DRS219
Dynamic reflux sample

Clean samples for your process analyzer

Measurement made easy

Introduction
DRS219 Dynamic Reflux Sampler for gas chromatographs, photometers and other analyzers. The DRS219 solves complex sampling problems (such as hot, particulate laden, corrosive and otherwise nasty samples in a process for application engineering. The primary sample conditioning occurs in an in-situ fashion. Condensable components are removed and are used to support particulate removal before they can present problems in the sample transport system's downstream components and the analyzer. The unit is a self-contained sampling device suitable for mounting at or near the process pipeline tap.

For more information
Further publications for the DRS219 are available for free download from: www.abb.com/measurement
Table of Contents

1 Safety and symbols ............................................ 3

2 Introduction ...................................................... 4
  2.1 Application ................................................... 4
  2.2 Drawings ....................................................... 4
  2.3 Functional description ....................................... 4
  2.4 Principles of operation ...................................... 4

3 Installation ....................................................... 5
  3.1 Safety considerations ....................................... 5
    3.1.1 Mounting the equipment ................................ 5
    3.1.2 Vortex cooler hot air exhaust .......................... 5
    3.1.3 Hot surfaces and components ............................ 5
    3.1.4 Electrical components ................................... 5
    3.1.5 Maintenance and repair .................................. 5
  3.2 Preparing for installation ................................... 6
  3.3 Flange mounting DRS ......................................... 6
  3.4 Plumbing connections ........................................ 6
    3.4.1 Air ...................................................... 6
    3.4.2 AC power in ............................................. 7
    3.4.3 Temperature alarm ........................................ 7
    3.4.4 Sample inlet ............................................ 7
    3.4.5 Plumbing from the DRS to the sample handling system ........................................ 7
    3.4.6 Service port ............................................. 7
    3.4.7 Sample shutoff valve default (fail-safe mode) ...................... 7
  3.5 Before startup ................................................ 7
  3.6 Functional test procedure .................................... 8

4 Operation ........................................................ 9
  4.1 Air-cooled DRS ............................................... 9
    4.1.1 Startup procedure ........................................ 9
    4.1.2 Shut-down procedure ..................................... 9

5 Functional description ......................................... 10
  5.1 Temperature controller’s controls and indicators .......... 10
  5.2 Fuse indicator ................................................ 10
  5.3 Temperature controller operations menu ..................... 10
    5.3.1 Autotune (AUt1) ......................................... 10
    5.3.2 True tune (t.tU1) ....................................... 10
    5.3.3 Alarm low set point 2 (A.Lo2) ........................... 11
    5.3.4 Alarm high set point 3 (A.Lo3) ........................... 11
    5.3.5 Temperature set point adjustment ....................... 11

6 Maintenance and troubleshooting ............................. 12
  6.1 Safety ....................................................... 12
    6.1.1 Vortex cooler hot air exhaust .......................... 12
    6.1.2 Hot surfaces and components ............................ 12
    6.1.3 Electrical components ................................... 12
    6.1.4 Sample .................................................. 12
    6.2 Power off .................................................... 13
  6.3 Maintenance equipment ...................................... 13
  6.4 Maintenance procedures ..................................... 13
    6.4.1 Before starting the steam cleaning procedure ......... 13
    6.4.2 Isolate the DRS from the process ....................... 13
    6.4.3 Prepare for steam cleaning ............................... 13
    6.4.4 Steam blow down from the service port ................ 14
    6.4.5 Steam blow down from the top of the DRS column ..... 14
    6.4.6 Reconnect the DRS ....................................... 14
  6.5 Troubleshooting .............................................. 14
    6.5.1 No flow from DRS at conditioned sample output ....... 14
    6.5.2 Condensation appears in handling system flowmeter tubes and filters .......................... 15
    6.5.3 Quench section of DRS column is frozen ............... 15

7 Repair ............................................................ 16
  7.1 General instructions ........................................ 16
  7.2 Control enclosure ........................................... 16
    7.2.1 Replacing the temperature controller .................. 16
    7.2.2 Replacing the fuse ....................................... 16
  7.3 Pneumatic section ............................................. 16
    7.3.1 Removing the pneumatic valve ........................... 16
    7.3.2 Installing a new pneumatic valve ....................... 17
  7.4 Column section ................................................ 17
    7.4.1 Reworking a flange-mounted column ..................... 17
    7.4.2 Removing the I/P transducer ............................ 17
    7.4.3 Installing a New I/P transducer ......................... 18
    7.4.4 Removing the solenoid valve ............................. 18
    7.4.5 Installing a new solenoid valve ......................... 18
    7.4.6 Removing the RTD sensor ................................ 18
    7.4.7 Installing a new the RTD sensor ......................... 18

8 Replacement parts .............................................. 19
  8.1 Ordering information ........................................ 19
    8.1.1 Equipment identification ............................... 19
    8.1.2 Configuration identification ............................ 19
  8.2 Control enclosure ........................................... 19
  8.2 Pneumatic section ........................................... 20
  8.2 Column section ............................................... 20
# 1 Safety and symbols

The following symbols are used in this manual to alert the user to possible hazards and to provide additional information.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
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<tbody>
<tr>
<td>🔄️</td>
<td>Indicates that the referred item can be hot and should not be touched without care.</td>
</tr>
<tr>
<td>🚨</td>
<td>Indicates that a risk of electrical shock and/or electrocution exists.</td>
</tr>
<tr>
<td>⚠️</td>
<td>Indicates a potential hazard which could cause serious injury and/or death</td>
</tr>
<tr>
<td>⚠️</td>
<td>Indicates the presence of a hazard which could result in corruption of software or damage to equipment/property.</td>
</tr>
<tr>
<td>⚠️</td>
<td>Indicates that referenced items are susceptible to Electrostatic Discharge (ESD) damage and should not be touched without ESD safe handling tools.</td>
</tr>
<tr>
<td>📝</td>
<td>Alerts the user to pertinent facts and conditions.</td>
</tr>
</tbody>
</table>
2 Introduction

2.1 Application

This manual applies to the DRS219 Dynamic Reflux Sampler (DRS).
The DRS is an on-line sample conditioner that provides a clean, dry vapor sample for the analyzer sample handling system.

2.2 Drawings

Since DRS configuration depends on the particular application, this manual does not contain generic engineering drawings and diagrams. You should utilize the drawings, diagrams and replacement parts lists provided on the final document package with your DRS to ensure they are the correct ones for your system.

2.3 Functional description

The DRS219 uses process pressure for sample feed to the system. As the sample enters the DRS section, the DRS cleans and then temperature dries it. The sample flows from the process stream and undergoes some cooling prior to passing into the bottom of the packed distillation column. The wet, dirty, three-phase sample flows through a relatively large tube (which is not subject to plugging).
The sample flows upward at a rate of up to typically max. 500-NLPH @ process contains 50% (volume percentage) water vapor into the distillation column. Raschig rings serve as a barrier to particulate, causing axial flow of the sample for efficient cleaning and cooling. When required, steam, water, or solvent may be injected continuously into the stream to clean the sample and flush the particulate. In addition, the fluid generated from the cooling section of the DRS (reflux) will flush the system as it returns to the process or bypass line.
As the conditioned sample flows through the DRS, a temperature controller will continuously monitor the product. The temperature controller, together with the pressure transducer it controls, maintains the sample temperature within ±0.3°C under steady state conditions. The sample then flows to the analyzer.

2.4 Principles of operation

The DRS is a reliable, continuous sample conditioner for on-line gas analysis. The DRS cleans two- and three-phase process samples using fractional distillation.
The DRS has a fractionation column that is a straight stainless steel pipe with a one inch interior diameter; this larger interior diameter helps keep the column from plugging. There are no moving parts, filters, separators, traps, or drains in the column. The entire column is packed with Raschig rings.
Just above the sample inlet is the quench section of the DRS column and it is packed with Raschig rings. Usually it is unheated and uninsulated, which allows the rising vapor sample to start cooling; this section can be insulated if the ambient temperature requires it. Particulate begins to drop out of the sample flow and collect in the Raschig rings. As the wet, dirty vapor sample rises through the quench section of the DRS column, it encounters the reflux flowing back down the column from the cooled section above. This counter-current flow results in improved component separation.
The service port, located in the quench section of the DRS column, allows the addition of water, steam, or solvent, as the application requires. Steam, or water, can be added to the sample at the service port if the water content of the sample is insufficient (less than 5%) to create the reflux. Steam, or a suitable solvent, can be added to the sample at the service port if the sample contains waxy residue, or extra-heavy particulate.
The top of the column is insulated and cooled by a Vortex Cooler with a typical temperature setting @ 3°C, which causes the wet vapor to condense creating the reflux that flows back down through the column.
3 Installation

3.1 Safety considerations

3.1.1 Mounting the equipment

The DRS has a shipping weight of 65 kg (144 lbs.). You should have one or more persons help you lift it and move it.

The DRS must be mounted securely, without deflection of the DRS column or connections. There must be no movement of the enclosure when the temporary supporting device is removed after the DRS is mounted. Any movement of the enclosure after connections are made will result in damage to internal components and connections.

3.1.2 Vortex cooler hot air exhaust

The Vortex hot air exhaust is a metal tubing stub that can become hot enough to be a burn hazard. Be sure to wear insulated gloves when working in this area.

3.1.3 Hot surfaces and components

The following surfaces and components will be hot due to the temperature of the sample or process; these items are burn hazards. Always use insulated gloves and tools when working with the DRS.

- Sample remaining in the DRS column and lines
- Sample inlet, bypass line, connections and valves
- Sample return line, connections and valves
- Quench section of DRS column
- Service port and attachments
- Vortex exhaust tubing

3.1.4 Electrical components

Circuits inside the Control Enclosure contain high AC/DC voltage levels. When you are working inside this unit, be sure the power is turned OFF at the DRS isolation switch and the switch is marked to indicate that work is being done on the DRS with the power off.

3.1.5 Maintenance and repair

Do not attempt any service or repair work on the DRS if the unit is not mounted properly. It should be mounted securely, without deflection of column or connections.

Do not attempt any maintenance or repair work until the DRS has been isolated from the process by closing the customer primary block valves, sample inlet valve, and the return to process valve.
3.2 Preparing for installation

Operating instruction, data sheets and installation drawings are needed to support installation and setup of the DRS. This document refers to these data sheets and drawings as the “Final Document Package.”

The DRS should be located as close as possible to the process tap.

In general, for each DRS to be installed, the customer should provide:
• temporary support (68.2 kg / 150 lb. minimum load) for the DRS while it is being secured
• mounting bolts
• isolation switch for each DRS to be installed - customer supplied and installed according to local plant electrical specifications - this is highly recommended for safety and convenience
• circuit breaker (10 amps maximum) - customer supplied and installed according to local plant electrical specifications
• fittings and sufficient length of tubing or heat-traced bundle, ¼-inch tubing, 300 series SS, or PTFE for an acid gas sample, for the connection from the conditioned sample outlet of the DRS to the analyzer sample handling system inlet

It is required that the DRS shutoff valve connection, or the DRS sample return to process connection, be at a higher elevation than the return to process connection at the process line, to allow for efficient draining of the reflux produced by the DRS. For each flange mounted DRS installation, the customer must supply a flange gasket and flange bolts, in accordance with local plant piping specifications:
The flange-mounted DRS must be mounted vertically on the customer’s primary block valve (see Figure 1). This primary block valve must be capable of bearing a 68 kg (150 lb.) load minimum. A secure mounting results in no deflection (movement, bending or stress) of the process sample connection/DRS column.

A flange connection for the DRS is a Sales Order option that is totally application-dependent. A flange connection is always mounted vertically on the customer supplied and installed primary block valve.

The following tools and equipment are required to install the DRS:
• Hydraulic lift, crane/sling for placement of DRS enclosure
• SAE/Metric wrench and/or socket set for enclosure mounting bolts
• Pipe wrenches (2 each) for air connection
• Tube fitting wrenches
• Tube benders
• Wire pliers
• Screwdriver for terminal strip wiring connections
• M5 hex key wrench
• M8 hex key wrench

3.3 Flange mounting DRS

The process line ANSI flange, wall or pipe to which the DRS is connected must be capable of supporting more than the full weight of the DRS (50 kg /110 lbs.) A 68 kg (150 pound) minimum is recommended, though the weight of the unit varies slightly (±5 lbs./±2.3 kg) depending on the specific configuration.

When installing the DRS, the sample tap should be at a higher elevation than the DRS and the return to process connection at a lower elevation, to create a natural downward flow and to prevent reflux backup into the DRS column.

3.4 Plumbing connections

After the DRS has been properly mounted, the following connections should be made in the order listed.

3.4.1 Air
For the air-cooled DRS, the Instrument Air connection is a ½-inch tee connection. It is recommended, for efficient Vortex operation, that the Instrument Air quality be comparable to, or better than, ISA grade. The Instrument Air is used for Eductor Air, Vortex Cooler Air, and Valve Switching Air.
3.4.2 AC power in
It is recommended that a circuit breaker (or power switch), provided and installed by the customer, is installed outside the DRS on the power supply line. This circuit breaker (or power switch) may be used for all power On/Off control. The power-in connection is armored cable, to the bottom of the Control Enclosure. The only electronic component in the DRS is the temperature controller. The Neutral and Earth (Ground) connections must be at earth potential (0 volts). Failure to maintain earth potential at these connection points constitutes a serious safety hazard.

3.4.3 Temperature alarm
The Temperature Alarm connection is user defined. The user can set it for specific temperatures (e.g., 35°C) or for temperature deviations (e.g., ±3°C).

3.4.4 Sample inlet
The DRS is suitable for typical ethylene furnace and other similar applications (see Figure 2). It is connected directly to the process line with a 2-inch vertical 300 series stainless steel flange mounted on top of a primary block valve normally supplied and installed by the customer. The pressure of the process line pushes sample into the DRS inlet. The differential pressure between the DRS inlet and the sample handling system return vent allows the sample to flow through the DRS column to the sample handling system.

3.4.5 Plumbing from the DRS to the sample handling system
When there is no danger of the ambient temperature going below 50°F (10°C), unheated, ¼-inch stainless steel tubing can be used to make the connection between the DRS and the sample handling system. A heat-traced bundle is recommended to connect the DRS to the sample handling system in areas where ambient temperature may drop below 50°F (10°C). The heat-traced bundle must be connected directly to the ¼-inch tube connection to the outlet of DRS and connected directly to the sample handling system sample inlet. The heat-traced bundle is provided by the customer, unless specified otherwise.

3.4.6 Service port
The Service port is a ¼-inch tubing connection with a shutoff valve. As the application requires, the Service port can be used for the addition of water, steam, or solvent to the sample in the quench section of the DRS column. Water is added when the water content of the “wet” sample is insufficient (less than 5%) to support the reflux action. As regular maintenance, a steam connection can be made here to clean the quench section of the column. In some applications, the analyzer calibration sample can be connected here (the analyzer calibration sample is usually connected at the sample tap connection).

3.4.7 Sample shutoff valve default (fail-safe mode)
Once the DRS has started and power is interrupted (regardless of the reason), the Sample Shutoff Valve automatically closes, stopping the flow of conditioned sample. This describes the valve's operation as shipped from the factory. If the user changes the mode of this valve’s operation, the user assumes responsibility for this change.

3.5 Before startup
1 Review all data on alarms and corrective action before operating the instrument.
2 Observe and take note of all caution tags on the instrument; make all adjustments using the data sheets specifically for each instrument.
3 Be sure all air and sample supply lines are properly connected and turned OFF at the external flow shutoff valves (these shutoff valves are normally associated with instrument installation and are not part of the instrument itself).
4 Be sure the power supply line is properly connected and turned OFF at the circuit breaker outside the unit (this circuit breaker is associated with installation and is not part of the instrument itself).
5 Be sure the electronics housing is closed securely, and that the air purge requirements listed on the instrument tag have been complied with.
3.6 Functional test procedure

This procedure describes functional testing during startup or troubleshooting.

1. Remove the Control Enclosure cover, using a M8 hex key wrench.

2. Verify the AC power connections, per drawings in Final Document Package.

3. Close the air inlet valve in the DRS main air supply line.

4. Connect a ½-inch air line to the air inlet of the DRS.

5. Set the I/P transducer pressure regulator to set point 2.7 Barg.

6. Connect the air line to the plant air supply, through a high volume regulator and set the regulator for 5.5 - 7 Barg.

7. Check that if the Vortex solenoid valve is ENERGIZED.

8. Turn the DRS main air supply valve to the ON position.

9. Ensure the Vortex air pressure is greater than 4.5 Barg.

10. Reinstall the cover on the DRS Control Enclosure, tighten the bolts using M8 hex key wrench.

11. Allow the Vortex to cool for about 5 to 10 minutes.

12. Allow the temperature to stabilize at factory default temperature setting 3°C (37.4°F).

13. Check that if the sample solenoid is energized.

14. Turn the plant air supply OFF.

15. Disconnect the air supply from the unit being tested.
4 Operation

4.1 Air-cooled DRS

4.1.1 Startup procedure

Before starting the DRS ensure that it has been installed and verified as described in Section 3. The following instructions assume that the DRS and all external components required for DRS function have been properly installed and checked.

1. Open the external shutoff valve on the Instrument Air supply coming into the DRS.

2. Turn ON the power to the DRS at the circuit breaker outside the unit.

3. Verify that the default display appears; press the Infinity key if necessary.

4. Press the Advance key to advance to A2Lo.

5. Use the Arrow keys to set this for the desired temperature at which to inject the sample (e.g., 5°C).

6. Press the Advance key to advance to A3Lo.

7. Use the Arrow keys to set this for the desired temperature alarm value (e.g., 7°C).

8. Press the Infinity key.

9. Use the Arrow keys to set the green set temperature value (e.g., 3°C).

10. Press the Advance key.

11. Set Aut to On.

12. The unit will begin to autotune, which is simply characterizing the system and setting the constants for the PID control. This process could take an hour, depending on the ambient temperature and the air flow to the Vortex Cooler.

13. Allow sufficient time (approximately an hour) for the Vortex Cooler to start cycling ON and OFF. This time varies with Vortex Cooler air pressure and ambient temperature.

14. With a flange connection, open the customer primary block valve to allow sample flow.

15. Verify the instrument air pressure with that listed in the Final Document Package. Adjust as needed until the instrument air pressure agrees reasonably with that specification.

16. Turn ON the Eductor, or pump, on the Sample Handling System to draw sample flow through the DRS.

17. Observe the DRS operation to make sure it is cycling properly and the temperature control feature is functioning. Since there are no moving parts visible, this observation must be done by listening to the solenoids click and the Vortex Cooler air flow.

The DRS runs continuously. Once the connections are made and the air, power, and sample are turned ON, the DRS continues to operate until there is a failure or the unit is shut down.

4.1.2 Shut-down procedure

1. The analyzer and sample handling systems need to be put in an idle state (shut-down) because the conditioned sample flow from the DRS will be interrupted while the DRS is shut-down.

2. Isolate the DRS from the process by closing the customer probe valve/sample inlet valve first, the Eductor air if applicable, then the return to process valve; with a flange connection close the customer primary block valve.

If the DRS shut-down is due to a failure situation, begin troubleshooting immediately.

If the DRS shut-down is a planned shut-down for maintenance, it is not necessary to interrupt power or stop Vortex air flow (see Section 6).

If the DRS shut-down is a planned shut-down for a period of non-use or repairs, perform the following steps.

1. Turn the power OFF at the DRS isolation switch. When the loss of power occurs, the sample shutoff solenoid automatically defaults to vent.

   The sample trapped in the DRS column can be hot enough to be a burn hazard. Use insulated tools, wear insulated gloves, and wear appropriate eye protection.

   The Sample Shutoff System, consisting of Solenoid Valve and pneumatic valve, is normally configured with pneumatic valve third port unconnected and unplugged so it is open to ambient air if the valve shuts off sample flow from the DRS. With the sample flow stopped, the air vent provides an uninterrupted vapor flow to prevent “dead heading” the pump in the system down stream from the DRS. This configuration is typical with stack systems.

   When it is not permissible to allow air to enter the sample stream, in a pyrolysis/ethylene furnace or a flare sample return for example, the third port must be plugged to keep ambient air from entering the system if sample flow from the DRS is interrupted by the sample shutoff valve.

2. Disconnect the Instrument Air In connection. Sample may remain in the DRS column while the unit is not in operation.

   If the sample is under pressure, the pressure can be relieved by disconnecting the supply line to the service port and opening the service port to let the sample escape.
5 Functional description

5.1 Temperature controller’s controls and indicators

The Temperature Controller (see Figure 3) has LCD displays, switch keys, and indicator LEDs.

The LCD displays function as follows:
- The Upper Display shows the process value in the Operations Menu; otherwise shows the value of the parameter in the Lower Display.
- The Lower Display shows the set point or output power value during operation, or the parameter whose value appears in the Upper Display.

The function keys operate as follows:
- 
  **INFINITY** Key: press to return to the default display.
- 
  **ADVANCE** Key: press to advance through the parameter prompts.
- 
  **UP ARROW** or **DOWN ARROW**: press to sequence through available modes or values.
- 
  **EZ** Key; press to return to the default settings.

The indicator lights function as follows:
- % lights when the controller is displaying values as a percentage or when the open-loop set point is displayed.
- output 1 indicates activity of output 1
- output 2 indicates activity of output 2
- output 3 indicates activity of output 3.

5.2 Fuse indicator

The fuse indicator is just below the fuse (see Figure 4). This indicator illuminates to indicate a blown fuse.

5.3 Temperature controller operations menu

Upon power up of the system, the Temperature Controller assumes the default display (factory setup). Use the ADVANCE key to scroll through the Operations Menu.

At any point within the Operations Menu, you can return to the default display by pressing the INFINITY key. The Operations Menu prompts are as follows. The displays appear when the specific prompt is selected.

5.3.1 Autotune (AU1)

This prompt starts an autotune. While active, the upper and lower displays will flash tun1 and Attn. The default display is no.

5.3.2 True tune (t.U1)

This prompt continuously updates the PID settings. The default display is YES.
5.3.3 Alarm low set point 2 (A.Lo2)
This prompt sets the point at which the sample is switched in
to be dried. The default display is 5.0.

5.3.4 Alarm high set point 3 (A.Lo3)
This prompt sets the point at which the customer’s alarm will
be triggered. The default display is 7.0.

5.3.5 Temperature set point adjustment
The temperature set point can be adjusted with the Up and
Down Arrow keys. The set point temperature is displayed
in green numbers on the lower right section of the display.
6 Maintenance and troubleshooting

6.1 Safety

6.1.1 Vortex cooler hot air exhaust

The Vortex hot air exhaust is a metal tubing stub that can become hot enough to be a burn hazard. Be sure to wear insulated gloves and use an insulated screwdriver.

6.1.2 Hot surfaces and components

The following surfaces and components will be hot due to the temperature of the sample or the process; these items are burn hazards. Always use insulated gloves and tools when working with the DRS.

- sample inlet, bypass line, connections and valves
- sample return line, connections and valves
- sample remaining in the DRS column and lines
- quench section of DRS column
- service port and attachments
- Vortex exhaust tubing

6.1.3 Electrical components

Circuits inside the Control Enclosure contain high AC/DC voltage levels. When you are working in this unit, be sure the power is turned OFF at the DRS isolation switch and the switch is marked to indicate that work is being done on the DRS with the power off.

6.1.4 Sample

The sample trapped in the DRS column can be hot enough to be a burn hazard. Use insulated tools, wear insulated gloves, and wear appropriate eye protection.

Once the DRS has been started and then is shut down, sample remains in the DRS column while the unit is not in operation. If the sample is under pressure, the pressure can be relieved by disconnecting the supply line to the service port and opening the service port to let sample escape.
6.2 Power off

When power is interrupted, regardless of the reason, the Sample Shutoff Valve defaults to vent, stopping the flow of conditioned sample from the DRS (trapping sample in the column) and opening the third port to ambient air. This assumes the Sample Shutoff Valve still operates as set up in the factory.

The Sample Shutoff System, consisting of Solenoid Valve and pneumatic valve, is normally configured with pneumatic valve third port unconnected and unplugged. Therefore, it is open to ambient air if the valve shuts off sample flow from the DRS. With the sample flow stopped, the ambient air provides a continuous vapor flow to prevent “dead heading” the pump in the system downstream from the DRS. This configuration is typical with stack systems.

When it is not permissible to allow air to enter the sample stream (as in a pyrolysis/ethylene furnace or a flare sample return), the third port must be plugged to keep ambient air from entering the system if sample flow from the DRS is interrupted by the sample shutoff valve.

6.3 Maintenance equipment

- Low pressure steam supply complete with hose and isolation valves, ¼-inch tubing
- Containers suitable for collection of run-off from the opened bypass lines, or the open flange connection
- Safety clothing, equipment and tools appropriate for working with steam and hot liquid/vapor samples

6.4 Maintenance procedures

The operator should perform periodic maintenance on the DRS to ensure the equipment operates at optimum levels. Steam clean the column and sample bypass periodically to prevent buildup of waxy residue and particulate. In general, the DRS should be cleaned, from the top of the column down, often enough to prevent decreases in conditioned sample flow. How often this is done depends entirely on the quality (how wet and dirty) of the process sample and the individual DRS application. The steam can be connected at the Service Port, or the sample out connection at the top of the column, depending on what parts of the DRS are to be cleaned. Steam connected at the top of the column in a flange mounted DRS will clean the entire length of the column including the quench section. With the steam connected at the Service Port, only the quench section of the column will be cleaned.

6.4.1 Before starting the steam cleaning procedure

The analyzer and sample handling systems need to be put in an idle state (shut down) because the conditioned sample flow from the DRS will be interrupted while the DRS is shut down for maintenance. It is not necessary to stop the Vortex Cooler air flow when doing a steam blow down and it is not necessary to turn the DRS power OFF.

6.4.2 Isolate the DRS from the process

DRS maintenance is usually performed during a normal idle period in the process. Because of this, it is not necessary to isolate the DRS from the process, nor is it necessary to disconnect the DRS from the effluent line. Proceed to “Prepare for Steam Cleaning.”

Disconnecting the DRS from the effluent line is difficult and requires the use of a crane/lift. It is the customer’s responsibility to determine if it is necessary to disconnect the DRS from the effluent line.

6.4.3 Prepare for steam cleaning

The following surfaces and components will be hot due to the temperature of the sample or the process; these items can be burn hazards, always use insulated gloves and tools when working with the DRS.

- Sample trapped in the column and lines
- Sample inlet, bypass line, connections and valves
- Sample return line, connections and valves
- Quench section of DRS column
- Service port and attachments
- Vortex exhaust tubing

1 Place containers under each open end of the sample bypass (under the flange, if applicable) to collect any possible non-vapor run-off produced by the steam blow down. These containers must be suitable for the type of sample components that could be present in high concentration in the run-off and must be able to tolerate the temperature of the steam output.

For efficient cleaning of the sample bypass tubing, make sure the bypass lines slope smoothly down from the DRS to the run-off containers.

2 Open the DRS enclosure.
6.4.4 Steam blow down from the service port
This is the fastest and easiest method of cleaning the components and connections of the DRS where there is the greatest possibility of residue and particulate buildup.

1 Wearing insulated gloves and safety glasses, and using insulated tools, break the connection on the sample line coming from the top of the column. This line is connected to the branch port of the ½-inch tee fitting on the top of the column. Cap off or plug the tubing connection coming out of the top of the column.

2 If the Service Port connects to a supply line, isolate and disconnect this line.

3 Connect a steam supply to the Service Port (low pressure steam is recommended).

4 Steam blow down from the Service Port cleans the quench section of the column, the flange, and the customer primary block valve connection.

5 Continue steam blow down until run-off is clear, colorless, and does not contain any particulate. Stop the flow of steam and keep the run-off containers in place until there is no more run-off. Dispose of the run-off appropriately, considering the type of sample and all components present in it.

6 It is the customer’s responsibility to decide whether the steam blow down from the Service Port removed as much residue and particulate buildup as planned. If not, steam blow down from the top of the DRS column should be done.

7 Close the valves on the steam source and the Service Port; disconnect the steam source. If necessary, proceed with the steam blow down from the top of the DRS column, which follows. If steam blow down from the top of the column is not necessary, proceed to “Reconnect the DRS.”

6.4.5 Steam blow down from the top of the DRS column

1 Wearing insulated gloves and safety glasses, and using insulated tools, break the connection on the sample line coming from the top of the column. This line is connected to the branch port of the ½-inch tee fitting on the top of the column.

2 If the Service Port has a supply line connected to it, close the valve to isolate it. It may be disconnected, but it is not necessary.

3 Connect the steam supply to the tubing connection on the top of the column.

4 Steam blow down from the top of the column cleans the entire length of the column, including the quench section, the flange, and the customer primary block valve connection.

5 Continue steam blow down until run-off is clear, colorless, and does not contain any particulate. Stop the flow of steam and keep the run-off containers in place until there is no more run-off. Dispose of the run-off appropriately, considering the type of sample and all components present in it.

6 Close the valve on the steam source and disconnect it.

6.4.6 Reconnect the DRS

1 Remove the plug from the tubing at the top of the column (if doing a blow down from the Service port).

2 Reconnect the conditioned sample outlet line.

3 Turn on the educator air supply, if applicable. Close the Control Enclosure.

4 Re-connect the Service Port supply line, if appropriate.

5 Re-connect the flange to process line.

6 Connect the Service Port supply line properly; make sure the isolation valve is closed.

7 Open the primary valve on the process line to DRS.

8 Leak check these connections.

9 Allow time for the Vortex to start the cooling cycle.

10 Take the analyzer and the sample handling system out of the idle state.

6.5 Troubleshooting
This section provides troubleshooting information by symptom. Included in the information are symptoms, causes and suggested solutions.

6.5.1 No flow from DRS at conditioned sample output

1 Cause: DRS sample inlet clogged (flange connection on process line)
Solution: Blow down steam or solvent from top of column, or at the sample port; see procedure (Section 6.4.4 or Section 6.4.5)

2 Cause: DRS sample inlet clogged (pipe tee or educator connection with sample bypass)
Solution: Blow down steam or solvent from top of column, or at the sample port; see procedure (Section 6.4.4 or Section 6.4.5)

3 Cause: DRS quench section frozen due to ambient temperature below 32F/0°C
Solution: Insulate quench section of DRS column; also inlet fittings and valve, if applicable

4 Cause: Reflux frozen in Vortex cooled section of DRS column (other components are operating normally)
Solution:
   a. Check air pressure (high) and Vortex tube cold air outlet temperature (low); adjust to correct pressure and temperature
   b. Check RTD in DRS column; replace if faulty.
5 Cause: Sample transport tubing between DRS and sample handling system is clogged;

Liquid carryover may occur due to the entrainment properties of two-phase (gas-liquid) samples. Carryover within the DRS is a sample flow rate problem, not a DRS sample high temperature problem, so the Sample Shutoff Valve will not stop the conditioned sample flow from the DRS. The sample flow rate through the DRS must be reduced.

Solution: Check and clean or replace; this is due to “carryover” within the DRS; reduce sample flow to stop carryover.

6 Cause: Sample outlet tubing clogged between the Sample Shutoff Valve and the sample outlet connections; see NOTE at step 5

Solution: Check and clean or replace; this is due to “carryover” within the DRS; reduce sample flow to stop carryover.

7 Cause: Sample Shutoff Valve is clogged; see NOTE at step 5

Solution: Check and clean or replace; this is due to “carryover” within the DRS; reduce sample flow to stop carryover.

8 Cause: Tubing/fittings between the top of the column and the Sample Shutoff Valve are clogged; see NOTE at step 5

Solution: Check and clean or replace; this is due to “carryover” within the DRS; reduce sample flow to stop carryover.

9 Cause: Sample Shutoff Valve stops sample flow due to sample more than 50°F/10°C in Vortex cooled section of column; opens ambient air port in fail-safe mode

Solutions:
   a. Check Vortex air supply for low pressure; restore pressure or replace air supply; check Temperature Controller PCB for failure; replace PCB
   b. Check Temperature Probe Assembly (thermistor/thermocouple) in DRS column; replace if faulty
   c. Check Temperature Probe position in older units; secure in correct position if needed; replace if faulty

10 Cause: Sample Shutoff Valve stops sample flow due to loss of power or loss of Vortex Cooler air supply; opens ambient air port fail-safe mode

Solution: Restore power or restore air supply.

6.5.2 Condensation appears in handling system flowmeter tubes and filters

1 Cause: Improper installation of transport tubing between DRS and sample handling system that results in a cold spot during low ambient temperatures (less than 50°F/10°C)

Solution: Check transport tubing and correct cold spot (reinstall, repair, or replace).

2 Cause: Sample handling system temperature is less than 50°F/10°C

Solution: Increase temperature of sample handling system to more than 50°F/10°C.

3 Cause: Sample handling system pump pressure is greater than the DRS sample pressure, which raises the dew point of the sample

Solution: Increase temperature of sample handling system to eliminate the condensation.

4 Cause: Temperature Probe Assembly in the DRS column may be faulty; check connections in the electronics housing

Solutions:
   a. Check Temperature Probe (thermistor/thermocouple) function; secure connections if needed
   b. Check Temperature Probe position in older units; secure in correct position if needed; replace if faulty

5 Cause: DRS column outlet flow is too high

Liquid carryover may occur due to the entrainment properties of two-phase (gas-liquid) samples. Since it is not a DRS sample high temperature problem, the Sample Shutoff Valve will not stop the conditioned sample flow from the DRS. The sample handling system flow rate must be reduced and the temperature raised.

Solution: Lower the flow rate at the sample handling system; check the flowmeter range and scale calibration, i.e., Air at STP on H2 stream.

6.5.3 Quench section of DRS column is frozen

1 Cause: Ambient temperature has dropped lower than was anticipated

Solution: Insulate the quench section of DRS column; verify flow after DRS is functioning again.

2 Cause: Sample handling system temperature is less than 50°F/10°C

Solution: Increase temperature of sample handling system to more than 50°F/10°C.
7 Repair

7.1 General instructions

The following surfaces and components will be hot due to the temperature of the sample or the process; these items are burn hazards. Always use insulated gloves and tools when working with the DRS.

- sample inlet, bypass line, connections and valves
- sample return line, connections and valves
- sample remaining in the DRS column and lines
- quench section of DRS column
- service port and attachments
- Vortex exhaust tubing

Circuits inside the Control Enclosure contain high AC/DC voltage levels. When you are working in this unit, be sure the power is turned OFF at the DRS isolation switch and the switch is marked to indicate that work is being done on the DRS with the power off.

Before you start replacing any components within the DRS, you must shut off all power and allow the components to cool to a safe temperature.

Do not attempt any maintenance or repair work until the DRS has been isolated from the process by closing the customer primary block valves.

7.2 Control enclosure

Figure 5 identifies the location of the Temperature Controller and fuse in the Control Enclosure.

7.2.1 Replacing the temperature controller

1. Carefully open the Control Enclosure cover.
2. Loosen the screws of mounting bracket and remove the Temperature Controller.
3. Insert the new Temperature Controller and tighten the screws again.
4. Close the Control Enclosure cover.

7.2.2 Replacing the fuse

1. Carefully open the Control Enclosure cover.
2. Unlock the lever and remove the defective fuse.
3. Insert the new fuse.
4. Install and push down the lever firmly.
5. Close the Control Enclosure cover.

7.3 Pneumatic section

Figure 6 identifies the location of Pneumatic Valve.

7.3.1 Removing the pneumatic valve

1. Remove the three fittings on the pneumatic Valve.
2. Remove the four screws holding the pneumatic Valve in place.
3. Remove the pneumatic Valve from the DRS.
7.3.2 Installing a new pneumatic valve
1 Place the pneumatic valve on the plate.
2 Install the four mounting screws.
3 Install the three fittings, making certain to install each one in its proper place.

7.4 Column section

Figure 7 identifies the location of the replaceable components in the Column Section.

![Column section diagram]

7.4.1 Reworking a flange-mounted column
1 Verify that the sample tap has been turned OFF.
2 Disconnect the DRS from the sample inlet at the Flange Mount.
3 Remove the gasket from the Flange Mount and discard it.
4 Take the DRS to the shop.
5 Disconnect the upper column from the lower column (see Figure 7).
6 On the lower column, turn the column over and empty out the packing beads.
7 On the upper column, remove the screen and empty out the packing beads.
8 Disconnect and remove the RTD.
9 Remove the ball valve from the flush tube on the lower column.
10 Note the location of the score mark on the flush tube.
11 Remove the flush tube and connector from the column and retain the connector for re-use.
12 Install the new flush tube into the connector, being careful to orient the score mark on the tube the same as on the one that was removed.
13 Wrap the connector threads with PTFE tape.
14 Install the new flush tube and connector into the lower column, being careful to have the score mark facing the top of the column.
15 Insert the probe end of the new RTD into the top fitting of the upper column, inserting it until the score mark on the probe is aligned with the top of the fitting.
16 Tighten the RTD fitting to secure it.
17 Repack the upper column with new beads.
18 Install the new screen.
19 Repack the lower column with new beads.
20 Reconnect the upper column and lower column.
21 At the installation site, insert the new gasket onto the Flange Mount.
22 Reconnect the DRS to the sample inlet at the Flange Mount.
23 Turn the sample tap ON and check for leaks.

7.4.2 Removing the I/P transducer
1 Unscrew the bottom (electronics module) cover of the I/P Transducer (see Figure 8).
2 Loosen two wires in the I/P Transducer and then disconnect them.
3 Loosen earth cable on the I/P Transducer and then disconnect them.
4 Reinstall the cover on the I/P Transducer.
5 Remove Fitting #1.
6 Remove Fitting #2.
7 Remove the plug from the I/P Transducer and retain the plug for re-use.
8 Remove the cable gland from I/P Transducer.
9 Remove the earth cable from I/P Transducer.
7.4.3 Installing a New I/P transducer
1. Remove the bottom (electronics module) cover from the I/P Transducer.
2. Route the cable into the I/P Transducer, connect black wire to + and white wire to - terminals.
3. Install cable gland on the I/P Transducer.
4. Clean the threads on the connections.
5. Wrap the connector threads with PTFE tape.
6. Install fittings #1 and #2.
7. Install the plug on the outlet connection of I/P Transducer.
8. Select the correct range by dip switch, refer to below figure.

![I/P Transducer DIP switch setting](image)

Figure 9 I/P Transducer DIP switch setting

9. Install the cover on the I/P Transducer.

7.4.4 Removing the solenoid valve
1. Unscrew the front cover of the solenoid valve (see Figure 10).
2. Loosen two wires in the solenoid valve and then disconnect them.
3. Loosen earth cable on the solenoid valve and then disconnect them.
4. Reinstall the cover on the solenoid valve.
5. Remove Fitting #1.
6. Remove Fitting #2.
7. Remove the solenoid valve from the cable gland.

![Solenoid Valve](image)

Figure 10 Solenoid Valve

7.4.5 Installing a new solenoid valve
1. Remove the font cover from the solenoid valve, using a M5 hex key wrench.
2. Route the cable into the solenoid valve.
3. Install cable gland on the solenoid valve.
4. Clean the threads on the connections.
5. Wrap the connector threads with PTFE tape.
6. Install fittings #1 and #2.
7. Connect the wires inside the solenoid valve to the terminals.
8. Install the cover on the solenoid valve.
9. Connect earth cable on the solenoid valve.

7.4.6 Removing the RTD sensor
1. Unscrew the top cover of the RTD sensor (see Figure 11).
2. Loosen three wires in the RTD sensor and then disconnect them.
3. Remove the cable gland form the RTD sensor.
4. Unscrew the RTD senor from thermowell via RTD fitting.

![RTD connection: RTD fitting & thermowell](image)

Figure 11 RTD connection: RTD fitting & thermowell

7.4.7 Installing a new the RTD sensor
1. Wrap the connector threads with PTFE tape.
2. Install the RTD senor in the thermowell.
3. Remove the top cover from the RTD sensor.
4. Route the cable into the RTD sensor.
5. Clean the threads on the connections.
6. Connect the wires inside the RTD sensor to the terminals.
7. Install the cover on the solenoid valve.
8 Replacement parts

8.1 Ordering information

This section lists the replaceable parts and components by their location in the equipment. Part numbers and drawing numbers listed here are for identification purposes only. Since the particular application defines the component parts specific to any given system, refer to the “Recommended Spare Parts Lists” in the final document package to obtain the full and correct part number for the desired part or assembly.

8.1.1 Equipment identification

Include the following information, found in the final document package and on the nameplate, in any communication concerning replacement parts or components:

- Sales Order Number.
- Serial Order Number.
- Model Number.
- Purchase Order Number.
- Description of part.

8.1.2 Configuration identification

The nameplate (see Figure 12) lists the analyzer configuration information.

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature Controller, DRS219 (Factory Programmed)</td>
<td>3KXGDRS219U0200</td>
</tr>
<tr>
<td>Fuse, 400 mA, Slow Blow (115 VAC)</td>
<td>3KXGDRS219U0350</td>
</tr>
<tr>
<td>Fuse, 200 mA, Slow Blow (230 VAC)</td>
<td>3KXGDRS219U0250</td>
</tr>
</tbody>
</table>

Figure 12  Typical nameplate

Figure 13  Control enclosure
### 8.2 Pneumatic section

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vortex Tube</td>
<td>3KXGDRS219U0600</td>
</tr>
<tr>
<td>Pneumatic Valve</td>
<td>3KXGDRS219U1100</td>
</tr>
</tbody>
</table>

![Figure 14 Pneumatic enclosure](image)

### 8.2 Column section

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/P Transducer</td>
<td>3KXGDRS219U0300</td>
</tr>
<tr>
<td>Solenoid Valve</td>
<td>3KXGDRS219U0500</td>
</tr>
<tr>
<td>Pressure Booster</td>
<td>3KXGDRS219U0400</td>
</tr>
<tr>
<td>Resistance Temperature Detector (RTD)</td>
<td>3KXGDRS219U0900</td>
</tr>
<tr>
<td>Pressure Regulator</td>
<td>3KXGDRS219U1300</td>
</tr>
<tr>
<td>Ball Valve</td>
<td>3KXGDRS219U1200</td>
</tr>
</tbody>
</table>

![Figure 15 Column section](image)
Note
Note
Note