U S Chemical

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Understanding the Institutional Laundry Environment and Laundry Product Selection

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INTRODUCTION

Many types of businesses have On Premise Laundries (OPL's) to handle their laundry. Other businesses in the same industry may send their laundry to an outside source. Over the years a fierce debate has raged about which is the better option. Most experts have concluded that in the long term, OPL's save money and provide better control of the quality of washing which leads to longer fabric life. Contrary to popular belief, customers don't really buy laundry chemicals. They buy clean laundry. The chemicals are just a means to that end. To properly identify the products a customer needs, as the first step in the selling of a new account, a process called a survey is used.

In a survey, all of the necessary information is gathered, either through observation, testing, or asking questions of the customer, so that the appropriate products are selected to insure satisfactory results. To properly answer the question "What product is the best one for this customer?", it is necessary to understand the effect of the environment on product performance. This brochure examines the fundamentals of cleaning in an institutional laundry, surveying an institutional laundry and laundry product selection.

COSTS IN AN OPL

Costs in an OPL laundry are typically as follows:

Labor, Wages and Fringe Benefits	46%
Indirect Costs, G&A, Taxes, Rent, Insurance	13%
Utilities	12%
Laundry Supervision	10%
Fabric Replacement	7%
Chemical Costs	6%
Distribution Cost	5%
Equipment/Building Repairs	1%
Total	**100%**

BASIC LAUNDRY MACHINE OPERATION

The most common type of laundry machine used in an OPL is called a washer-extractor, which comes in a variety of styles and sizes. They all work in approximately the same way. A perforated ribbed stainless steel inner drum mounted horizontally holds the fabrics. An outer stainless steel shell holds the drum and wash water. Some older machines have only one drum, but these are rare today. Machines with a latching door through which the fabrics are loaded are called "front loaders" for this reason. When the cycle is running and the drum turning, the perforations in the drum allow the wash water to mix with the fabrics in the drum. The turning of the drum tumbles the fabrics and produces friction. Between the friction from the tumbling and the chemicals that are injected into the machine, soils are removed from the fabrics.

Most machines rotate the drum in 30 second blocks of time called a 12-3-12 action. The drum will rotate at a rate of 30 revolutions per minute (RPM) for 12 seconds, pause for 3 seconds and then turn in the opposite direction for 12 seconds. When turning, the drum rotates at a rate of 30 (rpm). This action takes about 30 seconds to complete. During a cycle, the machine will fill with water, rotate for a series of 12-3-12 actions, and then drain out the used water. This process will be repeated several times. Every time the machine fills with water, washes and drains, a step, bath or operation in the formula has occurred. A series of steps, baths or operations is called a laundry formula or laundry cycle. The last step in any laundry formula is a high speed spin of the drum called a final extract. This removes water from the fabrics as they are pressed against the drum wall by centrifugal force. After the extract, the fabrics are removed from the laundry machine and dried in a dryer or pressed in a flatwork press, such as an ironer. The fabrics are then ready for reuse, folding or storage.

Laundry machines are rated by the number of pounds of fabric that are washed in each load. A typical machine size is 50 pounds of "average" fabric. When the machine fills with water, it fills to either a high level or a low level. A low level is usually to the bottom of the window and a high level is halfway or 2/3 of the way up the window. A 50 pound machine will hold about 14 gallons of water at low level and 22 gallons of water at high level. Low levels are selected whenever chemicals are being injected. High levels are selected any other time. A typical medium soil laundry formula is as follows. There would be a one minute drain between each step in the formula.

Operation	Water Temp	Water Level	Time	Chemical Added
Flush	Warm	High	2:00	None
Wash	Hot	Low	5-8:00	Break, Suds or Build Detergent
Bleach Bath	Hot	Low	5-8:00	Destainer, Chlorine or Oxygen
Rinse	Warm	High	2:00	None
Rinse	Warm	High	2:00	None
Final Rinse	Warm	Low	4-5:00	Sour, Softener or Sour/Soft
Extract	None	None	2-5:00	None
Tumble	None	None	1:00	None

Total Time: 23-33 Minutes

The amount of time the machine takes to fill with water is not reflected in the formula, but would affect the total cycle time. During a typical laundry cycle, as shown above, there will be three high level fills and three low level fills. This results in a water consumption of 2 gallons of water per pound of fabric washed. This is a typical number, but can be driven lower by using larger industrial machines called tunnel washers which process millions of pounds of fabrics in a year. In a tunnel washer, the water consumption can approach 1 gallon per pound. Some laundry machines use more water because of a larger drum volume. Water consumption can approach 3.5 gallons per pound of fabric in these machines. Highly soiled fabrics can require extra flushes or wash baths, which increases water consumption as well.

There are a variety of chemicals injected into the laundry machine at different times in the cycle. Each performs a specific function. These product types include breaks, built detergents, suds, destainers, sours, softeners and sour/softs. In addition, there is a separate group of specialty products that may be needed based on certain conditions that may exist at an OPL.

There are 2 basic types of institutional laundry machines, nonprogrammable and programmable. The nonprogrammable machine may have several formulas to choose from, but the number of steps in any given formula cannot be changed. Also, in some nonprogrammable machines, there may be push buttons that allow the operator to select the water temperature for the cycle. By comparison, a programmable machine may come with preprogrammed formulas, but the number of steps, water temperatures, water levels, and washing times for each step can be changed. If desired, the entire formula can be erased and a new one entered. A typical laundry formula can be as short as 20 minutes or as long as 60 minutes. The programming of the length of the formula should be based on the fabric type and soil load present.

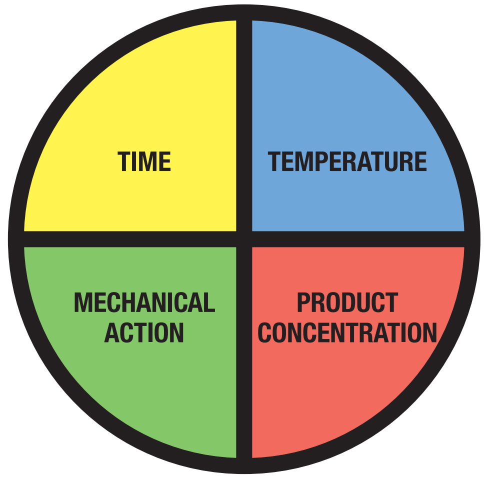
By comparison, homestyle machines have either plastic or ceramic coated steel drums and shells. In homestyle machines the fabrics are loaded through the top, leading this type of machine to be referred to as “top loaders.” This is to differentiate them from industrial institutional machines, which are front loading. Homestyle machines don’t tumble the fabrics. The mechanical action is caused by an agitator, located in the center of the drum, which turns and causes the fabrics to rub together. This type of mechanical action is inferior to an industrial machine that tumbles the fabrics. Because the machine is not made from stainless steel, most of the products used in institutional machines cannot be used in homestyle machines. Breaks, built detergents, institutional strength chlorine destainers, sours, and sour/softs are corrosive to the machine. Some homestyle machines are made out of stainless steel. These machines are called “industrial homestyle” machines and can use the institutional style products.

The amount of fabric generated by different types of facilities varies considerably. It is helpful to know what the requirements are for typical sized facilities. Based on industry survey data, numbers for per day usage are given.

Based on these numbers and occupancy rates of the facility, projected chemical requirements can be forecasted. This information will be gathered in a survey discussed later in this brochure. Now that laundry machine operation has been explained, next is a look at the basics of cleaning.

Facility	lbs. per room per day	lbs. avg
Hotels/Motels	6-9	8
Hotels/Motels with Food Service	9-13	11
Luxury Hotels	16-22	18
Nursing Homes	8-14	11
Hospitals	11-16	14

ESSENTIAL COMPONENTS OF CLEANING



ESSENTIAL COMPONENTS OF CLEANING

The four essential components of cleaning are: time, temperature, mechanical action and product concentration. These four factors work in balance with each other to clean. If any one area is to be decreased, such as cleaning time, there must be a corresponding increase in another area. These factors hold true for all cleaning, not just in a laundry machine. Working hand-in-hand with these components is water. Water is known as the universal solvent and is necessary to perform proper cleaning in the laundry machine. Laundry machines that don't use water use other solvents. This cleaning process is known as dry cleaning. Dry cleaning is beyond the scope of this brochure. In a water washing system, such as a laundry machine, there are 2 basic soil types: water soluble and non-water soluble. Whenever the soils are water soluble, the presence of large quantities ofwater will aid in the cleaning.

A. Time

In programmable machines, the time for each step in a formula can be changed. This allows for increasing or decreasing the total cycle time as is appropriate for the soil load and fabric type being washed. The ability to control the time for each step greatly affects the results. On nonprogrammable machines, the time for any given step is fixed and cannot be changed. This makes it more difficult to achieve acceptable results economically with a nonprogrammable machine.

B.Temperature

Water temperatures are controlled in one of two ways. Hot and cold water are both plumbed to a laundry machine. When only one water valve is opened to fill the machine, the water temperature will be whatever the incoming hot or cold water temperature is at that time. When both valves are open to fill the machine, warm water, or "split temperature" water, fills the machine. In some programmable machines, a specific temperature can be programmed. The water valves will then be controlled to give the appropriate temperature inside the machine. Some machines are equipped with steam to raise the water temperature above the temperature of the incoming hot water. In nonprogrammable machines, there are often push buttons on the front of the machine to control the water temperature during the cycle. Ideally, cold water is about 60–80°F, warm or "split temperature" water is 100–120°F and hot water is 140–160°F. When the main washing and bleaching occurs during the cycle, the expectation is for the temperature to be 140–160°F. At this temperature, the chemicals will perform best.

C. Mechanical Action

Laundry machines rotate the drum in 30 second blocks of time called a 12-3-12 action. The drum will rotate for 12 seconds, pause for 3 seconds and then turn in the opposite direction for 12 seconds. While the drum is turning, it rotates at a rate of 30 rpm. This action takes about 30 seconds to complete and is called a normal action or 2 way wash. In a gentle cycle for delicate fabrics, the action is 3-12-3. The drum rotates for 3 seconds, pauses for 12, and rotates in the opposite direction for 3 seconds. This process takes about 20 seconds to complete. As the fabrics are tumbled in the drum, they rub together and against the drum wall and the ribs. This provides the mechanical action that helps to clean the fabrics.

D. Product Concentration

Concentrations for the products used vary based on the water quality, soil load, formula being run, and fabric type. In nonprogrammable machines, this is often the only variable that can be changed. For recommended use dilutions for US Chemical laundry products, a list is available from the US Chemical Training Department.

THE ENVIRONMENT

The environment for a laundry operation consists of the following 5 areas.

Procedures
Water Quality
Equipment
Nature of Substrate
Nature of Soil

By surveying all 5 areas, anything that can cause poor results can be identified.

PROCEDURES

There are 7 procedures that need to be surveyed as follows:

1. Collection of Fabrics

It is helpful if the fabrics are presorted at the time of collection. Presorting prevents excess handling in the laundry room and allows for the removal of items that should not be laundered, such as glasses, scissors and other items that end up in the fabric. In nursing homes, large amounts of fecal material should be removed from the fabrics during collection. Soiled fabrics should be collected with a minimum amount of shaking. Excessive movement of fabrics that have high numbers of microorganisms present can result in thousands of bacteria becoming airborne. Once the fabric is collected, it should be put in a hamper, laundry bag, or other device to facilitate transportation to the laundry room without the risk of having the laundry contaminate other surfaces. Fabric contaminated with potentially infectious microorganisms have special handling procedures as described later in the "sorting" section.

Collection should take place as quickly as possible after use and the soiled fabrics should then be washed as quickly as possible. The longer soils remain in fabrics, the more difficult they are to remove. This results in longer cycle times and extra chemical usage. Soiled fabrics should not be dropped on the floor or down a laundry chute, unless inside a collection container. Finally, soiled fabrics should be transported in well covered, clearly identified carts used exclusively for that purpose.

Wet or damp fabrics can be a real problem. If damp fabrics are put down a laundry chute, bacteria can grow in the chute producing odors and an unsanitary condition. If damp fabric is placed on a concrete floor, the alkalinity from the cement creates a stain that cannot easily be removed.

Laundry chutes and carts may have "burrs" that can tear fabrics. The tears caused by the burrs may go unnoticed until finishing. This can be avoided by using bags to hold the fabrics during collection and transportation to the laundry room. It is advisable to use several different color coded bags for collection to allow for sorting and identification of unusually heavily soiled fabrics. If carts are being used, they should be plastic lined to allow for easy cleaning and disinfection, or have removable liners that can then be laundered. Carts should not be overloaded to prevent fabrics from spilling on the floor or being run over with the carts. The use of personal protective equipment (PPE) while fabrics are being collected, sorted and loaded into laundry machines is highly recommended. Gloves and protective aprons should be worn as well as protective eyewear, such as safety glasses or goggles. This will help prevent the spread of disease.

2. Sorting

While washing all fabrics on an extra heavy wash formula will clean better than 99.9% of the fabrics, this is not an economical way to run a laundry. By presorting and pretreating fabrics, the washing formula time and amount of chemicals used can be minimized. There are three standard ways to sort fabric: by color, fabric type and soil load. Depending on the facility, an appropriate sorting method can easily be chosen. If fabrics of different colors are washed together, colors may bleed, especially onto whites. Certain fabric types require special washing formulas and need to be washed separately to avoid fabric damage. Greasy terry cloth kitchen rags will need to be washed separately from VISA table napkins, even if both are white. Sorting by soil load allows for maximizing the efficiency of the wash formula and chemical concentration being used.

When sorting by soil load, fabrics are grouped into light, medium and heavy classifications. While there can be additional classifications, such as extra heavy, or extra light, these three are the most basic.

Presorting can be done at the time of collection, but if it is done in the laundry room, a dedicated area should be provided. Sorting soiled fabrics puts high numbers of bacteria in the air. The sorting area should be properly ventilated and kept separate from the processing area. It should be under negative air pressure so that the air does not recirculate. The sorting area should be cleaned and disinfected at least daily. Personnel should wear clean uniforms every day and should report open sores or respiratory illnesses. Employee hygiene should include instructions on not touching their hands to their mouth or eyes. Hand washing should occur before entering and upon leaving the sorting area. Smoking, eating and drinking are prohibited in the laundry room.

Fabrics coming from isolation rooms or known to contain blood, body fluids or other potentially infectious materials are called contaminated fabrics. These fabrics may not be sorted under any circumstances. Special bags are made for holding contaminated fabrics while being transported to the laundry room. The bags are usually color coded and can only be opened when they are being emptied into the laundry machine. Sometimes a water soluble bag is used as an inner liner. This allows for dumping the contaminated fabrics directly into the laundry machine without opening the inner bag. The water soluble bag then dissolves, allowing the fabrics to be cleaned. Handling of contaminated fabrics is regulated by the Occupational Safety and Health Administration (OSHA) under a law called the “Bloodborne Pathogen Standard.” Please see 29 CFR 1910.1030 for details.

3. Pretreatment

Prespotting and presoaking are the two basic ways to pretreat fabrics. In prespotting, the fabric is wetted, and chemicals are applied to the discrete areas needing treatment. The fabric is then washed immediately. In presoaking, a presoak solution is prepared and the whole fabric is immersed in the solution. Contact times range from 15 minutes. to overnight. It is common to presoak fabrics overnight that need rewashing and to then wash them the first thing in the morning. This can often recover stained fabrics.

Pretreatment is important, because soils that are not removed by the laundry cycle can become permanent stains once dried. To avoid this, either identify those fabrics that are the most heavily soiled so that they can be pretreated prior to their first wash, or check fabrics after they have been washed but before drying.

4. Loading of the Laundry Machine

Machines should be loaded to their correct weighted capacity of dry cloth. A 50 pound machine will hold 50 pounds of typical dry fabric, such as terry cloth towels. However, certain fabrics which are lower in bulk density require that the amount of fabric in the washer be reduced. Many polyester fabrics can only be washed at 80% of the washer’s rated capacity. To avoid wasting chemicals, water and time, only launder full loads. Don’t overload the machine. This reduces the mechanical action of the machine, which causes poor results and a higher reject rate. Overloading and underloading are the most common causes of poor results and wasted time, chemicals and money.

When the wash wheel is turning during the cycle and if a clock were superimposed over the laundry machine door, the fabrics would fall from 11:00 to 5:00 when the drum is turning clockwise and the fabrics would fall from 1:00 to 7:00 when the drum is turning counterclockwise. If the fabrics do not mimic this action, the machine may be improperly loaded, which significantly reduces the mechanical action of the laundry machine, leading to poor results.

There are several ways to load the machine properly. Fabric care tags should be checked to see whether the full dry weight capacity of the washer is appropriate. Fabric can then be loaded by weight, piece count or height inside the drum. Some facilities use a scale to weigh each load of fabric being washed. Others use charts to determine the appropriate number of pieces to make up a load. When the drum has been loaded, there should still be four to six inches between the top of the load and the drum wall. If your arm is placed inside the laundry machine on top of the fabrics, you should be able to touch the back wall of the drum.

Some extremely heavy soiled fabrics, such as mops and rags, might be washed only by half loads. This allows for extra mechanical action and chemical contact to remove these heavy soils.

5. Washing of the Fabrics

Before setting up any wash formula, be sure to review the laundering tags on the fabrics in the facility. Regardless of any other information, always follow these directions to eliminate the potential for fabric damage.

A good washing formula uses high alkalinity, surfactant based products, chlorine bleach, softener and souring of the finished fabric to a pH of 5.5 – 6.5 at the end of the laundry cycle. Water temperatures of 140 – 160°F should be available for "hot" portions of the cycle. Hot water and the presence of chlorine will kill bacteria and other microorganisms in the laundry cycle. For a complete review of constructing laundry formulas, please see the U S Chemical publication "Laundry Formulas and Laundry Cycle Functionality" available from the U S Chemical Literature Department.

Fabrics should be washed in a formula that is appropriate for the soil load and fabric type. For example, chlorine bleach should not be used on colors and fabric softener should not be used on VISA. The high speed spin at the end of the cycle, called a final extract, should be just long enough to remove the proper amount of water from the fabrics. Over extraction is a common source of wrinkling in the laundry. As a general rule, extraction should continue until one minute of extraction yields one ounce of water per ten pounds of fabric. This is the amount of water removed by a standard dryer. Drying costs eight times more per minute than does a washer in extract, so it is important to properly extract fabrics to control costs.

ITEM PIECES PER LOAD BY WASHER SIZE

Laundry Item	Item Size	Unit Wt	18 lb	25 lb	35 lb	50 lb	60 lb	75 lb	100 lb
Sheet, Twin	66 x 104	1.2	12	17	23	33	40	50	67
Sheet, Double	81 x 104	1.5	9	13	19	27	32	50	67
Sheet, Queen	90 x 110	1.8	8	11	16	22	27	33	44
Sheet, King	108 x 110	2.2	6	9	13	18	22	27	36
Pillowcase	42 x 36	0.25	56	80	112	160	192	240	320
Towel, Bath	20 x 40	0.4	36	50	70	100	120	150	200
Towel, Hand	16 x 27	0.25	56	80	112	160	192	240	320
Bathmat	20 x 30	0.6	24	33	47	67	80	100	133
Bedspread	80 x 105	2.5	6	8	11	16	19	24	32
Blanket	100 x 90	2.5	6	8	11	16	19	24	32
Pillow	20 x 26	1.1	3	4	6	8	10	12	16
Napkin	17 x 17	0.12	117	167	233	333	400	500	667
Napkin	22 x 22	0.16	88	125	175	250	300	375	500
Tablecloth	45 x 45	0.6	24	33	47	67	80	100	133
Tablecloth	54 x 54	0.8	18	25	35	50	60	75	100
Tablecloth	64 x 64	1.2	12	17	23	33	40	50	67
Tablecloth	54 x 110	1.7	8	12	16	24	28	35	47

A typical piece count loading chart is shown. Actual item weight and size will vary based on brand and quality. This information is a guideline only.

Another way to determine the correct amount of extraction is by weighing the fabrics. Every fabric type will absorb a certain amount of water. During the extract, cotton fabrics should be spun until they are about 50% over their dry weight. For synthetics, the moisture retention will be lower. To determine the correct weight for unloading, the percent moisture retention can be calculated as follows:

$$\textbf{\% Moisture Retention} = \frac{(\text{Extracted Weight} - \text{Dry Weight}) \times 100}{\text{Dry Weight}}$$

A load of cotton towels that weighs 50 pounds dry, should weigh 75 pounds at the end of extraction. The speed of extraction is determined by the G-force of the washer during extraction. To compare speeds of extraction the G-force can be calculated as follows:

$$\textbf{G-Force} = \frac{(\text{rpm} \times \text{rpm} \times \text{shell diameter})}{70{,}500}$$

Where the drum diameter is measured in inches.

On a typical laundry machine with a 30 inch drum and an extract speed of 600 rpm, the G force is 153 g's. Differences in extract speeds and G-forces may make it impossible to achieve a 50% moisture retention, so the amount of water being extracted should be monitored as well. Each pound of cotton can absorb 2.5 – 3 pounds of water. Each pound of polyester can absorb 0.4 – 0.6 pounds of water. 50/50 blends of cotton/poly absorb 1.0 – 1.3 pounds of water per pound of fabric. When synthetic fabrics are being used, the moisture retention will be much lower, since they can't absorb all that much water to start with.

Unloading should occur promptly when the load is finished washing. Fabrics that remain in the wash wheel will tend to wrinkle. Once again, always check the fabric laundering tags, as some fabrics should not be extracted at high speed. Fabrics that do not come clean in the standard wash cycle are called rejects or rewash. A small percentage of rejects are normal in any OPL.

6. Drying of the Fabrics

After the final extract, the fabric should be immediately removed from the machine and any stained fabrics should be removed for additional treatment. This rewash will need to be pretreated and rewashed. Leaving washed fabrics in the washing machine overnight can allow microorganisms to grow in the damp fabric causing odors and health dangers.

Dry fabrics at the recommended temperatures, which is usually 180 – 200°F for cotton, or 160 – 180°F for synthetics, such as polyester. When a thermometer in the dryer reads 180 – 190°F, the exhaust temperature is 160 – 170°F or 20°F colder. Some care instructions list the exhaust temperature rather than the temperature in the dryer, since not all dryers have thermometers in them. Drying takes 970 British Thermal Units (BTU) to remove one pound of water from cotton fabrics, so proper extraction is critical to controlling energy costs in the laundry.

Use a dryer cycle with a cool down to minimize wrinkling for synthetics, such as polyester and to reduce static, making loads easier to handle. Synthetics, such as polyester are plastics. When heated, as in the dryer, they become soft. Stopping the cycle when the fabric is hot causes this soft plastic to become brittle. This usually locks in wrinkles. Using a cool down gradually lowers the temperature of the fabric, keeping it flexible and wrinkle free.

Do not overdry, as this causes fabric damage, static, wrinkling and wastes energy. It is common to change the dryer formulas from season to season. When the air is drier, as in the winter, the drying time can be decreased because the fabrics dry faster. When fabrics come out of a dryer, they should be slightly damp (not wet). If fabrics are completely dry, they have been overdried. Drying should be done until the moisture retention for cotton is between 5 - 10%. A 50 pound load of cotton towels should weigh 53 - 55 pounds when unloaded from the dryer. The remaining water will evaporate as the fabric finishes cooling. This moisture retention rate should coincide with achieving a dryer temperature of 180 - 200°F. Either method can be used to determine the correct drying time.

Fabrics are usually folded prior to storage. While fabrics are being folded is a good time to double check that the fabrics are clean and ready for service, but checking immediately after washing is the best time to check for staining. When a fabric with a stain has been dried, the stain is much more difficult to remove. The special treatment for difficult stains is much more effective as a pretreatment than as a post wash treatment.

When folding fabrics, the work area should be clean and separate from the sorting area. Employees should have clean hands and uniforms. Employees that both sort dirty fabrics and fold clean fabrics should take precautions to insure that they do not contaminate clean fabrics by contact with their dirty uniforms or hands.

A charred or black ash on fabrics can indicate a dryer problem. The dryer flame color should be checked. The flame color should be blue except for a hint of yellow on the flame tip. A yellow color in most of the flame indicates an improper fuel to air ratio. 95% of the time, there is not enough oxygen getting to the burners. The air intake baffles should be wide open. Lint traps in dryers should be cleaned regularly, or at least daily. Excessive lint slows drying and can cause fires in the dryer.

Some facilities use steam heated flatwork presses or ironers for tablecloths, sheets and other fabrics. When fabrics are run through presses, they may be partially dried first. Usually they will be dried until the moisture retention is 25 – 30% (for cotton). This is called conditioning the fabric. This is the optimum moisture content for flatwork ironing of cotton fabrics. These machines use high heat or steam to quickly dry the fabrics and to remove wrinkles. Usually these presses are run at temperatures of 315 – 350°F. Below 310°F, many fabrics will not feed properly. Over 400°F, glazing or melting of the fabric occurs. At 100 pounds of steam pressure, 338°F is achieved. Some presses are oil heated. The oil should be 400 – 425°F to give the correct temperatures to the fabric. The heat from the drying process also kills bacteria and other microorganisms. Sometimes fabrics will be automatically folded during the pressing, other times the fabrics will still be folded by hand. When folding fabrics, the work area should be clean and separate from the sorting area. Employees should have clean hands and uniforms. Employees that both sort dirty fabrics and fold clean fabrics should take precautions to insure that they do not contaminate clean fabrics by contact with their dirty uniforms or hands.

Some facilities will use steam tunnels to finish the fabrics, especially uniforms and shirts. Air temperatures in the tunnels should not exceed 280 – 300°F. A steam pressure of 40 – 45 psi should give a temperature of 290°F.

7. Storage of the Fabrics

After drying and folding, store the fabrics in clean protected areas. This prevents recontamination or resoiling of clean fabrics. In most health care environments it is a requirement to use covered shelves and carts for the distribution of the fabrics. It is best to allow fabrics to “rest” for 24 hours prior to reuse. To do this, a facility must have enough fabrics to have one set in use, another in storage and a third in washing at any time. One complete change of fabrics for a facility is a “par” for the facility. An ideal par level is at least 3.

WATER QUALITY PARAMETERS

The water quality affects the choice of laundry products. Desired water quality parameters are as follows:

Total Dissolved Solids (TDS)	<500 ppm
pH	6 - 8
Calcium and Magnesium Hardness	
gpg	**Classification**
(gpg = grains per gallon, 1 gpg = 17.1 ppm hardness)	
0 - 0.5 gpg	Soft
0.5 - 3.5 gpg	Slightly Hard
3.5 - 7.0 gpg	Moderately Hard
7.0 - 12.0 gpg	Hard
12.0 - 20 gpg	Very Hard
20+ gpg	Extremely Hard
Softening is recommended for water above 7 gpg hardness	
Silica	<50 ppm
Iron	0 ppm
Copper	0 ppm
Manganese	0 ppm
Chlorides	<50 ppm
Sulfates	<200 ppm
Bicarbonate Alkalinity	<200 ppm

1. Total Dissolved Solids (TDS)

TDS is a measure of all of the minerals present in the water supply. High TDS can contribute to problems with soil removal, graying and soil redeposition. Where there is high TDS, breaks and built detergents with good water conditioning can help with the wash and higher concentrations of sour may be needed during the final rinse.

2. pH

pH is a measure of the relative alkalinity or acidity of the water supply. The lower the pH, the less problems expected with mineral deposition in the fabrics, which can entrap soils. High pH water (over 8) usually has high TDS and/or bicarbonate alkalinity problems associated with it.

3. Calcium and Magnesium

Water hardness (lime scale) is made up of calcium and magnesium. Where there is heat, cold or alkalinity, water hardness will become insoluble and attach itself to surfaces. In a laundry machine, heat and alkalinity are present, so water hardness can cause problems. Where there is high water hardness, a break or built detergent with good water conditioning ability is needed. This will allow for chelation or sequestration of the hardness, which means that the hardness is held in suspension and prevented from depositing onto the fabric. Poor water conditioning ability of the break or built detergent can lead to mineral buildups on fabric. This can cause graying of the fabric, odors in the fabric, scale buildups on the laundry machine, and an increased usage of products to get good results.

Water softeners are often installed in laundry operations to remove the water hardness so that it doesn't have to be dealt with in the laundry machine. High water hardness often dictates that the built detergent be separated into a separate break and suds product. This allows for increasing the water conditioning by increasing the amount of the break without adding additional suds, which might not provide any additional cleaning. When testing the water at a laundry, both the hot and cold should be checked for hardness. Some facilities only soften the hot water.

4. Silica

Silica in the water supply is not a problem in a laundry environment. In a warewash environment, silica can cause nonremovable white films on glassware.

5. Iron

Iron can cause a rust colored or bluish residue on the walls inside the laundry machine. Chlorine will react with the iron in the water supply and precipitate out as rust. Concentrations over 0.1 ppm can precipitate out into the fabric causing staining problems. Water with high concentrations of iron may necessitate the use of an oxygen bleach instead of a chlorine bleach. Iron in the water dictates that a separate sour and softener be used so that a sour that inhibits iron, often called a sour and rust remover, is used. These iron inhibiting sours prevent the buildup of iron in the fabric. No liquid sour/softs inhibit iron. Iron buildups in fabric can lock in other soils causing graying, yellow, orange or brown stains. The iron in the fabric prevents soils from being removed that would ordinarily be removed.

Some water softeners will trap iron temporarily. Once a sufficient concentration has built up on the inside of the softener, large amounts will begin leaching back into the water. Some water softeners will remove iron. These softeners use a salt that has an added ingredient to remove the iron. This type of salt is usually twice as expensive as regular water softener salt, and generally well worth the money.

6. Copper and Manganese

Copper and manganese react similarly to iron in a laundry. Copper causes green spots and manganese causes black spots. Both can lock other soils into the fabric.

7. Chlorides

Chlorides are salts that can cause corrosion of metal parts in the laundry machine. High levels of chlorides are usually caused by water softener malfunctions or a contamination of the fresh water supply with sea water. Otherwise, chlorides do not generally cause a problem in a laundry. On rare occasions, well water will have high chlorides levels due to salt in the bedrock above the water table.

8. Sulfates

Many sulfates are natural laxatives. This can cause an increase in incontinence in hospitals and nursing homes, which can cause an increase in staining problems with adult diapers and pads. When the sulfate level rises over 600 ppm, the laxative effect usually starts to become pronounced to the average person. Water with over 200 ppm sulfates will usually have a bitter taste.

9. Bicarbonate Alkalinity

Bicarbonate alkalinity (bicarb) is inactive alkalinity naturally occurring in the water supply. The water supply picks up these minerals as water is filtered through the ground into the water table. Bicarbs tend to raise the pH of the water supply and can cause mineral buildups in the fabric that cause staining or lead to a rough feel. Bicarbs are not removed by using a water softener. As the water table changes during the year, it is very common for the bicarb levels to change as well. High bicarbonate alkalinity levels (over 200 ppm) dictate that the sour/soft should be separated into a sour and a softener. This allows for additional sour to be used without increasing the amount of softener. Excessive softener usage can cause waterproofing of the fabric.

When souring fabrics, especially in health care, a pH of 5.5 – 6.5 should be achieved. At this pH, buildups in the fabric from bicarbonate alkalinity can be prevented and the pH is close to the pH of skin, which minimizes skin irritation.

To summarize, there are three main water quality rules, which affect the selection of the products in a laundry.

1. Water hardness over 12 grains per gallon (gpg) dictates separating the built detergent into separate break and suds products. This allows for increasing the amount of break to increase the amount of water conditioning being added without increasing the amount of suds being added.

2. Bicarbonate alkalinity over 200 ppm dictates separating the sour/soft into separate sour and softener products. This allows for increasing the amount of sour being added without increasing the amount of fabric softener, which could cause waterproofing of the fabric.

3. Iron in the water dictates separating the sour/soft into separate sour and softener products. This allows for the use of an iron inhibiting sour.

EQUIPMENT

The customer's equipment (laundry machine) needs to be investigated, and anything that might be a problem should be identified. Among the things to check are the following:

1. Chemicals should only be injected when the machine has achieved level, not during the fill, and only at a low water level.

2. Check the mechanical aspects of the machine including the drains, agitation, extracts, voltage, make and model, belts and product supply signals.

3. Drains should be open when the machine is off. Check the door seal and drain for leaking during a cycle.

4. Before the machine goes into a high speed extract, the drain should be open for one minute. All during the extract the drain should be open. Check to see if the formula(s) call for an intermediate extract. An intermediate extract is a special type of extract that is often used in place of a rinse. This causes problems because the machine spins at a high speed forcing water out of the fabric. To do so, the water must pass through the fabric. This makes the fabric act as a filter for the rinse water, leading to an increase in soil redeposition.

5. Is the machine programmable or nonprogrammable? Survey the wash formulas being used.

6. When doing the installation, where will our equipment be placed? Is there adequate access to water and electrical hookups? The peristaltic pumps on US Chemical's dispensing equipment can pull product 6 feet and push it 20 feet.

7. Check water levels. A low level is from the bottom of the window to 1/3 of the way up the window. A high level is half to 2/3 of the way up the window.

8. Check water temperatures. We want 140 – 160°F for hot water.

9. Check the water pressure. Low water pressure will affect machine fill times.

10. The capacity of the wash drum can be calculated as this indicates how much water will be used for fills and what level should be expected in the window at low and high level. To calculate the drum capacity:

$$\textbf{Cubic feet of washer capacity} = \frac{\text{diameter x diameter x length}}{2200}$$

All dimensions are in inches

A cubic foot holds 7.48 gallons of water. The wash drum capacity has also been used to calculate the weight of fabric that can be loaded in the machine. Cotton loads at 5.25 pounds per cubic foot. Polyester loads at 80% or 4.2 pounds per cubic foot. Better methods for loading can be found in the "Procedures" section of this brochure (page 7).

NATURE OF SUBSTRATE

This section is about the fabric types (substrates) being washed. When doing a survey it is important to know what fabrics are being put into the laundry machine. Fabric types can be divided into two main groups, natural and synthetic. Natural fibers include cotton, wool and silk. Synthetic fibers include polyester, nylon, rayon and dacron. Some fabrics are a blend, meaning that they have more than one type of fiber. Cotton/polyester blends are common in sheets and clothing. Before any fabric is washed, the fabric care tag should be read to insure proper washing conditions. Many fabrics require cooler temperatures, not using chlorine bleach or short extracts to promote fabric life.

Most synthetic fibers are derived from petrochemicals. Being oil derived, the fabrics made from these chemicals have an affinity for greases and oils. Small amounts of grease and oil or fabric softener can build up on the fabric. When this fabric is dried, the grease, oil or softener becomes baked into the core of the fibers. This provides sticky areas for soils to attach themselves to the fiber during the next use. As this process is repeated, soils build up in the fibers until the soils cannot be removed at all and a permanent stain develops. When this happens, the fabric becomes waterproofed. If water is sprinkled on synthetic fabrics, the water should be absorbed in less than 5 seconds. If longer than 10 seconds is required, the fabric is starting to repel water. This is an indication that there are unremoved soils in the fabric. If the water is absorbed between 5 and 10 seconds, the fabric is starting to repel water, but it is not yet a problem.

Barrier fabrics should not absorb water sprinkled on them in less than 30 seconds, if at all. Barrier fabrics, such as COMPEL, repel fluids. Laundering them often is a battle to wet the fabric and remove the soils without damaging the barrier properties of the fabric. Many barrier fabrics have a fluoropolymer finish to improve the barrier. This gives the fabric a useful life of 75 – 100 washings.

"Fabric quality" is a nonspecific term than can be related to any of a number of parameters. In general, the more threads per square inch, the heavier the fabric and the higher quality of the fabric. Most sheets are sold this way. The ability of a fabric to withstand loss of appearance, surface or use due to friction or rubbing is its abrasion resistance. The more resistant to abrasion, the better the fabric. As fabrics are used, the abrasion tends to form little fiber balls on the surface of the fabric. Fibers pull out of the fabric yarn and entangle themselves with other fiber still held in the yarn. This process is called pilling. The more abrasion resistant a fabric is, the less it will pill. Pilling is a special case of a fabric producing lint. Lint is short fibers that are produced and loosened by mechanical action, alkalinity and chlorine bleach. Lint is usually collected in the dryer lint traps. Air permeability is the ease with which air can pass through a fabric. The higher the air permeability, the more the fabric "breathes." This can be desirable or not desirable, depending on the application. Bursting strength is the minimum amount of pressure needed to break through the face of the fabric. The higher the bursting strength, the better the fabric. Closely related to this is a fabric's tensile strength. Tensile strength is determined by stretching a fabric until it ruptures. The force needed to do this is its tensile strength.

Calendaring is a finishing process used to give fabrics a smooth glossy surface. This is done by passing the fabric through heated rollers under pressure. Colorfastness is the degree to which fabrics retain their color during normal use and washing. The gauge of a fabric applies to knitted fabrics and is a count of the number of horizontal stitches in 1.5 inches. The higher the gauge, the stronger the fabric. Napping is the raising of fibers from the surface of the cloth by mechanical means to achieve a soft fuzzy feel or "hand." The higher the nap, the softer the cloth, but the more a fabric is prone to suffer damage and give off lint. Wicking is the ability of moisture to travel through a fabric. Some fabrics, such as towels, need to wick water. Others, such as barrier fabrics, need to repel water. Fabrics with fugitive colors are colored/dyed fabrics in which the dyes become unstable when a high alkaline material is used. The dyes then bleed onto other areas of the fabric or onto other fabrics. Presoaking colored fabrics with alkalinity is to be avoided because of this. Mercerization of cotton is treating it with high alkalinity during manufacture to make it stronger and more lustrous. Next is a brief description of some common fabrics.

1. Cotton is harvested from cotton plants. This natural cellulose vegetable fiber is separated from the husk and carded. The fibers are typically 0.75 to 1.5 inches in length. Carding sorts and aligns fibers. The more times fibers are carded, the stronger the yarn. Carded fibers are then either spun directly into yarns, or combed first. Combing is a process that produces a stronger twisted yarn by recarding the fibers several times. Twisted yarns are stronger and wear better, but cost more to make. Yarns are then used to weave a fabric. Cotton is very absorbent. One pound of cotton can absorb 2.5 to 3 pounds of water. Cotton is known as "water loving" or hydrophilic in nature. Because of this, it is relatively easy to clean when compared to "water hating" hydrophobic fabrics, such as polyester. Cotton attracts water soluble soils and tends to repel greasy, oily soils. Alkalinity has no negative effect on cotton, but swells fibers during washing. This aids the cleaning by making it easier toremove soils trapped between the fibers. Alkalinity does not have this effect on synthetic fibers. Strong acidity, such as from mineral acids like phosphoric and hydrochloric acids, damages cotton. Chlorine can damage cotton if used improperly.

2. Polyester is a synthetic fabric made from petroleum products. Polyester is very resistant to chlorine, oxygen bleaches and mineral acids, but it can be attacked by strong alkalinity through a process called alkaline hydrolysis. The use of fabric softeners can make this problem worse and trap soils, so fabric softeners should be used sparingly on polyester. Polyester is widely used when blended with cotton in 65%/35% or 50%/50% poly/cotton blends. Polyester is an "oil loving" fabric and is more difficult to clean than cotton. Greases and oils are attracted to polyester and are difficult to remove. Because of this, most polyester is treated with a soil release chemical. This makes the polyester easier to clean.

3. COMPEL is a barrier technology fabric used in healthcare to prevent exposure to blood and other body fluids. When washed at 160°F, the fibers will swell and separate. This makes soil removal easier. As the fibers cool, they shrink and reform the barrier. Drying should be done at an exhaust temperature of 160°F. Proper drying at 180°F (or an exhaust temperature of 160°F) is very important to realign the COMPEL fibers and reform the barrier. Overdrying the fabric will permanently damage the barrier.

4. COMPLY is used to make incontinent pads and adult diapers. A vinyl or rubberized outer barrier is added to the COMPLY inner layer. Fabric softener cannot be used on these pads. High alkalinity can also damage the pads.

5. CON/SEPT is a spun polypropylene fiber used to make adult pads and bed sheets. Fabric softener cannot be used on CON/SEPT. The pads are very absorbent, but require short extract times to prevent wrinkling. The makers of CON/SEPT pads require that their laundry formulas be followed exactly. These formulas allow only 1 oz. of a suds product, no break and 1 oz .of a household strength chlorine bleach. CON/SEPT should be dried at 150°F maximum (or an exhaust temperature maximum of 130°F).

6. Gingham is a dyed cotton yarn woven into fabrics that have a check or striped pattern.

7. Linen/Flax is a natural cellulose fiber obtained from the flax plant. It is very strong and the fibers tend to be very long. Linen tends to be a very soft fabric with an off-white to gray color. Linen is degraded by strong acids and oxidizing bleaches. Alkalinity can damage the fabric if the wash solution is hot. When linen is subjected to temperatures of 300°F or more, it is severely weakened and turns brown.

8. Muslin is a white bed sheeting made from plain weave carded cotton.

9. Nylon is a synthetic fabric that is similar to silk but more elastic and less absorptive. Nylon is resistant to organic acids, but not mineral acids. Alkalinity and chlorine have no effect on nylon. Normal ironing temperatures can melt nylon. Because it absorbs so little water, it is easy to over-extract, causing wrinkling. Other forms of nylon, such as are used for tubing and pipes can be damaged by alkalinity and chlorine.

10. Percale is bed sheeting made of plain weave combed cotton. Combed yarns are made by carding fibers two or more times which are then spun into yarns. This produces a more compact and even fabric with fewer projecting fibers than carded yarns. Percale sheets generally have a thread count between 180 – 220 threads per square inch.

11. Rayon is a synthetic cellulose fiber. There are two main types of rayon. The pure regenerated cellulose type, which includes the viscose, cuprammonium (Bemberg), and nitrocellulose processes. This type reacts chemically like cotton,but is weak when wet. The acetate type rayon is a combination of cellulose and acetic anhydride. It is more fragile, being harmed by even moderate alkalinity, most solvents and heat. When rayon is heated to 300°F, it loses its strength. It does not melt, but decomposes at 350 – 400°F. All types of rayon are damaged by strong acids. Strong alkalinity tends to cause the fibers to swell and reduces the fabric strength. Chlorine bleach and oxygen bleaches will not attack the fabric if used properly.

12. Silk is a natural protein animal fiber obtained from the cocoon of silkworms. It is a fine (thin), but strong fiber. The fibers can be hundreds of feet long. Never use chlorine bleach on silk.

13. Vicara is a synthetic fiber generally used in blends with other fibers. Chemically, it is similar to wool and should be handled like wool. Chlorine will cause yellowing of Vicara.

14. VISA is a synthetic blend of dacron polyester used mainly for table linens. It has excellent soil releasing properties, especially when washed with alkalinity, but can become stained with greasy soils. When laundering this fabric, washers can only be loaded to 90% of their rated capacity if ironing and 60% capacity if tumble drying. VISA wrinkles easily and can develop permanent wrinkles. Chlorine can be used on white VISA. It is a very durable fabric that tends to last longer than cotton, but it also is more expensive. Because VISA has a strong affinity for oils and greases, fabric softener cannot be used at all. Suds products need to be boosted with solvents to work properly in most cases.

15. Wool is a natural animal derived protein fiber. The hair of sheep, goats and other animals is shaved and carded to produce wool yarns, which are then woven into fabrics. Heat, mechanical action, and strong alkalis shrink or “felt” wool. Wool is more resistant to acids than cotton, but can be attacked by enzymes. Gentle cycles with a minimum of temperature and mechanical action work best for washing. Chlorine bleach should never be used on wool.

Spontaneous Combustion of Fabrics

Under certain conditions, fabrics can spontaneously combust. This is usually caused by washing fabrics that are heavily contaminated with unsaturated vegetable oils, including canola, soybean, corn, and sunflower oils, or petroleum oils, such as motor oils, greases, or gasoline. Thesefires can start in the dryer or while the fabric is sitting in storage. The fires are caused by oxidation of the oils not removed from the fabric releasing heat. This in turn oxidizes more oil, which releases more heat. Eventually, the fabric smolders and burns. Because homestyle machines have inferior mechanical action to industrial machines, homestyle machines should not be used for washing fabrics that have a high concentration of oils. Suds products boosted with solvents should also be used to remove the oils during laundering.

NATURE OF SOIL

It is important to review the types of soils found in the laundry, so those problems that might be encountered can be identified. Certain soils, especially those that are heavy proteins or heavy greases, can cause results problems. Before explaining how to clean various soils, the concept of pH first needs to be explained.

pH is a measure of the relative acidity or alkalinity of a substance. Everything has a pH. pH is not strictly a measure of strength. It is a logarithmic scale going from 0 to 14. A pH of 7 is neutral, meaning it is neither acidic nor alkaline. As the pH changes from 7 to 8 to 9, the substance becomes more alkaline. A pH of 9 is ten times more alkaline than a pH of 8. A pH of 10 is 100 times more alkaline than a pH of 8. Whereas pure water has a pH of 7, baking soda has a pH of 8 - 9, meaning that it is slightly alkaline. Bar soap is more alkaline with a pH of 9 - 9.5, while laundry breaks have a pH from 11 - 12.5. Pure caustic soda (sodium hydroxide or lye) has a pH of 13.2. The higher the pH, the more the substance will desire to react with an acidic soil.

On the acidic side, the lower the pH the more acidic the substance. A pH of 5 is ten times more acidic than a pH of 6. A pH of 4 is 100 times more acidic than a pH of 6. The pH of skin is 5 - 6. The pH of a laundry sour is 3 - 3.5. The pH of a strong mineral acid, like phosphoric or hydrochloric (muriatic) acid is 1 - 1.5. The lower the pH, the more a substance desires to react with something alkaline. Many foods that are acidic, such as tomato sauces, fats, greases and oils, will react with alkalinity. This reaction makes them easier to remove.

In addition to being either acidic or alkaline, there are several other ways to classify soils:

Soluble soils are those that dissolve in water. This includes: sugars, blood, starch and many proteins.
Saponifiable soils are usually animal fats, vegetable oils or greases that can be saponified by alkalinity. When these soils react with alkalinity, they are converted into water soluble soaps, which are then easy to rinse out of the fabrics.
Emulsifiable soils do not react with alkalinity. These soils are often petroleum based, such as motor oil, mineral oils and paraffin waxes. **Inert soils or particulate soils** such as sand, dirt, concrete and other abrasives. These soils are removed through the mechanical action of the machine and the detergent suspending the soils. **Combination soils** are soils that have characteristics from more than one group. Oil may have sand in it making it both an emulsifiable and particulate soil. Sebum, or the oily residue from human skin, is a combination of saponifiable, nonsaponifiable and particulate soils.

To understand how the laundry products work, next is a look at the cleaning processes at work in the laundry machine.

CLEANING PROCESSES

A. Emulsification is a process by which soils are broken down, held in suspension and prevented from depositing back onto the fabric. The chemicals that perform this cleaning process are called surfactants, which is short for "surface active agents." Surfactants in the suds and built detergents perform this cleaning process. This is the primary cleaning process in a laundry machine. In products boosted with solvents, the solvents also clean by this process.

B. Saponification is the reaction of an alkaline detergent with an acidic soil which forms a water soluble soap. The alkalinity in all breaks and built detergents use this cleaning process.

C. Oxidation is a reaction that removes the color or pigment of an organic stain. The chlorine or oxygen in a laundry destainer does this. Destainers do very little cleaning, but rather destain. If small amounts of soils are entrapped in fabric, forming a stain, the destainer will remove the color of the stain. Oxidation doesn't remove soils that are causing stains, it only removes the color so that the stains cannot be seen.

D. Dissolving/Neutralizing is the reaction of an acidic detergent with an alkaline soil. The acid breaks down (dissolves or neutralizes) the alkaline soil. All sours use this process. Alkaline soils are associated with water, water minerals and detergent residues. Proteins can also be dissolved by alkalinity. Unlike saponification, which is a quick process, dissolving of proteins can occur by contact with alkalinity over a longer period of time.

E. Wetting is the process by which water penetrates the fabric and loosens soils. Once loosened, the soil can be removed. Surfactants help the water penetrate the fabric by lowering the surface tension of the water. Particulate soils are removed by a combination of wetting and emulsification.

These are the five cleaning processes that take place in a laundry machine. While chelation or sequestration of the water hardness is not a cleaning process, performing chelation of the hardness minerals is necessary for the laundry products to clean properly. Having explained how the cleaning processes work, the chemistry of laundry products is now described.

LAUNDRY PRODUCTS

1. Breaks are formulated with three main ingredients.

A. Alkalinity. Regardless of the source, alkalinity is a substance with a high pH that provides saponification and dissolving of some soils, such as proteins. Products in which the alkalinity source is free caustics (sodium or potassium hydroxide) are considered "heavy duty" as they will handle the heaviest of soil conditions. However, they are not safe to use on soft or precious metals, such as aluminum, regular steel, tin, copper, gold or silver. Metal safe detergents use silicates, phosphates and carbonates to provide alkalinity without damaging metals. However, even a metal safe detergent can damage soft metals if used improperly, so care should be exercised in using the product. Homestyle machines have soft metals, so most breaks cannot be used in homestyle machines. One of the added benefits of washing cotton fabrics with alkalinity is that the alkalinity causes the cotton fibers to swell. This makes it much easier to remove the soils trapped between the fibers. Fibers of polyester and many other synthetics do not swell when washed in alkalinity. Some fabrics will have zippers or snaps made from soft metals, such as aluminum. High alkalinity can corrode or degrade these metals causing staining of fabrics.

B. Water Conditioners. Water conditioners are used to chelate or sequester the water hardness. Water conditioners can also help suspend minerals in waters with high TDS. Some types of water conditioners can also contribute a small amount of alkalinity. However, their primary purpose is to control the water hardness. Breaks are often formulated to handle a certain level of water hardness.

C. Silicates. Silicates are often used as metal protectors or corrosion inhibitors. In older laundry machines, it was common to not use stainless steel for various parts. Using a detergent with metal protectors will help protect the machine from corrosion.

Graying of fabric can be caused by inadequate levels of break in the laundry machine. As a result there can be partially saponified soaps left in the fabric, or a buildup of hardness minerals in the fabric. Higher concentrations of break will add more alkalinity to saponify all saponifiable soils and provide more water conditioning so that the hardness can be properly chelated.

2. Suds products are surfactant based and emulsify the soils present. In suspending the soils present, the suds products help prevent the soils from becoming deposited back into the fabric. This is known as antiredeposition. All suds products provide some level of antiredeposition. Suds products contain an additional chemical known as an optical brightener. This is essentially a dye that makes clothes look brighter when under fluorescent lights. Brighteners do this by converting ultraviolet (UV) light, which cannot be seen, into visible light, which can. The effect is to have more light reflected from the fabric, making it look whiter and brighter. Many synthetic fabrics are made with optical brighteners in the fabric fiber. Cotton does not have this, so the use of brighteners is more important on cotton than on synthetic fabrics.

Some accounts will have soils that are difficult to remove. When a suds product is not strong enough, there are boosted suds products to use in their place. A boosted suds product has either enzymes or solvents with the surfactants to increase the performance.

3A. Enzyme boosted suds products have protease enzymes to attack protein soils. Enzymes are very specific in the soils they will attack. Enzymes that attack grease will not also attack proteins and vice versa. The boosted suds products with enzymes U S Chemical manufactures are designed for environments with heavy amounts of protein soils, such as food processing plants that handle meat, sports uniforms, adult pads and diapers in nursing homes. The enzymes in these products work best at temperatures of 130 – 150°F and in the pH range of 9 – 11. Enzymes digest the soils and stains present, so they work by an entirely different cleaning process than the processes explained thus far. Wool and silk are protein based natural fabrics that come from animals. The enzymes in the products cannot distinguish between protein soils and protein based fabrics. Because of this, enzyme boosted suds products should not be used on wool or silk. Fabric damage may result.

3B. Solvent boosted suds products use the emulsification power of solvents to enhance the cleaning performance. Solvents work best on grease, oils, makeup and petroleum based oils. Petroleum based oils are not saponifiable, so thealkalinity from break type products does a poor job on petroleum based oils.

4. Built Detergents are combinations of break and suds products. They combine most of the properties of each product type. Built detergents are often rated by the level of alkalinity, the level of surfactant and their water conditioning ability.

5. Destainers remove the pigment of a stain through oxidation. Destainers are chosen based on the fabric color and the water temperature available. Destainers are either chlorine or oxygen based. Chlorine destainers work best in water temperatures of 140 – 160°F, but are not to be used on colored fabrics. Oxygen destainers work best above 120°F for powdered oxygen bleaches and above 160°F for liquid oxygen bleaches. Both oxygen bleaches require a pH of 10 – 11 to work effectively. Chlorine destainers will still work if the temperature is below the ideal range, but oxygen destainers work very poorly once the temperature gets to be 10 to 20° below the ideal range. Chlorine destainers also provide sanitizing of the fabric, while oxygen destainers do no sanitizing. Some fabrics are chlorine retentive, or have a resin finish applied that is chlorine retentive. This means they tend to entrap chlorine. These fabrics should only be washed with an oxygen destainer as a chlorine residual can severely damage the fabric. The fabric care tag will identify those fabrics that should not have chlorine applied. An overuse of chlorine or improper rinsing of the fabric can cause a chlorine residual in the fabric which can cause skin irritation, yellowing of the fabric, or fabric damage (excess lint).

6. Sours are acidic products added during the final rinse to neutralize the bicarbonate alkalinity of the water supply. In a properly constructed laundry formula, the pH of the fabrics in the final rinse will be roughly the same as the pH of the water supply. The concentration of sour being added depends on the bicarbonate alkalinity of the water supply. The higher the bicarbonate alkalinity, the more sour needed to sour the laundry to a pH of 5.5 – 6.5. The pH of skin is between 5.0 – 6.0. Properly soured fabrics are critical inpreventing skin irritation, especially in a health care environment where the fabric receives extended contact with human skin. In addition, the slightly acidic pH prevents the buildup of bicarbonate alkalinity minerals in the fabric, which can cause graying or fabric color loss. This is one of the strongest arguments for souring all fabrics, not just those in health care environments. Also, if the fabric is going to be pressed on an ironer, alkalinity residuals can cause the fabric to stick to the rollers, so souring helps prevent ironing problems.

Some sours also are iron inhibitors, meaning that they aid in preventing the buildup of iron in the fabric. These sours, often called "Sour and Rust Remover" should not be confused with reclaim products, which are designed to strip out the buildups of iron in fabric. Sours that prevent the buildup of iron are called iron inhibitors and only inhibit the iron in the wash formula being used. Never use sours in a homestyle machine as the acidity can damage the drum. Iron reclaim products, such as the U S Chemical powdered rust remover, are not sours and cannot be used in place of the sour. Reclaim products are too aggressive to be used in the final rinse. Residuals in the fabric will cause skin irritation. Reclaims must be used in a reclaim formula before the standard wash formula can be run.

7. Fabric Softeners are products that lubricate and relax fabric fibers, giving the fabric a softer feel. This reduces static cling, fabric damage and the amount of lint generated. Fabric softeners also reduce the moisture content of the fabric, which shortens the extract time. Like suds products, softeners have optical brighteners to make fabrics look brighter. When fabric softeners are injected in the final rinse of a laundry cycle, they need a pH of 5.5 – 6.5 and 4 – 5 minutes to adhere properly. For this reason, any time a fabric is going to be softened, the fabric should also be soured. Otherwise it will be difficult for the fabric to absorb the softener. In home washers, the time in which a fabric softener is in contact with the fabric is considerably longer.

Overuse of fabric softeners can cause waterproofing of the fabric and increase staining. One of the ways to test for oversoftening is to fill an empty 5 gallon pail with 3 gallons of cold water. Fold the article to be tested so that it will fit in the pail and set it on the water surface. If it submerges between 10 and 30 seconds, it is not waterproofed and the proper amount of fabric softener is being used. If it submerges within 10 seconds, not enough fabric softener is being used. If it takes between 30 and 45 seconds, the fabric is starting to become waterproofed, but it is not yet a problem. If it takes more than 45 seconds, the fabric is waterproofed.

8. Pretreatment is done by either prespotting or presoaking of fabrics prior to washing. With prespotting, the fabric is wetted and a chemical is applied directly to the fabric. The fabric is then immediately washed. This treats discrete areas of a fabric. If the fabric is not wetted, fabric damage can result from the direct contact with chemicals. Presoaking is done by preparing a container of diluted presoak and submerging the entire fabric in the solution. This treats the entire fabric, not just the heavily soiled areas. Fabrics are usually soaked overnight before washing. Presoaking is the more time consuming process, but it yields better results. The active ingredients in pretreatment products are usually a combination of surfactants, solvents, alkalinity and enzymes. It is rare to find high amounts of alkalinity in a presoak. The long contact time increases the risk of fabric damage from the alkalinity.

9. Starches and Sizings are added to the final rinse to make fabric stiffer. This added body allows table napkins to sit up straight. This artificial stiffening results in up to 25% less fabric life. Both starches and sizings adhere better to fabrics if the fabrics are slightly acidified, such as being soured to a pH of 5.5 – 6.5. Starches are polysaccharide carbohydrates derived from rice, wheat or corn. Starches do a good job of coating the prickly surface of the cotton fiber, but roll right off the smooth surface of synthetics. Sizings are synthetic and are derived from polyvinyl acetate or polyvinyl alcohol. Sizings work well on synthetic fabrics, such as VISA. Some sizings will also work on natural fabrics, such as cotton, and are preferred for cotton/poly blended fabrics. Some sizings have starch added to improve adherence to blended fabrics. Fabric softeners should not be used when starch or sizing is used. Starches and sizings will be stripped off of the fabric by alkalinity during the next wash cycle.

Overapplication of starch or sizing will cause spots or streaking called highlighting and overstiffening of the fabric. When ironers are being used, the use of a starch or sizing will require daily cleaning and up to 4 applications per day of wax to the ironers to keep the metal chests free of buildups of the starch or sizing.

10. Antichlors are reducing agents added to neutralize chlorine residuals or medicinal iodine. When washing hospital fabrics, antichlors are often added in a prewash. This avoids the danger of setting the iodine stains. When added to neutralize chlorine, an antichlor is added during the final rinse. A chlorine residual can react with acids to produce several corrosive chemicals that cause fabric damage. To avoid this, adding an antichlor will neutralize the chlorine residual. Even a highly chlorinated water supply (over 5 –10 ppm) can cause a chlorine residual, especially if the fabric is chlorine retentive.

SURVEYING

Now that the areas to survey in an institutional laundry have been explained, here is a list of what is needed to perform a proper survey.

1. Procedures. Check all of the procedures to insure that the customer is using the laundry machine properly.
Using the Total Test Kit, test the fabric as it comes out of the laundry machine for pH, chlorine and iron.

2. Water Quality. Test the water hardness and the bicarbonate alkalinity and look for evidence of problems caused by the water.

3. Equipment. Note what equipment the laundry manager is using and any problems with the equipment. What laundry machine is being used is also important in selecting our chemical dispensing equipment.

4. Nature of Soil. What types of soils are present? What gives the laundry manager the most cleaning problems?

5. Nature of Substrate. What types of fabrics are being washed? Are there special laundering requirements on the fabric care tags? Are there other materials (floor mats, etc.) being washed on an occasional basis in the machine?

Having surveyed the environment, the correct products and dispensing equipment can be selected. A cost per pound, room or patient day can be calculated, an appropriate proposal can be written and the sales presentation can be made. For assistance in survey selling, U S Chemical has published another brochure to address this issue.

SUMMARY

This brochure explained all of the factors that are important in an institutional laundry environment and how those factors can affect results. The fundamentals of cleaning were reviewed as was proper laundry product selection. This brochure is designed as an aid for the sales/service specialist to familiarize them with the factors important in surveying and ultimately, in getting and maintaining good results.