



CEMENTITIOUS Grouts - Mixing

Five Star® prepackaged cementitious grouts are formulated with additives (corrosion inhibitors, plasticizers, water reducing agents, etc.) which take effect only when water is added to the dry material and the grout is thoroughly mixed with a high shear mixer. Use of a mortar mixer (stationary barrel with moving blades) with shearing action is required to completely mix Five Star® cementitious grouts. For small volume bucket mixing, refer to Section D.

Many Five Star® cementitious products appear too dry until the additives in the mix react with the water.

If the minimum water volume has been added and the product still appears dry, the product probably hasn't been mixed thoroughly enough or long enough. Mix the product for an additional minute before adding additional water.

- For mortar mixer guidelines, refer to Five Star® Technical Bulletin 406 *Recommended Mixers for Cementitious Materials*.
- For information on how to mix material packaged in bulk bags refer to Five Star® Technical Bulletin 405 *Mixing Bulk Bags in a Ready-Mix Truck*.
- Mixing by hand, including the use of an electric handheld mixer with a propeller blade, may produce a less thorough blend, will take more time, and may result in lower strength, lumps, segregation, and less flowability. Hand mixing should be used only when a very small amount of grout is needed.

A. Prior to Mixing Product

The following needs to be determined:

- Minimum water volume per bag
- Maximum water volume per bag
- 90% of maximum water volume per bag
- Number of bags/units to be mixed at one time (based on size of the mixer, coarse aggregate extension, etc.)¹

Calculate the minimum water, maximum water, 90% of the maximum water volumes, and the number of bags of Five Star® grout for each batch. These volumes are referred to as “batch mix water volumes” in the Mixing Procedure.

The published minimum water volume per bag/unit is the amount of water that must be added to make a mixture usable and activate the additives in the grout.² The published maximum water volume per bag/unit is the amount of water that if added will result in the material performing and developing the properties described on the Five Star® Technical Data Sheet.³

Adding less than the minimum water volume, not thoroughly and completely mixing the grout, and/or adding more than the maximum water volume will result in the Five Star® product not performing as described on the Technical Data Sheet. REMEMBER: As the amount of water in the mix goes up, the strength of the grout goes down.

The grout will mix more completely if the user adds the water in multiple steps. Wherever possible, the user is encouraged to use a volume of water that is less than the maximum water volume. The lower the water content in the mix the higher the strength of the material.

Through extensive testing and observation, Five Star Products has found that if 90% of the maximum mix water is added on the initial mix, the remaining 10% of the mix water often does not need to be added to achieve a desirable consistency.



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Refer to Five Star® Cementitious Grouts Mix Water Chart below for 90% and 10% calculations per bag.

CEMENTITIOUS GROUTS	WEIGHT	MINIMUM WATER	MAXIMUM WATER	90% OF MAX*	10% OF MAX*
Five Star® Grout	50 lb. (22.7 kg)	3.5 qts (3.3 L)	5.5 qts (5.2 L)	5 qts (4.7L)	0.5 qts (0.47L)
Five Star® Fluid Grout 100	55 lb. (25 kg)	4.5 qts (4.2 L)	FLUID: 5.5 qts (5.2 L)	FLUID: 5 qts (4.7L)	FLUID: 0.5 qts (0.47L)
Five Star® High Strength Grout	50 lb. (22.7 kg)	2.75 qts (2.6 L)	3.75 qts (3.5 L)	3.25 qts (2.8 L)	0.5 qts (0.47L)
Five Star® High Strength 130 Grout	50 lb. (22.7 kg)	3.25 qts (3.1 L)	4.5 qts (4.2 L)	4.0 qts (3.8 L)	0.5 qts (0.47L)
Five Star® Hybrid Grout	45 lb. (20.4 kg)	3.3 qts (3.0 L)	3.6 qts (3.5 L)	3.25 qts (3.1 L)	0.35 qts (0.33 L)
Five Star® HTR Grout	50 lb. (22.7 kg)	3.0 qts (2.8 L)	3.5 qts (3.3 L)	3.0 qts (2.8 L)	0.5 qts (0.47 L)
Five Star® Special Grout 400	49 lb. (22.2 kg)	6.0 qts (5.7 L)	6.5 qts (6.2 L)	6.0 qts (5.0 L)	0.5 qts (0.47 L)
Five Star® Instant Grout	55 lb. (25 kg)	3.0 qts (2.8 L)	3.5 qts (3.3 L)	3.0 qts (2.8 L)	0.5 qts (0.47 L)
Five Star® Cementitious Underwater High-Strength Grout	50 lb. (22.7 kg)	4.0 qts (3.8 L)	4.25 qts (4.0 L)	4.0 qts (3.3 L)	0.25 qts (0.24 L)
Five Star® NSG Grout	50 lb. (22.7 kg)	3.0 qts (2.8 L)	4.5 qts (4.2 L)	4.0 qts (3.8 L)	0.5 qts (0.47L)

*Values may be approximated or adjusted to be at least equal to the Minimum Water to make measurements easier in the field.

B. Material, Equipment, and Labor Requirements and Recommendations

- Cold or iced potable water should always be used for the product's "mix water" unless the product is being installed in ambient conditions less than 40° F (4° C).⁴
- An adequate supply of potable water shall be available for pre-wetting, mixing, and cleaning.
- Know the working time of the grout. Do not mix more grout than can be placed within the working time of the grout.
- If the depth of the grout placement requires that coarse aggregate be added to the mix, refer to Five Star® Technical Bulletin 105 *Cementitious Grouts Aggregate Extension Guidelines*.
- The planned volume that can be mixed in any mixer should not exceed 1/2 of the total volume of the mixer. It is recommended that a trial/test batch of grout be mixed to confirm the capability of the mixer.
- Having multiple mixers available is always preferred to relying on a single mixer.
- It takes an average of 5-10 minutes to mix and dump a batch of grout.
- Five Star recommends six individuals per mortar mixer to efficiently mix, transport, and place the grout.

C. Mixing Procedure

Total mixing time per batch is approximately 5 minutes. Mixing longer than that will add heat to the mix and shorten the working time of the grout.

1. Prior to mixing the first batch:
 - Inspect and clean the mixer; the blades must be in good physical condition and be able to make contact with the walls of the mixer. The mixer should be robust and in top working order. Testing of the mortar mixer is recommended prior to using it to mix grout.
 - Wet down the inside of the mixing chamber with potable water and drain the water out. This is referred to as "wetting out the mixer." Note: Wetting out the mixer is also an effective way to cool off the mixer if it is at a temperature greater than desirable.

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2. Accurately measure 90% of the batch mix water volume in one container and in a second container accurately measure 10% of the batch mix water volume.
3. Add 90% of the batch mix water volume to the mixer.
4. Start the mixer.
5. Add the correct number of bags of the Five Star® grout.
6. Mix for 3 – 4 minutes at high speed. The grout should develop a flowable, non-dry consistency once the additives in the product react to the mixing and the water.
7. Stop the mixer and check the consistency of the batch and whether the grout is flowable enough to be installed.
8. If more water is necessary, start the mixer and slowly add a portion of the remaining 10% of the batch mix water (in intervals) and allow the material to thoroughly mix. Do not add more water than is published on the bag or an amount that will cause segregation.
9. Stop the mixer and check the consistency of the batch and whether the grout is flowable enough to be installed.
10. Repeat steps 8-10 as required but stop adding water once the desired consistency is achieved, or the maximum amount of batch water is added (the 10% container is empty).

NOTE: Steps 7-10 should take approximately 2 minutes or less.

It is recommended that the initial batch is used to evaluate the consistency of the grout. Strength sampling should occur at a later batch when the consistency has reached a steady state. Several times during the working time of the material inspect the mixer and scrap any unused grout down into the drum and dump it out of the mixer.

CAUTION: Wear appropriate PPE to protect personnel from dust, splashes, etc. (safety glasses, face shield, dust mask, gloves are all recommended). Un-cured mixed grout can be cleaned up with soap (i.e., Dawn dishwashing liquid) and water. Unused mixed product should be allowed to harden and disposed of with construction debris.

D. Bucket Mixing

Small volumes of grout may be bucket mixed. A drill/mixer with adequate torque is required. For drill and paddle recommendations, refer to Five Star® Technical Bulletin 406 - *Recommended Mixers for Cementitious Materials*.

Prior to mixing the grout, refer to Section A. The requirement for determining the number of bags/units to be mixed at one time is not applicable.

D.1. Material and Equipment Requirements and Recommendations

- Cold or iced potable water should always be used for the product's "mix water" unless the product is being installed in ambient conditions less than 40°F (4°C).
- Know the working time of the grout. ALL of the grout under a piece of equipment should be placed within the working time of the grout.
- A clean 5-gallon pail or larger is required.
- If the depth of the grout placement requires that coarse aggregate be added to the mix, the product should NOT be bucket mixed.
- If planning to use less than a full bag of material, make sure the bag of material is uniformly mixed. Grout settles in shipping so if only a portion of the bag is used, the entire bag must be mixed prior to use to avoid any segregation.
- It takes an average of 5-10 minutes to bucket mix and dump a batch of grout.



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D.2. Mixing Procedure

To bucket mix a Five Star® cementitious grout:

1. Add 90% of the maximum water to the bucket. (Refer to Five Star® Cementitious Grouts Mix Water Chart for amounts)
2. Add ½ of the bag of the grout to the water and mix until all the water is incorporated,
3. Add the remaining grout to the bucket and mix for three to five minutes until a homogeneous material is observed. Note: The material will appear dry until the plasticizers in the product are released, and then the grout will smooth out.
 - a. If the grout is of a consistency that it can be installed, Five Star recommends not adding the remaining water and installing it as is. Grouts mixed with 90% of the maximum water will be stronger than grouts mixed at maximum water.
4. If necessary, use the remaining 10% of the water to adjust the flowability of the mix, and incorporate it into the mix. If more water is added mix another two minutes.

Note: Steps 3 and 4 should take approximately five to seven minutes.

CAUTION: The person operating the drill/mixer should be prepared to resist the torque that will be developed by the mixer. There is a risk of injury from the mixer or bucket “spinning” if both are not securely held down.

For additional information, contact your Five Star® Technical Sales Representative.

¹ If coarse aggregate extension is required, refer to Five Star® Technical Bulletins for Aggregate Extension.

² Certain Five Star® cementitious grouts can be dry packed. When dry packing these grouts, less than the minimum published water will be used.

³ The properties shown on Five Star® Technical Data Sheets reflect typical results based on laboratory testing under controlled conditions at 70°F (21°C). Reasonable variations may result. Installation and curing at temperatures below 70°F (21°C) will result in the material developing lower strength properties.

⁴ Five Star Products (FSP) recommends that cold or “iced water” be used when mixing Five Star® cementitious grouts unless conditioning the product for cold weather installation. FSP has found that cold water maximizes the effectiveness of the water reducing agents in the product.