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EC88-424 The Laundry System

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The Laundry System

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This publication covers The Laundry System, including:

- Fabric and finishes • Soil • Wash water factors • Ways to soften water • If you have iron in the water • Using laundry detergents • Laundry practices • Sorting • Water temperature • Wash cycle and time • Load size and agitation • Energy considerations.

Washing clothes isn't simple anymore. Although it has become physically easier over the years, there are so many more factors to consider. Making good laundering decisions is difficult.

Some of the changes that have affected the way we do laundry are:

- a decrease in household size;
- an increase in the number of women working outside the home with less time to do laundry;
- new fibers, fabrics and finishes;
- new laundry products;
- changes in laundry equipment;
- concerns for the environment;
- energy costs.

Laundrying involves a whole system. The system includes the operator, clothing and other items to be washed, soil to be removed, water quality, laundry products and laundry equipment.

The operator is the key to making the system work. The operator makes the decisions about all the other factors. Because of the interdependence of the system, information relating to each part is needed when making decisions about home laundering. Some of the changes described above will be examined in the context of the laundry system to find out how today's technologies can be used to get acceptably clean laundry as easily as possible.

Fabrics and Finishes

Fiber content, color, construction and finish of garments influence how garments and other textile items are sorted and laundered. Always check care label directions on clothing for recommended washing and drying instructions. A knowledge of the special qualities of

different fibers that are laundered will help keep them like new.

Fibers that can be readily laundered include cotton; linen; high wet modulus rayon labeled as "polynosic," which is a rayon with stability when wet, which won't stretch out of shape like conventional rayon fibers; polyester; nylon and acrylic. Today's wash load most frequently contains fabrics of all cotton, all synthetics, and blends such as cotton and polyester. Other interesting blends that might cause new approaches in laundry include, but are not limited to, polyester and rayon, cotton and ramie, and rayon and ramie.

Untreated cotton is the easiest fiber to clean, but synthetic fibers predominate in the laundry basket. Cotton can withstand high temperatures, rigorous agitation and heavy-duty, moderately alkaline detergents. Linen fibers behave like cotton so are washed like cotton.

Synthetic fibers, such as nylon and polyester, are not damaged by high wash temperatures, but because the fibers are more pliable when hot, wrinkles form if hot fabrics are spin-extracted. For this reason washing in warm water and using a cool rinse usually is recommended. Nylon and polyester fabrics can be washed with heavy-duty detergents and can be bleached with either chlorine or oxygen bleaches. Avoid chlorine bleach on silk, wool, spandex and non-colorfast items. Some wools receive special finishing treatments, making them less susceptible to shrinkage from the washing process. Rayon fibers are weak when wet. Some should be washed by hand, others require dry cleaning and some can be washed and bleached like cotton.

Functional finishes have been added to many fabrics to improve appearance, texture, performance and/or to increase serviceability. Some finishes, such as durable press or flame-retardant finishes, limit laundry procedures. Restrictions on use of chlorine bleach, soap or use of hot water may be specified on the label. When laundering, follow care label directions to maintain the properties the finish imparts to the garment.

Fabrics treated with a durable press finish may require special attention in the laundry. Soil that has been allowed to age even as little as four to six days is more difficult to remove from durable press polyester-cotton fabric. Oily soils are particularly difficult to remove from durable press fabrics.



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Soil

Soils encountered in the laundry can be divided into four types: water-soluble soils; saponifiable-insoluble, organic soils, that are oily and react with alkaline builders in detergents; not saponifiable-insoluble, organic soils that are oily and do not react with alkaline builders in detergents; and insoluble, inorganic soils.

Wash Water Factors

Hard water is found in many regions in Nebraska. Water hardness is related to the amount of calcium and magnesium in the water. The more minerals, the harder the water. Soft water may contain sodium or other minerals, but it does not contain appreciable amounts of calcium, magnesium or iron.

Tests for hardness of a large group of Nebraska water supplies show:

Water Hardness in Nebraska	
Hardness (mg/l* as calcium carbonate)	Description
0-60	Soft
61-120	Moderately Hard
121-180	Hard
180 +	Very Hard

*mg/l - Milligrams per liter
Source: Groundwater Quality Atlas of Nebraska Resource Atlas No. 3/1978

Hardness is reported in parts per million or milligrams per liter as calcium carbonate. Usually the hardness is approximately 2/3 calcium and 1/3 magnesium in Nebraska. The hardness of groundwater ranges from less than 60 mg/l in the Sandhills region to the southeast corner of the state with a maximum hardness of 2,400 mg/l. This hardness may be predominately calcium. Hardness of groundwater tends to increase across Nebraska from west to east.

Laundrying problems related to using hard water are:

- Laundry may look dingy, gray or yellowed, and feel harsh and scratchy because of incomplete soil removal. A sour odor can develop.

- Damaged fibers. Continuous laundrying in hard water can shorten the life of fabrics by up to 40 percent by prematurely showing wear due to inadequate soil removal.

- Hard water minerals combine with soap to form a precipitate called soap curd or scum. This soap curd or scum can be redeposited on laundry items and can become difficult to remove. Choose detergents, not soaps, for laundrying in hard water.

- Hard water decreases the cleaning ability of detergents and increases laundry costs, as you must use more detergent and laundry aids per load.

- Hard water may cause build-up of lime or carbonate mineral deposits and soap curd on the washer's tub and internal parts. This reduces the machine's efficiency and life expectancy, and increases repair costs. A soap curd build-up eventually can cause a dank, unclear odor to develop in the washer.

Ways to Soften Water for Laundering

There are three ways to help control water hardness when doing the laundry.

- 1) Use increased amounts of a phosphate powdered detergent (read labels to identify).

- 2) Use a packaged, non-precipitating type of water softener — often labeled water conditioner.

- 3) Connect a mechanical water softening tank to your water supply — called ion exchange softeners.

If you have hard water problems, you will need to evaluate these methods to determine which will work best for your situation.

Controlling Water Hardness With Detergents

Laundry detergent ingredients vary with the brand, and brands may vary from one geographic region to the next, relative to active ingredient.

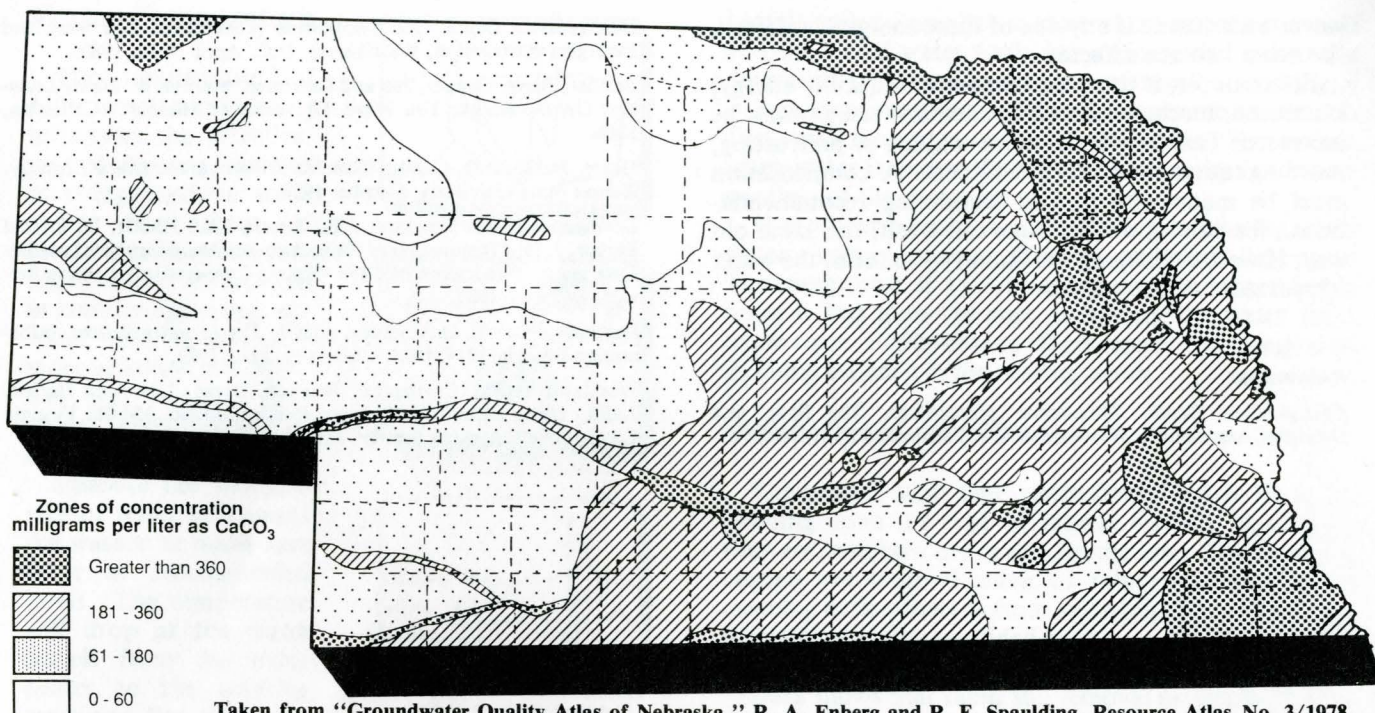
All laundry detergents contain surface-active agents (surfactants) and other ingredients necessary for cleaning. These additives help remove soil, soften water, prevent redeposition of soil, increase the brightness of the washed fabric, and protect washer parts. Optional ingredients improve appearance, pourability and odor (perfume), and may include bleaches, enzymes and fabric softeners.

One of the ingredients, called a builder, enhances or builds the cleaning efficiency of the surfactant by controlling the hardness of the water. Phosphate is the most frequently used builder. Phosphates react with the water hardness minerals and hold them in solution (called sequestering) until they are rinsed away. Phosphates also can hold iron dissolved in water in suspension. This helps prevent iron deposits from discoloring fabrics.

Some powdered detergents contain carbonate builders instead of phosphate builders in their formulas. Use of phosphates in detergents became an environmental issue in the 1970s. Some environmentalists believe phosphates contribute to the acceleration of water pollution of lakes and rivers.

Carbonates soften water by combining with the hardness minerals to form an insoluble residue that makes the water appear cloudy. This residue is called a precipitate, and can settle onto fabrics and washer parts. It makes fabrics feel stiff and harsh and look dingy, and it dulls colors, especially on solid-colored fabrics. The precipitate can contribute to abrasion damage to fibers, and leads to premature failure of the fabric. This precipitate also builds up gradually on washer parts, reducing the efficiency and wear life of the equipment and possibly increasing the need for repair. Carbonate-based detergents are not a good choice in hard water areas, but because they are highly alkaline make effective cleaners.

Other builders used in detergents are sodium citrate, sodium silicate and zeolite. Sodium citrate is found in some nonphosphate liquid laundry detergents. Research findings indicate the cleaning efficiency of citrate-based detergent is excellent for lightly soiled cotton and synthetic blends without oily soil. It is less effective in maintaining fabric whiteness through repeated launder-



Taken from "Groundwater Quality Atlas of Nebraska," R. A. Enberg and R. F. Spaulding, Resource Atlas No. 3/1978.

COMMON LAUNDRY SOILS*

Soil Groups	Examples	Suggestions for removal
<i>Type 1</i> Water-soluble soils	Salt; sugar; fresh tea and coffee; some components of perspiration; some proteins	Easily removed by water alone; hot water aids in dissolving soils.
<i>Type 2</i> Insoluble, organic soils-saponifiable (Oily soils that react with alkaline builders in detergents)	Oils; fats; fatty acids from food, skin; hair dressings; cosmetics	Removal more difficult as soil ages. Soap or detergent required for removal; heavy-duty laundry detergents more effective than mild detergents. Builders in detergents react with this soil; abundant detergent required to react with, make soluble, and emulsify this soil. Hot water speeds soil removal and results in more complete soil removal.
<i>Type 3</i> Insoluble, organic soils-not saponifiable (Oily soils that do not react with alkaline builders in detergents)	Mineral oil; car grease; some body oil; lint; skin particles; tar; wax; protein dyes	Removal more difficult as soil ages. Soap or detergent required for removal; abundant detergent required to make soluble and emulsify this soil. Hot water speeds removal.
<i>Type 4</i> Insoluble, inorganic soils	Dust; mud; clay; smoke; soot; mineral ash; metals; metal oxides	These soils often are held on fabric by oily soils; need detergent to remove oil and release this soil. Soil not soluble in wash water; requires much agitation by washer for removal and adequate suspending agent in detergent to prevent redeposition.

*Source: The Laundry System, Purchase & Lemley

ing. Sodium silicate, as with carbonate, reacts with minerals in hard water and forms white powdery precipitates which can collect on fabrics and in washing machines.

Zeolite, another detergent builder, ties up calcium ions, but an additional builder is needed to control magnesium ions. Zeolite is finely pulverized insoluble resins, and may adversely affect rural sewage systems, particularly in heavy clay soils.

To tell which builder a detergent contains, read the

detergent label. Powdered detergents containing phosphates are labeled as to the percent of phosphorus in the package and its equivalent on grams per recommended use. A typical label would read: "This formula averages 6.4 percent phosphorous, in the form of phosphates, which is equivalent to 6.6 grams per one cup use level."

For best cleaning in hard water, compare brands and choose the one with the highest percentage of phosphate, or choose a detergent that is not sensitive to hard water, such as a heavy duty liquid detergent. The pow-

dered detergent labels containing nonphosphate builders list one or more ingredients such as sodium carbonate, sodium silicate or sodium citrate.

Unbuilt laundry detergents do not contain a builder and are sold as liquids. These liquid laundry detergents contain a higher concentration of surfactants. They do a good job of removing oily soil and hold it in suspension to be rinsed away. Surfactants do not react with hardness minerals, so no precipitate is formed.

As detergent formulations change and detergent types differ less and less, experience may be the best indicator in adjusting detergent amount for best cleaning results. When purchasing and using laundry detergents you need to be aware of the characteristics of the water supply, laundry detergent, washing machine, the articles to be washed and the types of soil.

If You Have Iron in the Water...

Iron may be dissolved and enter the water as it passes through the earth, or it may come from rusting pipes or water heaters. As little as 0.2 parts of iron per million parts of water can cause staining of fabrics and plumbing fixtures.

Iron can discolor fabrics during laundering. It is present in two forms — ferrous oxide or ferric oxide. In the ferrous oxide form, the dissolved iron in water is nearly colorless and generally causes little trouble. In the ferric oxide form, iron oxidizes and becomes largely insoluble in the presence of oxidizing agents such as air or chlorine bleach. Small reddish-orange particles form and may remain in suspension for long periods. These particles attach themselves to clothes, leaving them yellow or rusty in color.

Avoid using chlorine bleach if your water contains iron, since the chlorine oxidizes the iron and increases the dull orange or brown-colored stains. If you have an iron or rust stain on a fabric, soaking in chlorine bleach usually makes it worse.

Although they are much slower-acting and less powerful, oxygen bleaches (sodium perborate or potassium monopersulfate) can be used in water containing iron or on rust stains. They seldom remove the rust stains. A commercial rust remover labeled safe for fabrics is the best choice for removing rust stains.

A non-precipitating water softener added to the wash water before adding the laundry will keep the iron from depositing on the garment. Use the water softener in the rinse cycle as well.

Using Laundry Detergents

The recommended amount of detergent to use is usually listed on the detergent package. Recommendations vary with the products because detergent formulations vary, and some products are more concentrated than others. For best results, always measure a detergent with a standard measuring cup or scoop. Some detergents come with a cap that doubles as a measuring cup.

The amount of detergent recommended by the manufacturer and listed on the package is based on the following conditions:

- five to seven pound load of clothes;
- moderate soil;

•moderately hard water — approximately four to seven grains per gallon;

•average water volume — 16 or 17 gallons of water for a top-loading washer; eight gallons for a front loader.

If any of these conditions change, increase or decrease the recommended amount of detergent. There is no set rule. You can experiment and judge by results.

More than the recommended amount of detergent is needed if you have:

•hard or very hard water (over seven grains per gallon), especially for powdered detergents;

•very dirty clothes, those with a lot of greasy or ground-in dirt;

•large loads of clothes (over five to seven pounds);

•cold water in wash cycle;

•a top loading washer using more than 17 gallons of water, or a front loading washer that fills with more than eight gallons of water (see washer use and care guide for information).

Use less detergent if you have:

•soft water (less than 3.6 grains per gallon) especially with powdered detergents;

•very light soil;

•small loads of clothes;

•a partial fill is selected;

•a suds saver model — add 1/2 the normal amount.

Laundry Practices

When doing the laundry, one of the most important factors to consider is the amount of soil to be removed. Soil occurs from use as well as build-up caused by incorrect laundry procedures. For sufficient soil removal the operator needs to consider proper sorting, water temperature, load size and type of agitation.

Sorting

Sorting the laundry into wash loads can help prevent problems. Group items together that can be washed in the same water, with the same laundry product, and with the same agitation. Factors to consider in sorting garments are:

Color — Dyes may transfer from dark items to white or light items when washed in the same cycle. Separate light colors from bright or dark colors and whites from *all* colors. Prolonged presoaking of colored items can result in dye transfer in some fabrics.

Soil — Group heavily soiled clothing separately from lightly soiled items. Pretreating or soaking heavily soiled items may be required for adequate soil removal.

Tendency to Lint — Separate “lint-givers”, such as cotton towels, sweatshirts and flannels, from “lint-takers”, such as corduroy, velveteen, and permanent press fabrics.

Fabric — Sort durable items such as jeans from delicate fabrics found in such things as lingerie. Separate socks, sheets and towels needing to be washed in hot water from fabrics with a permanent press finish and bright colors that may need warm water. Loosely knit, lace-trimmed and other delicate fabrics need to be together for gentle laundering.

Water Temperature

The temperature of water used in laundering influences the effectiveness of cleaning, the cost of energy and, in some cases, the extent of fabric wrinkling and fading of colors. Authorities in laundry agree that hot water (140°F) produces more efficient and effective soil removal than warm (100-120°F) or cold water.

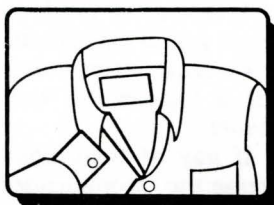
Measure the temperature of water as it enters the washer to make sure it is at recommended levels. The temperature will drop as the water travels from the water heater to the washing machine. For each one foot of water pipe the temperature drops one degree. The water in the washer is likely to be at least 10° below the temperature in the water heater.

A warm water wash may vary from 70°F to 110°F. Remember that the temperature of water depends on the mixing ratio of hot and cold water. A warm wash is either a 50/50 or 40/60 mixture of hot and cold water.

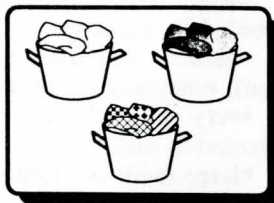
Variation in water temperature also is due to the season of the year, the geographic location, and the thermostat setting on the water heater. Detergent and appliance manufacturers agree that detergent effectiveness declines rapidly in water below 70°. No detergent is effective in water below 60°F.

Most fibers can be washed in hot water except acetate, fabrics with the generic name olefin (polypropylene) and some acrylics. Permanent press fabrics will wrinkle more when washed in hot water. However, if permanent press articles are heavily soiled, you will get better results by using hot water with plenty of detergent, and ironing the items using a medium to low setting on the iron.

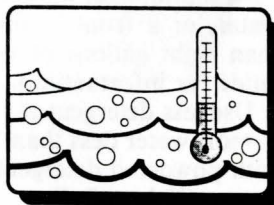
Most consumers use warm water washes more frequently than either hot or cold. A warm wash setting (105-120°F) usually is recommended for colored fabrics and lightly soiled articles. Complete soil removal is not as critical in these fabrics as in whites, and a lower temperature helps preserve the color. Hot water cleans



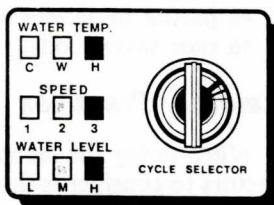
1. Read care labels



2. Sort clothes carefully



3. Use the right water temp.



4. Use the proper washing



5. Rinse thoroughly

heavily soiled items better than warm or cold water. If you use a cold water wash, use an increased amount of detergent. If you use lower temperatures for washing, it is important to add powdered detergents to the washer first, with the water, then add the clothes. Remember, when water is below 60° very little cleaning results, regardless of the detergent.

Hot or warm water is not necessary for rinsing. Cold water rinsing is just as effective, and saves fuel costs. The energy cost of a cold water rinse with longer drying times is less than the cost of heating the water for a warm rinse. Eighty-five to 90 percent of the energy used in doing laundry is for heating water.

Wash Cycle and Time

The proper wash time varies from load to load, depending upon the type of fabrics washed, how soiled they are, and how heavy or light the load. The fewer the clothes the more flushing of fabric and mechanical cleaning action there is from agitation. The agitation or mechanical action provided by the machine is needed to remove the soil.

Data shows that rapid soil removal occurs during the first five minutes of washing, and that soil removal continues, but at a much slower rate, after the first five minutes.

An automatic washing machine usually should be set for two to four minutes for delicates, eight to 10 minutes for whites or really dirty clothes, and six to eight minutes for "no-iron" or permanent press clothes.

Load Size and Agitation

Clothes should circulate freely during agitation for thorough cleaning and rinsing. Agitation is very important in dislodging soluble soil such as mud, smoke, soot and dust from fabric.

Overloading can cause poor cleaning, excessive lint and extra wear on clothes. Load the washer loosely with dry, unfolded clothes of varying sizes. Judge the size of wash loads by bulk rather than pounds.

An example would be to limit to no more than two or three sheets in a load; then fill it with small articles. Put in fewer permanent press and synthetic items per load to minimize wrinkling and improve cleaning. A load that has pieces of various sizes will wash better than a load made entirely of large items, such as sheets.

If your washer allows a choice in washing action, select the regular setting for most loads of clothes. Use gentle action for delicate fabrics and knits. Since washing machine capacities vary, read the instruction manual for your machine to determine correct agitation and load size.

Energy Considerations

When doing the laundry there is a delicate balance of *mechanical energy* — the agitation provided by the washer; *chemical energy* — the detergent, pretreatment product and bleach used; and *utility energy* — the hot or

warm water used. If any one of these energies is altered, the other two are affected.

For example, if the water temperature (utility energy) is reduced, mechanical and/or chemical energy must be increased. This may mean more soaking or pretreating, more agitation, and more detergent. A compensation must be made with revised laundering recommendations. We cannot do the same old wash, the same old way, if we are changing the laundry products, the water temperature or the washer.

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