≠ OFF**	-85 to 170°F (-47 to 94°C)

664 **View** Menu (2 of 2)

Item Field	Section	Access Level: LTD	Access Level: USER	Access Level: INST	Access Level: ADV	Description	Range
Boil SUP	A C1		●	●	●	**Boil Supply** Current boiler supply water temperature as measured by the boiler sensor. **Boil SENS = SUP**	-31 to 266°F (-35 to 130°C)
Boil RET	A C2		●	●	●	**Boil Return** Current boiler return water temperature as measured by the boiler sensor. **Boil SENS = RET**	-31 to 266°F (-35 to 130°C)

664 **Adjust** Menu (1 of 3)

Item Field	Section	Access Level: LTD	Access Level: USER	Access Level: INST	Access Level: ADV	Description	Range	Actual Setting
RUN TIME	B1	●	●	●	●	**Run Time** The time for which a zone is operated once it has reached its melting temperature. This item cannot be viewed if a Remote Start / Stop Module 039 has been connected.	0:30 to 17:00 hr, INF (Infinity) Default = 4:00 hr	
ADD MELT	E1				●	**Add Melt** The additional time for which a zone is operated once the Snow / Ice Sensor 090 becomes dry. **090** is present	0:00 to 6:00 hr Default = 0:30 hr	
SENSTVTY	D1		●	●	●	**Sensitivity** Sensitivity of water detection of the Snow / Ice Sensor 090. **090** is present	AUTO, 20 to 80% Default = AUTO	
ZONE 1	E1			●	●	**Zone 1** Selects zone 1 as operational or not.	OFF, AUTO Default = AUTO	
MELT 1	E1		●	●	●	**Melt 1** The desired slab surface temperature of zone 1 while in the Melting mode. **Zone 1 = AUTO**	32 to 95°F (0 to 35°C) Default = 36°F (2°C)	
IDLE 1	F1			●	●	**Idle 1** The desired slab surface temperature of zone 1 while in the Idling mode. **Zone 1 = AUTO**	OFF, 20 to 95°F (OFF, -7 to 35°C) Default = OFF	
ZONE 2	E1			●	●	**Zone 2** Selects zone 2 as operational or not.	OFF, AUTO Default = OFF	

Item Field	Section	Access Level: LTD	USER	INST	ADV	Description	Range	Actual Setting
MELT 2	E1		●	●	●	**Melt 2** The desired slab surface temperature of zone 2 while in the Melting mode. **Zone 2 = AUTO**	32 to 95°F (0 to 35°C) Default = 36°F (2°C)	
IDLE 2	F1			●	●	**Idle 2** The desired slab surface temperature of zone 2 while in the Idling Mode. **Zone 2 = AUTO, PRIORITY = NONE**	OFF, 20 to 95°F (OFF, -7 to 35°C) Default = OFF	
TMPY IDL					●	**Temporary Idle** Time for which the temporary idle is active.	OFF, 0:30 to 40:00 hr Default = OFF	
WWSD	B			●	●	**WWSD** Warm Weather Shut Down. Slab must exceed 34°F to enter WWSD.	AUTO, 32 to 95°F (AUTO, 0 to 36°C) Default = AUTO	
CWCO	B1			●	●	**CWCO** The Cold Weather Cut Out temperature for the snow melting system.	OFF, -30 to 50°F (OFF, -34 to 10°C) Default = 10°F (-12°C)	
PRIORITY	E1			●	●	**Priority** Selects priority of zone 1 over zone 2. **ΔT MAX = OFF**	NONE, COND, FULL Default = COND	
PRIORITY	E1			●	●	**Priority** Selects priority of zone 1 over zone 2. **ΔT MAX ≠ OFF**	COND, FULL Default = COND	
MIX MAX	A			●	●	**Mix Maximum** The maximum supply water temperature for the mixing system.	80 to 210°F, OFF (27 to 99°C, OFF) Default = 150°F (66°C)	
MIXING	A			●	●	**Mixing** The type of mixing device that is to be used.	FLOT (Floating), VAR (Variable Speed), 4 – 20 (4-20 mA) Default = VAR	
MOTR SPD	A			●	●	**Motor Speed** The time the actuating motor requires to operate from fully closed to fully open. **MIXING = FLOT or MIXING = 4 – 20**	30 to 230 seconds Default = 150 sec	
Boil SENS	C			●	●	**Boiler Sensor** The location of the boiler sensor. This affects operation of the *Boiler* contact.	SUP, RET, NONE Default = SUP	

664 **Adjust** Menu (3 of 3)

Item Field	Section	Access Level: LTD	USER	INST	ADV	Description	Range	Actual Setting
ΔT MAX	B1			●	●	**ΔT Maximum** The maximum ΔT for the snow melting system. **PRIORITY ≠ NONE**	10 to 70°F, OFF (5 to 39°C, OFF) Default = OFF	
DIFF	C1				●	**Differential** The differential for the snow melting system. **Boil SENS = SUP**	AUTO, 2 to 42°F (AUTO, 1 to 23°C) Default = AUTO	
Boil MIN	A C1			●	●	**Boiler Minimum** The minimum temperature allowed for the boiler target temperature. **Boil SENS ≠ NONE**	OFF, 80 to 180°F (OFF, 27 to 82°C) Default = 140° (60°C)	
FIRE DLY	C1			●	●	**Fire Delay** The time delay the control can expect between the time the *Boiler* contact closes and the boiler fires. **Boil SENS = SUP**	0:00 to 3:00 minutes Default = 0:10 min	
Boil MASS	C1			●	●	**Boiler Mass** The thermal mass characteristics of the boiler(s) that is being used. **Boil SENS = SUP**	LITE, MED, HEVY Default = MED	
STAGE 1	C1		●	●	●	**Stage 1** Selects stage 1 as operational or not. **Boil SENS = SUP**	AUTO, OFF Default = AUTO	
STAGE 2	C1		●	●	●	**Stage 2** Selects Stage 2 as operational or not. **Boil SENS = SUP**	AUTO, OFF Default = OFF	
ROTATE	C1			●	●	**Rotate** Sets the rotation time for the stages. This item is used by the Equal Run Time Rotation function. **Boil SENS = SUP**	10 to 72 hours, OFF Default = 48 hr	
EXERCISE	A				●	**Exercise** The frequency with which the control exercises the pumps and valves that are operated by the control.	30 to 240 hours, (in 10 hour steps) Default = 70 hr	

664 **Monitor** Menu (1 of 2)

Note: To clear the recorded information in the specific item field, press and hold ▲ and ▼.

Item Field	Access Level LTD	USER	INST	ADV	Description	Range
OUT HI	•	•	•	•	**Outdoor High** The highest recorded outdoor air temperature since this item was last cleared.	-85 to 170°F (-65 to 77°C)
OUT LO	•	•	•	•	**Outdoor Low** The lowest recorded outdoor air temperature since this item was last cleared.	-85 to 170°F (-65 to 77°C)
SLAB 1 HI		•	•	•	**Slab 1 High** The highest recorded temperature at the slab sensor of zone 1 since this item was last cleared. **Zone 1 = Auto**	-85 to 170°F (-65 to 77°C)
SLAB 1 LO		•	•	•	**Slab 1 Low** The lowest recorded temperature at the slab sensor of zone 1 since this item was last cleared. **Zone 1 = Auto**	-85 to 170°F (-65 to 77°C)
SLAB2 HI		•	•	•	**Slab 2 High** The highest recorded temperature at the slab sensor of zone 2 since this item was last cleared. **Zone 2 = Auto**	-85 to 170°F (-65 to 77°C)
SLAB2 LO		•	•	•	**Slab 2 Low** The lowest recorded temperature at the slab sensor of zone 2 since this item was last cleared. **Zone 2 = Auto**	-85 to 170°F (-65 to 77°C)
MIX HI			•	•	**Mix High** The highest recorded temperature at the mixing supply sensor since this item was last cleared.	-25 to 230°F (-32 to 110°C)
MIX LO			•	•	**Mix Low** The lowest recorded temperature at the mixing supply sensor since this item was last cleared.	-25 to 230°F (-32 to 110°C)
ZN1 P/V			•	•	**Zone 1 Pump or Valve** The total number of zone 1 pump or valve running hours since this item was last cleared. **Zone 1 = Auto**	0 to 9999 hr
ZN2 P/V			•	•	**Zone 2 Pump or Valve** The total number of zone 2 pump or valve running hours since this item was last cleared. **Zone 2 = Auto**	0 to 9999 hr
SYS PUMP			•	•	**System Pump** The total number of system pump (Sys P1) running hours since this item was last cleared.	0 to 9999 hr

664 **Monitor** Menu (2 of 2)

Note: To clear the recorded information in the specific item field, press and hold ▲ and ▼.

Item Field	Access Level LTD	USER	INST	ADV	Description	Range
B1 FIRE			•	•	**Boiler 1 Fire** The total number of running hours for Stage 1 since this item was last cleared. This total time does not include the Fire Dly time set in the ADJUST menu. **Boil SENS = SUP**	0 to 9999 hr
B1 CYCLE				•	**Boiler 1 Cycle** The total number of firing cycles that Stage 1 has had since this item was last cleared. This item can be used in conjunction with the B1 Fire item to determine the average cycle length of Stage 1. If the cycle length is too short, a larger differential will allow for a longer cycle length. **Boil SENS = SUP**	0 to 9999 hr
B2 FIRE			•	•	**Boiler 2 Fire** The total number of running hours for Stage 2 since this item was last cleared. This total time does not include the Fire Dly time set in the ADJUST menu **Boil SENS = SUP**	0 to 9999 hr
B2 CYCLE				•	**Boiler 2 Cycle** The total number of firing cycles that Stage 2 has had since this item was last cleared. This item can be used in conjunction with the B2 Fire item to determine the average cycle length of Stage 2. **Boil SENS = SUP**	0 to 9999 hr
Boil HI			•	•	**Boiler High** The highest temperature recorded at the boiler sensor since this item was last cleared. **Boil SENS ≠ NONE**	-25 to 230°F (-32 to 110°C)
Boil LO			•	•	**Boiler Low** The lowest temperature recorded at the boiler sensor since this item was last cleared. **Boil SENS ≠ NONE**	-25 to 230°F (-32 to 110°C)
NO HEAT				•	**No Heat** This item is an adjustable warning. If a zone's slab temperature does not reach its slab target temperature within the set time, the control displays a warning message.	1 to 24 hr, OFF Default = OFF
COP				•	**Cop** The number of times that the microprocessor in the control has reset since this item was last cleared. The control will reset itself if it has experienced some form of interference that has disrupted its operation. This can be used to give an indication of the quality of the electrical environment that the control has been installed in.	0 to 255
NON-COP				•	**Non-Cop** The number of times that the control has been powered up since this item was last cleared. This number will increase if there is a lowering of the input voltage beyond the control's usable range. This item can be used as an indication of the quality of the power source.	0 to 255
tN2 COMM				•	**tN2 Communication** The number of times that a communication error has been detected between the control and either an RDM or Remote Start / Stop Module since this item was last cleared. If the wires between the control and the tekmar Net™ tN2 device are run in a noisy electrical environment, this can cause interference in the communication between the control and the tN2 device.	0 to 255

664 **Schd** (Schedule) Menu (1 of 1)

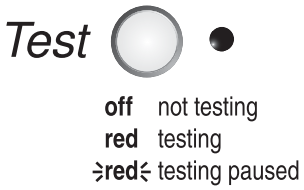
Item Field	Access Level LTD	USER	INST	ADV	Description	Range
OVERRIDE	●	●	●	●	**Override** The setback override that is in effect for the snow melting system.	NONE, AWAY (Ovr) Default = NONE

664 **Misc** (Miscellaneous) Menu (1 of 1)

Item Field	Access Level LTD	USER	INST	ADV	Description	Range
UNITS		●	●	●	**Units** The units of measure that all of the temperatures are to be displayed in by the control.	°F, °C Default = °F
BACKLITE		●	●	●	**Backlite** The operating mode for the back lighting on the LCD as well as time of keypad inactivity until the control automatically returns to the default display.	OFF, 30 sec, ON Default = ON
ACCESS	●	●	●	●	**Access** The access level that is to be used by the control. **DIP switch = *Unlock***	ADV, INST, USER, LTD Default = INST

Testing the Control

The Snow Detector and Melting Control 664 has a built-in test routine which is used to test the main control functions. The 664 continually monitors the sensors and displays an error message whenever a fault is found. See the following pages for a list of the 664's error messages and possible causes. When the ***Test*** button is pressed, the test light is turned on. The individual outputs and relays are tested in the following test sequence.



TEST SEQUENCE

Each step in the test sequence lasts 10 seconds.

During the test routine, the test sequence is paused by pressing the ***Test*** button. While paused, the control displays the testing step as well as the word PAUS. If the ***Test*** button is not pressed again for 5 minutes while the test sequence is paused, the control exits the entire test routine. If the test sequence is paused, the ***Test*** button can be pressed again to advance to the next step. This can also be used to rapidly advance through the test sequence. To reach the desired step, repeatedly press and release the ***Test*** button until the appropriate device and segment in the display turn on.

Step 1 If FLOT is selected in the MIXING item, the mixing valve is run fully open in the time set by the MOTR SPD item. If VAR is selected in the MIXING item, the injection pump is ramped up over 10 seconds. If 4-20 is selected in the MIXING item, the 4-20 mA device is modulated up in the time set by the MOTR SPD item.

Step 2 If FLOT is selected in the MIXING item, the mixing valve is run fully closed in the time set by the MOTR SPD item. If VAR is selected in the MIXING item, the injection pump is ramped down over 10 seconds. If 4-20 is selected in the MIXING item, the 4-20 mA device is modulated down in the time set by the MOTR SPD item.

Step 3 If the Zone 1 item is set to *AUTO*, the *Zone 1* contact (Zn 1) is turned on for 10 seconds. After 10 seconds the *Zone 1* contact (Zn 1) is turned off.

Step 4 If the Zone 2 item is set to *AUTO*, the *Zone 2* contact (Zn 2) is turned on for 10 seconds. After 10 seconds the *Zone 2* contact (Zn 2) is turned off.

Step 5 The *System Pump* contact (Sys P1) is turned on for 10 seconds.

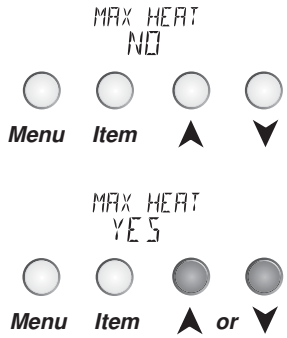
Step 6 The *Stage 1* contact is turned on for 10 seconds

Step 7 If SUP is selected in the Boil SENS item, the *Stage 2* contact is turned on for 10 seconds. After 10 seconds, the Stage 1, Stage 2 and Sys P1 contacts are shut off.

MAX HEAT

The Snow Detector and Melting Control 664 has a function called Max Heat. In this mode, the 664 turns on and operates the system up to the maximum set temperatures, and the mixing device at the set percentage. The control continues to operate in this mode for up to 24 hours or until either the ***Item***, ***Menu*** or ***Test*** button is pressed. This mode may be used for running all circulators during system start-up in order to purge air from the piping. To enable the Max Heat feature, use the following procedure.

1) Press and hold the ***Test*** button for more than 3 seconds. At this point, the control displays the words MAX HEAT and the word NO.
2) Using the ▲ or ▼ buttons, select the word YES. After 3 seconds, the control flashes the word MANUAL and the number 100. This number represents the desired output from the mixing device.
3) Set the desired output of the mixing device by using the ▲ and / or ▼ buttons on the control.
4) To cancel the Max Heat mode, press either the ***Item***, ***Menu***, or ***Test*** button.
5) Once the Max Heat mode has either ended or is cancelled, the control resumes normal operation.



Troubleshooting

When troubleshooting any heating system, it is always a good idea to establish a set routine to follow. By following a consistent routine, many hours of potential headaches can be avoided. Below is an example of a sequence that can be used when diagnosing or troubleshooting problems in a hydronic heating system.

Establish the Problem

Establish the problem. Get as much information from the customer as possible about the problem. Is there too much heat, not enough heat, or no heat? Is the problem only in one particular zone or area of the building or does the problem affect the entire system? Is this a consistent problem or only intermittent? How long has the problem existed for? This information is critical in correctly diagnosing the problem.

Understanding the Sequence of Operation

Understand the sequence of operation of the system. If a particular zone is not receiving enough heat, which pumps or valves in the system must operate in order to deliver heat to the affected zone? If the zone is receiving too much heat, which pumps, valves or check valves must operate in order to stop the delivery of heat?

Use the Test Routine

Press the ***Test*** button on the control and follow the control through the test sequence as described in the Testing section. Pause the control as necessary to ensure that the correct device is operating as it should.

Sketch the Piping in the System

Sketch the piping of the system. This is a relatively simple step that tends to be overlooked, however it can often save hours of time in troubleshooting a system. Note flow directions in the system paying close attention to the location of pumps, check valves, pressure bypass valves and mixing valves. Ensure correct flow direction on all pumps. This is also a very useful step if additional assistance is required.

Document the Control

Document the control for future reference. Before making any adjustments to the control, note down all of the items that the control is currently displaying. This includes items such as error messages, current temperatures and settings, and which devices should be operating as indicated by the LCD. This information is an essential step if additional assistance is required to diagnose the problem.

Isolate the Problem

Isolate the problem between the control and the system. Now that the sequence of operation is known and the system is sketched, is the control operating the proper pumps and valves at the correct times? Is the control receiving the correct signals from the system as to when it should be operating? Are the proper items selected in the menus of the control for the device that is to be operated?

Test the Contacts, Voltages and Sensors

Test the contacts, voltages and sensors. Using a multimeter, ensure that the control is receiving adequate voltage to the power terminals and the demand terminals as noted in the technical data. Use the multimeter to determine if the internal contacts on the control are opening and closing correctly. Follow the instructions in the Testing the Wiring section to simulate closed contacts on the terminal blocks as required. Test the sensors and their wiring as described in the sensor Data Brochures.

Monitor the System

Monitor the system over a period of time. Select the applicable items in the MONITOR menu of the control and reset them to zero. Allow the system and the control to operate over a known period of time and then record the Monitor items. Use this information to help diagnose any remaining problems.

664 **Error** Messages (1 of 3)

Error Displayed	Description of Error
CTRL ERR EE W	The control was unable to store a piece of information into its EEPROM. This error can be caused by a noisy power source. The control will display the error message and will continue to operate as normal. Pressing either the ***Menu*** or ***Item*** button will clear this error.
CTRL ERR ADJS	The control was unable to read a piece of information stored in the ADJUST menu. Because of this, the control was required to load the factory settings into all of the items in the ADJUST menu. The control will stop operation until all of the items available in the ADJUST menu of the control have been checked by the user or installer. ***Note:*** Access level must be ADV in order to clear the error.
CTRL ERR MNTR	The control was unable to read a piece of information stored in the MONITOR menu. Because of this, the control was required to load the factory settings into all of the items in the MONITOR menu. The control will continue to display the error message until all of the items available in the MONITOR menu of the control have been checked by the user or installer. ***Note:*** Access level must be ADV in order to clear the error.
CTRL ERR SCHD	The control was unable to read a piece of information stored in the SCHEDULE menu. Because of this, the control was required to load the factory settings into all of the items in the SCHEDULE menu. The control will continue to display the error message until all of the items available in the SCHEDULE menu of the control have been checked by the user or installer. ***Note:*** Access level must be ADV in order to clear the error.
CTRL ERR MISC	The control was unable to read a piece of information stored in the MISCELLANEOUS menu. Because of this, the control was required to load the factory settings into all of the items in the MISCELLANEOUS menu. The control will continue to display the error message until all of the items available in the MISCELLANEOUS menu of the control have been checked by the user or installer. ***Note:*** Access level must be ADV in order to clear the error.
tN2 TYPE	An incorrect device has been connected to the *tekmar Net™ tN2* input terminal. Once the problem has been corrected, press either the ***Menu*** or ***Item*** button to clear the error message from the control.
tN2 SHRT	A short circuit has been read between the *tN2* terminal and a *Com* terminal on the control. Either the wires leading to the tN2 device are shorted or the polarity of the wires is reversed. Determine the cause and remove the short. To clear this error, press either the ***Menu*** or ***Item*** button.
OUTDOOR SHRT	The control is no longer able to read the outdoor sensor due to a short circuit. In this case the control assumes an outdoor temperature of 32°F and continues operation. Locate and repair the problem as described in the Data Brochure D 070. To clear the error message from the control after the sensor has been repaired, press either the ***Menu*** or ***Item*** button.
OUTDOOR OPEN	The control is no longer able to read the outdoor sensor due to an open circuit. In this case the control assumes an outdoor temperature of 32°F and continues operation. Locate and repair the problem as described in the Data Brochure D 070. To clear the error message from the control after the sensor has been repaired, press either the ***Menu*** or ***Item*** button.
MIX SUP SHRT	The control is no longer able to read the mixing supply sensor due to a short circuit. In this case, the control does not operate the snow melting system. Locate and repair the problem as described in the Data Brochure D 070. To clear the error message from the control after the sensor has been repaired, press either the ***Menu*** or ***Item*** button.

664 **Error** Messages (2 of 3)

Error Displayed	Description of Error
MIX SUP OPEN	The control is no longer able to read the mixing supply sensor due to an open circuit. In this case, the control does not operate the snow melting system. Locate and repair the problem as described in the Data Brochure D 070. To clear the error message from the control after the sensor has been repaired, press either the ***Menu*** or ***Item*** button.
MIX RET SHRT	The control is no longer able to read the mixing return sensor due to a short circuit. If the ΔT MAX item is set to *OFF*, the control will continue to operate as if the as if the mixing return sensor was not connected to the control. If the ΔT MAX item is not set to *OFF*, the control does not operate the snow melting system. Locate and repair the problem as described in the Data Brochure D 070. To clear the error message from the control after the sensor has been repaired, press either the ***Menu*** or ***Item*** button.
MIX RET OPEN	The control is no longer able to read the mixing return sensor due to an open circuit. If the ΔT MAX item is set to *OFF*, the control will continue to operate as if the mixing return sensor was not connected to the control. If the ΔT MAX item is not set to *OFF*, the control does not operate the snow melting system. Locate and repair the problem as described in the Data Brochure D 070. To clear the error message from the control after the sensor has been repaired, press either the ***Menu*** or ***Item*** button.
Boil SENS SHRT	The control is no longer able to read the boiler sensor due to a short circuit. If the Boil MIN item is set to *OFF*, the control operates the *Boiler* contact when the mixing device starts to operate. If the Boil MIN is not set to *OFF*, the control does not operate the snow melting system. Locate and repair the problem as described in the Data Brochure D 070. To clear the error message from the control after the sensor has been repaired, press either the ***Menu*** or ***Item*** button.
Boil SENS OPEN	The control is no longer able to read the boiler sensor due to an open circuit. If the Boil MIN item is set to *OFF*, the control operates the *Boiler* contact when the mixing device starts to operate. If the Boil MIN is not set to *OFF*, the control does not operate the snow melting system. Locate and repair the problem as described in the Data Brochure D 070. If the boiler sensor was deliberately not installed, set the Boil SENS item to *NONE*. To clear the error message from the control after the sensor has been repaired, press either the ***Menu*** or ***Item*** button.
SLAB 1 SHRT	The control is no longer able to read the slab sensor of zone 1 due to a short circuit. In this case, if the control is currently in the Melting mode, the control will target a fixed mixing water temperature until the melting cycle is finished. Locate and repair the problem as described in the Data Brochure D 070. To clear the error message from the control after the sensor has been repaired, press either the ***Menu*** or ***Item*** button.
SLAB 1 OPEN	The control is no longer able to read the slab sensor of zone 1 due to an open circuit. In this case, if the control is currently in the Melting mode, the control will target a fixed mixing water temperature until the melting cycle is finished. Locate and repair the problem as described in the Data Brochure D 070. To clear the error message from the control after the sensor has been repaired, press either the ***Menu*** or ***Item*** button.
YELLOW SHRT	The control is no longer able to read the yellow sensor due to a short circuit. In this case, the control will turn off the heater in the Snow / Ice Sensor 090. Check the 090 yellow temperature sensor (black and yellow wires, terminals 7 and 9), and the wiring from the terminal plug to the sensor. To clear the error message from the control after the sensor has been repaired, press either the ***Menu*** or ***Item*** button.
YELLOW OPEN	The control is no longer able to read the yellow sensor due to an open circuit. In this case, the control will turn off the heater in the Snow / Ice Sensor 090. Check the 090 yellow temperature sensor (black and yellow wires, terminals 7 and 9), and the wiring from the terminal plug to the sensor. To clear the error message from the control after the sensor has been repaired, press either the ***Menu*** or ***Item*** button.
BLUE SHRT	The control is no longer able to read the water detection circuit due to a short circuit. In this case, if the control is currently in the Melting mode, the control will finish the snow melting cycle. The snow melting system can only be operated using an external melt demand, Remote Display Module 040, Remote Start / Stop Module 039 or the ***Start*** button on the control. Otherwise, the control will operate as if the Snow / Ice Sensor 090 is dry. Check the 090 water detection circuit (black and blue wires, terminals 7 and 8) according to the Data Brochure D 090. To clear the error message from the control after the error has been repaired, press either the ***Menu*** or ***Item*** button.

664 **Error** Messages (3 of 3)

Error Displayed	Description of Error
BLUE OPEN	The control is no longer able to read the water detection circuit due to an open circuit. In this case, if the control is currently in the Melting mode, the control will finish the snow melting cycle. The snow melting system can only be operated using an external melt demand, Remote Display Module 040, Remote Start / Stop Module 039 or the ***Start*** button on the control. Otherwise, the control will operate as if the Snow / Ice Sensor 090 is dry. Check the 090 water detection circuit (black and blue wires, terminals 7 and 8) according to the Data Brochure D 090. To clear the error message from the control after the error has been repaired, press either the ***Menu*** or ***Item*** button.
RED ERR	The control is reading a heater malfunction. In this case, unless the yellow sensor becomes too hot, the heater continues to try to operate. The snow melting system can only be operated using an external melt demand, Remote Display Module 040, Remote Start / Stop Module 039 or the ***Start*** button on the control. Check the 090 heater circuit (red and black wires, terminals 6 and 7) according to the Data Brochure D 090. Make sure the yellow and brown wires are not reversed. To clear the error message from the control after the error has been repaired, press either the ***Menu*** or ***Item*** button.
SLAB 2 SHRT	The control is no longer able to read the slab sensor of zone 2 due to a short circuit. In this case, if the control is currently in the Melting mode, the control will target a fixed mixing water temperature until the melting cycle is finished. Locate and repair the problem as described in the Data Brochure D 070. To clear the error message from the control after the sensor has been repaired, press either the ***Menu*** or ***Item*** button.
SLAB 2 OPEN	The control is no longer able to read the slab sensor of zone 2 due to an open circuit. In this case, if the control is currently in the Melting mode, the control will target a fixed mixing water temperature until the melting cycle is finished. Locate and repair the problem as described in the Data Brochure D 070. To clear the error message from the control after the sensor has been repaired, press either the ***Menu*** or ***Item*** button.
CTRL ERR HOT	The control's internal sensor is too hot (above 160°F (71°C)). In this case, the control will turn off the heater in the Snow / Ice Sensor 090 until the control cools off. To clear the error message from the control after the error has been repaired, press either the ***Menu*** or ***Item*** button.
NO HEAT SLB1	This warning message will be displayed if the Slab 1 temperature does not increase to the SLB1 TRG temperature while zone 1 is melting within a set time. The time limit is set using the NO HEAT item in the MONITOR menu. To clear this warning, press either the ***Menu*** or ***Item*** button.
NO HEAT SLB2	This warning message will be displayed if the Slab 2 temperature does not increase to the SLB2 TRG temperature while zone 2 is melting within a set time. The time limit is set using the NO HEAT item in the MONITOR menu. To clear this warning, press either the ***Menu*** or ***Item*** button.

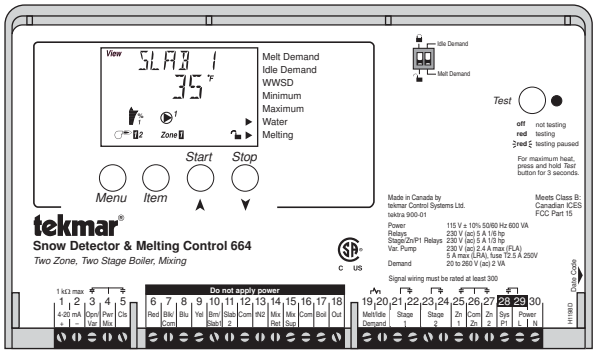
Notes

Notes

Technical Data

Snow Detector & Melting Control 664 *Two Zone, Two Stage Boiler, Mixing*

Literature	—	D 664, A 664's, D 001, D 070, E 021, U 664.
Control	—	Microprocessor PID control; This is **not a safety (limit) control.**
Packaged weight	—	3.5 lb. (1600 g), Enclosure A, blue PVC plastic
Dimensions	—	6-5/8" H x 7-9/16" W x 2-13/16" D (170 x 193 x 72 mm)
Approvals	—	CSA C US, CSA 22.2 N°24 and UL 873, meets class B: ICES & FCC Part 15.
Ambient conditions	—	Indoor use only, 32 to 122°F (0 to 50°C), < 90% RH non-condensing.
Power supply	—	115 V (ac) ±10%, 50/60 Hz, 600 VA
Relays	—	230 V (ac) 5 A 1/6 hp
Stage/Zn/P1 Relays	—	230 V (ac) 5 A 1/3 hp
Var. Pump	—	230 V (ac) 2.4 A max (FLA) 5 A max (LRA), fuse T2.5 A 250V
Demand	—	20 to 260 V (ac) 2 VA
Sensors included	—	NTC thermistor, 10 kΩ @ 77°F (25°C ±0.2°C) ß=3892 Outdoor Sensor 070 and 3 of Universal Sensor 082
Optional devices	—	tekmar type #: 741, 039, 040, 072, 073, 090, 091.



The installer must ensure that this control and its wiring are isolated and/or shielded from strong sources of electromagnetic noise. Conversely, this Class B digital apparatus complies with Part 15 of the FCC Rules and meets all requirements of the Canadian Interference-Causing Equipment Regulations. However, if this control does cause harmful interference to radio or television reception, which is determined by turning the control off and on, the user is encouraged to try to correct the interference by re-orientating or relocating the receiving antenna, relocating the receiver with respect to this control, and/or connecting the control to a different circuit from that to which the receiver is connected.

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Caution The nonmetallic enclosure does not provide grounding between conduit connections. Use grounding type bushings and jumper wires.

Attention Un boîtier nonmétallique n´assure pas la continuité électrique des conduits. Utiliser des manchons ou des fils de accord spécialement conçus pour la mise á la terre.

Limited Warranty and Product Return Procedure

Limited Warranty ***The liability of tekmar under this warranty is limited. The Purchaser, by taking receipt of any tekmar product ("Product"), acknowledges the terms of the Limited Warranty in effect at the time of such Product sale and acknowledges that it has read and understands same.***

The tekmar Limited Warranty to the Purchaser on the Products sold hereunder is a manufacturer's pass-through warranty which the Purchaser is authorized to pass through to its customers. Under the Limited Warranty, each tekmar Product is warranted against defects in workmanship and materials if the Product is installed and used in compliance with tekmar's instructions, ordinary wear and tear excepted. The pass-through warranty period is for a period of twenty-four (24) months from the production date if the Product is not installed during that period, or twelve (12) months from the documented date of installation if installed within twenty-four (24) months from the production date.

The liability of tekmar under the Limited Warranty shall be limited to, at tekmar's sole discretion: the cost of parts and labor provided by tekmar to repair defects in materials and/or workmanship of the defective product; or to the exchange of the defective product for a warranty replacement product; or to the granting of credit limited to the original cost of the defective product, and such repair, exchange or credit shall be the sole remedy available from tekmar, and, without limiting the foregoing in any way, tekmar is not responsible, in contract, tort or strict product liability, for any other losses, costs, expenses, inconveniences, or damages, whether direct, indirect, special, secondary, incidental or consequential, arising from ownership or use of the product, or from defects in workmanship or materials, including any liability for fundamental breach of contract.

The pass-through Limited Warranty applies only to those defective Products returned to tekmar during the warranty period. This Limited Warranty does not cover the cost of the parts or labor to remove or transport the defective Product, or to reinstall the repaired or replacement Product, all such costs and expenses being subject to Purchaser's agreement and warranty with its customers.

Any representations or warranties about the Products made by Purchaser to its customers which are different from or in excess of the tekmar Limited Warranty are the Purchaser's sole responsibility and obligation. Purchaser shall indemnify and hold tekmar harmless from and against any and all claims, liabilities and damages of any kind or nature which arise out of or are related to any such representations or warranties by Purchaser to its customers.

The pass-through Limited Warranty does not apply if the returned Product has been damaged by negligence by persons other than tekmar, accident, fire, Act of God, abuse or misuse; or has been damaged by modifications, alterations or attachments made subsequent to purchase which have not been authorized by tekmar; or if the Product was not installed in compliance with tekmar's instructions and/or the local codes and ordinances; or if due to defective installation of the Product; or if the Product was not used in compliance with tekmar's instructions.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, WHICH THE GOVERNING LAW ALLOWS PARTIES TO CONTRACTUALLY EXCLUDE, INCLUDING, WITHOUT LIMITATION, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, DURABILITY OR DESCRIPTION OF THE PRODUCT, ITS NON-INFRINGEMENT OF ANY RELEVANT PATENTS OR TRADEMARKS, AND ITS COMPLIANCE WITH OR NON-VIOLATION OF ANY APPLICABLE ENVIRONMENTAL, HEALTH OR SAFETY LEGISLATION; THE TERM OF ANY OTHER WARRANTY NOT HEREBY CONTRACTUALLY EXCLUDED IS LIMITED SUCH THAT IT SHALL NOT EXTEND BEYOND TWENTY-FOUR (24) MONTHS FROM THE PRODUCTION DATE, TO THE EXTENT THAT SUCH LIMITATION IS ALLOWED BY THE GOVERNING LAW.

Product Warranty Return Procedure All Products that are believed to have defects in workmanship or materials must be returned, together with a written description of the defect, to the tekmar Representative assigned to the territory in which such Product is located. If tekmar receives an inquiry from someone other than a tekmar Representative, including an inquiry from Purchaser (if not a tekmar Representative) or Purchaser's customers, regarding a potential warranty claim, tekmar's sole obligation shall be to provide the address and other contact information regarding the appropriate Representative.

tekmar® Control Systems

tekmar Control Systems Ltd., Canada
tekmar Control Systems, Inc., U.S.A.
Head Office: 5100 Silver Star Road
Vernon, B.C. Canada V1B 3K4
(250) 545-7749 Fax. (250) 545-0650
Web Site: www.tekmarcontrols.com

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Printed in Canada. D 664 - 07/09.

LIMBACH

Since 1901 Consistently Exceeding Expectations

Date: January 8, 2015.

Project: Jackson Home Office Expansion.

Phase: 3 – Office Building / Connector.

Product: Snow Melt System.

Document: Shop Drawings.

Notes: No shop drawings available.

LIMBACH

Since 1901 Consistently Exceeding Expectations

Date: January 8, 2015.

Project: Jackson Home Office Expansion.

Phase: 3 – Office Building / Connector.

Product: Snow Melt System.

Document: Product Data.

Notes: No notes.

Performance Engineering Group, Inc.
32995 Industrial Road
Livonia, MI 48150-1617
Phone: 734.266.5300
Fax: 734.266.5310

SUBMITTAL PACKAGE
CONTROLS

Job: **Jackson National Life Phase 3.1**

Architect: **Gresham Smith and Partners**

Engineer: **Edwards & Zuck**

Construction Manager: **The Christman Company**

Mechanical Contractor: **Limbach Company LLC**

PERFORMANCE engineering group

SUBMITTED BY:	ATTACHMENT INCLUDES	REF #
	Tekmar 664 Control	D 664
	Tekmar 090 Sensor and Socket	D 090
	Electrical panel - skid	PEG 14-009S E1

tekmar® Submittal
Snow Detector & Melting Control 664

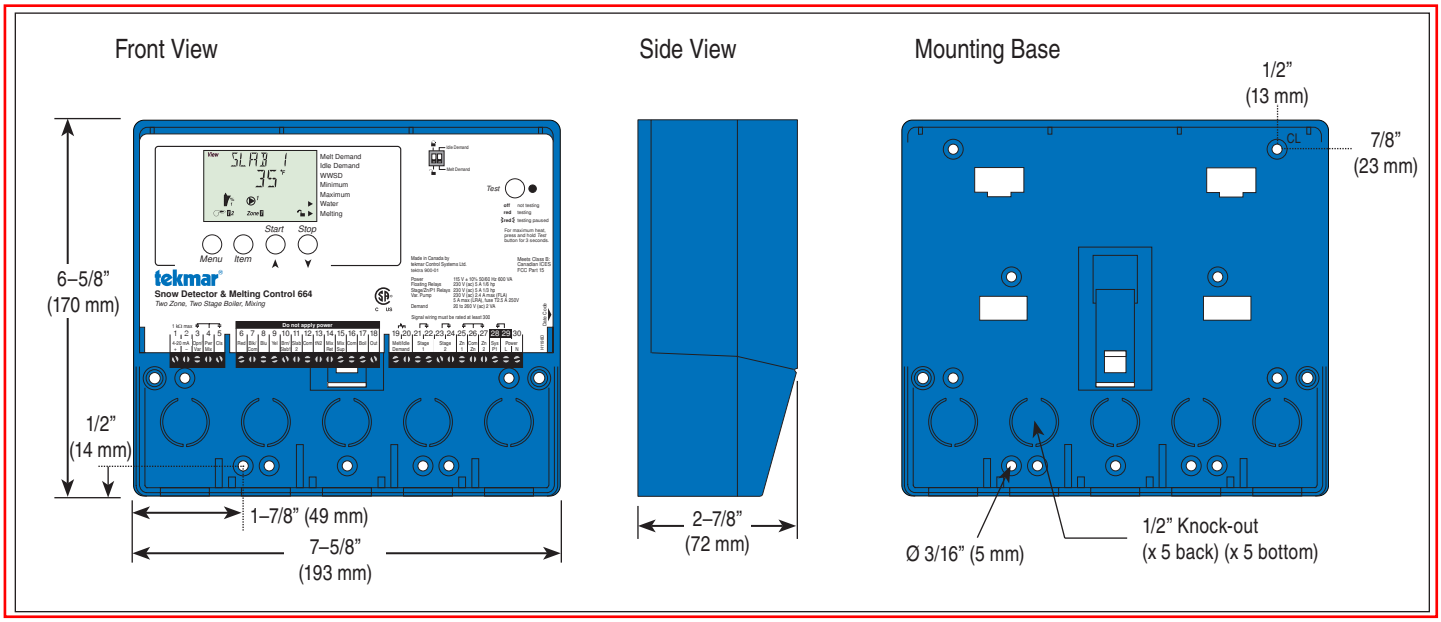
C 664
01/11

ces: New

ATC Contractor to coordinate with Limbach and Snow melting system vendor for additional monitoring sensors, and install of all devices and output to BMS.

Job _____ Designer _____

The Snow Detector & Melting Control 664 is designed to operate mechanical s. It can be used in hydronic snow melting applications consisting of up to 2 zones and pendent temperature. This product uses a tekmar snow/ice detection sensor in orde ce while protecting the boiler plant with a mixing device. It is capable of controlling up to 2 boilers, a variable speed or modulating (4-20 mA) mixing device, a mix system pump, and 2 zone pumps.



Specifications

Snow Detector & Melting Control 664 *Two Zone, Two Stage Boiler, Mixing*	
Literature	D664, A664, U664, D001, D070, E021
Control	Microprocessor control. This is not a safety (limit) control
Packaged weight	3.5 lb. (1600 g)
Dimensions	6-5/8" H x 7-9/16" W x 2-13/16" D (170 x 193 x 72 mm)
Enclosure	Blue PVC plastic, NEMA type 1
Approvals	CSA C US, meets class B: ICES & FCC Part 15
Ambient conditions	Indoor use only, 32 to 122°F (0 to 50°C), RH ≤90% Non-condensing
Power supply	115 V (ac) ±10%, 50/60 Hz, 600 VA
Floating relays	230 V (ac) 5 A, 1/6 hp
Stage/Zn/P1 relays	230 V (ac) 5 A, 1/3 hp
Var. pump	230 V (ac) 2.4 A max (FLA) 5 A max (LRA), fuse T2.5 A 250 V
Demands	20 to 260 V (ac) 2 VA
Sensors	NTC thermistor, 10 kΩ @ 77°F (25°C ±0.2°C) ß=3892
–Included	Outdoor Sensor 070 and 3 of Universal Sensor 082
–Optional	tekmar type #: 039, 040, 072, 073, 090, 091, 094, 741
Warranty	Limited 3 Year (See D664 for full warranty)

Features

- Automatic snow detection and melt control (with 090 Sensor)
- Control up to 2 zones
- Control up to 2 boilers
- Slab temperature control
- Mixing control (floating, variable speed, or proportional)
- Temporary Idle
- Optional priority zoning operation
- Slab protection for the snow melting system
- Boiler Protection
- Manual Override
- Warm Weather Shut Down
- Cold Weather Cut Out
- Remote display and adjustment capabilities
- Test sequence to ensure proper component operation
- Equipment Exercising
- CSA C US certified (approved to applicable UL standards)

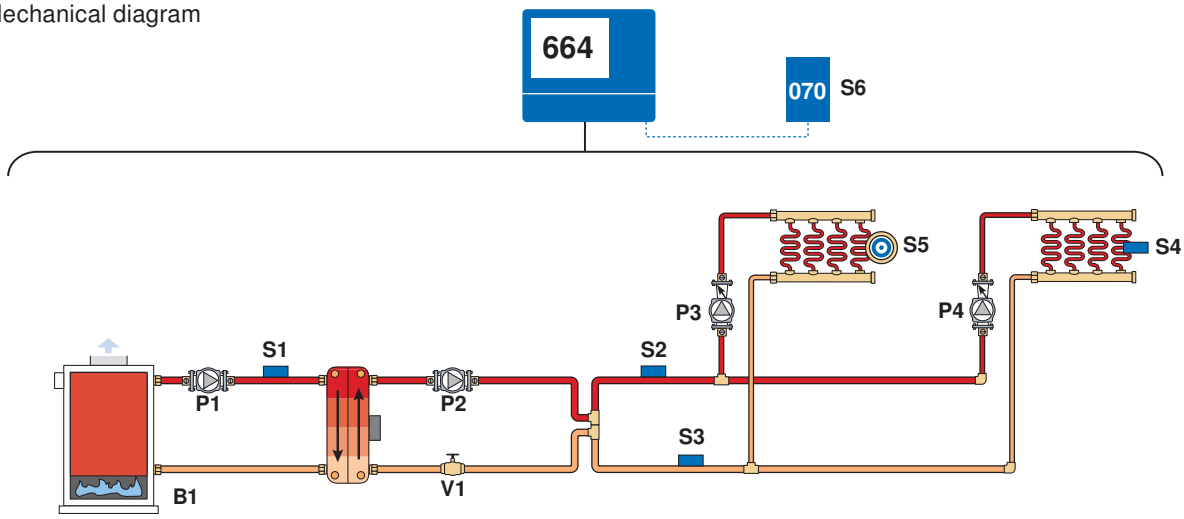
SPECIAL REQUIREMENTS

An 090 Snow/Ice Sensor or Slab Sensor.

Sample Application Drawing

Below is a sample application drawing for this product. This application may include other tekmar products that are required for installation. More sample applications can be found at www.tekmarcontrols.com.

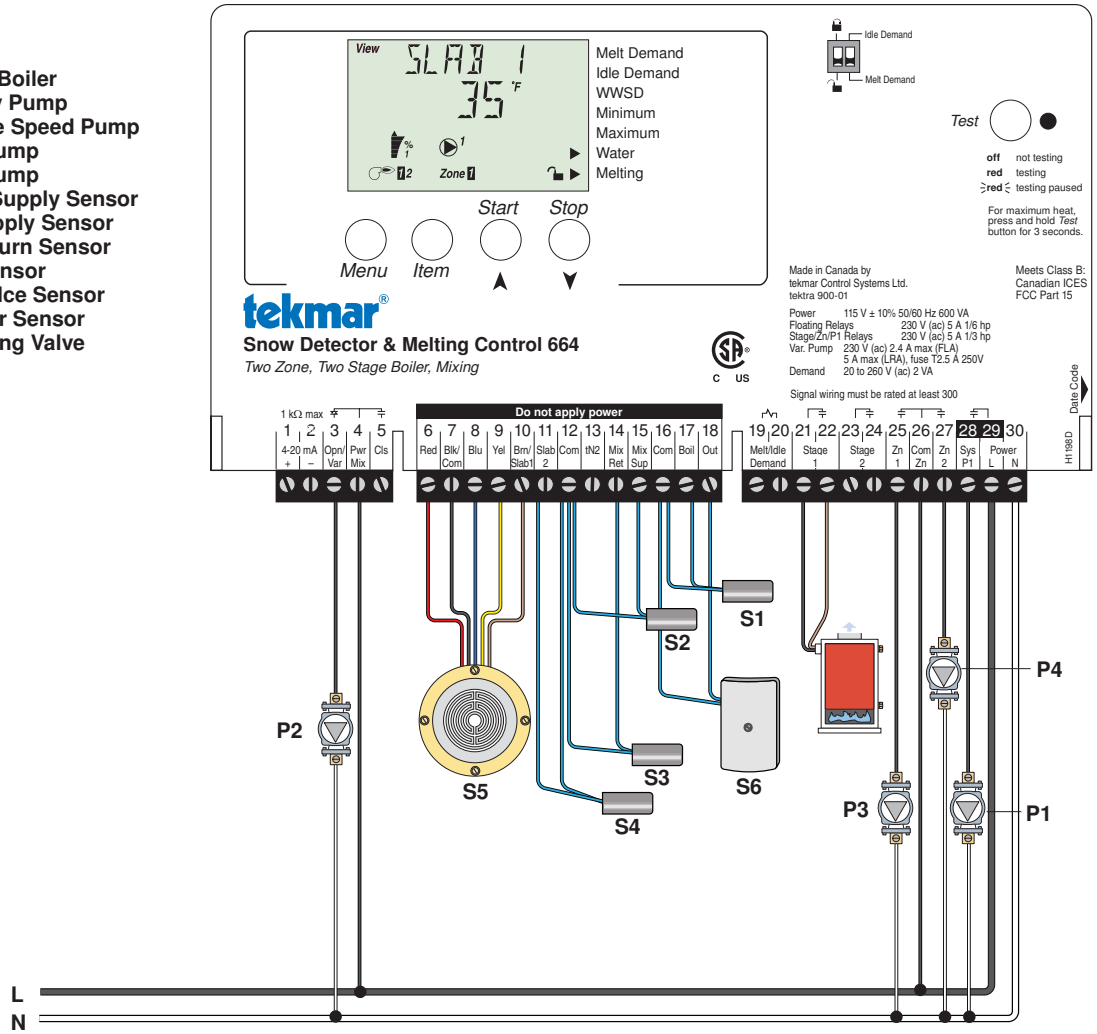
Sample Mechanical diagram



Sample Electrical diagram

Legend

B1 = On/Off Boiler
P1 = Primary Pump
P2 = Variable Speed Pump
P3 = Zone Pump
P4 = Zone Pump
S1 = Boiler Supply Sensor
S2 = Mix Supply Sensor
S3 = Mix Return Sensor
S4 = Slab Sensor
S5 = Snow / Ice Sensor
S6 = Outdoor Sensor
V1 = Balancing Valve



tekmar Control Systems

tekmar Control Systems Ltd., Canada, tekmar Control Systems, Inc., U.S.A. **Head Office: 5100 Silver Star Road, Vernon, B.C. Canada V1B 3K4, 250-545-7749, Fax. 250-545-0650 Web Site: www.tekmarcontrols.com**

All specifications are subject to change without notice.
Printed in Canada. C 664 - 01/11.

tekmar® - Data Brochure

Snow / Ice Sensor 090 / 094, Sensor Socket 091

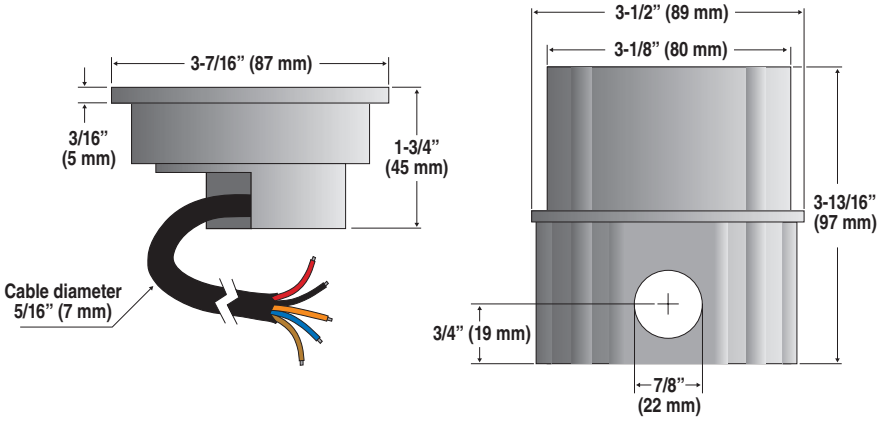
D 090

08/05

The tekmar Snow/Ice Sensor 090/094 and tekmar Sensor Socket 091 are used with all tekmar snow/ice melt controls. The 090 has a 65' (20 m) cable while the 094 has a 210' (64 m) cable.

The Snow/Ice Sensor is designed to sit flush with the slab surface after being mounted into the Sensor Socket. The socket is installed directly into the snow melt slab halfway between the heating elements or pipes.

The sensor measures the slab temperature, sensor surface temperature and sensor surface moisture level.



Installation

CAUTION

Improper installation and operation of this sensor could result in damage to equipment and possibly even personal injury. It is your responsibility to ensure that this sensor is safely installed according to all applicable codes and standards. Please follow these step-by-step instructions to gain a full understanding of this device.

STEP ONE — GETTING READY

Check the Contents

Check the contents of this package. If any of the contents listed are missing or damaged, please refer to the Limited Warranty and Product Return Procedure on the back of this brochure and contact your wholesaler or tekmar sales representative for assistance.

Type 090 includes: • One Snow/Ice Sensor 090 with "O" ring • Four, #6-32 x 3/8" screws • Four, #4-40 x 7/16" screws • One Data Brochure D 090

Type 094 includes: • One Snow/Ice Sensor 094 with "O" ring • Four, #6-32 x 3/8" screws • Four, #4-40 x 7/16" screws • One Data Brochure D 090

Type 091 includes: • One Snow/Ice Sensor Socket 091 • One protective plastic plug • One plastic mounting plate • Eight, #6-32 x 3/8" screws • One Data Brochure D 090

STEP TWO — MOUNTING THE SENSOR

Location of the Sensor

- The location of the snow/ice sensor determines how well the snow melt detector responds to conditions on the snow melting slab. The sensor measures the temperature of the slab surface, and would normally be installed in a location that is representative of the average surface temperature and moisture conditions. The only exception to this practice would be those applications where the sensor is placed in a specific problem area where ice or snow often forms first.
- The installer should be careful to place the sensor in a location where it will not be affected by abnormal temperature conditions that may occur near buildings, hot air exhaust ducts or other heat sources, or sunny areas within a larger slab area.
- As well as reading temperatures, the sensor also detects surface water. The installer should be careful not to place the sensor where standing water could accumulate on its surface. This may cause the snow melt system to be held on far longer than necessary, as the control will be getting a signal that water is present even through the rest of the slab surface may be dry. In addition, the sensor should not be placed in areas where drainage is considerably better than the surrounding area.
- The snow/ice sensor should not be installed in locations where vehicles park, near building overhangs or near trees since this may interfere with snow fall accumulation. If in doubt about the location of these obstacles, a second spare socket and conduit can be installed in order to provide a backup sensor location if the first location is not found to be ideal.
- Vehicle tire and pedestrian traffic can track water and contaminants onto the snow melt area. If the snow/ice sensor is located in the traffic area, snow melting will be triggered by the passing traffic. This may be desirable in commercial areas where excessive traffic can cause the surface to become icy. In residential installations, the amount of traffic is usually limited, and it may be desirable to locate the snow/ice sensor away from the traffic area. This will reduce the number of snow melt events that occur and thereby reduce the annual fuel consumption.
- The location of the sensor should be midway between the heating pipes or elements.

Conduit

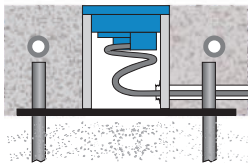
Place the sensor socket at the chosen location and run a conduit for the cable from the socket to the snow/ice detection control. If more than 210' (64 m) of cable is required to reach the control, run the conduit to a weatherproof junction box. The sensor cable should be run in its own conduit and not in combination with high voltage wiring.

The conduit length from the sensor to the junction box should be less than the 210' (64 m) of cable supplied with the 094 snow/ice sensor.

At the junction box, additional 18 AWG, 5 conductor cable can be spliced on to increase the total length to 500' (150 m) from the sensor to control.

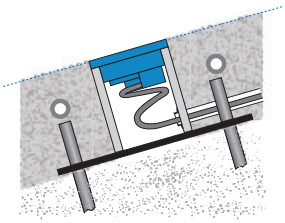
Avoid tying the conduit to the rebar within 6' (2 m) of the socket. This allows the rebar grid to move without disturbing the position of the socket.

Sloped Surfaces



The top of the snow/ice sensor should be flush and parallel to that of the snow melt surface.

When the sensor is installed on a sloped driveway, the sensor must be installed near the lowest elevation of the slope. This is required since the melting snow or ice runoff water will drain toward the lowest point on the driveway and keep this area wet for longer periods of time.



Installing the Socket

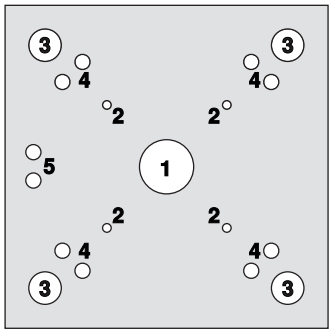
A mounting plate has been included to simplify the installation of the sensor socket. When possible, the mounting plate should be located directly on top of gravel in order to provide good drainage. If the slab is more than 4" thick, a mound of crushed rock or a styrofoam or wooden block can be used to elevate the socket. A hole must be punched or drilled in the styrofoam or wooden block in order to provide drainage.

Failure to provide adequate drainage under the socket may reduce the life expectancy of the snow/ice sensor.

The mounting plate can be fastened to the ground by driving 1/2" (12.7 mm) rebar through the four holes located on each of the four corners and then tying the mounting plate to the rebar.

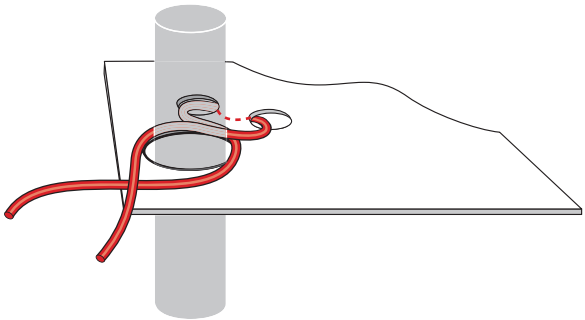
1) Cut four pieces of rebar at least 12" (300 mm) long.
2) Drive the rebar into the ground through each of the mounting plate rebar holes. Leave approximately 2" (50 mm) of rebar above the ground.
3) Cut several 12" (300 mm) pieces of steel wire.
4) Form a "U" shape and pull wire through the rebar tie hole from the bottom to the top side.
5) Repeat by pulling the "U" shape from the top to the bottom side.
6) Repeat (4) and (5) for each of the four corners.
7) Cross the wire, then wrap around the rebar.
8) Twist wire using pliers to tighten.

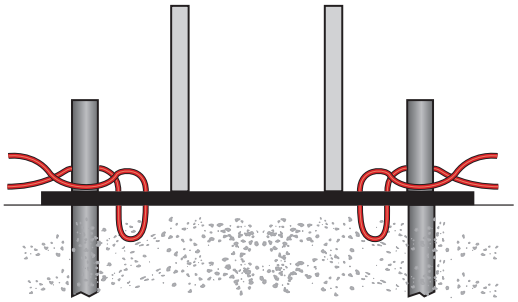
The mounting plate also has conduit tie holes to allow a cable tie or steel wire to fasten the conduit to the mounting plate.



Mounting Plate

1. Drainage hole
2. Socket screw holes
3. Rebar holes
4. Rebar tie holes
5. Conduit tie holes





Placing Concrete

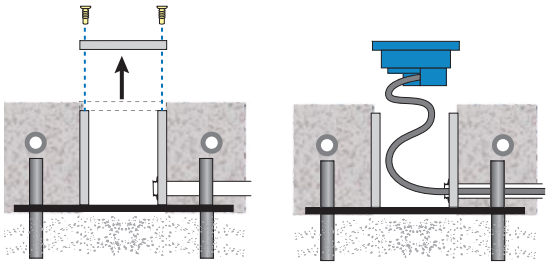
A plastic plug is provided with the socket to prevent it from being accidentally filled with concrete. The plastic plug is the same thickness as the sensor flange. This allows the finished surface of the concrete (asphalt, etc.) to be troweled flush with the plug. The plug must be installed prior to placing the concrete. Also ensure that the mounting plate drainage hole remains unplugged once the concrete has cured.

Installing Brick Pavers

If using brick pavers instead of concrete, it is recommended to mortar surrounding brick pavers to the side of the socket. This ensures good thermal conduction from the brick pavers to the socket. The top of the brick pavers should be level with the socket when the plastic plug is installed.

Install the Sensor and Cable

When the snow melt surface is finished, remove the plastic plug from the socket and fish the cable through the conduit until there is only 6 to 12" (150 to 300 mm) of cable between the sensor and conduit. Loop this remaining extra wire in a loose coil so as to not twist it, and place it, and the sensor into the socket. Secure the sensor to the socket with the four screws provided, making sure the "O" ring is in place and properly seated.



Replacing old 090 or 094

Current versions of the Snow/Ice socket 091 use #6-32 screws. Previous versions of the 091 used smaller #4-40 screws. When replacing an 090 or 094, both sets of screws are provided. It is recommended to try the smaller screws first to avoid cross threading.

Salt and Brine Contamination

The performance of the snow/ice sensor water detection can be compromised when exposed to deicing agents such as road salt, magnesium chloride, or calcium chloride. These contaminants can permanently damage the sensor. It is recommended to locate the sensor away from areas exposed to these deicing agents when at all possible. Locations to avoid could include tire track areas or areas close to a curb where traveling vehicles may splash contaminated water on to the sensor.

Maintenance

The Snow/Ice Sensor is installed in a hostile environment. Accumulation of dirt, salty grime, etc., on its surface will inhibit proper water detection. It should be checked on a regular basis and, when necessary, cleaned. Before cleaning, the control power should be shut off to prevent the control from entering the snow melt mode. Next, use a soft bristle brush and warm soapy water to clean the sensor surface. Do not use a steel wire brush as this will damage the sensor. Then use a paper towel to thoroughly dry the sensor surface. After cleaning, re-power the control and push the test button to cycle the control through the test routine.

STEP THREE — WIRING THE SENSOR

Electrical Connections

The snow/ice sensor cable has 5 wires: Red, Black, Blue, Yellow, and Brown. The wires connect to the respective Red, Black, Blue, Yellow and Brown terminals on the Snow Detector & Melting Control.

Testing and Troubleshooting

TEST THE SENSOR

When performing these tests:

- The sensor head should be installed in the slab.
- The five cable wires at the control should be disconnected (unplug terminal plug).
- Use a good quality electrical testing meter with an ohm scale range of 0 to 2,000,000 Ohms.

The sensor has two 10k Ohm thermistors. One reads slab surface temperature, and the other checks sensor heater temperature.

If the sensor has been disconnected from the control for an hour or more, the readings for both thermistors should be very close.

- Using the ohmmeter and standard testing practices, measure the resistance between:

  (a) the yellow and black sensor wires (sensor temperature), and

  (b) the brown and black sensor wires (slab temperature).

The table below lists the expected resistance values at various sensor temperatures.

- Measure the resistance between the blue and black wires. When the sensor surface is dry, the reading should be 2,000,000 Ohms. When the sensor surface is wet it should be between 10,000 and 300,000 Ohms.
- Measure the resistance between the red and black wires of the heating element. This reading should be close to 50 Ohms.

Temperature		Resistance	Temperature		Resistance	Temperature		Resistance
°F	°C	Ω	°F	°C	Ω	°F	°C	Ω
-49	-45	472,000	5	-15	72,900	59	15	15,700
-40	-40	337,000	14	-10	55,300	68	20	12,500
-31	-35	243,000	23	-5	42,300	77	25	10,000
-22	-30	177,000	32	0	32,600	86	30	8,060
-13	-25	130,000	41	5	25,400	95	35	6,530
-4	-20	97,000	50	10	19,900	104	40	5,330

Technical Data

Snow / Ice Sensor 090 / 094	
Literature	D 090
090 Packaged weight	4.4 lbs (2000 g)
094 Packaged weight	10.5 lbs (4762 g)
Dimensions	1-3/4" H x 3-7/16 O.D. (45 x 87 O.D. mm)
Material	Brass, epoxy
Cable material	18 AWG, 5 conductor stranded wire with polyethylene jacket
090 Cable length	65' (20 m)
094 Cable length	210' (64 m)
Approvals	CSA C US with applicable tekmar snow melting controls
Operating range	-30 to 170°F (-34 to 77°C)
Sensor	NTC thermistor, 10kΩ @ 77°F (25°C ± 0.2°C), ß = 3892

Snow / Ice Sensor Socket 091	
Literature	D 090
Packaged weight	1.5 lbs (675 g)
Dimensions	3-13/16" H x 3-1/2 O.D. (97 x 89 O.D. mm)
Socket material	Brass
Cap material	Polyethylene
Mounting plate material	Polyethylene
Approvals	CSA C US with applicable tekmar snow melting controls

Limited Warranty and Product Return Procedure

Limited Warranty ***The liability of tekmar under this warranty is limited. The Purchaser, by taking receipt of any tekmar product ("Product"), acknowledges the terms of the Limited Warranty in effect at the time of such Product sale and acknowledges that it has read and understands same.***

The tekmar Limited Warranty to the Purchaser on the Products sold hereunder is a manufacturer's pass-through warranty which the Purchaser is authorized to pass through to its customers. Under the Limited Warranty, each tekmar Product is warranted against defects in workmanship and materials if the Product is installed and used in compliance with tekmar's instructions, ordinary wear and tear excepted. The pass-through warranty period is for a period of twenty-four (24) months from the production date if the Product is not installed during that period, or twelve (12) months from the documented date of installation if installed within twenty-four (24) months from the production date.

The liability of tekmar under the Limited Warranty shall be limited to, at tekmar's sole discretion: the cost of parts and labor provided by tekmar to repair defects in materials and / or workmanship of the defective product; or to the exchange of the defective product for a warranty replacement product; or to the granting of credit limited to the original cost of the defective product, and such repair, exchange or credit shall be the sole remedy available from tekmar, and, without limiting the foregoing in any way, tekmar is not responsible, in contract, tort or strict product liability, for any other losses, costs, expenses, inconveniences, or damages, whether direct, indirect, special, secondary, incidental or consequential, arising from ownership or use of the product, or from defects in workmanship or materials, including any liability for fundamental breach of contract.

The pass-through Limited Warranty applies only to those defective Products returned to tekmar during the warranty period. This Limited Warranty does not cover the cost of the parts or labor to remove or transport the defective Product, or to reinstall the repaired or replacement Product, all such costs and expenses being subject to Purchaser's agreement and warranty with its customers.

Any representations or warranties about the Products made by Purchaser to its customers which are different from or in excess of the tekmar Limited Warranty are the Purchaser's sole responsibility and obligation. Purchaser shall indemnify and hold tekmar harmless from and against any and all claims, liabilities and damages of any kind or nature which arise out of or are related to any such representations or warranties by Purchaser to its customers.

The pass-through Limited Warranty does not apply if the returned Product has been damaged by negligence by persons other than tekmar, accident, fire, Act of God, abuse or misuse; or has been damaged by modifications, alterations or attachments made subsequent to purchase which have not been authorized by tekmar; or if the Product was not installed in compliance with tekmar's instructions and / or the local codes and ordinances; or if due to defective installation of the Product; or if the Product was not used in compliance with tekmar's instructions.

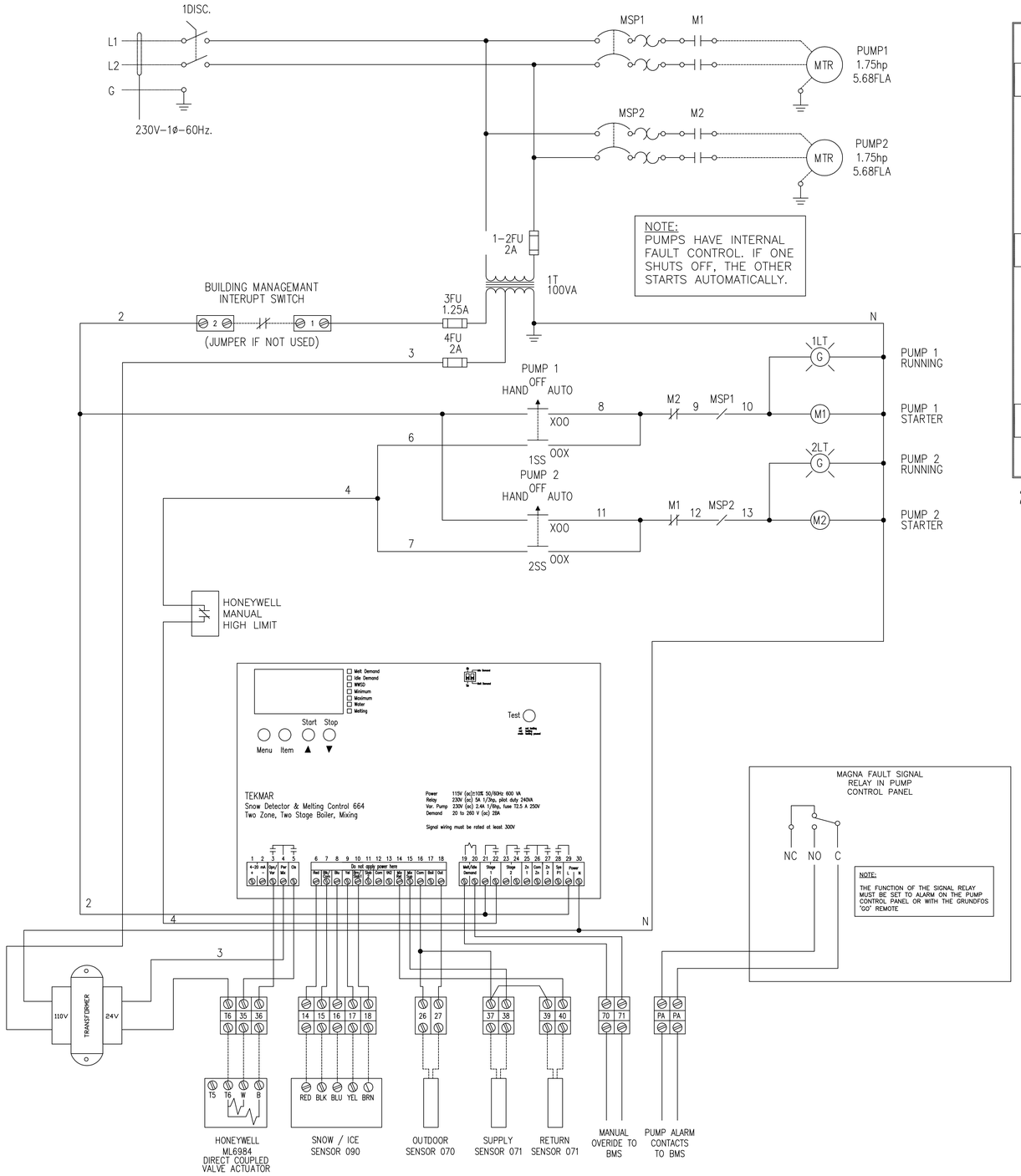
THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, WHICH THE GOVERNING LAW ALLOWS PARTIES TO CONTRACTUALLY EXCLUDE, INCLUDING, WITHOUT LIMITATION, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, DURABILITY OR DESCRIPTION OF THE PRODUCT, ITS NON-INFRINGEMENT OF ANY RELEVANT PATENTS OR TRADEMARKS, AND ITS COMPLIANCE WITH OR NON-VIOLATION OF ANY APPLICABLE ENVIRONMENTAL, HEALTH OR SAFETY LEGISLATION; THE TERM OF ANY OTHER WARRANTY NOT HEREBY CONTRACTUALLY EXCLUDED IS LIMITED SUCH THAT IT SHALL NOT EXTEND BEYOND TWENTY-FOUR (24) MONTHS FROM THE PRODUCTION DATE, TO THE EXTENT THAT SUCH LIMITATION IS ALLOWED BY THE GOVERNING LAW.

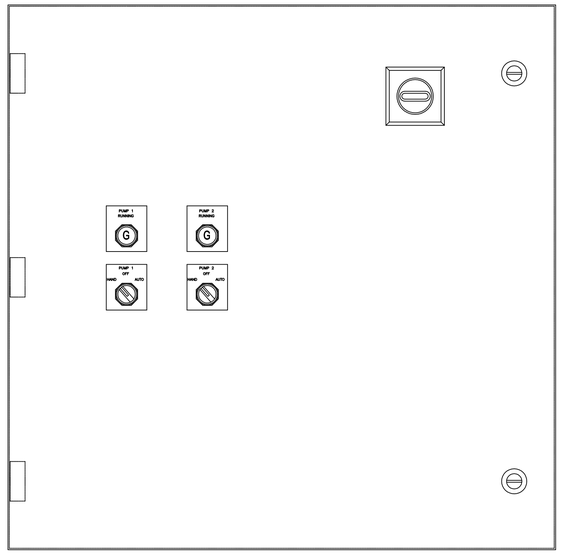
Product Warranty Return Procedure All Products that are believed to have defects in workmanship or materials must be returned, together with a written description of the defect, to the tekmar Representative assigned to the territory in which such Product is located. If tekmar receives an inquiry from someone other than a tekmar Representative, including an inquiry from Purchaser (if not a tekmar Representative) or Purchaser's customers, regarding a potential warranty claim, tekmar's sole obligation shall be to provide the address and other contact information regarding the appropriate Representative.

tekmar®
Control Systems

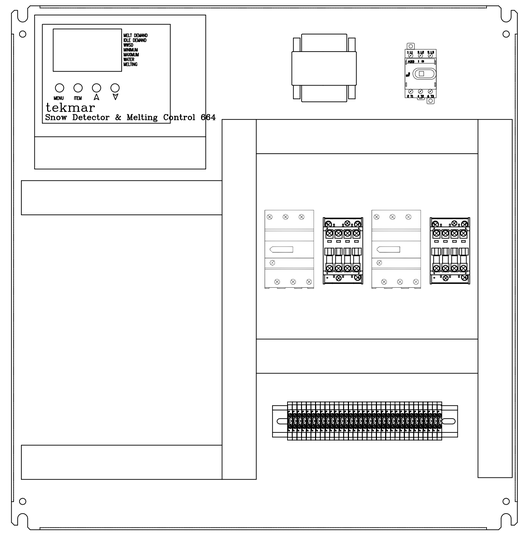
tekmar Control Systems Ltd., Canada
tekmar Control Systems, Inc., U.S.A.
Head Office: 5100 Silver Star Road
Vernon, B.C. Canada V1B 3K4
(250) 545-7749 Fax. (250) 545-0650
Web Site: www.tekmarcontrols.com

All specifications are subject to change without notice.
Printed in Canada. D 090 - 08/05.





24 X 24 X 8 NEMA 4/12 ENCLOSURE



#	ITEM	PART NUMBER	DESCRIPTION	MFR	QTY
1	ENCLOSURE	EN4SD30248CG	30 X 24 X 8 NEMA 4/12 ENCLOSURE	HAMMOND	1
2	ENCLOSURE	EP3024	STEEL BACK PANEL	HAMMOND	1
3	DISC	OT32E3	30 AMP NON FUSED DISCONNECT	ABB	1
4	DISC	OHB2AJ	DISCONNECT HANDLE	ABB	1
5	DISC	OXS5X180	DISCONNECT SHAFT	ABB	1
6	MSP1–2	MS325–9.0.3	MOTOR CIRCUIT PROTECTOR, 6.3–9.0AMP	ABB	2
7	MSP1–2	MS325–HK11	AUXILLARU CONTACTS	ABB	2
8	M1–2	A9–30–10–84	3 POLE CONTACTOR	ABB	2
9	1–2FU	ATDR2	2 AMP CLASS CC FUSE	FERRAZ	2
10	1CT	9070TF100D15	100VA 460–230/120–24 CPT	SQUARE D	1
11	3FU	TRM1 1/4	1.25 AMP TIME DELAY FUSE	FERRAZ	1
12	4FU	TRM2	2 AMP TIME DELAY FUSE	FERRAZ	1
13	1–2LT	CBK–KLF1G	GREEN PILOT LIGHT, 120VAC BULB	ABB	1
16	DETECTOR	664	SNOW/MELTING CONTROL	TEKMAR	1
18	SENSORS	090	SLAB TEMP MOISTURE SENSORS	TEKMAR	1
19	TERMINALS	3004362	IEC TERMINAL BLOCKS	PHOENIX	34
20	TERMINALS	3003020	IEC TERMINAL BLOCK END PLATE	PHOENIX	1
21	TERMINALS	3022218	IEC TERMINAL BLOCK DIN CLAMPS	PHOENIX	4

CONTROLS DIAGRAM

SCALE: NONE

LIABILITY

This drawing and our recommendations and suggestions, are intended to assist our customers. Our design represents our best judgment based on our experience and the best facts provided to us, any use thereof is at the sole risk of the customer.

It is assumed that the customer will install the THAW-PAK system in compliance with all local, state and national codes.

CONSULTANTS: LIMBACH CO. LLC CITY MICHIGAN

THAW-PAK DISTRIBUTOR: thawPAK Snow Melting & Radiant Heating Systems

PROJECT NAME: JACKSON NATIONAL LIFE MICHIGAN

PERFORMANCE engineering group

DRAWN BY: *Gordon Faustich*

REVIEWED BY: *AD*

APPROVED BY: *AD*

ISSUED FOR

12/09/14	APPROVAL
12/31/14	INCREASED FLOW AND BTU'S/F
02/24/15	ADDED SENSOR WELLS TO SKID
03/23/15	UPDATED CONTROLS
03/24/15	UPDATED SENSORS ON SKID

DRAWING NO. PEG14-009S_E

SHEET NO. E1

Performance Engineering Group, Inc
32995 Industrial Road
Livonia, MI 48150-1617
Phone: 734.266.5300
Fax: 734.266.5310

SUBMITTAL PACKAGE
HEAT DISTRIBUTION

Job: **Jackson National Life Phase 3.1**

Architect: **Gresham Smith and Partners**

Engineer: **Edwards & Zuck**

Construction Manager: **The Christman Company**

Mechanical Contractor: **Limbach Company LLC**

SUBMITTED BY:	ATTACHMENT INCLUDES	REF #
	ViegaPEX™ Polyethylene Tubing	TD-PFVP 0307
	Uponor Pre-Insulated Pipe Systen	
	Uponor Connection Vault	
	Uponor End cap	
	1-1/2" Manifold Sets with 7/8" Ball Valves	BAM00-15.2
	Quazite Manifold Box and Cove	
	Enerco Corporation Propylene Glycol, 40%	8406-40
	Thaw-Pak tubing layout & Installation inf	PEG 014-009S M1 thru M-5

PLUMBING

TechData
PRODUCT SPECIFICATION SHEET

viega

PureFlow SYSTEMS

ViegaPEX™ Cross-linked Polyethylene (PEX)

Scope
This material specification designates the requirements for ViegaPEX hot and cold water distribution tubing. All ViegaPEX tubing is copper tube size dimension (CTS), SDR-9 wall thickness and meets the respective requirements of ASTM F876 and F877.

Materials
All ViegaPEX tubing is manufactured from a cross-linkable high density polyethylene produced by grafting organo-silanes onto a polyethylene base. A catalyst (accelerator) added to the cross-linkable polyethylene during extrusion initiates the cross-linking process. Cross-linking is completed with hot water or steam (sauna). ViegaPEX tubing is available in red, white, or blue for easy identification of hot and cold lines.

Marking and Certification
All ViegaPEX tubing is marked with the name Viega as the manufacturer, nominal size, plastic tubing material designation code (PEX 1006), design pressure and temperature ratings, relevant ASTM standards, manufacturing date and production code, as well as both the NSF-pw and the NSF CL-R/CL-TD stamps indicating third-party certification by NSF International for meeting and exceeding performance and toxicological standards, as well as achieving the highest chlorine resistance rating (NSF Protocol P171) in the PEX industry. NSF conducts random on-site inspections of Viega manufacturing facilities and independently tests ViegaPEX tubing for compliance with physical, performance and toxicological standards. ViegaPEX is also certified to meet the Uniform Plumbing Code, IAPMO, CSA B137.5 Warnock Hersey, the ICBO Evaluation Service and HUD (Housing and Urban Development).

Recommended Uses
ViegaPEX tubing is intended and recommended for use in hot and cold potable water distribution systems. Design temperature and pressure ratings for ViegaPEX is 160 psi @ 73°F and 100 psi @ 180°F. ViegaPEX tubing can also be used in "continuously-recirculating" plumbing systems at temperatures of up to 140°F while still maintaining excellent chlorine resistance. For information on the suitability for other hot and cold water applications not listed here, consult with your Viega representative.

Handling and Installation
ViegaPEX cross-linked polyethylene tubing is tough yet flexible. However, it is softer than metals and may be damaged by abrasion or by objects with a cutting edge. Use of these materials in hot and cold water distribution systems must be in accordance with good plumbing practices, applicable code requirements, and current installation practices available from Viega. ViegaPEX is manufactured to meet written national standards. Contact a Viega representative or the applicable code enforcement bureau for information about approvals for specific applications.

Property	ASTM Test Method	Typical Values	
		English Units	SI Units
Density	D 792	–	0.946 g/cc
Melt Index[1] (190°C/2.16 kg)	D 1238	–	0.7g/10 min
Flexural Modulus[2]	D 790	120,000 psi	830 MPa
Tensile Strength @ Yield (2 in/min)	D 638	2,900 psi	20 MPa
Coefficient of Linear Thermal Expansion @ 68°F	D 696	$8x10^{2}$/°F	$15x10^{-5}$/°C
Hydrostatic Design Basis @ 73°F (23°C)	D 2837	1,250 psi	8.6 MPa
Hydrostatic Design Basis @ 180°F (82°C)	D 2837	800 psi	5.5 MPa
Vicat Softening Point	D 696	255°F	124°C
Thermal Conductivity	D 177	2.4 Btu-in (hr)(ft^2)(°F/in)	$3.5x10^{-3}$ Watts/(cm^2)(°C/cm)

1. Before Cross-linking
2. 73°F

VIEGA
301 N. Main, Floor 9
Wichita, KS 67202
Phone: 1-877-VIEGA-NA
Fax: 1-800-976-9817

service@viega.com
www.viega-na.com

viega

Vanguard Piping Systems, Inc.
A Viega Company

TechData
PRODUCT SPECIFICATION SHEET

PLUMBING

viega

PureFlow SYSTEMS

ViegaPEX™

Quality Assurance
When the product is marked with the ASTM F876/F877 designation, it affirms that the product was manufactured, inspected, sampled and tested in accordance with these specifications and has been found to meet the specified requirements.

Certifications
NSF-pw - tested for health effects to ANSI/NSF standard 61 and performance to ANSI/NSF standard 14.

NSF CL-R/CL-TD - Tested and conforms to NSF Protocol P171, Chlorine Resistance of Plastic Piping Materials. Meets and exceeds pass/fail criteria of both Traditional Domestic and Domestic Continuous Recirculation ratings. NSF tested according to ASTM Standard F2023, Evaluating the Oxidative Resistance of Crosslinked Polyethylene (PEX) Tubing and Systems to Hot Chlorinated Water greatly exceeding the minimum chlorine resistance requirements of ASTM F876.

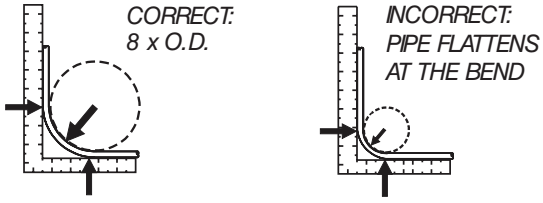
- **IAPMO Certified**

- **ICBO ER #5287** - listed for plumbing and hydronic heating applications.

- **Intertek Testing Services** (Warnock Hersey) - certification to CSA B137.5 (Canadian Standards Association)

HUD (Housing and Urban Development) - MR 1276

Minimum Bend Radius



NOTE: ViegaPEX tubing may be bent to a minimum of 5 x O.D. with approved bend support.

SDR-9 PEX Tubing
ASTM F876/F877/CTS-OD SDR-9

STOCK CODE	TUBING SIZE	O.D.	WALL THICKNESS	NOM. I.D.	WEIGHT PER FT	VOLUME (Gal.) PER 100 FT
PX2	3/8"	0.500±.003	0.070+.010	0.350	.0413	0.50
PX3	1/2"	0.625±.004	0.070+.010	0.475	.0535	0.92
PX4	3/4"	0.875±.004	0.097+.010	0.671	.1023	1.82
PX5	1"	1.125±.005	0.125+.013	0.863	.1689	3.04

NOTE: Dimensions are in English units. Tolerances shown are ASTM requirements. ViegaPEX is manufactured within these specifications.

Pressure Drop Table
Expressed as PSI/ft. Pressure Drop

GPM	SIZE 3/8"	1/2"	3/4"	1"
1	.070	.016		
1.5	.149	.034		
2.2	.303	.069		
2.5	.385*	.087		
3	.539	.122	.023	
3.5	.717	.162	.030	
4		.208*	.039	
5		.314	.059	
6		.440	.082	.024
7		.586	.109	.032
8			.140	.041
9			.174*	.051
10			.211	.062
11			.252	.074
12			.296	.087
13			.343	.101
14				.116
16				.148*
18				.184
20				.224
22				.267

EXAMPLE: To calculate the pressure drop of a 1/2" line, 40 ft. long, with a 3 gpm flow rate, calculate .122 psi x 40 ft. = 4.9 psi pressure drop. Most plumbing codes require 8 psi residual pressure at the fixture. Refer to your local code requirements.

*Indicates 8 fps maximum velocity required by some plumbing codes. NOTE: Maximum flow for each size based on 12 FPS velocity. PSI x 2.307 = head loss.

Minimum Burst Pressure (PSI) Per ASTM F876/F877

SIZE	73°F (23°C)	180°F (82°C)
3/8"	620	275
1/2"	480	215
3/4"	475	210
1"	475	210

VIEGA
301 N. Main, Floor 9
Wichita, KS 67202
Phone: 1-877-VIEGA-NA
Fax: 1-800-976-9817

service@viega.com
www.viega-na.com

ASTM Ecoflex® Potable HDPE

Submittal Information
Revision E: Feb. 3, 2014

Project Information

Job Name:

Location: Part No. Ordered:

Engineer: Date Submitted:

Contractor: Submitted By:

Manufacturer's Representative: Approved By:

Technical Data

Service Pipe:	High-density polyethylene (HDPE); NSF certified SDR-11
Insulation:	Multilayered, closed-cell, crosslinked polyethylene (PEX) foam insulation with a thermal conductivity of 0.26 BTU in./sq. ft./hour/°F; Vapor permeability of 0.1g/100 sq. in./day
Jacket:	Corrugated, seamless HDPE; UV-protected
Operating Limits:	-30°F to 73°F at 160 psig (-34°C to 23°C at 11.0 bar) -30°F to 100°F at 125 psig (-34°C to 38°C at 8.6 bar) -30°F to 120°F at 101 psig (-34°C to 49°C at 6.9 bar) -30°F to 140°F at 80 psig (-34°C to 60°C at 5.5 bar)

Product Information and Application Use

Uponor's ASTM Ecoflex® Potable HDPE features high-density polyethylene (HDPE) service pipe protected by multilayer PEX-foam insulation and covered by a corrugated, waterproof HDPE jacket. Use Ecoflex Potable HDPE for cold potable-water, cooling and low-temperature heating applications.

✓	Part Description	Part Number	Service Pipe O.D.	Service Pipe I.D.	Foam Thickness	Insulation Value[1]	Bend Radius	Weight (lb./ft.)
	1¼" Potable HDPE with 5.5" Jacket, 300-ft. coil	5115513	1.660"	1.368"	1.54"	R-7.57	14"	1.0 lbs.
	1½" Potable HDPE with 5.5" Jacket, 300-ft. coil	5115515	1.900"	1.554"	1.42"	R-6.75	18"	1.0 lbs.
	2" Potable HDPE with 5.5" Jacket, 300-ft. coil	5115520	2.375"	1.943"	1.18"	R-5.36	30"	1.4 lbs.
	3" Potable HDPE with 6.9" Jacket, 300-ft. coil	5116930	3.500"	2.860"	1.18"	R-5.27	32"	2.4 lbs.
	4" Potable HDPE with 7.9" Jacket, 300-ft. coil	5117940	4.500"	3.680"	1.06"	R-4.76	48"	3.6 lbs.

Installation

Install Ecoflex Potable HDPE in cold potable-water, chilled-water, cooling and low-temperature heating applications. Join pipes through fusion welding, electro-fusion fittings or HDPE compression fittings (not sold by Uponor). For additional information, refer to the Uponor Pre-insulated Pipe Systems Design and Installation Manual.

Standards

PE 3408, PE 3608 or PE 3454; AWWA C906; ASTM F714; NSF/ANSI Standard 61

Codes

UPC; IPC; NSPC

Listings

NSF/ANSI 61-certified or NSF-pw

Related Applications

Pre-insulated Pipe Systems
Radiant Heating and Cooling Systems
Snow and Ice Melting Systems
Permafrost Prevention Systems
Turf Conditioning Systems

Contact Information

Uponor, Inc.
5925 148th Street West
Apple Valley, MN 55124 USA
Phone: 800.321.4739
Fax: 952.891.2008
www.uponorpro.com

Uponor Ltd.
2000 Argentia Road, Plaza 1, Suite 200
Mississauga, ON L5N 1W1 CANADA
Phone: 888.994.7726
Fax: 800.638.9517
www.uponorpro.com

[1]R-value is normalized based on the nominal foam thickness for a circular shape.

Ecoflex® Connection Vault

Submittal Information
Revision A: August 24, 2009

Project Information

Job Name: Jackson National Life phase 3.1

Location: Okemos, MI
Part No. Ordered:

Engineer: Edwards & Zuck
Date Submitted: 12-11-14

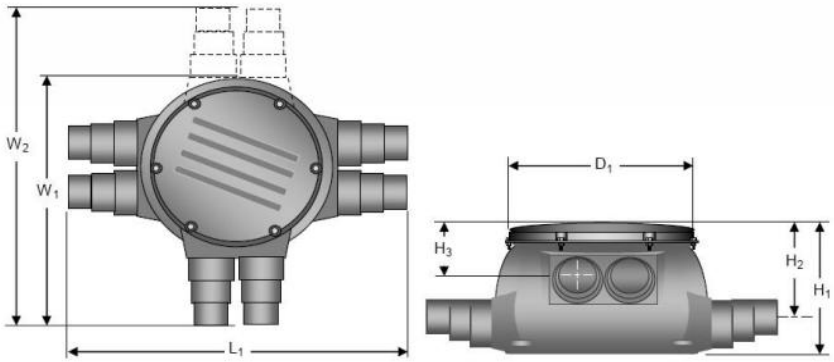
Contractor: Limbach LLC
Submitted By:

Manufacturer's Representative: Performance Engineering
Approved By:

Technical Data

Material:

Body:	Rotationally-molded Polyethylene
Body Interior:	Polyethylene Insulation
Cover:	Polyethylene
Cover Fasteners:	Stainless Steel
Cover Gasket:	EPDM Rubber



Product Information and Application Use

The Ecoflex® Connection Vault provides a fully watertight, insulated enclosure for multiple straight-through and branch underground connections. This product is designed to eliminate the need for multiple branch connections, saving installation time and cost. Step-down outlets are compatible with the majority of Ecoflex piping. **Note:** End Caps are required at all ends of the piping system to ensure insulation integrity.

✓	Description	Part Number	Access Cover (D_1)	Height: Overall (H_1)	Height: Top to Centerline (H_2)	Height: Top to Centerline (H_3)	Width (W_1 W_2)	Length (L_1)	Weight
✔	Ecoflex Connection Vault, 6 outlet	1018326	30"	29"	19"	11"	52" (W_1)	66"	108 lbs.
	Ecoflex Connection Vault, 8 outlet	1018327	30"	29"	19"	11"	65" (W_2)	66"	112 lbs

Installation

The Connection Vault is designed for burial. Position the Connection Vault in the trench to achieve proper pipe alignment prior to inserting the piping. For complete instructions, refer to the Pre-insulated Pipe System Connection Vault Instruction Sheet.

Standards

N/A

Codes

N/A

Listings

N/A

Related Applications

Radiant Heating and Cooling Systems
Snow and Ice Melting Systems
Permafrost Protection Systems
Turf Conditioning Systems

Contact Information

Uponor, Inc.
5925 148th Street West
Apple Valley, MN 55124 USA
Phone: (800) 321-4739
Fax: (952) 891-2008
www.uponor.com

Uponor Ltd.
2000 Argentia Rd., Plaza 1, Ste. 200
Mississauga, ON L5N 1W1 CANADA
Phone: (888) 994-7726
Fax: (800) 638-9517
www.uponor.ca

ASTM Ecoflex® Rubber End Cap, Single

Submittal Information
Revision C: Feb. 3, 2014

Project Information

Job Name: Jackson National Life phase 3.1

Location: Okemos, MI
Part No. Ordered:

Engineer: Edwards & Zuck
Date Submitted: 12-11-14

Contractor: Limbach LLC
Submitted By:

Manufacturer's Representative: Performance Engineering
Approved By:

Technical Data

Material:

Rubber End Cap: EPDM (ethylene propylene diene monomer) rubber

Clamp Device: Stainless steel

O-ring: EPDM rubber

Product Information and Application Use

Use the EPDM Rubber End Cap to seal the exposed insulation between the jacket and service pipe when cutting pipe to make a connection. Designed to support system integrity, Ecoflex® End Caps are required on all exposed ends of Ecoflex pipes to avoid ground water contamination.

✓	Description	Part Number	Jacket (mm)	Jacket (inches)	Length	Weight	Compatible Pipes
☐	End Cap, ¾" and 1" PEX Pipe with 2.7" Jacket	5852710	68mm	2.7"	5.25"	0.378 lbs.	5012775, 5012710, 5212775, 5212710
☐	End Cap, 1" and 1¼" PEX Pipe with 5.5" Jacket	5855513	140mm	5.5"	3.5"	1.0 lbs.	5015510, 5015513, 5215510, 5215513
☐	End Cap, 1¼", 1½" and 2" HDPE Pipe with 5.5" Jacket	5855520	140mm	5.5"	3.5"	1.0 lbs.	5115513, 5115515, 5115520
☑	End Cap, 1½", 2", 2½" PEX and 3" HDPE Pipe with 6.9" Jacket	5856930	175mm	6.9"	3.5"	1.0 lbs.	5016915, 5016920, 5016925, 5116930, 5216915, 5216920
☐	End Cap, 3", 3½", 4" PEX and 4" HDPE Pipe with 7.9" Jacket	5857940	200mm	7.9"	3.5"	1.0 lbs.	5017930, 5017935, 5017940, 5117940, 5217930

Installation

The End Cap includes an O-ring and clamp device for a water-tight installation. Slip the End Cap on the jacket pipe and ensure that the O-ring stays in place. Refer to the Uponor Pre-insulated Pipe Systems Design and Installation Manual for more information.

Standards

N/A

Codes

N/A

Listings

N/A

Related Applications

Pre-Insulated Pipe Systems
Radiant Heating and Cooling Systems
Snow and Ice Melting Systems
Permafrost Prevention Systems
Turf Conditioning Systems

Contact Information

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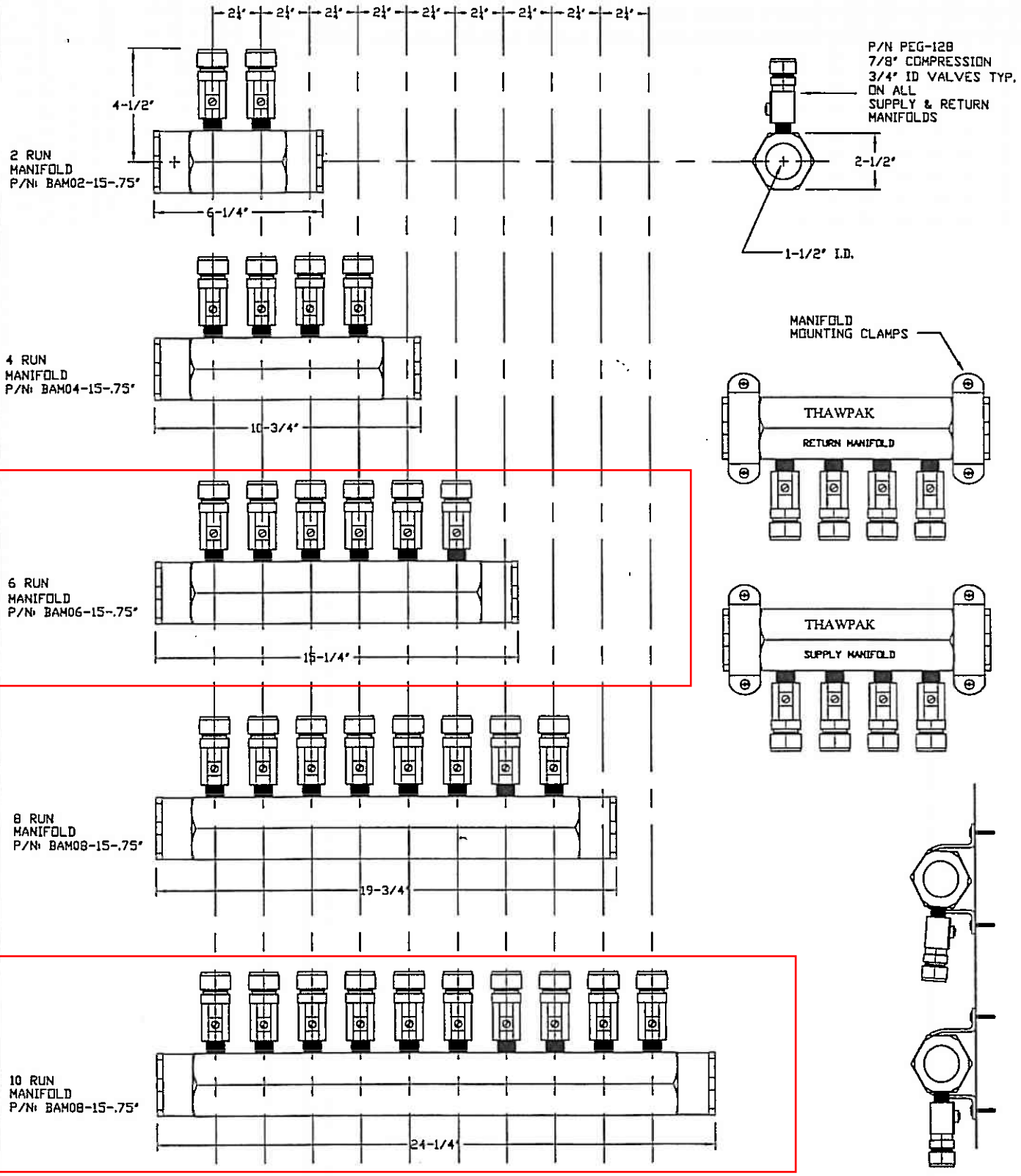
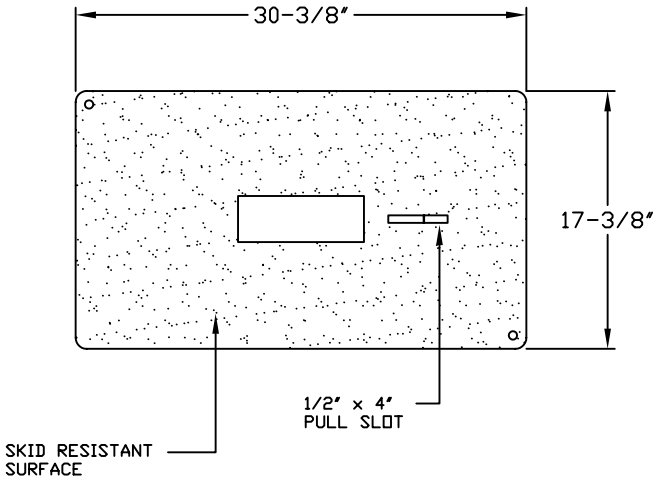


TITLE

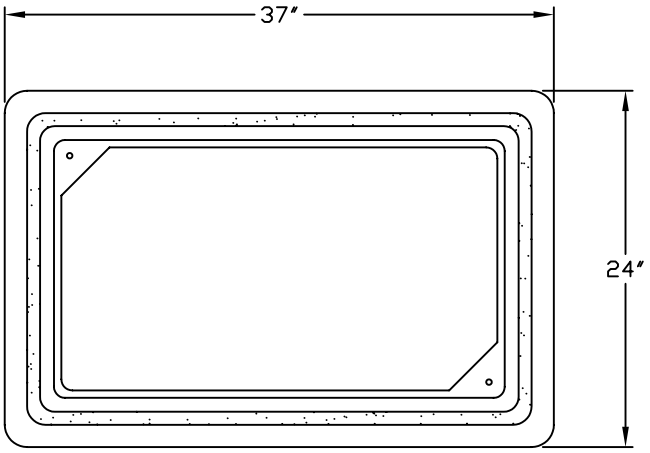
1-1/2" SUPPLY & RETURN MANIFOLDS W/ 7/8" BALL VALVES

DWG. #	DRAWN BY:	DATE:	SCALE:	PAGE:
PEG-712	DM	2/04/02	NOT TO SCALE	1

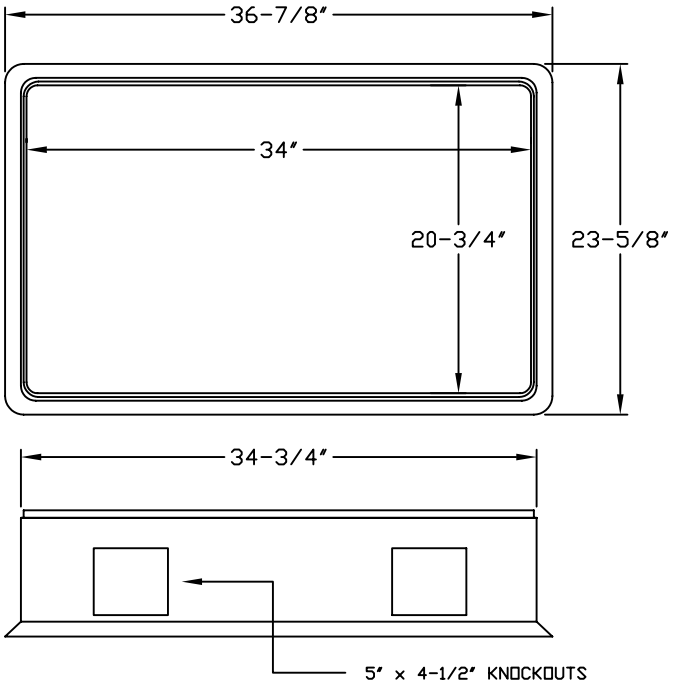
THAW-PAK
RADIANT HEATING & SNOW MELTING SYSTEMS
32995 INDUSTRIAL RD. LIVONIA, MI. 48152
OFFICE:(734)266-5300 FAX:(734)266-5310



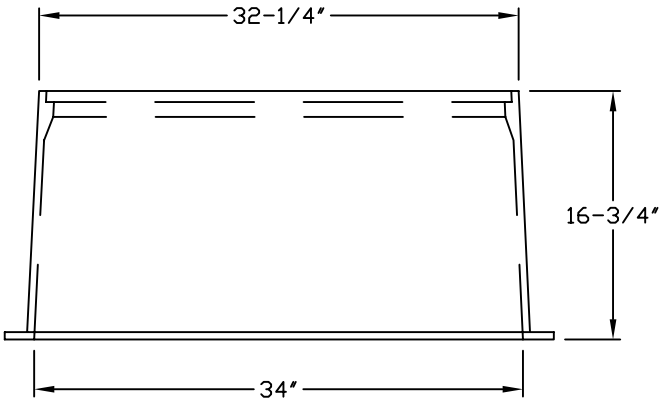
COVER



TOP VIEW



EXTENSION



FRONT VIEW

TITLE: 17"x30" "PX" STYLE MANIFOLD BOX/COVER			EXTENSION PART NO. PX1730EA08	
DWG. # PEG-708	DRAWN BY: DM	DATE: 5/22/2000	BOX PART NO. PX1730BA16	COVER PART NO. PX1730CA00

THAW-PAK
RADIANT HEATING & SNOW MELTING SYSTEMS
32615 PARK LANE, GARDEN CITY, MI. 48135
OFFICE:(734)266-5300 FAX:(734)266-5310

Quazite® Underground Handhole Enclosure Selection Guide

PG Style

Stackable for increased depth. Straight sides for easy adjustment of box to grade.

- Available in sizes:

11" x 18"	24" x 24"	30" x 60"	36" x 72"	48" x 96"
13" x 24"	24" x 36"	36" x 36"	48" x 48"	
17" x 30"	30" x 48"	36" x 60"	48" x 72"	

- Design load: 22,500 lbs. Test load: 33,750 lbs. (Loadings comply with ANSI/SCTE 77. These boxes, with a design load of 22,500 lbs. and a test load of 33,750 lbs., meet ANSI Tier 22 test provisions.)
- 12" - 48" depths

PD Style

Enclosures with 1° (degree) flare for maximum strength. Flared design optimizes internal volume and prevents frost heave.

- Available in sizes: 13" x 24", 17" x 30", 24" x 36", 30" x 48"
- Design load: 22,500 lbs. Test load: 33,750 lbs. (ANSI Tier 22)
- 18" - 48" depths

PR Style

Round enclosures. Cover cannot fall into the box.

Available in sizes:
27" dia. x 36" & 48" depths
39" dia. x 18", 24", 36" & 48" depths.

- Design load: 22,500 lbs. Test load: 33,750 lbs. (ANSI Tier 22)

PC Style

Straight sides permit easy movement of box should grade level change. Gasketing also available. All sizes are stackable.

- Sizes: 6" x 8" , 8" x 18", 11" x 18" and 12" x 12"
  Design load: 15,000 lbs. Test load: 22,500 lbs. (ANSI Tier 15)
- Sizes: 13" x 24" and 17" x 30"
  Design load: 5,000 lbs. Test load: 7,500 lbs. (ANSI Tier 5)
- Sizes: 8" x 8"
  Design load: 22,500 lbs. Test load: 33,750 lbs. (ANSI Tier 22)
- 6" - 18" depths

PX Style

Service box assemblies with flared sides. Nestable for compact storage.

- PX Size: 12" x 12" x 24"
  Design load: 15,000 lbs. Test load: 22,500 lbs. (ANSI Tier 15)

PT Style

Flared design prevents frost heave. Covers are interchangeable with many precast concrete parts. Nestable for compact storage.

- Sizes: 10" x 15", 13" x 24", 17" x 30"
- Design load: 15,000 lbs. Test load: 22,500 lbs. (ANSI Tier 15)
- 18" deep

Application Tiers & Static Vertical Wheel Load Ratings per ANSI/SCTE 77 2007 "Specification for Underground Enclosure Integrity"

NOTE *- QUAZITE® products are not intended for use in deliberate traffic areas.*

Application Tiers	Loading Requirements				UL Listed to meet ANSI 77 Requirements[2]
TIER 5[1] Sidewalk applications with a safety factor for occasional non-deliberate vehicular traffic	**Vertical**	**Design Load**	22.2 kN	5,000 lbs.	PC 13"x24" or PC 17"x30" style enclosure and cover assemblies with standard covers (**CA**) and standard covers w/o bolts (**WA**).
		Test Load	33.3 kN	7,500 lbs.	
	Lateral	**Design Load**	28.7 kPa	600 lbs./sq. ft.	
		Test Load	43.1 kPa	900 lbs./sq. ft.	
TIER 8[1] Sidewalk applications with a safety factor for non-deliberate vehicular traffic	**Vertical**	**Design Load**	35.6 kN	8,000 lbs.	PG and PT style enclosure and cover assemblies up to 30" x 48" and PC style in sizes 6"x8", 8"x18", 11"x18" and 12"x12" with standard covers (**CA**) and standard covers w/o bolts (**WA**).
		Test Load	53.4 kN	12,000 lbs.	
	Lateral	**Design Load**	28.7 kPa	600 lbs./sq. ft.	
		Test Load	43.1 kPa	900 lbs./sq. ft.	
TIER 15[1] Driveway, parking lot, and off-roadway applications subject to occasional non-deliberate heavy vehicular traffic	**Vertical**	**Design Load**	66.7 kN	15,000 lbs.	PG, PT and PC style enclosure and cover assemblies up to 30"x48" with heavy duty covers (**HA**).
		Test Load	100.1 kN	22,500 lbs.	
	Lateral	**Design Load**	38.3 kPa	800 lbs./sq. ft.	
		Test Load	57.5 kPa	1,200 lbs./sq. ft.	
Tier 22[1] Driveway, parking lot, and off-roadway applications subject to occasional non-deliberate heavy vehicular traffic	**Vertical**	**Design Load**	100.1 kN	22,500 lbs.	PC, PD, PG and PT style enclosure and cover assemblies up to 30" x 48" with extra heavy duty covers (HH).
		Test Load	150.1 kN	33,750 lbs.	
	Lateral	**Design Load**	38.3 kPa	800 lbs./sq. ft.	
		Test Load	57.5 kPa	1,200 lbs./sq. ft.	
AASHTO H-20 Deliberate vehicular traffic applications ONLY. Quazite does not currently offer any enclosures for this application tier.	Certified precast concrete, cast iron or other AASHTO recognized materials.* **There are no AASHTO design or test provisions for polymer composites. Therefore there is no recognized method of testing for qualification. Applying other material testing methods to polymer composites is not recognized by AASHTO.* **BUYER BEWARE !**				

QUAZITE® underground handhole enclosures are designed to meet or exceed the tier loadings set forth in the American National Standards Institute's ANSI/SCTE 77 2007 "Specification for Underground Enclosure Integrity"[1]. ANSI tier designations are minimum specifications used by the industry to ensure the safe and reliable performance of underground handhole enclosures.

The ANSI application tier number relates to a nominal design load times 1,000 pounds (i.e.: Tier 8 = 8 x 1,000 lbs. = 8,000 lbs.). All ANSI tier loadings will have a corresponding test load which is 50% greater than the design load. The maximum deflection at the indicated design load shall be 1/2 inch for vertical tests and 1/4 inch per foot of length for lateral tests.

1 Electronic file available at www.scte.org/documents/pdf/ANSISCTE%2077%202007.pdf.

2 Some QUAZITE® products are currently not UL Listed. Refer to Quazite catalog pg. 15 for a complete listing of products.

Yellow highlights indicate UL Listing

NOTE: Because Hubbell has a policy of continuous product improvement, we reserve the right to change design and specifications without notice.

HUBBELL LENOIR CITY, INC.
QUAZITE®
3621 Industrial Park Drive
Lenoir City, TN 37771
Phone: 800-346-3062 or 865-986-9726
Fax: 865-986-0585
Web: http://www.quazite.com
e-mail: hpsliterature@hps.hubbell.com

QZ-4
June, 2008

Material Safety Data Sheet

Product Name: 8406-40% **Revision Date: March 18, 2013**

Section #1: Chemical Product and Company Identification

Product Name: 8406-40%
Manufacturer / Distributor: Enerco Corporation
Address: 317 N. Bridge St., Grand Ledge, MI 48837
Telephone: (800) 292-5908 Fax: (517) 627-8037

For chemical emergency - spill, leak, fire, exposure or accident - call CHEMTREC - day or night - (800) 424-9300

Section #2: Composition/Information on Ingredients

	Chemical Name	CAS Number	Weight %	OSHA PEL	ACGIH TLV
☐	Propylene Glycol	57-55-6	40%	unknown	unknown

☑ Indicates hazardous substances. Remainer of components comprise proprietary information. This document is prepared pursuant to the OSHA Hazard Communication Standard, 29 CFR 1910.1200. In addition, other substances not "hazardous" per this OSHA standard may be listed.

Section #3: Hazards Identification

EMERGENCY OVERVIEW: May cause irritation to skin and eyes.

Potential Health Effects: See Section 11 for toxicological data

Effects of Acute Exposure: Eye: Mild irritation may occur.
Skin: Mild irritation may occur.
Inhalation: Harmful effects are not expected from short term inhallation.
Ingestion: Not expected to result in harmful effects under anticipated conditions of normal use. Excessive ingestion may cause central nervous system effects.

Effects of Chronic Exposure: Normal use of this product does not result in chronic exposure.

Medical Conditions Generally Aggravated by Exposure: May aggrevate pre-existing eye disease.

Section #4: First Aid Measures

Eye: Immediately flush with water for 15 minutes - be sure eyelids are held open during flushing. If irritation occurs, consult physician.

Skin: Flush with water for 15 minutes. If irritation occurs, consult physician.

Inhalation: First aid not normally required. Remove to fresh air if effects occur. Consult physician if symptoms persists.

Ingestion: First aid not normally required. If symtoms develop, consult physician - get medical attention. Never give anything by mouth to an unconscious person.

Continued on next page...

Material Safety Data Sheet

Continued from previous page...

Section #5: Fire-Fighting Measures

NFPA Hazard Codes - (Health / Flammability / Reactivity):

0 / 1 / 0

NFPA Code Legend
4 - Severe Hazard
3 - Serious Hazard
2 - Moderate Hazard
1 - Slight Hazard
0 - Minimal Hazard

Flash Point: Greater than 200°F.

Flammable Limits: Not determined.

Extinguishing Media: Water, fog, dry chemical, carbon dioxide, foam.

Special Fire Fighting Procedures: Fire fighters should wear full protective gear including self-contained breathing apparatus.

Unusual Fire and Explosive Hazards: May form carbon dioxide and carbon monoxide.

Section #6: Accidental Release Measures

Spill and Leak Procedure: Contain spill. Keep out of drains, sewers, lakes, streams, or other water systems. Use absorbent to clean up. Transfer to suitable container for disposal.
Large spills: Dike or contain material and recover it for use as originally intended.

Disposal: Dispose of in accordance with applicable environmental standards.

Section #7: Handling and Storage

Precautions to be Taken in Handling: Avoid contact with eyes, skin, and clothing. Avoid breathing vapor. Keep container tightly closed when not in use. Do not ingest.

Precautions to be Taken in Storage: Store in a cool, dry place. Store below 120°F. Normal shelf life 1 year. Do not store with or near food supplies or potable water.

Continued on next page...

Material Safety Data Sheet

Continued from previous page...

Section #8: Exposure Controls / Personal Protection

Ventilation: Good general ventilation should be sufficient to control airborne levels of vapor and mist.

Eye Protection: Chemical safety goggles.

Skin Protection: Rubber gloves.

Respiratory Protection: None needed, if ventilation is adequate.

Other Protection Equipment: Any other protective clothing or use of equipment necessary to prevent eye and skin contact.

Permissible Exposure Limits: None established for product.

Section #9: Physical and Chemical Properties

Appearance:	Clear Liquid (Unless Dye Specified)	**Boiliing Point (deg. F):**	Greater than 212
Odor:	Little Or No Odor	**Vapor Pressure:**	<0.1 mm Hg
pH (1% sol'n, unless noted):	9.0-10.0	**Vapor Density:**	2.6 (air = 1)
Solubility in Water:	Complete	**Evaportation Rate:**	Similar to water

Section #10: Stability and Reactivity

Chemical Stability: Stable

Conditions to Avoid: Avoid storage temperatures above 120°F or below 40°F.

Incompatibility: Strong bases. Strong acids. Oxidizing agents.

Hazardous Decomposition Products: Carbon monoxide and other toxic vapors.

Hazardous Polymerization: Will not occur.

Section #11: Toxicological Information

Skin and eye (mild irritation) are expected to be the primary target organs of this product. May be harmful if ingested in large quantities.

Ingredients as Carcinogens: To the best of our knowledge, this product does not contain any substances that are considered by OSHA, NTP, IARC, or ACGIH to be 'probable' or 'suspected' human carcinogens.

Section #12: Ecological Information

Practicallly non toxic to mammalian wildlife. Insignificant toxic hazard to aquatic organisms and fish.

Section #13: Disposal Considerations

Best route is to use product for its originally intended purpose.
Dispose of in accordance with applicable environmental standards.

Continued on next page...

Material Safety Data Sheet

Section #14: Transport Information

DOT Proper Shipping Name: Not hazardous as regulated by DOT.

DOT Hazard Class: Not Applicable. **DOT UN Number:**

DOT Label: Not Applicable **DOT Packing Group:** None

The shipping name listed above applies to a 55 gallon drum of the product. This product may have more than one proper shipping name, depending on packaging, product properties, and mode of shipment.

Section #15: Regulatory Information

TSCA: All ingredients are on the TSCA inventory or are not required to be listed on the TSCA inventory.

RCRA Hazard Class: No components of this product are listed.

CERCLA RQ: No components of this product are listed.

SARA Title III

Extremely Hazardous Substance: No components of this product are listed.

Hazardous Substance: Hazard due to: Irritability

Hazard Catagorization:

- ☐ Sudden Release of Pressure
- ☐ Reactive
- ☐ Fire
- ☑ Immediate (Acute) Health
- ☐ Delayed (Chronic) Health

Section 313 Chemicals: No components of this product are listed.

STATE RIGHT-TO-KNOW

CHEMICAL NAME	CAS NUMBER	LIST
Propylene Glycol	57-55-6	MN, PA1

MN=Minnesota Hazardous Substance PA1=Pennsylvania Hazardous Substance (present at greater than or equal to 1.0%)

California Proposition 65 (Safe Drinking Water and Toxic Enforcement Act of 1986) This product when clear contains no listed substances know to the State of California to cause cancer, birth defects or other reproductive harm, at levels which would require a warning under the statute.

Section #16: Other Information

PIPE MATERIALS

1. ALL PIPING SHOULD BE SIZED AND INSTALLED AS SHOWN ON THE THAW-PAK SYSTEM DRAWING.
2. NO CHANGES SHALL BE MADE TO THE SYSTEM LAYOUT OR PIPE SIZE WITHOUT PRIOR APPROVAL IN WRITING FROM THAW-PAK REPRESENTATIVE.
3. A MINIMUM OF TYPE L COPPER TUBING IS SUGGESTED FOR SUPPLY AND RETURN MAINS, OTHER TYPES OF PIPING AND MATERIALS SHOULD BE APPROVED IN WRITING FROM A THAW-PAK REPRESENTATIVE.

INSULATION

UNDERGROUND INSTALLATIONS:

1. IT IS SUGGESTED THAT ALL SUPPLY AND RETURN MAINS BE INSULATED TO CONSERVE ENERGY AND PROTECT ALL PIPE FROM POSSIBLE DAMAGE FROM SOIL CONDITIONS. INSULATION WILL MINIMIZE WARM SPOTS IN UNHEATED AREAS.

2. RIGID FOAM GLASS, INSULATION WITH PIT WRAP IS RECOMMENDED.
·PIPE SIZES UP TO 2" USE 1-1/2" FOAM GLASS INSULATION THICKNESS
·PIPE SIZES OVER 2" USE 2" FOAM GLASS INSULATION THICKNESS

ABOVE GROUND INSTALLATIONS:

1. WATERPROOF COVER IS NOT REQUIRED ON INDOOR INSTALLATIONS OR OUTDOOR INSTALLATIONS UNLESS THE INSULATION IS SUBJECTED TO VAPOR LADEN AIR OR WET CONDITIONS THAT WOULD SATURATE THE INSULATING MATERIAL.

AIR TESTING

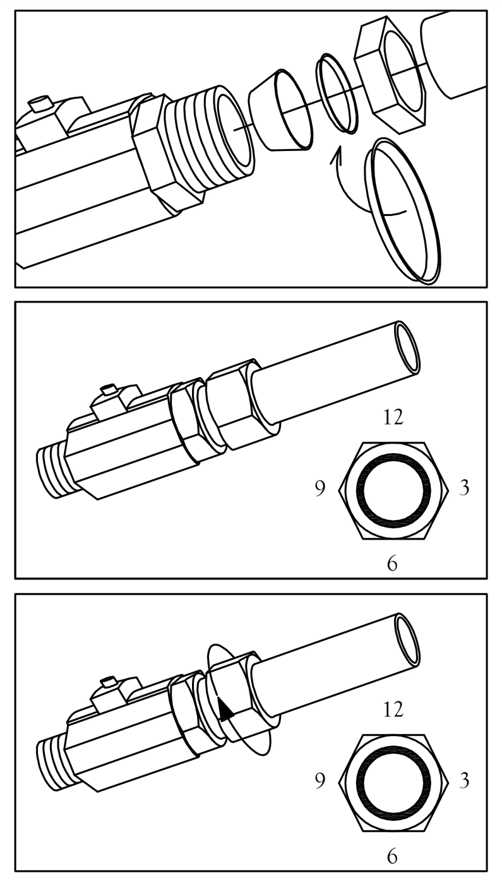
POURED / UNDERGROUND INSTALLATIONS:

1. REFER TO DRAWING:
   PEG-422A - 1" MANIFOLD
   PEG-422B - 1 1/2" MANIFOLD
2. EACH SUPPLY AND RETURN MANIFOLD WITH TUBING CIRCUITS MUST BE AIR TESTED
3. IF SUPPLY AND RETURN MAINS ARE INSTALLED UNDERGROUND OR IN CONCEALED LOCATIONS THEY MUST BE TESTED AS A PART OF THE COMPLETE SYSTEM FOR LEAKS BEFORE BEING CONCEALED OR COVERED.
4. INSTALL THE SOLID BLACK BUSHING WITH PRESSURE GAUGE ON THE RETURN MANIFOLD OR MAIN AS SHOWN ON THE DRAWING PEG-422A OR 422B.
5. INSTALL TEFLON BASED PIPE JOINT COMPOUND ON EACH MANIFOLD WHERE 1" OR 1-1/2" ALUMINUM FLUSH PLUGS WILL BE INSTALLED.
6. TAKE THE ALUMINUM FLUSH PLUGS AND WRAP EACH ONE WITH FOUR LAYERS OF PTFE THREAD SEAL TAPE AND INSTALL IN MANIFOLD AS SHOWN ON DRAWING. PLUGS ARE DESIGNED TO BE FLUSH AND SNUG.
7. INSTALL THE SOLID BLACK BUSHING WITH THE AIR CHARGE VALVE ON THE SUPPLY MANIFOLD OR MAIN AS SHOWN ON THE DRAWING.
8. PRESSURIZE THE SYSTEM AT THE AIR CHARGE VALVE TO 100 POUNDS PER SQUARE INCH.
9. MAINTAIN AIR PRESSURE IN THE UNDERFLOOR SYSTEM AT 1-1/2 TIMES THE SYSTEM OPERATING PRESSURE OR AT 100 PSI, WHICH EVER IS GREATER FOR A MINIMUM OF 30 MINUTES TO DETERMINE IF ANY LEAKS EXIST IN THE SYSTEM.
10. THE PRESSURE MAY DROP 3-4 POUNDS OVERNIGHT DUE TO COOLING.
11. SOAP AND WATER SOLUTION MAY BE USED TO FIND THE LOCATION OF ANY LEAKS.
12. IF A LEAK OCCURS IN A RUN OF THAW-PAK TUBING CONTACT YOUR THAW-PAK DISTRIBUTOR FOR A NEW ROLL OF TUBING. REPLACE THE DAMAGED TUBING RUN AND TEST THE SYSTEM AGAIN AS OUTLINED ABOVE.
13. WHILE POURING CONCRETE OR COVERING TUBING WITH OTHER MATERIALS CONNECT AN AIR COMPRESSOR AND PROVIDE A CONTINUOUS FORTY (40) PSI OF AIR PRESSURE TO INSURE THAT NO LEAKS DEVELOP DURING THE POURING PROCESS.
14. IF A LEAK OCCURS THE COMPRESSOR WILL BEGIN TO RUN AND THE DAMAGED TUBING WILL BEGIN TO LEAK AIR UP THROUGH THE CONCRETE.
15. LOCATE THE LEAK AND CUT THE TUBING AT THAT POINT. INSTALL ONE OF THE BRASS COUPLINGS FROM THE REPAIR KIT AND COMPLETELY WRAP THE FITTING.
16. AFTER THE CONCRETE INSTALLATION IS COMPLETED, REMOVE THE COMPRESSOR AND MAINTAIN 40 PSI FOR A MINIMUM OF 24 HOURS, IF NO LEAKS ARE DETECTED REMOVE SOLID BLACK BUSHINGS, AIR VALVE & AIR GAUGE FROM THE SUPPLY AND RETURN MAINS AND CONNECT BOILER AS SHOWN ON DRAWINGS PROVIDED.
17. FILL THE SYSTEM AS OUTLINED IN THE FILLING INSTRUCTIONS.

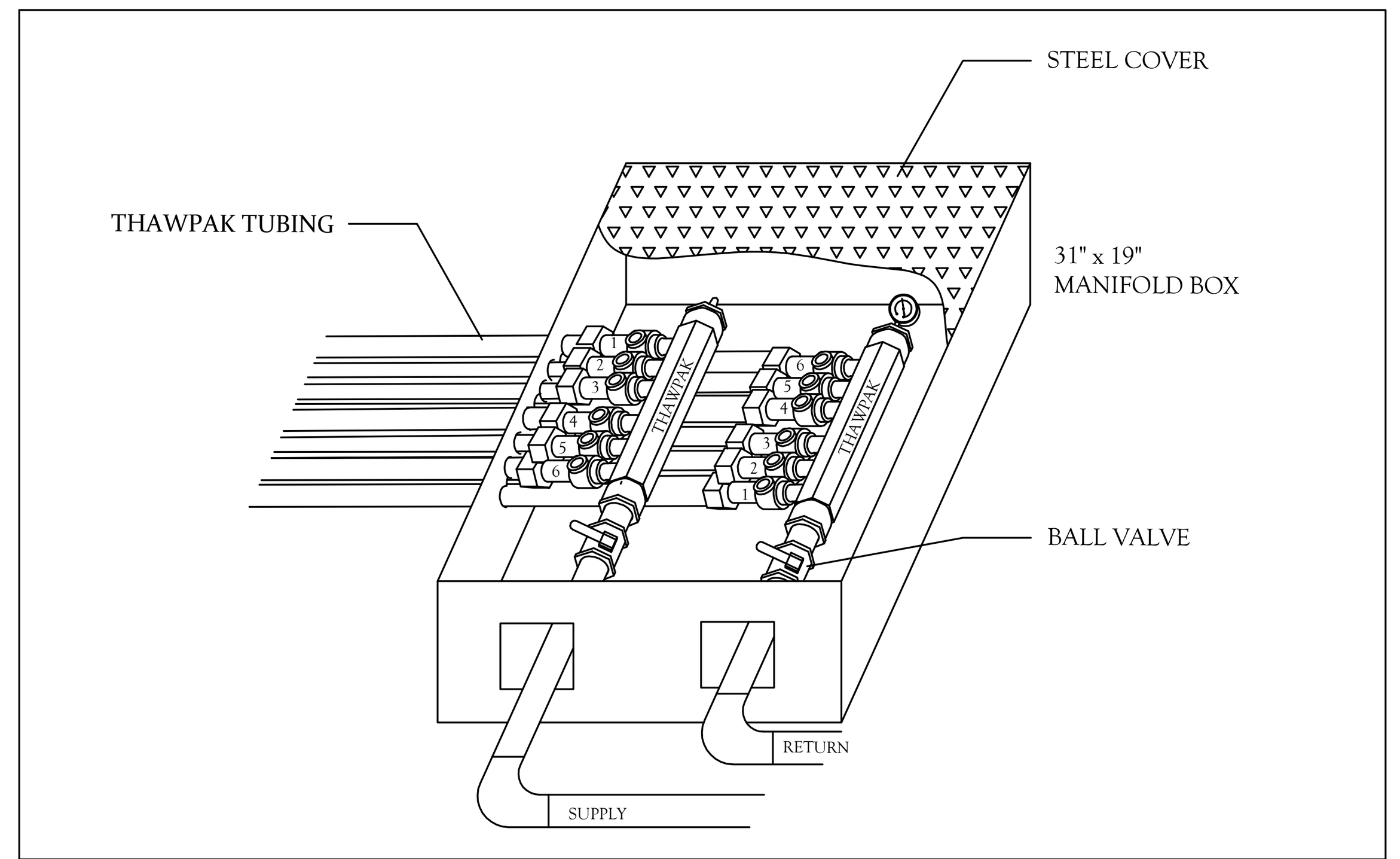
TUBE CUTTING

1. DO NOT PRE-CUT TUBING LENGTHS.
2. IDENTIFY THE LENGTH AND SIZE OF TUBING ON EACH ROLL AND LABEL THE ROLL WITH A NUMBER CORRESPONDING TO THE TUBE CUTTING SCHEDULE ON THE THAW-PAK SYSTEM DRAWING.
3. EACH RUN SHOULD BE INSTALLED AND LENGTH VERIFIED BEFORE CUTTING FROM THE ROLL.
4. TUBING IS MANUFACTURED WITH FOOT MARKERS PRINTED DOWN THE ENTIRE LENGTH OF THE TUBING ROLL. THESE NUMBERS PROVIDE THE INSTALLER WITH A METHOD TO DETERMINE THE AMOUNT OF TUBING USED FROM THE ROLL.
5. RECORD THE NUMBER AT THE BEGINNING OF THE TUBE ROLL.
6. LAY-OUT THE ENTIRE TUBING RUN AS SHOWN ON THE THAW-PAK SYSTEM DRAWINGS.
7. RECORD THE NUMBER AT THE END OF THE RUN LAID OUT.
8. SUBTRACT THE SMALLER NUMBER FROM THE LARGER NUMBER TO CONFIRM THE LENGTH OF TUBING USED.
9. COMPARE THIS NUMBER TO THE LENGTH OF THE CIRCUIT PRINTED ON THE THAW-PAK DRAWING. THE ACTUAL INSTALLED LENGTH MAY BE DIFFERENT, BUT SHALL BE WITHIN THE LENGTHS INDICATED ON THE CHART BELOW.
10. IF THE LENGTH OF TUBING FALLS BETWEEN THE MINUMUM AND MAXIMUM LENGTHS INDICATED ON THE CHART, THE TUBING CAN BE CUT FOR ATTACHMENT TO THE SYSTEM MANIFOLD.
11. IF TUBING LENGTH IS NOT WITHIN THE MINUMUM AND MAXIMUM LENGTHS INDICATED ON THE CHART, INSPECT THE TUBING INSTALLATION FOR ERRORS AND MAKE CORRECTIONS. IF THE TUBING LAYOUT ERROR CANNOT BE VERIFIED CONTACT YOUR THAW-PAK DISTRIBUTOR FOR FURTHER INSTRUCTIONS.

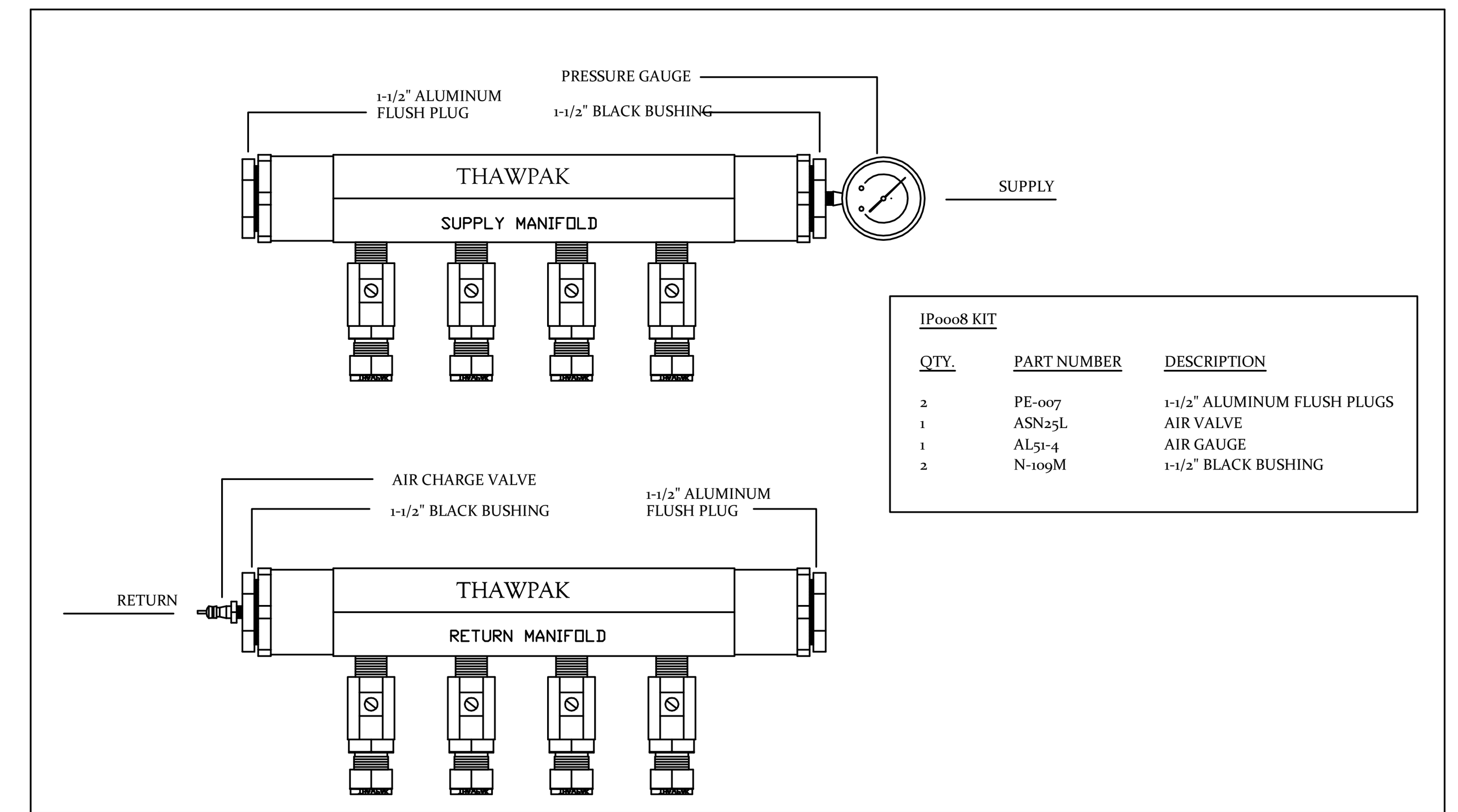
UNION INSTALLATION INSTRUCTIONS



1. Insert the tubing into the THAW-PAK tube fitting. Make sure the tubing rests firmly on the shoulder of the fitting and the nut is finger tight.
2. Before tightening the THAW-PAK nut, scribe the nut at the 6 o'clock position.
3. While holding the fitting body steady with a back-up wrench, tighten the nut 1-1/4 turns. Watch the scribe mark, make one complete revolution and continue to the 9 o'clock position.

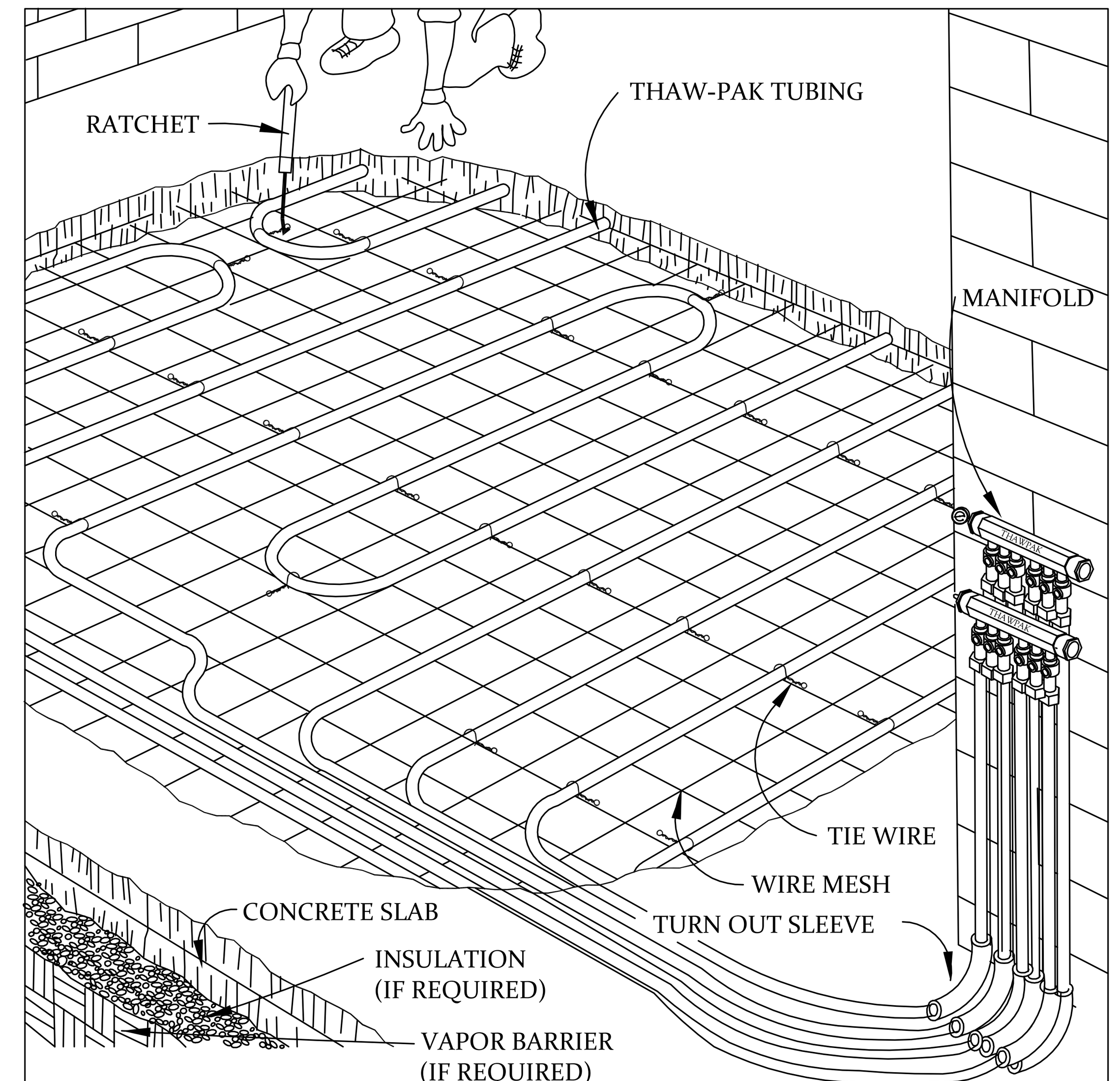


Drawing No: PEG-425 **MANIFOLD BOX INSTALLATION DETAIL**



Drawing No: PEG-422B **1-1/2" MANIFOLD PRESSURE TEST DETAIL**

Sleeves to be provided at all expansion joints. Sleeves and expansion joints can be PVC. Sleeves to be provided at slab penetrations shall be steel.
All installation details on this submittal to be coordinated as required with all trades. Concrete contractor to provide 3/4" flexible insulation under slab.



1. Use a 4" minimum depth of 1./2" or 3/4" pea gravel or sand.
2. Use 10" gauge 6" X 6" wire mesh as layout grid.
3. Follow layout design closely, allowing for manifold connection.
4. Plastic tubing layout should be 1-1/2" below slab surface.
5. Secure tubing to the grid with ratchet and tie wires as needed.
6. Terminate turn out sleeve above grade.

Drawing No: PEG-431 **TUBING INSTALLATION DETAIL**

PROJECT DESIGN SUMMARY

TOTAL AREA:	7,899 SQ.FT.
NUMBER OF ZONES:	4
NUMBER OF MANIFOLDS:	4 SETS
BTU'S/SF:	223 BTU
MAX. HEAT LOAD:	1,761,477 MBTU
FLUID TYPE:	40% PROPYLENE GLYCOL
SYSTEM VOLUME:	381 GALLONS
TOTAL NUMBER OF LOOPS:	35
DESIGN TEMP:	-10°
TEMP. RISE:	36.1°

THAWPAK MATERIAL LIST
RADIANT EQ. LIST

QTY.	PART NUMBER	DESCRIPTION
1	1K0015	RADIANT FLOOR- EMBEDDED- 3/4"
1	1P0008	MANIFOLD PRESSURIZATION KITS 1-1/2"
1	BAM05-15-.75"	5-CIRCUIT MANIFOLD SET
3	BAM10-15-.75"	10-CIRCUIT MANIFOLD SET
3500	806018	TIE WIRE - 16 GAUGE x 6"
4	008858	MANIFOLD BOX
4	0088581	MANIFOLD BOX COVER
12	TPX4C10	TUBING - 3/4"x1000' PEX (WHITE)
2	BDUA14	7/8" REPAIR COUPLERS
1	TE 664/090/091	TEKMAR SNOW CONTROL AND SENSOR
8	8406-40%-50	PREMIXED PROPYLENE GLYCOL

HEATING EQUIPMENT:

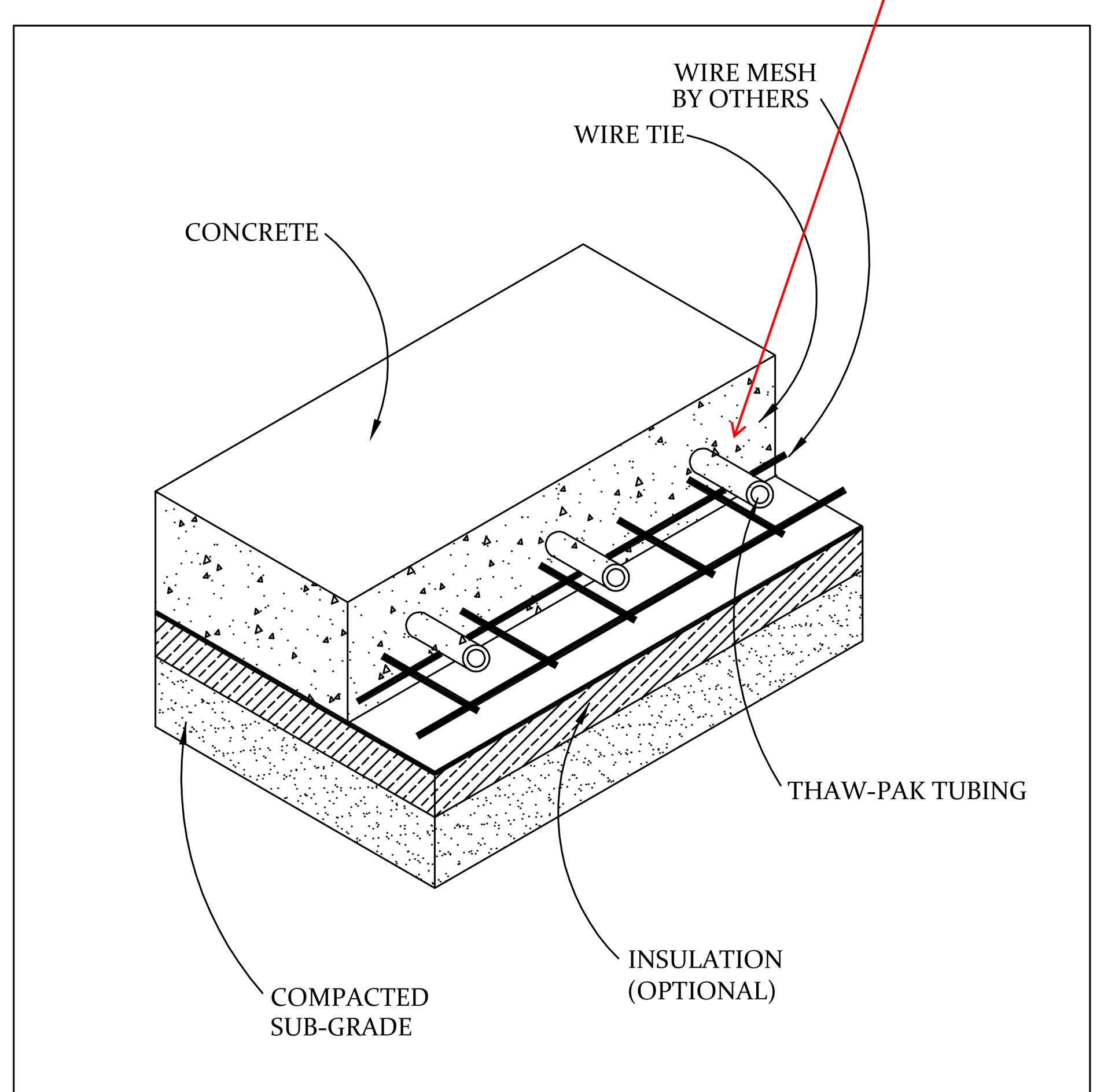
QTY.	PART NUMBER	DESCRIPTION

SEE SKID DRAWING SHEET M6

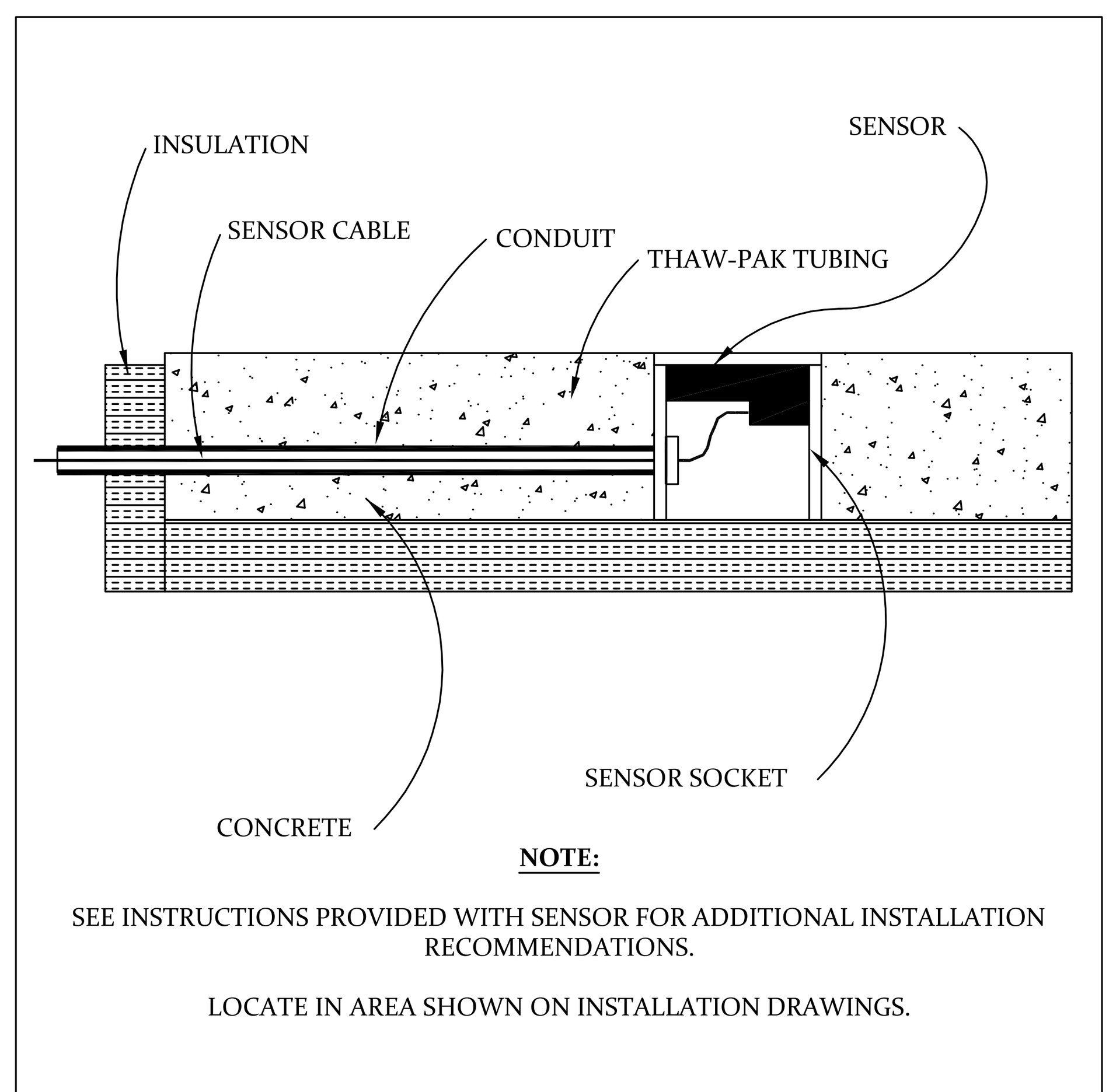
PUMP SCHEDULE

MODEL	TYPE	HP	PHASE	VOLTS	SPD.	FLANGE	MAT. #	SIZE	PUMP#
UPS	CI	-	1	115	1	-	-	-"	P-1

Concrete contractor to provide sufficient blocking undermesh to assure that tubing is installed in the middle of the slab. Concrete contractor to verify saw cutting depth prior to cutting to maintain 3/4" spacing between top of tubing and bottom of saw cut.



Drawing No: PEG-451 **CONCRETE SLAB DETAIL**



NOTE:

SEE INSTRUCTIONS PROVIDED WITH SENSOR FOR ADDITIONAL INSTALLATION RECOMMENDATIONS.

LOCATE IN AREA SHOWN ON INSTALLATION DRAWINGS.

Drawing No: PEG-454 **SNOW/ICE SENSOR INSTALLATION**

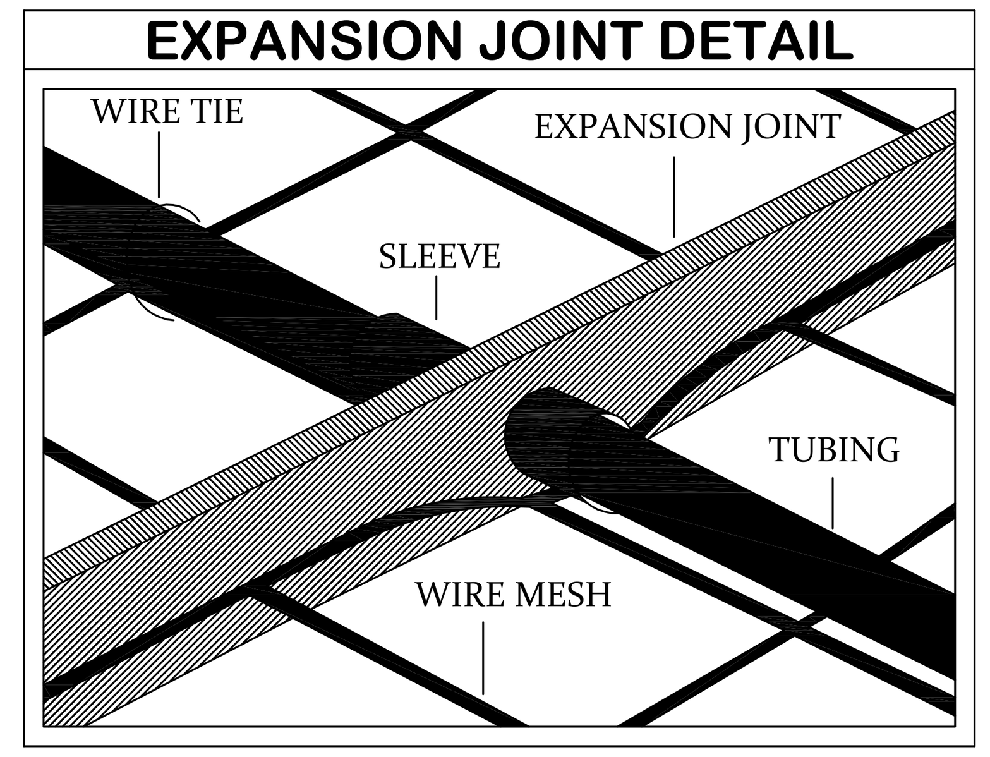
TUBE LENGTH VARIANCE ALLOWED FROM DRAWING DESIGN LENGTH (FEET)

TUBING LENGTH	50'	100'	150'	200'	250'	300'	350'	400'	450'	500'
1/2" ID										
MINIMUM	45'	91'	136'	182'	227'	270'	N/A	N/A	N/A	N/A
MAXIMUM	55'	110'	165'	220'	275'	330'	N/A	N/A	N/A	N/A
3/4" ID										
MINIMUM	45'	91'	136'	182'	227'	270'	318'	364'	409'	455'
MAXIMUM	55'	110'	165'	220'	275'	330'	385'	440'	495'	550'

TUBE CUTTING SCHEDULE

ROLL #1	3/4" X 1000' PEX	329'-326'-325'
ROLL #2	3/4" X 1000' PEX	323'-323'-323'
ROLL #3	3/4" X 1000' PEX	322'-322'-322'
ROLL #4	3/4" X 1000' PEX	322'-321'-321'
ROLL #5	3/4" X 1000' PEX	321'-319'-319'
ROLL #6	3/4" X 1000' PEX	317'-317'-317'
ROLL #7	3/4" X 1000' PEX	316'-315'-314'
ROLL #8	3/4" X 1000' PEX	320'-316'-313'
ROLL #9	3/4" X 1000' PEX	313'-313'-313'
ROLL #10	3/4" X 1000' PEX	312'-312'-312'
ROLL #11	3/4" X 1000' PEX	312'-311'-311'
ROLL #12	3/4" X 1000' PEX	310'-310'

EXPANSION JOINT DETAIL



TUBE FASTENER - SPACING

TUBE TIE WIRES OR FASTENERS AS PROVIDED SHALL BE INSTALLED AT LEAST EVERY 36" AND AT THE ENDS OF TURNS. TIES OR FASTENERS MAY BE ADDED AS NEEDED TO PROPERLY HOLD THE TUBING IN PLACE.

SNAP TRACK CHANNEL SHOULD BE PLACED 24" TO 36" APART ON STRAIGHT RUNS AND AT THE ENDS OF THE TUBING RUNS TO PROPERLY HOLD THE TUBING IN PLACE.
4.2.8

NOTES:

1. SEE INSTALLATION INSTRUCTIONS FOR LAYOUT DETAILS
2. SYSTEM BY-PASS VALVE MUST BE INSTALLED
3. ALL PIPING FROM BOILER TO MANIFOLDS, SUPPLIED BY OTHERS
4. DUE TO UNFORESEEN CONDITIONS AT TIME OF INSTALLATION, RUNS MAY VARY FROM GIVEN LENGTH
5. LAY PLASTIC TUBING BEFORE CUTTING FROM ROLL
6. KEEP TUBING 6" MAX FROM SIDES & DRAINS
7. NOT RESPONSIBLE FOR SYSTEM OPERATION IF NOT INSTALLED AS SHOWN ON PRINT
8. KEEP TUBING 6" AWAY FROM ALL TOILETS.
9. ALL CIRCUIT LENGTHS INCLUDE A 10' ALLOWANCE FOR RISERS TO MANIFOLDS AND PLACEMENT TOLERANCE.

CONSULTANTS: LIMBACH CO. LLC
CITY: MICHIGAN

thawPAK Snow Melting & Radiant Heating Systems

PROJECT NAME: JACKSON NATIONAL LIFE
MICHIGAN

THAW-PAK DISTRIBUTOR: PERFORMANCE engineering group

DRAWN BY: *Gordon Faustich*

REVIEWED BY: *AD*

APPROVED BY: *AD*

ISSUED FOR

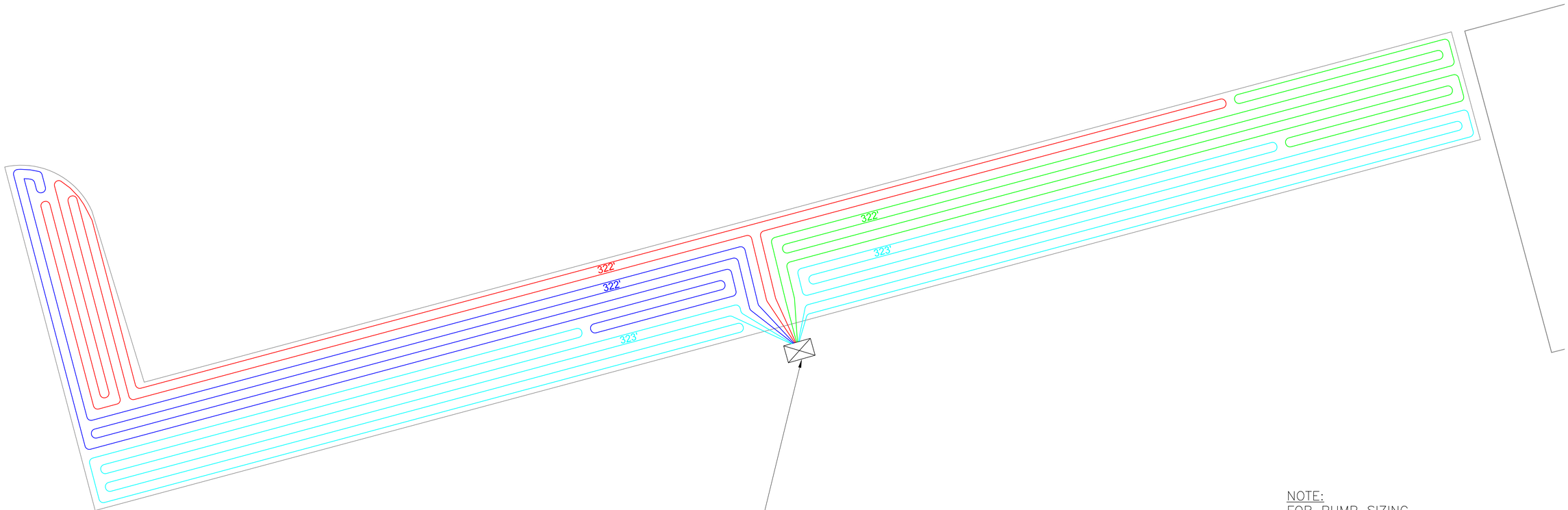
12/09/14	APPROVAL
12/31/14	INCREASED FLOW AND BTU/SF
02/24/15	ADDED SENSOR WELLS TO SKID
03/23/15	UPDATED CONTROLS
03/24/15	UPDATED SENSORS ON SKID

DRAWING NO. PEG14-009S_E

SHEET NO. M4

Jackson National SIM Design Criteria for PEX									
Heated Area:	7,899	sf.	Max. Heat Load	1,761,477	MBTU	Temp. Difference:	36	° ΔT	ΔP HX: 13.57
BTU's / sf:	223		Flow:	105.0	gpm	PEX Headloss:	17.77	ft.	
Tubing Type:	3/4"		Centers:	9	"	Tubing Rato:	1.4		
Longest Loop:	329	ft.	Shortest Loop:	310	ft.	Difference:	19	ft.	# Loops: 35
Total Tubing:	11,112	ft.	Total Tubing Volume:	204.5	Gallons				

Manifold	SM-1	SM-2	SM-3	SM-4
Area (sf)	1,180	2,302	2,300	2,117
Tube Dia.	3/4"	3/4"	3/4"	3/4"
# Runs	5	10	10	10
Btu/sf	223	223	223	223
Btu/hr	263,140	513,346	512,900	472,091
Flow Rate	15.69	30.60	30.57	28.14
Gpm/tube	3.137	3.060	3.057	2.814
Head loss/ft	0.055	0.052	0.052	0.046
Circuit length	323	325	329	322
Pressure Drop	17.77	16.90	17.11	14.81



NOTE:
FOR PUMP SIZING
SEE MAINS ON
SHEET M5

SIM PLAN NORTH WALK

SCALE: 1/4" = 1'-0"

RADIANT HEAT SCHEDULE							
ZONE	MANIFOLD	LOCATION	AREA	LOOPS	GPM	HEAD	TUBE SPACING
SM-1	SM-1	BELOW NORTH WALK	1180	5	15.69	17.77	0'-9"

LEGEND:
T = THERMOSTAT
= MANIFOLD
= SLAB SENSOR

NOTE:
1. ALL CIRCUIT LENGTHS INCLUDE A 5' SUPPLY AND A 5' RETURN ALLOWENCE FOR RISERS TO MANIFOLD AND PLACEMENT TOLERANCE.
2. ALL THERMOSTAT LOCATIONS ARE APPROXIMATE, MUST BE APPROVED BY OWNER.
3. CONTRACTOR TO VERIFY DIMENSIONS IN FIELD.

CONSULTANTS:
LIMBACH CO. LLC
CITY MICHIGAN

thaw-PAK
Snow Melting & Radiant Heating Systems

PROJECT NAME:
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MICHIGAN

THAW-PAK DISTRIBUTOR:
PERFORMANCE engineering group

DRAWN BY: *Gordon Faustich*
REVIEWED BY: *AD*
APPROVED BY: *AD*
ISSUED FOR

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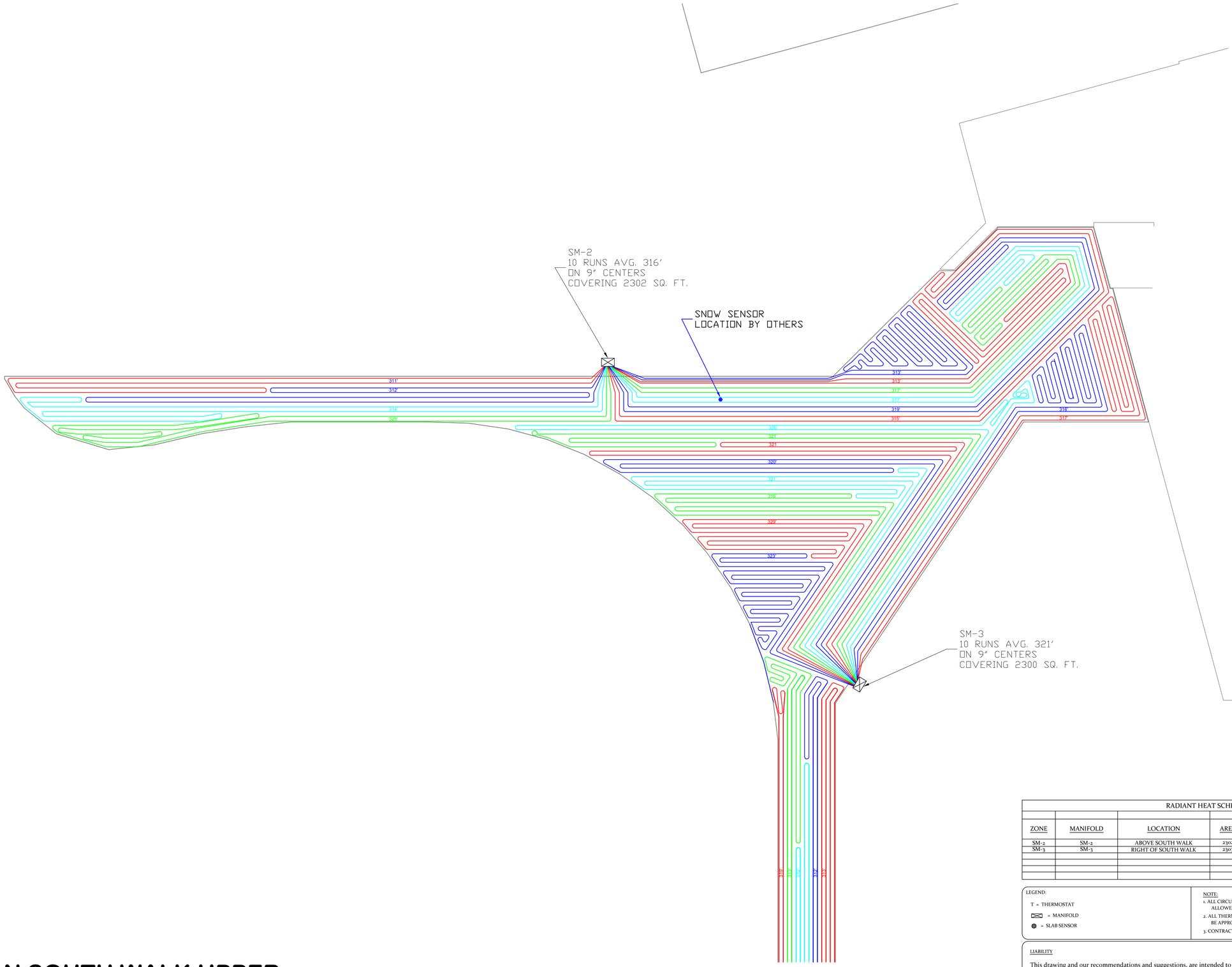
02/24/15	ADDED SENSOR WELLS TO SKID
03/23/15	UPDATED CONTROLS
03/24/15	UPDATED SENSORS ON SKID

DRAWING NO.
PEG14-009S_E

SHEET NO.
M1



SIM PLAN SOUTH WALK UPPER

SCALE: 1/8" = 1'-0"

RADIANT HEAT SCHEDULE							
ZONE	MANIFOLD	LOCATION	AREA	LOOPS	GPM	HEAD	TUBE SPACING
SM-2	SM-2	ABOVE SOUTH WALK	2302	10	30.60	16.90	0'-9"
SM-3	SM-3	RIGHT OF SOUTH WALK	2303	10	30.57	17.11	0'-9"

LEGEND:

T = THERMOSTAT

= MANIFOLD

= SLAB SENSOR

NOTE:

1. ALL CIRCUIT LENGTHS INCLUDE A 5' SUPPLY AND A 5' RETURN ALLOWENCE FOR RISERS TO MANIFOLD AND PLACEMENT TOLERANCE.
2. ALL THERMOSTAT LOCATIONS ARE APPROXIMATE, MUST BE APPROVED BY OWNER.
3. CONTRACTOR TO VERIFY DIMENSIONS IN FIELD.

LIABILITY

This drawing and our recommendations and suggestions, are intended to assist our customers. Our design represents our best judgment based on our experience and the best facts provided to us, any use thereof is at the sole risk of the customer.

It is assumed that the customer will install the THAW-PAK system in compliance with all local, state and national codes.

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CITY MICHIGAN

thaw-PAK
Snow Melting & Radiant Heating Systems

PROJECT NAME:
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MICHIGAN

THAW-PAK DISTRIBUTOR:
PERFORMANCE engineering group

DRAWN BY: *Gordon Faustich*

REVIEWED BY: *AD*

APPROVED BY: *AD*

ISSUED FOR

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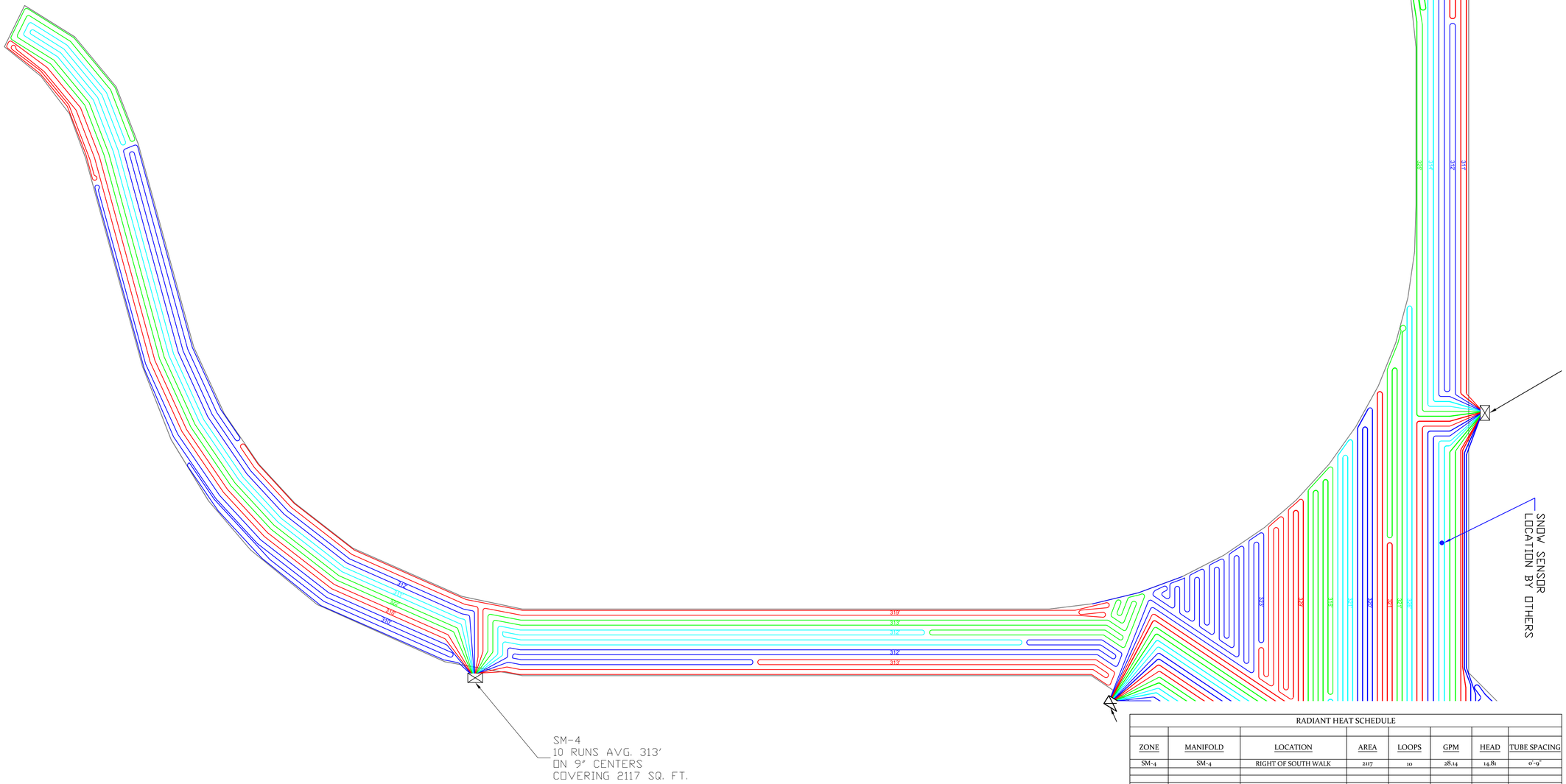
03/24/15	UPDATED SENSORS ON SKID

DRAWING NO.
PEG14-009S_E

SHEET NO.
M2



SIM PLAN SOUTH WALK LOWER (ROTATED 90°)

SCALE: 1/8" = 1'-0"

RADIANT HEAT SCHEDULE

ZONE	MANIFOLD	LOCATION	AREA	LOOPS	GPM	HEAD	TUBE SPACING
SM-4	SM-4	RIGHT OF SOUTH WALK	2117	10	28.14	14.81	0'-9"

LEGEND:

T = THERMOSTAT

= MANIFOLD

= SLAB SENSOR

NOTE:

1. ALL CIRCUIT LENGTHS INCLUDE A 5' SUPPLY AND A 5' RETURN ALLOWENCE FOR RISERS TO MANIFOLD AND PLACEMENT TOLERANCE.
2. ALL THERMOSTAT LOCATIONS ARE APPROXIMATE, MUST BE APPROVED BY OWNER.
3. CONTRACTOR TO VERIFY DIMENSIONS IN FIELD.

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CITY MICHIGAN

thaw-PAK Snow Melting & Radiant Heating Systems

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03/24/15	UPDATED SENSORS ON SKID

DRAWING NO.
PEG14-009S_E

SHEET NO.
M3

Performance Engineering Group, Inc.
32995 Industrial Road
Livonia, MI 48150-1617
Phone: 734.266.5300
Fax: 734.266.5310

SUBMITTAL PACKAGE
HEAT TRANSFER SKID

Job: Jackson National Life Phase 3.1

Architect: Gresham Smith and Partners

Engineer: Edwards & Zuck

Construction Manager: The Christman Company

Mechanical Contractor: Limbach Company LLC

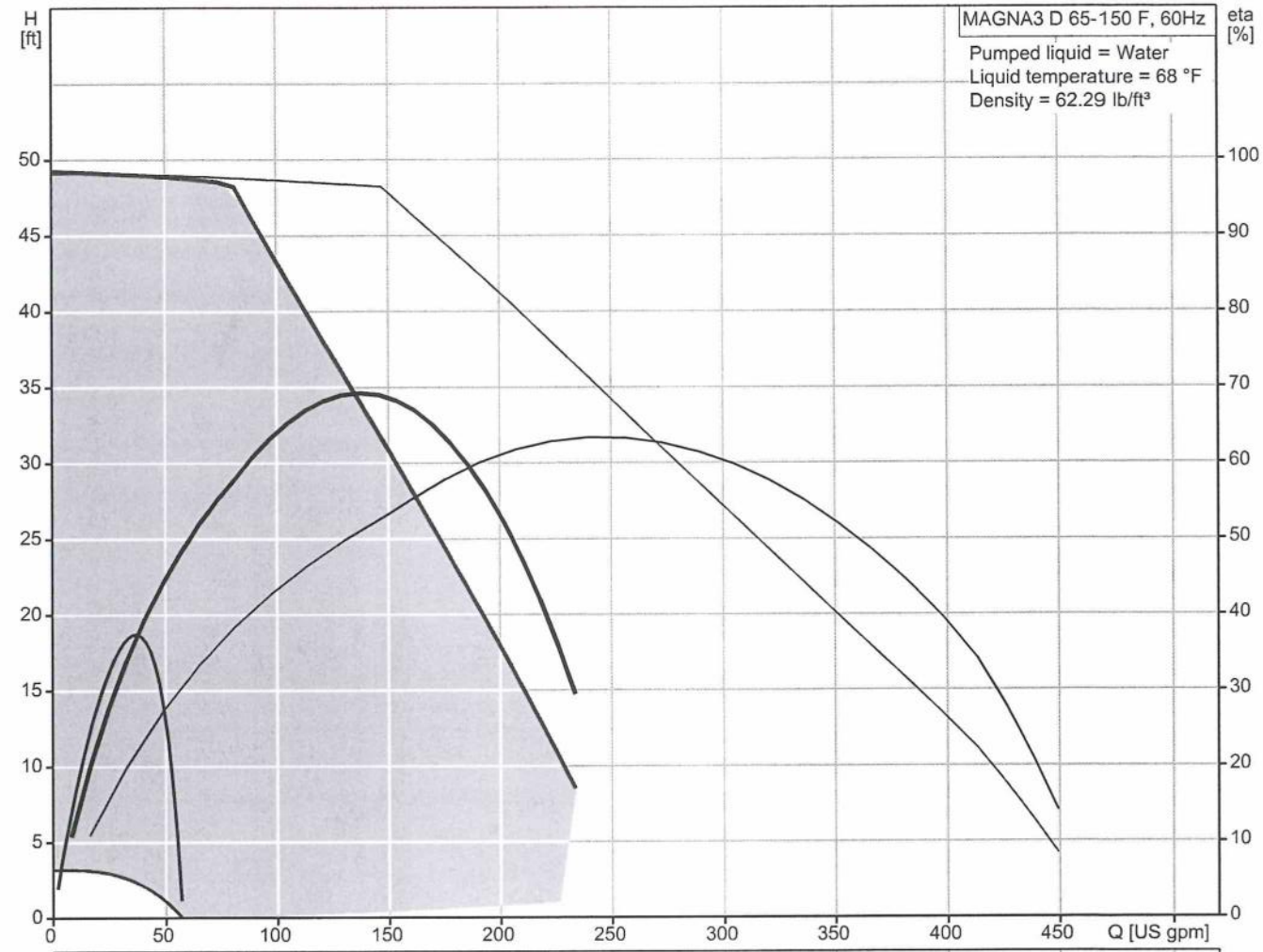
PERFORMANCE engineering group

SUBMITTED BY:	ATTACHMENT INCLUDES	REF #
	Grundfos Magna3 65-150F Pump with Data Sheet	
	T5-BFG - Plate Heat Exchanger	
	NTA-80 Wessels Expansion Tank	A-1004C
	SPA-3 Wessels Air Separator	D-1003A
	Control Valve and V5011N Actuator	63-2548
	Heat Transfer skid	PEG 014-009S - M6

GRUNDFOS

Company name: -
Created by: -
Phone: -
Fax: -
Date: -

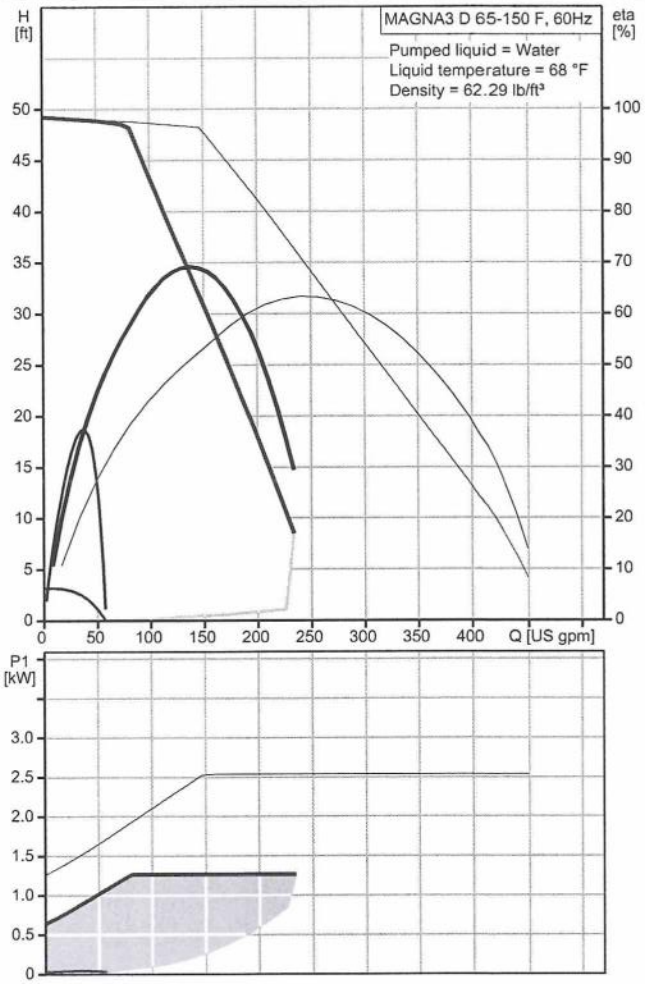
98126863 MAGNA3 D 65-150 F 60 Hz



GRUNDFOS

Company name: -
Created by: -
Phone: -
Fax: -
Date: -

Description	Value
General information:	
Product name:	MAGNA3 D 65-150 F
Product No.:	98126863
EAN:	5710629500250
Price:	On request
Technical:	
Head max:	49.2 ft
TF class:	110
Approvals on nameplate:	ETL, FCC W_RADIAL
Model:	A
Materials:	
Pump housing:	Cast iron EN-GJL-250 ASTM A48-250B
Impeller:	PES 30%GF
Installation:	
Range of ambient temperature:	32 .. 104 °F
Flange standard:	GF
Pressure stage:	PN12
Port-to-port length:	13 7/16 in
Liquid:	
Liquid temperature range:	14 .. 230 °F
Electrical data:	
Power input - P1:	29 .. 1301 W
Maximum current consumption:	0.3 .. 5.68 A
Main frequency:	60 Hz
Rated voltage:	1 x 208-230 V
Enclosure class (IEC 34-5):	X4D
Insulation class (IEC 85):	F
Others:	
Energy (EEI):	0.17
Net weight:	101 lb
Gross weight:	118 lb
Shipping volume:	4.66 ft³

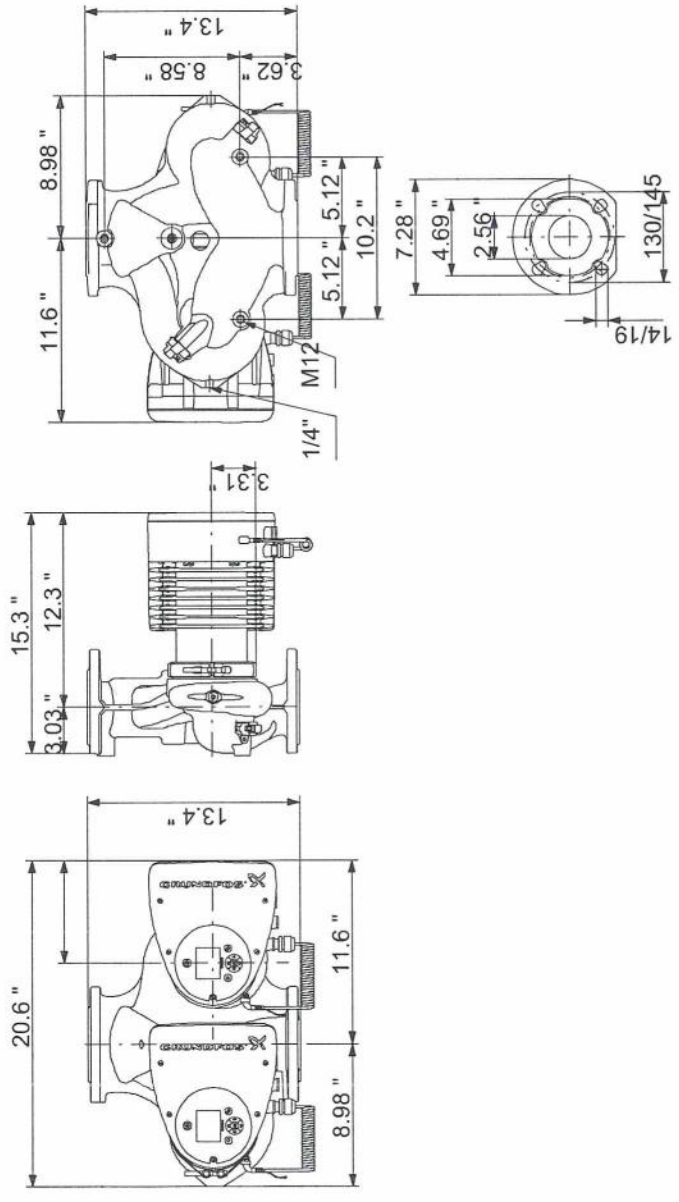


Coordinate power and control requirements with respective trades

GRUNDFOS

Company name: -
Created by: -
Phone: -
Fax: -
Date: -

98126863 MAGNA3 D 65-150 F 60 Hz



Note! All units are in [mm] unless otherwise stated.
Disclaimer: This simplified dimensional drawing does not show all details.

Additional operating modes for multi-pump setup

Multi-pump function

The multi-pump function enables the control of single-head pumps connected in parallel and twin-head pumps without the use of external controllers. The pumps in a multi-pump system communicate with each other via the wireless GENIair connection.

A multi-pump system is set up via a selected pump, i.e. the master pump (first selected pump). The multi-pump functions are described in the following sections.

Alternating operation

Only one pump is operating at a time. The change from one pump to the other depends on time or energy. If a pump fails, the other pump will take over automatically.

Pump system:

- Twin-head pump.
- Two single-head pumps connected in parallel. The pumps must be of equal size and type. Each pump requires a non-return valve in series with the pump.

Back-up operation

One pump is operating continuously. The back-up pump is operated at intervals to prevent seizing up. If the duty pump stops due to a fault, the back-up pump will start automatically.

Pump system:

- Twin-head pump.
- Two single-head pumps connected in parallel. The pumps must be of equal size and type. Each pump requires a non-return valve in series with the pump.

Cascade operation

Cascade operation ensures that the pump performance is automatically adapted to the consumption by switching pumps on or off. The system thus runs as energy-efficiently as possible with a constant pressure and a limited number of pumps.

The back-up of a twin-head pump will start at 90 % and stop at 50 % performance when operating in constant-pressure mode.

It can be advantageous to choose a twin-head pump, as the back-up pump will start for a short period in peak-load situations. If an oversized single-head pump is chosen, it may run outside its best efficiency range most of the time.

All pumps in operation will run at equal speed. Pump changeover is automatic and depends on speed, operating hours and fault.

Pump system:

- Twin-head pump.
- Two single-head pumps connected in parallel. The pumps must be of equal size and type. Each pump requires a non-return valve in series with the pump.
- The control mode must be set to "Const. press." or "Constant curve".

Readings and settings on the pump

Control panel and display

The MAGNA3 pump features a 4" TFT display with intuitive and user-friendly interface. The control panel has self-explanatory push-buttons made of high-quality silicone for precise navigation in the menu structure. The control panel is designed to give the user quick and easy access to pump and performance data on site.

When the pump is started up for the first time, the user is presented with a start-up guide enabling easy setting of the pump. Additionally, the "Assist" menu can guide the user through the various settings of the pump.

TM05 7642 2113

Fig. 23 Control panel

Button	Function
⌂	Goes to the "Home" menu.
↩	Returns to the previous action.
< >	Navigates between main menus, displays and digits. When the menu is changed, the display will always show the top display of the new menu.
^ v	Navigates between submenus.
OK	Saves changed values, resets alarms and expands the value field.

9. Product numbers

MAGNA3

Single-head pump	Cast iron		Stainless steel	
	115 V	208-230V	115 V	208-230V
MAGNA3 40-80 F (N)	98126800	98126828	98126802	98126830
MAGNA3 40-120 F (N)	98126804	98126832	98126806	98126834
MAGNA3 40-180 F (N)	98126808	98126836	98126810	98126838
MAGNA3 50-80 F (N)	98126812	98126840	98126814	98126842
MAGNA3 50-150 F (N)	98126816	98126844	98126818	98126846
MAGNA3 65-120 F (N)	98124696	98124696	98124702	98126850
MAGNA3 65-150 F (N)		98126852		98126854
MAGNA3 80-100 F (N)		98126856		98126858
MAGNA3 100-120 F (N)		98126860		98126862

Single-head pump	Cast iron		Stainless steel	
	115 V	208-230V	115 V	208-230V
MAGNA3 D 65-150 F		98126863		
MAGNA3 D 80-100 F		98126864		
MAGNA3 D 100-120 F		98126865		

External sensors

Sensor	Type	Measuring range °F [°C]	Power supply [VDC]	Transmitter output [ma]	Process connection	Product number
External Temperature Kit	DPI +T	-22 to 248 °F [-30 to 120 °C]	11 to 30	4 to 20	G½--G½	98477669
					G½--G1/4	98477668

Sensor	Type	Measuring range psi	Measuring range [bar]	Transmitter output [mA]	Power supply [VDC]	Process connection	Product number
Pressure transmitter	RPI	0 - 9	[0 - 0.6]	4 to 20	12-to 30	G 1/2	96611522
		0 - 14	[0 - 1.0]				96611523
		0 - 23	[0 - 1.6]				96611524
		0 - 36	[0 - 2.5]				96611525

Blanking flange

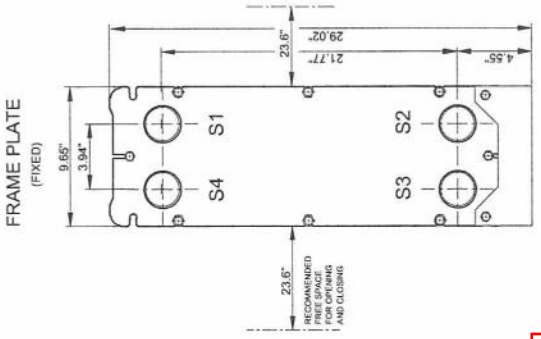
A blanking flange is used to blank off the opening when one of the pumps of a twin-head pump is removed for service to enable uninterrupted operation of the other pump.

Blanking flange	Product number
All pumps	98159372

Alfa Laval Plate Heat Exchanger Specification

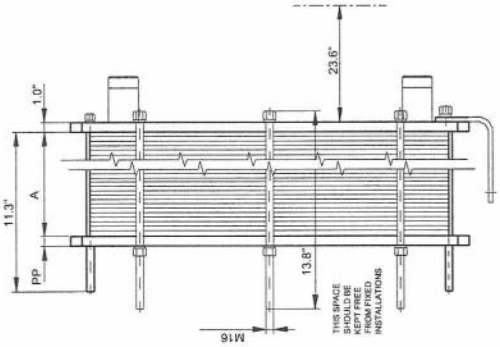
Customer: Performance Engineering
Model: T5B-FG
Project: Snow Melt 1.2 or 1.7 MBTUH
Item: PHE, 1.74 MBTUH **Date:** 12/22/2014

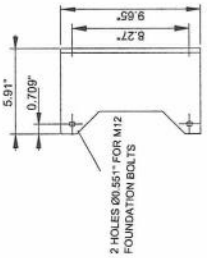
		Hot Side	Cold Side
Fluid		Water	40.0% Prop.glycol
Density	lb/ft³	61.34	63.12
Specific heat capacity	Btu/lb,°F	1.00	0.92
Thermal conductivity	Btu/ft,h,°F	0.377	0.249
Viscosity.inlet	cP	0.397	2.19
Viscosity.outlet	cP	0.562	1.17
Volume flow rate	GPM	87.0	105.0
Inlet temperature	°F	160.0	98.9
Outlet temperature	°F	119.0	135.0
Pressure drop	psi	3.81	5.89
Heat exchanged	kBtu/h	1740	
Rel. directions of fluids		Countercurrent	
Number of plates		76	
Number of passes		1	1
Additional plate capacity		2	
Plate material / Thickness		ALLOY 316 / 0.40 mm	
Gasket material		NBRP CLIP-ON	NBRP CLIP-ON
Connection material		Stainless steel	Stainless steel
Connection diameter	in	2	2
Nozzle orientation		S1 -> S2	S4 <- S3
Pressure vessel code		ASME	
Design Pressure	psi	150.0	150.0
Test pressure	psi	195.0	195.0
Design temperature	°F	180.0	180.0
Overall length x width x height	in	16 x 10 x 29	
Liquid volume	ft³	0.2	0.2
Net weight, empty / operating	lb	203 / 225	

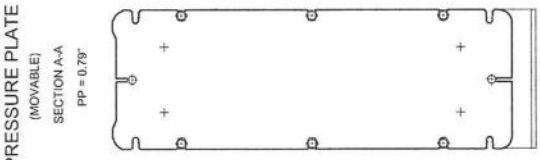


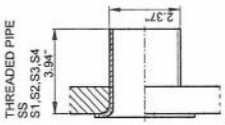
TOTAL LENGTH 16"
TOTAL WIDTH 9.7"
TOTAL HEIGHT 29"

Contractor has verified proper space is provided for installation including required clearances.









Do not use this drawing for foundation bolting or piping layout.

ALL DIMENSIONS IN INCHES

SIDE	MEDIA	F.D.G.	INLET	TEMP.	OUTLET	TEMP.	FLOW RATE	PRESSURE DROP
1	Water		S1	160.0 °F	S2	119.0 °F	87.0 GPM	3.807 psi
2	40.0% Prop.glycol		S3	98.9 °F	S4	135.0 °F	105.0 GPM	5.891 psi

REMARKS:	SIDE 1	SIDE 2		
TEST PRESSURE	195 psi	195 psi	GASKET	NBRP CLIP-ON
DESIGN PRESSURE	150 psi	150 psi	PLATE MATERIAL	ALLOY 316
MAX TEMPERATURE	180 °F	180 °F	PLATE THICKNESS	0.40 mm
MIN TEMPERATURE	32 °F	32 °F		
WEIGHT WITH WATER	225 lb		HEAT LOAD	1740 kBtu/h

SUPPLIER	REF.	ITEM NO.
		PHE, 1.74 MBTUH

AGENT / REF.

CUSTOMER NAME / REF. NO.
Performance Engineering

SIGN. | RISK CATEGORY N/A

PLATE HEAT EXCHANGER

T5-BFG

ASME

Snow Melt 1.2 or 1.7 MBTUH

DATE 12/22/2014 | REV NO. 0

SINCE 1908
wessels company

SUBMITTAL

NTA-SERIES

HYDRONIC EXPANSION TANKS

Models: NTA-15 thru NTA-280
Submittal Sheet No. A-1004C Date: 4/13

Job Name	Jackson National Life	Submitted By	A Deal	Date	12/11/14
Location		Approved By		Date	
		Order No.		Date	
Engineer	Edwards & Zuck	Notes			
Contractor	Limbach Company LLC				
Sales Rep.					

Description

Wessels NTA series are ASME fixed diaphragm type pre-charged expansion tanks. They are designed to absorb the expansion forces and control the pressure in heating/cooling systems. The system's expanded water (fully compatible with water/glycol mixtures) is contained in heavy-duty diaphragm that prevents tank corrosion and waterlogging problems. All NTA expansion tanks can be installed vertically or horizontally.

Construction

Shell: Carbon Steel
Bladder: Heavy Duty Butyl
System Connection: Carbon Steel

Performance Limitations

Maximum Design Temperature: 240°F
Maximum Design Pressure:
NTA 15 thru NTA 60: 150 PSIG*
NTA 80 thru NTA 280: 125 PSIG*
*200 & 250 PSIG available

Model Number	Part Number	Tank Volume (Gallons)	Acceptance Volume (Gallons)	Tagging Information	Quantity
NTA-15	19010015	7.8	6.3		
NTA-20	19010020	11	8.8		
NTA-40	19010040	25	20.2		
NTA-60	19010060	35	28		
NTA-80	19010080	45	36		
NTA-100	19010100	60	48.5		
NTA-120	19010120	70	56.5		
NTA-144	19010144	80	65		
NTA-180	19010180	90	73		
NTA-200	19010200	115	93		
NTA-240	19010240	140	113.5		
NTA-260	19010260	158	128		
NTA-280	19010280	211	171		

Typical Specification

Furnish and install, as shown on plans, a _____ gallon _____" diameter X _____" (high) pre-charged steel expansion tank with a fixed heavy-duty butyl diaphragm. The tank shall be equipped with a NPT system connection, and a 0.302"-32 charging valve connection (standard tire valve) to facilitate the on-site charging of the tank to meet system requirements. The tank must be constructed in accordance with most recent addendum of Section VIII Division 1 of the ASME Boiler and Pressure Vessel Code.

Each tank shall be Wessels model number NTA-_____ or approved equal.

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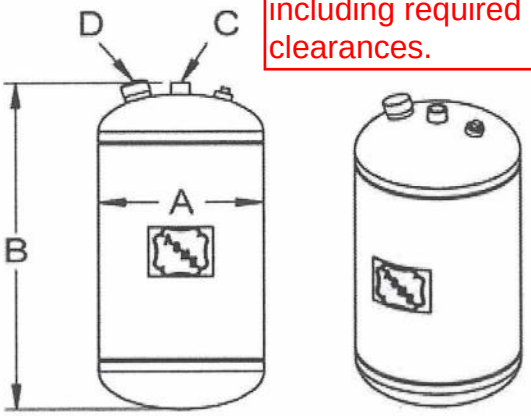
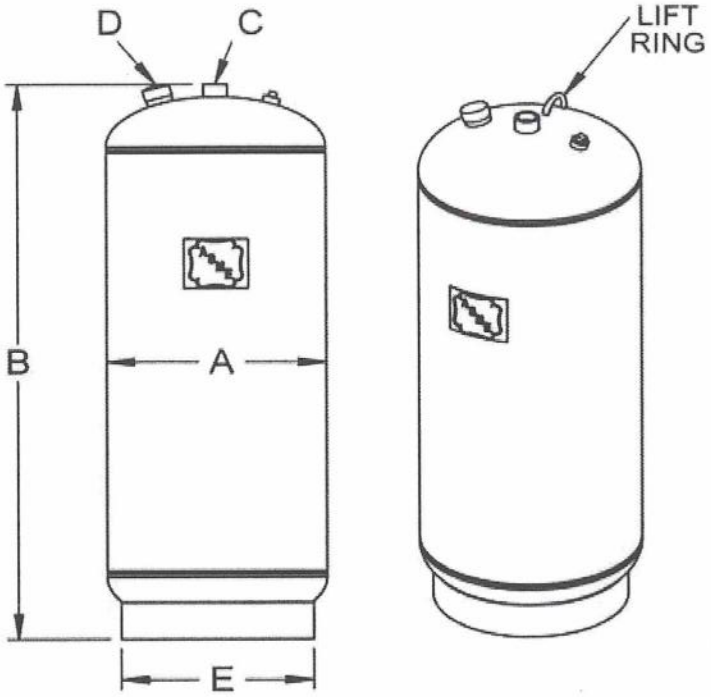
Contractor has verified proper space is provided for installation including required clearances.



NTA 15 & NTA 20



NTA 40 thru NTA 280

Dimensions & Weights

Model Number	Dimensions in Inches					Approx. Ship Weight (lbs)
	A	B	System Connection C	Charging Valve D	E	
NTA-15	12	19	3/4	0.302" -32NC	-	42
NTA-20		25				52
NTA-40	16	33	1		14	84
NTA-60		44				97
NTA-80	20	38			18	148
NTA-100		49				175
NTA-120	24	46	1 1/2		22	259
NTA-144		49				268
NTA-180		52				283
NTA-200		66				325
NTA-240		78				362
NTA-260	30	63			24	591
NTA-280		81				752

Notes

- Tanks are factory pre-charged at 12 psi and field adjustable.
- California code-sight glass is available upon request.
- Available with mounting clips.

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SINCE 1908
wessels company

SUBMITTAL

SPA-SERIES
AIR SEPARATOR

Models: SPA-2 thru SPA-24
Submittal Sheet No. D-1003A Date: 7/13

Job Name	Jackson National Life	Submitted By	A Deal	Date	12/11/14
Location		Approved By		Date	
		Order No.		Date	
Engineer	Edwards & Zuck	Notes			
Contractor	Limbach Company LLC				
Sales Rep.					

Description
Wessels SPA ASME Vortex type Air Separators eliminate air quickly and efficiently from open and closed loop heating/cooling systems. Water enters and exits through unique "tangential" connections, which promote a low velocity swirling effect in the center of the unit. Natural centrifugal forces allow the heavier air-free water to move toward the outer edges while entrained air is captured within the "eye" of the vortex and released out of the top of the separator. The bubble-free water then exits near the bottom of the unit, protecting the systems against the noise, corrosion, and damage commonly caused by entrained air.

Construction
Shell: Carbon Steel
Heads: Carbon Steel
Exterior: Primer Painted

Performance Limitations
Maximum Design Temperature: 450°F
Maximum Design Pressure: 125 PSIG*

*200 & 250 PSIG available

Model Number	Part Number	Max Flow (GPM)	Tagging Information	Quantity
SPA-2	72006019	56		
SPA-2.5	72006025	90		
SPA-3	72006030	190		
SPA-4	72006035	300		
SPA-5	72016036	530		
SPA-6	72001060	850		
SPA-8	72016080	1900		
SPA-10	72030010	3200		
SPA-12	72030012	4800		
SPA-14	72072014	6100		
SPA-16	72072016	8000		
SPA-18	72072018	9700		
SPA-20	72072020	12000		
SPA-22	72072022	15000		
SPA-24	72072024	17000		

Typical Specification
Furnish and install, as shown on plans, a vortex type air separator model SPA 3 sized for _____GPM, with _____" (NPT/Flanged) tangential connections, as manufactured by Wessels Company. A blowdown connection shall be provided to facilitate routine cleaning of the unit. The tank must be constructed in accordance with most recent addendum of Section VIII Division 1 of the ASME Boiler and Pressure Vessel Code, and shall be constructed and stamped for 125 PSI working pressure @ 450°F.

Each air separator shall be Wessels model number SPA-_____ or approved equal.

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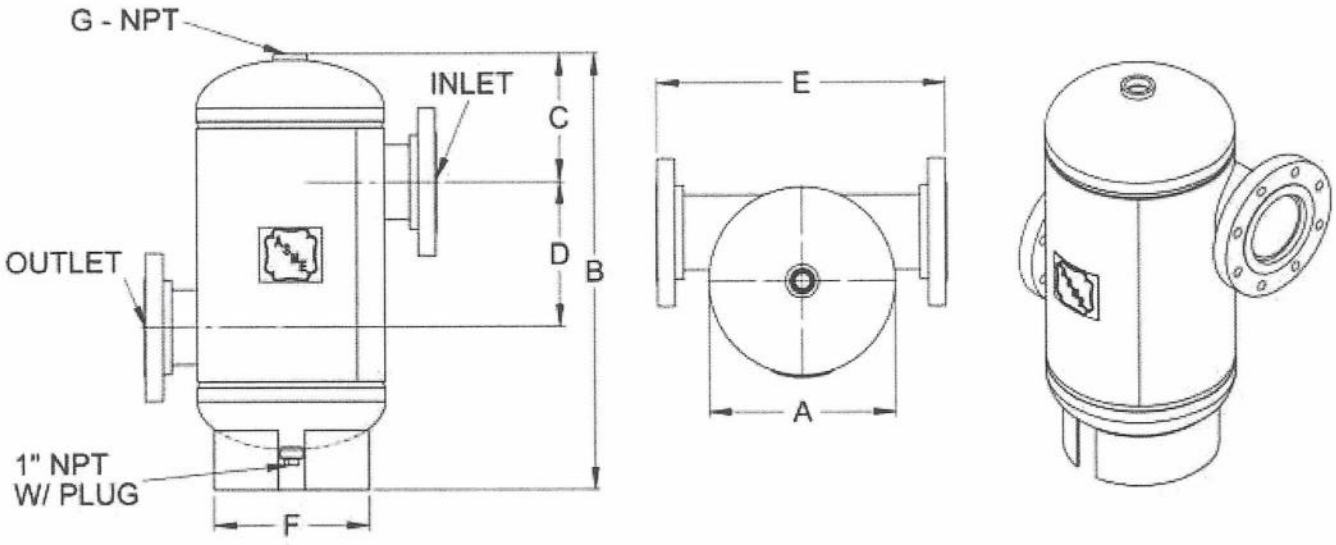


SPA-2 thru SPA-24

Dimensions & Weights

Model Number	Dimensions in Inches								Approx. Shipping Wt (lbs)
	Connection Size	A	B	C	D	E	F	G	
SPA-2	2 NPT	12	22 1/2	5 1/2	8 1/2	16 5/8	9 1/2	1 1/4	34
SPA-2.5	2.5 NPT								37
SPA-3	3		25	6 1/4	8	19 3/4			45
SPA-4	4	14	32	9 1/8	10 3/4	21 3/4	11 1/2	1 1/2	80
SPA-5	5								125
SPA-6	6	20	44	13 1/4	14 1/2	28	18	2	175
SPA-8	8								210
SPA-10	10	30	60 1/2	19	20	41	24		460
SPA-12	12								577
SPA-14	14	36	78	22	31 1/2	46 3/8	30		850
SPA-16	16	48	108	30	40	60	38		1858
SPA-18	18	54	124	33	50	66	44		2490
SPA-20	20	60	138	35	60	72	50		3346
SPA-22	22	66	150	38	66	78	56		3879
SPA-24	24	66				80			4211

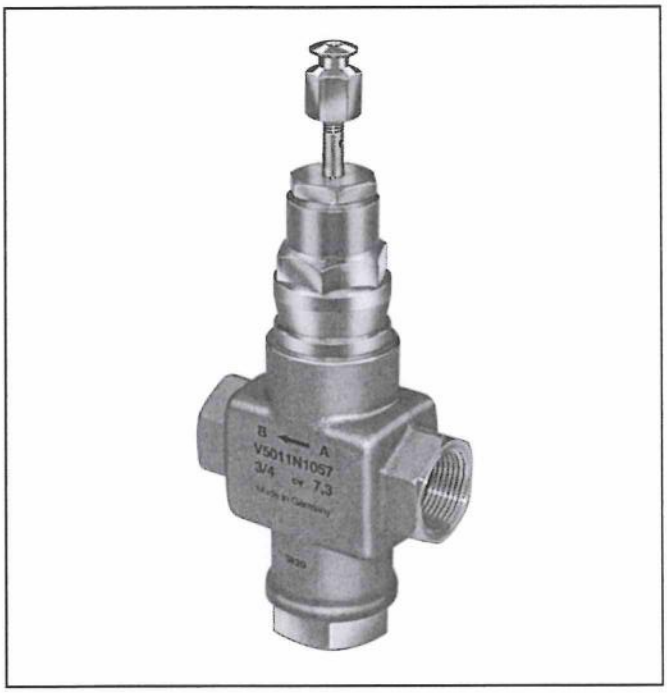
Notes

- Available with mounting clips.

Honeywell

V5011N
Two-Way Threaded Globe Valve

PRODUCT DATA



FEATURES

- Red brass body with NPT-threaded end connections.
- Low seat leakage rate (≤0.05 percent of C_v).
- 50:1 rangeability per VDI/VDE 2173.
- Spring-loaded, self-adjusting packing.
- Accurate positioning to ensure state of the art temperature control.
- Directly coupled electric and pneumatic actuators for easy mounting.
- Sizes range from 1/2 in. to 2 in.
- Valve designs provide equal percentage flow characteristic for water and linear flow characteristic for steam.
- Stainless steel stem and metal-to-metal seats.
- Repack and rebuild kits for field servicing.

APPLICATION

The V5011N is a two-way threaded globe valve that controls steam, water, and glycol solutions (up to 50 percent concentration) in heating or cooling HVAC applications. The valve is used in two-position and modulating control systems. The valve is not suitable for combustible gas service.

SPECIFICATIONS

IMPORTANT

The specifications given in this publication do not include normal manufacturing tolerances. Therefore, an individual unit may not exactly match the listed specifications. Also, this product is tested and calibrated under closely controlled conditions and some minor differences in performance can be expected if those conditions are changed.

Models:
V5011N Valve: Two-way threaded globe valve for steam, water, or glycol. NPT-threaded pipe connections. Throttling plug provides equal percentage flow characteristic for water (V5011N1xxx, V5011N3xxx), linear flow characteristic for steam (V5011N2xxx).

NOTE: V5011N1xxx and V5011N2xxx are direct acting (stem down to close).
V5011N3xxx is reverse acting (stem up to close).

Dimensions: See Fig. 1.

Valve Sizes and Flow Capacities: See Table 1.

Pipe Connections: Internal NPT-threaded connections.

Seat: Stainless steel, replaceable (except V5011N3xxx 3/4 in. to 1-1/4 in. which have an integral brass seat).

ANSI Body Class: 150 psi.

Stem: Stainless steel.

Plug: Brass on V5011N1xxx and V5011N3xxx for water; stainless steel on V5011N2xxx for steam.

Stroke: 3/4 in. (20 mm).

Approximate Leakage Rate: 0.05 percent C_v.

Pattern: 2-way, straight-through.

Body Material: Red brass.

Packing: Spring-loaded, carbon fiber reinforced PTFE V-rings.

Rangeability: 50:1 per VDI/VDE 2173.

Pressure-Temperature Ratings:
Water: 36°F to 248°F, 217 psi (15 bar).
248°F to 337°F, 185 psi (12.8 bar).
Maximum Water Differential Pressure: 230 psid (15.8 bar).
Steam: 100 psi (6.9 bar) at 337°F (V5011N2xxx).

Maximum Differential for Quiet Water Service: 20 psid.

Valve Flow Characteristics:
Water: Equal percentage (V5011N1xxx, V5011N3xxx).
Steam: Linear (V5011N2xxx). See Fig. 2.

Close-Off Pressure Ratings: See Fig. 3, and Table 2.

Valve Design Life: 250,000 full cycles at maximum rated temperature.

Replacement Parts: See Fig. 5 and Table 3.

Motor and Linkage Selection:

Electric	Pneumatic
ML6421/ML6425	MP953C (5 and 8 in.)
ML7421/ML7425	MP953E (5 and 8 in.)
ML7984/ML6984	—
Modutrol IV with Q5001	—
Damper DCA with Q5020	—

Table 1. Valve Size and Flow Capacities.

Size (in.)	Capacity (C_v)
1/2	0.73
	1.16
	1.85
	2.9
	4.7
3/4	7.3
1	11.7
1-1/4	18.7
1-1/2	29.3
2	46.8

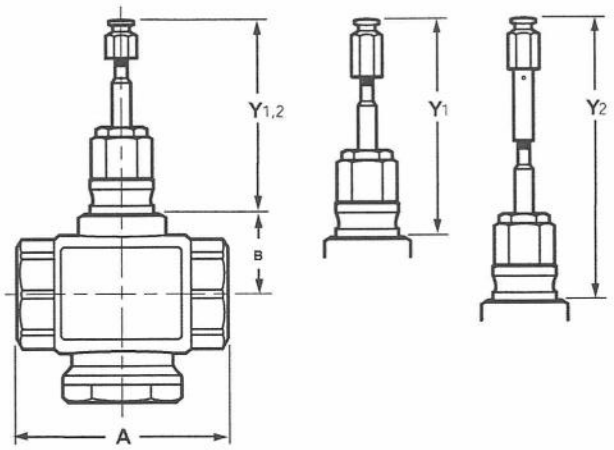
ORDERING INFORMATION

When purchasing replacement and modernization products from your TRADELINE® wholesaler or distributor, refer to the TRADELINE® Catalog or price sheets for complete ordering number.

If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:

1. Your local Honeywell Automation and Control Products Sales Office (check white pages of your phone directory).
2. Honeywell Customer Care
   1885 Douglas Drive North
   Minneapolis, Minnesota 55422-4386

In Canada—Honeywell Limited/Honeywell Limitée, 35 Dynamic Drive, Scarborough, Ontario M1V 4Z9.
International Sales and Service Offices in all principal cities of the world. Manufacturing in Australia, Canada, Finland, France, Germany, Japan, Mexico, Netherlands, Spain, Taiwan, United Kingdom, U.S.A.



VALVE SIZE (IN)	A in. (mm)	B in. (mm)
1/2	3-1/4 (83)	1-9/16 (40)
3/4		
1	4-1/16 (103)	
1-1/4	4-3/16 (106)	
1-1/2	4-3/4 (120)	1-13/16 (47)
2	5-1/4 (134)	

VALVE	Y1 in. (mm)	Y2[a] in. (mm)
V5011N1XXX OR V5011N2XXX	3-1/2 (89)	5-1/4 (133)
	STEM FULLY DOWN	
V5011N3XXX	4-3/16 (107)	5-15/16 (151)
	STEM FULLY UP	

[a]Y2 WITH STEM EXTENSION FOR MP953C,E (8 IN. ONLY)

M17378A

Fig. 1. V5011N body dimensions in in. (mm).

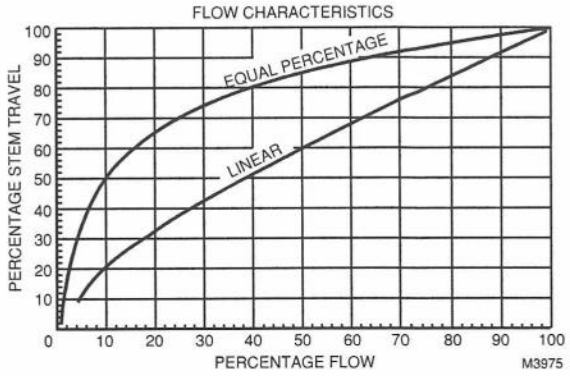


Fig. 2. Equal percentage and linear flow characteristics.

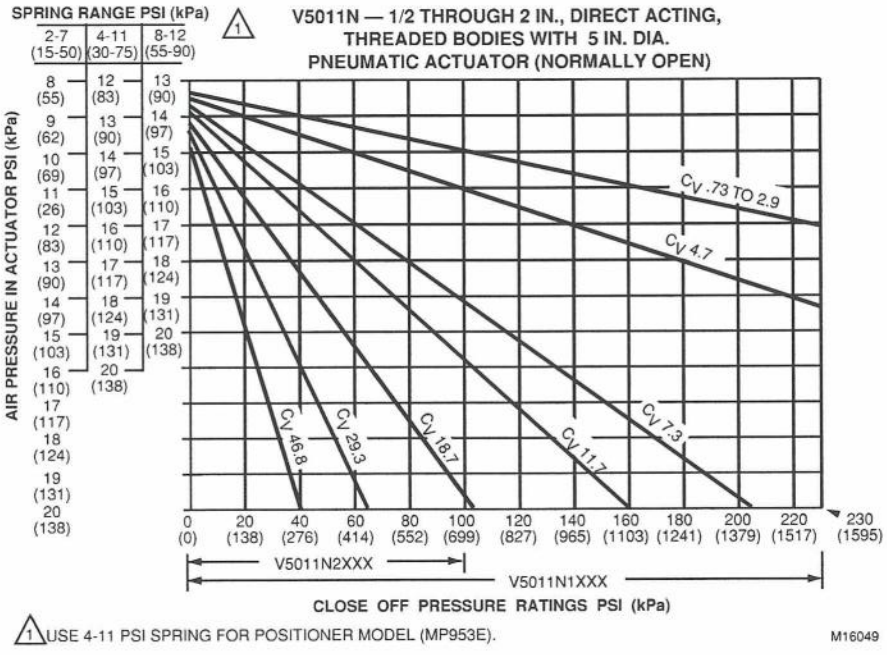
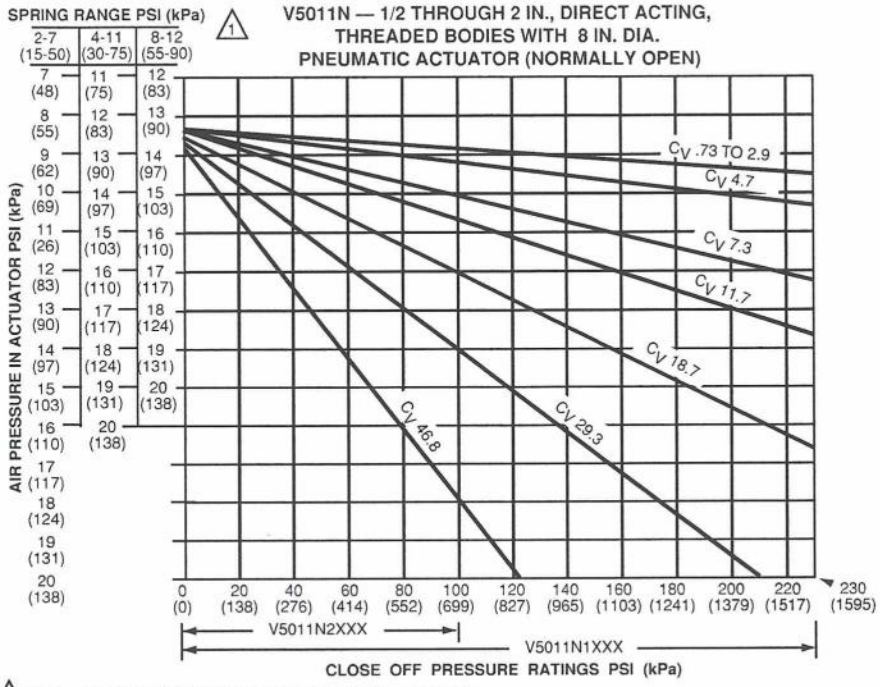
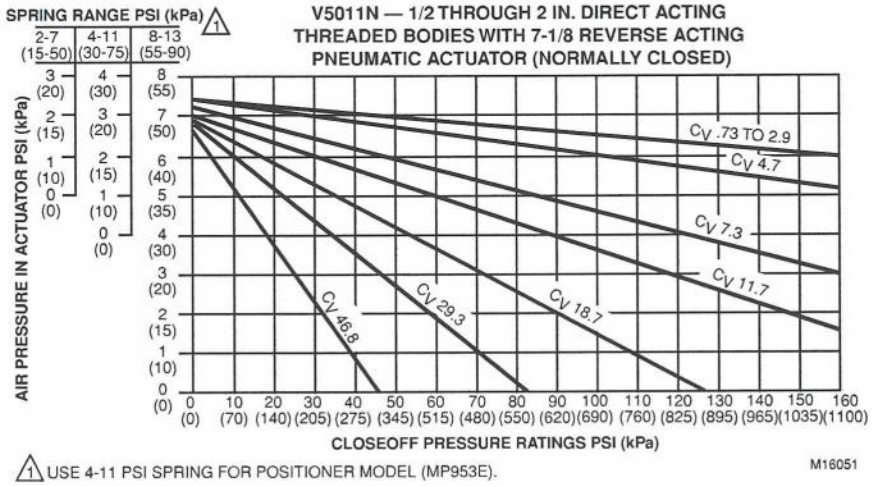


Fig. 3. Close-off ratings at various control air pressures for V5011N Valves and MP953 Pneumatic Actuators.





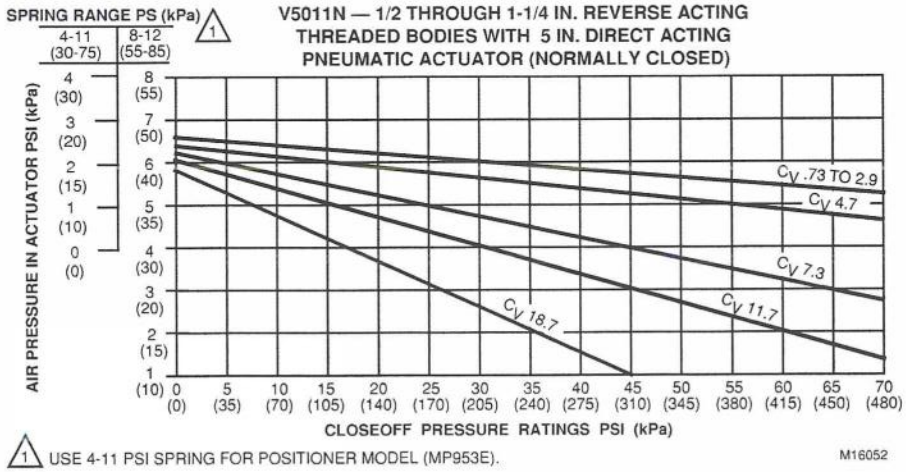
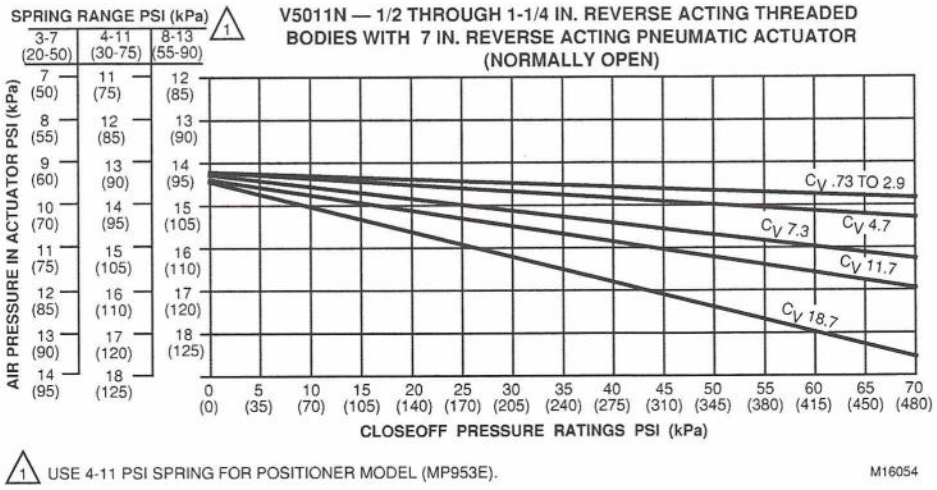


Fig. 3. Close-off ratings at various control air pressures for V5011N Valves and MP953 Pneumatic Actuators. (continued)



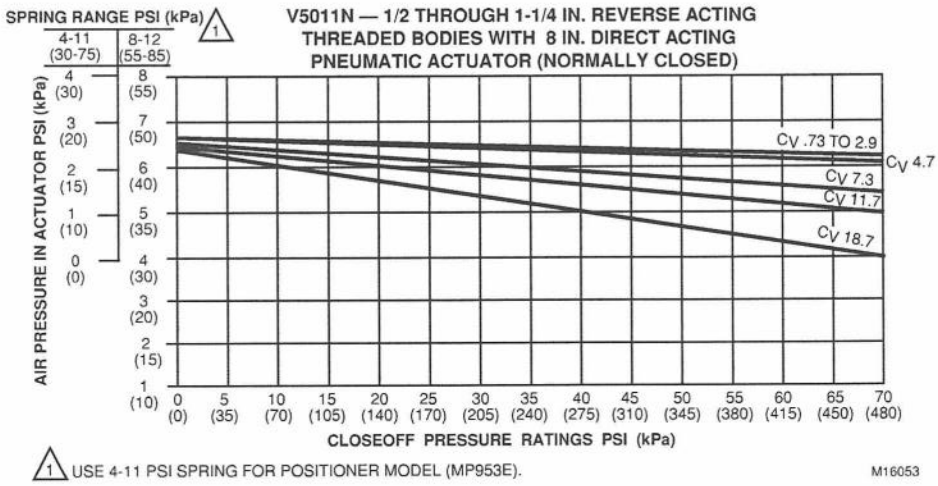


Fig. 3. Close-off ratings at various control air pressures for V5011N Valves and MP953 Pneumatic Actuators. (continued)

INSTALLATION

When Installing This Product...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check out product operation as provided in these instructions.

IMPORTANT

1. *Do not lift the valve by holding the stem.*
2. *Do not mount the valve with the stem pointed lower than horizontal.*
3. *Mount the valve with the flow arrow pointed in the direction of flow through the valve.*
4. *Mount the valve between aligned pipes. Mounting the valve on pipes that are not aligned causes leakage at the valve-to-pipe connection.*
5. *Ensure complete engagement on pipe to valve body threads.*
6. *Hold the valve body with a clamp or pipe wrench on the hexagonal fitting nearest the pipe to prevent damage to the valve body while mounting on the pipe. Refer to Fig. 4.*
7. *Be sure to allow enough room for installation and service. Clearance for valve installation is dependent on actuator size and the valve pipe size.*

Location

Select a location where the valve, linkage, and actuator are within the appropriate pressure and temperature ratings.

Leave sufficient clearance above the valve to accommodate actuator installation and allow room for servicing the valve body. (Completely install the valve body in the pipe line before installing the actuator and linkage.)

When selecting a location for the valve, consider actuator mounting restrictions. Modutrol IV™ Motor crankshafts must be mounted horizontally.

Mounting

The preferred valve mounting position is with the stem vertical. For steam applications, mount with the stem at a 45 degree angle. Do not mount the valve with the stem more than 90 degrees from the vertical (pointing lower than horizontal). Scale and foreign material can collect, scoring the stem and causing packing leakage. Protect the stem from damage due to bending or scratching.

IMPORTANT

1. *Before installing linkage and actuator, make sure that the valve stem operates freely. Impaired stem operation can indicate that the body was twisted or the stem was bent. Either of these conditions can require valve replacement.*
2. *Align pipes squarely with valve at each end connection.*
3. *If the pipes are forced into the valve, the body can become twisted and improper seating can result.*
4. *Apply pipe dope sparingly.*
5. *Be careful to prevent pipe debris, such as chips and scale, from entering the piping because this material can lodge in the seat and prevent proper closing.*

NOTE: Threading on threaded bodies conform to NPT.

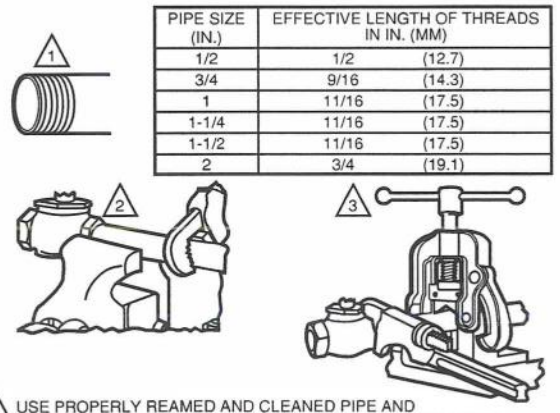
Refer to the table in Fig. 4 for valve pipe sizes and thread lengths. Fig. 4 also shows two effective methods of holding the valve and pipe when attaching it. Refer to installation information furnished with the linkage and motor when installing these controls.

Table 2. Close-off Ratings (psid) for V5011N Valves with Electric/Electronic Actuators.

Valve Size (NPT)	Mod IV Motor with Q5001 Linkages			ML6421A, ML7421A	ML6425, ML7425 ML6420, ML7420	ML7984, ML6874
	320 lb	160 lb	80 lb	405 lb	135 lb	160 lb
V5011N1xxx and V5011N3xxx Valves						
1/2	—	230[a]	230[a]	—	230[a]	230[a]
3/4	—	230[a]	131			
1	230[a]	196	91	230[a]	163	196
1-1/4	230[a]	126	57	230[a]	104	126
1-1/2	173	81	36	221	67	81
2	98	46	19	126	37	46
V5011N2xxx Valves						
1/2, 3/4	—	100[a]	100[a]	—	100[a]	100[a]
1	100[a]	100[a]	91	100[a]		
1-1/4	100[a]	100[a]	57			
1-1/2	100[a]	81	36	100[a]	67	81
2	98	46	19	100[a]	37	46

[a]Pressure is limited by fluid temperature. See valve temperature/pressure ratings.

Fig. 4. Installing valves with threaded connections.



CHECKOUT

Use the following procedure to check for proper valve operation:

1. Check valve body and connections for leaks.

IMPORTANT

Before installing linkage (if used) and actuator, make sure that the valve stem operates freely. Impaired stem operation can indicate that the body was twisted or the stem was bent. Either of these conditions can require valve replacement.

2. After installing linkage and actuator, check operation according to installation information furnished with these controls.
3. Operate system through one complete cycle to ensure valve controls properly.
4. Check valve at regular intervals for leakage around packing.

   NOTE: Packing is spring-loaded and should seldom require attention.

5. If leakage is discovered and inspection shows that the packing gland is screwed down tightly, then repack the valve.

Table 3. Valve Rebuild and Repack Kits.

Valve OS No.	NPT Size (in.)	Flow Capacity (C_v)	Stem Diameter (in.)	Repack Kit	Rebuild Kit	Stem Button
V5011N1008	1/2	0.73	1/4	0901786A	0901746A	0901116A[a]
V5011N1016		1.16			0901747A	
V5011N1024		1.85			0901748A	
V5011N1032		2.9			0901749A	
V5011N1040		4.7			0901750A	
V5011N1057	3/4	7.3			0901751A	
V5011N1065	1	11.7			0901752A	
V5011N1073	1-1/4	18.7			0901753A	
V5011N1081	1-1/2	29.3	3/8	0901787A	0901754A	
V5011N1099	2	46.8			0901755A	
V5011N2006	1/2	0.73	1/4	0901786A	0903422A	
V5011N2014		1.16			0903423A	
V5011N2022		1.85			0903424A	
V5011N2030		2.9			0903425A	
V5011N2048		4.7			0903426A	
V5011N2055	3/4	7.3			0903427A	
V5011N2063	1	11.7			0903428A	
V5011N2071	1-1/4	18.7			0903429A	
V5011N2089	1-1/2	29.3	3/8	0901787A	0903430A	
V5011N2097	2	46.8			0903431A	
V5011N3004	1/2	2.9	1/4	0901786A	0901759A	
V5011N3012		4.7			0901760A	
V5011N3020	3/4	7.3			0901761A	
V5011N3038	1	11.7			0901762A	
V5011N3046	1-1/4	18.7			0901763A	

[a]Each 0901116A contains 10 stem buttons.

NOTE: Seat removal tools are required to rebuild valves:
32003941-001 for 1/2 in. through 1-1/4 in. sizes.
32003941-002 for 1-1/2 in. through 2 in. sizes.

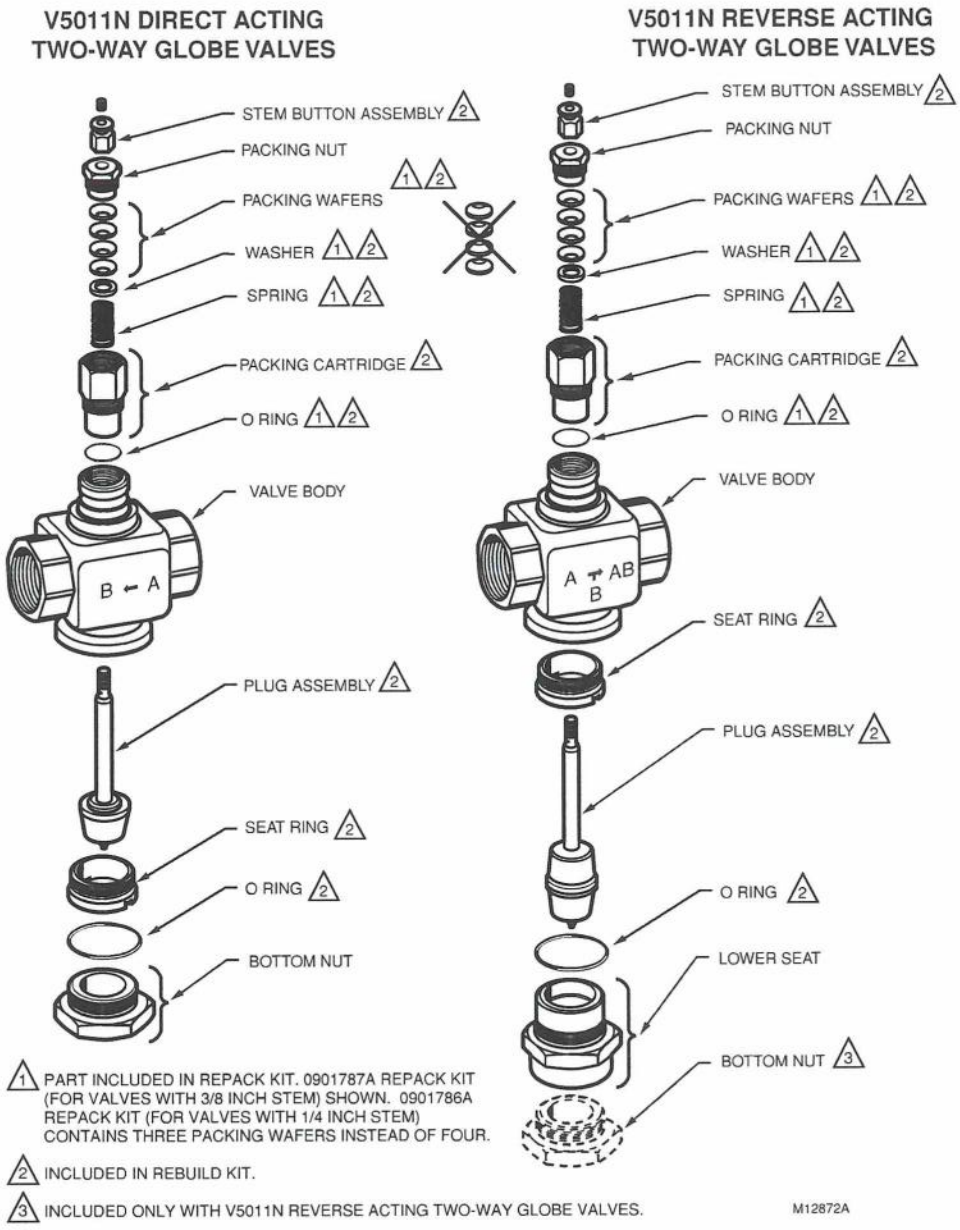


Fig. 5. V5011N replacement parts.

Honeywell

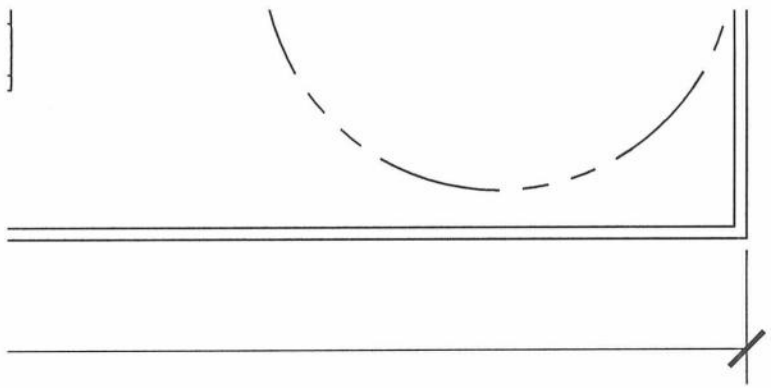
Automation and Control Solutions
Honeywell International Inc.
1985 Douglas Drive North
Golden Valley, MN 55422

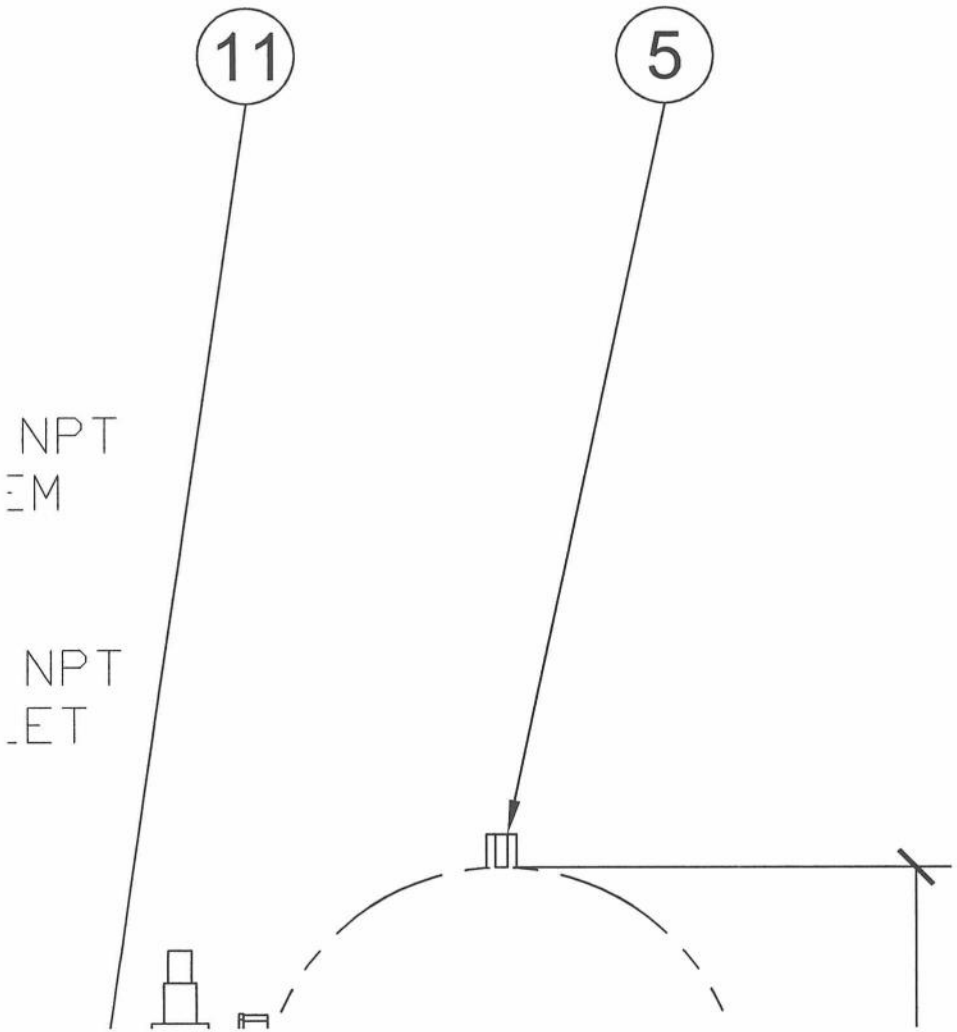
Honeywell Limited-Honeywell Limitée
35 Dynamic Drive
Scarborough, Ontario
M1V 4Z9

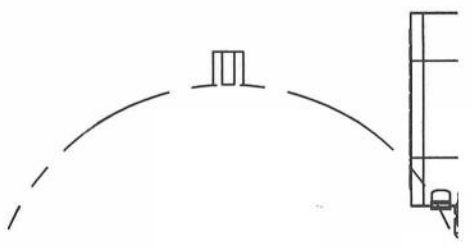
Honeywell International
Control Products
Honeywell Building
17 Changi Business Park Central 1
Singapore 486073

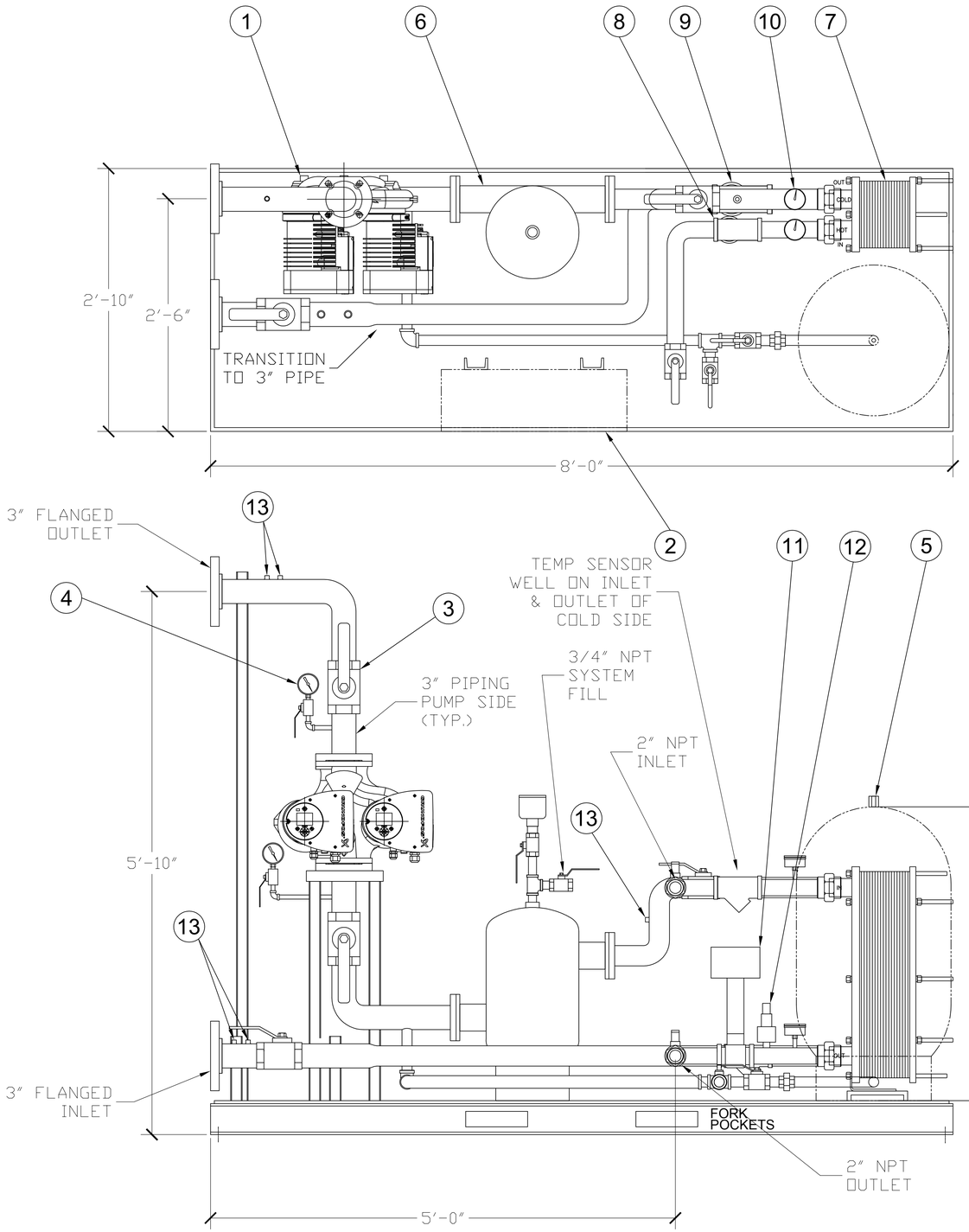
Honeywell Europe S.A.
3 Avenue du Bourget
1140 Brussels
Belgium

Honeywell Latin American Region
480 Sawgrass Corporate Parkway
Suite 200
Sunrise FL 33325

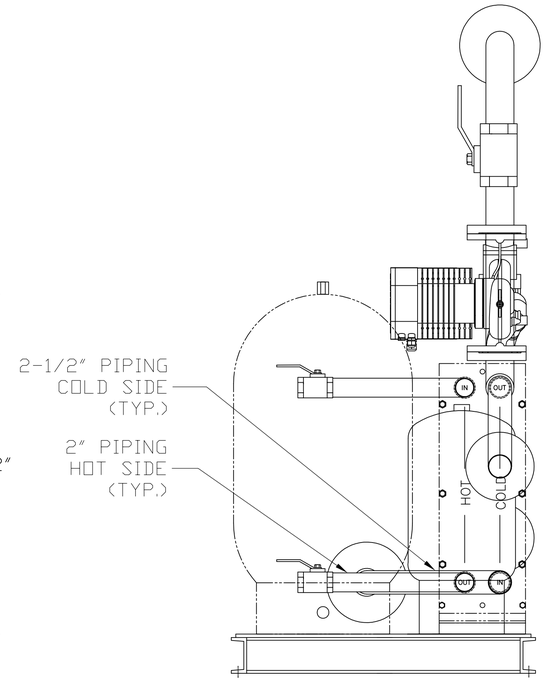



11
5
NPT
EM
NPT
ET





Contractor has verified
proper space is provided for equipment.
Snow melt contractor to provide 3/4 wells on supply and return piping on both sides of heat exchanger



EQUIPMENT LIST

ITEM	QTY.	DESCRIPTION
1	1	GRUNDFOS MAGNA3 D 65-150 F 60 Hz MATERIAL # 98126863 CAPACITY: 105 GPM AT 46' TDH
2	1	NEMA 12 CONTROL PANEL
3	4	WATTS 3" BRASS FP BALL VALVE MODEL # FBV-3C
4	2	WEISS LIQ-FILLED PRESSURE GAUGE 0-60 PSI MODEL # LF25S-1
5	1	WESSELS EXPANSION TANK MODEL # NTA-80
6	1	WESSELS AIR SEPERATOR MODEL # SPA-3
7	1	ALFA LAVAL PLATE AND FRAME HEAT EXCHANGER MODEL T5-BFG WITH 2.375" NPT CONNECTIONS
8	1	WATTS SERIES 77SI Y-STRAINER SIZE: 2"
9	1	WATTS SERIES 77SI Y-STRAINER SIZE: 2.5"
10	4	WATTS TEMP & PRESSURE GAUGE 1/2 LFDPTG3-3 0-200 60-320 F MODEL NO.: 0121662
11	1	2" HONEYWELL CONTROL VALVE W/ ACTUATOR VALVE BODY MODEL V5011N1099 ACTUATOR MODEL ML69841006
12	1	WATTS PRESSURE RELIEF VALVE SIZE 3/4" MODEL # 740
13	4	1/2" TEMPERATURE SENSING WELL

HEAT EXCHANGER SKID PLAN

SCALE: 1:8

LIABILITY

This drawing and our recommendations and suggestions, are intended to assist our customers. Our design represents our best judgment based on our experience and the best facts provided to us, any use thereof is at the sole risk of the customer.

It is assumed that the customer will install the THAW-PAK system in compliance with all local, state and national codes.

CONSULTANTS:
LIMBACH CO. LLC
CITY MICHIGAN

thaw-PAK
Snow Melting & Radiant Heating Systems

PROJECT NAME:
JACKSON NATIONAL LIFE
MICHIGAN

THAW-PAK DISTRIBUTOR:
PERFORMANCE engineering group

DRAWN BY: *Gordon Faustich*
REVIEWED BY: *AD*
APPROVED BY: *AD*

ISSUED FOR

12/09/14	APPROVAL
12/31/14	INCREASED FLOW AND BTU/SF
02/24/15	ADDED SENSOR WELLS TO SKID
03/23/15	UPDATED CONTROLS
03/24/15	UPDATED SENSORS ON SKID

DRAWING NO.
PEG14-009S_E

SHEET NO.
M6