# Technical Service Bulletin 030629
# Cooling System Flush Procedure

Comark IOT-based television transmitters employ a liquid coolant composed of ethylene glycol and water, with a glycol-to-volume percentage of 10% to 50%, depending on the desired level of antifreeze protection and station preference. During the course of normal transmitter operation, this liquid coolant loses its natural anti-corrosion properties and becomes progressively more acidic. As a result, the contents of the liquid cooling system must be periodically drained and refilled with a fresh complement of water and glycol. If this periodic cooling system flush is not performed on a timely basis, corrosion and damage to the transmitter cooling system and tube collector(s) will result.

The determination as to whether a cooling system flush is indicated is made by a visual inspection and pH test of the coolant. A 50% glycol solution will start with a pH of 9.3. The pH will progressively drop as the glycol ages. When the pH drops below 8.0, a cooling system flush is indicated. Additionally, if a visual inspection reveals that the solution has changed color or contains solid particulates (cloudy), a cooling system flush may be indicated.

A second opinion on glycol integrity may be obtained by laboratory testing performed by the glycol manufacturer. Contact the Dow Chemical Company • Thermal Fluids Testing Lab • 1691 N. Swede Road • Midland MI 48674 at 1-800-447-4369 for more details.

On average, most systems require a flush every one to three years, with flushes required every four to five years sometimes being possible.

Comark nominally recommends DowTherm SR-1 as the glycol coolant, but the final recommendation as to acceptable coolants should ideally come from the tube manufacturer. New glycol is typically purchased in 55 gallon drums, either as pure glycol or as a 50/50 glycol/water pre-mixed solution. A pre-mix solution is convenient for those stations operating with a 50% glycol mixture, while pure glycol is generally required to mix to other common percentages such as 30% or 10%. Note that even if a 50/50 pre-mix solution is to be used, it is advisable to purchase a spare drum of pure glycol to keep on hand for fine tuning the final solution to 50%.

This bulletin contains a procedure to perform a typical cooling flush for a system already installed and operating. This procedure features a single, water-only system rinse. Certain Comark manuals make reference to a more elaborate flush procedure featuring a soapy water flush with Tygloss or Cascade and up to four water-only rinses to clear soap from the system. Such a procedure is appropriate for removing solder flux and other contaminants from a newly installed system or perhaps in cases of extraordinary contamination. Such a complete flush procedure is not required for systems that have already been in operation for a number of years.

| **Procedure 030629: Cooling Flush Procedure** | |
|---|---|
| Applicability | All IOT equipped transmitters. |
| Prerequisites | Knowledge of total cooling system capacity in gallons. |
| Equipment Required | (2) Pump & gauge assembly (see note below)<br>(2) 50 or 100 ft. garden hoses<br>(2) Clean, unused, plastic garbage cans<br>AC extension cords<br>pH tester: Extech Instruments 120000 or equivalent.<br>Refractometer (% solution tester): Misco DFR or 7084VP or equivalent.<br>Bung wrench (Grainger cat# 1A121 or equivalent)<br>Pipe wrench.<br>Styrofoam cup, pencil & paper, flashlight, bucket.<br><br>**Option 1: purchase 50/50 water/glycol premix solution**<br>50/50 water/glycol premix solution = 100% of system capacity.*<br>Waste water drums = 100% of system capacity.*<br>Distilled water = 100% of system capacity.*<br>Reserve drum of pure glycol solution.<br><br>**Option 2: purchase pure glycol solution**<br>Waste water drums = 100% of system capacity.*<br>Pure glycol solution = 50% of system capacity, or as desired.*<br>Distilled water = 150% of system capacity.*<br><br>* Add 30% to total or round up to next largest drum size, as desired, to have a safety margin in case of miscalculation or leaks. |
| Comments | The photos for this procedure were taken at WGBH-TV. Special thanks to Jon Frank and John Rogers of WGBH-TV for their valuable assistance in writing and proofreading this procedure. |

**NOTE:** This procedure makes use of a home-made integrated pump and flow gauge assembly. The pump is a TEEL brand type 1V391 (Grainger cat# 1V391). The flow gauge is a Fill-Rite 807CN1X250 from Tuthill Transfer Systems (Grainger cat# 1P951A). The inlet and outlet connections to the assembly are based on standard hose threads for easy interface to ordinary garden hoses. This pump & gauge assembly is an integral part of this procedure and is strongly recommended. It is strongly advisable to keep a spare pump & gauge assembly on hand throughout the flushing process, to serve as a replacement, should the first unit become inoperable midway through the procedure.

*Pump & gauge assembly.*

**Drain old glycol / water solution**

1. Make note of total system capacity in gallons, if available. The original transmitter installer may have written this value near the flow meter. A typical value is 150 to 250 gallons. Record value as *(system capacity)*.
2. Assemble necessary supplies and equipment near sump tank area of transmitter cooling system.
3. Place transmitter into STOP mode to deactivate cooling system pump.
4. Connect pump & gauge assembly to drain valve at low point in system. Route pump exhaust flow to empty waste glycol barrel.

*Connect to drain valve*

*Pump used solution into waste barrels*

5. Open drain valve, and connect AC to pump and begin pumping waste glycol from system.

**NOTE:** To minimize mess, cut AC power to pump & gauge assembly while transferring exhaust flow from one waste barrel to another.

6. When pump begins to suck air (chugging), immediately disconnect AC to pump. Close drain valve. Note number of gallons drained thus far.
7. Connect pump & gauge assembly to other low-lying drain valves in system. In the example shown here, a sub-floor run of cooling pipes required that additional pumping be done at indoor drain valves.

*Additional drain points in floor*

8. Attempt to remove as much waste glycol mixture as possible. Flow meter will serve as a guide as to how much used glycol mixture still remains. It will not be possible to remove 100% of the total system capacity *(system capacity)*. Record amount of waste glycol successfully drained as *(glycol drained)*.
9. Once system is drained, open Y strainer and drain liquid contents into bucket.
10. Remove strainer element, clean debris from strainer element, and reinstall element in cooling system.

*Open Y strainer*

*Clean strainer element*

**Water rinse procedure**

11. Open water bottles and pour into clean garbage cans.

*Empty distilled water into cans*

12. Position pump & gauge assembly to draw water from garbage cans and exhaust water into system sump tank. Mechanically secure hose to ensure it remains in sump tank.

*Pump water from holding cans*

*Route exhaust hose to sump tank*

13. Reset flow meter on pump & gauge assembly to 000 gallons.
14. Connect AC to pump & gauge assembly to commence pumping of clean water into transmitter system. Monitor flow meter to ensure that number of gallons of water pumped into system matches amount of waste glycol mixture drained from system previously *(glycol drained)*.

**CAUTION:** Do not allow entrance to pump & gauge intake hose to become obstructed; this may damage pump.

15. Use flashlight to monitor filling progress in sump task. If water level nears top of sump tank, yet flow meter indicates that system is not full (i.e. flow meter not yet equal to *(glycol drained)* in previous step), place transmitter HPA cabinet in COOLING mode for a few moments until system pump has partially drained sump tank (typically 15 - 60 seconds). Return HPA cabinet to STOP mode and continue filling process.
16. Once amount of clean water added matches amount waste glycol previously removed *(glycol drained)*, disconnect AC to pump to cease pumping.
17. Place HPA cabinet in COOLING mode to activate system pump.
18. Allow system pump to circulate rinse water for one hour.
19. Place HPA cabinet in STOP mode to deactivate system pump and cease water circulation.
20. Connect pump & gauge assembly to low-lying drain valve as was done in previous glycol-draining steps.
21. Route pump & gauge exhaust hose to either outdoor grassy area or optional waste water drums in accordance with local regulations. Solution will be mostly water, but will still contain some percentage of glycol.
22. Reset flow meter to 000 gallons.
23. Connect AC to pump & gauge assembly to begin pumping of used rinse water.
24. Continue pumping until maximum amount of water is drained from system. Move pump to various low-lying drain valves, as necessary, until a maximum of water is drained. Note total number of gallons drained from system. Record value as *(water drained)*.
25. Subtract total number of gallons drained from system from total system capacity to derive an estimate of how much water remains in system: *(water remaining)* = *(system capacity)* – *(water drained)*. For sake of simplicity, assume remaining fluid is pure water (no trace glycol).
26. If system is designed to operate with a 50% glycol solution and replacement glycol is a 50/50 premix solution, use “Glycol reload procedure for 50/50 premix solution” immediately below. Otherwise, use “Glycol reload procedure using pure glycol only” contained later in this bulletin.

**Glycol reload procedure for 50/50 premix solution.**

27. Position pump & gauge assembly to draw 50/50 glycol from pre-mix drum(s) and exhaust into sump tank. Reset flow meter to 000 gallons. Connect AC to pump & gauge assembly to commence addition of 50/50 solution to system. Observe number of gallons added via flow meter. Add 50/50 mixture according to formula: *(50/50 added)* = *(system capacity)* – 2 x *(water remaining)*. If sump tank fills prematurely, run system pump to pull new solution through cooling system. Disconnect AC to pump & gauge assembly to cease pumping when finished.

*Draw glycol pre-mix from drums*

28. Position pump & gauge assembly to draw pure glycol from reserve glycol drum and exhaust into sump tank. Reset flow meter to 000 gallons. Connect AC to pump to commence addition of glycol to system. Observe number of gallons added via flow meter. Add same number of gallons pure glycol as *(water remaining)* from previous step(s). Record value as *(glycol added)*. Disconnect AC to pump & gauge assembly to cease pumping when finished.
29. As a check: *(water remaining)* = *(glycol added)* and *(water remaining)* + *(glycol added)* + *(50/50 added)* = *(system capacity)*.
30. Place HPA cabinet in COOLING mode to activate system pump. Allow system pump to circulate coolant mixture for five minutes.
31. Draw sample from drain valve.
32. Allow sample to settle for five minutes to equalize temperature.
33. Stir sample and allow to re-settle.
34. Measure sample with refractometer.
35. Repeat measurement several times until reading stabilizes.

*Test solution % with refractometer*

36. Use pump & gauge assembly to add small amounts of water or pure glycol to fine-tune mixture to 50%. Retest solution with refractometer as necessary.

37. Contact liquid waste disposal company to have used glycol solution hauled away.

> **NOTE:** Look in yellow pages under "recycling" for companies specializing in liquid waste removal.

38. Procedure complete.

**Glycol reload procedure using pure glycol only.**

39. Position pump & gauge assembly to draw water from water cans and exhaust into sump tank. Reset flow meter to 000 gallons. Connect AC to pump & gauge assembly to commence addition of water to system. Observe number of gallons added via flow meter. Add new water to system according to formula: *(water added)* = ((*100% - desired mixture percentage)* x *(system capacity))* – *(water remaining*). If sump tank fills prematurely, run system pump to pull new solution through cooling system. Disconnect AC to pump & gauge assembly to cease pumping when finished.
40. Position pump & gauge assembly to draw pure glycol from glycol drum(s) and exhaust into sump tank. Reset flow meter to 000 gallons. Connect AC to pump to commence addition of glycol to system. Observe number of gallons added via flow meter. Add pure glycol to system according to formula: *(glycol added) = (system capacity) – (water added) – (water remaining)*. Disconnect AC to pump & gauge assembly to cease pumping when finished.
41. As a check: *(water remaining) + (water added) + (glycol added) = (system capacity)* and *(glycol added) / (system capacity) = (desired mixture percentage).*
42. Place HPA cabinet in COOLING mode to activate system pump. Allow system pump to circulate coolant mixture for five minutes.
43. Draw sample from drain valve.
44. Allow sample to settle for five minutes to equalize temperature.
45. Stir sample and allow to re-settle.
46. Measure sample with refractometer.
47. Repeat measurement several times until reading stabilizes.
48. Use pump & gauge assembly to add small amounts of water or pure glycol to fine-tune mixture to *(desired mixture percentage).* Retest solution with refractometer as necessary.
49. Contact liquid waste disposal company to have used glycol solution hauled away.

> **NOTE:** Look in yellow pages under "recycling" for companies specializing in liquid waste removal.

50. Procedure complete.

**Worked Examples**

Station XYZ's cooling system has a capacity of 150 gallons, of which typically only 130 gallons can be successfully drained at a given time. They have opted to use a 50% glycol solution and have purchased 50/50 premix solution.

1. *(system capacity)* = 150 gallons
2. *(glycol drained)* = 130 gallons
3. *(water remaining)* = 150 - 30 = 20 gallons
4. *(50/50 added)* = 150 - (2 x 20) = 110 gallons
5. *(glycol added)* = 20 gallons
6. Final result = 110 gallons 50/50 + 20 gallons water + 20 gallons pure glycol = 150 gallons

Station ABC's cooling system has a capacity of 110 gallons, or which typically only 85 gallons can be successfully drained at a given time. They have opted to use a 30% glycol solution.

1. *(system capacity)* = 110 gallons
2. *(glycol drained)* = 85 gallons
3. *(water remaining)* = 110 - 85 = 25 gallons
4. *(water added)* = ((100% - 30%) x 110 gals) - 25 gals = 52 gallons
5. *(glycol added)* = 110 - 52 - 25 = 33 gallons
6. Final result = 25 gallons water + 52 gallons water + 33 gallons glycol = 110 gallons
7. Final result = 33 gallons glycol / 110 gallons total = 30% mixture.

At Comark, we are constantly striving to improve the satisfaction of both our new and existing customers. Please do not hesitate to contact Comark Customer Service with any questions you may have concerning the contents of this service bulletin.

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