Centraz Industries
Laundry Product Systems

Recommended Wash Formulas

The right **Wash Formula** is necessary for a good wash. Two possible results of a poor **Wash Formula** are: Soil redeposition and needless rewashes due to stains. Needless washes take up time, product and energy and will result in customer dissatisfaction.

Redeposition is a great problem. It may not be evident immediately but, when the characteristic gray caused by redeposition is apparent it will require several washes, at best, to bring the fabric back to its original state, if ever.

In general, **Wash Formulas** are designed around soil classification and type of fabric. The following are some recommended **Wash Formulas** that should be followed when servicing a laundry. Although it may be necessary to modify a particular formula to meet the needs of a specific soil classification, water condition or fabric, it is strongly suggested that you do not change these **Wash Formulas** greatly. All of the **Wash Formulas** listed below are based on machines rated for 50 lb. wash loads. When using these formulas, refer to the product label to be sure that the supplies are being used correctly (e.g. Bleach 10 should not be used on colored fabrics.)

The Mechanisims of Detergency

Detergency is defined as cleaning power. It is the combination of physical and chemical forces which wet fabric, neutralizes acidic soils, dissolve water soluble soils, saponify fatty soils, emulsify oily soils, and then suspend these soils and prevent them from redepositing back on the fabric until they are removed from the wash wheel.

Mechanical Energy: This is the force that comes from the type of washer that is being used. When fabric is agitated in the wash wheel, the motion helps to loosen soil.

Although you don't have much control over which machine is used at the account, you can see to it that its mechanical energy is not hindered by overloading the machine, preventing good agitation. Washers should only be loaded to 80% of their recommended fabric weight level. Another hindrance to mechanical energy is too much sudsing. Oversudsing will cusion the agitation and thus reduce mechanical energy. The use of low sudsing detergents reduces this problem. In addition, too high a water level can cushion the drop of the fabric, reducing mechanical energy. It will also dilute the chemicals to an unacceptable concentration.

Chemical Energy: The chemical energy needed for cleaning comes from the supplies sold by Centraz. For a more detailed description of these products see their technical data sheets.

Temperature: Chemical energy, mechanical energy, soil removal and suspension are all affected by temperature, e.g., in the case of stains that would be set by increased temperatures, such as proteinaceous stains, lower temperatures are used. In today's programmable machines, these temperatures are adjusted to fit wash requirements. A further discussion of this subject will be found in the section on **Wash Formulas**.

Time: All of the forces listed above require time. Time is needed for the chemicals to react to soils, and fabrics to be rinsed out. Because time is a factor in the profitability of an operation, it has been carefully studied by many people for many reasons. While operation times that are too short can result in poor detergency, times that are too long are of little value and result in customer dissatisfaction. Recommended times for specific operations will be given later.

The important thing to remember is that all of the above factors are adjustable to a degree. For example, if the **Temperature** is too low then it might be necessary to extend the **Time**, or if the **Mechanical Energy** is too low, it might be necessary to increase the **Chemical Energy**. The proper combination of factors should be determined only after a laundry survey is done.

Water and Its Effect On the Laundry

Water plays a paramount role in achieving clean fabric. Water is known as a universal solvent because of its ability to dissolve a wide variety of substances. In its pure chemical state, only a little surfactant is necessary to enable water to wet fabric and do a good job of cleaning. Unfortunately, most water is found with levels of impurities which affect the laundry, e.g., high levels of hardness and iron.

Hardness: The major cause of poor performance of supplies in the laundry and thus a poor wash is water hardness. In addition, each year thousands of dollars are spent on plumbing made useless by scale build-up, the result of hard water.

Water hardness is expressed in parts per million, (ppm), of calcium carbonate but is actually a measurement of dissolved calcium and magnesium ions. These two chemical substances use up laundry supplies and make insoluble chemicals which deposit on the fabric to give a gray wash. The laundry test kit is used to make a determination of the water hardness. This should be done periodically, especially during the spring and fall when the water supplies are disturbed by thermal churning. The nonionic surfactants in the **Centraz Detergents** are less reactive to water hardness and so can work over a wider range of hardness. When the hardness is in excess of 200 ppm, however, increased amounts of supply or a water treatment system should be employed.

Iron: The presence of iron in the water supply with levels higher than 0.2 ppm will cause fabric discoloration and eventual fabric damage. Discoloration caused by iron may appear as a general yellow to reddish brown color. **The Rust Removing Sour** is effective in removing this discoloration. Here, as in the case of hardness, the laundry test kit can be used to determine the presence of iron. Large amounts of iron can be introduced at any time to the water supply by disruption of water lines or the opening of fire hydrants.

Less common impurities in water are chlorine, organic growth, hydrogen sulfide and suspended matter. Since they are not of major concern to use, due to their infrequency, they are only mentioned here.

The use of complex phosphates is one way of treating water hardness. These chemicals tie up the hardness so the water and supplies can do their job of cleaning.

In high hardness areas, the best way to treat water for hardness and other impurities is with a water purification system. These are usually units that have ion exchange resins in them. These units replace calcium and magnesium ions with the sodium ion that will not affect the wash. If the account you are servicing has extremely hard water and does not have a water treatment system, you might suggest that they get one installed. In the long run they will save on time, supplies, and maintenance fees. It should be remembered that water treatment systems have to be properly maintained.

Surfactants

In laundering, the soil removal procedure is one of loosening and lifting soil from a fiber surface and holding it in suspension until it can be removed by rinsing. The compound primarily responsible for soil removal and suspension is the surface active agent, or surfactant. Surfactants also act as wetting agents, which enhance the penetration of textile fiber by water.

Surfactants are divided into three categories:

a. **Anionics:** These are surfactants such as sodium linear alkyl benzene sulfonate, a compound which is found in high suds detergents. This class of surfactant has a relatively high suds profile, with good suds stability, and also the advantage of being a good agent for particulate soil removal. The solubility of anionic surfactants increase as the water temperature in which they are dissolved increases; thus, these surfactants are more effective in higher water temperatures. Anionic detergents are adversely affected by higher water hardness.

b. **Nonionics:** Nonionic Surfactants, such as that found in the Clean Cept detergent, are low sudsing. These surfactants, due to their chemical structure, are excellent for removal of oily soil. Generally Nonionics are more soluble in colder water than Anionics. This makes Nonionic surfactants useful as low temperature wash detergent ingredients. Another advantage of this type of surfactant is it is not affected by water hardness. Nonionics are only fair particulate soil removal agents.

c. **Cationic:** Cationic Surfactants are not used as laundry detergents. However, they are found as the active ingredients in fabric softeners and quaternary disinfectant cleaners.

Regardless of the classification, all surfactants have a “water-loving”, or hydrophilic group, and a “water-hating” or hydrophobic group. It is the interaction between these groups, the wash water and the soil, which make possible soil removal and suspension.

<u>Comparison of Surfactant Types</u>

	Anionic	Nonionic	Cationic
Solubility	Temp. Increases	Temp. Decrease	----------
Sudsing	Voluminous	Low-Medium	----------
Suds Stability	Good-Excellent	Poor-Good	-----------
Detergency			
Particulate Soils	Excellent	Fair	-----------
Oily Soils	Good	Excellent	------------
Emulsifying	Fair-Very Good	Excellent	------------
Soil Suspending	Fair-Good	Excellent	------------
Softening	Poor	------------	Excellent
Bacteriostatic	-----------	------------	Very Good
Anti-Static	-----------	------------	Fair\Excellent

Alkalinity

Detergency is most effective in an alkaline medium. An alkali is one which yields hydroxyl (OH) ions in water. Alkalies are found to have a pH above 7 on the pH scale. Some common laundry alkalies and their pH in a 1% solution are:

Alkali	**pH**
Sodium Orthosilicate	13.0
Sodium Metasilicate	12.6
Sodium Carbonate	11.3
Sodium Hydroxide	13.1
Trisodium Phosphate	12.1

Alkalies have the property of being synthetic detergent boosters, in that they aid in soil suspension and act as pH stabilizers, especially in heavy soil medium.

Soils which are particularly affected by alkali are kitchen grease, perspiration stains, and other such fatty soils. Petroleum based stains are not affected by alkali.

Typical Synthetic Detergent Components and Their Role in Washing

Ingredient Category	
Surfactant	Wetting, lifting and suspending agent for soil.
Builder (Sodium Tripolyphosphate, NTA, Sodium Carbonate)	Hardness neutralizers.
Anti-redeposition agent (Carboxymethyl Cellulose/ Polyacrylates)	Suspension of soil during wash.

Opitcal whiteners (F dyes)	Mask yellowing or graying of wash.
pH buffers (Sodium Silicates)	Maintain pH of wash.
Perfumes	Consumer acceptability of product <u>and in some cases substantive perfume for fabrics</u>
Colorants	Consumer acceptability.

Listed above is a typical synthetic detergent system. Some of these ingredients may be found in both liquid and powdered detergents but all of them need not be in every product.

The Wash Formula

The **Wash Formula** is a step-by-step procedure that is designed to combine time, water temperature, mechanical action and chemicals in the best possible way to achieve clean fabric. The Wash Formula is like a computer program in that it controls the operation and sequence of events in the washer to perform the task of treating specific wash problems in a cost efficient manner. Since wash loads are quite different, especially in commercial laundries, different **Wash Formulas** have to be designed to meet different needs. It is for this reason that the programming of the **Wash Formula** is done at the account with formula cards that are easily changeable from wash to wash once the initial cards are made. The duty of making these cards rests with the chemical supply person; he is the technical expert that knows when his products will do the most good. It is his responsibility to analyze the wash loads to be processed and determine the **Proper Formula**. The **Wash Formula** consists of several steps. Let's begin the study of the **Proper Formula** by first defining and explaining the steps involved.

The **Flush** usually consists of water at a high level without supplies. In essence, it is a rinse used to remove some water soluble soil such as particulate and proteinaceous soils; also, the **Flush** can be used to bring up the bundle temperature. In the case of proteinaceous soils like blood, semen, and food, lower temperatures between 100 to 110 F are necessary to avoid setting the stains. These temperatures may not be high enough for soil removal for the rest of the wash.

In general, the **Flush** can be of great assistance to the wash operations that follow. It will remove soil that does not need to be removed with product and will bring up the bundle temperature so that a cold washer shell and wash load will not lower the temperature of the next step.

The term **Break** applies to the first operation wherein alkali or emulsifier is used at a low water level. This operation is used when large amounts of fatty or oily soils are present. A **Break** alone will help to loosen soil if done at the appropriate temperature. The use of a **Break** in this manner can save on detergent costs and acts as a detergency booster to the wash.

The **Suds** is the operation where surfactant, either soap or detergent, is added at low water levels. The soil-to-cloth bonds are "broken" and soil is suspended and made ready for removal. This operation is best done at high temperatures. A few suds operations may be necessary if soil level is very heavy.

The **Bleach** is run at temperature in the range of 140 to 160 degrees F. Chlorine bleach works best in the alkaline pH range; this operation will rely on residual supply from the **Break** and/or **Suds** to assist in proper pH maintenance. Oxygen bleaching requires temperatures of 120 to 150 degrees F. or higher.

The **Break**, **Suds**, and **Bleach** may be combined. The operations would then take their names from those combinations, i.e. **Break/Suds**, **Suds/Bleach**, and **Break/Suds/Bleach**.

These combinations may be created to save time or treat a particular soil problem. It is always advisable to use the most products in the beginning of a wash and work down from that point, so the concentration of product is proportionate to the concentration of soil.

A **Flush** may be inserted between these operations to dilute soil concentration or change temperatures.

The **Rinse** is the operation that removes the residual products and soil. A **Rinse** longer than 3 minutes is a waste of time in that it can do little after that. A few rinses are required to remove any residual product. **Rinses** are also used to bring bundle temperature down to a temperature that can be handled by the operators. In the case of polyester fabrics, this operation should only drop the temperature no faster than 20 F. for 15 or 20 minutes when possible in order to avoid the setting of wrinkles.

The **Sour** operation is usually the last operation involving water. **Souring** neutralizes residual alkalinity and lowers the pH of the fabric to either an acceptable range for human skin, (pH range between 5.5 and 6.5) or to a pH that will be process able in a flatwork ironer. If fabric that is in contact with human skin for prolonged periods of time is unsoured, skin irritation may occur. If the fabric is processed in a flat work ironer without proper souring, curling, browning and/or fading of colors may occur. The **Sour** operation, as with all usual supply operations, is done at low water temperatures because of its location at the end of the wash. Special water conditions may require a rust removing sour. In addition to the above stated reasons for the **Sour**, this operation can be used to remove discoloration on fabric that comes from rust in the water supply.

The **Softener** operation is used to introduce fabric softener to the wash. This is to impart a soft feel to items being washed, as well as reduce static charges on polyester/cotton fabrics. This operation can include a bacteriostatic softener, which has the property of inhibiting the growth of certain micro-organisms which are present in storage and during fabric use. The Softener operation may be done in conjunction with the **Sour** operation called the **Sour/Softener** operation. This operation is done at low water levels and lower temperatures.

The **Starch** or sizing operation serves to give body to the fabric and improve its hand. This operation is the last operation in the wash wheel and is done at a very low water level (approximately 3 inches). The operation should run for approximately 10 minutes at a temperature above 100 F. Fabric is best sized if it is first soured to a pH between 5 and 6. After the **Starch** operation, the wash wheel should be drained with the wheel turning and extracted only as long as it takes to remove the unbound water. This is approximately 30 seconds for fifty pounds of 50/50 fabric.

The **Extract** operation is the final operation. Its purpose is to remove the excess "bound water" that is in the fabric. The **Extract** promotes ease of handling and assists in the drying of the fabric after the wash. The **Extract** is like the spin operation in the home laundry machine except that the R.P.M.'s of an industrial machine and the weight of fabric involved are greater. It is because of this that the proper balancing of load and draining of all "unbound water" is necessary to avoid the possibility of damage to the machine. Fabric that is thicker and more likely to hold water will require a longer **Extract** than those that are not.

An operation called the **Intermediate Extract** is sometimes used after the first rinse to assist in removal of bound water. This operation should be avoided if possible because of the likelihood of driving suspended soil back into the fabric. If it is necessary to use the **Intermediate Extract**, the time of run should not exceed 1 or 2 minutes.

Now that we have defined the terms, let's summarize these operations in chart form with the addition of recommended time and temperatures for these operations.

<u>Operation</u>	**<u>Time in Min.</u>** **<u>Min. Max.</u>**	**<u>Water Temp.</u>**	**<u>Water Level</u>**
Flush	2	cold, split, hot	high
Break	5 to 10	hot	low
Suds	5 to 10	hot	low
Bleach	6 to 8	hot (140-150F)	low
Rinse	2	hot, split	high
Sour	4 to 6	split	low
Softener	4 to 6	split	low
Starch	10	split	extra low
Extract	4 to 8	---------	-----------

N.B. The ranges for time and temperature are so that the operation can be tailored to the requirements of the wash.

The time on both **Flushes** and **Rinses** are fixed because longer than 3 minutes would not typically be of benefit; thus, several short operations are recommended. In like manner, **Suds** operations are not to exceed 10 minutes. Here, again, repeat operations are recommended. When discussing temperature ranges, words rather than numbers have been used to describe them. The reason for this is that in most accounts you have as little control of the high temperature range as you have on the type of machine you are working with.

The **Break** and **Suds** operations are run as hot as possible. The **Bleach** operation is usually run between 140 and 150 F. for best results with minimum fabric damage.