

Calculating and Documenting Functional Grating

July 2019

What is functional grating?

"Functional grating" means the percent open area of the grating that is not covered or blocked by any objects such as structural components, framing wood, flotation tubs, or objects placed on the surface of the grating (WAC 220-660-030(63)).

What are the functional grating requirements for residential pier, ramp and float structures?


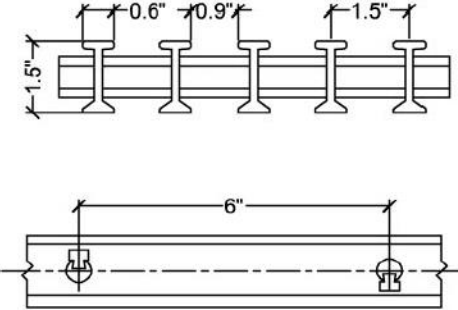
The construction plans for a pier, ramp and float must include functional grating in the design.

- North/south oriented piers (338 to 22 degrees, or 158 to 202 degrees) greater than four feet in width must have at least thirty percent of the entire deck surface covered in functional grating (WAC 220-660-380(4)(c)).
- Northeast/southwest, northwest/southeast, and east/west oriented piers (23 to 157 degrees, 203 to 337 degrees) must have at least fifty percent of the entire deck surface covered in functional grating regardless of width (WAC 220-660-380(4)(d)).
- The entire ramp surface must be covered in grating (WAC 220-660-380(4)(f)).
- A float six feet wide or less must have at least thirty percent of the entire deck surface covered in functional grating. A float between six and eight feet wide must have at least fifty percent of the entire deck surface covered in functional grating (WAC 220-660-380(5)(f)).

The grating installed on a float must have an open area of at least sixty percent (220-660-380(5)(g)). The grating installed on a pier can have an open area of 40 – 60 percent depending on how much deck area will be grated (WAC 220-660-380(4)(e)). Below is an example of grating with 60% open space.

Manufacturers offer other configurations that also meet the open space requirement.

I-Bar 1 1/2" Deep 60% Open (I15-60)

| | | | | |
|---|--|-------------------------|--------------------------|-------------------------|
| Engineering Properties Per Foot of Width: | | $A = 3.06 \text{ in}^2$ | $I = 0.88 \text{ in}^4$ | $S = 1.17 \text{ in}^3$ |
|  |  | # of Bars: | 8 | |
| | | Bar Depth: | 1.5" | |
| Stocked Item | | Open Area: | 60% | |
| Panel Sizes Available: | | Max Width: | 5' | |
| | | Load Bar Centers: | 1.5" | |
| | | Approx. Weight: | 3.30 lbs/ft ² | |
| | | Cross Bar Spacing | 6" | |

How to determine if the pier design achieves the functional grating requirement?

A 6-foot wide by 100-foot long pier has a surface area of 600 square feet. If the pier has a north/south orientation a minimum of 180 square feet of the deck surface must be covered in functional grating to comply with WAC 220-660-380(4)(c). If the pier is not oriented north/south a minimum of 300 square feet of the deck surface must be covered in functional grating to comply with WAC 220-660-380(4)(d). Since framing is located under the grating, the minimum area of deck surface covered by grating must be increased to factor in these components. To calculate how much more grating is required an applicant needs to know the thickness of the lumber being used. For example, 2x4s, 2x6s, and 2x8s are not actually 2 inches thick. When the board is first rough sawn from the log, it is a true 2 inches thick, but the drying process and milling of the board reduce it to 1.5 inches thick. Here is a [link](#) to common sizes of lumber, and their actual sizes. Second, they'll need to know the total length of the framing that will be under the grating.

Here is an example: a 6-foot wide by 100-foot long pier has a 4-foot wide by 90-foot long section of grating down the center of the pier. The pier has 216 linear feet of framing that will be under the grating. A combination of 3 x 6 and 3 x 8 lumber will be used. This lumber has a thickness of 2 1/2" or .21 feet. In this case, the gross grating area is 360 square feet. The gross framed area is 45 square feet. When you subtract the gross framed area from the gross grating area you get the total functional grating area of 315 square feet. This pier design achieves the functional grating requirement regardless of the orientation of the pier.

Gross Grated Area –
Gross Framed Area =
Total Functional Grated Area

Total Functional Grated Area ÷
Total Pier or Float Area =
Total Percentage

- 30% WAC 220-660-380(4)(c)
- 50% WAC 220-660-380(4)(d)
- 50% WAC 220-660-380(5)(f)

How do I determine if the float design achieves the functional grating requirement?

An 8-foot wide by 30-foot long float has a surface area of 240 square feet. To comply with WAC 220-660-380(5)(f) a minimum of 120 square feet of the deck surface must be covered in functional grating. An 8-foot wide and 60-foot long float width has a total area of 480 square feet. To comply, a minimum of 240 square feet of the deck surface must be covered in functional grating. To calculate how much more grating is required an applicant needs to know the thickness of the lumber being used.

Although the floatation must be located under the solid decked surface area only, framing is often located under the grating. As a result, the minimum area of deck surface covered by grating must be increased to factor in these components. To calculate how much more grating is required an applicant needs to know the thickness of the lumber being used. Second, they'll need to know the total length of the framing that will be under the grating.

For example: A proposed 8-foot wide and 30-foot long float has fourteen 2-foot wide by 3-foot long float tubs as shown in Exhibit A. The total surface area of the float is 240 square feet. The functional

grating area is the portion of the total surface area, which is not obstructed by framing and/or floats. All framing lumber in this example has an assumed actual thickness of 1.5 inches. There are two pieces on each longitudinal side of the float with a combined thickness of 3.0 inches. From the exhibit, there are 7 functional grating areas with the same dimensions marked "A" and an additional group of 8 areas with the same dimensions marked as "B." Therefore, the combined total functional grating area for the float is $7 \times A + 8 \times B$.

Calculation of Functional Grating Area:

Total float area is $8' \times 30' = 240$ square feet.

The area of each "A" section is $(8' - 3' - 3') \times (2' - (1.5/12)' - (1.5/12)') = 3.50$ square feet.

The area of each "B" section is $(8' - (1.5/12)' - (1.5/12)' - (1.5/12)' - (1.5/12)') \times 2' = 15.00$ square feet.

The combined total functional grating area is $(7 \times 3.50 \text{ sf}) + (8 \times 15.00 \text{ sf}) = 144.50$ square feet.

Therefore, the overall percentage of functional grating is $144.50 / 240.00 = 60.21\%$.

How to document compliance with the functional grating requirements?

Use the WDFW Project Application Review Form (PARF) to document your rationale for accepting the proposed functional grating square footage. If the contractor submits the functional grating calculations, you can simply reference the plans in the PARF. If the contractor doesn't submit functional grating calculations you can ask them to do so or you may do the calculations for them. Regardless of who does the calculations, the assumptions and corresponding calculations must be uploaded into APPS and referenced in the PARF.

You may add a provision that requires the permittee or their contractor to upload as-built grating calculations within sixty days of project completion if they deviate from the lumber thickness or flotation dimensions specified in their approved plans. It will be your responsibility to verify this documentation is received so you may want to put a reminder on your calendar. These calculations will document that they complied with the functional grating provision (rule). Below is an example provision.

1. The structure must include grating. The grating material's open area must be at least sixty percent.
 - a. Grating installed parallel to the length of the pier must extend the length of the pier and at least fifty percent of the deck area must be covered in functional grating.
 - b. The ramp must have one hundred percent of the entire deck surface covered in grating.
 - c. The float must have at least fifty percent of the entire deck surface covered in functional grating. Orient grating so the lengthwise opening maximizes the amount of light penetration. Any objects that are not part of the structure on, above, or below the grating should not block light penetration. Flotation must be located under the solid decked area only.
 - d. If you deviate from the lumber thickness or flotation dimensions specified in your approved plans you must notify the Habitat Biologist listed below of the change prior to installing the

structure. Within sixty days of project completion you must upload an as-built drawing(s) of the structure into the online application system (APPS). The drawing(s) must show the new calculations of the gross grated area, gross framing area and the functional grated area. The calculations must demonstrate compliance with the functional grating requirements.



*WASHINGTON DEPARTMENT
OF FISH AND WILDLIFE*

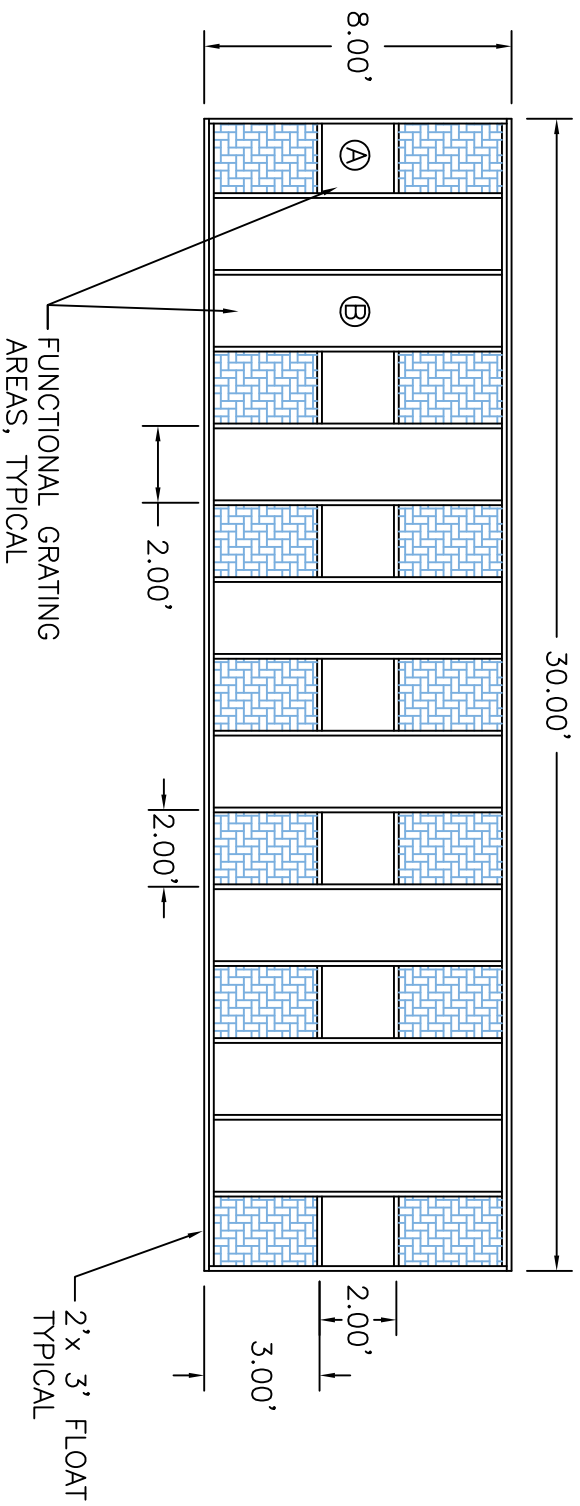


EXHIBIT - A
TYPICAL DOCK FLOAT LAYOUT
SCALE 1" = 5'