DOMESTIC HOT WATER SCALD BURN LAWSUITS

The Who, What, When, Why, Where, How

A Seminar and Technical Paper for the 25-28 Oct 98 Annual ASPE Meeting at the Indianapolis Convention Center in Indianapolis, Indiana

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Domestic Hot Water Scald Burn Lawsuits – The Who, What, When, Why, Where, How

abstract

An inordinate number of people of all ages suffer debilitating and sometimes fatal injuries, due to 2nd and 3rd degree hot water scald burns in sinks, showers and bathtubs each year. Young children and toddlers are especially vulnerable due to their tender skin and inability to take appropriate evasive action promptly. The elderly and handicapped are vulnerable due to their slower reaction time. People of all ages can incur seizures that extend their escape time. Even without a previous history or no expectation of seizures, burn injuries can occur due to a sudden change of hot water to a much higher temperature with the trauma of extraordinarily hot water then inducing a seizure.

The burns are normally classified as 1st, 2nd, 3rd, and 4th degree burns. A first degree burn is a low skin penetration burn like sunburn. Second degree is a middle penetration burn causing blisters which often become infected when the blister breaks. Third degree is a full skin penetration burn that destroys nerves and will require skin grafts. Fourth degree is a deep burn that goes through the skin and into muscle and possibly bone, which often requires amputation of the extremities.

Scald burns occur when the time-temperature envelopes are exceeded. It is not a simple matter of temperature only. For example, third degree burns will occur in 1 second at 160 degrees Fahrenheit(°F), or in 30 seconds at 130°F, 10 minutes at 120°F, at about 10 hours at 110°F. But the pain threshold is only about 106–108°F.

In addition to burn cases originating in single family dwellings, a large number occur in apartment complexes, hotels/motels, and housing projects. The incidents are due to thermostats set too high, faulty thermostats, and lack or malfunction of temperature and pressure balancing valves at the point of source. The burn injuries in single family dwellings occur for some of the same reasons and also occur because of the layering effects in small hot water heaters.

These are all accidents that could be, and should be, prevented. This is because the residential owner or renter, and the apartment renter is invariably in the inferior position of knowledge regarding the burn time-temperature relations, the physics of equipment malfunctions, and appropriate remedial actions.

As a consequence, the entities at risk include the housing owner, the leasing agent, the maintenance plumbing company, the plumbing designer, the plumbing contractor, and the hot water heater manufacturer.

In this seminar, the technical aspects of hot water scald burn will be discussed in detail by Dr. Bynum using various charts and diagrams. In those situations where due diligence is not given to the hot water temperature system, the possible consequences and legal liabilities will be discussed by Atty. Petri and Mr. Myers.

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introduction

Over 8,000,000 hot water heaters are manufactured in the U.S. each year. There were about 60 million gas water heaters in use in the U.S. in 1988 (we do not have later data). Most of the hot water heaters are extremely dangerous when installed with usual temperature settings and conditions.

Expected hot water temperatures lack fidelity because of inaccuracies or defects in the thermostats and because tempering valves are rarely included in the heaters for residential use. These problems are further compounded by the layering or stacking phenomenon. The layering problem in hot water heaters is the condition where, because of laminar flow, the hottest water rises to the top of the heater after a hot water draw is completed. So the next hot water draw temporarily produces water at an excessively high temperature.

These conditions and others combine to put so many individuals at risk. But the heater manufacturer, the plumbing engineer, the plumbing contractor, the maintenance plumber, and in the case of rental property, the owner and the leasing agent are all at high risk in lawsuits when adequate temperature control is not addressed, causing scald burn injuries.

According to data from the National Safe Kids Campaign, 4000–5000 children are scalded each year, most often in bathtubs. The average bathtub scald burn covers 12% of the body surface with a full thickness third degree burn. Statistics from the National Safe Kids Campaign indicate that the scald burn sources were 95% residential settings (54% in apartment houses and 46% in single family homes).

The resulting scald burn injuries are invariably horribly painful for the victim, with continuing trauma without end. With the deeper burns and large percentage of total body surface injured, the problems do not end with wound closure.

Our equation for approximately determining the total body surface of skin is given at the top of **Plate 1** p.9. Using this equation, given the height and weight, the approximate total body surface can be determined.

With children, the treating surgeon must periodically "release" the skin as it becomes tight from growth, since grafted skin does not stretch in a normal manner. Without these serious, continuing surgeries until the victim becomes an adult, the muscles would pull the bones into grotesque configurations. And then there is the emotional trauma of ugly scar tissue.

Very often, one or more of the responsible entities are successfully sued, with enormous costs to all of society. It does not have to be this way.

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the skin

The surface area of the skin varies from about 0.2,– 0.3 square meters for a newborn baby to about 1.5 – 2.0 square meters for an adult human. The outer layer of the skin or epidermis ranges from about 0.05 mm thick in the eyelids and other body fold areas, to about 1 mm thick on the soles of the foot.

The dermis or inner skin layer is usually about 10 times the thickness of the associated epidermis. Average total skin depth is 1–2 mm thick in males, thinner in females, and thinner in newborns. The skin thickness increases into middle age, then progressively becomes thinner. The average total body surface of the skin constitutes between 15 to 20 percent of total body weight.

The 1st degree burns are equivalent to sunburn and rarely cause any permanent injury. The 2nd degree burns can vary in depth from superficial dermal assault to deep 2nd degree burns, which can sometimes evolve into 3rd degree injury.

Medium to deep 2nd degree burns cause blisters, which can provide an ideal breeding ground for all sorts of nasty creatures, especially if the blister is punctured. Third degree burns are full penetration and skin grafts will be required.

The 3rd degree burn destroys the sebaceous glands, nerves, sweat glands, and hair follicles. Sometimes the veins, arteries, and subcutaneous fat are injured. The muscle, ligaments, tendons, and bones are damaged in 4th degree burns.

The victim suffers less initial pain with 3rd degree burns since the nerves are destroyed. But greater pain with 3rd degree burns are endured in the prolonged treatment of various excisements, grafts, and scrubs, in addition to the problems with contractures.

time temperature relations and survival

Plate 2 p.10, gives the time temperature relations for both children and adult 2nd and 3rd degree burns, given in tabular and graphical form. The importance in scanning this presentation is to note that the graphs are plotted on semilog paper.

This shows how the time to burn increases exponentially with increasing hot water temperatures. Look at the 3rd degree burns for adults curve. It shows 3rd degree injuries occur in about 1 *second* at 160°F, 5 *seconds* at 140°F, 9 *minutes* at 120°F, 6.7 *hours* at 110°F.

The morbidity rate is given in **Plate 1** as a function of percent of burn area and age. The chance for fatality is given in percent, and note the drastic and exponential decrease in chance of survival as a function of increasing age and increasing extent of TBS (total body surface) burn percentage.

This graphical presentation is based on the work of Martin and Richardson, the original work of Hendriques and Moritz in the late 1940's, and other sources.

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classes of super risk victims

Plate 3 p.11, gives the anthropometric variation of percent of TBS of skin as a function of age. From newborn to adult, note how the TBS area of the head decreases, while the TBS area of the upper and lower legs increases. This explains why children with smaller legs with a given percent TBS on their legs can have so many problems with leg burns during their growth period.

The elderly are at especially high risk because of their reduced reaction time. **Plate 4** p.12, gives some approximations of bathtub and shower escape time as a function of age.

But it is not only the children or the aged who are at risk. In one case the victim was taking a shower in an apartment complex and had a seizure, even though the proper prescribed medication had been taken as directed. He turned on more hot water while grabbing the mixing valve handle in an attempt to break his fall. When he regained consciousness the hot water was at such excessively high temperatures that his skin had burned off and had clogged the drain. The bathtub then began filling with excessively hot water. When he came to the second time, he ran screaming down a hall until he passed out due to the trauma.

So, who is not at risk when the hot water supply is at excessively high temperatures?

codes and standards

The code identifications and the particular model code adopted for each state in the U.S. are shown in **Plate 5** p.13. The number of states that have adopted each particular model code are 18 IPC, 13 UPC, 10 SBCCI (or IPC), 5 NSPC, 3 special state codes, and 1 state, Ohio, with a modified IPC.

We have surveyed a large number of special state codes in the U.S., such as requirements for educational facilities, nursing homes, health departments, hospitals, mental rehab centers, adult day care, etc. The results give an average mandated maximum hot water supply temperature of 120°F for the 32 special regulations surveyed.

We made another survey of various standards, specifications, and guidelines from various standard associations. The results gave an average recommended maximum hot water supply temperature of 116°F for the 69 associations surveyed.

The short summary of Federal Regs is given in **Plate 6** p.14. The average for maximum allowable hot water temperature given here is 112°F.

The ACA (American Correction Association) standard of minimum 100°F and maximum 120°F is used by most states for regulation of maximum hot water temperature in jails and prisons. Some exceptions include Texas and Michigan at 110°F, and the lowest is California at 105°F. Note that the pain threshold while showering is normally a mixed water temperature of about 106°F.

Reasons for these prison regulations are that a couple of inmates could hold another prisoner under excessively hot water and torture or kill their target. This is because the normal comfortable temperature for bathing or showering is about 100°F. And a person should never jump into a spa or hot tub with water temperature over about 102°F, because with greater temperatures, any latent heart problems can be exacerbated by heart fibrillation from the shock and trauma.

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uselessness of meeting the present standards

One of the most abhorrent standards ever devised is ANSI Z21.10.1, for gas water heaters with 75,000 Btu/hour or less, as it is in its present form. Reason is the tremendous allowance in testing to meet the standard.

A part of this standard for example gives a tolerance of plus or minus 10°F allowable on the thermostat setting, or a 20°F spread. In addition, another test with a 160°F thermostat setting pronounces the product satisfactory if the outlet water temperature does not exceed 190°F, or a 30°F spread in excessively high temperature hot water.

And UL 174 is the normal standard for certifying electric hot water heaters. The heater tested under UL 174 is pronounced satisfactory if, in effect, the heater does not develop an electrical short circuit, nobody is electrocuted, and if nothing catches on fire.

These are good standards in the sense that the objectives are noble and worthwhile, but these standards are for performance only in testing, and not for usage. When will the subject of temperature control of the delivered hot water be addressed so that the temperature will not be inaccurate by 30 to 40°F?

bath / shower cycle periods

Plate 7 p.15, depicts the hot/cold water mixture temperature versus percent of hot water as a function of hot water temperature supply and cold water temperature supply. For example, for a comfortable 100°F shower with a 115°F hot water supply the percent of hot water out of the mixture valve will be 68% when the cold water supply is 70°F. Percent hot water in the mixture valve will be 77% when the cold water supply is 50°F, and 82% with 30°F cold water.

Proceeding a step further, the maximum shower time, the recovery time, and the cycle time are shown in **Plate 8** p.16. This uses as an example a 50°F cold water supply, 40 gal tank, 40,000 Btu/hour recovery, a 100°F mixed water shower temperature, and 4 GPM mixed water out of the shower, or into the bath.

With a 115°F maximum hot water supply, the mixture initially has 76.9% hot water, and the percent hot water will have to be steadily increased to maintain a 100°F mixed water from the shower. With these conditions note that the allowable shower time is 4 minutes but only 7.5 minutes for recovery, or 11.5 minutes cycle time. So that means 4 people can take a comfortable 4 minute shower at a constant 100°F by gradually increasing the percent of hot water from 76.9 to 100 over the 4 minutes, with a cycle time for 4 people of 46 minutes.

Next, consider the hot water supply to initially be at 160°F. This extends the allowable shower time at a comfortable 100°F mix to 10.5 minutes, but the recovery time is extended to 30 minutes, or 40.5 minutes cycle time per person. This now then requires 162 minutes or 2 hours 42 minutes total for 4 people to shower.

Net effect of all of these numbers is that turning a hot water heater up from 115°F to the extremely dangerous temperature of 160°F, the allowable time for shower increases by 10.5/4 = 2.62, but the cycle time increases more, by 162/46 = 3.52. So for how long a shower should the installation be designed?

Substantially increasing the allowable shower time is just like asking for a cup of coffee from a fast food restaurant at the standard 180°F holding temperature so that you will be able to drive down the highway for another 100 miles with hot coffee. Why not just buy a thermos bottle? Or stop again for a refill of coffee that you can drink without burning your mouth or suffering 3rd degree burns when you spill excessively hot coffee on yourself?

If the shower time simply must be increased, then the solution is to buy a larger capacity tank, and not to increase the hot water supply temperature to extremely dangerous temperatures. And the lower the heater temperature, the greater the energy savings.

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anti-scald devices

A patent search was done for U.S. patents on anti-scald valves. Interestingly, 41 patents going back to 1917 were reviewed. So a suitable means for alleviating the hot water scald burn issue has been a concern to some workers on the subject for over 80 years. The use of anti-scald valves is the most obvious manner to fix the problem.

The U.S. manufacturers of hot water heaters could and should incorporate tempering valves within the heater design. The heater could then have two hot water outlet ports.

One hot water port would be for bathroom sinks, kitchen sinks, showers, and bathtubs, with delivered hot water at a maximum of 115°F. The second port could then have delivered water at very high temperature (in excess of 115°F). What the purpose is for such high temperatures is unclear.

Reason is that some soaps are made so that clothes can be washed in cold water. Also, another argument is that water in excess of 115°F is needed for the dishwasher—not so.

As explained in information from the Soap and Detergent Association, the cleanliness of dishes from the washer depends upon: 1) type of soap; 2) amount of soap; 3) agitation in the washer; 4) soak time; 5) length of time dishes have sat dirty before washing; and of course; 6) hot water temperature. But never temperature of the hot water alone.

Further, nearly all of the newer dishwashers have a built-in water temperature booster. If an old dishwasher is being used, the 115°F hot water to the the washer can be more than compensated for with a judicious choice of soap, preferably a soap containing an appropriate detergent for the job, and a soap that contains a suitable surfactant.

We believe that hot water heater manufacturers could and should incorporate a tempering valve within the heater quite simply because of the economies of scale. Our survey shows that orders by tempering valve distributors are normally in the hundreds, and an extremely rare order is one for quantities of over 1000 units. It does not take much thought to realize how low the cost would be for orders of one million units or more. The tempering valve manufacturers could then appropriately tool up, change the design, and reduce the unit cost accordingly.

We are discussing here both the point-of-source (in or near the hot water heater) or point-of-use (at the bathtub/shower). For point-of-use, one manufacturer retails tempering valves at $24.99 for the tub spout, $12.00 for the shower head, and $6.99 for the sink.

The plumbing engineer and the plumbing contractor would be well advised to strongly recommend the use of either a point-of-source or a point-of-use tempering valve in all designs and installations.

installation, maintenance

The normal order of priorities in engineering product design are enumerated in **Plate 9** p.17. The basic design is the responsibility of the original manufacturer and the design normally should not be changed. Exception is the addition of protective measures such as heater lockdown, which in effect would be guarding.

This is exceptionally important in apartment complexes where, oftentimes anyone can get to, see, and adjust the hot water heater temperature. Better that the heater be installed so that the casual passerby cannot easily vary the thermostat setting.

The warnings on hot water heaters are usually inadequate. See **Plate 10**. p.17. The manufacturers should make the warnings more conspicuous, robust, harsh, and fewer in number.

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open & obvious

In litigation with various types of product liability cases, the most often used defense proffered has been that the danger giving rise to the injury was “open and obvious”, and hence the user, guardian or parent of a child or invalid (those generally injured) “incurred the risk” or “assumed the risk” and caused their own harm. This simply is not so in litigation with tap water scald burn injuries. The reasons are many. For example:

1. Very young children and toddlers may not be strong but they can be fast. Young children can easily turn on a worn hot water valve in the bathtub after their bathing water has been drawn. When the water is excessively hot, over 115°F by only 25 degrees, a child can incur 2nd or 3rd degree burns before the caretaker can turn off the hot water quickly enough, even if the caretaker is in the bathroom with the child.
2. There have been occasions where people of advanced age have slipped on the soapy floor of a bathtub while taking a shower, accidentally turned the mixing valve to all hot while falling, and be so severely injured from the fall that they simply cannot reach up to turn off the scalding water.
3. People of any age can have an unexpected petit or grand mal seizure and get severe scald burn injuries, regardless of any knowledge that they may have about scald burns.
4. It is not obvious what the temperature of hot water may be by smelling, hearing, or seeing the water. It will become obvious when the excessively hot water is felt during 2nd degree burns, which may be too late to avoid injuries.
5. It is not open and obvious to the average prudent member of the community that the risk of tap water scald burns increases exponentially with relatively small increases in decrements of temperature change.
6. It is not open and obvious to the vast majority of people what the time-temperature scald burn relations are for 2nd or 3rd degree burns, for adults or for children.
7. It is not open and obvious what the time-temperature scald burn relations are from reviewing hundreds of hot water heater manufacturer’s owner's manuals, or their installation manuals, or their product brochures.
8. It is not open and obvious what the hot water temperature in the hot water heater tank may be with any particular thermostat setting.
9. It is not open and obvious that a 4 GPM hot water draw rate exceeds the recovery of all normal residential hot water heaters. Hence the drastic change from the draw down temperature to the stacking temperature is not obvious.
10. It is not open and obvious to the ordinary consumer what, when, where, why, how an external tempering valve on the heater can or should be used.
11. It is not open and obvious as to the extreme consequences of incurring tap water scald burn injuries. The initial injuries may appear to be nothing more than a deep sunburn, until later when the blisters begin to form.
12. It is not obvious that blisters accidentally punctured are extremely susceptible to infection.
13. It is not obvious how a necrosis from deep 2nd degree burns can progress into the equivalent of full 3rd degree burns.
14. It is not open and obvious what time duration and extent of injury with scald burns can cause destruction of all the nerves in the skin.
15. It is not open and obvious what specific temperatures are extremely dangerous. After the E. Coli contamination of hamburgers in California occurred, the FDA passed a regulation that hamburger meat had to be cooked at 155°F—and ANSI Z21.10.1 has a test at 160°F that pronounces a gas water heater satisfactory if the temperature does not exceed 190°F!
16. It is not open and obvious how a dermatome is used to obtain a split skin graft from an unburned donor site of a burn victim to cover their 3rd degree burns.
17. It is not open and obvious that allografts, or cadaver skin from skin banks may have to be used to cover a high percent TBS 3rd degree burn.
18. It is not open and obvious that the area under allografts sometimes get infected, requiring excision, and reapplication.

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19 It is not open and obvious that a recovered victim of 3rd degree hot water scald burns will never sunbathe on the beach again, except for a few minutes.

20 It is not open and obvious what the temperature is in the hot water heater tank when the thermostat is marked WARM, NORMAL, HOT, and the ordinary consumer will not know that these vague terms usually mean 120°F, 140°F, 160°F respectively.

21 It is not open and obvious to the ordinary consumer what the vague terms of WARM, HOT mean regarding safe bathing/shower conditions, and the WARM or HOT is what a far North Eskimo or Laplander gets when the outside temperature gets up to 40°F.

22 It is not open and obvious to the ordinary consumer that water at "Normal" settings can cause 2nd degree burns to an adult in 2.8 seconds, and to a young child in 1.5 seconds.

23 It is not open and obvious to the ordinary and prudent member of the community that the delivered hot water may be layered or stacked causing the hot water temperature to be as much as 40°F more than expected from a review of the owner's manual for the heater.

24 It is not open and obvious to what extent trickle flow or selected intermediate hot water draw schedules will induce stacking.

25 It is not open and obvious to the ordinary consumer that when the thermostat has the temperature marked in decrements on the adjusting knob, the hot water temperature can be substantially different than the set point.

26 The ordinary, reasonable member of the community is not a learned hand relative to the expected knowledge of the heater manufacturer, the plumbing engineers, and the plumbing contractors and therefore cannot be expected to understand or appreciate the extreme dangers of scalding water.

27 The ordinary, reasonable, prudent member of the community can and should expect an implied warrant of habitability of a rented or leased dwelling from the owner and leasing agent that the premises shall be safe, which includes hot water at temperatures that cannot cause severe scald burns in only a few seconds. This type of warrant is often mandated by city ordinance.

28 It is not open and obvious to the ordinary consumer in an apartment dwelling that multiple, simultaneous cold draws by others flushing toilets or using cold water for other purposes can drastically and suddenly lower the cold water pressure to their shower so that the comfortable mixed water valve setting can immediately produce dangerous scalding water.

29 It is not open and obvious to the consumer that these drastic cold water changes in pressure call for a pressure balancing valve at the water heater.

30 It is or should be open and obvious to a hot water heater manufacturer that all of the above conditions often exist, but that the ordinary prudent member of the community would not understand the nature of these dangerous conditions.

31 It is or should be open and obvious to hotel/motel/apartment managers and owners and maintenance personnel that the hot water temperature adjusting screw in individual point-of-use shower anti-scald valves may have to be readjusted after remodeling, etc. This is not obvious nor should it have to be a concern to the consumer.

32 It is not open or obvious to the ordinary consumer in an apartment complex when a point-of-source tempering valve does not fail safe. However maintenance should periodically check that valve and replace it if the point-of-source valve is not a fail safe design.

33 It is not open or obvious to the ordinary consumer in an apartment complex, what the extreme consequences may be if that consumer increases the setting of the thermostat that is too readily accessible.

conclusion

Excessively hot tap water is extremely dangerous, and at temperatures above 115–120°F can in an unimaginable short period of time, result in serious or fatal scald burn injuries. These burns cause horrendous injuries often requiring extensive hospital time for multiple excisement of necrotic tissue, debridements, skin grafts, multiple plastic surgeries, therapy, and counseling for extended periods of time. The required medical care is prolonged and expensive, and the usual ensuing litigation is time consuming and expensive to the clients of defense attorneys. All of this need not be.

ASPE may have the capability to alleviate all this pain, suffering, and unnecessary expense. We know that we have not been eloquent enough here. But surely there are others within ASPE and in the industry that could take appropriate steps to improve hot water heater design and to furnish informational and training materials to plumbing engineers, plumbing contractors, plumbers, owners, leasing agents, and maintenance personnel. To what end? So the horrendous problems described here can be put to rest, not in a grave, but in a gain of societal benefits.

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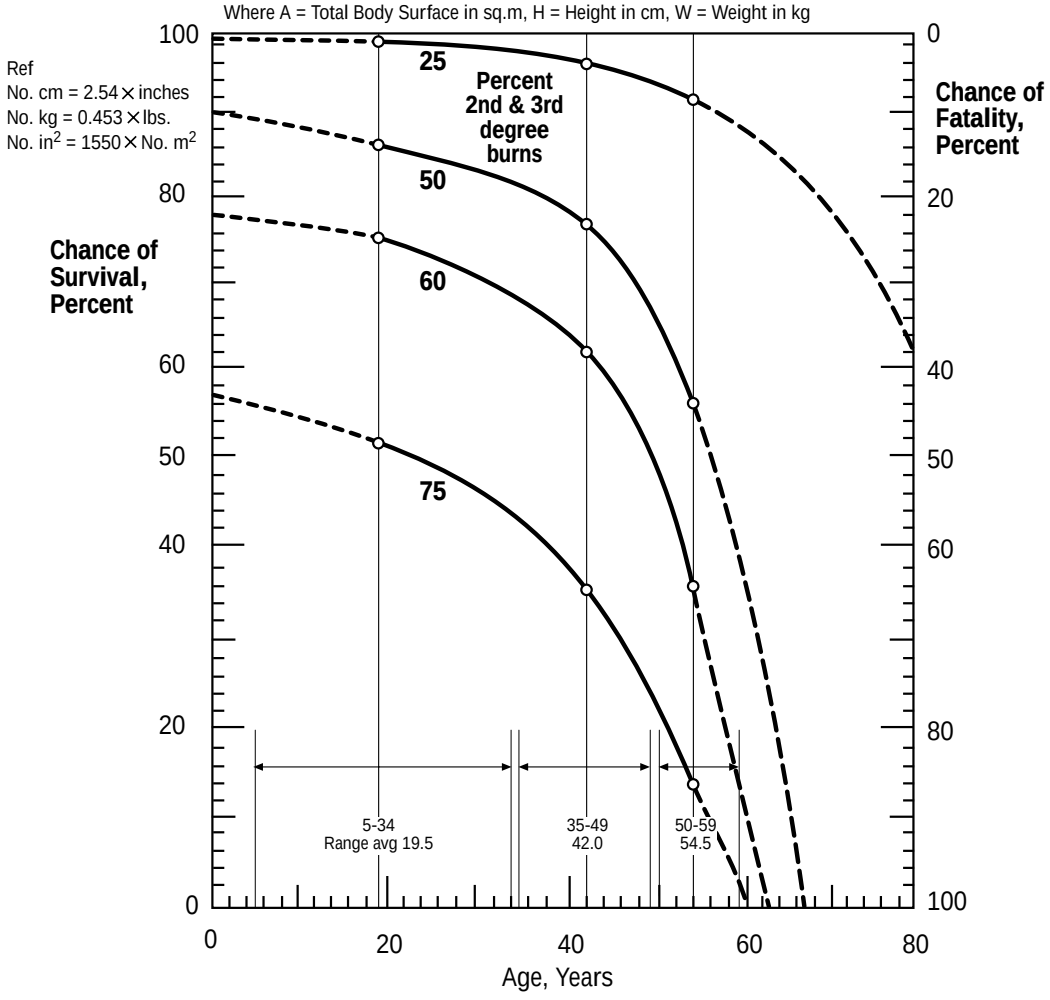
thermal radiation burn survivability vs age & percent, 2nd & 3rd degree burns

1st Approx., A = $\frac{2.63\,H + 8.36\,W - 99.9}{W + 429}$, after data by Woodson, Human Factors

Where A = Total Body Surface in sq.m, H = Height in cm, W = Weight in kg



Graph Ref Data: National Burn Information Exchange, 1986 Final Report
Est. 1964 at Univ. Mich., Ann Arbor, MI by US Public Health Svc.
After Du Pont / Nomex Brochure H-46338

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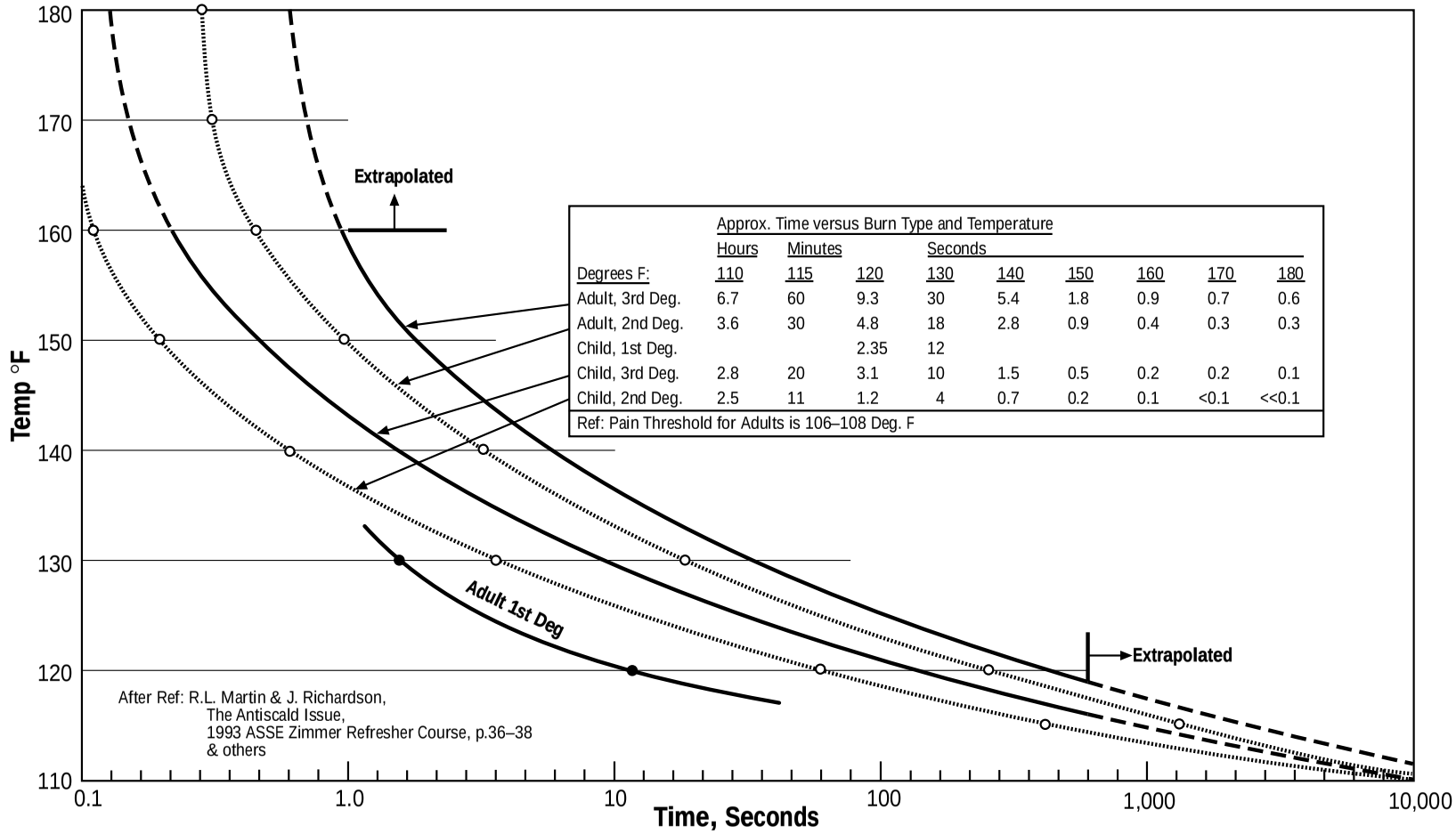
hot water scald burns, time - temperature relations, 2nd & 3rd degree burns, adults & children



Approx. Time versus Burn Type and Temperature

	Hours	Minutes		Seconds					
Degrees F:	110	115	120	130	140	150	160	170	180
Adult, 3rd Deg.	6.7	60	9.3	30	5.4	1.8	0.9	0.7	0.6
Adult, 2nd Deg.	3.6	30	4.8	18	2.8	0.9	0.4	0.3	0.3
Child, 1st Deg.			2.35	12					
Child, 3rd Deg.	2.8	20	3.1	10	1.5	0.5	0.2	0.2	0.1
Child, 2nd Deg.	2.5	11	1.2	4	0.7	0.2	0.1	<0.1	<<0.1

Ref: Pain Threshold for Adults is 106–108 Deg. F

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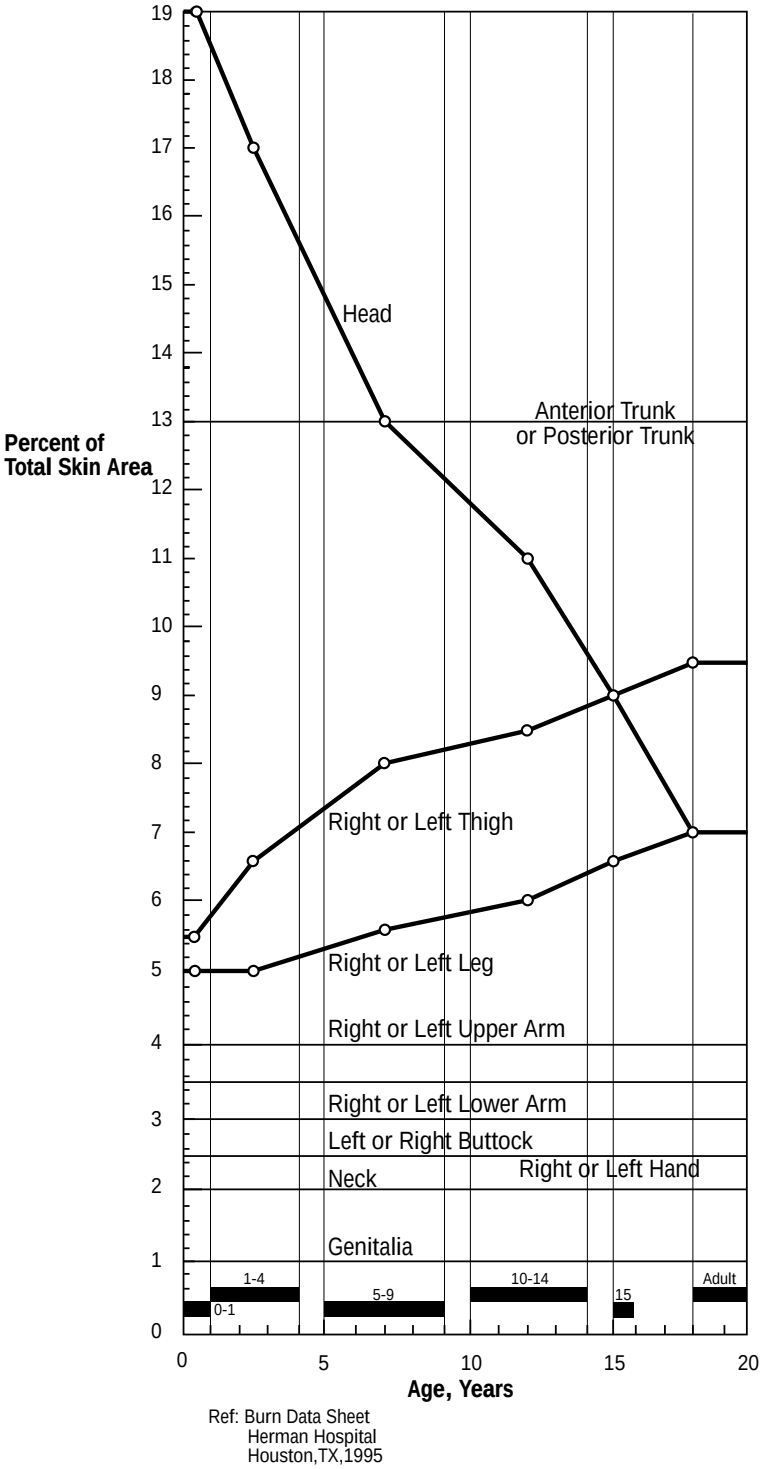
percent skin distribution vs age



Ref: Burn Data Sheet
Herman Hospital
Houston,TX,1995

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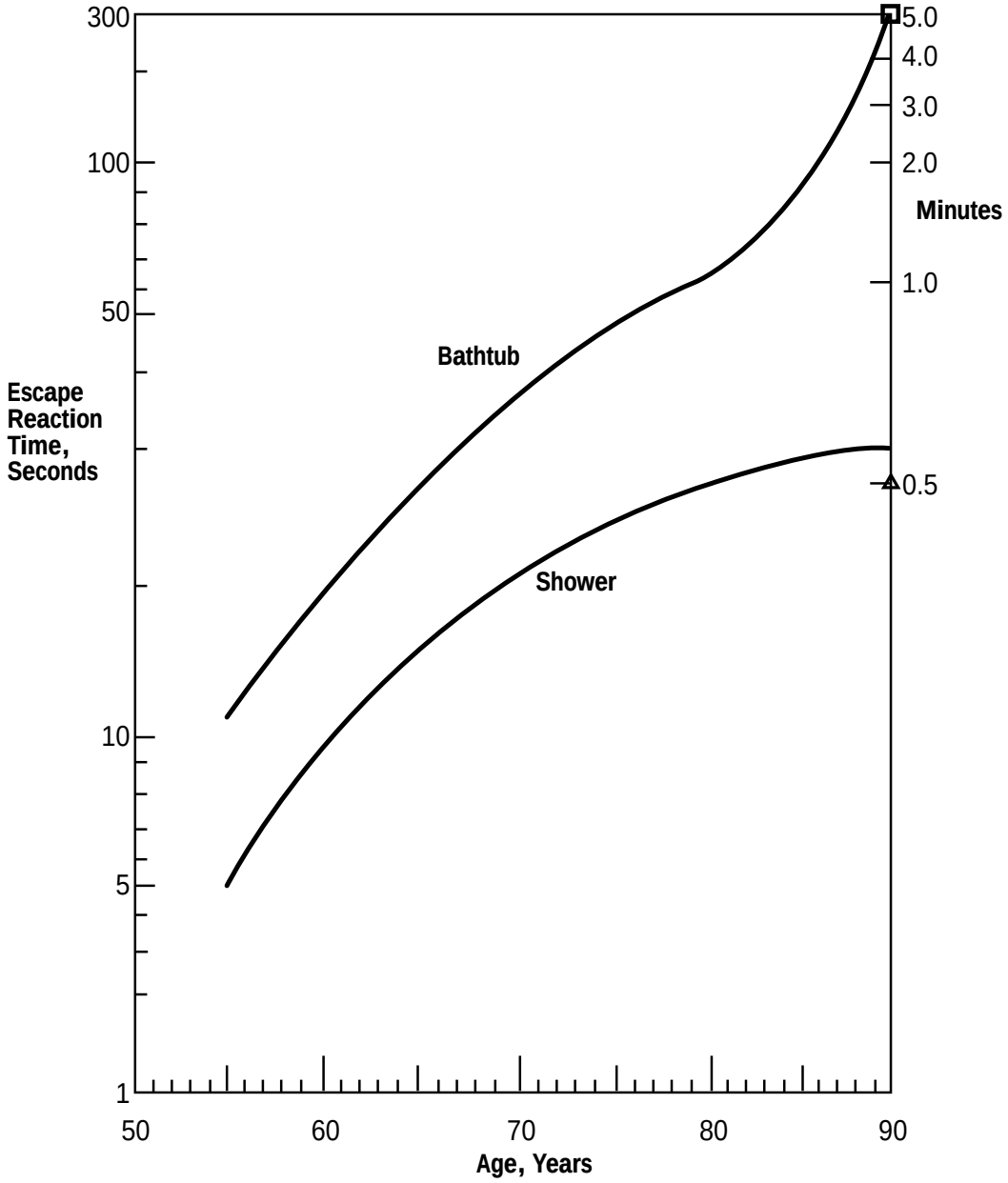
estimateD average escape reaction time from hot water by the elderly



Ref: A.L. Martin, "Antiscald Issue" ASSE Zimmer Refresher Course, 1993, p36–38 with inference

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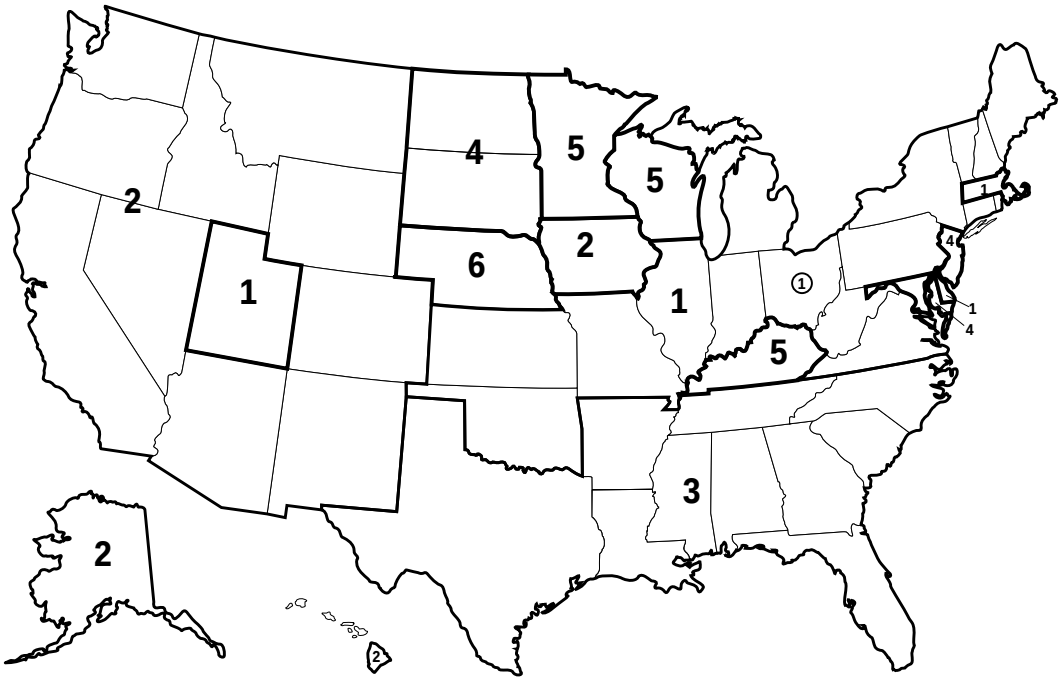
code adoptions by state



No. States	Key		Edition Last/Next
18	1	International Plumbing Code 1993 – Max 120°F	97/00
13	2	Uniform Plumbing Code (IAPMO/ICBO) 1994 – Max 120°F	97/00
10	3	SBCCI or International Plumbing Code 1996 – Max 120°F	97/00
5	4	National Standard Plumbing Code (PHCC) 1996 – Max 120°F	96/98
3	5	State Code or Not Yet Committed	
1/50 Ref.	6	A40 1993 Safety Standard for Plumbing (ANSI/MCA/PHCC/IAPMO)	93/?

Page 10/Plumbing Engineer, Mar 98 & Nov. 97

ANSI	American National Standards Institute
BOCA	Building Officials and Code Administrators, International
CABO	Council of American Building Officials
IAPMO	International Association of Plumbing and Mechanical Officials
ICBO	International Congress of Building Officials
ICC	International Code Council (BOCA/ICBO/SBCCI)
IPC	International Plumbing Code (ICC/BOCA/ICBO/SBCCI)
MCA	Mechanical Contractors Association of America
PHCC	Plumbing, Heating, Cooling Contractors, National Association
SBCCI	Southern Building Code Congress International
IRC	International Residential Code (was 1 & 2 Family Dwelling Code), (BOCA/ICBO/SBCCI)
①	Ohio, Modified IPC Effective 31 Aug 98 (Modified Interceptors and Floor Drain Reqts)

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summary–federal hot water regulations

1	110°F Max	U.S. Dept. Health & Human Services, *Guidelines for Construction & Equipment of Hospital & Medical Facilities*, HRP - 0905974, JUL84, avail. from NTIS, p48: "Hot water for showers and bathing facilities shall be at an appropriate temperature for comfortable use but shall not exceed 49°C (120°F) (see Table 4)." Table 4 gives temp in °F as 100 clinical (include shower), 120 dietary, 160 laundry.
2	105°F Max	*UFAS* (Uniform Federal Accessibility Standard), 105°F max by automatically controlled tempered water flow, 1988 edition, and ADA (American with Disabilities Act).
3	100–120°F	*ACA* (American Correctional Association), 100 to 120°F max automatically controlled for prison showers, "Adult Correctional Institutions, 3rd Ed, 1990."

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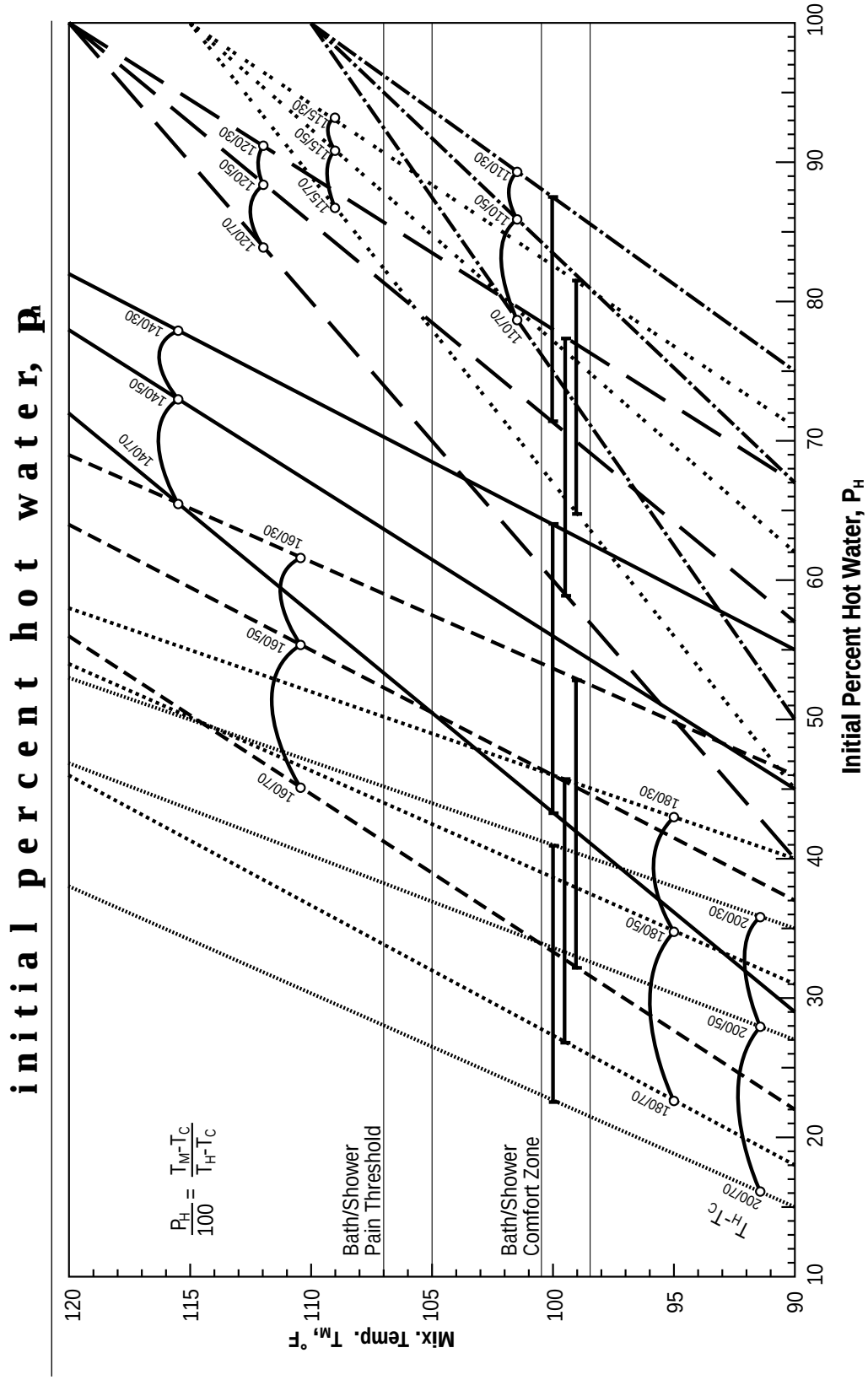

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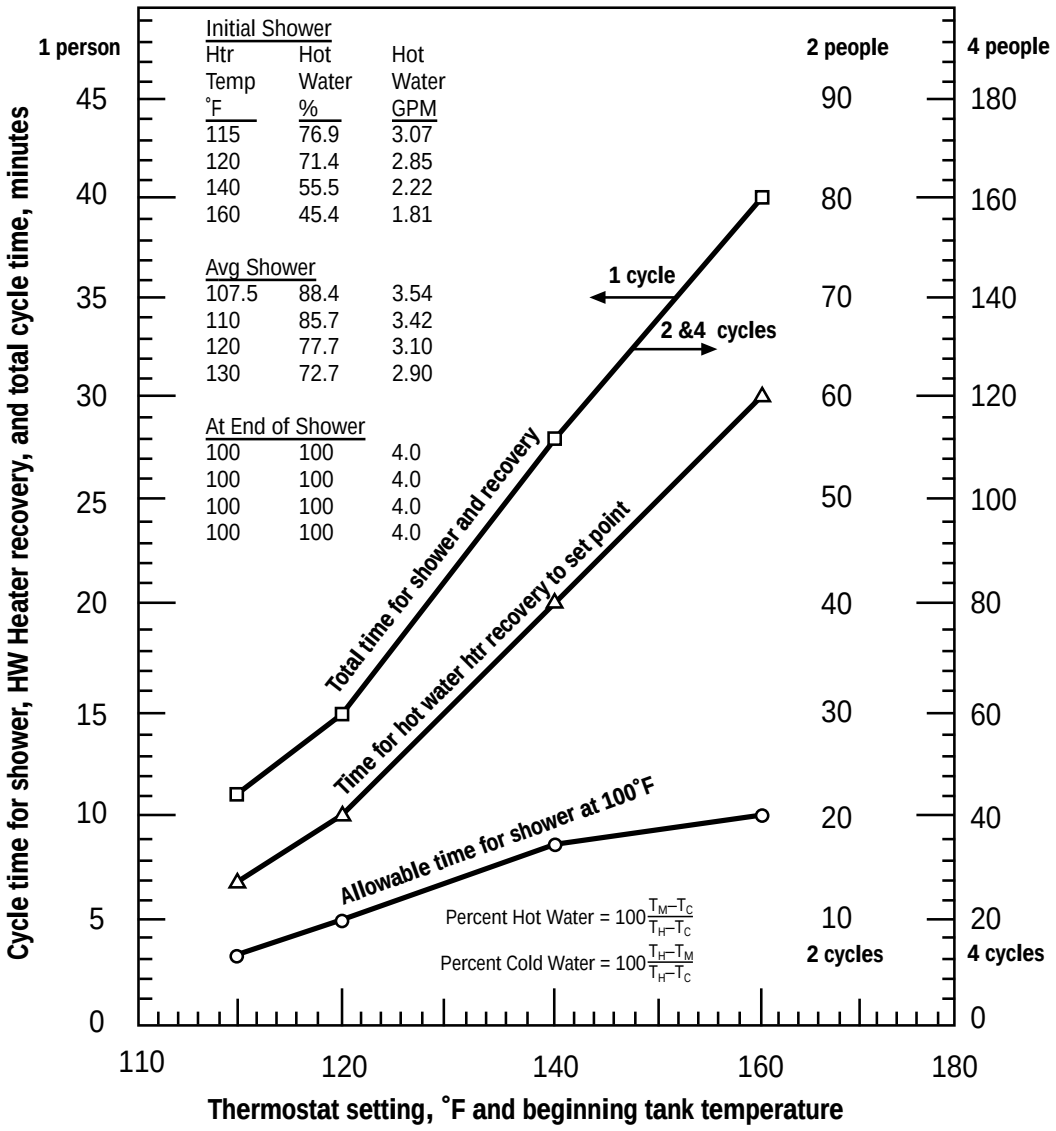
allowable shower time at constant 100°f, hot water heater recovery time and total cycle time

As a Function of HW Htr Thermostat Setting and

1. Cold Water Inlet Temp Constant at 50°F
2. Htr Recovery Rate at 40,000 Btu/Hr
3. 40 Gal HW Htr Tank Capacity
4. Shower Mix Temp of 100°F Constant
5. Percent Hot Water Increased From Initial to 100%
6. Shower Time Run Constant at 4GPM



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priorities of engineering product design/installation

a Design out all problems so that the product is fully functional, economical, attractive, and idiot proof. If all of these objectives are not fully satisfied, go to **B**.

b Provide guards on the product to protect the inattentive, and if that is not fully possible to do so, go to **C**.

c Provide warnings of suitable number, size, shape, and message to get the attention of the inexperienced and/or uninitiated user, and if that is not fully possible, go to **D**.

d Wear protective clothing for protection and/or to deflect the danger of a mishap, and if that is not appropriate, go to **E**.

e Prepare training materials to include safety instructions, background information, all in plain language, in the form of data sheets, brochures, books, or videotapes.

plate 9

rules for warning signs

1 Contains 4 Elements
- A. Signal word (always *Danger* re hot water)
- B. State admonition clearly
- C. State consequence unequivocally
- D. Provide pictorial

2 Use minimum but sufficient number of signs as an excess numbers of warning signs are usually ignored.

3 Avoid tiny printing, and use block letters of appropriate size.

4 Use permanent means of attachment of sign.

5 Make the sign aesthetically pleasing.

6 Give a source for additional information.

plate 10

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Atty. Vernon J. Petri and John T. Myers, Paralegal
Law Firm of Vernon J. Petri & Assoc., P.C.
Indianapolis, IN

Atty. Vernon J. Petri has over 25 years of trial experience and is with the law firm of Vernon J. Petri & Associates at 200 South Meridian Street, Ste. 301, Indianapolis, Indiana, 46225-1076.

Mr. Petri was awarded a Doctor of Jurisprudence degree from Indiana University in 1966, elected Prosecuting Attorney in 1966, re-elected in 1970 and served until 1974. He was elected President of the Indiana Prosecuting Attorneys Association and served on the Board of Directors for six years.

Mr. Petri is the ATLA National Chairman of Litigation involving burn injuries due to faulty products, defective products that are not fail safe, and gross negligence. Mr. Petri has a broad range of legal experience including trying numerous jury and court trials, and handling appeals to the Indiana Appellate and Supreme Courts.

He is a member of The Million Dollar Forum, a national organization reserved for lawyers who have won verdicts in excess of $1,000,000. Through his expertise and efforts he was successful in obtaining changes in the law beneficial to his clients and to the general public. Mr. Petri has been admitted to the bar of the State of Indiana, Federal Court, and the US Supreme Court.

Atty. Petri's varied area of practice includes serious injuries caused by defective products, including hot water heaters causing hot water scald burns, fires, explosions, vehicle crashes, highway maintenance and design defects. His work in the area of medical injuries includes medical malpractice, defective drugs or medical devices, birth injuries, breast implants, jaw implants, penile implants, and Norplant when they caused systemic disease and permanent harm. He has previously been engaged on various other types of cases such as general business litigation and business litigation involving fraud and misrepresentation.

Mr. John T. Myers is a Paralegal with the law firm of Vernon J. Petri & Associates in Indianapolis, IN. In this capacity he assists Atty. Petri in various lawsuits, including maintenance of a database on domestic hot water scald burn incidents.

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Dr. D. Bynum, Jr., P.E., Ph.D.
Forensic Engineer
Bynum Engineering PLLC
Montgomery, TX

Dr. Bynum is a consultant presently engaged primarily in Forensic Engineering with offices at 15001 Walden Road, Ste. 105, Montgomery, TX. 77356. He has had his own consulting practice for the last 22 years. His first 30 years of work experience was in design in various engineering disciplines and then followed by involvement in the litigation process as an expert witness for the past 12 years.

Dr. Bynum has the degrees of BSME from Texas A & M University, MSME from the University of Washington, post-graduate studies at the University of Texas, and a Ph.D. Degree from Texas A & M University in Interdisciplinary Engineering, resulting from post-graduate studies in Mechanical and Civil Engineering, and in Materials Sciences. He has been a registered Professional Engineer in the State of Texas since 1965, and is a member of ASPE.

Dr. Bynum has previously chaired numerous seminars and is the author of 3 patents, 7 books, and 100 published technical papers.

Dr. Bynum investigates various types of accidents then serves as an expert witness. He has been involved in over 300 litigation cases including 35 cases on hot water scald burns.

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Additional Reading and Information Sources for Protection Against Scalding Tap Water

Scalds & Falls of Infants & Small Children
U.S. Consumer Product Safety Commission
www.healthtouch.com/bin/Econtent

Scald Fact Sheet
Deaths and Injuries; How and Where Burn Deaths and Injuries Occur; Who is At Risk; Burn Prevention Effectiveness; Burn Protection Laws; Health Care Costs and Savings; Prevention Tips
www.safekids.org/fact99/burns99

Boston Shriners Researchers Complete Burn Survivor Study
Study shows majority of children who survive massive burns can expect favorable quality of life
www.shrinershq.org/WhatsNew/jama-00

Scalding Hot Water
ATLA Litigation Group
www.tap-water-burn.com/index

Scald Burns
Harborview Medical Center
www.atomz.com/search

Fire and Burn Injury Interventions:
Interventions to Prevent Scald Burns
http://depts.washington.edu/hiprc/chilinjury/topic/fireburns/scalds

Tap Water Scalding Alert
Electric water heaters; gas water heaters; furnace heaters.
www.safensoundkids.com/safetips

Tap Water Scald Database
Ravech, Roy & Ravech, P.C.,
Attorneys Specializing in
the Representation of Injured People
www.ultranet.com/~jroy/page10

Legionnaires' Disease: Facts & Liability Information
www.legionella.com/facts
www.legionella.com/Legionella%News.

Legionellosis: Legionnaires' Disease and Pontiac Fever
www.dcd.gov/ncidod/dbmd/diseaseinfo/legionellosis_g

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	WMS Sales, Inc.	56 Winchester Dr., Fairport, NY 14450	716 223-7980	716 223-7980
South East	Billingsley & Associates, Inc.	5609-D Salmen St., Harahan, LA 70123	504 733-7624	504 733-6904
	Billingsley & Associates, Inc.	478 Cheyenne Lane, Madison, MS 39110	601 856-7565	601 856-8390
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	Mid-America Marketing, Inc.	5466 Old Hwy. 78, Memphis, TN 38118	901 795-0045	901 795-0394
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	Target Marketing Enterprises, Inc.	118 West Grant St., Building M, Orlando, FL 32806	407 245-7838	407 245-7833
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	Hugh M. Cunningham, Inc.	475 West 38th St, Houston, TX 77018	713 695-0495	713 692-8991
	Mack McClain & Associates	11132 South Towne Square, Suite 202, St. Louis, MO 63123	314 894-8188	314 894-8388
	Mack McClain & Associates, Inc.	1537 Ohio St., Des Moines, IA 50314	515 288-0184	515 288-5049
	Mack McClain & Associates, Inc.	15090 West 116th St., Olathe, KS 66062	913 339-6677	913 339-9518
	Pro-Spec, Inc.	P.O. Box 472226, Tulsa, OK 74147-2226	918 461-0066	918 461-0105
North Central	Associated Independent Marketing	1606 Commerce Dr., Sun Prairie, WI 53590	608 837-5005	608 837-2368
	Dave Watson Associates	1325 West Beecher, Adrian, MI 49221	517 263-8988	517 263-2328
	Disney-McLane, Inc.	428 McGregor, Cincinnati, OH 45206	513 861-1682	513 487-5337
	Mid-Continent Marketing Services Ltd.	1724 Armitage Ct., Addison, IL 60101	630 953-1211	630 953-1067
	Marketing Affiliates	107 Cypress St. SW, Reynoldsburg, OH 43068	740 927-6880	740 927-4545
	Marketing Affiliates	4920 Commerce Parkway, Warrensville Hts., OH 44122	740 927-6880	740 927-4545
South West	Delco Sales, Inc.	2267 Yates Ave., Los Angeles, CA 90040	323 890-9250	323 724-5227
	Phoenix Marketing, Ltd.	3322 Columbia Dr. N.E., Albuquerque, NM 87107	505 883-7100	505 883-7101
	P I R Sales, Inc.	3050 North San Marcos Place, Chandler, AZ 85225	480 892-6000	480 892-6096
	R. C. Hartnett & Associates	30852 Huntwood Ave., Hayward, CA 94544	510 471-7200	510 471-4441
North West	Delco Sales, Inc.	111 Sand Island Access Rd., Unit I-10, Honolulu, HI 96819	808 842-7900	808 842-9265
	Fanning & Associates, Inc.	6765 Franklin St., Denver, CO 80229-7111	303 289-4191	303 286-9069
	Hollabaugh Brothers & Associates	1260 6th Ave. South, Seattle, WA 98134-1308	206 467-0346	206 467-8368
	Hollabaugh Brothers & Associates	3028 S.E. 17th Ave., Portland, OR 97202	503 238-0313	503 235-2824
	R. E. Fitzpatrick Sales, Inc.	4109 West Nike Dr. (8250 South), West Jordan, UT 84088	801 282-0700	801 282-0600
	Soderholm & Associates, Inc.	7150 143rd Ave. N.W., Anoka, MN 55303	763 427-9635	763 427-5665
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	Hydro-Mechanical Sales Ltd.	297 Collishaw St., Ste. 7 (shipping) Moncton, New Brunswick E1C 9R2	506 859-1107	506 859-2424
	Hydro-Mechanical Sales Ltd.	85 Tolt Rd., St. Phillips, Newfoundland A1B 3M7	709 895-0090	709 895-0091
	Le Groupe B.G.T. Inc.	2800 Rue Dalton Ste. 3, Parc Colbert, St-Foy, Quebec G1P 3S4	418 657-2800	418 657-2700
	Le Groupe B.G.T. Inc.	140 Rue Merizzi, Ville St. Laurent, Quebec H4T 1S4	514 341-9010	514 341-4464
	Walmar Mechanical Sales	24 Gurdwara Rd., Nepean, Ontario K2E 8B5	613 225-9774	613 225-0673
	Mar-Win Agencies Ltd.	1123 Empress St., Winnipeg, Manitoba R3E 3H1	204 775-8194	204 786-8016
	Mech-Mart	107 Hamilton Rd., P.O. Box 69, New Hamburg, Ontario N0B 2GO	519 662-2460	519 662-2491
	Northern Mechanical Sales	P.O. Box 280 (mailing) 163 Pine St. (shipping), Garson, Ontario P3L 1S6	705 693-2715	705 693-4394
	RAM Mechanical Marketing	441 Quebec St., Regina, Saskatchewan S4R 1K5	306 525-1986	306 525-0809
	RAM Mechanical Marketing	#13 - 1100 7th Ave. N., Saskatoon, Saskatchewan S7K 2V9	306 244-6622	306 244-0807
	Con-Cur West Marketing Inc.	7870 Express Street, Burnaby, B.C. V5A 1T4	604 420-6070	604 420-9022
	D.C. Sales, Ltd.	10-6130 4th St. S.E., Calgary, Alberta T2H 2A6	403 253-6808	403 259-8331
	D.C. Sales, Ltd.	11420 142 Street, Edmonton, Alberta T5M 1V1	780 496-9495	780 496-9621
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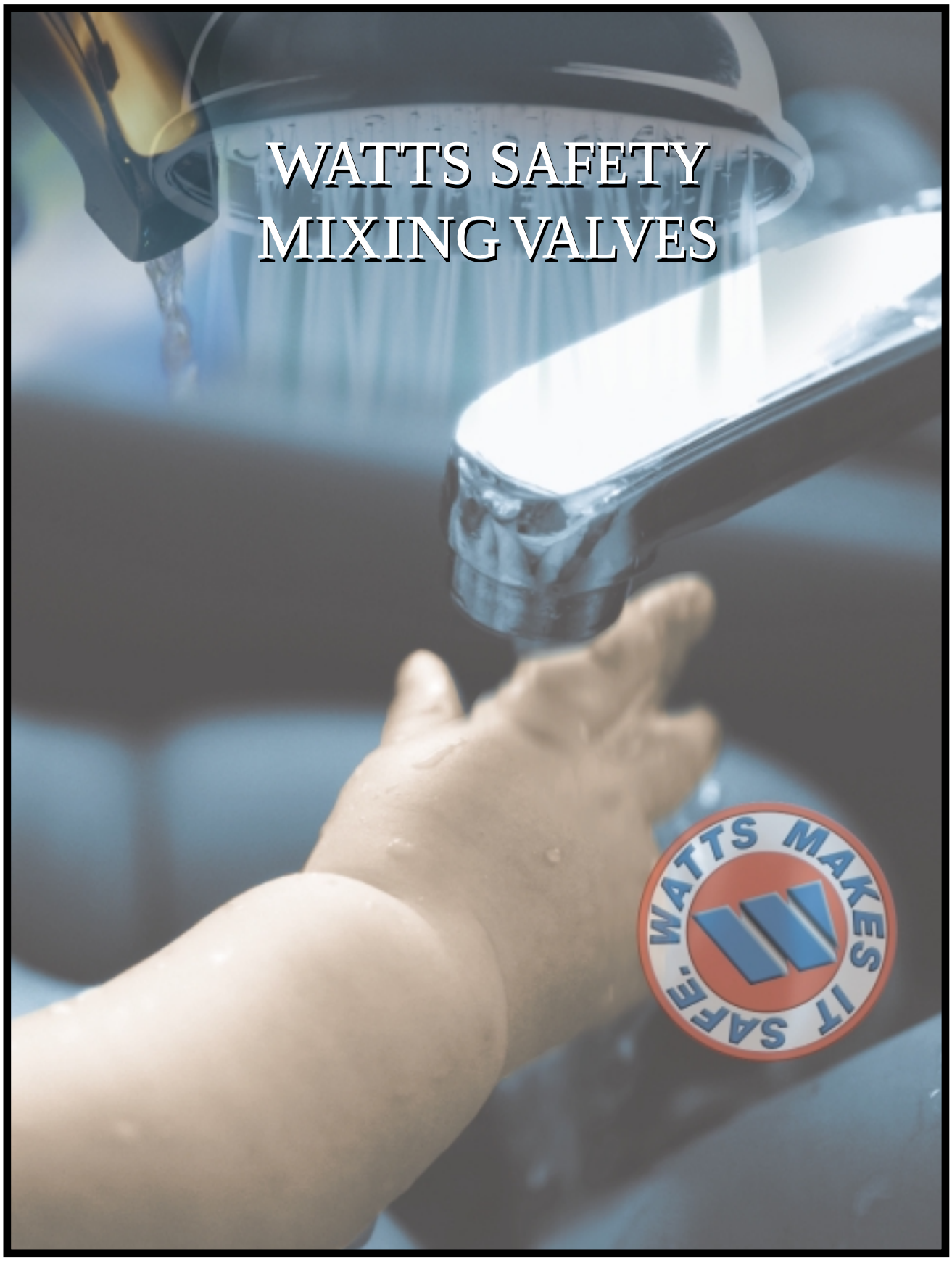

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