ASHRAE Modified Hunter Curve - Flow Charts

Chart 12-1

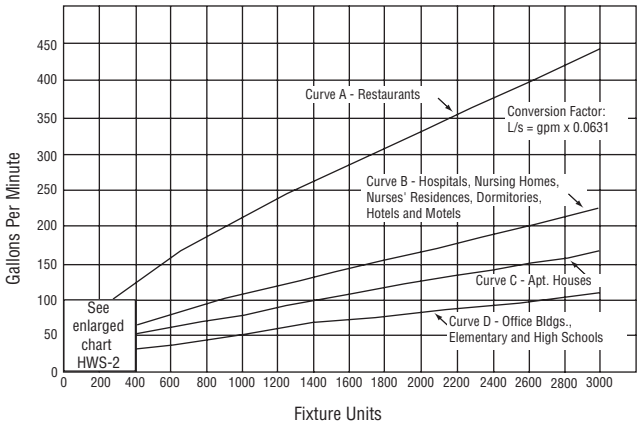
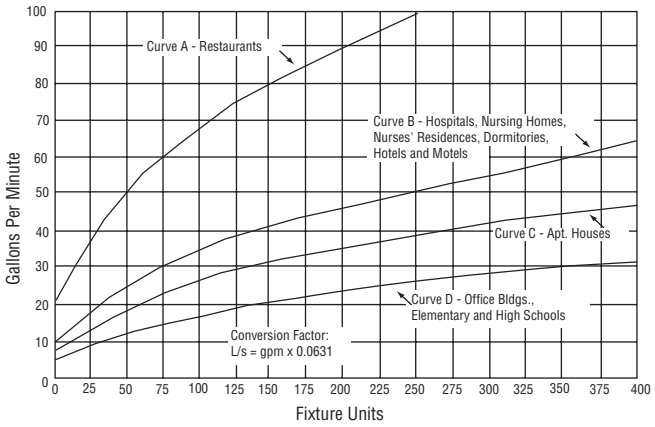


Chart 12-2. Enlarged Section



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Hunter curves should be used for intermittent, insignificant fixtures only.

Step 1

Determine the total fixture unit load for all the fixtures serviced by your water heater application using the Fixture Units Table on page 13. See example below.

Step 2

Using the total fixture units for your application, enter the Hunter Curves (Chart 12-1) from the bottom on the total fixture units line for your application. Read up to the curve that best fits the application. Then read to the left for the corresponding gpm requirement.

Step 3

Select the proper Armstrong Water Heater/Water Temperature Controller.

Example: College Dormitory

No. Fixtures	Type of Fixture	Fix. Unit	Demand Fix. Unit
150	Private Lavatory	.75	113
120	Private Shower	1.5	180
20	Slop Basin	2.5	50
8	Clothes Washer	2.0	16
Total Fixture Units			**359**

Refer to the modified Hunter Curves in Chart 12-2. Curve B represents dormitories. Enter the graph from the bottom at 359 fixture units and go up to curve B. Then move to the left horizontally to read approximately 60 gallons per minute of hot water capacity required.

NOTE: Remember to add any constant flow capacities, as determined under “Important Note” below, to this 60 gpm.

Important Note

Special consideration should be given to applications involving periodic use of gang showers, process equipment, laundry machines, etc., as may occur in field houses, gymnasiums, factories, hospitals, etc. Because these applications could have all equipment on at the same time, their total hot water capacity should be determined and then added to the maximum hot water demand as read from the modified Hunter Curves. Use the following formula to determine total hot water capacity needed for these applications when final water temperatures are lower than that of the water heater.

$$\frac{(B - C)}{(H - C)} \times \left(\begin{array}{c} \text{Total water flow from all} \\ \text{gang shower heads in gpm} \end{array} \right) = \text{Hot water needed (gpm)}$$

Where:

B = Blended water temperature out of the fixture
H = Hot water temperature to the fixture
C = Cold water temperature to the fixture

ASHRAE Modified Hunter Curve - Fixture Units

140°F Temperature From Heater

Hospital	
Type of Fixture	**Fix. Units**
Private Lavatory	.75
Public Lavatory	1.0
Semi-Private Lavatory	1.2
†Private Shower	1.5
†Ward Shower	2.5
†Semi-Private Shower	1.5
Private Bath	1.5
Ward Bath	2.0
Sink - Flushing Rim	2.0
Sink - Scrub-Up	1.5
Sink - Laboratory	1.5
Sink - General Purpose	1.0
Bath - Leg	6.0
Bath - Arm	4.0
Bath - Sitz	3.0
Bath - Foot	3.0
Bath - Emergency	2.0
Hydrotherapeutic Showers	
#1 Shower Head	8.0
#2 Spray	12.0
Continuous Flow Bath	
Continuous Flow Fill	2.0
Continuous Flow Operate	1.5
Hubbard	4.0
Autopsy Table	2.0
Autopsy Sink and Table	2.5

Club	
Type of Fixture	**Fix. Units**
Private Lavatory	.75
Public Lavatory	1.0
†Private Shower	1.5
†Public Shower	1.7
†Tub and Shower	1.5
Sink - Slop	2.5
36" Half Bradley	1.0
36" Full Bradley	1.5
54" Half Bradley	1.5
50" Full Bradley	2.0

Gymnasium	
Type of Fixture	**Fix. Units**
Private Lavatory	.75
Public Lavatory	1.0
Private Shower	1.5
Public Shower	3.0
Sink - Slop	1.5
Basin - Foot	1.2
36" Half Bradley	1.0
36" Full Bradley	1.5
54" Half Bradley	1.5
54" Full Bradley	2.0

Assoc. Bldg. YMCA	
Type of Fixture	**Fix. Units**
Private Lavatory	.75
Public Lavatory	1.0
†Private Shower	1.5
†Tub and Shower	1.7
Sink - Slop	2.5
Janitor Drop	2.0

Restaurant**	
Type of Fixture	**Fix. Units**
Private Lavatory	.70
Public Lavatory	2.0
†Private Shower	1.5
†Public Shower	1.7
Sink - Kitchen	3.0
Sink - Pantry	2.5
Sink - Slop	2.0
Sink - Pot (Single)	2.5
Sink - Pot (Double)	3.5
Sink - Pot (Triple)	5.5
Sink - Vegetable	2.0
Sink - Bar	2.5
Washer - Silver	2.0*
Washer - Glass	2.0*
Washer - Can	3.0
Coffee Urn	1.2
Bain Marie	1.0
Pot and Pan Washer	2.0*
Dish Pre-Rinse	2.5
Pre-Scraper	2.0
Pre-Scraper Conveyor	2.5
36" Half Bradley	1.0
36" Full Bradley	1.5

***Dishwashers (use booster to heat from 140° to 180°F)**

Single Tank - Stationary Rack	
16 x 16 Rack	2.5
18 x 18 Rack	3.9
20 x 20 Rack	4.2
Multiple Tank Conveyor Type	
Dishes - Inclined	2.0
Dishes - Flat	2.5
Single Tank Conveyor Type	2.3

Hotel - Motel

Type of Fixture	Fix. Units
Private Lavatory	.75
Public Lavatory	1.0
†Private Shower	1.5
†Tub and Shower	1.5
Basin - Barber	2.0
Sink - Slop	2.5
Basin - Beauty Parlor	2.5

Office Building

Type of Fixture	Fix. Units
Private Lavatory	.75
Public Lavatory	1.0
Private Shower	1.5
Sink - Slop	2.5
Janitor Drop	2.5
36" Half Bradley	1.0
36" Full Bradley	1.5

Factory	
Type of Fixture	**Fix. Units**
Private Lavatory	.75
Public Lavatory	1.0
†Private Shower	1.5
†Public Shower	3.0
Sink - Slop	2.5
36" Half Bradley	1.0
36" Full Bradley	1.5
54" Half Bradley	1.5
54" Full Bradley	2.0

Correctional or Mental Institution

Type of Fixture	Fix. Units
Private Lavatory	.70
Public Lavatory	1.0
†Private Shower	1.5
†Public Shower	3.0
†Tub and Shower	1.5
Sink - Slop	2.0
Janitor Drop	2.0
36" Half Bradley	1.0
36" Full Bradley	1.5
54" Half Bradley	1.5
54" Full Bradley	2.0

Apartment

Type of Fixture	Fix. Units
Private Lavatory	.75
Public Lavatory	1.0
†Private Shower	1.5
†Public Shower	1.5
†Tub and Shower	1.5
Sink - Kitchen	.75
Sink - Slop	1.5
Sink - Pantry	1.5
Domestic Clothes Washer	1.2
Domestic Dishwasher	1.5
Laundry Tray	1.5

Private - Public School

Type of Fixture	Fix. Units
Private Lavatory	.75
Public Lavatory	1.0
†Private Shower	1.5
†Tub and Shower	1.7
Sink - Slop	2.5
Janitor Drop	1.5
Domestic Clothes Washer	2.0
Domestic Dishwasher	2.0

Institution - Home

Type of Fixture	Fix. Units
Private Lavatory	.70
Public Lavatory	1.0
†Private Shower	1.5
†Tub and Shower	1.5
Sink - Slop	2.0
Janitor Drop	2.0

*These items require 180°F hot water. The consumption figures are based on supplying 140°F water with a booster heater used to obtain 180°F water.

**Add 20% to all figures when not used in combination with other building services from same heater.

†The fixture units listed for shower heads are based on a flow rate of 3 gpm. These units should be corrected for other flow rates. Multiply the fixture units by Correction Factor "C" from the formula: C = G x .33, where C = Correction Factor and G = gpm of shower head being used. Example: Shower head 4 gpm = C = 4 x .33 or 1.32. From Fixture Units Table, Hotel-Motel (shower) which shows 1.5 fixture units, multiply 1.5 x 1.32 = 2.10 fixture units per shower head using 4 gpm.