ON-PREMISES LAUNDRY PLANNING GUIDE

IPSO

INDUSTRIAL BY DESIGN

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Basic Conversion Factors

Cylinder Volume

Cylinder volume in Cu. Ft. = $\frac{\text{(Cylinder Diameter) x (Cylinder Diameter) x Cylinder Depth}}{2200}$

G Force

G Force = $\frac{\text{(Cylinder RPM) x (Cylinder RPM) x Cylinder Diameter}}{70{,}500}$

Moisture Content After Extraction

Remaining moisture in percentage to be evaporated through a drying process after extraction of the goods.

Remaining moisture in percentage = $\frac{\text{Weight of load after extraction – Weight of load when dry}}{\text{Weight of load when dry}}$

Example:

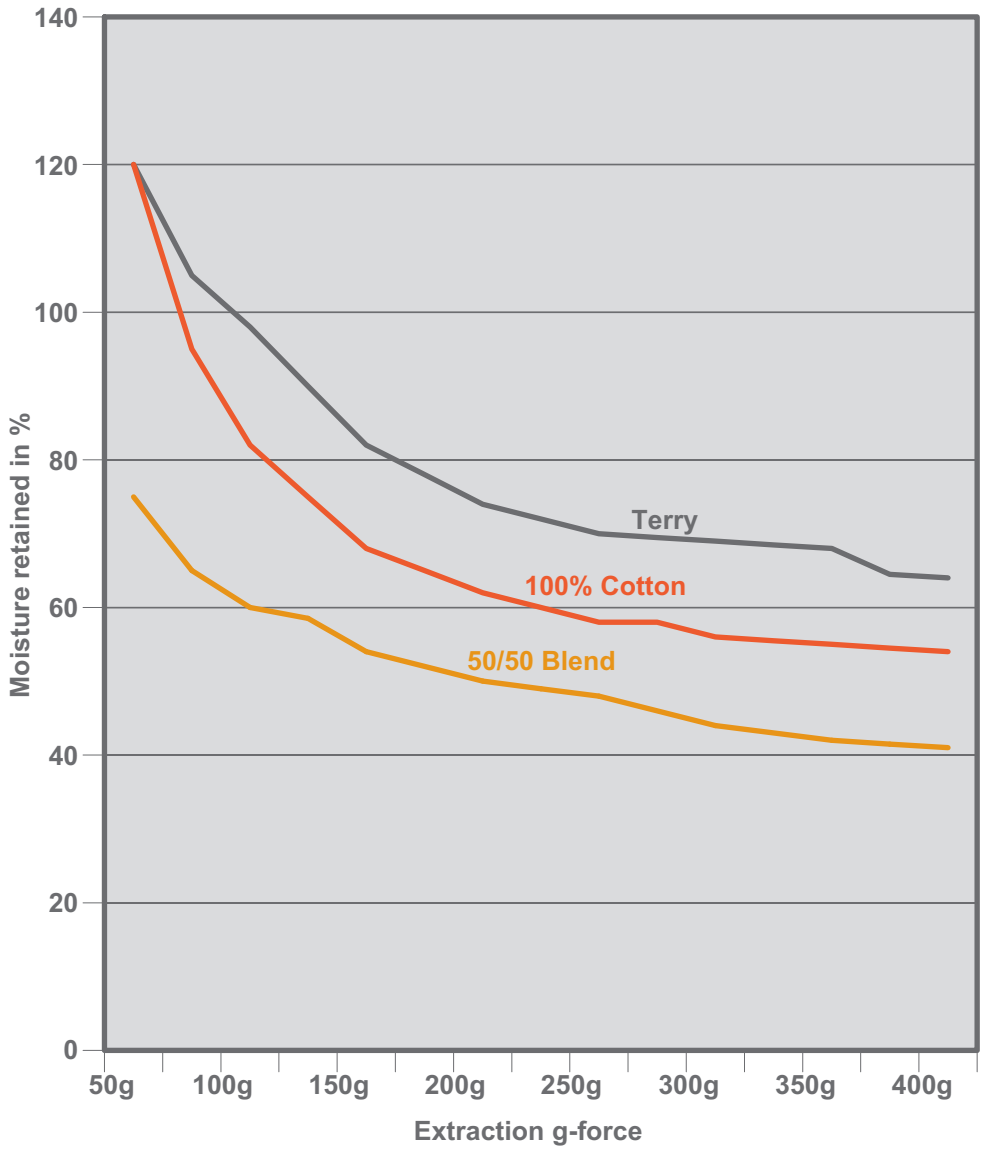
A load weighs 50 lbs. before processing. The load weighs 97 lbs. after washing and extraction.

$$\frac{97 - 50}{50} = \frac{47}{50} = .94$$

Percentage of moisture content remaining = 94%

NOTE: You can also estimate the amount of water remaining after extraction at a particular G-Force (refer to graph on next page).

Moisture Retention



Electricity

1 kW hr = 3413 BTU or 0.03413 Therm 1 Therm = 29.99 kW hr Kilowatt-hours, kW hr = Horsepower x .7457
For rough planning purposes, the cost of electrical power may be estimated to be about $0.0996 per kilowatt-hour. For accurate costing information, please contact your local power company for current costing.
Amps (3 phase) $\frac{\text{KW x 1000}}{\text{Volts x 1.732}}$ (1 phase) $\frac{\text{KW x 1000}}{\text{Volts}}$

Gas

1 BTU (British Thermal Unit) is defined as the amount of heat energy needed to raise the temperature of one pound (or 0.12 gallons) of water 1 degree Fahrenheit.
1 Therm is equal to 100,000 BTU or 100 cubic feet of Natural gas
1 Cubic foot of Natural gas is equal to approximately 1,075 BTU
1 Cubic foot of Liquid Petroleum (L.P.) gas is equal to approximately 2,450 BTU
1 Cubic foot of Butane gas is equal to approximately 3,260 BTU
1 Gallon of #2 Diesel fuel is equal to approximately 138,000 BTU
1 Gallon of #6 fuel oil is equal to approximately 142,000 BTU
1 Gallon of Propane is equal to approximately 92,000 BTU

Gas Cost:

Gas cost is usually stated as “Price per Therm” or “Price per M or MCF”.
When calculating costs, the total amount billed should be divided by the total Therms used.
Please contact local utility provider in order to obtain accurate pricing information as the price fluctuates dramatically.

Water

1 Gallon of fresh water weighs 8.33 pounds
1 Cubic foot of water equals 7.48 gallons

The capacity of a cylinder in gallons is equal to the length in inches of the cylinder multiplied by the square of the cylinder diameter in inches then multiplied by .0034.

NOTE: Doubling the diameter of a pipe increases its capacity four times.

PH Above 7.0 = Alkaline
Below 7.0 = Acid
Equal to 7.0 = Neutral

For planning purposes, you should contact your local water and sewer service provider for current costing information.

WATER HARDNESS

When processing goods in Hard Water, soap consumption will be higher than if Soft Water is used. A water softener is recommended when water hardness exceeds 3 grains per gallon of water.

Grains per gallon	Parts per million	Description
Less than 1	Less than 17.1	Soft
1 to 3.5	17.1 to 60	Slightly hard
3.5 to 7.0	60 to 120	Moderately hard
7.0 to 10.5	120 to 180	Hard
10.5 and over	180 and over	Like a stone

NOTE: One grain per gallon = 17.1 parts per million.

WATER SOFTENER SIZING

1. Determine the hardness of the water. A hardness of 3 grains or less is generally acceptable for use without additional softening.
2. Determine the total number of gallons of water per hour used, hot and cold.

3.Multiply the hardness of the water in grains x the total amount in gallons of water used per hour x the number of hours between regeneration/backwash of the softener. This will provide the size of the softener, in grains required. You should, however, make sure that the flow rate of the softener is adequate to provide the GPM (gallons per minute) flow required for the facility.

Example:
15 grains hardness x 750 gallons per hour x 48 hours between regeneration = 540,000 grain water softener required.

DRAIN TROUGH SIZING

1. Determine the total number of gallons water that may be drained at one time by all equipment in the facility (both present and future machines). Use the highest water level of each machine in order to calculate this number.
2. Divide the total number of gallons calculated above by 7.48 gallons per cubic foot. This will provide you with the cubic area required in order to capture the water if all machines drained at the same time.
   Example:
   125 total gallons ÷ 7.48 gallons per cubic feet = 16.71 cubic feet of trough required.
3. In order to minimize splashing, the trough depth should be a minimum depth of 12" and width of at least 15" if possible.
4. Using the example listed above requiring 16.71 cubic feet of trough area, and using the 12" depth and 15" width criteria, calculate as follows:

   12" depth x 15" width = 180 square inches

   180 square inches ÷ 144 (one square foot) = 1.25 cubic feet per linear foot

   16.71 cubic feet required ÷ 1.25 cubic feet
   per linear foot = 13.37 feet of trough

   Using these criteria the trough would be
   12" deep x 15" wide x 13.37 feet in length.
5. To ensure proper drainage, the drain trough should have a slope of ¼" per linear foot whenever possible (⅛" minimum).

BOILER HORSEPOWER

1 lb. Steam per hour = approximately 970 BTU per hour
1 Boiler Horsepower (B.H.P.) = 33,500 BTU per hour
1 Boiler Horsepower (B.H.P.) = 9.803 Kilowatts
1 Boiler Horsepower (B.H.P.) = 34.5 lbs. of steam

To determine the requirements, first determine all of the equipment that will require steam. Next, list the B.H.P requirements of each piece of equipment and total. In order to allow for heat loss and inefficiencies, divide the total by 1.1. This will provide a 10% safety factor. Divide the total by 0.7 and this will provide you with the minimum boiler size required.

Metric Equivalents and Common Conversion Factors

1 liter = 0.264 gallons	1 pound = 0.4536 kilogram
1 U.S Gallon = 3.785 Liters	1 inch = 0.0254 meters
1 liter = 0.035 cubic feet	1 psi = 0.069 bar
1 cubic foot = 0.028 cubic meters	1 square foot = 929.03 square cm
1 meter = 39.37 inches	1 bar = 14.5 psi
1 cubic foot = 28.317 liters	1 square foot = 0.0929 square meters
1 kilogram = 2.20 pounds	1 BTU = 3.968 kcal
1 inch = 25.4 mm	1 square meter = 10.76 square feet

Basic Labor Requirement Estimates

For a laundry facility with 125 pounds per load washing capacity or less, you should allow for 1 FTE (full time employee) for each 60 pounds of washer capacity.

For a laundry facility with more than 125 pounds per load washing capacity, you should allow for 1 FTE (full time employee) for each 80 pounds of washer capacity.

Example:
A laundry with one 40 lb. washer, and one 60 lb. washer would require 1.67 FTEs. (100 lbs. total capacity divided by 60 lbs.)

A laundry with one 60 lb. washer, two 80 lb. washers, and one 100 lb. washer would require 4 FTEs (320 lbs. total capacity divided by 80 lbs.)

Please remember that these guidelines are for estimation purposes only. Many factors such as automation of system may affect these figures. Please exercise good judgment at all times when calculating for labor.

Laundry Cart Capacities

Approximate Laundry Cart Capacity Chart				
Bushels	**Dim. LxWxD**	**Dry Soiled lbs.**	**Wet Clean lbs.**	**Folded lbs.**
1	22 x 14 x 14	6	12	14
2	30 x 18 x 16	12	25	30
4	30 x 20 x 20.5	20	40	48
6	30 x 20 x 20.5	37	74	89
8	34 x 22 x 23	49	99	119
10	36 x 24 x 25	62	124	149
12	36 x 26 x 27.5	74	149	179
14	40 x 28 x 27.5	87	174	209
16	40 x 28 x 30	99	199	239
18	42 x 30 x 30	112	224	268
20	44 x 32 x 33	124	249	298
You should provide cart capacity enough to hold at least one day of soiled linen				

Gas Hot Water Heater Sizing

1. Determine hot water consumption requirements by adding up the total wash capacity of the laundry. A good rule of thumb in order to tally the total hot water used, is to allow 2 gallons of hot water for each pound of washer capacity. While not exact due to variations in wash process, water levels etc., this should handle most projects.
2. Determine the average temperature of the incoming water supply, and then subtract this number from the desired water temperature. This will provide you with the required temperature rise in Fahrenheit.
3. The minimum heat input required to heat the water from the incoming water supply, to the desired temperature may now be calculated as follows:

$$\text{BTU/hour} = \frac{(\text{Gallons per hour}) \times (\text{Temperature rise}) \times (8.33)}{0.75 \text{ (efficiency factor)}}$$

   The formula above will give you the BTU rating of the gas fired Hot Water Heater required to satisfy the laundry. To calculate for use with an Electric Water Heater, divide the figure by 3413.
4. Hot water storage capacity should be a minimum of 2/3 of a 1 hour hot water demand.

Example:
A new installation with three 80 lb. washers, and one 60 lb. washer with an incoming average water temperature of 55 degrees, and a desired hot water temperature of 160 degrees.
The estimated total hot water consumption is 600 gallons. (Total wash capacity x 2)
The desired temperature rise is 105 degrees. (160 desired temp – 55 incoming supply)
The required BTU input for the hot water heater would then be 699,720 BTU.
(600 gallons x 105-degree rise x 8.33 divided by .75 = 699,720)
The hot water storage tank should be able to hold at least 400 gallons. (⅔ of 600 gallons)

General Planning Information

WASHER-EXTRACTORS

1. Two smaller washers are better than one big one if possible.
2. Small loads accumulate faster than large ones, so plan accordingly.
3. Try to use similar equipment if possible in order to ease training issues.
4. Provide adequate room for loading, unloading and service access.

DRYERS

1. The rated capacity ratio of dryer to washer should be 1.5 dryers to 1.0 washer.
2. One of the most common problems with workflow is related to lack of dryer capacity.

APPROXIMATE LOADS PER HOUR / FACTOR

1. Heavy soil 1.0 loads per hour
2. Normal soil 1.25 loads per hour
3. Light soil 1.5 loads per hour

NOTE: Many factors may affect the number of loads processed per hour such as wash formulas and drying capacity.

Typical Dry Weights of Selected Items

Item	Weight in Pounds
Apron (waitress)	0.36
Apron (bibbed)	0.45
Apron (waist)	0.36
Apron (shop)	0.69
Bath mat (terry)	0.59
Bath mat (heavy)	1.35
Blanket (84" x 110")	4.2
Bedspread (84" x 118")	4.7
Bed Pad (60" x 76")	2.75
Chef's Cap	0.07
Lab Coat	1.23
Coat, Utility	2.5
Coverall (lightweight)	2.2
Coverall (flame retardant)	2.84
Coverall (freezer)	5.0
Diapers (baby)	0.6-0.12
Draw Sheet (63" x 99")	1.17
Dress (uniform)	0.91
Dust Mop (36")	1.5
Fire Station Duty Shirt	1.0
Fire Station Duty Pants	1.5
Fire Station Workout Sweatshirt	1.3
Fire Station Workout Sweat Pants	0.8
Gloves	0.5-0.75
Gloves (cotton)	0.5
Gloves (canvas)	0.75

Item	Weight in Pounds
Gown (patients)	0.64
Gown (surgical)	0.9
Jacket (waiter)	1.4
Mop Head	1.5
Napkin (20" x 20")	0.11
Pants (cotton)	1.27
Pillow Case	0.32
Sheet (king size)	2.25
Sheet (queen size)	1.9
Sheet (double)	1.75
Sheet (twin)	1.48
Shirt (cotton)	0.65
Smock (Poly/cotton blend)	1.11
Smock (100% cotton)	3.25
Tablecloth (54" x 54")	0.7
Tablecloth (54" x 96")	1.35
Tablecloth (45" x 45")	0.53
Tablecloth (64" x 64")	0.98
Tablecloth (54" x 120")	3.0
Hand Towel (17" x 26")	0.18
Bath Towel (24" x 44")	0.49
Turnout Gear Parts	5.0
Turnout Nomex Hood	0.2
Turnout Gear Coat	6.0
Turnout Gear Gloves (leather)	0.8
Wash Cloth (12" x 12")	0.06

These figures are based upon samples provided, and are in no means intended to be used for any purpose other than as a general reference. Use actual weights whenever possible.

Sizing Formulas and Information by Market

HOSPITALITY

Type of Property	Pounds Per Room	Description of Services	Occupancy Factor
Budget Motel	10	Rooms only. No food service. No pool.	Less than 60% occupancy average, use .80 factor.
Mid Range Hotel	12	Rooms, swimming pool. No food service.	
Full Service Hotel	14	Rooms, swimming pool, food service, small banquets.	
Luxury Hotel	16	Rooms, swimming pool, food service, large banquets.	Greater than 60% occupancy average, use 1.0 factor.
Resort Hotel	18	Rooms, large volume restaurant, swimming pool, full banquets, golf, health club, etc.	

Formula

Pounds Per Room	x	Number of Rooms	x	Occupancy Factor	x	7 Days	÷	Hours Weekly	÷	Loads Per Hour	=	Pounds Per Cycle
	x		x		x		÷		÷		=	

Example:
A 100-room Mid Range Hotel is contemplating an on-premise laundry for their property. The average occupancy is 72% and they need to process the goods within a 40-hour week.

12 Pounds	x	100 Rooms	x	1.0 Factor	x	7 Days	÷	40 Hours	÷	1.25 Loads Per Hour	=	168 Pounds per Load
	x		x		x		÷		÷		=	

Using this model, the lbs. to be processed each cycle is 168.

Sizing Formulas and Information by Market (continued)

RESTAURANT

Types of Covers	Napkin Only Weights	Napkin and Tablecloth Weights	Tablecloth Only Weights	One cover is intended to equal One meal Served
Restaurant and Banquet	.11 pound	.46 pound	.35 pound	
Meeting	N/A	N/A	.35 pound	

Formula for amount of covers to be processed

Type of Cover Used	Pounds Per Cover Used	x	Total Number Covers Used Daily	x	Days of Operation	+	Towels Uniforms Misc. Items	÷	Laundry Hours Per Week	÷	Laundry Loads Per Hour	=	Total Pounds Per Cycle
Restaurant and Banquet Seats		x		x		+		÷		÷		=	
Meeting Seats		x		x		+		÷		÷		=	
Total		x		x		+		÷		÷		=	

Example:
A banquet facility is in operation for 7 days a week. They are primarily full service and use tablecloths and napkins.

They typically serve about 250 meals a day.
They use on the average of 200 hand towels a week.
Uniforms are shirt and pants, and they use 20 per week.
They want to operate their laundry for a total of 20 hours a week.

Type of Cover Used	Pounds Per Cover Used	x	Total Number Covers Used Daily	x	Days of Operation	+	Towels Uniforms Misc. Items	÷	Laundry Hours Per Week	÷	Laundry Loads Per Hour	=	Total Pounds Per Cycle
Restaurant and Banquet Seats	.46	x	250	x	7	+	74.4 lbs.	÷	20	÷	1.25	=	35.2

The total pounds per cycle to be processed in this facility would be 35.2.

Sizing Formulas and Information by Market (continued)

HEALTHCARE

Pounds per bed of facility

Type of Facility	W/O Diapers and Pads Calculated	With Personal Garments	*Diapers and Pads Calculated at 35% Incontinency Rate (for each additional 10% incontinency add 2 pounds)
Assisted Living	1.2 pounds	2.7 pounds	N/A
Rehab Center	2.0 pounds	3.5 pounds	N/A
Intermediate Care	10.0 pounds	N/A	*12 pounds
Skilled Care	12.0 pounds	N/A	*14 pounds

Formula

Total Number of Beds	x	Pounds Per Bed	x	7 Days	÷	Hours Per Week Worked	÷	Loads Per Hour	=	Pounds Per Cycle
	x		x		÷		÷		=	

Example:
116 beds x 12 pounds x 7 days ÷ 49 hours worked ÷ 1.25 loads per hour = 159 pounds per cycle to process.

CORRECTIONAL

Pounds per Inmate

Category	Items To Be Processed	1 Change Per Week	2 Changes Per Week	3 Changes Per Week	7 changes Per Week
A	Inmate Clothing	2.2 pounds	4.4 pounds	6.6 pounds	15.4 pounds
B	Bed Linen	6.4 pounds	9.7 pounds	13 pounds	26 pounds
C	Terry Goods	.7 pounds	1.4 pounds	2.1 pounds	4.9 pounds
C	Misc. Items	.6 pounds	.6 pounds	.6 pounds	1.6 pounds

Formula

Categories A + B + C + D (Select values from appropriate columns)	x	Number of Inmates	÷	Hours Per Week Worked	÷	Loads Per Hour	=	Pounds Per Cycle
6.6 + 6.4 + 2.1 + .6 = 15.7	x	1200	÷	60	÷	1.25	=	251.2

Example:
At 3 changes of clothes per week and 1 change of bed linen per week: 15.7 lbs (a+b+c+d) x 1200 inmates ÷ 60 hours worked ÷ 1.25 loads per hour = 251.2 lbs per cycle.

Laundry Site Survey Information

DATE:_____

Customer Name: _____ Title: _____
Company Name: _____
Address: _____ City: _____ State: _____ Zip: _____
Telephone: _____ Fax: _____ E-Mail: _____
Type of Facility: _____

Laundry Room Specs

Room Size: _____x_____ Ceiling Height: _____ Location: _____
Foundation Type: _____ Thickness: _____ Condition: _____
Smallest Access Door Size: _____ Door Jams Removable? _____ Window Size: _____
Notes: _____

Availability of Gas Service

None: _____ Natural Gas: _____ Propane: _____ Supply Line Size: _____ Pressure: _____
Adequate Supply? _____ Distance to Install: _____
Notes: _____

Availability of Electrical Service

Voltage: _____ Phase: _____ Available Amperage: _____ Distance: _____
Breaker Panel Access: _____ Model and Type Panel: _____ Space Available: _____
Notes: _____

Availability of Water Supply

Size of Cold Water Supply: _____ Size of Hot Water Supply: _____ PSI of Supply: _____
Distance to Installation: _____
Adequate Hot Water Supply? _____ Hot Storage Tank Size: _____
New Heater Required? _____ Size Required: _____
Notes: _____

Drain Specs

Size: _____ Height of Drain: _____ Distance to install: _____
Trough: _____ Size: _____ Location of Trough: _____
Sump Pump Required: _____
Notes: _____

(Survey continued on next page.)

Venting Specs

Number of Existing Vents: _____ Size: _____ New Vent Required: _____

Size: _____ Length of New Run: _____ Bends: _____

Type of Wall: _____ Thickness: _____ Type of Ceiling: _____ Thickness: _____

Makeup Air Available: _____ Square Inches/Feet: _____ Length of Run: _____

Notes: _____

Chemical specs

Will they use liquid or powder chemicals: _____ Both: _____

Existing Supplier: _____

Notes: _____

Other Information

Loading Dock: _____ Loading Dock Height: _____ Distance to Install: _____

Elevator: _____ Size of Elevator: _____ Capacity of Elevator: _____

Sharp turns or corners to navigate?_____

Smallest access door or opening: _____

Fork lift available: _____ Capacity: _____

General Notes:

_____

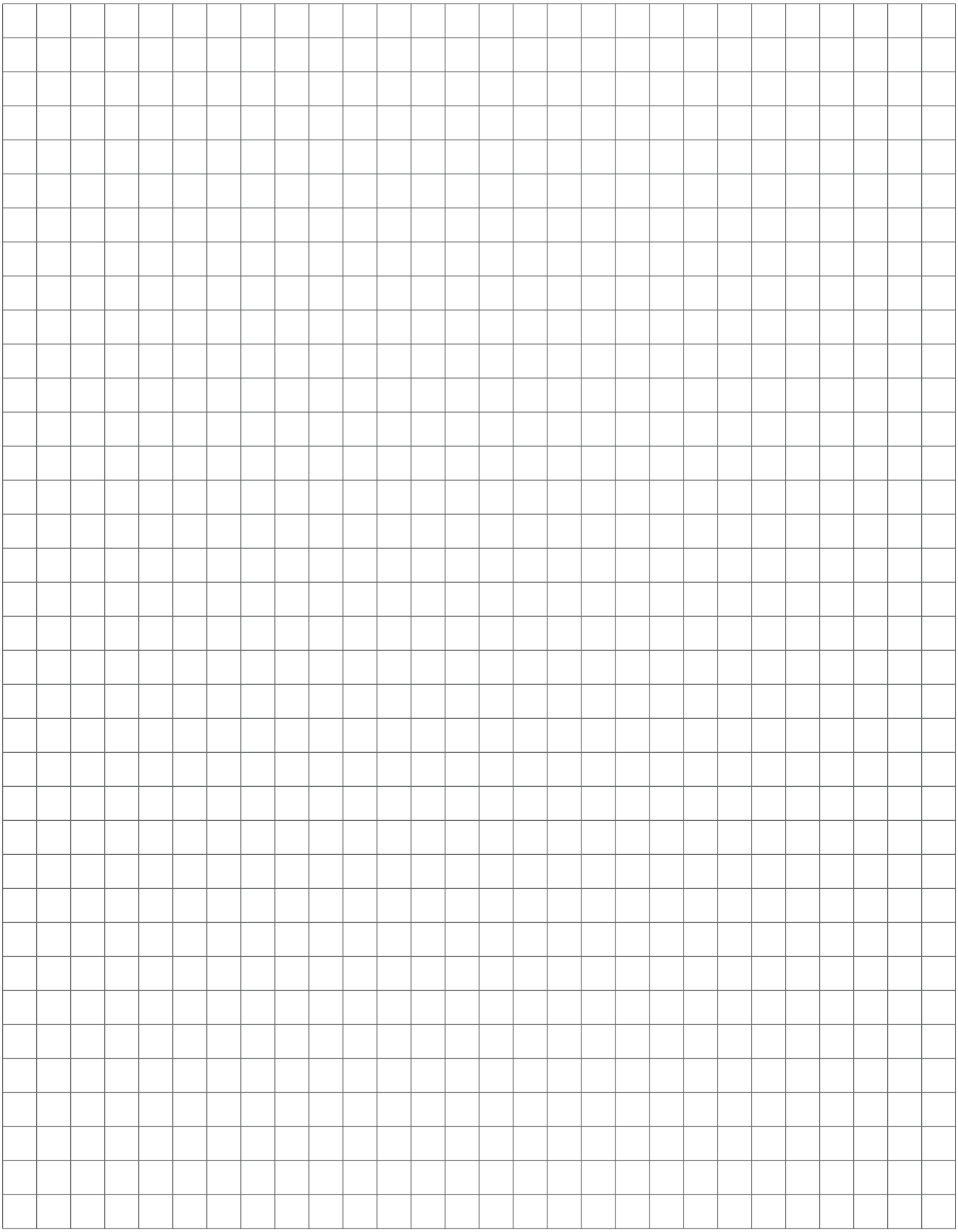
_____

_____

_____

_____

Sketch of Laundry Site



IPSO Laundry Design Services

For assistance in designing and planning your laundry area, please contact your distributor for information about IPSO Laundry Design Services.

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