

# Application Brochure

# Smart Heat Pump Control 291



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**⚠ WARNING**

**Please read carefully before proceeding with installation. Your failure to follow any attached instructions or operating parameters may lead to the product's failure.**

**Keep this Manual for future reference.**



tekmar® is not responsible for failures due to connectivity issues, power outages, or improper installation.

# 2-Pipe with 4 Heat Pumps

## Application A291-1

Mechanical

### Description

The 2-pipe system is heated by four air-to-water heat pumps. The radiant floor provides the first stage of heating. The air handling unit provides second-stage heating and first-stage cooling.

### Legend

AHU1 = Air Handling Unit

E1 = Expansion Tank

HP1 to HP4 = Air-Source Heat Pumps

S1 = Tank Sensor 082

S2 = Tank Return Sensor 082

S3 = Outdoor Sensor 070 (not shown)

P1 to P4 = Heat Pump Loop Pumps

P5 = Tank Loop Pump

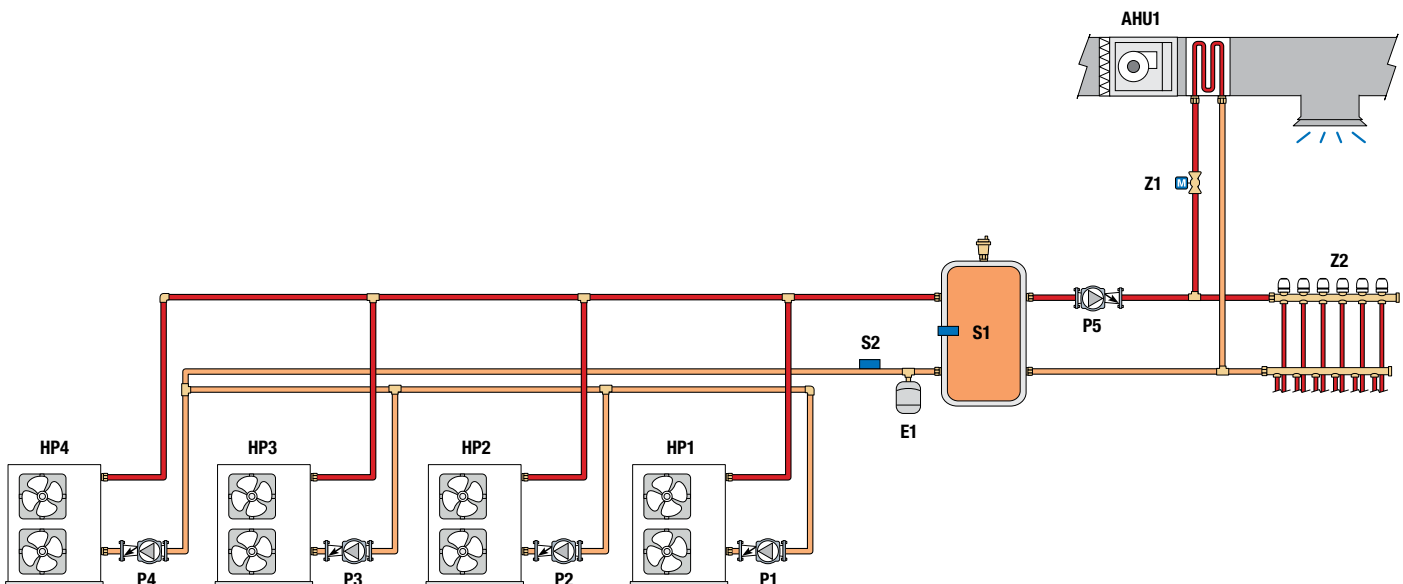
T1 = Optional Thermostat Heat Call

T2 = Optional Thermostat Cooling Call

tN4-1 = Optional tekmarNet® Thermostat Call

Z1 = Air Handling Unit Zone Valve

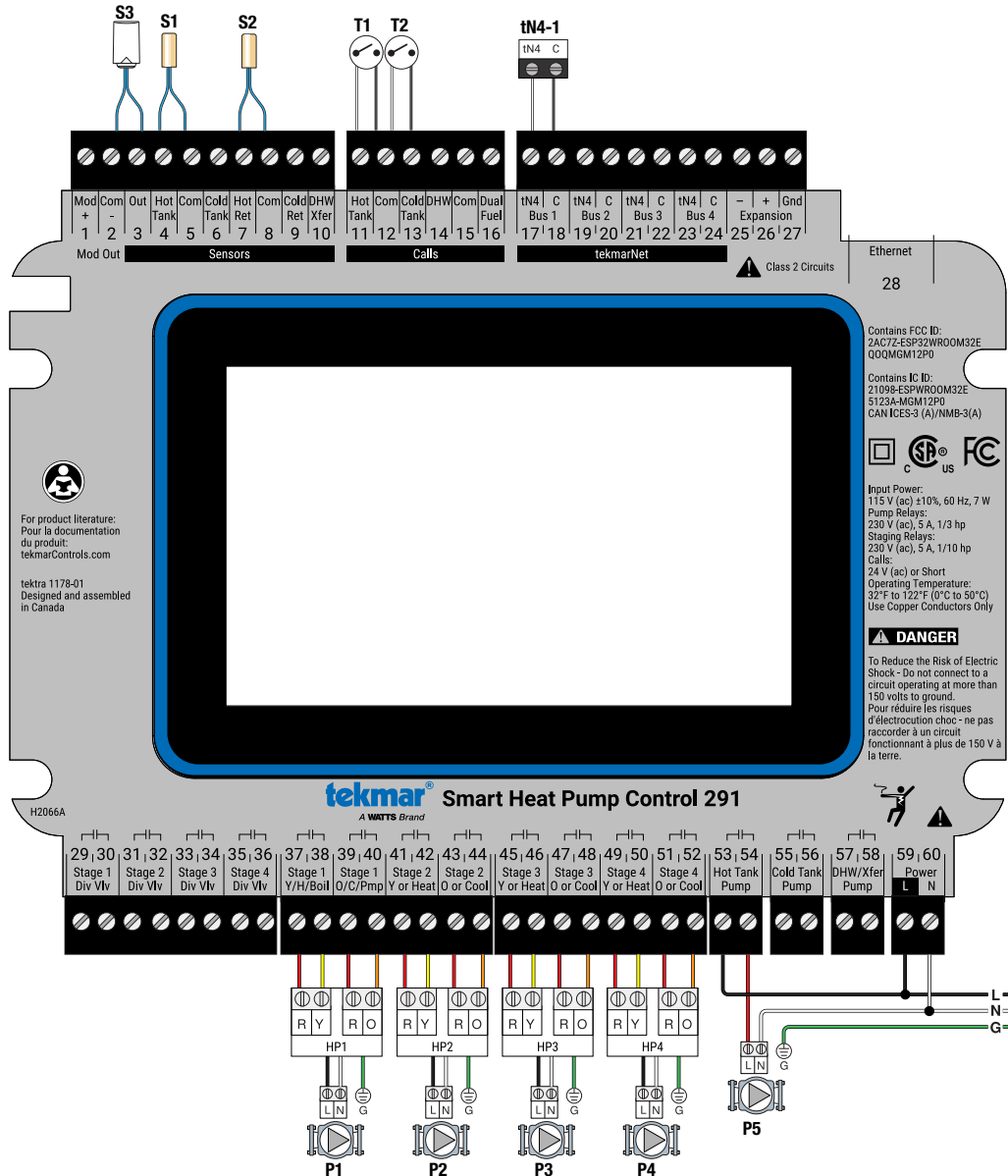
Z2 = Radiant Floor Heating Zone Valves



**Concept Drawing:** This is only a concept drawing, not an engineered drawing. It is not intended to describe a complete system, nor any particular system. It is up to the system designer to determine the necessary components for and configuration of the particular system being designed, including additional equipment, isolation relays (for loads greater than the control's specified output ratings), and any safety devices which in the judgment of the designer are appropriate, in order to properly size, configure and design that system and to ensure compliance with building and safety code requirements.

## Essential Settings:

- System Type = 2-Pipe
- Backup Type = None
- Mix 1 Enable = Off



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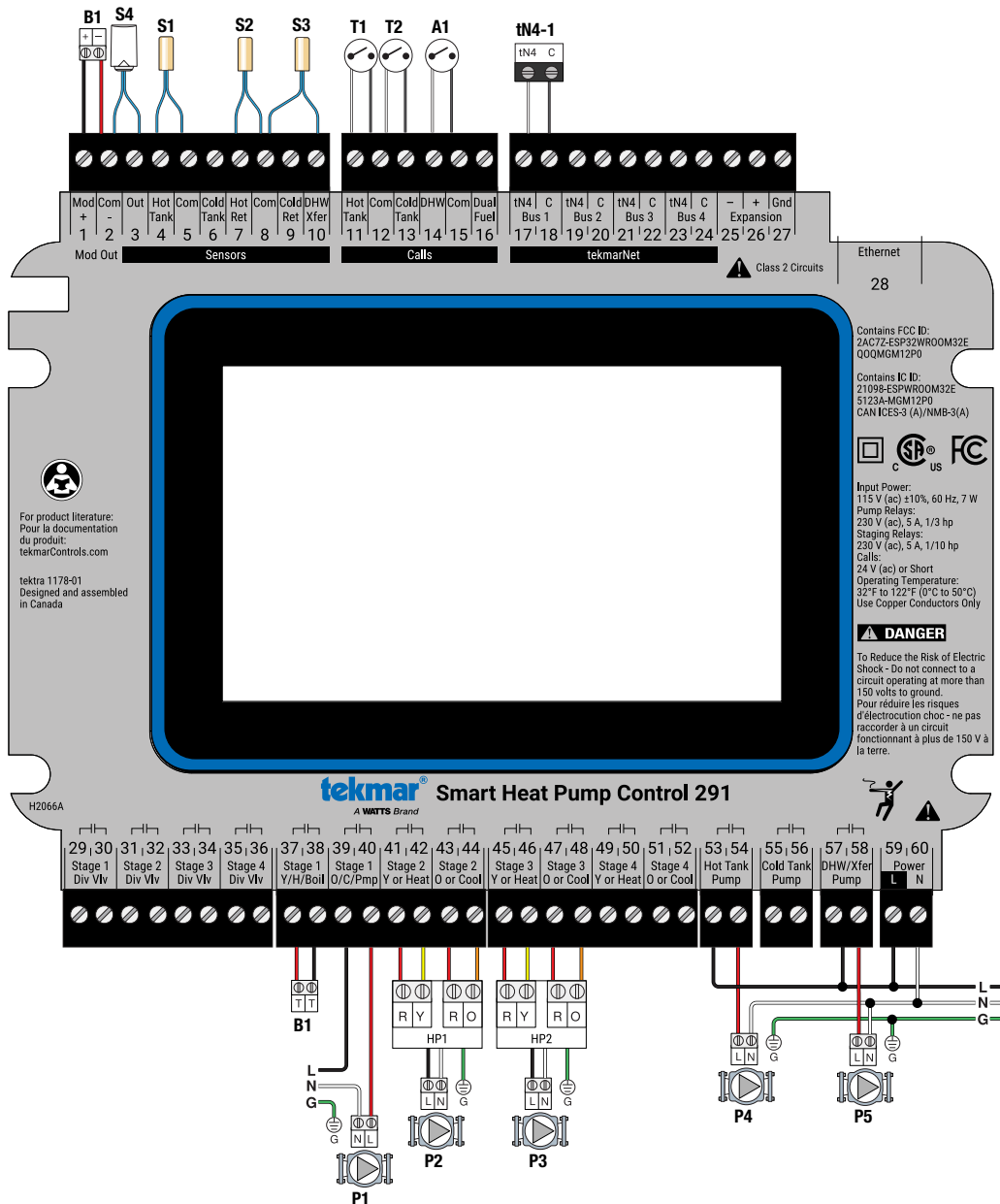
## Essential Settings:

System Type = 2-Pipe

Backup Boiler = Single Boiler

Mix 1 = Off

DHW Type = Side Arm



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# 2-Pipe with 2 Heat Pumps, DHW Pre-Heat and Mixing

## Application A291-3

*Mechanical*

### Description

The 2-pipe system is heated by two geo exchange water-to-water heat pumps and electric resistance heater. The radiant floor provides the first stage of heating and cooling. The air handling unit provides second-stage heating and second-stage cooling. A 3-way valve diverts the heat pump's supply water to heat a domestic hot water pre-heat tank which feeds an electric hot water tank for domestic hot water heating.

### Legend

AHU1 = Air Handling Unit

E1 = Expansion Tank

P1, P2 = Heat Pump Loop Pump

P3 = Tank Loop Pump

P4 = Variable Speed Injection Pump

P5 = Mix Loop System Pump

R1 = Electric Resistance Heater

S1 = Tank Sensor 082

S2 = Tank Return Sensor 082

S3 = DHW Pre-Heat Tank Sensor 082

S4 = Mix Loop Supply Sensor 082

S5 = Outdoor Sensor 070 (not shown)

T1 = Optional Thermostat Heat Call

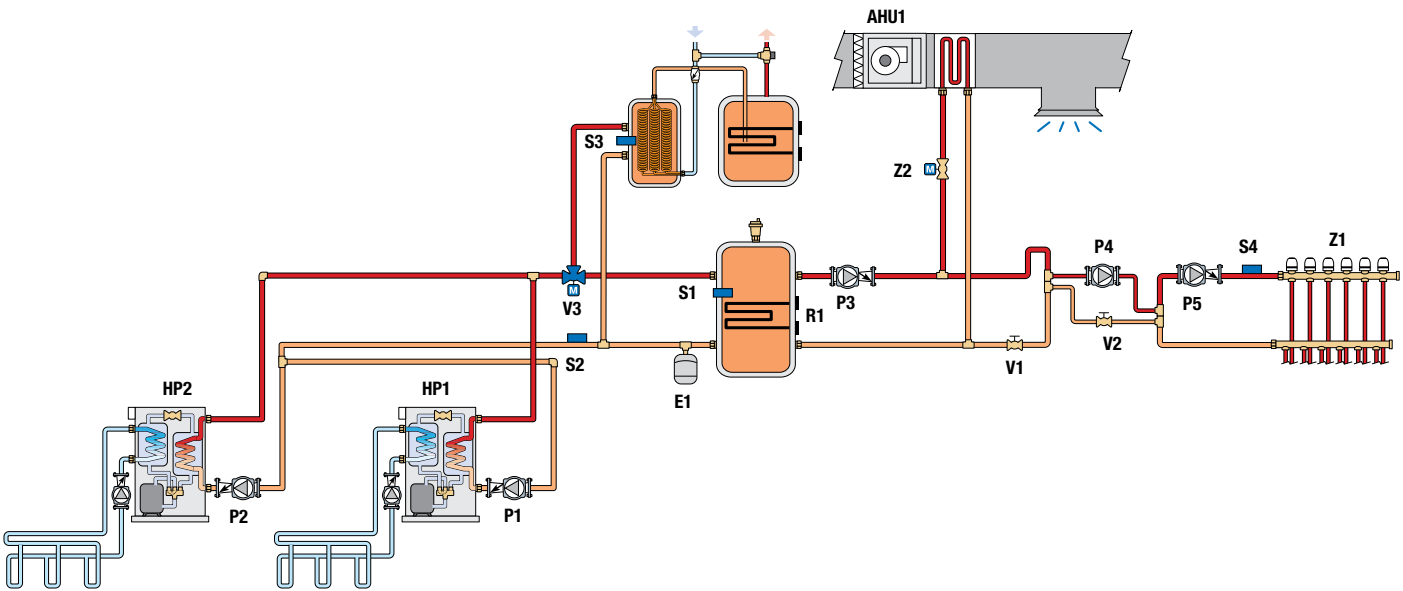
T2 = Optional Thermostat Cooling Call

V1, V2 = Globe or Balancing Valve

V3 = DHW 3-Way Diverting Valve

Z1 = Radiant Floor Zone Valves

Z2 = Air Handling Unit Zone Valve



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## Essential Settings:

System Type = 2-Pipe

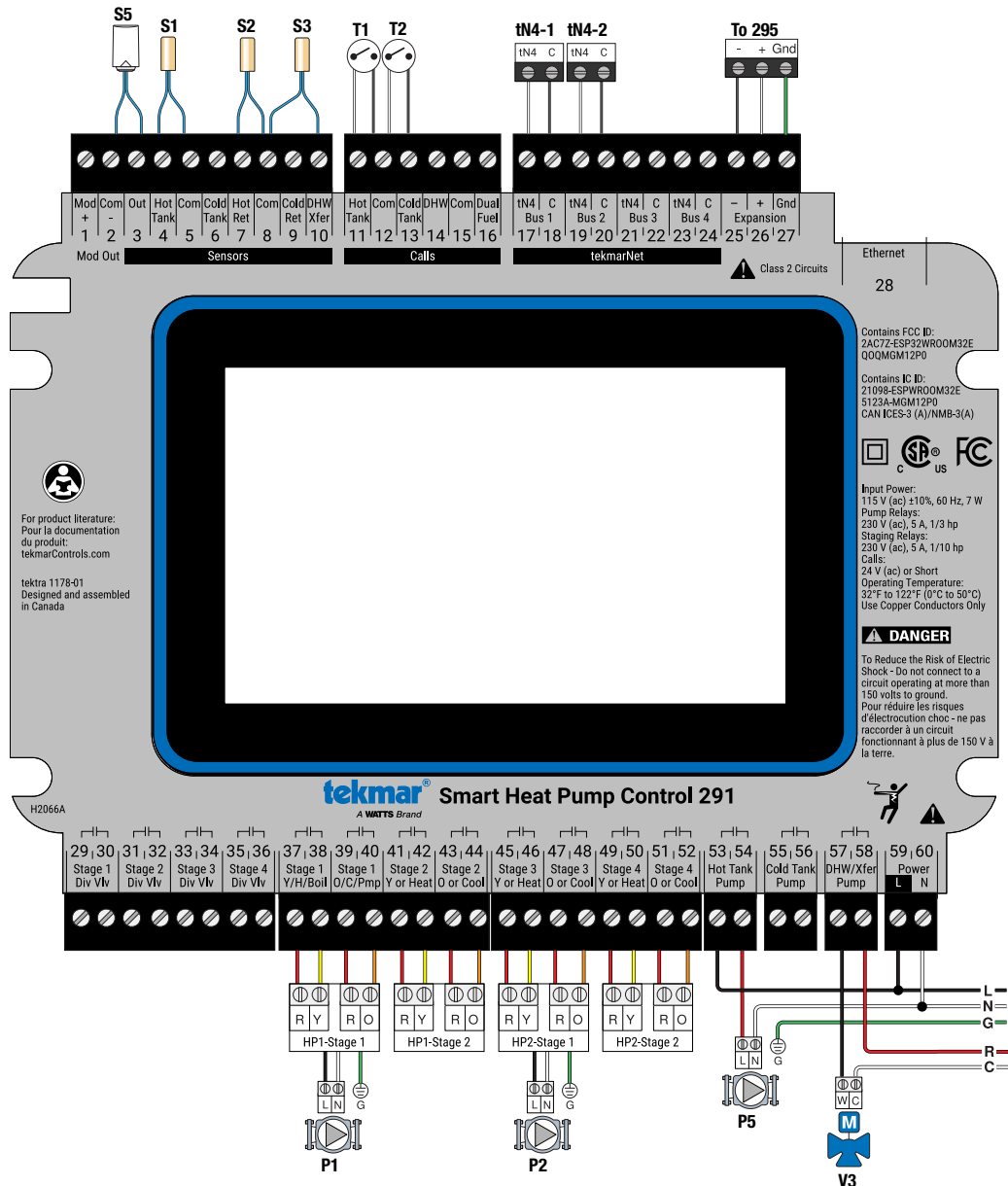
Backup Boiler = Single Boiler

Mix 1 = On

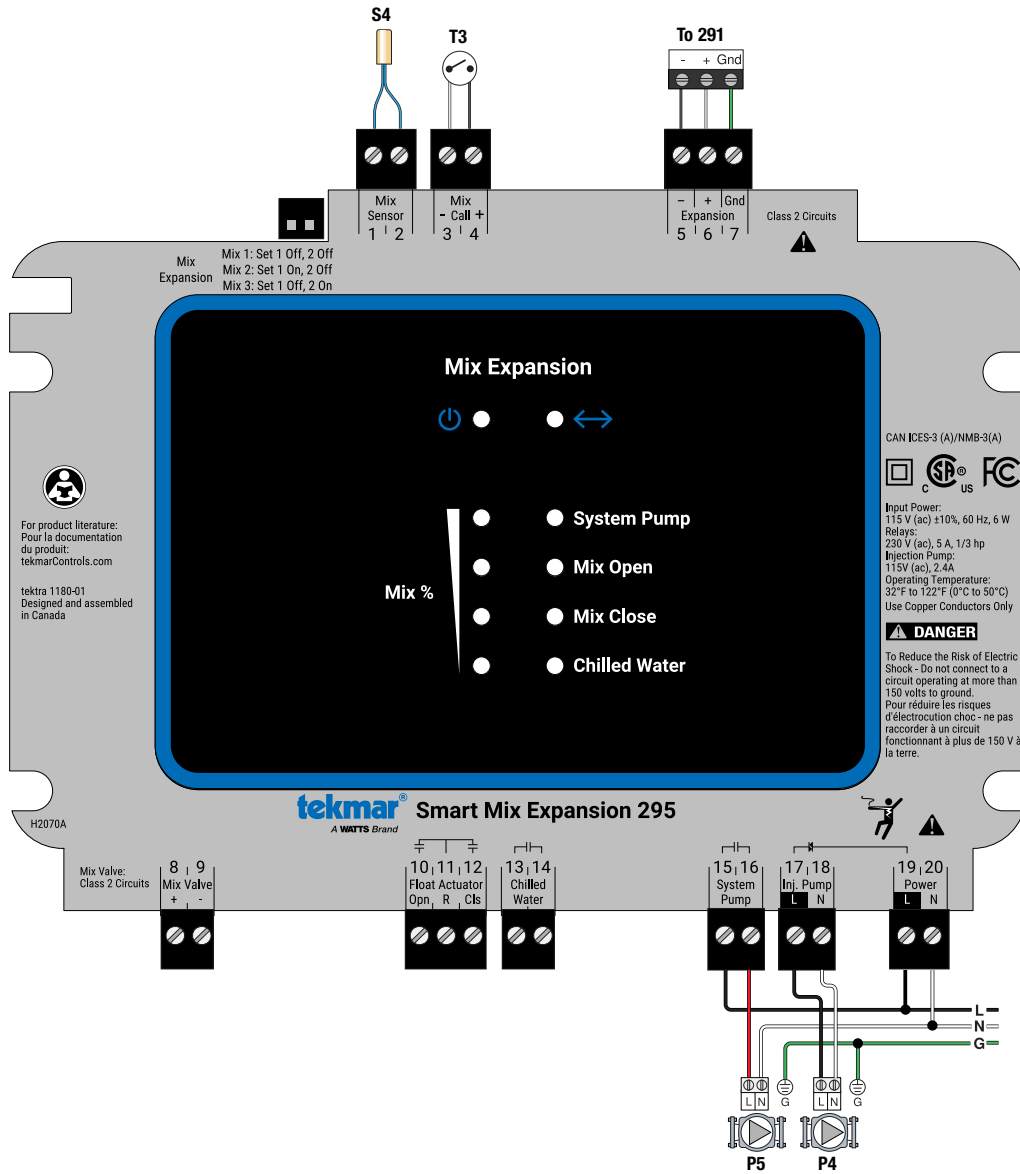
Boiler Type = Electric Water Heater

DHW Type = Heat Pump Loop

Mix 1 Type = Variable Speed Injection



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# 2-Pipe with 2 Heat Pumps and Multiple Backup Boilers with DHW

## Application A291-4

Mechanical

### Description

The 2-pipe system is heated and cooled using two geo exchange-to-water heat pumps. A boiler loop heated by two modulating condensing boilers provides supplemental heat to the central heating system through a transfer pump. The boiler loop also heats a domestic hot water tank and high temperature zones. A radiant floor provides first stage heating, and an air handling unit provides second-stage heating and first-stage cooling.

### Legend

B1, B2 = Modulating Condensing Boilers

D1 = Pressure Differential Bypass Valve

E1 = Expansion Tank

HP1, HP2 = Geo Exchange Heat Pumps

P1, P2 = Heat Pump Loop Pump

BP1, BP2 = Boiler Pumps

P3 = Tank Loop Pump

P4 = Transfer Pump

P5 = DHW Pump

P6 = Boiler Loop Pump

S1 = Tank Sensor 082

S2 = Tank Return Sensor 082

S3 = Boiler Supply Sensor 082

S4 = DHW Tank Sensor 082

S5 = Outdoor Sensor 070 (not shown)

T1 = Optional AHU Thermostat Heat Call

T2 = Optional AHU Thermostat Cool Call

T3 = Optional Boiler Loop Thermostat Heat Call

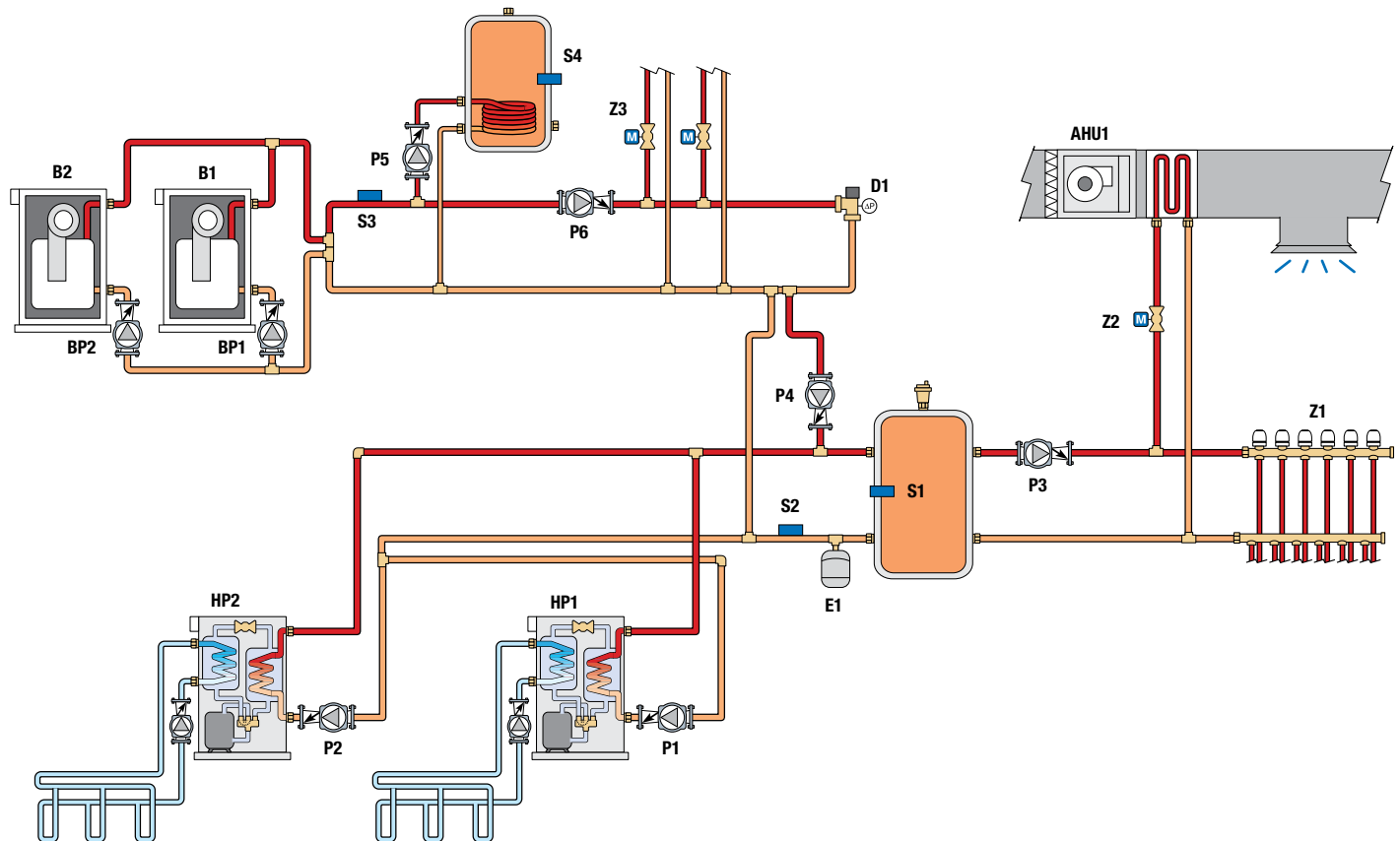
tN4-1 = Optional tekmarNet Thermostat

V1, V2 = Globe or Balancing Valves

Z1 = Radiant Floor Zone Valves

Z2 = Air Handling Unit Zone Valve

Z3 = Boiler Loop Zone Valves



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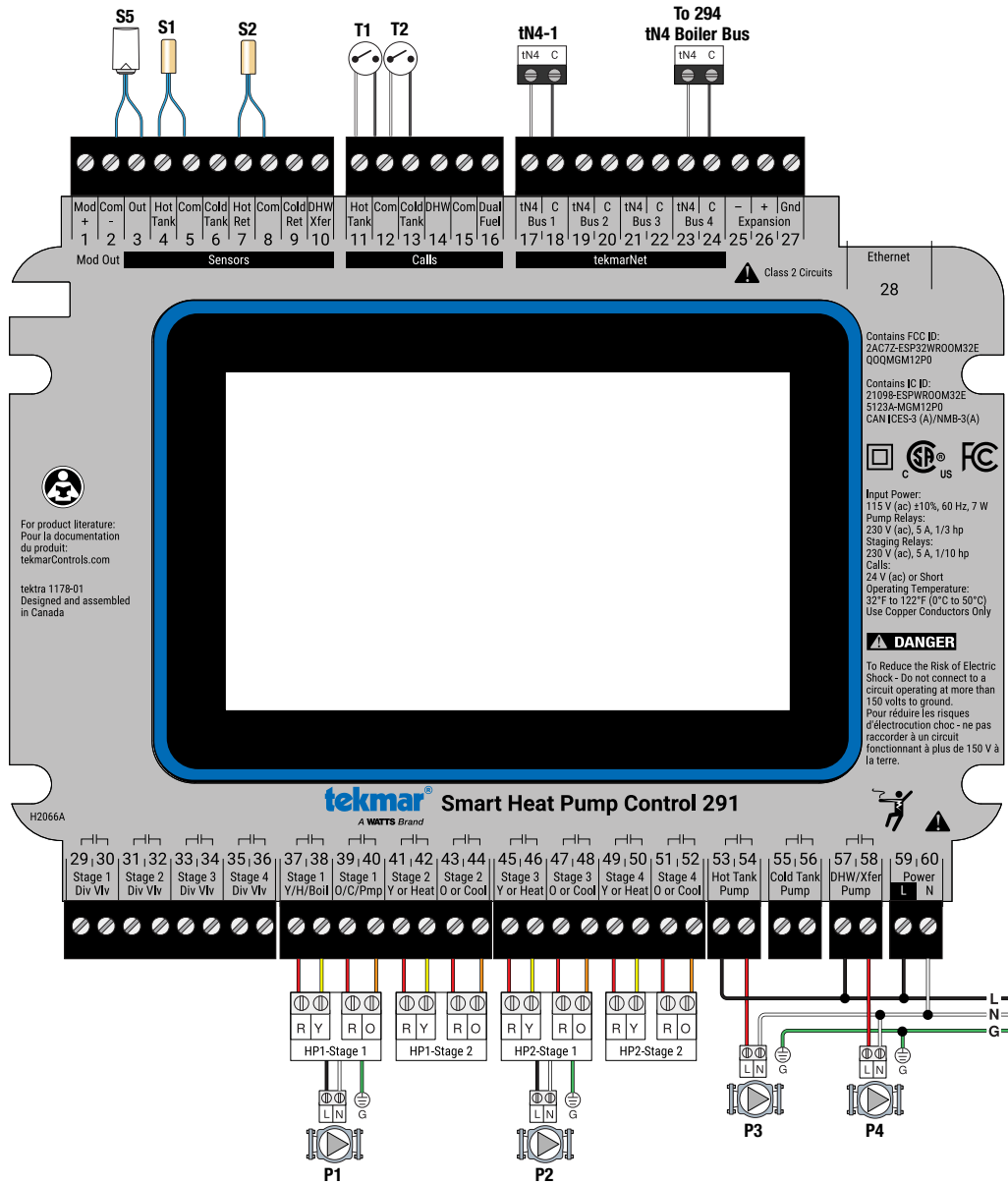
## Essential Settings:

System Type = 2-Pipe

Backup Boiler = Single Loop

Mix 1 = Off

Transfer Pump Type = On-Off



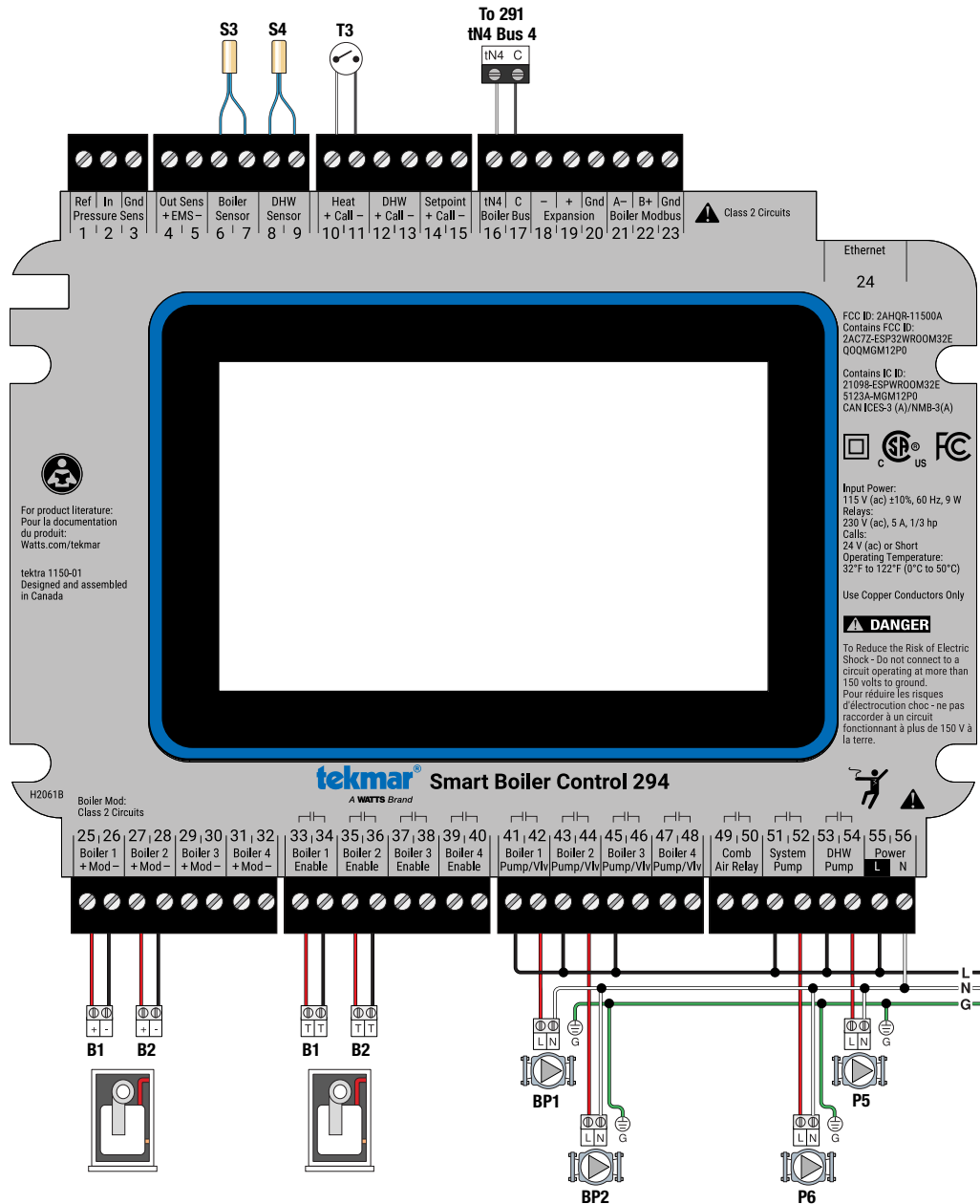
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## Essential Settings:

DHW = On

DHW Type = System

Indirect DHW System Pump = Off



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# 4-Pipe with 4 Heat Pumps

## Application A291-5

Mechanical

### Description

The 4-pipe system is heated and cooled by up to 4 air-to-water heat pumps. Each heat pump has a 6-way diverting valve to select either the hot or cold tank. A radiant floor provides first-stage heating and the air handling unit provides second-stage heating and first-stage cooling.

### Legend

AHU1 = Air Handling Unit

E1, E2 = Expansion Tanks

HP1 to HP4 = Heat Pumps

P1 to P4 = Heat Pump Loop Pumps

P5 = Hot Tank Pump

P6 = Cold Tank Pump

V1 to V4 = 6-Way Diverting Valve Panel 731 or 732

S1 = Hot Tank Sensor 082

S2 = Cold Tank Sensor 082

S3 = Hot Tank Return Sensor 082

S4 = Cold Tank Return Sensor 082

S5 = Outdoor Sensor 070 (not shown)

T1 = Optional Thermostat Heat Call

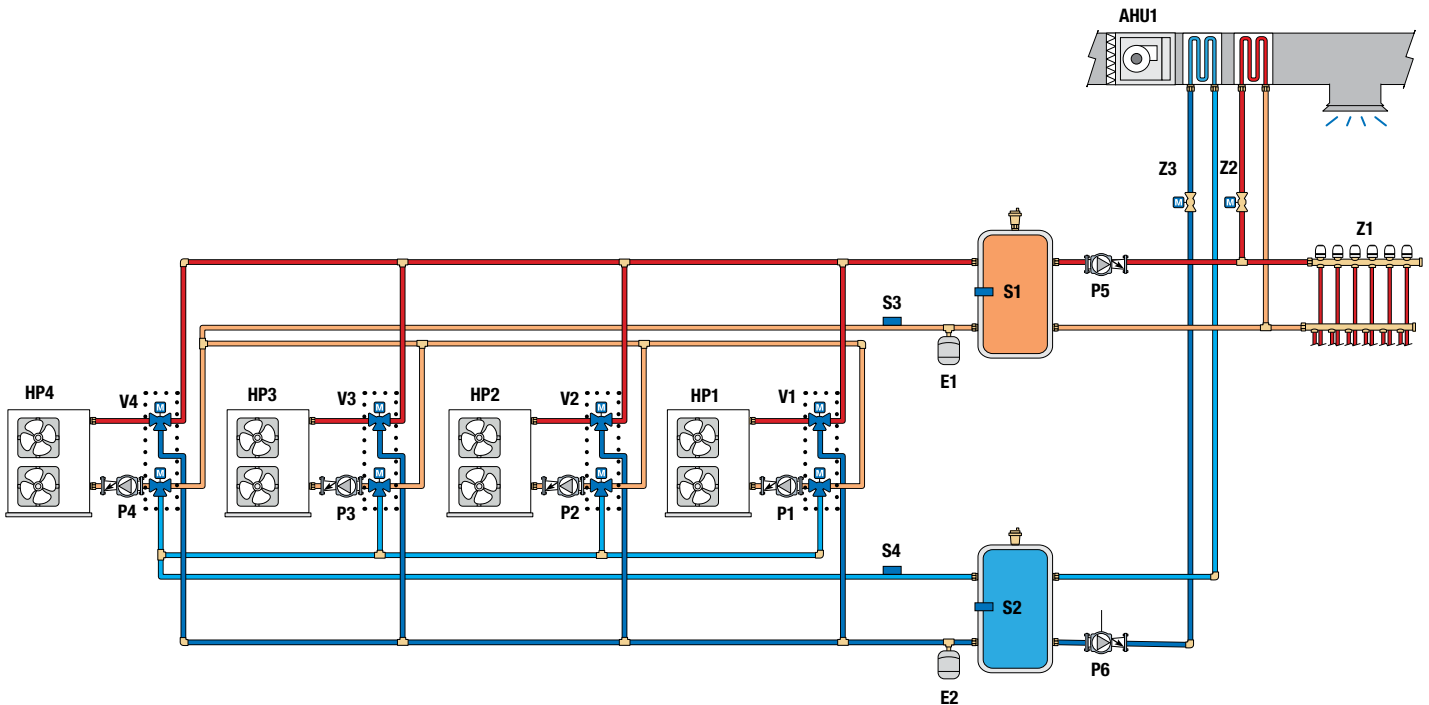
T2 = Optional Thermostat Cooling Call

tN4-1 = Optional tekmarNet Thermostat Call

Z1 = Radiant Floor Zone Valves

Z2 = Hot Water Zone Valve

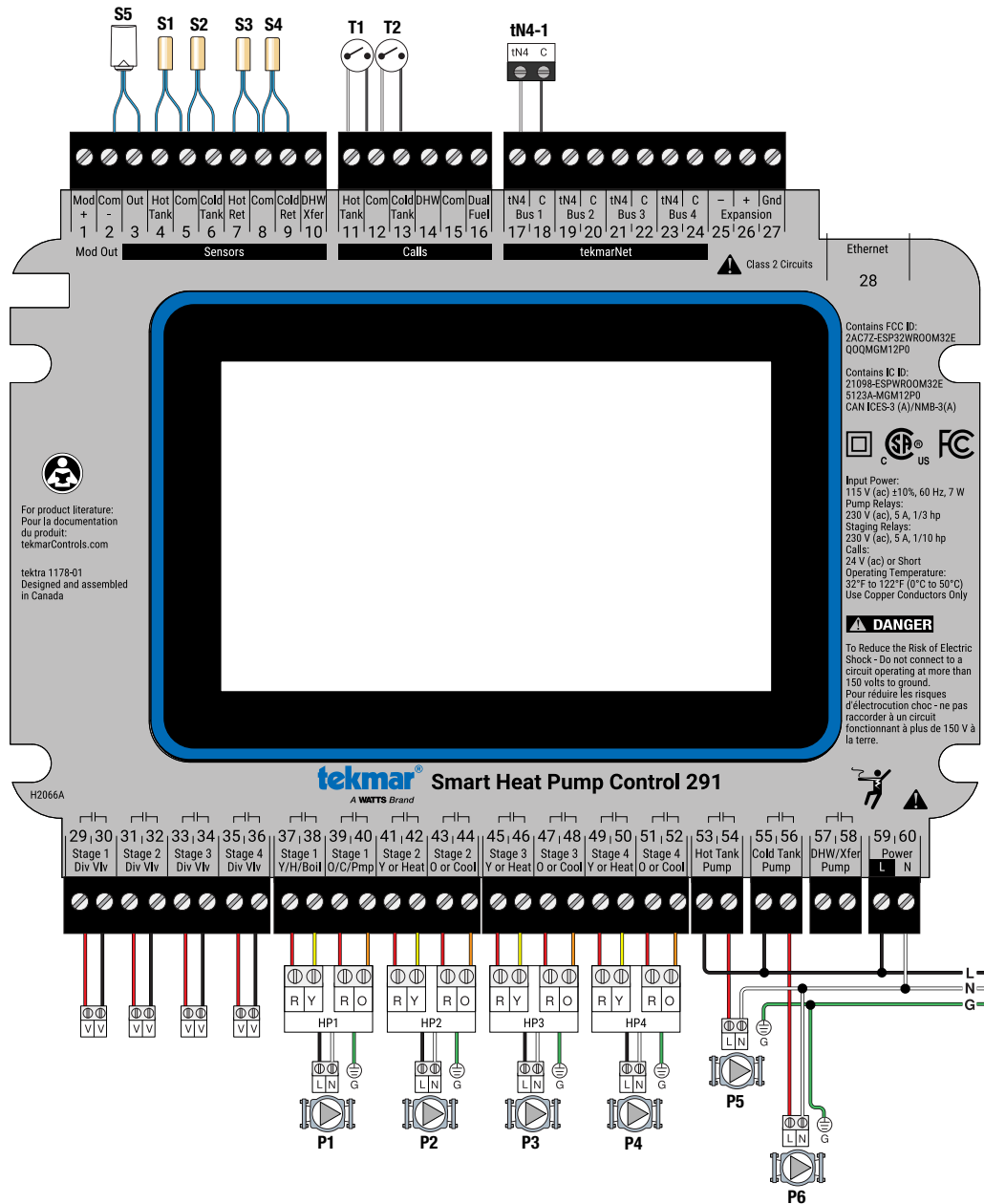
Z3 = Chilled Water Zone Valve



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## Essential Settings:

- System Type = 4-Pipe
- Backup Boiler = None
- Mix 1 = Off



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# 4-Pipe with 3 Heat Pumps, Backup Boiler, Side Arm DHW and Mixing

## Application A291-6

*Mechanical*

### Description

The 4-pipe system is heated and cooled by up to 3 air-to-water heat pumps. Each heat pump has a 6-way diverting valve to select either the hot or cold tank. A modulating condensing boiler provides backup heating and side arm domestic hot water tank heating. An air handling unit provides heating and cooling to the air handling unit. The backup boiler operates on a time delay to provide supplemental heating once all heat pumps are operating. The boiler can provide full backup heating when the heat pumps are shut off when the outdoor air temperature is below the balance point, a dual fuel schedule is enabled or based upon a dual fuel call.

### Legend

AHU1 = Air Handling Unit

B1 = Modulating Condensing Boiler

E1, E2 = Expansion Tanks

HP1 to HP4 = Heat Pumps

S1 = Hot Tank Sensor 082

S2 = Cold Tank Sensor 082

S3 = Hot Tank Return Sensor 082

S4 = Cold Tank Return Sensor 082

S5 = DHW Sensor

S6 = Mix Supply Sensor 082

P1 = Boiler Pump

P2 to P4 = Heat Pump Loop Pump

P5 = DHW Side Arm Pump

P6 = Hot Tank Pump

P7 = Cold Tank Pump

P8 = Variable Speed Injection Pump

P9 = Mix Supply Pump

T1 = Optional AHU Thermostat Heat Call

T2 = Optional AHU Thermostat Cooling Call

T3 = Optional Radiant Thermostat Heat Call

tN4-1 = Optional tekmarNet Thermostat Tank Call

tN4-2 = Optional tekmarNet Thermostat Mix Call

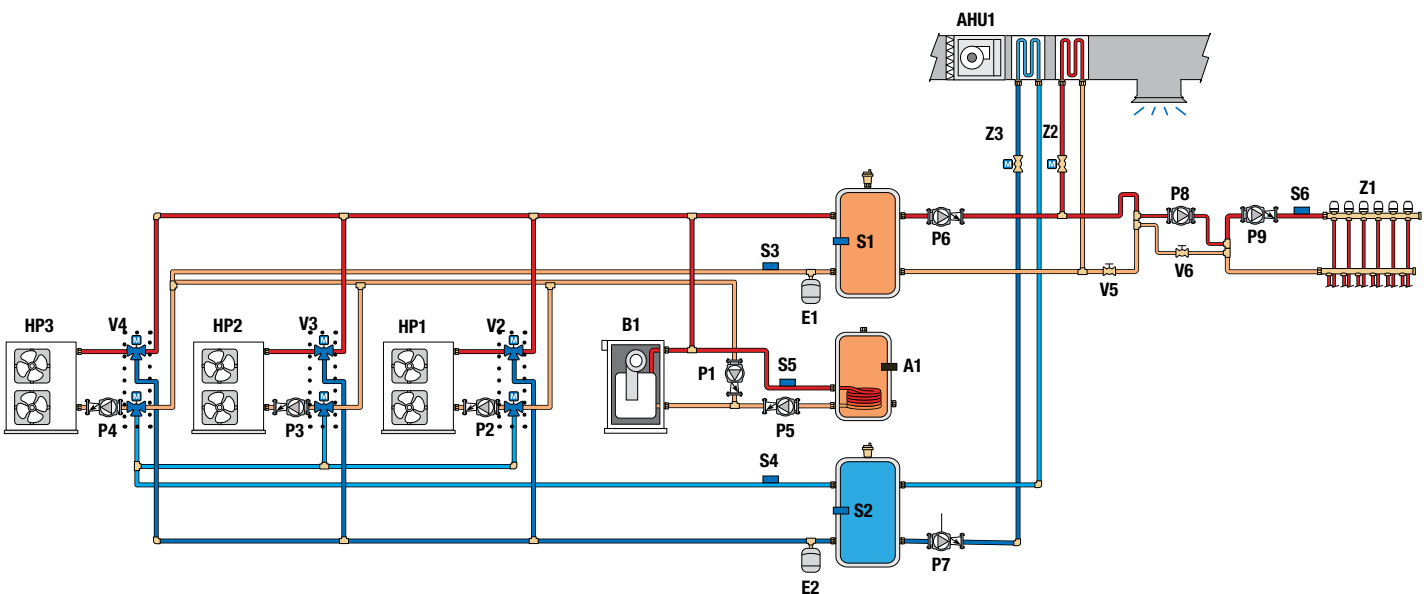
V2 to V4 = 6-Way Diverting Valve Panel 731 or 732

V5, V6 = Globe or Balancing Valves

Z1 = Radiant Floor Zone Valves

Z2 = Hot Water Zone Valve

Z3 = Cold Water Zone Valve



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## Essential Settings:

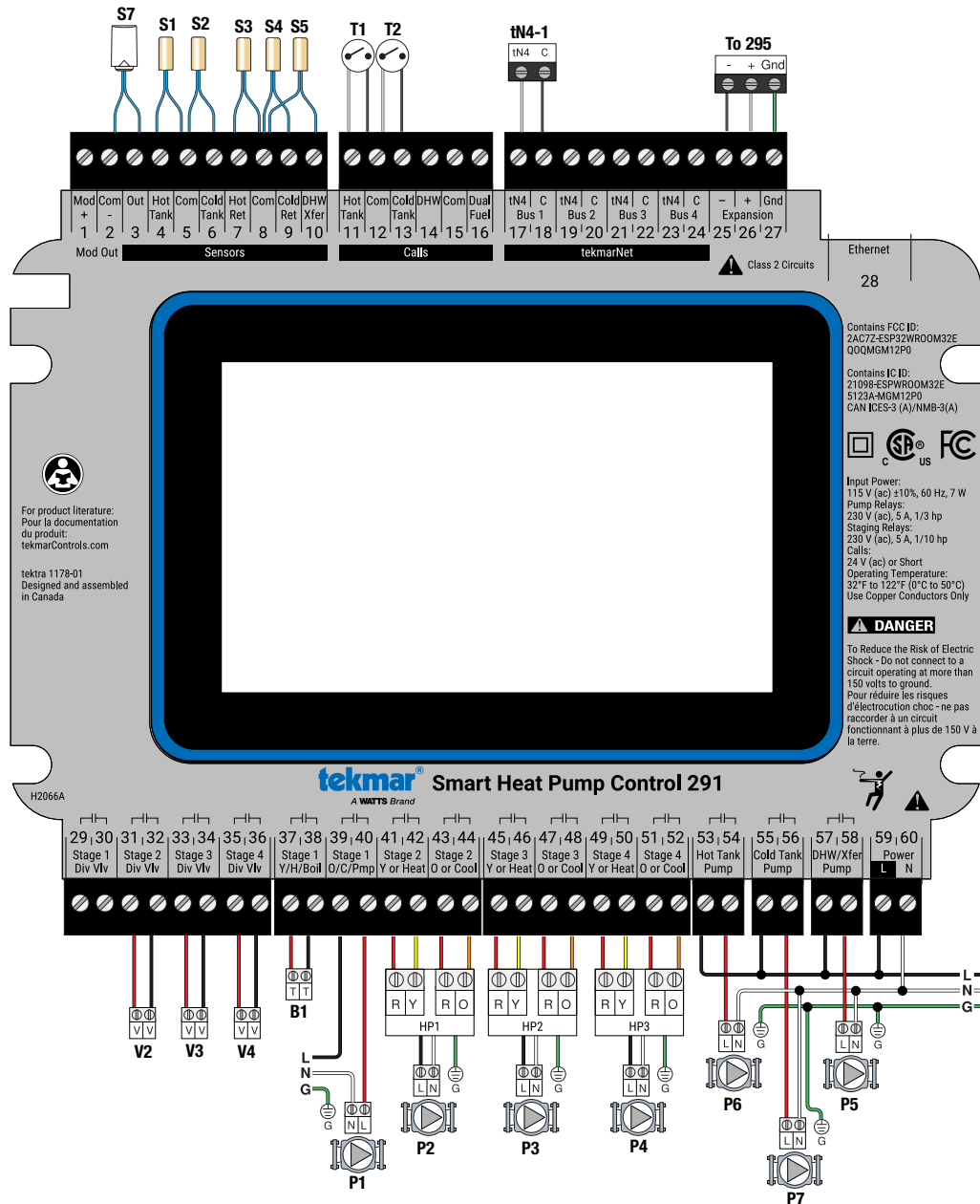
System Type = 4-Pipe

Backup Boiler = Single Boiler

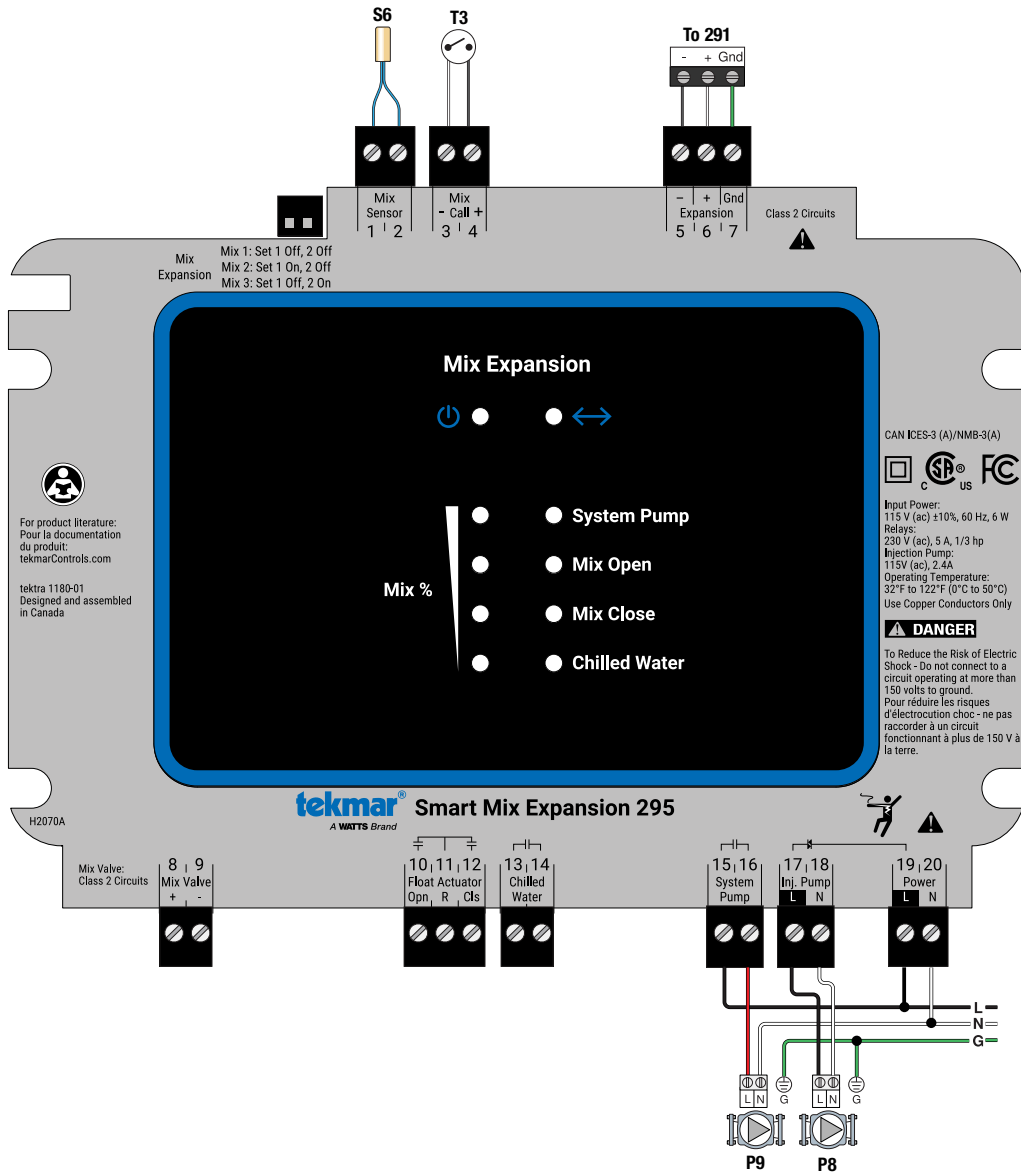
DHW Type = Side Arm

Mix 1 = On

Mix 1 Type = Variable Speed Injection



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# 4-Pipe with 4 Heat Pumps with 6-Way Diverting Valve Per Group

## Application A291-7

Mechanical

### Description

The 4-pipe system is heated and cooled by up to 4 air-to-water heat pumps. All four heat pumps are diverted to either the hot or cold tanks as a group. A radiant floor provides first-stage heating and an air handling unit provides second-stage heating and first-stage cooling.

### Legend

AHU1 = Air Handling Unit

E1, E2 = Expansion Tanks

HP1 to HP4 = Heat Pumps

S1= Hot Tank Sensor 082

S2 = Cold Tank Sensor 082

S3 = Hot Tank Return Sensor 082

S4 = Cold Tank Return Sensor 082

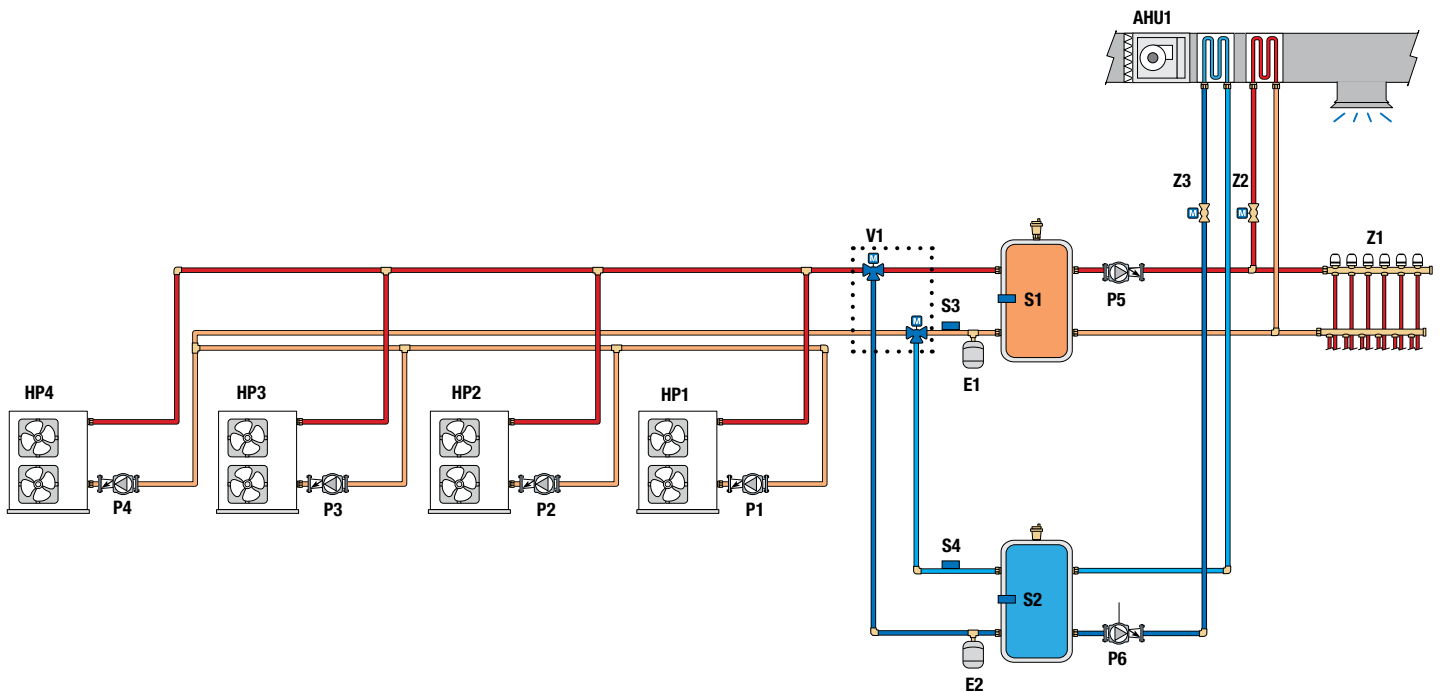
P1 to P4 = Heat Pump Loop Pump

V1 = 6-Way Diverting Valve Panel 731 or 732

Z1 = Radiant Floor Zone Valves

Z2 = Hot Tank Zone Valve

Z3 = Cold Tank Zone Valve



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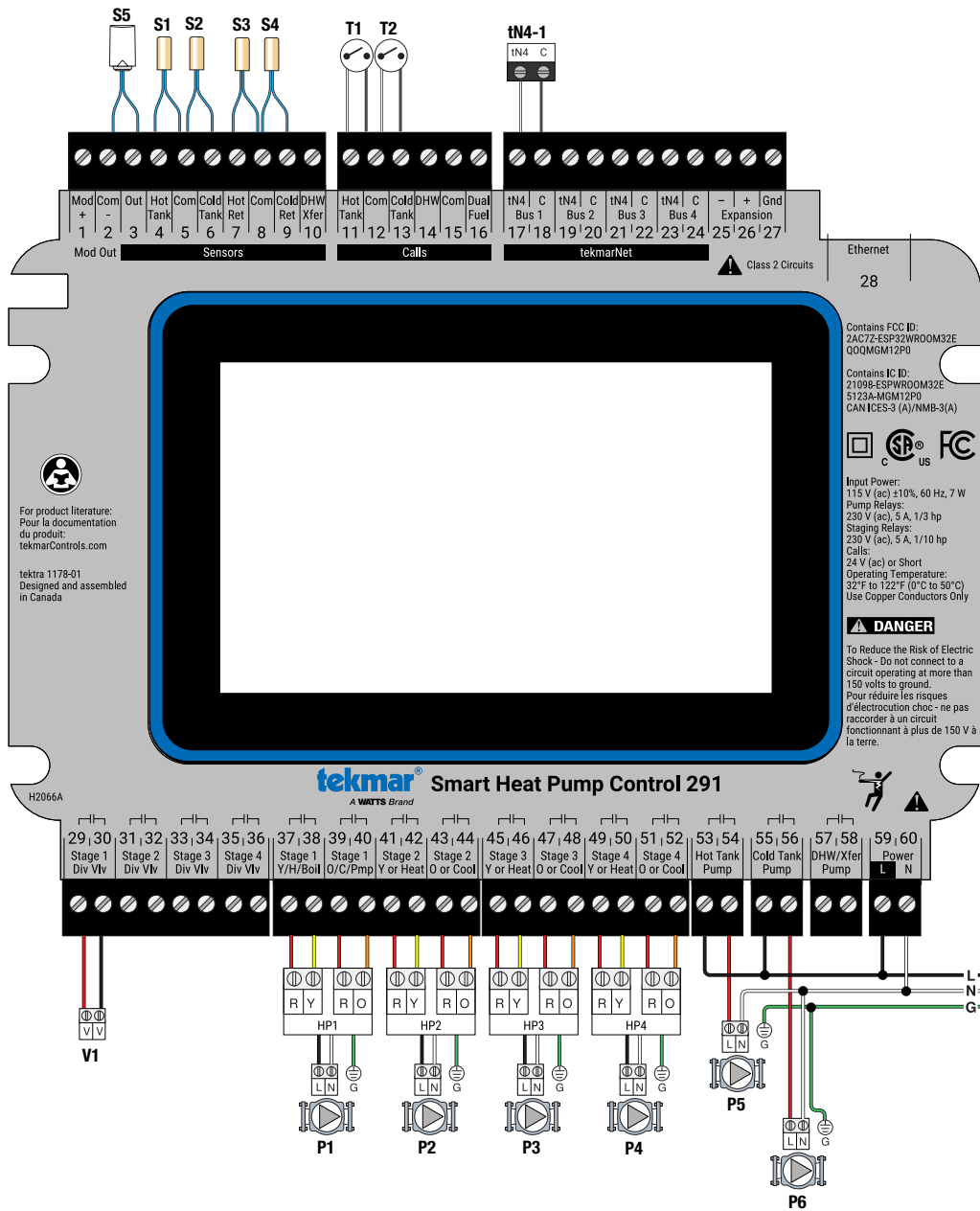
## Essential Settings:

System Type = 4-Pipe

Backup Boiler = None

Mix 1 = Off

Diverting Valve Pairs = Per Group



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# 4-Pipe with 4 Heat Pumps, 4 Backup Boilers, DHW, Mixing

## Application A291-8

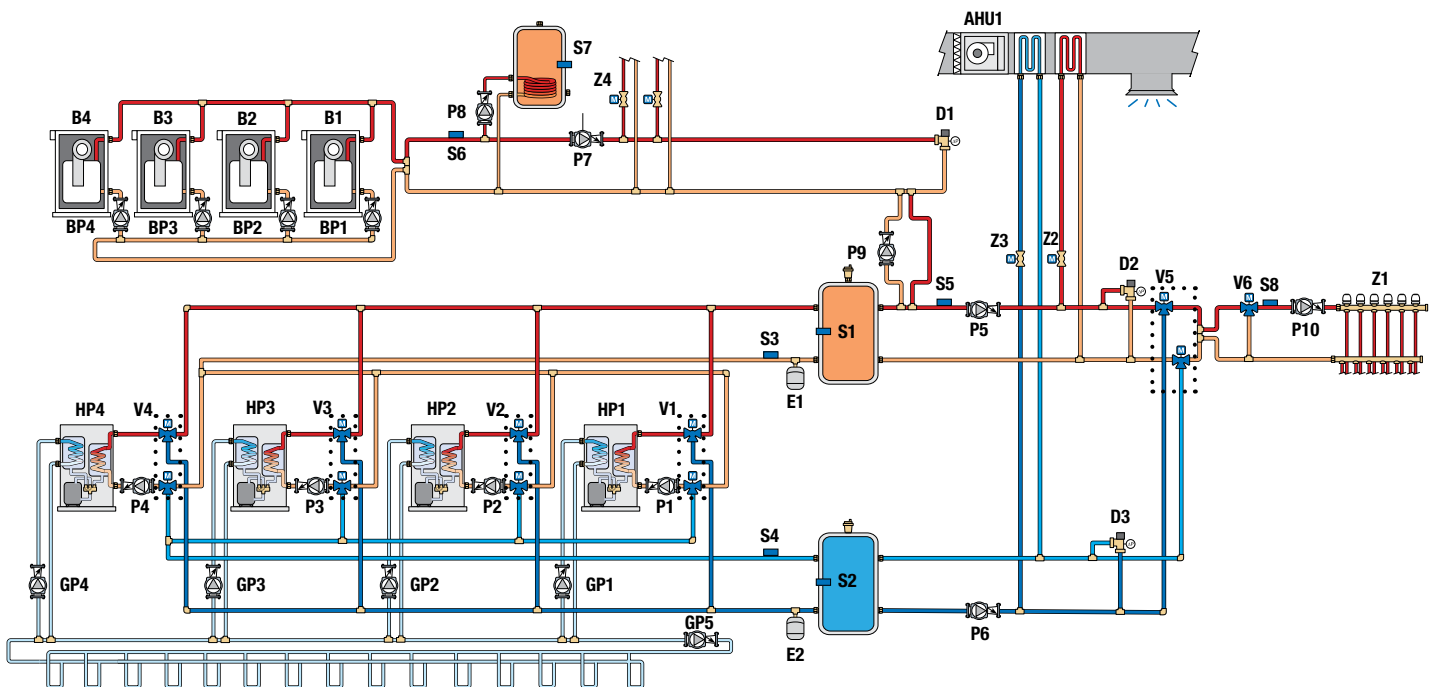
*Mechanical*

### Description

The 4-pipe system is heated and cooled by up to 4 geo exchange water-to-water heat pumps. Each heat pump has a 6-way diverting valve to select either the hot or cold tank. Up to 4 backup boilers provide supplemental and dual fuel heating to the hot tank loop, domestic hot water tank heating and high-temperature heating loads. A mixing valve regulates the mix supply temperature to the radiant floor to provide first-stage heating and first-stage cooling. The mixing valve ensures the radiant floor operates above the dewpoint temperature. An air handling unit provides second-stage heating and second-stage cooling.

### Legend

AHU1 = Air Handling Unit	S3 = Hot Tank Return Sensor 082
B1 to B4 = Modulating Condensing Boilers	S4 = Cold Tank Return Sensor 082
BP1 to BP4 = Boiler Pumps	S5 = Transfer Sensor 082
D1 to D3 = Differential Pressure Bypass Valve	S6 = Boiler Supply Sensor 082
GP1 to GP4 = Geo Field Pumps	S7 = DHW Sensor
HP1 to HP4 = Geo Exchange Heat Pumps	S8 = Mix Supply Sensor 082
P1 to P4 = Heat Pump Loop Pumps	tN4-1 = tekmarNet Tank Bus Call
P5 = Hot Tank Pump	tN4-2 = tekmarNet Mix Bus Call
P6 = Cold Tank Pump	tN4-3 = tekmarNet Boiler Bus Call
P7 = Boiler Supply Pump	V1 to V5 = 6-Way Diverting Valve Panel 731 or 732
P8 = DHW Pump	V6 = 3-Way Mixing Valve 710 through 714
P9 = Transfer Pump	Z1 = Radiant Floor Zone Valve
P10 = Mix System Pump	Z2 = Hot Tank Zone Valve
S1 = Hot Tank Sensor 082	Z3 = Cold Tank Zone Valve
S2 = Cold Tank Sensor 082	



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## Essential Settings:

System Type = 4-Pipe

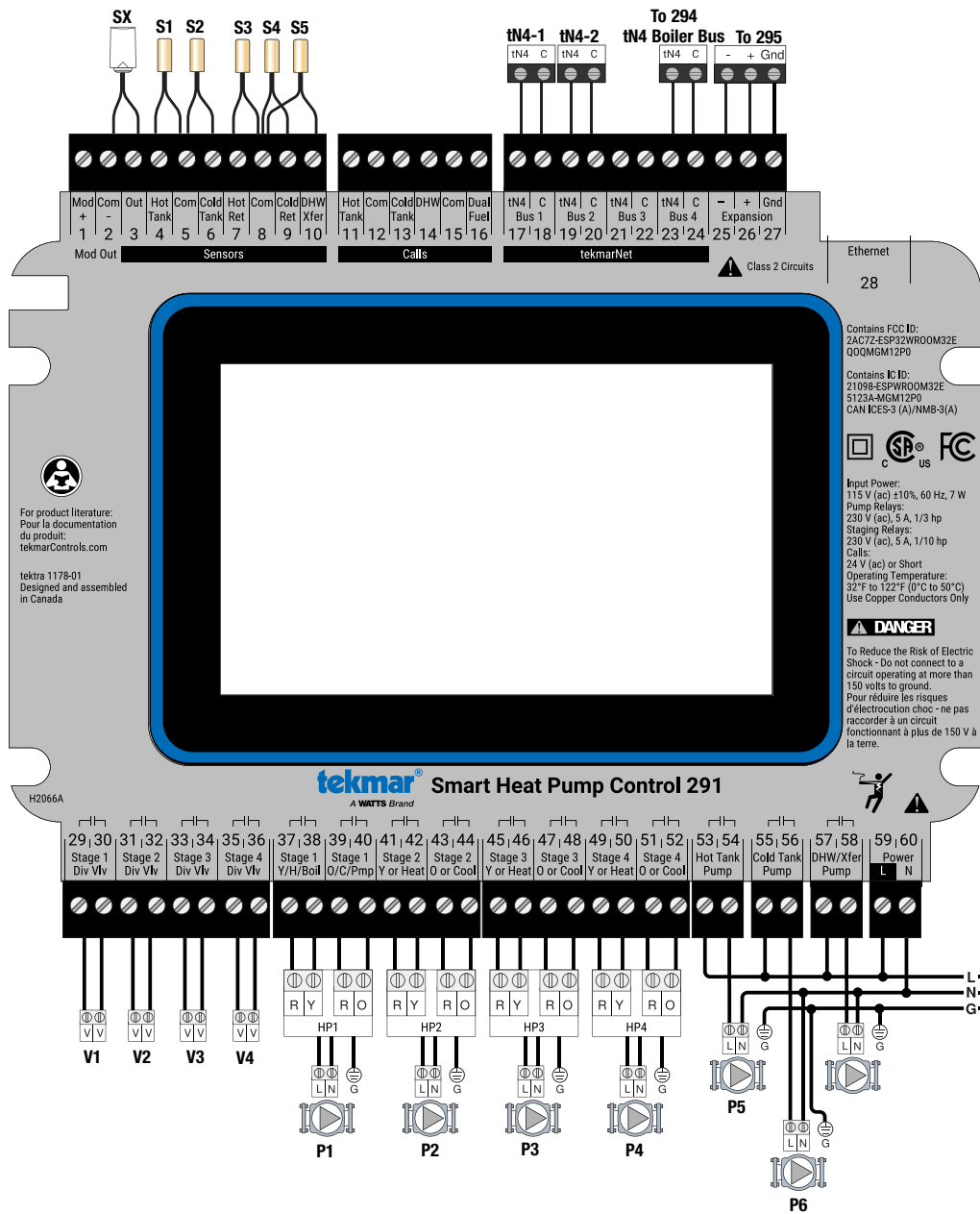
Backup Boiler = Boiler Loop

Mix 1 Enable = On

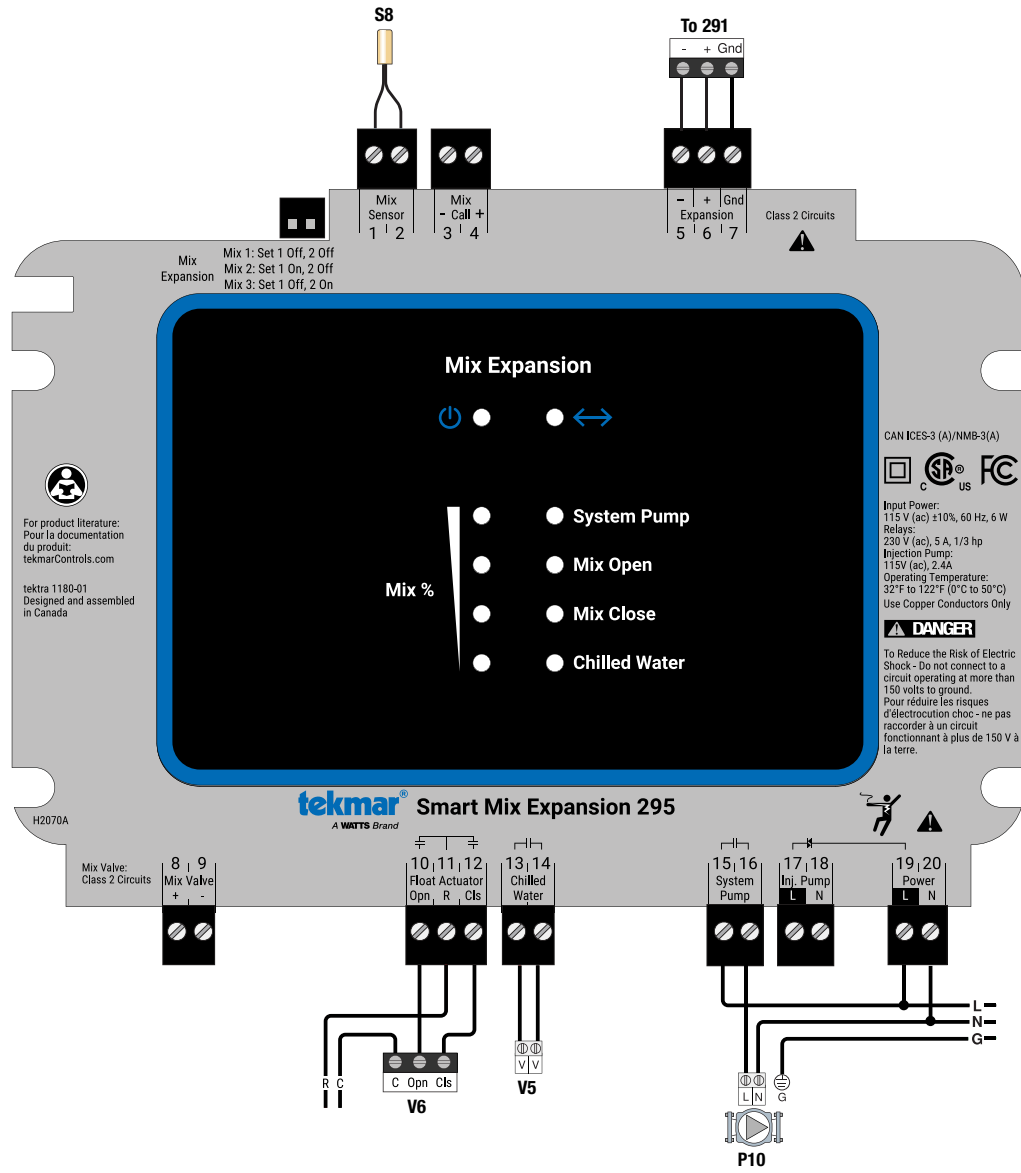
Mix 2 Enable = Off

Mix 1 Type = Floating Action Valve

Transfer Pump Type = 0-10V (dc)



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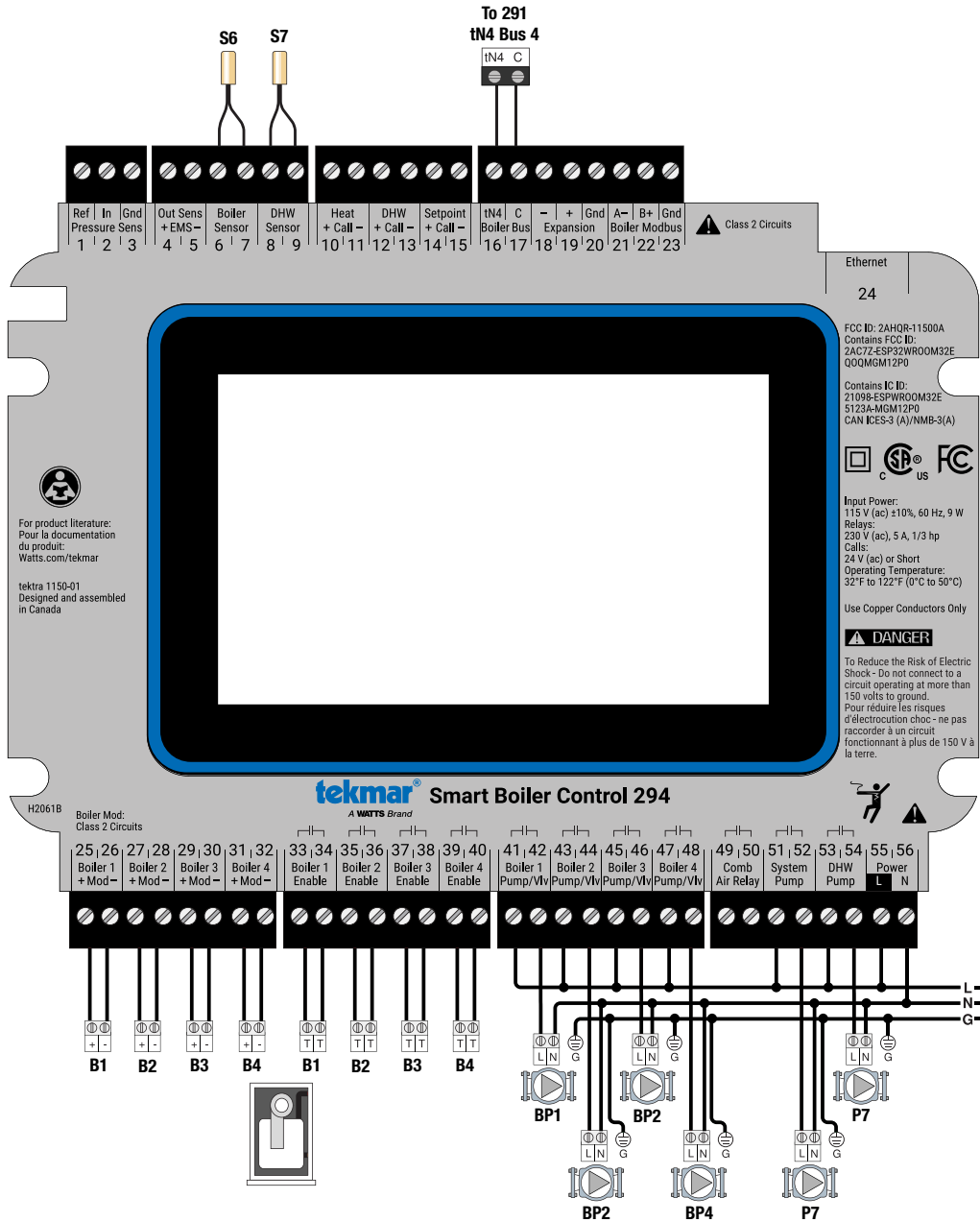
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## Essential Settings:

DHW = On

DHW Type = System

Indirect DHW System Pump = Off



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