



OPERATOR MANUAL

Central Heating Unit
Model 2100-DG-0400



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CORP.**
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1. Warranty Policies & Claim Procedures

DRYAIR MANUFACTURING CORP. (referred to within as DRYAIR) warrants its new, unused equipment to be free of defects in material and workmanship at the time of delivery to the original retail purchaser.

1. STANDARD WARRANTY

- a. DRYAIR will repair or replace, without charge, any defective part of the equipment for a period of twenty four (24) months from delivery to the first retail purchaser, F.O.B St.Brieux, SK., Canada.
- b. All replacement parts shipped out for Warranty purposes will be invoiced to the customer. The Warranty Claim procedure is the process for compensation.
- c. Any parts that are covered by an extended warranty published by DRYAIR are an exception to the STANDARD Warranty policy and are to be warrantied as per the details of the Extended Warranty Policy. *(Section #3 below)*.
- d. DRYAIR labor rate for Warranty Compensation is \$85.00/HR USA.
- e. DRYAIR reserves the right to cap the number of labor hours claimed based on the type of procedure being performed to correct the warranty issue. *(Schedule below in Section 4)*
- f. The Warranty Policy, terms and conditions, may change from time to time without prior notice.
- g. Warranty terms and conditions are transferable in the event of the sale to a second owner.
- h. Replacement parts will be warrantied for 90 days from the repair date. Bill of sale must accompany the warranty claim.
- i. The terms of this Warranty Policy are subject to provincial and state legislation. DRYAIR reserves the right to make modifications in accordance with provincial and state legislation without prior notice or obligation.

2. Exceptions to STANDARD WARRANTY POLICY

- a. Under no circumstance shall the owner be entitled to recover costs for incidental, special or consequential damages such as, but not limited to: loss of profit or revenue, other commercial losses, inconvenience and/or replacement equipment rental cost.
- b. Maintenance, repair or service items not related to warrantable defects.
- c. Loss or damage during shipping.
- d. Failure resulting from lack of or improper maintenance.
- e. Damage caused by operator abuse, negligence or improper operation.
- f. Damage resulting from improper voltage supply.
- g. Damage from improper installation. Installation done by other than the manufacturer.
- h. Non-defective items replaced at the request of the customer.
- i. Damage due to accidents.
- j. Damage resulting from improper fuel supply (i.e. pressure or contamination).
- k. Damage resulting from cracked or broken lines occurring during transport.

4. ELIGIBLE WARRANTY HOURS

- | | |
|--|--------------|
| a. Electrical Components (examples below) | 1 hour |
| i. Relays | |
| ii. Switches | |
| iii. Thermostats | |
| iv. Breakers | |
| v. Transformers | |
| vi. Temperature controls (ie:Aquastats) | |
| vii. Ignition Modules | |
| viii. Solenoids | |
| b. Electrical Motors & Gear Boxes (examples below) | 1 hour |
| i. Hose reel drives motors | |
| ii. Fan coil motors | |
| iii. Gear boxes – hosereels | |
| iv. Altivar drives | |
| c. Plumbing Components (examples below) | 1 hour |
| i. Flow reverser control | |
| ii. Flow switches | |
| iii. Valves (ball & thermostatic) | |
| iv. Various plumbing fittings | |
| v. Electric preheaters | |
| d. Pumps (examples below) | 2.5 hours i. |
| Various HP water pumps in our systems | |
| e. Burners (all Diesel, LP or NG burners) | 2 hours |
| f. Refractory Bricks (Model 2000-1200) | 8 hours |

5. OWNER'S OBLIGATIONS

- a. It is the responsibility of the owner, at the owner's expense, to transport the equipment to the service facility of an authorized DRYAIR distributor/dealer or alternately to reimburse the distributor/dealer, for any traveling expenses incurred in fulfilling this warranty.
- b. The terms of this Warranty Policy are subject to provincial and state legislation. DRYAIR reserves the right to make modifications in accordance with provincial and state legislation without prior notice or obligation.
- c. It is the responsibility of the owner to read, understand and implement the maintenance, safety and operational guidelines as laid out in the Operation and Maintenance Guide.



- d. All parts to be tagged with warranty claim number and shipped prepaid to DRYAIR within 30 days.

6. MANUFACTURER’S OBLIGATIONS

- a. DRYAIR reserves the right to continually improve the product’s parts or specifications at any time without notice or obligation.
- b. The terms of this Warranty Policy are subject to provincial and state legislation. DRYAIR reserves the right to make modifications in accordance with provincial and state legislation without prior notice or obligation.

7. NORTH AMERICAN WARRANTY DEPOTS

USA

DRYAIR Manufacturing Corp.
410 Douglas Road, Box 264
Bradner, OH 43406
Ph. 1 (888) 750-1700

Canada

DRYAIR Manufacturing Corp.
400 Service Road, Box 126
St. Brieux, SK S0K 3V0
Ph. 1 (888) 750-1700

All Warranty Claims, without exception, require a WARRANTY CLAIM AUTHORIZATION NO. Please call 1-888-750-1700 or email service@dryair.ca for number, DRYAIR Warranty Claim Form and Warranty Claim Procedures.

Completion and Submission of Warranty Claim

1. All Warranty Claims, without exception, require a WARRANTY CLAIM AUTHORIZATION NO. Please call 1-888-750-1700 or email service@dryair.ca for number, DRYAIR Warranty Claim Form and Warranty Claim Procedures.

2. All warranty credits must be processed with a DRYAIR Warranty Claim Form.

3. Each warranty claim should only refer to one Serial No. unit. Each Warranty Claim can have multiple items on the claim.

4. Mileage and travel time to/from the customer are not eligible for warranty credit.

5. Freight charges for warranty parts are not eligible for warranty credit.

6. When claiming for warranty labor the allowable warranty labor rate will be \$85.00/hour

7. All warranty parts, unless otherwise specified, are to be returned to one of our DRYAIR Warranty Depots. *(Details of exceptions described below)*

i. Parts **required to be returned** to factory must be tagged with warranty claim number.

ii. **Examples** of items that are required to be returned to factory are: Pumps, electric motors, gas or diesel burners, hose, any gas valves or controls.

iii. Examples of items that are **not required to be returned** to the factory *(in these instances, please provide a picture of the defective part with the warranty claim)*: Seals, mechanical switches, relays, refractory bricks, various plumbing fittings, ball valves, level switches, enclosure, fender or cabinet components, chimney components, fuel lines.

iv. If in doubt about whether a component is required to be returned, please email service@dryair.ca for direction.

2. Safety Concerns

General Safety Guidelines

- Make certain that the operator reads and understands all the information in this manual.
- All unauthorized people must be kept away from the equipment when in operation.
- All doors and covers must be in place when the equipment is in operation.
- Maintain instructional and safety decals. Replace damaged decals (Figure 2-1 & 2-2).

Water Heater Module

CAUTION! *The water heater is a heating appliance.*

- Observe all posted warnings and cautions when dealing with any heating appliance.
- Keep children and pets away from all piping and fuel accessories.
- While the system is operating the water heater housing panels must be kept closed - This prevents drafts from affecting water heater operation.

Heat Transfer Fluid

Follow the following precautions and measures when working with “heat transfer fluid” (“DOWFROST* HTF” & “BOSS CHILL PG”).

Fluid Handling Precautions

- Ventilation Good general ventilation should be sufficient for most conditions.
- Respiratory protection No respiratory protection should be needed.
- Skin protection For brief contact, no precautions other than clean, body-covering clothing should be needed.
..... Use impervious gloves when prolonged or frequently repeated contact should occur.
- Eye protection Use safety glasses.

First Aid Measures

- Eyes Flush eyes with plenty of water.
- Skin Wash off in flowing water or shower.
- Ingestion Induce vomiting if large amounts are ingested.
..... Consult medical personnel.
- Inhalation Remove to fresh air if effects occur.
..... Consult a physician.
- Note to Physician No specific antidote.

Supportive care.

Figure 2-2: Safety Decals



..... Treatment based on judgment of the physician in response to reactions of the patient.

For complete "heat transfer fluid" information, refer to the Material Safety Data Sheets for "Dowfrost HTF" & "Boss Chill PG" included with the manuals package.

Fuel System Safety

CAUTION! Propane and Natural Gas DRYAIR systems are designed to be connected and permitted by a licensed supplier or gas fitter only. Propane systems operate on Propane vapour only! Provide your local Propane supplier with BTUH input requirements to ensure an adequate volume of vaporized propane even in the coldest ambient conditions. Improper hook-up can lead to an extreme fire or explosive situation!

Diesel fuel must be supplied from an external fuel tank. A 2-line connection with a return line is needed. The water heater will not work properly if a return line is not installed.

3. Introduction

Water Heater Module

- A compact, portable and light weight design.
- Forklift pockets on all four sides allow for easy positioning on the work site.
- Automatic water heater temperature control and fuel usage which responds to work site demands.
- Low pressure atmospherically vented circulation system ... no special boiler certification is required to operate the system.
- Circulation system integral air vent to quickly eliminate air from the fluid circulation system for quick setup-and-go operation.
- A water heater module control center which monitors and controls system operations.
- A multi-light system operation feature for easy system troubleshooting.



Figure 3-1 2100-0400

Accessories

Extension Reservoir Assembly (Figure 3-2)

The Extended Reservoir Tank is required in scenarios when “portable heat exchangers” are higher than the top level of the central heating unit glycol reservoir tank. If the Extended Reservoir tank is not used, the following can occur:

- **Insufficient Fluid in the System**
Fluid can drain back to the heat transfer reservoir tank from the over-elevated fluid lines when the pump is shut off. The heat transfer reservoir tank will show adequate fluid, but when the pump is started, extra fluid will be required to recharge the over-elevated fluid lines and portable heat exchangers and the system will then have insufficient fluid in the reservoir.
- **Fluid Overflow**
If fluid is added to maintain proper fluid levels while the pump is running, overflow at the reservoir tank may occur when the pump is shut off. This would occur because of the drain back from the over-elevated fluid lines.



Figure 3-2
Extended Reservoir

Fluid Circulation Lines

Fluid circulation lines are designed to endure the toughest work site environment. Portable distribution manifolds connected to the primary circulation system redistribute the heat transfer fluid through secondary lines. All fluid circulation components come with isolation valves and quick couplers, ensuring quick set up and start up, and quick disassembly when the job is done. DRYAIR provides a full range of hoses, adapters, and manifolds for handling and distributing HTF.

Remote Manifold (Figure 3-3)

- Allows for distribution and/or separation between the central heating unit and the portable heat exchangers.



Figure 3-3 Remote Manifold

Insulated Line Jackets

- Insulated circulation line jackets are also available. These insulated jackets will prevent exposed circulation line heat loss in extreme subzero conditions.

Portable Heat Exchangers (Figure 3-4)

Portable heat exchangers are the ideal way to heat and/or dry enclosed structures. Their compact and mobile design allows them to be positioned where required on the job site. The efficient fan/coil design provides a high rate of heat transfer. High volume fans then deliver this heat evenly throughout a large area. The clean, low relative humidity heat delivery minimizes energy costs by eliminating the need to draw in fresh outside air. With the DRYAIR system, you just reheat warm internal air, rather than heating cold external air.



Figure 3-4 Portable Heat Exchangers

Circulation line heat exchangers

The circulation line heat exchangers are the perfect solution for:

- Heating and/or thawing cold or frozen ground.
- Frost prevention.
- Concrete curing and heating in subzero environments.

The DRYAIR system can be applied to all types of concrete applications. Circulation line heat exchangers can be secured directly against the surface of the concrete or concrete forms. Alternately, an expendable circulation line can be incorporated into the concrete structure during the pour. Thus the slab floor can continue being heated, to provide radiant floor heat during construction.

Mixing/Booster Pump (Figure 3-5)

The multifunctional mixing/booster ensures maximum flexibility in the use of this system.

- Tempering mode supplies lower temperature fluid for concrete cure and radiant floor heat applications eliminating the need to reduce the water heater operating temperatures below safe operating ranges.
- When operating in booster mode, the system can increase flow rates or function as a pumping station to increase pumping distances by over 300 feet per station.



Figure 3-5 Mixing/Booster Unit

- The system also allows for dual-temperature control. High temperature fluid can be provided to portable heat exchangers, along with a lower temperature fluid for concrete cure and radiant floor heat applications.
- The multifunctional mixing/booster ensures maximum flexibility in the use of this system.

Plate Heat Exchanger (Figure 3-6)

The plate heat exchanger module creates two separate fluid loops. It can extend the range of the HTF distribution and eliminate the need for extended reservoirs in elevated applications. The plate heat exchanger, combined with a central heating module can be used to:

- Extend the effective range and lengths of the primary distribution lines.
- Be used in a multi-story application to extend the vertical distance that a portable heat exchanger can be used from the heating module.



Figure 3-6 Plate Heat Exchanger Unit

How the System Works

(Figure 3-7)

The system uses a low-pressure, open fluid loop distribution system with an atmospherically vented fluid reservoir. A central heating module warms the heat transfer fluid. This heated fluid is pumped through a distribution system loop, passing through heat exchangers in remote locations.

Two types of exchangers are available:

- Fan/Coil portable heat exchangers include a heat transfer coil, fan and thermostatic temperature control.

The heat transfer fluid

flows through the transfer coil, where heat is transferred to the air being drawn through the coil by the fan. The coil is specially designed for optimum heat transfer, without adding any moisture or combustion by-products to the air.

- Passive heat exchangers such as Circulation line flexible hose, submersible stainless steel plates and insert type tank heaters use Camlock or hydraulic-style quick-couplers for ease in hookup. Heat transfer occurs by direct contact heat transfer and radiant heat conduction.

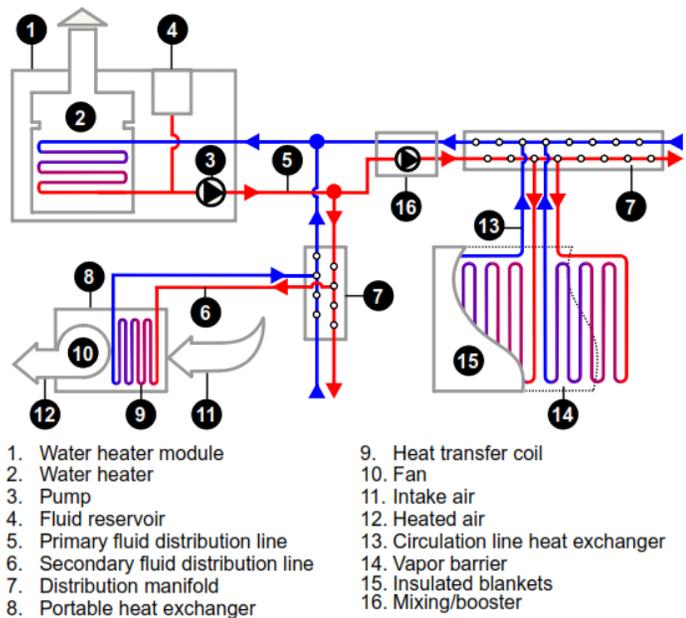


Figure 3-7 How the System Works

4. Setup

The positioning of all the system components on the site will be influenced by a number of factors. Please read all of the “Setup” section before beginning.

- Be sure to observe all local electrical codes, gas codes and fire regulations when setting up the DRYAIR system.
- The cabinet must be leveled and not set on any type of combustible material.
- Consider cabinet positioning in relation to gas supply, power supply and portable heat exchanger positioning.

Required Safety Clearances

The central heating unit is a heating appliance, therefore safe heat and exhaust clearances must be observed from combustible materials and for service access. See Figure 4-1 and Figure 4-2 for graphical representation of clearances.

- Maintain 24" (61 cm) of clearance on all sides of the unit.
- Maintain 36" (91 cm) of clearance on all sides of the flue pipe and chimney cap.

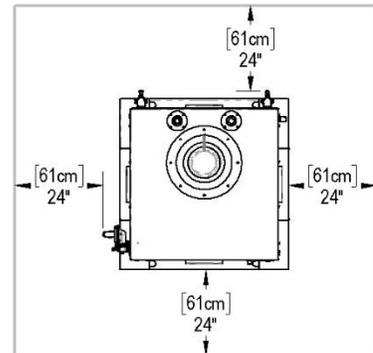


Figure 4-1 Top View Clearances

Elevation Concerns

Do not place any "portable heat exchangers" or "circulation line heat exchangers" higher than the top of the integral heat transfer fluid tank without using a reservoir extension kit. If this is not observed, the following can occur:

- **Insufficient Fluid in the System**
Fluid can drain back to the heat transfer reservoir tank from the over-elevated fluid lines when the pump is shut off. The heat transfer reservoir tank will show adequate fluid, but when the pump is started, extra fluid will be required to recharge the over-elevated fluid lines and portable heat exchangers and the system will then have insufficient fluid in the reservoir.
- **Fluid Overflow**
If fluid is added to maintain proper fluid levels while the pump is running, overflow at the reservoir tank may occur when the pump is shut off. This would occur because of the drain back from the over-elevated fluid lines.

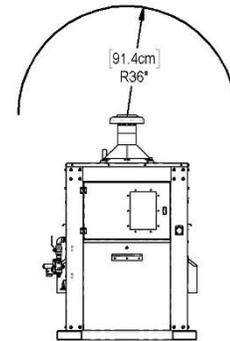


Figure 4-2 Side View Clearances

Electrical Requirements & Connection

When determining the "Central Heating Unit" location on site, consider setting up within close proximity to the electrical power supply.

- The central heating unit's main feed wiring must be adequately sized to carry the minimum ampacity shown on the water heater cabinet's rating label. All electrical connections, connectors and wire must be CSA/UL compliant and installed according to local laws and codes.
- Before making any electrical connections, be sure that the power supply is "Off".
- The 2100-0400 must be run on 120VAC.
- The 120VAC power is input through a standard NEMA 5-15 plug (Figure 4-3).
- Plug cord (not supplied) into 2100-0400 Electrical Connection (Figure 4-4):

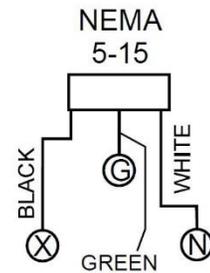


Figure 4-3 NEMA 5-15 Wiring



Figure 4-4 Power Connection

Heat Transfer Fluid Circuit

- If possible, position the primary circulation lines out of high traffic areas.
- Connect the primary circulation lines to the "supply" and "return" Camlock couplers (Figure 4-5) on the unit. Isolation valves and Camlock couplers are attached at both ends of the primary circulation lines to enable quick coupling. This also allows the isolation of the primary lines while retaining the heat transfer fluid (HTF) in the lines. Plus ... setup and dismantling of the circulation system is much quicker.
- Connect primary circulation lines direct to heat exchangers or to distribution manifold if required.
- Connect secondary circulation lines to heat exchangers as required.
- Purge air from the fluid circuit (see "5. Operation – Purging air from the "HTF" circulation system).



Figure 4-5 Supply & Return Isolation Valves

Heat Transfer Fluid (HTF)

CAUTION! At no time should you use automobile antifreeze in your DRYAIR system. The use of automobile antifreeze WILL VOID YOUR DRYAIR WARRANTY.

The HTF level (cold fluid) should show no more than ½ on the gauge (Figure 5-1) at startup. As the HTF warms to the operating temperature, fluid expansion will raise the level on the gauge (depending on the total volume of fluid in the circulation system including number, size and length of hoses, number and type of heat exchangers, etc.).

HTF Specifications

- DRYAIR pre-mixed “HTF” fluid is made up of 50% “Dowfrost ® HTF” or “Boss Chill PG” and 50% water, by weight - freeze protection down to -28°F (-33°C).
- The “glycol/water mixture chart” (Table 4-1) will provide you with more information on the proper mixture for your area.
- Soft water with a neutral pH level (#7) must be used.

Table 4-1 Glycol Mixing Guide

Percent Propylene Glycol		Freezing Point	
By Mass	By Volume	°F	°C
0.0	0.0	32.0	0.0
10.0	9.6	26.1	-3.2
20.0	19.4	17.9	-7.8
30.0	29.4	6.7	-14.0
40.0	39.6	-8.1	-22.3
50.0	49.9	-28.9	-33.8
60.0	60.0	-54.9	-48.3

CAUTION! Whenever coupling or uncoupling the Camlock couplers, make sure that the isolation valves (Figure 4-5) are closed and the pump is turned off. Failure to do so may put you at risk of injury from eye or skin exposure to hot glycol.

Insulating Hoses

Whenever hoses are placed outside (either from the unit to the interior of a building, performing ground thaw, concrete curing, or any other operation) the hoses should be insulated to protect against any form of heat loss. It will make your operation run more efficient as you are not losing heat unnecessarily.

- When thawing ground or curing concrete, it is best to place insulated blankets over of the hose to keep the heat directed towards the ground or concrete.
- When running lines to a building from outside, insulation should be wrapped around the supply and return hoses to prevent heat loss to the outside atmosphere.



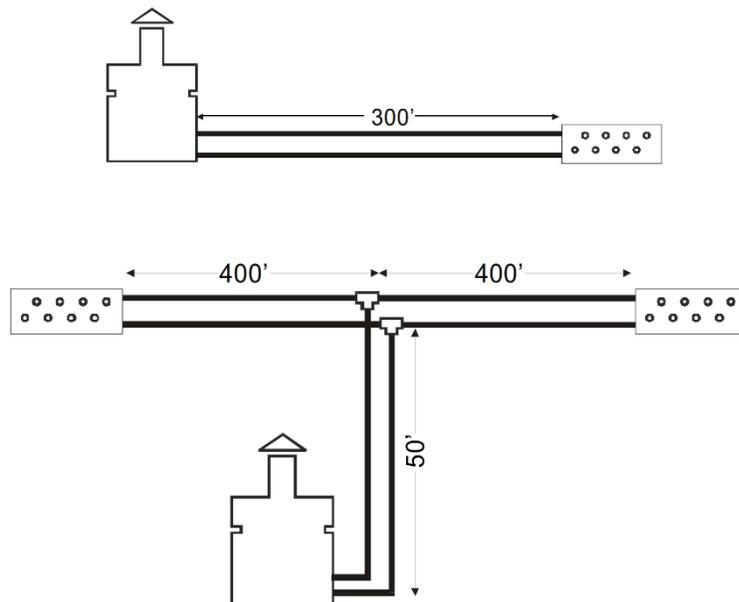
Hanging Hoses

Hoses may need to be hung from time to time to keep them off of the floor for different purposes. When hanging hoses be sure to never kink hoses as fluid will not be able to pass through them as easily as it should. Hanging hoses should be done with a solid support, and no sharp edges. This will be the best way to keep your hoses flowing correctly, as well keeping them in good condition. Try to hang hoses in a way which creates the least amount of pulling stress on the hose connections.

Recommended Maximum Hose Lengths

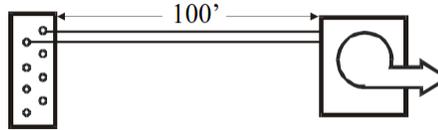
"Central Heating Unit" to "Manifold"

- One way – 300 feet (Figure 3-1)
- Two way – 400 feet each way (Figure 3-2).



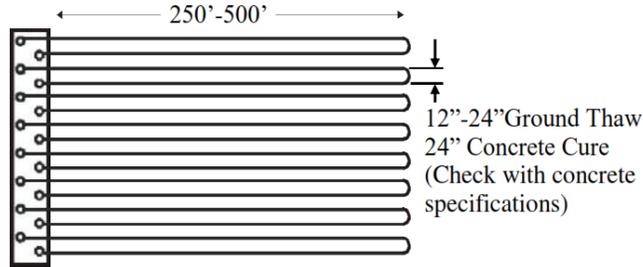
“Manifold” to “Portable Heat Exchanger”

- 100 feet (Figure 3-3).



Ground Thaw Loops

- 500 foot loops
- Max up to 1000 feet by using two hoses together (Figure 3-4).



Formulas & General Information

Hose length required for ground thaw or concrete curing.

$$L_H = \frac{SF}{H_{SP}}$$

Where:

L_H = Hose Length required to cover area.

SF = Area of ground to be thawed or concrete to cure.

H_{SP} = Hose spacing in feet;

- 1.5' Ground Thawing @ 84 BTU/ft typically
- 2' Curing Concrete @ 50 BTU/ft typically

Example:

An area of 7500ft² to be thawed.

$$L_H = \frac{7500ft^2}{1.5ft}$$

$$5000ft = \frac{7500ft^2}{1.5ft}$$

What size of GTS would be required?



$$\text{Machine} = L_h \times 84 \frac{\text{BTU}}{\text{ft}}$$

$$\text{Machine} = 5000 \text{ft} \times 84 \frac{\text{BTU}}{\text{ft}}$$

$$420,000 \text{BTU} = 5000 \text{ft} \times 84 \frac{\text{BTU}}{\text{ft}}$$

This indicates that a GTS600 would do the job. However extra hoses may be required.

Glycol weight calculation;

$$W_G = SG \times 1 \frac{\text{Kg}}{\text{liter}}$$

$$W_G = SG \times 8.345 \frac{\text{lbs}}{\text{USGallon}}$$

Where: W_G = Weight of Glycol
SG = Specific Gravity of Glycol
(From the MSDS of the Glycol product)

Fuel

NOTE: 2100-0400 V2 CHU can be equipped with either a Natural Gas, Propane Gas, or Diesel burner. If burner type is unknown, verify burner type by removing burner assembly and checking nozzle number (4-6). Natural Gas burners will have a "2.2" nozzle. Propane burners will have a "1.5" nozzle. Diesel burners will have 2x fuel connection couplers.



Figure 4-6 Burner nozzle number

Gas Connection and Start-up for Natural Gas Burner

NOTE: This sequence must be performed by "Qualified Personnel" only. All permit processes and codes must be followed as administered by the local authority having jurisdiction. Provide your local Natural Gas Utility Company with BTUH input and pressure requirements, to insure an adequate volume of gas at the required pressure.



Figure 4-7 Gas supply valve

- If the water heater was previously equipped for propane, it may have a secondary regulator (Figure 4-13) installed on the manual gas supply valve, outside of the cabinet as indicated, which **must be removed**. Close the manual gas supply valve (Figure 4-7).
- Natural gas supply should be connected to the manual gas supply valve (Figure 4-7) at a pressure of 6 – 7" W.C. Use only CGA/AGA approved thread sealant when making gas piping connections. Turn on the gas at the supply meter, and soap test all piping joints to ensure no leaks are present. Bleed air from the supply line as far as the manual gas supply valve (Figure 4-7). Allow 5 minutes for purged gas to dissipate from the area.
- Open internal gas valve (Figure 4-8).
- CSD-1 code gas trains have a low-gas pressure switch (Figure 4-9). Verify switch is set 3.0" W.C.
- Connect the electrical supply to the burner by coupling the 4 blade Molex connector (Figure 4-17) with the hanging 4 blade Molex connector. Connect the gas train to the burner by coupling the 6 blade Molex connector to the 6 blade Molex connector on the gas train. Note that the 6 blade Molex connector is only present on Natural Gas and Propane burners, and isn't present on Diesel burners.



Figure 4-8 Internal gas valve



Figure 4-9 Low gas pressure switch reset

- Open the manual gas supply valve (Figure 4-7) and internal gas valve (Figure 4-8), adjust the metered gas supply pressure until a static reading of 6 - 7" W.C. is achieved at the gas supply pressure gauge (Figure 4-10).
- Open Supply & Return isolation valves (Figure 4-5). Connect power supply to the water heater and establish flow of heat-transfer-fluid by turning on the pump toggle switch (Figure 5-2), located on the control panel.
- Reset low-gas pressure switch (Figure 4-9) by pressing the reset button on the top of the switch. Initiate ignition by turning on the water heater toggle switch (Figure 5-2) located on the control panel. The burner will go through a pre-purge cycle (approximately 30 seconds) before trying for ignition. Due to air in the gas train, you may have to re-initiate the ignition cycle multiple times, by pressing and holding the burner reset button (Figure 4-14) for at least 10 seconds. Once all air is eliminated, the burner should light and remain running.
- Soap test all gas line connections to be certain there are no leaks present.
- Set the supply gas pressure (Figure 4-10) to 7" W.C., while the burner is firing. Adjust the manifold gas pressure (Figure 4-11) if necessary to achieve a reading of 3.5" W.C. by adjusting the main gas valve pressure regulator (Figure 4-12).



Figure 4-10 Gas supply pressure gauge



Figure 4-11 Gas manifold pressure gauge



Figure 4-12 Main gas valve

Gas Connection and Start-up for Propane Burner:

NOTE: The following steps must be performed by "Qualified Personnel" only. All permit processes and codes must be followed as administered by the local authority having jurisdiction. Provide your local propane supplier with BTUH input requirements to ensure an adequate volume of vaporized propane even in the coldest ambient conditions.

- If the water heater was already equipped for propane, it should have a secondary regulator (Figure 4-13) installed on the outside of the cabinet as indicated. If the propane burner was purchased as an alternate, the secondary regulator (Figure 4-13) will be shipped loose with the burner and **must be installed**. Use only CGA/AGA approved thread sealant when making gas piping connections. The manual gas supply valve (Figure 4-7) should be closed.
- A supply of "**Propane Vapor**" should be connected to the inlet of the secondary regulator (Figure 4-13) at a pressure of 10-12 PSI.



Figure 4-13 Secondary Regulator

Turn on the gas at the supply tank, and soap test all piping joints to ensure no leaks are present. Bleed air from the supply line as far as the secondary regulator (Figure 4-13). Allow 5 minutes for purged gas to dissipate from the area.

- Open manual gas supply valve (Figure 4-7).
- CSD-1 code gas trains have a low-gas pressure switch (Figure 4-9). Verify switch is set 3.0" W.C.
- Connect the electrical supply to the burner by coupling the 4 blade Molex connector (Figure 4-17) with the hanging 4 blade Molex connector. Connect the gas train to the burner by coupling the 6 blade Molex connector to the 6 blade Molex connector on the gas train. Note that the 6 blade Molex connector is only present on Natural Gas and Propane burners, and isn't present on Diesel burners.
- Open the internal gas valve (Figure 4-8) and adjust the secondary regulator (Figure 4-13) until a static reading of 6-7" W.C. is achieved at the gas supply pressure gauge (Figure 4-10).
- Open Supply & Return isolation valves (Figure 4-5). Connect power supply to the water heater and establish flow of heat-transfer-fluid by turning on the pump toggle switch (Figure 5-2), located on the control panel.
- Reset low-gas pressure switch (Figure 4-9) by pressing reset button on the top of the switch. Initiate ignition by turning on the water heater toggle switch (Figure 5-2) located on the control panel. The burner will go through a pre-purge cycle (approximately 30 seconds) before trying for ignition. Due to air in the gas train, you may have to re-initiate the ignition cycle multiple times, by pressing and holding the burner reset button (Figure 4-14) for at least 10 seconds. Once all air is eliminated, the burner should light and remain running.
- Soap test all gas line connections to be certain there are no leaks present.
- Set the supply gas pressure (Figure 4-10) to 7" W.C., while the burner is firing. Adjust the manifold gas pressure (Figure 4-11) if necessary by adjusting the main gas valve pressure regulator (Figure 4-12) to achieve a reading of 5.0" W.C.



Figure 4-14 Burner reset button

Purging Air from the Gas System

If the burner does not fire, the burner control will “lock out”. If the burner is in “lock out” the burner reset button (Figure 4-14) will be illuminated red. The fuel system may have to be purged of air.

- Confirm that there is an adequate fuel supply.
- Confirm that the pump switch (Figure 5-2) is in the "On"(up) position.
- Confirm that the water heater switch (Figure 5-2) in the "On" (up) position.
- Depress the reset button (Figure 4-14) on the burner. This will reset the burner and activate the firing sequence.

Fuel Connection and Start-up for Diesel/Light Oil Burner:

- Insert the burner into the mounting bracket (Figure 4-15b).
- Install 2 bolts (Figure 4-15a) at top of burner tube bracket.
- Connect the oil supply hose (Figure 4-16a) and oil return hose (Figure 4-16b) by coupling them to the quick connections on the side of the burner. Ensure hoses are attached to the correct connectors.
- Couple the Supply and Return connectors on the outside of the water heater cabinet to a customer supplied external fuel source. Note that the Return line must be installed for the unit to work properly.
- Connect the electrical supply to the burner by coupling the 4 blade Molex connector (Figure 4-17) with the hanging 4 blade Molex connector. Note that the 6 blade Molex connector is only present on Natural Gas and Propane burners, and isn't present on Diesel burners.
- Energize the burner by turning on the burner switch. The burner reset button (Figure 4-14) may need to be pressed several times to ensure the burner is primed.

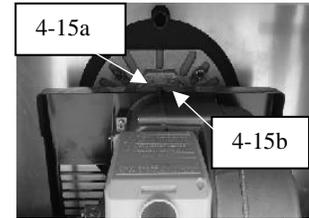


Figure 4-15 Burner attachment

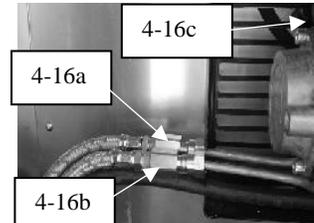


Figure 4-16 Burner Diesel Connection

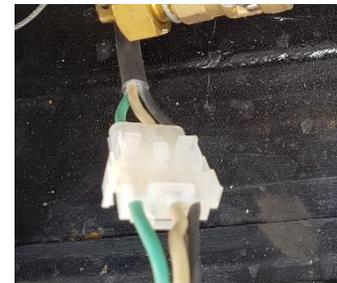


Figure 4-17 Burner Power Connection



Figure 4-18 External Diesel Connection

FOR ADDITIONAL ASSISTANCE, CALL 1(888) 750 1700

5. Operation

Purging Air from the "HTF" Circulation System

- Verify that the heat transfer fluid level is $\frac{1}{4}$ to $\frac{1}{2}$ on the level gauge. (Figure 5-1).
- Complete the connection for at least one "portable heat exchanger" or heat exchanger loop" and open isolation valves (Figure 4-5). This will complete the circulation loop and allow circulation.
- Toggle the pump switch (Figure 5-2) to the "On"(up) position and run the pump. This will release the air from the system.
- Air is vented directly through the integral expansion/reservoir tank.
- Monitor the "heat transfer fluid level gauge" and make sure that the heat transfer fluid level stays $\frac{1}{4}$ to $\frac{1}{2}$ range throughout this entire process.

Note that there may be a certain amount of air in the system. "HTF" levels may change as air is displaced from the system. Add "HTF" fluid to maintain level $\frac{1}{4}$ to $\frac{1}{2}$ range when the fluid is cold. When the air is eliminated, the "System Pressure" gauge (Figure 5-3) will hold at a steady reading of between 10 to 40 PSI.

Before operating the water heater:

- Verify that the power supply is correct and that the electrical hook up is as specified in "Setup".
- Verify that the water heater is being supplied with the correct fuel type as indicated on the Burner data plate.
- Verify that the heat transfer fluid level gauge shows $\frac{1}{4}$ to $\frac{1}{2}$ range.
- Verify the manual gas supply valve is open (handle in line with flow) (Figure 4-7).
- Verify the internal gas valve is open (handle in line with flow) (Figure 4-8).



Figure 5-1 HTF Level Gauge



Figure 5-2 Control Panel Switches



Figure 5-3 System Pressure Gauge

6. Start Procedure

Initiate Firing

- Verify that the Pump Switch (Figure 5-2) is in the "On" (up) position.
- Toggle the Water heater switch (Figure 5-2) to the "On" (up) position.
- The burner will proceed through its firing sequence.
- Once the burner is operating smoothly and the system pressure is steady (air has been eliminated from the system), monitor the "supply temperature". Supply temperature should be rising.
- Verify that only one "circulation line heat exchanger loop" or one "portable heat exchanger" is connected to the primary lines or through the distribution manifold.
- Monitor the "Return Temperature" gauge.
- Before fully connecting more "circulation line heat exchanger loops" or "portable heat exchangers", this gauge must show a noticeable rise in temperature indicating the heat transfer fluid has made a full circuit. With "circulation line heat exchanger loops", this may take 20 minutes or more.

Repeat the previous step until all "portable heat exchangers "or" heat exchanger loops" are connected and circulating.



Figure 6-1 Control Panel Gauges

Extreme cold Start Procedure

Note: In extreme cold 0° F (-18° C), the HTF becomes very viscous (resistant to flow) and can cause overloading of the pump causing circuit breakers to trip. In extreme cold conditions, closing the pump isolation valve (Figure 6-2) on the supply side of the pump reduces the pump load allowing the pump to start without overloading the electrical circuit. Once the pump is running, pump isolation valve (Figure 6-2) can be gradually opened to the full open position allowing normal operation.



Figure 6-2 Pump Isolation Valve

This procedure will not harm the pump. In extreme cold, pump seal leakage is normal and will subside once HTF temperature rises.

Shut down procedure

- Toggle burner switch (Figure 5-2) to the “off” position.
- Toggle pump switch (Figure 5-2) to the “off” position.
- Close the internal gas valve (Figure 6-3).
- Close manual gas supply valve (Figure 6-4).
- Disconnect power from unit.

**Note: Always keep the manual gas supply valve and internal gas valve shut off if the burner is shut down for an extended period of time.*

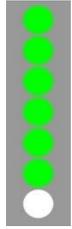


Figure 6-3 Internal gas valve (closed)



Figure 6-4 Manual gas valve (closed).

7. Troubleshooting



- There are 6 green lights on the control panel, which indicate the status of a sequence of functions while the unit is running.
- When the burner is on, all green lights should be on. With the burner on, any of the six green lights which is not on should be considered burned out.
- Aqua-stat and burner light go off and on as the burner cycles.
- Pump and Burner switches in the ON position for troubleshooting.
- The terminal strips, located behind the control panel, must be accessed to initiate troubleshooting procedures.
- Use electrical schematic decal assist in locating components.



No power

Check for 120 VAC power between letter N and H on the terminal strip. If there is no power, check the following:

- Check that the water heater circuit breaker has been reset (pushed in).
- Check for power in and out of the circuit breaker.
- Check that correct power supply has been connected to the unit. Investigate power source and be certain that the power characteristics are correct. (120 VAC, 15 A, single phase, 3-conductor, 0'-100' - 12 AWG, over 100' - 10 AWG)



No power at Terminal#6 (low water cut-off)

Check for 120 VAC power between letter N and #6 on the terminal strips. If there is no power, check the following:

- Low water situation. Check fluid level in tank and add if necessary.
- 24 VAC power. Check that the 24V circuit breaker has been reset (pushed in). Check for 24 VAC power between #1 and #3 on the terminal strip. Replace transformer if 24 VAC is not present.
- Ensure pump is running. If not, turn burner switch off and recheck for pump operation. If pump is running with burner switch off but stops running when burner is switched on, the lower float switch in glycol tank or circuit is faulty.
- If pump is running with burner switched on, check for 120 VAC power on right-hand C and N/O contacts of relay #1. If power is present on only 1 contact, replace relay #1 (120V). If power is present on both contacts, check for 120 VAC power on right-hand C and N/O contacts on relay #3. If power is present on only 1 contact, replace relay #3 (24V).
- If pump is not running with burner switch off, check for 120 VAC power on both terminals of the pump switch. If power is present on only 1 terminal, replace the switch. If power is present on both terminals, check for 120 VAC power on left-hand C and N/O contacts of relay #1. If power is present on only 1 contact, replace relay #1 (120V). If power is present on both contacts, check for 120 VAC power on left-hand C and N/O of relay #3. If power is present on only 1 contact, replace relay #3 (24V). If power is present on both contacts, replace pump.



No power at terminal #7 (flow switch)

Check for 120 VAC power between letter N and #7 on the terminal strips. If there is no power, check the following:

a) Pump not running. Check for 120 VAC power on both terminals of the pump switch. If power is present on only 1 terminal, replace the switch. If power is present on both terminals, check for 120 VAC power on left-hand C and N/O contacts of relay #1. If power is present on only 1 contact, replace relay #1 (120V.) If power is present on both contacts, check for 120 VAC power on left-hand C and N/O of relay #3. If power is present on only 1 contact, replace relay #3 (24V). If power is present on both contacts, replace pump.

b) Inadequate flow.

- Check that at least 1 heat exchanger or hose loop is connected allowing flow.
- Check that all valves are open in the fluid-circulation loop.
- Check that hose quick couplers are fully seated and allowing flow.
- Check that pressure bypass valve is open, if fluid-receiving units are closed off.
- Air present in the circulation system. Air in the system can cause cavitation in the pump and pressure loss. Refer to "Operation, Purging air from the system" for air purging instructions.
- Supply temperature overrun causing vaporization (steam) & pump pressure to be lost. Cavitation will occur in the "water heater heat exchanger" causing a noticeable bubbling, popping sound. Check the "overflow outlet" to confirm presence of fluid vapor. If vaporization is occurring, the "Aqua-stat" setting is set too high. Reset the "Aqua-stat" to a lower temperature (10°F increments) and allow cool-down. When the "heat transfer fluid" cools down, the system will regain pump pressure. Allow the burner to cycle back on and observe to ensure that the vaporization situation does not reoccur. If it does reoccur, reset the "Aqua-stat" to a lower temperature until the problem is rectified.

Note: This situation will occur most often in a "low flow and/or low heat requirement" situation.

c) Defective flow switch. If a) and b) check out, the flow switch will need to be recalibrated or replaced.

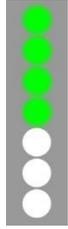


No power at terminal #8 (High Limit).

Check for 120 VAC power between letter N and #8 on the terminal strip. If there is no power, check the following:

a) Check control settings. The automatic reset high limit should be set 10°F higher than the set point of the aqua-stat.

b) With control setting 10°F above aqua-stat setting and above current supply temperature, check for 120 VAC power on both terminals of high limit control. If power is present on only 1 terminal, replace high limit control.



No power at terminal #9 (Aqua-stat and Burner)

Check for 120 VAC power between letter N and #9 on the terminal strip. If there is no power, check the following:

- a) Check that aqua-stat set point is above current supply temperature.
- b) Check aqua-stat sensor and verify that it is positioned properly in its well.
- c) If a) and b) check out, replace both aqua-stat and well sensor.

FOR ADDITIONAL ASSISTANCE, CALL 1(888) 750 1700

8. Maintenance

The DRYAIR system is designed to be a low maintenance system. All system equipment is assembled using extensively tested and certified components. Following these maintenance procedures will ensure the maximum benefit and minimal downtime for the system. The daily maintenance schedule is designed to be a quick system check and ensures a low risk of operating interruptions. Additional supplemental information provided by component manufactures such as the Burner is included with each unit. Use the supplemental information for maintenance procedures and frequency as directed.

Daily Checklist

A daily inspection of the water heater cabinet should be performed with attention paid to the following:

Check for strong odor of gas

- If a leak or the odor of gas is noticed, immediately turn off all power switches and the main fuel supply to the water heater cabinet.
- Ventilate the water heater cabinet.
- Find and correct the leak before turning on any power or trying to relight the water heater.

Check heat transfer fluid "HTF" level every day

- Maintain HTF level at $\frac{1}{2}$ or more when the fluid is hot
- Top up as necessary
- For "HTF" specifications, see "Setup, Heat Transfer Fluid "HTF", Fluid Specifications.
- For "HTF" handling precautions, refer to the "Safety Concerns, Material Safety Data Sheet".
- If loss of fluid is excessive, check for leaks at all fittings and connections in the water heater cabinet as well as the fluid circulation system.

Check the supply temperature gauge

- Verify that the supply temperature gauge is within 10°F of the Aqua-stat setting.

Seasonal checklist

Hoses

- Periodically check all hoses for damage due to aging, elevated temperatures, over-torqued hose clamps, abrasion and weathering.
- Replace damaged hoses as required.
- Seasonally check hose clamp torque and adjust accordingly.

Fuel (water block / particulate) Filter

- The water block/particulate filter should be changed every heating season or as required.

Water Heater Heat Exchanger

- Keep the flues in the water heater clean. Because soot is a non-conductor of heat, a dirty water heater requires more fuel to heat a structure than a clean one. Water heaters can corrode on the fireside. This results from corrosive substances in the fuel and can be difficult to control. Some fuel oils contain substances, which cause fireside corrosion. Sulphur, vanadium and sodium are among the materials that may contribute to this problem. The probability of trouble from this source depends to a large degree on the amount of Sulphur in the fuel and on the care used in cleaning the fireside heating surfaces. This is particularly true when preparing a boiler for a period of idleness. Preventing this problem also depends on keeping the boiler heating surfaces dry when a boiler is out of service.
- The person responsible for water heater maintenance should be certain that the fireside surfaces of the water heaters in his care are thoroughly cleaned at the end of the firing season. He should also observe the fireside surfaces during the firing season and if signs of corrosion are discovered, a reputable consultant should be contacted.
- The flue pipe and chimney cap should be taken off once a year and thoroughly cleaned of all soot.

Note: Check the gauge panel at regular intervals for any irregular gauge readings

Heat Transfer Fluid "HTF"

- A clean, properly maintained hot water system should not be drained unless: there is possibility of freezing, the water heater has accumulated a considerable amount of sludge or dirt on the water side, or draining is necessary to permit repairs. Very little sludge should accumulate in a water heater where little make-up water is added and where an appropriate water heater water treatment is maintained at proper strength.
- The Heat transfer fluid should be tested from year to year for freeze protection and should be strong enough for your area. The heat transfer fluid should be checked with a refractometer. Check the glycol/water mixture chart (see "Setup, Heat transfer fluid HTF) for mixing ratios.
- The pH level of the heat transfer fluid requires an annual check to see if the pH level is neutral. The pH level should be at #7. This should be checked with a pH instrument.

Note: See "Setup, Heat transfer fluid HTF, Heat transfer fluid specifications" for complete heat transfer fluid specifications

Burner

- For burner seasonal maintenance, see the "Service Manual".

Burner Removal

To remove an existing **Riello Model 40-G400 Gas Burner**, use the following sequence:

1. Make certain that the power supply to the central heat module is disconnected.
2. Make certain external and internal gas valves are closed (handle of valve 90 degrees to the gas line).
3. Mark wires for reconnection and disconnect the electrical connections (Figure 8-1) to the burner. Remove the retaining nut from the strain relief connection located in the back of the burner assembly.
3. Disconnect gas line at coupling (Figure 8-2).
4. Remove 4 bolts (Figure 8-3) from burner flange.
5. Pull burner toward you and away from the heat exchanger.

Burner Installation

To install a **Riello Model 40-G400 Gas Burner**:

1. Insert burner into the heat exchanger.
2. Install 4 bolts (Figure 8-3) through burner flange, gasket and heat exchanger.
3. Connect gas line at coupling (Figure 8-2).
4. Install strain relief connection into the burner chassis, located in the back of the burner assembly. Secure strain relief with retaining nut. Connect the electrical connections to the burner (Figure 8-1).
4. Open gas valves and soap test gas line connections.

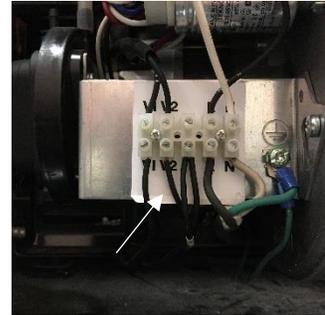


Figure 8-1 Burner Electrical Connections



Figure 8-2 Burner Gas Line Connection



Figure 8-3 Burner flange

9. Converting gas types

NOTE: This sequence must be performed by “Qualified Personnel” only. All permit processes and codes must be followed as administered by the local authority having jurisdiction.

To convert a **Riello Model 40-G400 Gas Burner:**

1. Remove retaining nut (Figure 9-1).
2. Pull burner straight back to clear electrodes, un plug ignitor wire (Figure 9-2) and swing burner out of the way (Figure 9-3).
3. Note where combustion head depth is set at for reinstallation. Remove hex bolt (Figure 9-4).
4. Remove combustion head (Figure 9-5).
5. Mark electrode positions (depth and rotation) for reinstallation (Figure 9-6).
6. Loosen electrode clamp screw and remove electrodes (Figure 9-7).
7. Remove nozzle from center of combustion head (Figure 9-8) and remove diffuser (Figure 9-9). Natural gas is marked “2.2”. Propane gas is marked “1.5”
8. Remove screws from distributor head (Figure 9-10) and remove distributor head (Figure 9-11).
9. Remove seal (Figure 9-12) and diaphragm (orifice) (Figure 9-13). Natural gas orifice is marked “C5”. Propane orifice is marked “C15”.
10. Install required orifice (Figure 9-13).
11. Install seal and distributor head (Figure 9-12 and 9-10).
12. Install diffuser (Figure 9-9) and required nozzle (Figure 9-8).
13. Install electrodes and position carefully (Figure 9-6). Verify proper alignment of electrodes (Figure 9-14).
14. Tighten electrode clamp.
15. Install combustion head into burner tube and position as noted in step 3 (Figure 9-4). (Factory setting is #4).
16. Swing burner carefully back into position ensuring electrodes are aligned.
17. Plug ignitor wire on to ignitor electrode (Figure 9-2).
18. Push burner forward into position and secure in place with retaining nut (Figure 9-1).
19. Remove burner cover and adjust air damper to initial setting of:
 - Natural gas 3.4
 - Propane gas 3.9
20. Install burner cover.
21. Switch gas line tag (Figure 9-15) to the appropriate gas type. Retain gas line tag and conversion parts removed for future conversions.
22. Install or remove secondary regulator assembly (Figure 9-16). Secondary regulator is required for Propane Gas but **must be removed** for Natural gas operation.
23. Fire burner and adjust manifold pressure to 3.5” W.C. for Natural Gas or 5” W.C. for Propane Gas.
24. Perform a combustion check. Adjust air damper as necessary to achieve 10% ± 0.5% CO² for Natural Gas or 12% +/- 0.5% CO² for Propane Gas. CO should be less than 50ppm (must not exceed 200ppm).



Figure 9-1 Burner Retaining Nut



Figure 9-2 Unplug Ignitor Wire

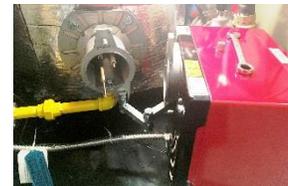


Figure 9-3 Burner Separation



Figure 9-4 Hex Bolt



Figure 9-5 Combustion Head Removal



Figure 9-6 Mark Electrode Positions



Figure 9-7 Electrodes Removed



Figure 9-8 Gas Nozzle



Figure 9-9 Diffuser Removed



Figure 9-10 Distributor Head Screws



Figure 9-11 Distributor Head Removed

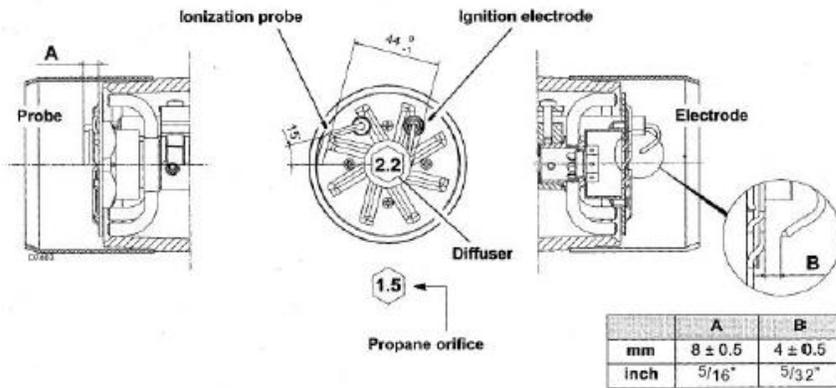


Figure 9-12 Diaphragm Seal



Figure 9-13 Diaphragm (Orifice)

ELECTRODE AND FLAME PROBE ADJUSTMENTS



WARNING:
Do not turn the ignition electrode. Leave it as shown in the drawing.
If the ignition electrode is put near the ionization probe, the amplifier of the control box may be damaged.

Figure 9-14 Electrode adjustment



Figure 9-15 Gas Line Tag



Figure 9-16 Secondary Regulator

10. Appendix

Electrical Schematic (Figure 10-1)

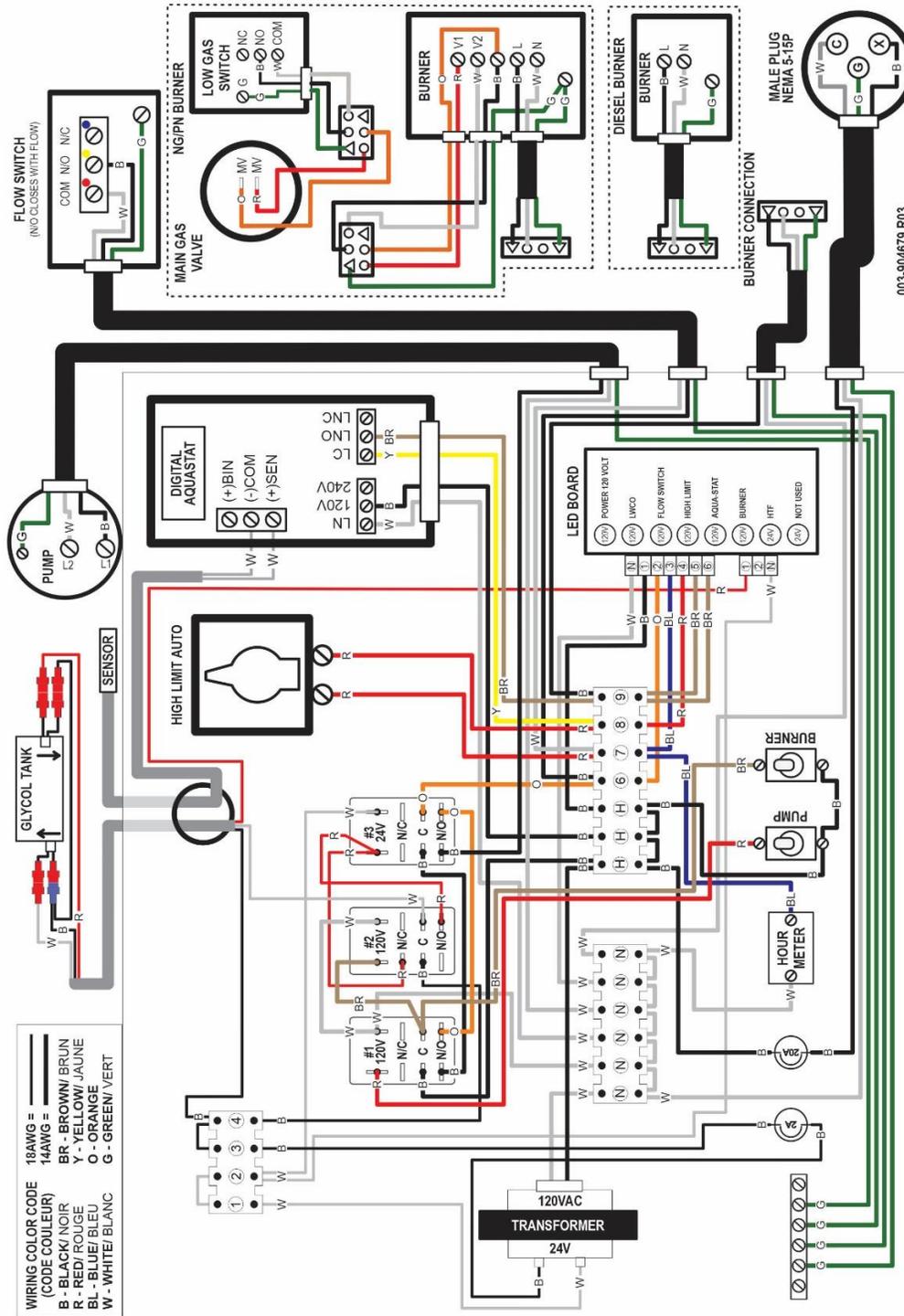


Figure 10-1: 2100-0400 Electrical Schematic



Material Safety Data Sheets

The Material Safety Data Sheets (MSDS) included with this manual have been provided by Dryair's suppliers.



SAFETY DATA SHEET

Issuing Date 03-Jun-2019

Revision date 03-Jun-2019

Revision Number 1

1. Identification

Product identifier

Product Name BOSS Chill Propylene Glycol

Other means of identification

Product Code(s) GHSRBS-041

UN/ID no. UN 3082

Synonyms None

Recommended use of the chemical and restrictions on use

Recommended use Heat transfer medium

Restrictions on use No information available

Details of the supplier of the safety data sheet

Initial supplier identifier

BOSS Lubricants

Manufacturer Address

6303 30 ST SE Calgary, AB T2C 1R4

Emergency telephone number

Initial supplier phone number (800) 844-9457
Emergency Telephone Chemtrec 1-800-424-9300

2. Hazard(s) identification

Classification

Not a hazardous substance or mixture according to the Globally Harmonized System (GHS) and Canada's Hazardous Products Regulations

Label elements

Hazard statements

Not a hazardous substance or mixture according to the Globally Harmonized System (GHS) and Canada's Hazardous Products Regulations.



Precautionary Statements - Disposal

Dispose of contents/container in accordance with local, regional, national, and international regulations as applicable

Other information**3. Composition/information on ingredients****Substance**

Chemical name	CAS No.	Weight-%	Hazardous Material Information Review Act registry number (HMIRA registry #)	Date HMIRA filed and date exemption granted (if applicable)
Water	7732-18-5	0.1 - 1	-	
Propylene glycol	57-55-6	80 - 100	-	
PROPRIETARY ADDITIVES	PROPRIETARY	1 - 5	-	

If CAS number is "proprietary", the specific chemical identity and percentage of composition has been withheld as a trade secret.

4. First-aid measures**Description of first aid measures**

Inhalation	Remove to fresh air. If not breathing, give artificial respiration. IF exposed or concerned: Get medical advice/attention.
Eye contact	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention if irritation develops and persists.
Skin contact	Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes. Get medical attention if symptoms occur.
Ingestion	Do NOT induce vomiting. Call a physician or poison control center immediately. If vomiting occurs spontaneously, keep head below hips to prevent aspiration. Never give anything by mouth to an unconscious person.

Most important symptoms and effects, both acute and delayed

Symptoms Prolonged contact may cause redness and irritation.

Indication of any immediate medical attention and special treatment needed

Note to physicians Treat symptomatically.

5. Fire-fighting measures

Suitable Extinguishing Media	Carbon dioxide (CO ₂). Foam. Dry chemical. Water spray or fog. Alcohol resistant foam.
Unsuitable extinguishing media	Do not scatter spilled material with high pressure water streams.
Specific hazards arising from the chemical	Use water spray to cool fire-exposed containers and structures. Isolate and restrict area access. Violent steam generation or eruption may occur upon application of direct water stream to hot liquids. Container may rupture from gas generation in a fire situation. Fight fire from a safe distance and from a protected location. Do not direct a solid stream of water or foam into hot, burning pools; this may cause frothing and increase fire intensity. Consider use of unmanned hose holder or monitor nozzles.
Explosion data	
Sensitivity to mechanical impact	None.
Sensitivity to static discharge	None.
Special protective equipment for fire-fighters	Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protection equipment.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

Personal precautions Use personal protective equipment as required. See section 8 for more information. Ensure adequate ventilation.

Methods and material for containment and cleaning up

Methods for containment Stop leak if you can do it without risk. Keep out of drains, sewers, ditches and waterways. Ventilate the area. Avoid breathing vapors or mists.

Methods for cleaning up Cover liquid spill with sand, earth or other noncombustible absorbent material. Prevent product from entering drains.

7. Handling and storage

Precautions for safe handling

Advice on safe handling Avoid breathing dust/fume/gas/mist/vapors/spray. Avoid contact with skin, eyes or clothing. Use only with adequate ventilation. Handle in accordance with good industrial hygiene and safety practice. Do not eat, drink or smoke when using this product. Do not ingest. If swallowed then seek immediate medical assistance. For industrial use only.

Conditions for safe storage, including any incompatibilities

Storage Conditions Keep container tightly closed in a dry and well-ventilated place. Keep away from heat, sparks, flame and other sources of ignition (i.e., pilot lights, electric motors and static electricity). Do not contaminate food or feed stuffs. Store only in containers resistant to alkaline solutions with a pH of 9.0 to 12.0.

8. Exposure controls/personal protection

Control parameters

Exposure Limits This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

Appropriate engineering controls

Engineering controls Ensure adequate ventilation, especially in confined areas.

Individual protection measures, such as personal protective equipment

Eye/face protection Wear safety glasses with side shields (or goggles). If splashes are likely to occur, wear safety glasses with side-shields. Avoid contact with eyes.

Hand protection Wear suitable gloves.

Skin and body protection Wear suitable protective clothing.

Respiratory protection No protective equipment is needed under normal use conditions. If exposure limits are exceeded or irritation is experienced, ventilation and evacuation may be required.

General hygiene considerations Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Information on basic physical and chemical properties

Physical state Liquid
Appearance No information available
Color purple
Odor Odorless
Odor threshold No information available

<u>Property</u>	<u>Values</u>	<u>Remarks • Method</u>
pH	9.0– 10.5	
Melting point / freezing point	No data available	None known
Boiling point / boiling range	188 °C / 317 °F	ASTM D7213
Flash point	116 °C / 240 °F	ASTM D93
Evaporation rate	No data available	None known
Flammability (solid, gas)	No data available	None known
Flammability Limit in Air		None known
Upper flammability or explosive limits	No data available	
Lower flammability or explosive limits	No data available	
Vapor pressure	No data available	None known
Vapor density	No data available	None known
Relative density	No data available	None known
Water solubility	completely soluble	
Solubility in other solvents	No data available	None known

Partition coefficient	No data available	None known
Autoignition temperature	No data available	None known
Decomposition temperature	No data available	None known
Kinematic viscosity	No data available	None known
Dynamic viscosity	No data available	None known

Other information

Explosive properties	No information available.
Oxidizing properties	No information available.
Softening point	No information available
Molecular weight	No information available
VOC Content (%)	No information available
Liquid Density	No information available
Bulk density	No information available

10. Stability and reactivity

Reactivity	No information available.
Chemical stability	Stable under normal conditions.
Possibility of hazardous reactions	None under normal processing.
Conditions to avoid	Heat, flames and sparks.
Incompatible materials	Strong oxidizing agents. Strong acids.
Hazardous decomposition products	Thermal decomposition can lead to release of irritating and toxic gases and vapors.

11. Toxicological information**Information on likely routes of exposure****Product Information**

Inhalation	No known effects under normal use conditions.
Eye contact	Irritating to eyes.
Skin contact	Avoid contact with skin and clothing.
Ingestion	Harmful if swallowed. Ingestion of larger amounts may cause defects to the central nervous system (e.g. dizziness, headache). Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea. May cause adverse kidney effects.

Symptoms related to the physical, chemical and toxicological characteristics

Symptoms	No information available.
----------	---------------------------

Acute toxicity

Numerical measures of toxicity
No information available

Unknown acute toxicity No information available
Product Information

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
Propylene glycol 57-55-6	= 20 g/kg (Rat)	= 20800 mg/kg (Rabbit)	Not available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation Based on available data, the classification criteria are not met.

Serious eye damage/eye irritation Based on available data, the classification criteria are not met.

Respiratory or skin sensitization Based on available data, the classification criteria are not met.

Germ cell mutagenicity Based on available data, the classification criteria are not met.

Carcinogenicity Based on available data, the classification criteria are not met.

Reproductive toxicity Based on available data, the classification criteria are not met.

STOT - single exposure Based on available data, the classification criteria are not met.

STOT - repeated exposure Based on available data, the classification criteria are not met.

Aspiration hazard No information available.

12. Ecological information

Ecotoxicity Harmful to aquatic life.

Persistence and degradability No information available.

Bioaccumulation No information available.

Other adverse effects No information available.

13. Disposal considerations

Waste treatment methods

Waste from residues/unused products Dispose of waste in accordance with environmental legislation.

Contaminated packaging Do not reuse empty containers.

14. Transport information

<u>Transport Canada</u>	Not regulated
<u>TDG</u>	Not regulated
<u>DOT</u>	Not regulated unless shipping container holds at least 5,000 pounds.
UN/ID no.	UN 3082
Hazard class	9
Packing group	III
<u>MEX</u>	Not regulated
<u>ICAO (air)</u>	no data available
<u>IATA</u>	no data available
<u>IMDG</u>	no data available
<u>RID</u>	no data available
<u>ADR</u>	no data available
<u>ADN</u>	no data available

15. Regulatory information

Safety, health and environmental regulations/legislation specific for the substance or mixture

International Regulations

The Montreal Protocol on Substances that Deplete the Ozone Layer Not applicable

The Stockholm Convention on Persistent Organic Pollutants Not applicable

The Rotterdam Convention Not applicable

International Inventories

TSCA	Complies.
DSL/NDSL	Complies.
EINECS/ELINCS	Contact supplier for inventory compliance status.
ENCS	Contact supplier for inventory compliance status.
IECSC	Contact supplier for inventory compliance status.
KECL	Contact supplier for inventory compliance status.
PICCS	Contact supplier for inventory compliance status.
AICS	Contact supplier for inventory compliance status.

Legend:

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory

DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances

ENCS - Japan Existing and New Chemical Substances

IECSC - China Inventory of Existing Chemical Substances

KECL - Korean Existing and Evaluated Chemical Substances

PICCS - Philippines Inventory of Chemicals and Chemical Substances

AICS - Australian Inventory of Chemical Substances

16. Other information

NFPA	Health hazards 2	Flammability 1	Instability 0	Physical and chemical properties -
HMIS	Health hazards 2	Flammability 1	Physical hazards 0	Personal protection X

Key or legend to abbreviations and acronyms used in the safety data sheet**Legend Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION**

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
Ceiling	Maximum limit value	*	Skin designation

Key literature references and sources for data used to compile the SDS

Agency for Toxic Substances and Disease Registry (ATSDR)
 U.S. Environmental Protection Agency ChemView Database
 European Food Safety Authority (EFSA)
 EPA (Environmental Protection Agency)
 Acute Exposure Guideline Level(s) (AEGl(s))
 U.S. Environmental Protection Agency Federal Insecticide, Fungicide, and Rodenticide Act
 U.S. Environmental Protection Agency High Production Volume Chemicals
 Food Research Journal
 Hazardous Substance Database
 International Uniform Chemical Information Database (IUCLID)
 Japan GHS Classification
 Australia National Industrial Chemicals Notification and Assessment Scheme (NICNAS)
 NIOSH (National Institute for Occupational Safety and Health)
 National Library of Medicine's ChemID Plus (NLM CIP)
 National Library of Medicine's PubMed database (NLM PUBMED)
 National Toxicology Program (NTP)
 New Zealand's Chemical Classification and Information Database (CCID)
 Organization for Economic Co-operation and Development Environment, Health, and Safety Publications
 Organization for Economic Co-operation and Development High Production Volume Chemicals Program
 Organization for Economic Co-operation and Development Screening Information Data Set
 RTECS (Registry of Toxic Effects of Chemical Substances)
 World Health Organization

Issuing Date 03-Jun-2019

Revision date 04-Jun-2019

Revision Note No information available.

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

End of Safety Data Sheet

Data for Regulatory Rules

Region	Template name	Revision Note
Canada	HGHS	2.0

GHS Product Information

pH	9.0– 10.5
Physical state	Liquid
Flash point °C	116
Boiling point / boiling range °C	188

Component Information

Canada

GHS Classification

Not Hazardous

Not a hazardous substance or mixture according to the Globally Harmonized System (GHS) and Canada's Hazardous Products Regulations

Precautionary Statements - Disposal

Dispose of contents/container in accordance with local, regional, national, and international regulations as applicable



SAFETY DATA SHEET

DOW CHEMICAL CANADA ULC

Product name: DOWFROST™ Heat Transfer Fluid

Issue Date: 12/16/2019

Print Date: 12/17/2019

DOW CHEMICAL CANADA ULC encourages and expects you to read and understand the entire (M)SDS, as there is important information throughout the document. We expect you to follow the precautions identified in this document unless your use conditions would necessitate other appropriate methods or actions.

1. IDENTIFICATION

Product name: DOWFROST™ Heat Transfer Fluid

Recommended use of the chemical and restrictions on use

Identified uses: Intended as a heat transfer fluid for closed-loop systems. This product is acceptable for use where there is possibility of incidental food contact and as a product for use in the immersion or spray freezing of wrapped meat and packaged poultry products. We recommend that you use this product in a manner consistent with the listed use. If your intended use is not consistent with the stated use, please contact your sales or technical service representative.

COMPANY IDENTIFICATION

DOW CHEMICAL CANADA ULC
#2400, 215 - 2ND STREET S.W.
CALGARY AB T2P 1M4
CANADA

Customer Information Number:

800-258-2436
SDSQuestion@dow.com

EMERGENCY TELEPHONE NUMBER

24-Hour Emergency Contact (transportation emergencies only): 1-800-424-9300

Local Emergency Contact (transportation emergencies only): 1-800-424-9300

24-Hour Emergency Contact: 1-989-636-4400

2. HAZARDS IDENTIFICATION

Hazard classification

This product is not hazardous under the criteria of the Hazardous Products Regulation (HPR) as implemented under the Workplace Hazardous Materials Information System (WHMIS 2015).

Other hazards

No data available

3. COMPOSITION/INFORMATION ON INGREDIENTS

This product is a mixture.

Component	CASRN	Concentration (w/w)
Propylene glycol	57-55-6	> 95.0 %
Inorganic corrosion inhibitor	not hazardous	< 3.0 %
Water	7732-18-5	< 3.0 %

4. FIRST AID MEASURES

Description of first aid measures

General advice:

If potential for exposure exists refer to Section 8 for specific personal protective equipment.

Inhalation: Move person to fresh air; if effects occur, consult a physician.

Skin contact: Wash off with plenty of water.

Eye contact: Flush eyes thoroughly with water for several minutes. Remove contact lenses after the initial 1-2 minutes and continue flushing for several additional minutes. If effects occur, consult a physician, preferably an ophthalmologist.

Ingestion: Rinse mouth with water. No emergency medical treatment necessary.

Most important symptoms and effects, both acute and delayed:

Aside from the information found under Description of first aid measures (above) and Indication of immediate medical attention and special treatment needed (below), any additional important symptoms and effects are described in Section 11: Toxicology Information.

Indication of any immediate medical attention and special treatment needed

Notes to physician: No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.

5. FIREFIGHTING MEASURES

Extinguishing media

Suitable extinguishing media: Water fog or fine spray.. Dry chemical fire extinguishers.. Carbon dioxide fire extinguishers.. Foam.. Alcohol resistant foams (ATC type) are preferred. General purpose synthetic foams (including AFFF) or protein foams may function, but will be less effective..

Unsuitable extinguishing media: Do not use direct water stream.. May spread fire..

Special hazards arising from the substance or mixture

Hazardous combustion products: During a fire, smoke may contain the original material in addition to combustion products of varying composition which may be toxic and/or irritating.. Combustion products may include and are not limited to:.. Carbon monoxide.. Carbon dioxide..

Unusual Fire and Explosion Hazards: Container may rupture from gas generation in a fire situation.. Violent steam generation or eruption may occur upon application of direct water stream to hot liquids..

Advice for firefighters

Fire Fighting Procedures: Keep people away. Isolate fire and deny unnecessary entry.. Use water spray to cool fire exposed containers and fire affected zone until fire is out and danger of reignition has passed.. Fight fire from protected location or safe distance. Consider the use of unmanned hose holders or monitor nozzles.. Immediately withdraw all personnel from the area in case of rising sound from venting safety device or discoloration of the container.. Burning liquids may be extinguished by dilution with water.. Do not use direct water stream. May spread fire.. Move container from fire area if this is possible without hazard.. Burning liquids may be moved by flushing with water to protect personnel and minimize property damage..

Special protective equipment for firefighters: Wear positive-pressure self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, trousers, boots, and gloves).. If protective equipment is not available or not used, fight fire from a protected location or safe distance..

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures: Use appropriate safety equipment. For additional information, refer to Section 8, Exposure Controls and Personal Protection.

Environmental precautions: Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. See Section 12, Ecological Information.

Methods and materials for containment and cleaning up: Small spills: Absorb with materials such as: Cat litter. Sawdust. Vermiculite. Zorb-all®. Collect in suitable and properly labeled containers. Large spills: Dike area to contain spill. Recover spilled material if possible. See Section 13, Disposal Considerations, for additional information.

7. HANDLING AND STORAGE

Precautions for safe handling: No special precautions required. Keep container closed. See Section 8, EXPOSURE CONTROLS AND PERSONAL PROTECTION. Spills of these organic materials on hot fibrous insulations may lead to lowering of the autoignition temperatures possibly resulting in spontaneous combustion.

Conditions for safe storage: Do not store in: Galvanized steel. Opened or unlabeled containers. Store in original unopened container. See Section 10 for more specific information. Additional storage

and handling information on this product may be obtained by calling your sales or customer service contact.

Storage stability

Shelf life: Use within 60 Month

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

If exposure limits exist, they are listed below. If no exposure limits are displayed, then no values are applicable.

Consult local authorities for recommended exposure limits.

Component	Regulation	Type of listing	Value
Propylene glycol	US WEEL	TWA	10 mg/m3
	CA ON OEL	TWAEV Total	155 mg/m3 50 ppm
	CA ON OEL	TWAEV	10 mg/m3
	Further information: C: For assessing the visibility in a work environment where 1,2-propylene glycol aerosol is present.		
	CA ON OEL	TWA	155 mg/m3 50 ppm
	CA ON OEL	TWA	10 mg/m3
	Further information: (c): For assessing the visibility in a work environment where 1,2-propylene glycol aerosol is present		
	CA ON OEL	TWA Vapour and aerosols	155 mg/m3 50 ppm
	CA ON OEL	TWA aerosol	10 mg/m3
	Further information: (c): For assessing the visibility in a work environment where 1,2-propylene glycol aerosol is present		

Exposure controls

Engineering controls: Use local exhaust ventilation, or other engineering controls to maintain airborne levels below exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, general ventilation should be sufficient for most operations. Local exhaust ventilation may be necessary for some operations.

Individual protection measures

Eye/face protection: Use safety glasses (with side shields).

Skin protection

Hand protection: Use gloves chemically resistant to this material when prolonged or frequently repeated contact could occur. Examples of preferred glove barrier materials include: Butyl rubber. Natural rubber ("latex"). Neoprene. Nitrile/butadiene rubber ("nitrile" or "NBR"). Polyethylene. Ethyl vinyl alcohol laminate ("EVAL"). Polyvinyl chloride ("PVC" or "vinyl"). Avoid gloves made of: Polyvinyl alcohol ("PVA"). NOTICE: The selection of a specific glove for a particular application and duration of use in a workplace should also take into account all relevant workplace factors such as, but not limited to: Other chemicals which may be handled, physical requirements (cut/puncture protection, dexterity, thermal protection), potential body reactions to glove materials, as well as the instructions/specifications provided by the glove supplier.

Other protection: Wear clean, body-covering clothing.

Respiratory protection: Respiratory protection should be worn when there is a potential to exceed the exposure limit requirements or guidelines. If there are no applicable exposure limit

requirements or guidelines, wear respiratory protection when adverse effects, such as respiratory irritation or discomfort have been experienced, or where indicated by your risk assessment process. In misty atmospheres, use an approved particulate respirator. The following should be effective types of air-purifying respirators: Organic vapor cartridge with a particulate pre-filter.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Physical state	Liquid.
Color	Colorless
Odor	Characteristic
Odor Threshold	No test data available
pH	10.0 50% <i>Literature</i>
Melting point/range	Not applicable to liquids
Freezing point	supercools
Boiling point (760 mmHg)	152 °C <i>Literature</i>
Flash point	closed cup 104 °C <i>Pensky-Martens Closed Cup ASTM D 93</i> (based on major component), Propylene glycol. open cup <i>Cleveland Open Cup ASTM D92</i> None
Evaporation Rate (Butyl Acetate = 1)	<0.5 <i>Estimated.</i>
Flammability (solid, gas)	Not applicable to liquids
Flammability (liquids)	Not expected to be a static-accumulating flammable liquid.
Lower explosion limit	2.6 % vol <i>Literature</i> Propylene glycol.
Upper explosion limit	12.5 % vol <i>Literature</i> Propylene glycol.
Vapor Pressure	2.2 mmHg <i>Literature</i>
Relative Vapor Density (air = 1)	>1.0 <i>Literature</i>
Relative Density (water = 1)	1.05 at 20 °C / 20 °C <i>Literature</i>
Water solubility	<i>Literature</i> completely soluble
Partition coefficient: n-octanol/water	No data available
Auto-ignition temperature	371 °C <i>Literature</i> Propylene glycol.
Decomposition temperature	No test data available
Kinematic Viscosity	43.4 cSt at 20 °C <i>Literature</i>
Explosive properties	No data available
Oxidizing properties	No data available
Molecular weight	76.9 g/mol <i>Literature</i>

NOTE: The physical data presented above are typical values and should not be construed as a specification.

10. STABILITY AND REACTIVITY

Reactivity: No data available

Chemical stability: Stable under recommended storage conditions. See Storage, Section 7.
Hygroscopic

Possibility of hazardous reactions: Polymerization will not occur.

Conditions to avoid: Exposure to elevated temperatures can cause product to decompose. Generation of gas during decomposition can cause pressure in closed systems. Avoid direct sunlight or ultraviolet sources.

Incompatible materials: Avoid contact with: Strong acids. Strong bases. Strong oxidizers.

Hazardous decomposition products: Decomposition products depend upon temperature, air supply and the presence of other materials.. Decomposition products can include and are not limited to: Aldehydes.. Alcohols.. Ethers.. Organic acids..

11. TOXICOLOGICAL INFORMATION

Toxicological information appears in this section when such data is available.

Information on likely routes of exposure

Ingestion, Inhalation, Skin contact, Eye contact.

Acute toxicity (represents short term exposures with immediate effects - no chronic/delayed effects known unless otherwise noted)

Acute oral toxicity

Very low toxicity if swallowed. Harmful effects not anticipated from swallowing small amounts.

For the major component(s): Propylene glycol.
LD50, Rat, > 20,000 mg/kg

Information for components:

Propylene glycol

LD50, Rat, > 20,000 mg/kg

Inorganic corrosion inhibitor

LD50, Rat, female, > 2,000 mg/kg No deaths occurred at this concentration.

Acute dermal toxicity

Prolonged skin contact is unlikely to result in absorption of harmful amounts.

For the major component(s): Propylene glycol.
LD50, Rabbit, > 20,000 mg/kg

Information for components:

Propylene glycol

LD50, Rabbit, > 2,000 mg/kg No deaths occurred at this concentration.

Inorganic corrosion inhibitor

LD50, Rabbit, > 5,000 mg/kg

Acute inhalation toxicity

At room temperature, exposure to vapor is minimal due to low volatility. Mist may cause irritation of upper respiratory tract (nose and throat).

For the major component(s):

LC50, Rat, 4 Hour, vapour, 6.15 mg/l No deaths occurred following exposure to a saturated atmosphere.

Information for components:

Propylene glycol

LC50, Rabbit, 2 Hour, dust/mist, 317.042 mg/l No deaths occurred at this concentration.

Inorganic corrosion inhibitor

Based on information for a similar material: Maximum attainable concentration. LC50, Rat, male and female, 4 Hour, dust/mist, > 0.83 mg/l No deaths occurred at this concentration.

Skin corrosion/irritation

Based on information for component(s):

Prolonged contact is essentially nonirritating to skin.

Repeated contact may cause flaking and softening of skin.

Information for components:

Propylene glycol

Prolonged contact is essentially nonirritating to skin.

Repeated contact may cause flaking and softening of skin.

Inorganic corrosion inhibitor

Prolonged contact may cause slight skin irritation with local redness.

Serious eye damage/eye irritation

Based on information for component(s):

May cause slight temporary eye irritation.

Corneal injury is unlikely.

Information for components:

Propylene glycol

May cause slight temporary eye irritation.

Corneal injury is unlikely.

Mist may cause eye irritation.

Inorganic corrosion inhibitor

May cause slight eye irritation.

May cause slight temporary corneal injury.

Dust may irritate eyes.
Mist may cause eye irritation.

Sensitization

For the major component(s):
Did not cause allergic skin reactions when tested in humans.

For respiratory sensitization:
No relevant data found.

Information for components:

Propylene glycol

Did not cause allergic skin reactions when tested in humans.

For respiratory sensitization:
No relevant data found.

Inorganic corrosion inhibitor

For similar material(s):
Did not demonstrate the potential for contact allergy in mice.

For respiratory sensitization:
No relevant data found.

Specific Target Organ Systemic Toxicity (Single Exposure)

Evaluation of available data suggests that this material is not an STOT-SE toxicant.

Information for components:

Propylene glycol

Evaluation of available data suggests that this material is not an STOT-SE toxicant.

Aspiration Hazard

Based on physical properties, not likely to be an aspiration hazard.

Information for components:

Propylene glycol

Based on physical properties, not likely to be an aspiration hazard.

Chronic toxicity (represents longer term exposures with repeated dose resulting in chronic/delayed effects - no immediate effects known unless otherwise noted)

Specific Target Organ Systemic Toxicity (Repeated Exposure)

In rare cases, repeated excessive exposure to propylene glycol may cause central nervous system effects.

Information for components:

Propylene glycol

In rare cases, repeated excessive exposure to propylene glycol may cause central nervous system effects.

Inorganic corrosion inhibitor

Based on available data, repeated exposures are not anticipated to cause significant adverse effects.

Carcinogenicity

Similar formulations did not cause cancer in laboratory animals.

Information for components:

Propylene glycol

Did not cause cancer in laboratory animals.

Inorganic corrosion inhibitor

No relevant data found.

Teratogenicity

For the major component(s): Did not cause birth defects or any other fetal effects in laboratory animals.

Information for components:

Propylene glycol

Did not cause birth defects or any other fetal effects in laboratory animals.

Inorganic corrosion inhibitor

For similar material(s): Did not cause birth defects or any other fetal effects in laboratory animals.

Reproductive toxicity

For the major component(s): In animal studies, did not interfere with reproduction. In animal studies, did not interfere with fertility.

Information for components:

Propylene glycol

In animal studies, did not interfere with reproduction. In animal studies, did not interfere with fertility.

Inorganic corrosion inhibitor

For similar material(s): In animal studies, did not interfere with reproduction.

Mutagenicity

In vitro genetic toxicity studies were negative. For the major component(s): Animal genetic toxicity studies were negative.

Information for components:

Propylene glycol

In vitro genetic toxicity studies were negative. Animal genetic toxicity studies were negative.

Inorganic corrosion inhibitor

In vitro genetic toxicity studies were negative.

12. ECOLOGICAL INFORMATION

Ecotoxicological information appears in this section when such data is available.

Toxicity

Propylene glycol

Acute toxicity to fish

Material is practically non-toxic to aquatic organisms on an acute basis (LC50/EC50/EL50/LL50 >100 mg/L in the most sensitive species tested).
LC50, Oncorhynchus mykiss (rainbow trout), static test, 96 Hour, 40,613 mg/l, OECD Test Guideline 203

Acute toxicity to aquatic invertebrates

LC50, Ceriodaphnia dubia (water flea), static test, 48 Hour, 18,340 mg/l, OECD Test Guideline 202

Acute toxicity to algae/aquatic plants

ErC50, Pseudokirchneriella subcapitata (green algae), 96 Hour, Growth rate inhibition, 19,000 mg/l, OECD Test Guideline 201

Toxicity to bacteria

NOEC, Pseudomonas putida, 18 Hour, > 20,000 mg/l

Chronic toxicity to aquatic invertebrates

NOEC, Ceriodaphnia dubia (water flea), semi-static test, 7 d, number of offspring, 13,020 mg/l

Inorganic corrosion inhibitor

Acute toxicity to fish

Material is practically non-toxic to aquatic organisms on an acute basis (LC50/EC50/EL50/LL50 >100 mg/L in the most sensitive species tested).
LC50, Leuciscus idus (Golden orfe), static test, 48 Hour, > 900 mg/l, Method Not Specified.

Persistence and degradability

Propylene glycol

Biodegradability: Material is readily biodegradable. Passes OECD test(s) for ready biodegradability. Biodegradation may occur under anaerobic conditions (in the absence of oxygen).

10-day Window: Pass

Biodegradation: 81 %

Exposure time: 28 d

Method: OECD Test Guideline 301F or Equivalent

10-day Window: Not applicable

Biodegradation: 96 %

Exposure time: 64 d

Method: OECD Test Guideline 306 or Equivalent

Theoretical Oxygen Demand: 1.68 mg/mg

Chemical Oxygen Demand: 1.53 mg/mg

Biological oxygen demand (BOD)

Incubation Time	BOD
5 d	69.000 %
10 d	70.000 %
20 d	86.000 %

Photodegradation

Atmospheric half-life: 10 Hour

Method: Estimated.

Inorganic corrosion inhibitor

Biodegradability: Biodegradation is not applicable.

Bioaccumulative potential

Propylene glycol

Bioaccumulation: Bioconcentration potential is low (BCF < 100 or Log Pow < 3).

Partition coefficient: n-octanol/water(log Pow): -1.07 Measured

Bioconcentration factor (BCF): 0.09 Estimated.

Inorganic corrosion inhibitor

Bioaccumulation: No bioconcentration is expected because of the relatively high water solubility.

Mobility in soil

Propylene glycol

Given its very low Henry's constant, volatilization from natural bodies of water or moist soil is not expected to be an important fate process.

Potential for mobility in soil is very high (Koc between 0 and 50).

Partition coefficient (Koc): < 1 Estimated.

Inorganic corrosion inhibitor

No relevant data found.

13. DISPOSAL CONSIDERATIONS

Disposal methods: DO NOT DUMP INTO ANY SEWERS, ON THE GROUND, OR INTO ANY BODY OF WATER. All disposal practices must be in compliance with all Federal, State/Provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator. AS YOUR SUPPLIER, WE HAVE NO CONTROL OVER THE MANAGEMENT PRACTICES OR MANUFACTURING PROCESSES OF PARTIES HANDLING OR USING THIS MATERIAL. THE INFORMATION PRESENTED HERE PERTAINS ONLY TO THE PRODUCT AS SHIPPED IN ITS INTENDED CONDITION AS DESCRIBED IN MSDS SECTION: Composition Information. FOR

UNUSED & UNCONTAMINATED PRODUCT, the preferred options include sending to a licensed, permitted: Recycler. Reclaimer. Incinerator or other thermal destruction device.

14. TRANSPORT INFORMATION

TDG

Not regulated for transport

Classification for SEA transport (IMO-IMDG):

	Not regulated for transport
Transport in bulk according to Annex I or II of MARPOL 73/78 and the IBC or IGC Code	Consult IMO regulations before transporting ocean bulk

Classification for AIR transport (IATA/ICAO):

Not regulated for transport

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Transportation classifications may vary by container volume and may be influenced by regional or country variations in regulations. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

15. REGULATORY INFORMATION

Canadian Domestic Substances List (DSL)

All substances contained in this product are listed on the Canadian Domestic Substances List (DSL) or are not required to be listed.

16. OTHER INFORMATION

Hazard Rating System

NFPA

Health	Flammability	Instability
0	1	0

Revision

Identification Number: 11045208 / A208 / Issue Date: 12/16/2019 / Version: 8.0

Most recent revision(s) are noted by the bold, double bars in left-hand margin throughout this document.

Legend

CA ON OEL	Canada. Ontario OELs
TWA	8-hr TWA
TWAEV	time-weighted average exposure value
US WEEL	USA. Workplace Environmental Exposure Levels (WEEL)

Full text of other abbreviations

AICS - Australian Inventory of Chemical Substances; ASTM - American Society for the Testing of Materials; bw - Body weight; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DOT - Department of Transportation; DSL - Domestic Substances List (Canada); ECx - Concentration associated with x% response; EHS - Extremely Hazardous Substance; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; ERG - Emergency Response Guide; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; HMIS - Hazardous Materials Identification System; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization; ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardization; KECI - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; MSHA - Mine Safety and Health Administration; n.o.s. - Not Otherwise Specified; NFPA - National Fire Protection Association; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NTP - National Toxicology Program; NZIoC - New Zealand Inventory of Chemicals; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; RCRA - Resource Conservation and Recovery Act; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; RQ - Reportable Quantity; SADT - Self-Accelerating Decomposition Temperature; SARA - Superfund Amendments and Reauthorization Act; SDS - Safety Data Sheet; TCSI - Taiwan Chemical Substance Inventory; TSCA - Toxic Substances Control Act (United States); UN - United Nations; UNRTDG - United Nations Recommendations on the Transport of Dangerous Goods; vPvB - Very Persistent and Very Bioaccumulative

Information Source and References

This SDS is prepared by Product Regulatory Services and Hazard Communications Groups from information supplied by internal references within our company.

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