Yamaha Guitars

Essential Knowledge
Yamaha Guitars: Essential Knowledge has been created to give you a behind-the-scenes view of the surprisingly vast and varied resources, facilities, skills, and people involved in making Yamaha guitars the special instruments that they are. Yamaha’s enviable position in musical instrument manufacturing is not only a result of more than 120 years of experience (the company was established in 1887), but also of the unique strengths that its expansive operations bring to bear. From research and development through design and manufacturing to sales and support, Yamaha goes to lengths that are simply beyond the capabilities of most guitar makers. But an underlying dedication to music and the creation of fine musical instruments is always there, forming a steadfast foundation that often results in profit taking a back seat to the pursuit of quality.

Yamaha’s true strengths as a guitar maker are not apparent in product brochures or specifications, but they are clearly reflected in the sound, playability, dependability, and overall quality of every guitar that bears the Yamaha name. “Essential Knowledge” includes information that will hopefully provide a clearer picture of the prodigious resources and effort that give artists who choose Yamaha a significant musical advantage.
A.R.E. – Acoustic Resonance Enhancement

There is no question that the sonic properties of wood change, often improving, as the wood ages. Although time is the only factor that can truly age anything, Yamaha embarked on an in-depth research program to try and understand what changes were actually occurring in the wood, and how that information might be applied to improve the characteristics of younger woods. After years of development, the Acoustic Resonance Enhancement (A.R.E.) process was born, and is gradually being implemented in more instruments as its benefits are being proven.

To clarify, an A.R.E. is not specifically an aging process. The changes it brings about in the wood are similar to those observed in aged wood, but the focus is resolutely on achieving superior sound rather than high-tech man-made materials. To put it as directly as possible: there is simply nothing better. But ensuring that the wood rather than high-tech man-made materials are used to deliver optimum performance in the form of musical results is not easy. There is simply nothing better. But ensuring that the wood rather than high-tech man-made materials are used to deliver optimum performance in the form of musical results is not easy.

Finishes and Adhesives

Most of the finishes used on Yamaha guitars are formulated in-house. Off-the-shelf products simply will not do; because, in addition to looking good and providing durable protection under a wide range of conditions, guitar finishes have to complement the instrument’s sound as well. The Yamaha research center employs advanced techniques to test and measure the sonic characteristics of finishes as applied to guitar tone woods. The finish must allow the most desirable sonic properties of the wood to come through without damping resonance or sustain, while at the same time providing protection and lasting beauty.

But even the most perfectly formulated finish won’t deliver the desired results unless it is applied properly. And this is another important area for research. The quality of finishes is affected during application by many factors: temperature, humidity, spray flow, number of applications, thickness, drying, and more. The research center performs exhaustive testing under a variety of conditions to determine the optimum application conditions for each type of finish, and that know-how is then taken to the factories where it is applied to actual production.

The same type of testing is carried out for adhesives. The research center performs exhaustive testing under a variety of conditions to determine the optimum application conditions for each type of finish, and that know-how is then taken to the factories where it is applied to actual production.

Experience Makes the Data Meaningful

Since initial testing on individual components such as woods, finishes, or adhesives only reveals the characteristics of the materials themselves, a great deal of experience is required to be able to predict how those components will affect the overall performance of an instrument. This is one of the areas where Yamaha’s many years of experience and accumulated know-how are extremely valuable.

Research performed without a strong background of experience is essentially being performed in the dark. Yamaha’s extensive history is the critical “secret ingredient” that throws light on the results, enabling engineers and craftsmen to apply them in meaningful ways.
Woods

The chart below lists some of the woods used for various parts of Yamaha guitars along with their source and main characteristics.

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<tr>
<th>Top</th>
<th>Species</th>
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<tr>
<td>Sitka Spruce</td>
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<td>German Spruce</td>
<td>European Alps</td>
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<td>Western Red Cedar</td>
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<tr>
<th>Back, Sides, and Neck</th>
<th>Species</th>
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<tr>
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<td>South America, Honduras</td>
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<tr>
<td>African Mahogany</td>
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<tr>
<td>Ovangkol</td>
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<td>Nato</td>
<td>Indonesia.</td>
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<td>Padouk</td>
<td>Central &amp; West Africa</td>
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<tr>
<th>Fingerboard</th>
<th>Species</th>
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<tr>
<td>Jacaranda (Brazilian Rosewood)</td>
<td>Brazil</td>
<td></td>
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<tr>
<td>Palisander (Indian Rosewood)</td>
<td>India</td>
<td></td>
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<td>Honduras Rosewood</td>
<td>Honduras</td>
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<td>Maple</td>
<td>America.</td>
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<tr>
<th>Solid Guitar Bodies</th>
<th>Species</th>
<th>Source</th>
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<tbody>
<tr>
<td>Ash</td>
<td>U.S.A.</td>
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<tr>
<td>Alder</td>
<td>South America</td>
<td></td>
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<tr>
<td>Agathis</td>
<td>Asia, South Pacific</td>
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Endangered Species and the Environment

Unfortunately unsustainable harvesting of some of the exotic woods used in guitars has endangered their continued existence, and they must be protected. This means that they cannot be harvested or traded, so fresh supplies are simply unavailable until alternative sources are secured. Existing stocks will continue to be used until they run out.

Although the acoustic properties of many of these woods are ideal for musical instrument use, the health of our planet is far more important. As outlined in the preceding section, Yamaha maintains an active materials research and development program that is working to optimize the characteristics of alternative woods as well as develop new materials that will have minimal impact on the environment.

Living trees absorb carbon dioxide from the air and produce vital oxygen as they grow. They are an essential part of the natural mechanism that maintains balance and sustains life on our planet. Yamaha has been making musical instruments for 120 years, but that legacy can only continue into the future if we promote the sustainable use of wood resources and sensitivity to issues of biodiversity and the depletion of natural resources. Toward this end, Yamaha has established the following “Yamaha Timber Procurement and Usage Guidelines.”

Yamaha Timber Procurement and Usage Guidelines

Fundamental Philosophy

Yamaha is working on measures aimed at preserving the global environment, and plans to enact the following guidelines for the procurement and use of timber in products that allow us to contribute to a more harmonious relationship between society and nature.

Procurement and Usage Guidelines

- Procuring appropriate timber. Promote procurement of timber that is environmentally friendly from harvest to product delivery, and that can be confirmed as having been appropriately managed.
- Prioritize procurement of afforested timber from planted forests. Put priority on procuring timber harvested from planted forests.
- Active use of manufactured wood materials. Promote use of plywood and wood fiberboard as these contain a high percentage of afforested timber and recycled timber.
- Increase the efficiency with which we use timber, raising our yield ratio. Actively promote the use of timber remnants and improve yield ratios through improved processing methods and technological development.

Drying and Seasoning

In Yamaha terminology, drying and seasoning are related but distinct processes that have different goals. Drying is initially employed to reduce the moisture content of the wood to a predetermined level, and seasoning then stabilizes the wood so that it maintains its dimensional and tonal characteristics through varying ambient conditions. Some manufacturers simply buy pre-dried wood from an outside supplier. Yamaha has a long history of wood processing expertise, and is very serious about ensuring that all woods used in Yamaha guitars are dried and seasoned to exacting standards.
The acoustic guitar's body is its main amplification and resonance structure, and it makes the largest contribution to the instrument's overall sound. But although it is the largest tone determining element, it is by no means the only one. The body's contribution is influenced by every other part of the instrument: from the relatively large neck right down to the glue that holds the bridge to the guitar's top. The guitar is an extremely complex sound producing mechanism, and everything in contact with it – including the player's body and fingers – makes a difference.

That's why producing a great guitar is such a difficult task. The number of factors affecting a guitar's tone is nothing less than overwhelming, and bringing them all together in an instrument that provides the desired sound and playability, not to mention durability and beauty, is a significant achievement that hinges as much on the experience and sensitivity of the builder as on fundamental physical principles.

In this section we’ll take a brief look at some of the main elements that influence an acoustic guitar's sound and playability. But keep in mind that none of these elements produce the desired result in isolation. Each depends on every other in a finely balanced and tuned music making system.

**Body**

Vibration of the guitar's strings is transmitted to the top of the body via the bridge. The top, driven by the strings, becomes the instrument's primary "diaphragm," producing most of its audible output. The top is supported by the back and sides, which make their own contributions to the guitar's tone and projection characteristics.

Here are just a few of the elements that add up to define how a guitar body will sound.

**Woods**

One of several varieties of spruce is used for the top of most Yamaha acoustic guitars. Select Engelmann spruce is an important feature of the LL, LS, and LJ series instruments. Back and sides might be a rosewood variety mahogany, nato, or ovangkol. But the fact that a particular type of wood is more exotic and expensive doesn't necessarily mean that it's "better" Only the player can decide what combination of woods and guitar design is best for his or her music.

Model numbers that include "ARE" indicate models with tops that have been processed using Yamaha's groundbreaking A.R.E. technology – discussed in more detail in the "Research and Materials Optimization" section – for exceptionally smooth, musical tone and response.

**Shape & Dimensions**

Acoustic guitar bodies are curvaceous creations for a very good reason: their shape allows them to resonate effectively over a broad range of frequencies, giving them the qualities of a musical instrument rather than just a box with a hole in it. Variations in body size and shape affect the balance of the tone produced as well as the instrument's volume.

Large bodies with a wide waist generally produce greater volume with a smooth, midrange and more emphasis on the lower frequencies. Bodies with a smaller waist usually deliver a tighter, more focused tone. The choice is entirely personal, and will depend on the type of music played, how it is played (strummed or finger picked, for example); and the environment it is played in (solo, with other guitars, in an ensemble with other types of instruments, etc.).

Another body shape consideration for players who frequently use the highest fret positions is the cutaway. This feature is provided on some Yamaha acoustic guitar models, allowing freer access and far greater mobility at the upper frets than is available on traditional non cutaway bodies.

**Bracing**

Bracing - thin strips of wood glued to the underside of the guitar's top – is, in addition to the type and cut of the wood, one of the most important elements influencing the guitar's volume and tone. Bracing applied to the back and sides also has an effect on some performance. The bracing configuration used can mean the difference between the success or failure of an instrument, and ideally will complement and enhance the qualities of the woods used and the instrument's overall design. Too much bracing or braces that are too heavy will result in a dead sounding guitar. At the other extreme – too little bracing or braces that are too light - the guitar might sound uncoaxed and boomy, and the top may be prone to distortion and breakage.

**Bookmatching**

Solid acoustic guitar tops are not a single piece of wood, but rather two pieces joined down the center of the top. These two pieces of wood are "bookmatched,” meaning that they are cut from the same plank, sliced into two thinner planks and opened up like a book. The resultant grain pattern will therefore be symmetrical with respect to the central seam. The very best guitar tops are cut so that the grain becomes wider toward the outside of the top. In all cases the selection, cutting, and bookmatching of woods for guitar tops are critical processes that demand a great deal of skill and experience.

**Fingerboard Inlay**

This pattern brings out the best in the GC series top materials. Bright, well defined highs plus deep, resonant lows. This pattern brings out the best in the GC series top materials.

**Guitar top bracing patterns can be broadly categorized into two types: “X bracing” and “fan bracing.” Each of which has essentially limitless variations. X bracing is generally the best match for the higher string tension of steel string guitars, while fan bracing is better suited to bringing out the tonal subtleties of nylon string guitars with their lower tension.

In addition to the placement of the braces and their dimensions, the taper of the braces is a critical feature that is crafted by hand in high end models. A straight taper is used on some types of bracing, while a curved taper is used on others. The tapers determine how the top flexes across its surface, defining its response and how vibrations from the strings are transmitted throughout the top. For the finest hand made guitars the craftsman will carefully shave the braces to their approximate final shape, tap the top to hear how it sounds, and then make adjustments and repeat until the response is perfect.

In some cases the braces will be "scalloped" - a curved depression will be carved near the center of the brace – to increase the flexibility of the top and increase bass response. But, like most other guitar features, this one has to be matched to the instrument's materials and design for optimum effect. Yamaha APX series guitars, for example, use scalloped bracing in order to deliver well balanced bass from their relatively compact, shallow bodies. In most larger bodies nonscalloped straight bracing delivers the optimum tonal balance.

Every Yamaha acoustic guitar model has its own bracing pattern that is designed to optimize the performance of that particular model. Some of the major variations are illustrated below.

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**Yamaha Bracing Patterns**

**LL/LJ series**

This is the basic configuration found on various Yamaha models. Sharp, punchy sound. Designed to bring out the best in the GC series top materials.

**FG series**

This is the basic bracing configuration found on Yamaha’s original FG series. Sharp and strong with crisp attack.

**FS series**

This pattern utilizes extended brace plates to balance the top and sides and compact bodies of the FS series. Well-balanced sound.

**NX Series, NCK/NTX Models**

This design faithfully reproduces the finest performance details with a clear, bright high range and deep, rich lows.

**APX series**

Designed to bring out the best in a nylon string tone while accommodating a wide range of playing styles.

**GC series**

Bright, well defined highs plus deep, resonant lows. This pattern brings out the best in the GC series top materials.

**CG series**

Frenetic pitch coverage with superb balance and excellent durability, used in high-quality standard models.
The guitar neck is often seen solely from the perspective of playability but there is much more to it than that. Although the neck is where much of the playing action happens, it also has a substantial influence on the instrument's tone and sustain.

**Bridge**
This critical component transfers the vibrations of the guitar's strings to the body where they are amplified and invested with the instrument's characteristic tone. The bridge also plays a vital role in determining the guitar's pitch accuracy and intonation, and must be installed with the utmost precision.

The bridge of an acoustic guitar usually consists of two main components: the bridge base and the saddle (sometimes multiple saddles). The saddle rests in a groove in the bridge base, which is glued directly to the top of the guitar. Since string vibrations must be transmitted accurately to the body with minimum damping, relatively hard materials are used for both bridge base and saddle. The bridge base is generally made of a dense hardwood such as ebony or rosewood, while the saddle will be made of bone (ivory is no longer an option) or a hard plastic. The material used for the bridge have a considerable effect on the guitar's tone.

The strings rest on the saddle, in grooves precisely cut to receive them while maintaining proper string spacing and radius. To maintain proper intonation for all six strings the saddle is installed at a precisely calculated angle, with the high E string closer to the neck than the low E string. The third (G) string sometimes requires a slight offset in the saddle to achieve proper intonation.

**Neck**
Yamaha five piece necks are fitted and glued into a recess in the end of the body. The recess is carefully cut to the appropriate size, shape and depth. A poorly cut recess that house the pickups, controls, and wiring can affect the tone, even though such changes may not be visually apparent.

The fit of the neck is so important to Yamaha that the neck and body are perfectly matched and numbered before the finish is applied. The neck and body are then finished separately, and once that process is complete the match pair is brought back together for final assembly. This painstaking approach ensures that every guitar that leaves the factory has a perfectly matched neck and body.

The guitar's strings are suspended between the bridge on the body and the nut, and it is the distance between the bridge and nut that determines the pitch of the open string. The need for precision is obvious. The nut has grooves in which the strings rest that are carefully cut to the appropriate size, shape and depth. A poorly cut nut can cause intonation problems and string buzz.

**Woods and Construction**
Since one of the most important characteristics of a guitar neck is rigidity, usually the hardest, densest woods are used: mahogany, rosewood, nato, padauk, and sometimes maple. Necks can be carved from a single piece of hardwood, or laminated in three or five pieces for added strength and rigidity. Yamaha laminates mahogany with rosewood, padauk, or ebony in three piece and five piece necks.

A. I. R. (Alternative Internal Resonance) Design
Using Yamaha's original Alternative Internal Resonance technology the RGXA2 and RBX4A2 offer players a full and warm sound that packs a surprising amount of volume. The RGXA2 and RBX4A2 can deliver groundbreaking playability and sound as well. It's how the materials are used that really matters, and that is both an art and a science that includes the body routing as well. Changing the shape of the instrument interacts - body, neck, headstock, machine heads, nut, bridge, tailpiece, pickups, - so that a given shape might result in different tonalities when matched with different components.

Body Shape
The body is the most evident structural component that affects tone in a big way: the pickup(s). We'll look at pickups in more detail in a later chapter, but there's no way to discuss electric guitar body/neck construction without pointing out that the matching between body and pickups is critical in achieving the desired sound. In some ways that makes it even more difficult to build a great electric guitar or bass than it is to create a first-class acoustic guitar. Electric guitars and basses are most definitely not, as some like to say, merely planks with pickups.

The woods used and the way they are constructed are critical to achieving optimum harmony and balance with the pickups used.

**Elements of Sound and Playability**

The Electric Guitar

Electric guitars and basses are just as dependent on woods and construction for great tone as acoustic guitars, but in a slightly different way. Whereas the sound of acoustic guitars is almost entirely created by the woods and materials used and how the instrument is constructed, electric instruments include an additional component that affects tone in a big way: the pickup(s). We'll look at pickups in more detail in a later chapter, but there's no way to discuss electric guitar body/neck construction without pointing out that the matching between body and pickups is critical in achieving the desired sound. In some ways that makes it even more difficult to build a great electric guitar or bass than it is to create a first-class acoustic guitar. Electric guitars and basses are most definitely not, as some like to say, merely planks with pickups.

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**Body Composition**
Like acoustic guitars, the wood or combinations of woods used in an electric guitar's body is a fundamental underlying factor in determining the instrument's tone. Also like acoustic guitars, there are no hard-and-fast rules. While traditional materials such as alder, maple, and mahogany are used for many Yamaha electric guitars and basses, innovative compositions like the A.I.R. (Alternative Internal Resonance) body of the RGXA2 and RBX4A2 can deliver groundbreaking playability and sound as well. It's how the materials are used that really matters, and that is both an art and a science that includes a combination of technological expertise, timeless trial-and-error testing, and an understanding of what artists really want and need to create great music.
Body Joinery
There are many reasons to use multiple pieces of wood for solid guitar bodies, including the ability to use the most choice sections of wood, response balancing and visual symmetry through book-matching, the ability to combine different types of wood to control tone, and economy among others. No matter what the reason, it is critical that the individual parts be joined with the utmost precision and intimacy so that the body can respond as a whole. The basics for achieving this are precise shaping of wood surfaces for a perfect fit, appropriate choice and application of adhesives, and the design and use of tools and jigs that ensure consistent joints from instrument to instrument. In some cases special techniques are used to ensure absolute body integrity. The BB2000/1000 series basses, for example, have three-piece bodies in which the upper center and side sections are joined using almost full-length hand-joined splines, ensuring optimum vibration transmission throughout the body for outstanding resonance and sustain.

Neck Construction and Attachment
The basic requirements for a great electric guitar or bass neck are the same as those for acoustic guitar necks, so you can refer to the “Neck” section in the “Elements of Sound and Playability – Acoustic Guitars” chapter for details. The main difference is in how the neck is attached to the body; set neck attachment similar to that used for Yamaha acoustic guitars is used in some Yamaha electric guitars as well, but not all. In some cases a through neck or bolt-on neck is a better choice for an electric instrument. Here’s a quick rundown:

Set Neck
One of the benefits of set necks for acoustic guitars is that they can provide a strong, intimate joint without intruding into the body and degrading acoustic performance. The situation is similar for electric guitars in which the intimacy of the body as a whole needs to be maintained for optimum tone.

Through Neck
This type of construction is often referred to as “routed” neck since the neck extension is routed to fit into the body. In this case, the pickup bridge, and tailpiece are all attached directly to the neck extension so that there is an uninterrupted transmission path from the tailpiece to the headstock.

Bolt-on Neck
In addition to convenience – and they most certainly are convenient in terms of setup, maintenance, and repair – bolt-on necks allow a more versatile option since they are designed in some instruments. While it’s easier to substitute different wood bodies through wood, for example, the top-of-the-line BB series electric basses have bolt-on necks that, in that particular context, provide ideal attack and response.

A.R.E. and I.R.A.
Yamaha’s original A.R.E. Acoustic Resonance Enhancement) wood processing technology is now being used in electric instruments as well as acoustic guitars (refer to the ‘Research & Material Optimization” chapter for details). BB2000/1000 series bass bodies, for example, are lovingly built from chosen alder that has undergone A.R.E. processing, delivering tone that is smooth and mature.

Bridge and Tailpiece
Since the bridge is the primary point at which string vibration is transferred to the instrument’s body, any changes in material and design will change the sound. Unlike acoustic guitar bridges, which are usually made of hard wood bonded directly to the body with bone or hard plastic saddles, electric guitar and bass bridges are most commonly made of metal alloys. The bridge and tailpiece can be separate, or both functions can be integrated into a single bridge/tailpiece unit. Electric guitar and bass bridges often feature “tunable” saddles that can be precisely positioned to achieve accurate intonation. One aspect of bridge/tailpiece design that has a surprisingly large effect on both tone and playability is the angle at which the strings meet the saddles from the tailpiece side. Some Yamaha instruments even provide a choice of stringing options, like the BB2000/1000/4000 series basses that provide both “Diagonal thru Body Stringing,” and “stringing directly through the tail end of the bridge,” whichever the player prefers.

Machine Heads
Not only are machine heads important for fast, accurate tuning and tuning stability, but they actually sit as tone as well. The mass of the machine heads directly affects the resonance of the instrument’s neck, thus playing a small but noticeable role in determining overall tone. The details really do count.

Electronics with Optimum Tone
When the size of a venue or the need to record makes amplification necessary, the main requirement is usually to improve the guitar sound as close as possible to the way it does naturally, and this is easier said than done. When we hear an acoustic guitar up close and unplugged we’re hearing sound from virtually every part of the instrument: the top, back, sides, and even the neck and headstock to some extent. The sum total of all that sound is the guitar’s true, natural tone.

Now consider what happens when the sound of the guitar is to be picked up by an external microphone. In order to pick up only the sound of the guitar as efficiently as possible the microphone has to be moved in quite close, but that at the same time means that the microphone “fores” on a small area of the instrument with the result that the tone becomes unbalanced. When using external microphones most live sound and recording engineers will, whenever possible, use two microphones on different areas of an acoustic guitar in order to achieve a balanced, musical sound.

Built in microphones, especially the “contact” type that are directly attached to a part of the guitar’s body, are an even greater challenge because they generally pick up the instrument’s sound only at the point of attachment. Not only do the microphones (usually called “pickups” when they are directly attached to the instrument) have to be specially designed for the application, they have to be positioned at the ideal location for optimum tonal and dynamic balance. Multiple pickups at different locations are often used to achieve a well balanced, natural sound. The preamp/processor built with built in pickups will also often be “voiced” (equalized) to achieve a natural tone, and variable EQ controls may be provided to give the performer some control to adjust for personal preference as well as the widely varying acoustics of performing venues.

Another issue with built in pickups is that they effectively turn the entire instrument into one big microphone that is extra care and attention in live performing situations. Output from the sound system speakers can be picked up by the guitar body, amplified again and fed back to the system, forming a loop that can cause the loud, piercing oscillation known as “feedback.” Careful pickup design and placement can go a long way toward minimizing this problem, as can sound hole covers and other means of reducing the instrument’s sensitivity to external sound waves.

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Yamaha Acoustic Resonance Transduser Technology
Piezo transducers are ideal for contact pickup use, allowing accurate, efficient pickup surfaces that work on a variety of instruments. The SRX100A is a great example of this. The A.R.T. pickup features a multi layer structure that provides the ideal degree of damping without losing touch of the dynamic characteristics of the guitar’s sound. Since it is possible to attach this advanced pickup directly to the underside of the guitar, tone more of the instrument’s inherent resonance and tone can be included in the amplified sound.

The A.R.T. pickup is available in one way and three way pickup systems, but even in the one way System 56 two pickups are employed for optimum balance.
The three way System 57, System 59 and System 60 configurations actually employ a total of four pickups strategically located for outstanding sound and tonal flexibility. In addition to two pickups placed under the ends of the saddle, two more pickups are located near the bass and treble ends of the bridge base. The output of the main (saddle), bass, and treble pickups can be blended as required to achieve the ideal balance. System 57 and System 59 additionally include a three band equalizer for fine tonal adjustment. Rather than a preamplifier panel fitted into the upper side of the guitar, System 60 features pop up knobs that provide easy control access while staying out of the way when not being used, without compromising the visual elegance of the instrument’s exquisite side wood. NX series guitars feature System 61, newly designed to complement the characteristic warmth and full midrange tone of these nylon string acoustic instruments.

First-class Studio Sound, Without the Studio

Yamaha’s groundbreaking SRT (Studio Response Technology) system employs advanced digital processing to accurately recreate the sound of the guitar as recorded in a world-class studio by a highly skilled engineer using the best microphones available. The data used for SRT processing has actually been recorded in some of the best studios in the world specifically for the guitar model in which it is to be applied. The player has fingertip control of microphone selection, positioning, and other parameters, making it easy to achieve optimum tone for a variety of live and recording applications.

Three High-End Mic Types

Select from models of three microphones most favored by recording engineers around the world. (Mic models are created using data collected from these microphones.)

Type 1: Neumann U87

Vintage condenser microphone favored for its warm frequency range and ability to capture brilliant high frequency harmonics. Suitable for both clean and distorted sounds.

Type 2: Seymour Duncan SH-112

Modern dynamic microphone favored for its articulate and balanced sound. Great for both clean and distorted sounds. Ideal for jazz, blues, and rock.

Type 3: SG1820

Seymour Duncan Pickup

Recommended for solo and ensemble playing.

Professional Mic Positions

Choose mic positions close or far.

FOCUS: On mic setting produces sound closest to the guitar. Captures string vibration and body resonance useful to deliver a fat, organic sound ideal for exuberant playing.

Blending Mic and Mic Source Sounds

Blend piezo pickup and microphone sources to create a wide palette of tonal variations. Blending the sound from the piezo pickup with the sound from the mic adsrishes.

Active or Passive

Like virtually all other pickup related choices, the choice of active or passive pickups is a highly subjective one. Both types have advantages, and it is up to the artist to decide which is best for his or her style. Yamaha’s current lineup of electric guitars and basses includes instruments with both types of pickups. Here’s a quick rundown of their main characteristics.

Passive

Passive pickups have no onboard electronics and don’t require battery power. They tend to bring out more of the instrument’s wood tone, and many feel that for this reason they have more “character.” The response and tone of passive pickups can be affected to some degree by the type and length of flexible lead used to connect the guitar to effect units or amplifiers, and by the input characteristics of the effect unit or amplifier used.

Active

Active pickups have onboard amplification that requires a power source, usually a battery housed in the instrument’s body. They tend to bring out more of the instrument’s wood tone, and onboard tone control electronics often allow a wide range of tonal variation right from the instrument’s controls. Active pickups are generally preferred by players and the input characteristics of the effect unit or amplifier used.

Matching the Pickups to the Instrument

Although the quality and performance of the pickups themselves are vitally important, equally critical to achieving optimum tone is how well the pickups are matched to the instrument. Why is this so? Electric guitar and bass pickups become an integral part of the instrument’s sound producing system. Although it seems that the pickups are simply picking up the vibrations of the strings and generating corresponding electrical output, the true situation is actually a little more complex. The body of the instrument resonates in response to string vibration, and since the pickups are attached to the body they are a part of that resonant system. A certain amount of inter-modulation between string vibration and resonance transmitted to the pickups via the body is inevitable, resulting in tone that is unique to that specific combination of pickup and instrument. The possible variations are innumerable, and a great deal of time and effort goes into developing or finding the pickup(s) that will give the most musical voice to any given instrument.

Taking Advantage of the World’s Pickup Resources

Yamaha develops and builds many pickups in-house, often in cooperation with renowned artists whose sound and approach to playing have become standards to which upcoming artists aspire. The pickups on the BB2000/1000 basses are eminent examples. But there’s no denying that some of the world’s leading dedicated pickup manufacturers produce pickups that deliver outstanding tone and response that are precisely what many players want, and there’s no reason not to take advantage of such high-quality resources. That’s why Yamaha’s SG1800 series electric guitars come fitted with pickups from some of the brightest stars in the business. The pickups on the BB2000/1000 basses are eminent examples. But there’s no denying that some of the world’s leading dedicated pickup manufacturers produce pickups that deliver outstanding tone and response that are precisely what many players want, and there’s no reason not to take advantage of such high-quality resources. That’s why Yamaha’s SG1800 series electric guitars come fitted with pickups from some of the brightest stars in the business. The pickups on the BB2000/1000 basses are eminent examples. But there’s no denying that some of the world’s leading dedicated pickup manufacturers produce pickups that deliver outstanding tone and response that are precisely what many players want, and there’s no reason not to take advantage of such high-quality resources. That’s why Yamaha’s SG1800 series electric guitars come fitted with pickups from some of the brightest stars in the business.

Electric Guitar Pickups and Electronics

Whereas acoustic guitar pickup systems are usually designed to deliver the acoustic tone of the guitar as naturally as possible, electric guitar and bass pickups are part and parcel of the instrument’s sound. In fact, they are just as important and influential as the woods used in an acoustic guitar. But the choice is by no means simple. The design and materials of the guitar, the player’s touch, the type of music being played, and the amplification system and processing gear being used are just some of the factors that play a significant role in determining the final tone produced by the pickups. It is both complex and subjective, and only the artist is qualified to judge. It is Yamaha’s role to provide a range of choices that satisfy the widest possible range of player requirements.
The Tone is in the Details

Literally everything about a guitar or bass pickup affects the way it sounds, right down to the type and placement of screws used to hold parts together. The materials used for bobbins and base plates are significant, and there are almost infinite variations in how the coils can be wound: type of wire, tighter, looser, even, scattered, and more. And, as implied above, the only way to know how a given pickup will sound in a given instrument is to install it and play it. The number of variations is astronomical, but Yamaha provides a comprehensive range of choices that provide solid foundations for a wide range of tonal preferences.

Even the controls, capacitors, and type of wire used to connect everything together can affect the final sound, so a great deal of R&D goes into selecting those components as well.

Craftsmanship

Even with the advanced manufacturing technology available today it simply isn’t possible to entirely automate the production of first-class guitars. The complexity of the task in addition to the need for constant awareness of the materials being used and the ability to minutely adjust for variations is beyond the scope of available technology.

Machines do play a vital role, but there is no substitute for the skill and sensitivity of experienced craftsmen at many stages during the production of fine musical instruments.

Turning Designs into Great Guitars

Turning designs into great instruments isn’t easy. Technical drawings can’t convey the intended tone of an instrument, or even much of the construction methodology that creates the desired characteristics and sound. A huge part of the process of creating great guitars comes down experience, craftsmanship, and extensive trial and error testing that builds more experience.

Before the building can even begin the plans and intentions of the designers have to be effectively communicated to the chief craftsmen at the factory who will then develop an appropriate production process. The process will be a combination of operations used for current models as well as new methods and tools devised for use with that specific instrument. Every guitar is different, and coming up with the ideal production methodology and workflow is a critical step in achieving consistently high quality.

Overdoing It

Sometimes ‘overdoing’ things is the only way to ensure that the desired quality is achieved consistently and in every possible situation. Yamaha does take manufacturing details to extremes in many cases, but the final results are unquestionably worth the extra effort.

The Yamaha process of pre-matching acoustic guitar bodies and necks before finishing is one example. Experience has shown that the quality of the neck-body joint plays an important role in maximizing the instrument’s tone and response. In short, the fit must be perfect with intimate contact between neck and body. The combination of pre-matching and Yamaha’s unique joint configuration ensures that the ideal is realized in every instrument produced.
Critical matching between neck and body is just as important for achieving optimum tone and response in electric guitars and basses as it is for acoustic guitars. This process is so sensitive that it can only be done by hand, even for bolt-on necks.

Another example worth noting is Yamaha’s approach to achieving the ideal top curvature for each instrument. A specially designed and built contouring sander is used to shape the edges of the sides such that the top is given an outward curve that places the point at which the bridge will be attached at a precisely defined height above the edges. This helps to optimize transmission of string vibration as well as producing a strong, durable top.

This type of attention to detail extends throughout every phase of the guitar production process, from raw materials and design through final testing.

An Ideal Blend of Machine Precision and Human Skill

There are, of course, some tasks that are best left to machines – particularly those that require extreme precision and repeatability. Cutting the fret slots in fingerboards is a critical job that is handled by precision computer-controlled machinery, as is basic shaping of solid bodies and necks, for example. But in order to deliver instruments that precisely meet our customer’s needs there is often a need for variations that require individual attention. That’s where the skill and experience of Yamaha craftsmen can really shine.

The Finishing Touches

Yamaha spares no effort in ensuring that every guitar and bass leaves the factory in optimum playing condition. Critical players may need to make minor string height adjustments to match their individual playing style, for example, but important details such as fret leveling and finishing are taken to custom-shop level right at the factory.

Final assembly is another production step that requires the utmost care if optimum tone and performance are to be achieved. Parts that are not properly aligned or not solidly attached can degrade both sound and playability. Workstations are designed and set up specifically for the assembly tasks to be performed so that the process is as smooth and efficient as possible, allowing the craftsmen to concentrate fully on achieving perfect results.

Crafting the Tools

There is innovation and craft behind the craftsmanship as well. Most of the tools and jigs used for making guitars have to be made by hand for the purpose, and many are created specifically for a single model and won’t be used for anything else. Inventing tools and jigs that make it easy for the factory staff to consistently produce perfect shapes and assemblies is an important element of Yamaha’s approach to craftsmanship. But tools and jigs can wear and go out of alignment with use, so special care is taken to keep them maintained and in perfect working condition at all times to ensure maximum quality control.

Keeping the Craft Alive

Because of the heavy reliance on skilled craftsmanship in the making of fine guitars, the only way to ensure consistent, continued quality into the future is to pass the know-how on to young craftsmen. Yamaha makes this process an “official” part of the guitar manufacturing process. This kind of skill can only be fully passed on person to person through involved hands-on apprenticeship. Craftsman come and go, but Yamaha is dedicated to ensuring that the basic skills as well as the many innovations developed along the way are effectively passed on so that Yamaha guitars can continue to evolve.
Yamaha takes the concept of “quality control” way beyond simply checking finished products for defects. In fact, Yamaha maintains dedicated staff and certified worldclass facilities that are devoted solely to quality control, ensuring that all products are designed, developed, manufactured, shipped, and serviced with maximum quality maintained throughout the entire process.

Quality control is just as important for guitars as it is for Yamaha’s industry-leading digital mixing consoles, for example, but the way it is applied differs in some ways in accordance with the way guitars are crafted as opposed to purely electronic devices. The most important similarity—a motif that runs through all Yamaha products—is that quality control begins at initial conception and design and carries on right through to customer service after the product has been sold.

Creating Quality that Lasts

The Yamaha quality control process can be broadly divided into 6 phases that begin at a guitar’s conception and continue for long after it is sold and in the player’s hands.

1: Virtual Review – Creating Quality on Paper
The Yamaha approach is to build quality into every guitar right from the beginning. This means that a proposed design will be subjected to multiple “virtual review” sessions while the instrument is just an idea on paper. Virtual reviews are attended by designers, engineers, craftsmen, players, sales staff anyone with experience or understanding that can be applied to improve the design and eliminate potential problems before they occur. Designers and engineers from other divisions often join in to help uncover issues from a fresh perspective: drum or violin developers, for example, sometimes make invaluable contributions. Every aspect of the proposed guitar is thoroughly reviewed, as are the tools and methods by which it will be constructed. Only when everyone involved is satisfied that the design meets Yamaha’s standards as well as those of the end user can development proceed to the next step.

Naturally, players are consulted at every stage of the development process, as appropriate to the product. For example, performing professionals might be enlisted to review a pro-class instrument, while guitar teachers might be consulted for student models. The players evaluate the guitars from a “musical instrument” perspective rather than a “product’s” perspective. And that, in the final analysis, is what it’s really all about.

2: Initial Prototype – Ideas Become Reality
Phase two of the development process is the construction of the first prototype. The first prototype will be built according to the specifications that come out of the initial virtual reviews, and will be once again subjected to multiple reviews at which problems will be identified and measures for their resolution decided upon. New features, in particular, will be examined in detail to determine whether they actually fulfill a need and whether there’s any way they might be improved. In general, the first prototype is used to physically review the design and features of the product itself.

3: Pre-production Prototype – Refining the Process
Once the first prototype gets the green light from the review teams, a second “preproduction” prototype is made. The second prototype is used both to check for problems that may have been overlooked in the first prototype, and to refine the production process by which the instrument will be made. Every design requires its own special manufacturing techniques in some areas, and it is essential to ensure that the entire manufacturing process will run smoothly and deliver consistent results. Every tool, jig, and process that will be used to build the final product will be reviewed in detail.

Guitar craftsmanship performs one of the most important quality control functions during production.

4: Production – Non-stop Quality Control
One major difference between guitar manufacture and other types of production is the involvement of craftsmen at every step along the way. On a television production line, for example, there might be tests at specified points during the assembly process, but quality is only monitored at those specific points. In the case of guitar manufacture, on the other hand, the craftsman who is drilling a hole, gluing a bracing, shaping a neck, or applying a finish is monitoring the quality of the result as he works. Quality monitoring is a continuous, uninterrupted process. Construction and crafting cannot be separated from quality control, and each individual craftsman monitors his own work as well as those of others working around him with great care and pride.

Severe Quality Testing
Since quality cannot be fully assured on the basis of theory alone, it becomes necessary to subject actual instruments and parts to “controlled abuse” that tests their actual performance, stability, and reliability to extremes.

Yamaha maintains a number of facilities dedicated to physical testing and quality control—including the world-class Yamaha Quality Support Center that houses some of the most advanced and sensitive testing facilities for electronic devices available anywhere, plus some tortuous durability tests that are almost shocking in their severity.

Yamaha’s Quality Support Center that houses some of the most advanced and sensitive testing facilities for electronic devices available anywhere.

Accelerated Environmental Testing
Of paramount importance in manufacturing guitars for worldwide distribution is the need to ensure that the instruments will be able to withstand a torturous range of environmental conditions without damage or compromised playability. A neck that warps with every change in humidity will be nothing but frustration for the player. At the extremes wood can crack and glue joints can separate... none of which is acceptable for Yamaha guitars.

5: Spot Checks and Feedback from the Field – Continued Vigilance
Spot checks are regularly performed prior to shipping products from the factory as well as on products received from off-site factories. If a problem is found on an instrument in production, shipment is stopped immediately and the cause is tracked down and rectified before shipment can commence. Any problems reported by customers are also examined and dealt with immediately.

In addition to spot checks at the factory and general feedback from the field, and functioning independently from the product divisions, is Yamaha’s overall quality control department. This dedicated quality monitoring organization will actually buy products from retail outlets at random, independent testing. Any issues uncovered are fed back to the respective product departments with orders that the problem be solved posthaste. This type of checking is done from the customer’s perspective, totally independent from the development and production divisions.

6: In the Player’s Hands – Lasting Quality
Guitar manufacture is not only a matter of selling guitars now, but also of considering how those guitars will perform decades after being made. In addition to a worldwide service network dedicated to responding to customer’s needs as swiftly and as appropriately as possible, Yamaha maintains stocks of parts that might be needed to repair and service guitars for as long as eight or ten years after the product has been discontinued. Sometimes longer. The cost is enormous, but the results in terms of overall “quality” are well worth it.

All Yamaha guitars undergo rigorous electromagnetic testing at Yamaha’s world-standard EMC testing facility.

Acoustic guitar electronics undergo rigorous electromagnetic testing at Yamaha’s world-standard EMC testing facility.
Although the foundation for Yamaha guitar craftsmanship was originally established in Hamamatsu, Japan, with assistance from distinguished Spanish guitar builders Eduardo Ferrer and Manual Hernandez, once the craft was mastered it was possible to move some production overseas in order to satisfy the growing need for high-quality instruments at all price points. That basic sequence continues to be repeated for each new model: initial development and manufacturing processes design take place at the Music Craft factory in Japan, then production is assigned to one of the overseas factories. The Music Craft factory is pivotal in achieving and maintaining Yamaha quality throughout the world.

To ensure that Yamaha guitars remain stable and reliable through all types of environmental conditions, year after year, samples are subjected to accelerated testing that simulates the severest conditions imaginable. The test samples will be kept at -20 degrees Celsius for a period of time and then moved to a +50 degree environment, and that process will be repeated several times while measurements are made to check integrity and dimensional stability. The same applies to extremes of atmospheric moisture, with instruments being subjected to alternating periods at 90% and then 20% humidity. This type of testing requires large-scale specialized facilities that are beyond the scope of most manufacturers.

Vibration and Drop Testing

Instruments must reach the customer in perfect condition, so packaging and shock resistance are important quality issues. Testing is brutally simple: drop the product from a specified height (onto corners as well as top, bottom, and sides), and subject it to severe mechanical vibration covering a range of frequencies for extended periods. If the product and packaging can survive Yamaha’s internal testing, they can survive transportation around the globe under the roughest conditions.

The ultimate goal of Yamaha quality control is total customer satisfaction. That not only means delivering guitars that are stable and reliable, but also instruments that fulfill the player’s musical needs and are capable of growing and improving along with the player. And when a problem occurs, responsive and effective support becomes an essential element of the quality equation as well. Easier said than done.

Like the products themselves, quality management must continually evolve to keep pace with continuously changing markets, user needs, and technology. Yamaha is right at the leading edge.

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From the Player’s Perspective

Yamaha’s goal is to create guitars that ideally meet the real-world needs of professional and amateur musicians who depend on their instruments for their livelihood, life, and enjoyment. Acquiring feedback directly from and cooperating with players in the development of designs and features is the most meaningful, effective way to refine the instruments we produce. With that understanding, Yamaha places great emphasis on communicating with players and providing opportunities for them to evaluate instruments and suggest improvements.

YASH: Yamaha Artist Services Hollywood

One facility set up specifically for artist involvement and cooperation is YASH: Yamaha Artist Services Hollywood. YASH is located at the heart of the LA music scene, sharing the area with numerous recording studios and venues as well as top-level artists in a wide range of musical genres.

The operation began as VGD (Yamaha Guitar Development) in 1989, and was expanded in 2006 to become YASH, with display and evaluation rooms, recording facilities, wood and metal shops, an electronics lab, and a photo studio.

Of course not all evaluation occurs at the YASH facility itself. The location of YASH provides easy access to a number of important music centers throughout North and South America, allowing us to stay in touch with artists wherever they may be and stay abreast of developments that can be implemented in our development and production.

ART: Artist Related Twenty-one, Tokyo

Another important center for artist relations is the ART (Artist Related Twenty-one) in Tokyo, Japan. It is a place where Yamaha designers and builders who are involved with day-to-day production at Yamaha’s main custom shop and factories can directly communicate and exchange ideas with artists who are either touring in Japan or have come specifically to work on Yamaha instruments. The ART is an important center for artist relations and Yamaha designers and builders can communicate and exchange ideas with artists who are not only dependent on the designers, craftsmen, and support staff at Yamaha’s guitar division for their livelihood, art, and enjoyment. Acquiring feedback directly from players in the development of designs and features is the most meaningful, effective way to refine the instruments we produce. With that understanding, Yamaha places great emphasis on communicating with players and providing opportunities for them to evaluate instruments and suggest improvements.

The guitar evaluation room at YASH.

A Noble Lineage

The tradition that is the foundation for the entire genre is inextricably intertwined with the evolution of guitar music. The classical guitars we know today in a steady, organic progression that is inextricably intertwined with the evolution of guitar music.

Classical guitars evolved from relatively simple four-string instruments in the 1400’s to the highly refined six-string concert instruments we know today. The development and application of new instruments in the 1400’s to the highly refined six-string concert instruments we know today is a steady, organic progression that is inextricably intertwined with the evolution of guitar music. The basic form of the “modern” classical guitar was developed by Spanish luthier Antonio de Torres in 1833, and it is his work that continues to influence and guide the hands of the world’s top craftsmen today.

Yamaha is proud and honored to have been able to take part in that evolution, through guidance received directly from eminent luthiers from the Torres line, as well as cooperation with some of the most distinguished artists in the genre.

Yamaha top-line Grand Concert Custom guitars. From left to right: GC70, GC70C (cedar top model), and GC71.

Classical Tradition

Classical guitars and classical guitar music are firmly rooted in a rich tradition that is the foundation for the entire genre. Through direct tutelage from renowned Spanish luthiers Eduardo Ferrer and Manuel Hernandez, as well as some reference to legendary instruments created by other masters such as Santos Hernandez, Marcello Barbero, and German luthier Hermann Hauser, Yamaha classical guitars are descendents of a proud lineage that began with Antonio de Torres (1817–1892), the father of modern classical guitar design.

No effort is spared in upholding and refining the demanding standards of tone and quality passed down to Yamaha from some of the most eminent luteans in the history of the classical guitar, and we carry on the tradition with both humility and pride.

Classes and guitarists alike are aware of their own needs as well as those of other musicians around them, and are usually happy to evaluate prototypes and share ideas and opinions on how instruments can be improved whenever the opportunity arises.

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This, perhaps more than anything else, is the true foundation of Yamaha quality. Mr. Sakurai’s influence actually extends beyond classical guitars. He was part of the first L series production team and remains involved to this day. He was also a key member of the team that developed the first Yamaha electro-acoustic guitars.

Mr. Narusue has seen Yamaha guitar production evolve significantly over the years, and offers the following insights: “In the early years much of Japan’s guitar production was based on copying existing designs. Yamaha was more interested in creating original instruments, so master classical guitar builder Eduardo Ferrer was invited from Spain to teach traditional Spanish guitar building technique to the Yamaha craftsmen from the ground up. That was in the late 60’s. One of Yamaha’s craftsmen then travelled to Spain where he studied for several years with Ferrer and later Manuel Hernandez, another renowned master Spanish luthier. In 1973 Hernandez came to Japan where he worked with the Yamaha custom guitar shop team to refine production techniques. Of course the climate and working environments of Spain and Japan are quite different, so adjustments had to be made—we experienced some problems. That’s what taught us the importance of creating an optimized working environment for both classical and steel string guitar production.”

Mr. Narusue has been with Yamaha for around 35 years, and currently applies his extensive experience and knowledge to guiding Yamaha classical guitar production. “Our biggest challenge is to impart as much of the quality we can into hand made guitars into our factory made guitars as well. A lot of this depends on the tools and jigs we make in order to build the guitars. But even if we have precisely machined jigs that can repeatedly create a specific shape, adjustments still have to be made to the thickness of the wood, for example, to compensate for variations. Two guitars built to precisely the same dimensions can sound completely different due to subtle differences in the materials used. The ability to adjust for those differences is essential to being able to deliver consistent quality.”

But it’s the elements that aren’t visually apparent that are the most difficult drying the wood, for example, or how the layers of finish are formulated. One of Yamaha’s strengths is its ability and dedication to creating our own finishes. These are formulated both to be optimal in acoustic terms—they won’t damp the sound of the instrument—and safe for the environment. We apply an extraordinary amount of energy and resources to this, and have spent many years researching and optimizing technology as well as adhesives and finishes. In a sense all of Yamaha’s research and development is directed toward achieving the best possible working environment. The benefits will continue to grow more apparent as time goes on.”

People

Any organization is the sum total of the people involved. Talking to the guitar design and production staff at Yamaha reveals a common thread of singular enthusiasm and dedication to creating some of the finest guitars in the world. These people are enviably happy doing what they do, and take great pride in the results. This, perhaps more than anything else, is the true foundation of Yamaha quality.

Hiroshi Sakurai
Product Planning Group

Hiroshi Sakurai leads Yamaha’s steel string and non-classical nylon string acoustic guitar design and production teams with enthusiasm and passion. Like most of the staff at Yamaha he is a player himself and makes it a point to get together with his band whenever possible in order to stay in touch with the needs of players and the underlying reasons he’s making musical instruments.

When asked what was special about Yamaha’s approach to designing and building guitars, Mr. Sakurai offered the following thoughts: “One of our strengths is the control and consistency of our design process. All designs begin with specifications and technical drawings from the design team rather than arising haphazardly or being copied from somewhere. All of our designs are original. Once the initial design has been committed to paper, the physical realization of that design becomes a matter of trial and error, usually involving multiple prototypes. Experience guides the process.”

‘Designing top quality guitars isn’t a straightforward undertaking. For example, a guitar’s neck has a large effect on the overall sound, but the neck itself is a complex structure consisting of five neck materials and shape, the headstock, the tuners, the truss rod, the nut, the fingerboard, and even the glue that attaches the fingerboard to the neck. All of these elements contribute to the total effect, and we will not compromise on any of them. And we use our original dovetail joint on all acoustic guitars, from the top to the bottom of the line. The decision to take that comparatively difficult route was made after extensive tests on dovetail bolt on necks. We came to the conclusion that our dovetail points produced superior results. There are an astonishing number of details that make up the total sound of the instrument that we have to be aware of and stay in control of at all times. Many of these details aren’t visible from the outside. The bridge plate—glued under the bridge area, under the top—is one such example. The material, size, and thickness of the bridge plate affect the basic tone of the guitar in a crucial way, and the parameters have to be carefully refined. Even the angle of the strings from the string pins to the bridge has a significant effect, and this is all part of the guitar’s design.”

‘It’s easy to build guitars with a big sound, but such guitars don’t usually age well and generally won’t have the durability to withstand years of use or changes in environment. Our ideal is to create guitars that will grow with the player, maturing over a period of years to become an integral part of the player’s sound and style.’

Fumio Narusue
Production Planning Group

Fumio Narusue has been with Yamaha for around 33 years, and currently applies his extensive experience and knowledge to guiding Yamaha classical guitar production. "Our biggest challenge is to impart as much of the quality we can into hand made guitars into our factory made guitars as well. A lot of this depends on the tools and jigs we make in order to build the guitars. But even if we have precisely machined jigs that can repeatedly create a specific shape, adjustments still have to be made to the thickness of the wood, for example, to compensate for variations. Two guitars built to precisely the same dimensions can sound completely different due to subtle differences in the materials used. The ability to adjust for those differences is essential to being able to deliver consistent quality.”

‘But it’s the elements that aren’t visually apparent that are the most difficult drying the wood, for example, or how the layers of finish are formed. One of Yamaha’s strengths is its ability and dedication to creating our own finishes. These are formulated both to be optimal in acoustic terms—they won’t damp the sound of the instrument—and safe for the environment. We apply an extraordinary amount of energy and resources to this, and have been doing so for more than 50 years. The accumulated result is a large part of what we call Yamaha quality.”

‘We take great pride in the fact that we don’t cut corners. All Yamaha guitars are built without compromise. We don’t follow trends or fashions either. We stick to the basic core values of guitar craftsmanship in order to deliver world class tone and playability.”

Hiroyasu Abe
Wood Engineering Group

Hiroyasu Abe is a key figure in Yamaha’s Wood Engineering Group. The division is responsible for basic research on wood processing and optimization technology as well as adhesives and finishes. In a sense all subsequent guitar production hinges on the quality and consistency of the materials we develop, test, and supply. Mr. Abe’s team “Our division provides a level of involvement that we believe is unique among guitar manufacturers. We develop and thoroughly test adhesives, finishes, and wood processing methods that are then passed onto the factories for actual application in the manufacturing process.”

‘One of our main concerns at the moment is the development of effective adhesive and finish formulations that don’t use VOCs (volatile organic compounds). VOCs are cheap and easy to use, but they’re bad for the environment and must be avoided.”

‘Since our work is essentially basic materials research, it can take years to arrive at successful solutions to some problems. That’s where Yamaha’s long years of experience in the field really make a difference. We have an extensive database of knowledge on which to draw, and are adding to it all the time. Our A.R.E. (Acoustic Resonance Enhancement) process that is beginning to be applied in guitar tops is a good example. We’re beginning to introduce it in actual products, but we’ve been developing and testing it for years. There is a lot of work behind A.R.E., but the advantages it provides in terms of tone make the effort more than worthwhile, and the benefits will continue to grow more apparent as time goes on.”
Effective quality control requires a fine balance between experience and innovation, and it is Tsugitomo Gotoh’s mission to ensure that the balance is maintained. Mr. Gotoh discusses his role in the overall guitar production operation with energy and devotion that one soon becomes accustomed to when discussing guitars with Yamaha personnel.

“Yamaha quality control is a long, continuous process that begins with the creation and maintenance of maximum quality from initial design through actual manufacture, and carries on through to the market where our response to feedback from the field after the products have been shipped and sold is just as important. Of course we're concerned with the quality of the product at the point of sale, but we're also very concerned about whether it will still satisfy the customer in, say, 10 years time.”

Yasuo Suzuki is a key figure behind the production of every Yamaha electric guitar and bass. He is in charge of building the prototypes on which production models are based, as well as special artist models. It's a demanding job that requires more than the ability to build fine guitars. When a drawing is received from the designers, the first task Mr. Suzuki's team must tackle is the creation of jigs and tools that will be needed to craft the instrument so that it faithfully reflects the designer's intent.

"The jigs come first, and we have to figure out how to make them. The designers just provide us with the drawings for the instrument. It's up to us to invent appropriate tools to make the design a reality." Many of the jigs created by Mr. Suzuki and his team appear to be fairly simple, but it takes years of experience and accumulated knowledge to come up with simple, versatile tools that perform precisely and effectively in a variety of situations. It is also essential to match the tools to the facilities in which they will be used, as well as the craftsmen who will use them, so they will consistently produce the desired results in the given conditions.

"We design the entire production process from start to finish. It doesn't matter if the workshop isn't equipped with the right tools. We'll find a way to create what the designers want.”

Of course jigs and tools aren't the whole story. Mr. Suzuki knows the woods he uses intimately. How they sound alone and in combinations, and how various cuts respond to stress. Balancing the characteristics of the woods symmetrically in a guitar body is important in achieving optimum sound. Ensuring that the woods don't "move" after the instrument is built is also critical, especially in the neck. As top-quality wood is scarce, the final quality of the instruments produced by consummate craftsmen like Mr. Suzuki depends more and more on skill. It all comes down to experience and craftsmanship.

"All of this is what makes my job worthwhile and enjoyable. I’ve been building electric guitars for about 35 years now, and I still find it satisfying.”

Already in his '70s, Mr. Samejima is still making guitars and loving it. The experience and dedication of the younger craftsmen he trains is part of the reason he continues to oversee production at the Yamaha Music Craft guitar factory in Hamamatsu, Japan, as well as Yamaha facilities overseas, while passing on his extensive knowledge to the younger, upcoming craftsmen.

Mr. Samejima has been making musical instruments for half a century, and guitars for 40 years. He joined Yamaha's guitar production team in the 60's and studied with Eduardo Ferrer while the Spanish master luthier was in Japan working with Yamaha. Although most of his time is spent on production guitars, one of Mr. Samejima's favorite sidelines is creating totally new "dream guitars" that are not based on existing designs or drawings. While allowing him to flex some creative muscle, it is also a source of new ideas for Yamaha, some of which eventually end up on the production line.

Yamaha had been mass producing guitars up until 1965, but the establishment of the Yamaha Custom Guitar Workshop in that year marked the beginning of development and production of high quality hand made guitars. Toshihiko Ito joined the workshop in 1967, and was among the craftsmen who studied with master Spanish luthiers Eduardo Ferrer and Manuel Hernandez. Mr. Ito has been a driving force at the workshop ever since.

In 2007 Mr. Ito received the "Award for Technical Excellence" from Japan’s Ministry of Health, Labor and Welfare. This is a yearly award presented to selected craftsmen and technicians who have distinguished themselves through outstanding skill and achievements in their field.

Attracted by the opportunity to build complete instruments from start to finish in accordance with the Spanish tradition, as opposed to working on just one part on a production line, Mr. Ito began studying and building guitars with a passion, often working long after regular working hours to perfect his skills and create the perfect guitar.

His motto: "Never be satisfied with the way things are. There is always a better way. To continually pursue new and better ways of doing things is the driving force behind progress.”

There’s no end to learning when it comes to building guitars. Every piece of wood is different, and every guitar must be treated as an individual. That’s the fascination for me. It is a very, very deep subject that constantly poses new challenges and surprises.”

Mr. Ito is concerned about the increasing difficulty of sourcing top quality woods for use in hand made guitars, but is confident that Yamaha technology as well as the skill and dedication of the younger craftsmen he trains will make it possible to continue to deliver uncompromised sound and playability. But although he is nearing retirement age, Mr. Ito has no intention of laying down his tools.

"I'll continue building guitars as long as I’m physically capable. This is a job I love, and there is no end to learning. It’s the driving force behind doing things in a better way. That’s what I want to be doing at any age.”
In the end it’s all about the sound and the music, and that is Yamaha’s primary focus. We do whatever we can to give the artist tools that provide maximum freedom of expression, with consistency and thorough dependability. We are proud to be able to say that our own history is tightly interwoven with the history of modern guitar music.

### Acoustic Guitars

- **1966** FG180 and FG150 Yamaha’s first production “FG” guitars.
- **1971** FG1500, FG2000 and FG2500 handcrafted series using top-quality solid tone woods.
- **1972** Overseas acoustic guitar production established.
- **1974** L31, the first of the high-end “L” series.
- **1975** Custom-order production started.
- **1985** 2nd generation L series (LL and LS).
- **1987** APX series with thin bodies and cutaways.
- **1995** FG180 & FG1500 reissued.
- **1998** CPX “Compass” series with deep bodies and cutaways.
- **2001** SLG100N Silent Guitar – a revolution in the “acoustic” guitar industry.
- **2008** SLG100N Silent Guitar.
- **2010** SRT pickup system achieves unprecedented amplified realism and tone.

### Electric Guitars

- **1966** SG2 and SG3 with bolt-on necks and single-coil pickups.
- **1969** Development temporarily suspended.
- **1972** Development resumed. SG40, SG60 & SG80 with set necks and hum-canceling pickups.
- **1973** SG2000 and SG1000 developed with assistance from Carlos Santana.
- **1974** SG175 model adopted by Carlos Santana.
- **1976** SG2000 and SG1000 developed with assistance from Carlos Santana.
- **1982** BB900 bass guitar – Yamaha’s enduring relationship with bassist Nathan East begins.
- **1983** Overseas electric guitar production established.
- **1987** RGX series launched.
- **1989** YGD established (Yamaha Guitar Development, later expanded to become Yamaha Artist Services Hollywood).
- **1990** Pacifica, Attitude, and other models developed by YGD released.
- **1991** TRB bass series.
- **1993** Best-selling Pacifica 112 released.
- **1997** Pacifica 1511MS (Mike Stern signature model), made-in-USA Pacifica USA1 and USA2 introduced.
- **2000** Drop-6 scale models introduced.
- **2003** AGS620 series solid body guitars with set necks.
- **2009** RGXA2 and SG series produced at Yamaha Music Craft in Hamamatsu, Japan.
- **2010** Thoroughly revised SG guitar and BB bass lineup takes Yamaha to the forefront of today’s rock sound.

Although full-scale production of Yamaha acoustic and electric guitars officially began in 1966, Yamaha’s relationship with guitar craft actually goes back another 20 years. Classical guitar production began in 1946 with the assistance of renowned Spanish luthier Eduardo Ferrer, and the two decades that led up to the launch of mass-produced acoustic and electric instruments in 1966 provided a solid foundation of skill and experience on which the quality and reputation of Yamaha guitars would be based. Yamaha is no newcomer to the field, and is proud to have introduced a number of innovations that have become standards to which others aspire.

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