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Laundry Cycle Functionality

**A guide to the operations in
institutional laundry machines.**



Constructing a laundry formula is not difficult if some simple rules are followed. This brochure will explain how a basic formula is constructed and what each of the operations are designed to accomplish. Basic laundry formulas can be found at the end of this brochure, so the experienced laundry specialist can use this brochure as a reference guide. For the novice, some of the general terms are not defined, because this brochure is intended to help the laundry specialist who already has a basic understanding of laundry formulas. It is not a substitute for a beginning laundry course.

PRINCIPLE OPERATIONS OF A LAUNDRY FORMULA

A laundry formula is broken into a series of steps or operations. These steps are selected to perform specific tasks. In some formulas steps are omitted. In other formulas steps are repeated. Knowing when to do each of these things is dictated by water conditions, soils loads and ultimately, results. These are the basic steps:

FLUSH/PREWASH

WASH (BREAK/SUDS)

BLEACH BATH

RINSES

FINAL RINSE

EXTRACT

TUMBLE

Laundry machines don't advance through the cycle until the machine has reached level. Low water pressures may lengthen cycles, so fill times affect total cycle time. There should always be a drain for a minimum of 1 minute between each step/operation in the cycle. What follows is a brief explanation of each step/operation.

FLUSH

A flush is designed to wet or condition fabrics and remove water soluble soils. This can also be a pretreatment step called a prewash. If the water temperature of the fabric changes too drastically, fabric damage results, so the water temperature should be warm (100 - 110°F) not hot. Hot water in a flush also tends to set stains. Cold water can be used, especially when blood is present, but then a second flush using warm water should follow. Hot water on blood sets the blood stain. When blood is present, as in surgical linens, always start the cycle with a cold water flush. A flush is usually 1 - 3 minutes. in length, while a prewash would

be 3 - 6 minutes. Water level is high for a flush and low for a prewash. No product is added to a flush, while product is added to a prewash. Products added to a prewash typically include breaks, suds and built detergents.

A prewash is generally used for heavy or extra heavy soils. Low water levels are always used in a laundry formula when adding chemicals to avoid diluting the product too much. This gives the most concentrated chemical solutions. High water levels are always used for flushes and rinses (where no product is being added). Dilution is how we remove soils and leftover chemicals from the fabric, so the more water, the more the dilution. As with other operations the operation timing does not start until the laundry machine reaches level. However, the mechanical action will occur while filling with water in most machines. If the flush is being used as a prewash, operation time is extended to 3 - 6 minutes at a low water level while chemicals are injected to start the cleaning process.

A reclaim is a special type of prewash. In a reclaim, iron has built up in the fabric and needs to be stripped out. When using a rust remover in a reclaim, start with a 2 minutes. warm water flush followed by a warm or hot wash for 8 to 12 minutes with the rust remover at low water level. Follow with 2 rinses of 2 - 3 minutes at a high water level before extracting or continuing on with the wash cycle.

WASH

The wash (also called the break/suds bath or wash bath) removes major soils and sets the pH for the bleach bath. You want a pH at the drain at the end of the wash cycle of 11 - 12, especially if bleaching is a separate operation. This allows an appropriate amount of alkalinity carry over to maintain a proper pH for bleaching. Where high levels of alkalinity are used, a rinse may be needed before the bleach bath to lower the pH, but this is rare. The pH during bleaching is critical, as described later.

As part of preventative maintenance, a specialist should regularly test the pH of the water when the wash bath drains. It is critical to control the pH in the bleach bath to avoid fabric damage. Low water levels are used in this step because we are adding chemicals. Hot water is usually used, but warm or even cold can be used in special circumstances. Cold water should never be used when bleaching. If a break is being used, the ideal temperature is 140 - 160°F, which is the ideal temperature for

saponification. The operation time is usually 5 - 8 minutes. No single operation in the cycle should be longer than 8 minutes. If you need more washing time, you should use multiple operations to get the desired wash time.

Products added include breaks, suds and built detergents. If the machine cycle does not have a separate bleach bath, bleach can be added as well, but it performs better in a separate operation. Breaks are often called laundry boosters or builders. You would not use breaks, built detergents or sours in a homestyle machine. The strong chemicals will attack the porcelain drum and lead to corrosion and rusting. If bleach is added with the break and suds, you may need to increase the amount of suds to achieve the same detergency. Bleach can affect the performance of the suds product, so more may be needed.

BLEACH

The bleaching operation or bleach bath is for stain removal and sanitization of fabrics (when using chlorine bleach). Use hot water and a low water level for 5 to 8 minutes. For chlorine bleaching, there are 3 critical factors:

1. Concentration of Chlorine should be 50 - 200 ppm during the cycle and 50 - 150 ppm at the drain. Under concentration leads to poor destaining. Over concentration leads to chlorine residual.
2. Water temperature should be 140 - 160°F. Under temperature leads to poor stain removal and poor results. Too high temperatures cause a decomposition of the bleach to chlorine gas which can leave a chlorine residual in the fabric.
3. pH at the drain should be 10.2 - 10.8 (10 - 11). High pH leads to poor bleaching and poor results. Low pH leads to fabric damage. If the pH drops below 9.5, the bleach vigorously attacks the fabric. Chlorine residual in fabrics leads to: skin irritation, yellowing of fabric and fabric damage. You should test the pH and chlorine concentration at the drain at the end of the operation to insure it falls within the listed parameters.

For **OXYGEN BLEACHES** (non-chlorine), the temperature should be >120°F for powders and >160°F for liquids. Temperatures below these numbers give poor results, as the performance falls off quickly as the temperature falls. The oxygen bleaches can be used on colored fabrics

without color loss, while chlorine will destroy the color. For this reason, oxygen bleaches are often called "color-safe bleaches." Chlorine bleach is very reactive. Because of this, care should be taken to avoid bleach coming in contact with sours, which causes chlorine gas to be released.

If an **ENZYME** detergent is being used, the enzymes and chlorine bleach should not be added in the same step/operation. The bleach will destroy the enzymes. If an oxygen bleach is used, there is generally no problem. Enzyme detergents, like bleaching, have an ideal temperature (140°F). Enzymes are not a replacement for bleaching in low water temperatures. As the water temperature falls, the stain removal decreases. Also, enzymes do nothing to sanitize fabrics as chlorine bleach does.

RINSES

Rinses use a high water level and warm water (100-120°F). No product is injected. There are generally two rinses unless using only suds and no bleach. Rinses are generally 2 - 3 minutes in length. You can use a rinse to neutralize chlorine residuals as well. Antichlor can be injected in the first or second rinse. In a rinse, the cleaning is over. Soil and stain removal are finished. Any chemical that remains needs to be removed from the fabric. Rinses are not done with hot water because hot temperatures reactivate the bleaching and without a proper pH, the chlorine will become unstable and attack the fabric. Always use warm water. Cold water would lead to fabric shock and needing to dry the fabric longer in the dryer.

In recent years, the use of intermediate extracts has been recommended as a replacement for a rinse. This is done to conserve water. We do not recommend an intermediate extract at all, unless you have mops or something equally as absorbent that needs to be wrung out during the rinsing. If this is the case, we still recommend two rinses plus the final rinse, but the intermediate extract might appear between the rinses. Intermediate extracts drive chemicals and water out of the fabric by going through the fabric. As the drum is spinning, the water and soils in the middle are forced through the fabric to exit the drum. This forces dirt back into fabric fibers which increases staining and soil redeposition in the fabric.

FINAL RINSE

The final rinse uses a low water level and warm (only warm) water for 3 - 5 minutes. Products injected are: sour & softeners, softeners, sours, bacteriostatic softeners, antichlors, starches, sizings and iron inhibitors. Multiple products can be added at the same time but don't have to be. Softeners

need 4 - 5 minutes. to adhere to the fabric properly. So if no softener is being used the final rinse can be shorter. Enough sour should be added to achieve a final fabric pH of 5.5 - 6.5 to minimize skin irritation. If the linen is restaurant linen, it doesn't require a sour or softener (unless the sour is needed for iron control). There are two types of sours. Neutralizing sours only handle bicarbonate alkalinity in the water, while iron inhibiting sours also remove the iron that has accumulated on the laundry from that cycle. Iron build ups in the fabric lock in other stains that would ordinarily be removable.

Starches or sizings may also be added to the final rinse to make the fabric stiffer. While this makes napkins stand up straight, it decreases fabric life by up to 25%. Starches are used on cotton, while synthetic sizings are used on synthetic fabrics like VISA.

EXTRACTS

Extracts (high speed spins) remove water from the fabric by spinning the laundry drum at high speeds (up to 900 rpm). There is no water added and no products are injected. The extract time varies based on fabric type; 3 minutes for sheets and pillow cases, 2 - 3 minutes for VISA, 5 minutes for towels and 5 - 8 minutes for pads and diapers. If multiple speed extracts are available, start with a low speed extract to sling off much of the water. This promotes longer machine life. Use a drain between the final rinse and the extract. Never allow the machine to go into an extract when full of water.

TUMBLE

A tumble/fluff/shakeout helps pull the fabric off of the walls of the dryer. Alternately you can program a drain after the extract to do the same thing. This also allows the drum to slow gradually rather than being braked suddenly, which is very hard on the machine. A tumble promotes machine life.

OTHER FACTORS IN DEVELOPING A LAUNDRY FORMULA

WATER QUALITY CONSIDERATIONS

1. If the water hardness is over 12 gpg, separate the break and suds so that more water conditioners can be added without adding excess surfactant.
2. If there is iron in the water, separate the sour and softener to use an iron inhibiting sour. Use Rust Remover to reclaim the laundry.
3. If the bicarbonate alkalinity is over 200 ppm, separate the sour and softener to add more sour without risking oversoftening.

4. Copper in the water can lead to green spots in the laundry. Use rust remover to remove these stains.

5. Manganese in the water can lead to black spots in the laundry. Use rust remover to remove these stains.

6. Water softening can remove the calcium and magnesium (hardness), but doesn't change the bicarbonate alkalinity or any other mineral present in the water supply.

FABRIC CONSIDERATIONS

1. If VISA® (100% dacron polyester) fabric is being washed, do not add fabric softener, because it will coat the fabric and lead to staining and waterproofing.
2. If synthetic fabrics are being washed (polyester, nylon, dacron or rayon), less alkalinity is needed. With cotton, alkalinity swells the fibers, aiding soil removal. With synthetics, alkalinity doesn't swell the fibers.
3. Most synthetics should be washed at lower than the rated capacity for a washer. Overloading leads to staining and poor results. VISA napery (as an example) should be washed at 2/3 the washer capacity if being tumble dried. Overloading the washer or dryer or over extraction in the washer may cause permanent wrinkling of synthetics.
4. Mixing fabric types can lead to poor results. Load like articles together.
5. If synthetic fabrics are being washed (polyester, nylon, dacron or rayon), a minimal amount of softener should be used. Softeners tend to waterproof synthetics quickly leading to staining problems.
6. If wool or silk is being washed, use a gentle cycle and do not add any product containing enzymes or chlorine bleach. Both will attack the fabric.

SORTING OF FABRICS

1. Fabrics can be sorted by: soil load, fabric type or fabric color. Mixing different types of fabrics can lead to poor stain removal. Mixing different colors can lead to dye transfer. Mixing different soil loads can lead to poor soil removal or overuse of chemicals.
2. Soil loads will affect the amount of chemicals being used in the formula. The general classifications for soil load are: light, medium, heavy, and extra heavy.

EXAMPLES OF BASIC LAUNDRY FORMULAS

The remainder of the brochure is a set of basic laundry formulas. These formulas can and should be modified based on the environmental conditions present.

Light Soil

| Operation | Water Level | Water Temp | Time | Products |
|--|-------------|------------|---------|------------------------------|
| Flush | High | Warm | 1:00 | --- |
| Drain | --- | --- | 1:00 | --- |
| Wash | Low | Hot | 5:00 | Break, Suds, Built Detergent |
| Bleach | | | | |
| Drain | --- | --- | 1:00 | --- |
| Rinse | High | Warm | 2:00 | --- |
| Drain | --- | --- | 1:00 | --- |
| Rinse | High | Warm | 2:00 | --- |
| Drain | --- | --- | 1:00 | --- |
| Final Rinse | Low | Warm | 4:00 | Sour, Softener, Sour/Soft |
| Antichlor | | | | |
| Drain | --- | --- | 1:00 | --- |
| Low Speed Extract | --- | --- | 0:30 | --- |
| High Speed Extract | --- | --- | 2-5:00* | *Depending on fabric type |
| Tumble | --- | --- | 0:30 | --- |
| Total Cycle Time: 22 – 25 minutes plus fill times | | | | |

Medium Soil

| Operation | Water Level | Water Temp | Time | Products |
|--|-------------|------------|---------|------------------------------|
| Flush | High | Warm | 1:00 | --- |
| Drain | --- | --- | 1:00 | --- |
| Wash | Low | Hot | 6:00 | Break, Suds, Built Detergent |
| Drain | --- | --- | 1:00 | --- |
| Wash | Low | Hot | 6:00 | Bleach, Chlorine or Oxygen |
| Drain | --- | --- | 1:00 | --- |
| Rinse | High | Warm | 2:00 | --- |
| Drain | --- | --- | 1:00 | --- |
| Rinse | High | Warm | 2:00 | --- |
| Drain | --- | --- | 1:00 | --- |
| Final Rinse | Low | Warm | 4:00 | Sour, Softener, Sour/Soft |
| Antichlor | | | | |
| Drain | --- | --- | 1:00 | --- |
| Low Speed Extract | --- | --- | 0:30 | --- |
| High Speed Extract | --- | --- | 2-5:00* | *Depending on fabric type |
| Tumble | --- | --- | 0:30 | --- |
| Total Cycle Time: 30 - 35 minutes plus fill times | | | | |

Heavy Soil

| Operation | Water Level | Water Temp | Time | Products |
|--|-------------|------------|---------|------------------------------|
| Flush | High | Warm | 2:00 | ---- |
| Drain | ---- | ---- | 1:00 | ---- |
| Wash | Low | Hot | 6:00 | Break, Suds, Built Detergent |
| Drain | ---- | ---- | 1:00 | ---- |
| Wash | Low | Hot | 6:00 | Break, Suds, Built Detergent |
| Drain | ---- | ---- | 1:00 | ---- |
| Wash | Low | Hot | 6:00 | Bleach, Chlorine or Oxygen |
| Drain | ---- | ---- | 1:00 | ---- |
| Rinse | High | Warm | 2:00 | ---- |
| Drain | ---- | ---- | 1:00 | ---- |
| Rinse | High | Warm | 2:00 | ---- |
| Drain | ---- | ---- | 1:00 | ---- |
| Final Rinse | Low | Warm | 4:00 | Sour, Softener, Sour/Soft |
| Antichlor | | | | |
| Drain | ---- | ---- | 1:00 | ---- |
| Low Speed Extract | ---- | ---- | 0:30 | ---- |
| High Speed Extract | ---- | ---- | 2-5:00* | *Depending on fabric type |
| Tumble | ---- | ---- | 0:30 | ---- |
| Total Cycle Time: 38 - 41 minutes plus fill times | | | | |

Personals or Blankets/Spreads

| Operation | Water Level | Water Temp | Time | Products |
|--|-------------|------------|---------|---------------------------|
| Flush | High | Cold | 1:00 | ---- |
| Drain | ---- | ---- | 1:00 | ---- |
| Wash | Low | Warm | 5:00 | Suds |
| Drain | ---- | ---- | 1:00 | ---- |
| Rinse | High | Warm | 2:00 | ---- |
| Drain | ---- | ---- | 1:00 | ---- |
| Final Rinse | Low | Warm | 4:00 | Sour, Softener, Sour/Soft |
| Drain | ---- | ---- | 1:00 | ---- |
| Low Speed Extract | ---- | ---- | 0:30 | ---- |
| High Speed Extract | ---- | ---- | 3-5:00* | *Depending on fabric type |
| Tumble | ---- | ---- | 0:30 | ---- |
| Total Cycle Time: 21-23 minutes plus fill times | | | | |

Extra Heavy Soil/Hospital/Nursing Home/Blood/Surgical

| Operation | Water Level | Water Temp | Time | Products |
|--|-------------|------------|---------|------------------------------|
| Flush | High | Cold | 2:00 | --- |
| Drain | --- | --- | 1:00 | --- |
| Flush | Low | Warm | 2:00 | Suds, Antichlor if desired |
| Drain | --- | --- | 1:00 | --- |
| Flush | High | Warm | 2:00 | --- |
| Drain | --- | --- | 1:00 | --- |
| Wash | Low | Hot | 6:00 | Break, Suds, Built Detergent |
| Drain | --- | --- | 1:00 | --- |
| Wash | Low | Hot | 6:00 | Break, Suds, Built Detergent |
| Drain | --- | --- | 1:00 | --- |
| Wash | Low | Hot | 6:00 | Bleach, Chlorine or Oxygen |
| Drain | --- | --- | 1:00 | --- |
| Rinse | High | Warm | 2:00 | --- |
| Drain | --- | --- | 1:00 | --- |
| Rinse | High | Warm | 2:00 | --- |
| Drain | --- | --- | 1:00 | --- |
| Final Rinse | Low | Warm | 4:00 | Sour, Softener, Sour/Soft |
| Antichlor | | | | |
| Drain | --- | --- | 1:00 | --- |
| Low Speed Extract | --- | --- | 0:30 | --- |
| High Speed Extract | --- | --- | 3-6:00* | *Depending on fabric type |
| Tumble | --- | --- | 0:30 | --- |
| Total Cycle Time: 45 - 51 minutes plus fill times | | | | |

Mineral Reclaim Formula (Iron, Copper, Manganese, Calcium, Magnesium)

| Operation | Water Level | Water Temp | Time | Products |
|--------------------|-------------|------------|---------|---------------------------|
| Flush | High | Warm | 1:00 | --- |
| Drain | --- | --- | 1:00 | --- |
| Wash | Low | Warm | 6-8:00 | Powdered Rust Remover |
| Drain | --- | --- | 1:00 | --- |
| Rinse | High | Warm | 2:00 | --- |
| Drain | --- | --- | 1:00 | --- |
| Rinse | High | Warm | 2:00 | --- |
| Drain | --- | --- | 1:00 | --- |
| Low Speed Extract | --- | --- | 0:30 | --- |
| High Speed Extract | --- | --- | 3-5:00* | *Depending on fabric type |
| Tumble | --- | --- | 0:30 | --- |

After the reclaim, the laundry would then be washed with a normal formula (based on the soil load). Or alternately, the reclaim formula may be at the front end of a formula and then after the second rinse, the formula would go into a normal cycle.

