



Danamark
W A T E R C A R E



DanaHub Module #8 – Espresso



What we will cover in this section

- **Basic Equipment Operation**
- **How Water Quality Impacts the Beverage & Equipment**
- **Potential Water Quality Problems**
- **Softening, Filtering & Buffering Systems**
- **Reverse Osmosis**
- **Profit Opportunity**
- **Importance of NSF**



Specialty Coffee – Espresso, Cappuccino...

By all estimates, Specialty Coffee is the fastest growing segment of the coffee industry.

This group of coffee professionals engages in a never ending quest to produce The Perfect Cup from a selection of coffee beans, roasting techniques, and brewing methods imported from around the globe.

Brewing to perfection strives to obtain the optimum aroma, taste, body and texture for each type and style of Specialty Coffee drink.



Specialty Coffee

Specialty Coffee is very focused on maximum control during the entire process:

- Growing, selection and roasting of robust beans for precise aromas and flavors
- Coffee grinding to expose the correct surface area and control density for brewing
- 3.25 to 4.25 ounces of coffee grind (depending upon style) to $\frac{1}{2}$ gallon of hot water
- Brewing temperature control at exactly 190 degrees F
- Flow control through the coffee grind for optimum extraction rates
- 1.15 to 1.35% Coffee Soluble Content for target strength in the final drink



Espresso

Espresso is an intense, aromatic coffee beverage, drawn under pressure to produce the concentrated essence of fine coffee in a 1.5-ounce shot.

Some have suggested that the Italian word “Espresso” (speed) may also suggest that each drink is made “expressly for” a customer; fresh to order; drawn within 20 seconds, and served at once.

Espresso coffee beans are usually dark roasted and finely ground to release the intense flavors required for this drink. Approximately 7 grams of the coffee grind is packed into a metal porta-filter and locked into the espresso machine.

Cold water enters the steam boiler and is heated to almost 195 degrees F, then forced through the grind with pressure exceeding 100 pounds per square inch. The brewing process is completed in less than 20 seconds, and produces about 1.5 ounces of liquid espresso drink. The balance of the water supply is superheated to steam and dispensed through an arm or “wand” to produce steamed milk for a variety of drinks.



Dissolved Solids

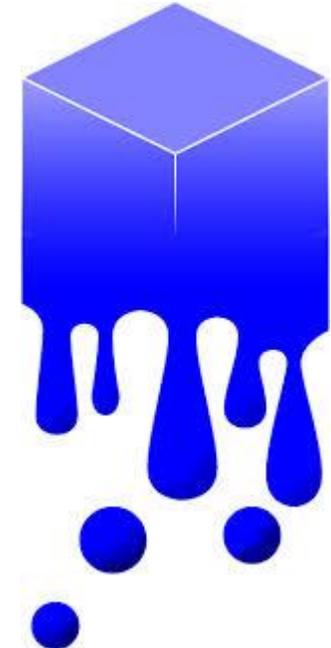
Like their counterparts in the Traditional industry, Specialty Coffee professionals are very concerned about the effects of water solids, chemical tastes and mineral scale on beverage quality and equipment performance.

But many also firmly believe that the dissolved mineral content must be controlled to produce The Perfect Cup.

Remember that coffee brewing is the process of extracting solids from ground coffee beans into a liquid and that the Specialty Coffee industry targets 1.15 – 1.35% Coffee Soluble Content (dissolved coffee beans into water) as the acceptable range for quality brewing. The balance of The Perfect Cup is clean, clear, hot water.

Also remember that the dissolved mineral content in any water supply adds density to the liquid. A water supply with 500 mg/L of Total Dissolved Solids (minerals) is much more dense than a supply with less than 100 mg/L.

The added density of higher mineral content changes the contact time in the brewing process – which alters the extraction rate. The hot water stays in the brew basket a little longer, and this can result in overly strong, sour or bitter tastes.



Water Specification Targets

For this reason, the Specialty Coffee Industry recommends water specification targets that also focus on the dissolved mineral content in the water supply.

- 150 mg/L of Total Dissolved Solids Acceptable Range: 75 – 250 mg/L
- 3 grains of Water Hardness Acceptable Range: 1 – 5 Grains per Gallon
- 40 mg/L of Carbonate Alkalinity Acceptable Range: 10 – 100 mg/L
- 10 mg/L of Sodium Acceptable Range: 10 - 30 mg/L
- Neutral pH Balance

To reach these water specifications we must reduce the dissolved mineral content in all water supplies with more than 250 mg/L. This can be accomplished with a Reverse Osmosis System, followed by a mineral blending process to reach the 150 mg/L target.

We will review RO further into this module.

Types of Espresso Equipment

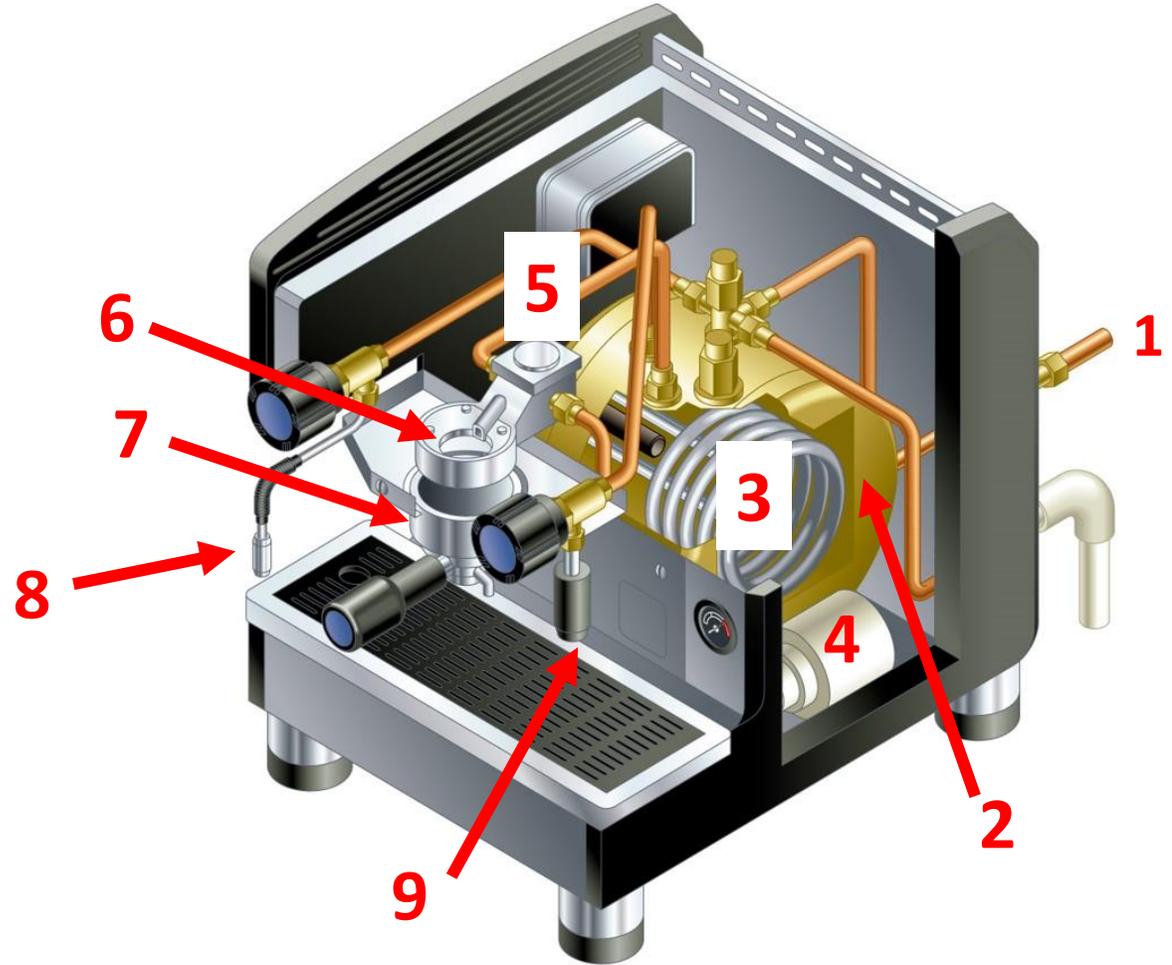
There are four basic types of espresso machines available:

- Manual espresso machines, as the name suggests are labor intensive, and require a greater level of operator skill. The barista (bar man) uses a pump handle to force hot water through the espresso coffee grind and his skill and timing will determine the drink quality. These machines are not typically seen in volume commercial use.
- Semi-automatic machines use an electric pressure pump with an on/off switch to control the timing of each shot. The porta-filter unit must be manually loaded, tamped, and cleaned with this equipment option.
- Automatic machines function in a similar manner to semi-automatic machines. However, electronic components and preset brewing options allow for one touch operation with the exception of loading coffee.
- Super automatic machines do everything that an automatic machine does and also grind coffee.



Components of an Espresso Machine

- 1) Water Supply
- 2) Reservoir
- 3) Heating Coils
- 4) Pump
- 5) Distribution Lines
- 6) Group Head
- 7) Espresso Basket
- 8) Steam Arm/Wand
- 9) Hot Water Dispenser



How Water Abuses Espresso Equipment & the Beverage

Dirt particles and other small solids create a variety of problems in the espresso equipment. The solids can clog small orifices and solenoids. They also provide the basis for mineral scale formation.

Just as a snowflake is formed around a nucleation site, mineral scale also needs a starting point. A substantial amount of what we call mineral scale is actually dirt particles that are present in untreated water and captured in between the minerals as they precipitate.

Dissolved Solids or minerals (calcium, magnesium, iron, etc.) precipitate out of water when it is heated. This process is referred to as the development of mineral scale. Scale insulates heating elements and fire tubes, coats submerged control sensors, clogs control valves and pipes.



How Water Abuses Espresso Equipment & the Beverage

Dissolved Solids – continued:

The layer of scale inhibits the heat transfer from the elements or tubes to the water supply, and slowly destroys the metals in these components. Scale removal requires considerable effort to open the boiler and remove the large chunks of rock, and finish the process with the use of harsh chemicals. These deliming agents chemically break down the rock into liquid minerals that can be flushed from the boiler, but they can also eat away layers of metal in the process.

Chemicals that are added to water for disinfectant purposes are no longer needed in water used to produce espresso. When water containing high levels of oxygen, chlorine, chloramine, chlorides (or other acidic conditions) is heated, the resulting gases can rapidly corrode the boiler shell. The same chemical contaminants can also create taste problems or a bitter after-taste in the drink.



The Answer for Espresso Machines

Remember that water contaminants come in three basic groups . . . solids, chemicals and dissolved solids & gases

A complete treatment approach should include the following:

- Reducing the amount of solid particles in the water by mechanical filtration.
- Reducing the chemical contaminants such as chlorine with activated carbon.
- Reducing the effects of mineral content in the water supply.

Everpure has the answers to water treatment for espresso machines. Remember that the issues are very similar to coffee equipment but there is much greater emphasis on scale reduction!



Choosing the Right System - Guidelines

Depending on the level of hardness, the effective treatment for espresso applications is a marriage of two separate technologies:

Carbon filtration followed by Water Softening

It is imperative to consider sizing issues for each process. Review each of these questions to determine the best combination of available product for your customer's needs:

1. Peak Flow Rate? Determine the number of espresso machines that will be served by your choice of treatment system. These units have a very slow water flow, but you should never select plumbing or tubing less than 3/8" i.d. for espresso applications. If there are more than three machines, it may be wise to consider a 1/2" water supply.
2. Required Volumes? Next you will need to determine the number of gallons to be treated each day, week, or service cycle. You can estimate the gallons of treated water needed each day by remembering that a 1.5 ounce shot (serving) requires approximately 4 ounces of water for the drink, extra hot water, steam use, and washing / waste.

This information will quickly translate into approximately **32 drinks per gallon of filtered water**.

Choosing the Right System – Guidelines – cont'd

Since most customers prefer a bi-annual filter service cycle, multiply the number of gallons needed each day by 180 days to begin determining your options. Then you need to factor in hardness levels. The number of grains per gallon can be estimated with a simple test strip.

640 drinks per day = 20 gallons per day x 180 days = 3600 gallons / 6 months

Everpure Softening, Filtering & Buffering Systems

Sizing Guidelines EXAMPLE

Grains of Hardness	Up to 150 shots per day	Up to 300 shots per day	Up to 500 shots per day
8	ES07 Single or Claris Ultra M	ES07 Twin or Claris Ultra L	ES07 Triple or Claris Ultra XL
12	ES07 Twin or Claris Ultra L	ES07 Triple or Claris Ultra XL	Claris Ultra XXL or RO

Basics of RO

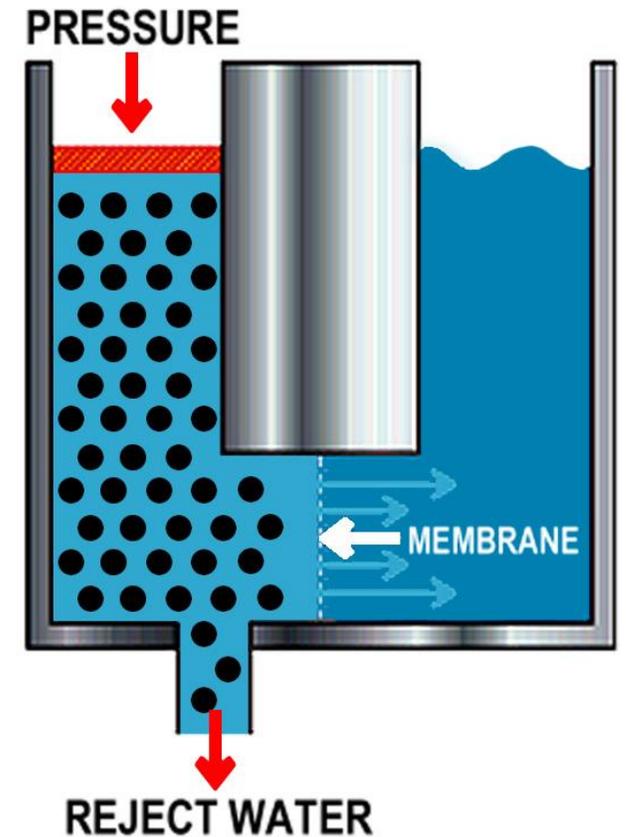
At higher hardness levels, RO is the best solution. Here is an overview of RO.

Reverse Osmosis Systems include a container or housing (RO Module) with a semi-permeable membrane.

As water passes through the module, some water molecules and a small percentage of dissolve minerals will pass to the product side of the membrane. The remaining water and concentrated minerals will travel as waste water to the drain.

Selection and proper use of an RO system always requires some planning around each of the following:

- Rejection Rate
- Recovery Rate
- Production Rate / Temperature
- Storage Tanks
- Water Pressure



Rejection Rate

Rejection Rate = Expresses the percentage of dissolved minerals that will be removed from the product water.

Most commercial RO Systems are designed to remove about 95% of the dissolved minerals, but service technicians should verify the Rejection Rate during installation and periodic service for each system. This task can be completed with a small pocket TDS Meter and the following formula:

Extreme levels of dissolved mineral content in the raw water supply will reduce the Rejection Rate and the Production Rate. If your customer's water supply has more than 1,000 mg/L of dissolved solids, you should discuss the need for a Booster Pump and the possibility of adjusting the Recovery Rate.

Increasing the inlet pressure and flushing more waste water to drain will help to dilute the mineral concentrations and prevent excessive fouling on the surface of the membrane.

$$\frac{\text{TDS Raw} - \text{TDS Product}}{\text{TDS Raw}} = \% \text{ Rejection Rate}$$

TDS Raw



Recovery Rate

Recovery Rate = Expresses the percentage of inlet water supply that will be available for product.

Most of the commercial RO Systems will provide 30 – 50% recovery when used within factory specifications.

Remember, the balance of the water (50 – 70%) is used to flush the rejected mineral content down the drain.

Locations with very high TDS / mineral content may require increased flushing action to prevent fouling of the membrane.

The Recovery Rate should also be verified during install and service visits. Use a measuring cup and the second hand on your wrist watch to count the ounces of product water in 60 seconds, and repeat the measurement for waste water.

$$\frac{\text{Product Water Per Minute}}{\text{Product + Waste Water Per Minute}} = \% \text{ Recovery Rate}$$

Production Rate

Production Rate = Expresses the volume of product water from the RO System and is usually expressed in gallons per day.

Each RO module is factory rated for daily production within certain operating conditions, but you must remember that the membranes produce water at a slow and steady rate.

Always review the Production Rate in gallons per hour (or gallons per minute) and compare against peak business demands to determine whether the volume from the selected system will be adequate for your customer's needs.

Gallons Per Day = Gallons Per Minute

1,440 Minutes Per Day



Temperature

RO modules are factory rated for daily production within certain operating conditions.

Reverse Osmosis membranes are factory production rated at 77 F degrees, and the amount of product water that you will obtain in any location is very dependent upon the water temperature.

In basic terms, cold water is more dense than warm water, flows through the membrane at a much slower speed, and delivers a lower production rate. A temperature correction chart is provided on the next slide, but it is always advisable to assume a 50% production loss during the winter months in cold climates.

Your choice of an RO System should always consider the effects of water temperature on expected production rates.



Storage Tanks

Storage of Product Water will almost always be required in the specification of RO Systems.

Many equipment designs include a pressurized bladder tank for this purpose, but some new systems offer an atmospheric tank with a small pressure pump to send the product water to the foodservice equipment.

This option requires a much smaller storage space, and allows the customer to choose larger storage volumes.

If a 240 gpd membrane produces 10 gallons per hour, and the business needs 50 gallons during the 2 hour morning rush, they will need 30 gallons of stored water to meet the peak demand.

A 30-gallon bladder tank requires a container almost as large as a commercial water heater, but the 30-gallon atmospheric tank will fit into a 4-cubic foot box with approximately 24" x 24" x 12" dimensions.

You may want to remember that each cubic foot will hold about 7.5 gallons of water.

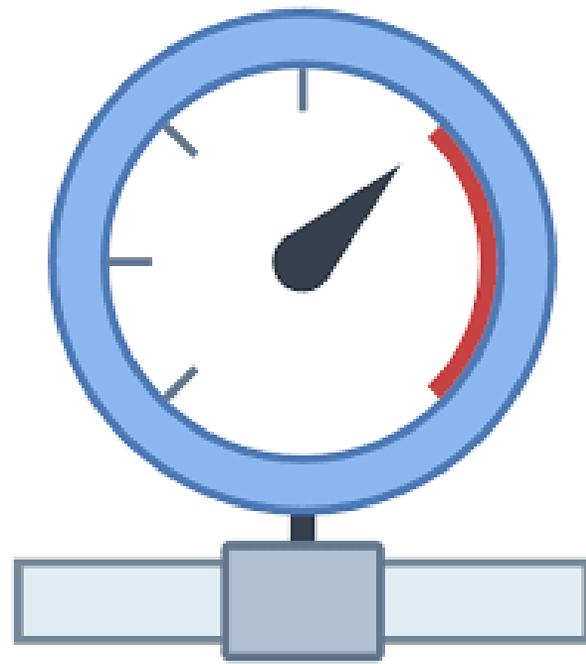


Inlet Water Pressure

All RO membranes require inlet water pressure to operate efficiently, and larger commercial units may include booster pumps that produce 150-200 psi for this purpose. In basic terms, higher inlet pressure increases the Rejection Rate and the daily Production Rate.

Note: “low pressure” membranes are offered in Everpure MRS Systems. This generally means that these membranes will operate within a range of 50-80 psi inlet pressure.

If your customer’s building pressure is less than a steady 50 pounds at all times, it is strongly recommended that you include a small booster pump.



The Importance of Blending – Two Options

To obtain the Specialty Coffee water specification of 150 mg/L dissolved mineral content and 3-5 grains of water hardness, it will be necessary to blend some calcium back into the RO product water in most locations. This target can usually be achieved by one of the following methods.

1. Calcium Feeder: A container or housing filled with a soft calcite material can be used to feed some hardness back into the water supply. The RO product water, with approximately 5% of the original TDS, will dissolve a small amount of the soft calcium – but you should remember that this method is usually limited to 1-2 grains of increased water hardness. This method may provide the only available option when the inlet water has been softened, and the RO product water only contains sodium cations.

2. Blending Filtered Water: After the suspended solids and chemical contaminants have been removed by filtration, a portion of the original water supply can be blended into the RO product water to increase the level of hardness. This method is more flexible and allows the use of a simple blending valve to dial into a desired target of water quality. The initial adjustment can be focused on the 150 mg/L target for dissolved mineral content, but remember to verify the critical 3-5 grains of hardness – and adjust the blend, if needed.



The Importance of Blending – cont'd

The added advantage of blending filtered water includes the ability to adjust the equipment settings when the significant changes occur in the customer's water supply. Most municipal supplies have reasonably stable TDS content during the course of each year, but cities occasionally change water sources to avoid specific problems or increase volume.

One final advantage of blending filtered water must be stated. Filtered Blending will add to the MRS System daily Production Rate. By adding some filtered water to the RO product water, you will increase the total capacity of the system and this can help offset the effects of temperature correction for the RO membrane.

Example:

At 500 TDS Raw Water
1.0 Gallon of Filtered (500 mg/L) Water
<u>+ 2.8 Gallons of RO Product (25 mg/L) Water</u>
= 3.8 Gallons of Blended (150 mg/L) Water



Let us help you size the right system...

Please remember that filtration sizing is not an exact science. Proper sizing will vary based on the amount of suspended solids in the water supply, and the available pressure to push water through the filters. In addition, multiple espresso machines will increase the peak water flow demands.

The product sizing recommendations assume:

- Less than 2.0 NTU of turbidity content in water.
- 50 PSI steady inlet water pressure.
- Moderate levels of water hardness (up to 20 grains).
- One to two espresso machines serviced by each treatment system.

The best selection may be different if water conditions vary from these assumptions.

Please contact our technical care team to assist you:

Email: technicalcare@danamark.com

Direct toll free: 1-888-326-1108

Profit Opportunity

We refer to Everpure products as 'backward compatible' which means that all our replacement cartridges fit into existing Everpure hardware regardless of when it was purchased. The universal design of the filter head/heads means your customers can enjoy new technology cartridges as they are introduced and you have lots of options in your 'toolkit' to address their needs in the future.

In addition to the ongoing revenue stream associated with selling water filtration systems, Everpure offers a broad range of 'upgrades' in the form of higher capacity cartridges, should you need longer life. Problem solving cartridges for problematic water and even shorter cartridges should you be tight on space.

By keeping track of your system sales and scheduled cartridge changes, and providing your customers with a planned PM programme, you can build a nice business that will only grow year over year.



Importance of NSF Certifications & Food Safety

The National Sanitation Foundation (NSF) is an independent third party certification organization. Drinking Water Treatment units are voluntarily submitted for certification. Everpure has the most certified products on the market today.

NSF/ANSI Certified Drinking Water Treatment units undergo the following testing:

- Extraction testing to ensure that wetted parts do not leach contaminants
- Structural Integrity testing
- Literature review to ensure honest and accurate product performance claims
- Performance testing against specific contaminants, per the NSF/ANSI Standard.

Look for the NSF Mark:

- NSF/ANSI Standard 42 certifies aesthetic claims, which include mechanical reduction of solids and reduction of chlorine.
- NSF/ANSI Standard 53 certifies health claims. NSF/ANSI Standard cyst reduction certification requires 99.95% or greater of cysts removed.



Protecting Espresso Equipment is as easy as 1,2,3

- 1) Install the proper Watercare Equipment
- 2) Assure results with the proper installation
- 3) Establish a Preventive Maintenance Schedule & Stay on Schedule!

Establishing Regular Preventative Maintenance (PM) with the customer and replacing filter cartridges when needed, is of paramount importance.

Preventative maintenance can be assured by scheduled automatic service calls, auto ship programs or by sending automatic reminders to the customers.

Remember: S I R - Select - Install - Replace

Is the key to providing quality, protecting equipment and selling filters.



Recap

WaterCare is a great business to be a part of...it benefits your customers and their operations and it provides you with a new revenue stream.

Water filters pay for themselves through:

- Customer satisfaction by delivering consistently high quality water, day in and day out
- Reduced emergency maintenance, wear & tear on equipment
- Extended equipment life, less deliming with harsh chemicals
- Peace of mind –water is food and food safety is everything (NSF Certification)

Thank you for your time.

This concludes our DanaHub Module on Espresso

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