



PACIFIC LUMBER INSPECTION BUREAU

Technical Report No. 6

Determining the Allowable Design
Values When Grade Stamps Have
Multiple Species and/or Countries

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INTRODUCTION

Building code authorities typically require lumber used in structural applications to be labeled with what is commonly referred to as a “grade stamp” or “grade mark” from a grading agency accredited by the American Lumber Standard Committee (ALSC). ALSC requires grade stamps under its purview to include the species or combination of species of the lumber. There is an important reason for this – different species of wood used to make softwood lumber sold in North America can have different allowable design values; that is, a No. 2 grade 2x4 of one species may not have the same design values as No. 2 grade 2x4 of a different species.

This Technical Report is intended to provide information on how to recognize when a grade stamp has multiple species listed and how to determine the appropriate allowable design values when a grade stamp includes more than one species.

ELEMENTS OF A GRADE STAMP

Voluntary Product Standard PS 20 American Softwood Lumber Standard ⁽¹⁾ specifies five elements that must be included on lumber grade stamps. Those elements are:

- 1) the mill number, name or abbreviation;
- 2) the agency symbol;
- 3) the species or combination of species of lumber;
- 4) the appropriate grade; and
- 5) for lumber of less than nominal 5-inch thickness, whether the lumber was dry or green when dressed.

Where required by the grading rules, grade marks shall also denote rule paragraphs under which the lumber was graded or other similar information.

For species imported from outside North America, the grade stamp will include the designation “(I)”, indicating “imported”.



Figure 1. An example of a typical PLIB grade stamp with the five required elements.

“SPECIES GROUPS” vs. A COMBINATION OF SPECIES

For a number of reasons, it is not always possible or desirable to separate individual species when logs are processed into lumber:

- Conditions in the forest may make it impractical to separate species during the logging operation;
- It can be difficult to tell some species apart once the logs arrive at the lumber mill;
- Once sawn into lumber some species cannot be differentiated without a microscope;
- Some species have similar mechanical properties and/or are grouped together for marketing reasons.

For these and other reasons, individual species may be sold in combination with one another. When this is done, the grade stamp must identify the combination of species that may be represented in the package.

Some species combinations are so common that the collective group of species has a commercially established name to represent it. These common species combinations are also known as “species groups”. One common species group in North America is Southern Pine (SYP), a combination of four different Southern pine species. Another common species group is known as SPF. The SPF species group is a combination of Canadian spruces, pines and firs that share similar properties and growing regions. A similar, but not identical, combination of species grown in the U.S. is known as SPF(S). In addition to species groups having their own unique name, they also have one set of allowable design values for the species group as a whole. Common commercially available species groups that carry a single set of allowable design values are shown in Table 1.

Not all species combinations are designated as a “species group” with a commercial name and unique allowable design values. Sometimes species that might normally be produced separately are mixed together during a particular mill’s manufacturing process for reasons that are unique to that manufacturer. When the species that are mixed together do not fit into a recognized species group, the grade stamp must indicate all of the individual species that may be included in the mix, as show in Figure 2. In addition, the allowable design values for each of the individual species must be considered when determining the final allowable properties for the mixture of species shown in the stamp. This is described in more detail in the next section.



Figure 2. Example of grade stamp with two species, Douglas fir (D Fir) and Southern pine (SYP).

Table 1. Examples of common North American species groups and their abbreviations.

Species Group	Common Abbreviations	Species permitted
Douglas fir-Larch	D Fir-L, DF-L D Fir-L (N), DF-L (N) <i>Note: (N) designates Canadian origin</i>	Douglas fir, Western larch
Hem-Fir	Hem-Fir, HF, Hem-Fir (N) HF(N) <i>Note: (N) designates Canadian origin</i>	<i>Canada:</i> Western hemlock, Amabilis fir/Pacific silver fir. <i>U.S.:</i> Western hemlock, Pacific silver fir, Noble fir, Grand fir, California red fir, White fir.
Eastern Hemlock – Tamarack	Hem-Tam (N)	Eastern hemlock, Tamarack
Northern Species	North Species, N. Species	Any Canadian lumber species covered by the NLGA Grading Rules except Norway spruce in Canada and Norway spruce, Red Alder and W. Birch in the U.S.
Southern Pine	SYP	Longleaf pine, Slash pine, Shortleaf pine, Loblolly pine
Spruce-Pine-Fir	SPF, SPF(S) <i>Note: (S) designates U.S. origin</i>	<i>Canada:</i> White spruce, Engelmann spruce, Black spruce, Red spruce, Lodgepole pine, Jack pine, Balsam fir, Alpine fir. <i>U.S.:</i> Sitka spruce, Engelmann spruce, Lodgepole pine, Balsam fir, Jack pine, Red pine, Eastern spruces.
Western Cedars	West Cdr, WC W Cedar (N) <i>Note: (N) designates Canadian origin</i>	<i>Canada:</i> Yellow cedar, Western red cedar. <i>U.S.:</i> Western red cedar, Incense cedar, Port Orford cedar, Alaska cedar.
Western Woods	West Woods, WW	Douglas fir, Bigcone Douglas fir, Larch, Western hemlock, Pacific silver fir, Noble fir, Grand fir, California red fir, White fir, Mountain hemlock, Sitka spruce, Engelmann spruce, Subalpine fir, Idaho white pine, Ponderosa pine, Sugar pine, Jeffrey pine, Bishop pine, Coulter pine, Digger pine, Knobcone pine, Limber pine, Whitebark pine, Lodgepole pine.

In some cases, lumber is manufactured from logs that are of the same species but originate from different countries or regions. This is a common practice in North America and Europe where manufacturers may source logs from neighboring countries, for example Canada and the United States or Germany and Austria. In North America, the growing region or country is designated in the species abbreviation itself with an “(N)” used to designate Canadian origin for some species, such as DF(N) or HF(N) or an “(S)” used to designate U.S. origin for other species combinations, such as SPF(S). If the country is not evident by the species designation, as is the case in Europe, each country from which logs may have originated must be shown on the stamp and the allowable design values for each country must be considered when determining the final allowable properties.



Figure 3. Example of grade stamp with two countries of origin, Germany (GER) and Romania (ROM). The (I) indicates the species are imported from outside North America.

DETERMINING ALLOWABLE DESIGN VALUES FOR SPECIES AND/OR COUNTRY COMBINATIONS

The term “allowable design values” commonly refers to the six main mechanical properties that are used when designing with wood. These are:

- F_b fiber stress in bending
- F_t fiber stress in tension
- $F_{c \perp}$ compression perpendicular to grain
- $F_{c \parallel}$ compression parallel to grain
- F_v shear
- E modulus of elasticity

Often another property, specific gravity (SG), is used for certain engineering design applications, so we will include it in when referring to “allowable design values.”

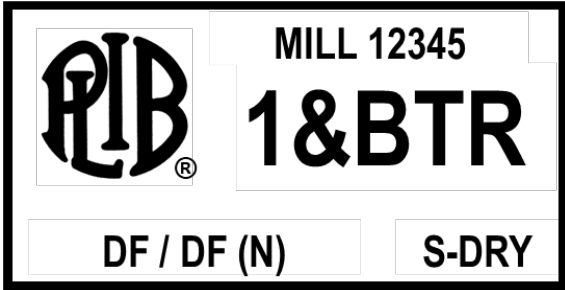
Determining the allowable design values for a “species group” is easy. As noted in the previous section species groups have a commercially recognized abbreviation that will appear on the grade stamp and one set of design values that applies to all lumber bearing a stamp with that abbreviation. Grading agencies like PLIB can provide the design values associated with the common species groups their subscribers produce. See <https://www.plib.org/staging/wp-content/uploads/2020/10/AP-4-2005.pdf>.

Determining the allowable design values when a combination of species and/or countries is listed on a stamp requires some analysis. Simply put, **when a grade stamp shows a combination of species and/or countries, the lowest design value for each property for the species and/or countries listed shall be used in design.**

This is best explained by a few examples:

Example 1.

The grade stamp shown to the right indicates that two different species may have been mixed together during production. The species shown on the stamp are Douglas fir (DF) and Douglas fir North DF(N). *Note: “Douglas fir” designates Douglas fir grown in the U.S. and “Douglas fir North” designates Douglas fir grown in Canada.*



Design values for Douglas fir from the U.S. are published in PLIB’s grading rules *Standard No. 17*⁽²⁾ whereas the design values for Canadian-grown Douglas fir are published by Canada’s National Lumber Grades Authority (NLGA) in its publication *Standard Grading Rules for Canadian Lumber*⁽³⁾. The appropriate allowable design values for this combination are determined by selecting the lower of the two values for each property, as shown in the shaded row of Table 2 below.

Table 2. Allowable base design values for 1&BTR grade with two species, Douglas fir (DF) and Douglas fir North (DF(N)) on the stamp.

Species group	Bending F _b	Tension parallel to grain F _t	Shear parallel to grain F _v	Compression perpendicular to grain F _{c⊥}	Compression parallel to grain F _{c∥}	Modulus of Elasticity E	Specific Gravity SG
Douglas fir	1,200	800	180	625	1,700	1,900,000	0.50
Douglas fir (N)	1,150	750	180	625	1,800	1,800,000	0.49
Appropriate Design Values	1,150	750	180	625	1,700	1,800,000	0.49

Example 2.

The stamp shown to the right indicates that more than one species from more than one country may be represented in the lumber shipment. The species shown on the stamp are Norway spruce (N. SPR) and Scots pine (Sc P) and the countries shown on the stamp are Germany (GER) and Romania (ROM).



Design values for all European species and countries are published in PLIB’s grading rules *Standard No. 17*⁽²⁾. The appropriate allowable design values for this combination are determined by selecting the lowest of the four values for each property shown in the shaded row of Table 3 below.

Table 3. Allowable base design values for a No. 2 grade with two species, Norway spruce (N. SPR) and Scots pine (Sc P), and two countries, Germany (GER) and Romania (ROM) on the stamp.

Species group	Bending F _b	Tension parallel to grain F _t	Shear parallel to grain F _v	Compression perpendicular to grain F _c ⊥	Compression parallel to grain F _c ∥	Modulus of Elasticity E	Specific Gravity SG
N. SPR Germany, NE France, & Switzerland	725	325	170	335	950	1,200,000	0.42
N. SPR Romania & Ukraine	725	325	100	275	950	1,200,000	0.38
Sc P Germany	700	325	160	395	950	1,100,000	0.53
Sc P Austria & the Czech Republic, Romania & Ukraine	775	350	135	270	1,000	1,400,000	0.50
Appropriate Design Values	700	325	100	270	950	1,100,000	0.38

ADDITIONAL RESOURCES

The American Wood Council (AWC) publishes the National Design Specification (NDS)⁽⁴⁾ and the NDS Supplement⁽⁵⁾ which are referenced by the model building codes. The NDS Supplement provides design value tables for all species and species groups. To assist the engineering and design communities, the AWC has developed and published Table 4G⁽⁵⁾ as an addendum to the NDS Supplement. Table 4G shows the design values for all of the species and/or country combinations that one might currently encounter in the field.

Additional technical reports and reference information published by PLIB can be found on the PLIB website at www.plib.org/resources/publications/

REFERENCES

1. U.S Department of Commerce. 2020. Voluntary Products Standard PS 20-20 American Softwood Lumber Standard. 1401 Constitution Ave NW Washington, DC 20230
2. Pacific Lumber Inspection Bureau. 2018. Standard No. 17 Grading Rules for West Coast Lumber. 1010 S. 336th St. Suite 210, Federal Way, WA 98003.
3. National Lumber Grades Authority. 2017. Standard Grading Rules for Canadian Lumber. Suite 303 – 409 Granville St, Vancouver, BC, Canada V6C 1T2.
4. American Wood Council. 2018. National Design Specification for Wood Construction. 222 Catoctin Circle SE, Suite 201, Leesburg, VA 20175.
5. American Wood Council. 2018. NDS Supplement. 222 Catoctin Circle SE, Suite 201, Leesburg, VA 20175

ABOUT PLIB

Founded in 1903, Pacific Lumber Inspection Bureau (PLIB) is a non-profit, accredited lumber and wood products inspection and certification agency. PLIB provides lumber-grading and grade-stamping services to the lumber industry along with a wide range of other inspection and certification services for related wood-products manufacturers including Heat Treatment, Wood Packaging, CE Marking, WUI, Glulam, Cross-Laminated Timber, and Wood Trusses.

In January 2019, PLIB merged operations with the West Coast Lumber Inspection Bureau (WCLIB) and with it, the American Institute of Timber Construction (AITC), retaining both the WCLIB and AITC trademarks. With the merger, PLIB added Glulam and Cross-Laminated Timber quality-control certification to its list of signature services and expanded coverage into the southern United States and Europe.

PLIB is accredited by the American Lumber Standards Committee (ALSC), the Canadian Lumber Standards Accreditation Board (CLSAB), North America's only lumber grading accreditation bodies, and by the International Accreditation Service (IAS), a nonprofit, public-benefit corporation and a subsidiary of the International Code Council (ICC), the governing body that develops the International Building Code (IBC).

For more information, visit our website at www.plib.org.