

# api casing and tubing sizes chart

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## Understanding the API Casing and Tubing Sizes Chart: A Complete Guide

When drilling an oil or gas well, every decision—from drilling fluid composition to the selection of drilling tools—has a direct impact on the well's safety, performance, and cost. Among the most critical decisions is choosing the correct **casing** and **tubing** sizes. These selections are guided by the **API (American Petroleum Institute) casing and tubing sizes chart**, a standardized reference that ensures consistency across the industry.

In this article, we'll dive deep into the API sizing system, explain why it matters, show you how to read and use the chart, and provide practical tips for selecting the right sizes for your drilling operations. Whether you're a drilling engineer, a field technician, or a student studying petroleum engineering, this guide will equip you with the knowledge you need to navigate the complexities of well casing and tubing.

## What Is the API Casing and Tubing Sizes Chart?

The API sizing chart is a table of standardized nominal pipe sizes (NPS) that the American Petroleum Institute has defined for the oil and gas industry. The chart lists:

- Nominal diameter (in inches)
- Wall thickness (inches)
- Outside diameter (OD)
- Inside diameter (ID)
- Weight per foot (or per meter)
- Common applications (e.g., surface casing, intermediate casing, production tubing)

These specifications are used worldwide, not only in the United States, because the API standards provide a common language that engineers can rely on when designing, fabricating, and installing well components.

## Why Is the API Chart Essential?

Choosing the wrong casing or tubing size can lead to:

1. Compromise of well integrity – A casing that is too thin may fail under high pressure, while an oversized casing can weaken the wellbore.
2. Increased costs – Larger diameters mean heavier steel and higher transport and installation costs.
3. Operational inefficiencies – Incorrect tubing can affect flow rates, pressure drops, and ultimately the production performance.
4. Safety hazards – Inadequate sizing can lead to blowouts, equipment failure, or exposure to hazardous substances.

Therefore, the API chart is not just a reference; it's a safety net that helps engineers and crews avoid costly mistakes.

## How to Read the API Casing and Tubing Sizes Chart

Below is a simplified example of a typical API sizing table. While the actual chart contains dozens of rows, the

structure remains consistent.

| Nominal Size (NPS) | Wall Thickness (in) | Outside Diameter (in) | Inside Diameter (in) | Weight per Foot (lb/ft) |
|--------------------|---------------------|-----------------------|----------------------|-------------------------|
| 12                 | 0.5                 | 12.75                 | 11.75                | 7.7                     |
| 14                 | 0.625               | 14.75                 | 13.50                | 10.4                    |
| 16                 | 0.75                | 16.75                 | 15.25                | 13.7                    |
| 18                 | 0.875               | 18.75                 | 17.00                | 17.5                    |
| 20                 | 1.0                 | 20.75                 | 18.75                | 22.0                    |

Key points to remember when consulting the chart:

- **Nominal Size** – The base diameter of the pipe in inches. It's not the actual outer diameter but a reference value.
- **Wall Thickness** – Determines the strength of the pipe. Thicker walls provide higher pressure rating.
- **Outside Diameter (OD)** – The actual outer dimension of the pipe. Critical for ensuring proper fit between casing and cement.
- **Inside Diameter (ID)** – The internal space through which fluids flow. Influences flow velocity and pressure drop.
- **Weight per Foot** – Useful for estimating material costs and transportation logistics.

## Common Casing and Tubing Sizes in the Industry

While the API chart includes a wide range of sizes, the following are the most frequently used:

### Casing Sizes

- **Surface Casing** – Typically 12" to 18" NPS, used to stabilize the surface wellbore and protect shallow formations.
- **Intermediate Casing** – Usually 8" to 14" NPS, placed between surface and production zones to isolate hazardous formations.
- **Production Casing** – Often 4" to 6" NPS, installed near the reservoir to provide a conduit for production tubing.

### Tubing Sizes

- **Production Tubing** – Commonly 2" to 4" NPS, designed for high flow rates and minimal pressure drop.
- **Completion Tubing** – May vary from 1.5" to 3" NPS, used for well completion tasks such as perforation and cementing.
- **Coiled Tubing** – Flexible tubing ranging from 1" to 4" NPS, employed for interventions and repairs.

## Converting Between Inches and Metric Units

In international projects, you'll often need to convert API sizes to metric units. The most common conversions are:

1. **Nominal Size to Millimeters** – Multiply the nominal diameter by 25.4.
2. **Wall Thickness to Millimeters** – Multiply the thickness by 25.4.
3. **Outside Diameter to Millimeters** – Multiply the OD by 25.4.
4. **Inside Diameter to Millimeters** – Multiply the ID by 25.4.
5. **Weight per Foot to Kilograms per Meter** – Multiply the weight by 0.3048 and convert pounds to kilograms (1 lb = 0.453592 kg).

Example: A 12" NPS pipe with a wall thickness of 0.5" has an OD of 12.75". Converting to metric:

- OD in mm:  $12.75" \times 25.4 = 323.85 \text{ mm}$
- ID in mm:  $11.75" \times 25.4 = 298.45 \text{ mm}$
- Wall thickness in mm:  $0.5" \times 25.4 = 12.7 \text{ mm}$

## Using the API Chart During Well Planning

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Choosing the right sizes involves several steps that integrate the API chart into the drilling design process.

### Step 1: Define Well Parameters

1. Identify the target depth and reservoir pressure.
2. Determine geological formations that need isolation.
3. Establish production goals (flow rate, pressure, and expected life of the well).

### Step 2: Select Casing Sizes

1. Use the API chart to choose surface casing that can handle surface pressures and mechanical stresses.
2. Choose intermediate casing to isolate high-pressure zones; ensure wall thickness meets pressure rating.
3. Select production casing with an ID that allows sufficient flow for the anticipated production rate.

### Step 3: Choose Tubing Sizes

1. Calculate pressure drop using the Darcy-Weisbach equation or the Hazen-Williams method, factoring in fluid viscosity and flow velocity.
2. Select tubing ID that minimizes pressure loss while staying within API size limits.
3. Consider coiled tubing for interventions if the well will require frequent maintenance.

### Step 4: Verify Compatibility

- Check that the casing OD is larger than the tubing ID to avoid interference.
- Ensure that cementing can be performed effectively; cement must bond to the casing's inside surface.
- Confirm that tooling such as drill collars, chokes, and blowout preventers fit the selected sizes.

## Safety and Regulatory Considerations

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In addition to mechanical integrity, compliance with regulatory standards is essential.

- API RP 2A – Provides guidelines for casing design and installation.
- API RP 5L – Defines standards for line pipe, often used as production tubing.
- ISO 3183 – International standard for steel pipes for pipeline transport of oil and gas.
- OSHA and DOT regulations – Govern transportation and handling of large-diameter pipes.

Adhering to these standards not only ensures safety but also protects the company from legal liabilities.

## Material Selection: Steel Grades and Coatings

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While the API chart specifies dimensions, the material choice can significantly influence performance.

### Steel Grades

- API 5CT – Common for casing; offers high tensile strength and corrosion resistance.
- API 5L X70/X100 – Typical for tubing; balances strength with weldability.
- API 5CT R90 – Used for deepwater casing; provides higher pressure tolerance.

### Coatings and Liners

- Polyurethane coatings – Protect against corrosion in sour gas environments.
- Galvanized steel – Provides sacrificial protection for shallow wells.
- Inner liners – Reduce friction and improve flow in production tubing.

## Installation and Maintenance Practices

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### Installation Sequence

1. Rig the surface casing and set it at the required depth.
2. Install intermediate casings, ensuring each is cemented properly.
3. Set production casing and run production tubing.
4. Perform pressure testing and leak checks before commissioning.

### Routine Inspection

- Use casing integrity surveys (CIS) to detect corrosion or cracks.
- Conduct well logging to verify cement bond quality.
- Schedule tubing inspections to monitor wear and erosion.

## Common Mistakes and How to Avoid Them

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- Choosing too large a casing – Leads to unnecessary weight and cost.
- Neglecting cementing – Can cause casing collapse or formation damage.

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