

## Sapa Industrial Extrusions

Sapa Industrial Extrusions markets several alloys in the 1xxx series for many specialty applications. This non-heat treatable aluminum alloy series is available in extruded sections with a minimum purity of 99.0% aluminum for 1100 alloy and as high as 99.6% minimum aluminum for 1060 alloy.

This alloy group offers the best corrosion resistance of any alloy group and displays excellent forming, welding, brazing and finishing characteristics. Excellent forming characteristics permit these alloys to be easily impacted, cold drawn, deep drawn and bent into various configurations. These alloys can be extruded as profiles, rod, bar and tubing. Common alloys available from Sapa are: 1050, 1060, 1100, and 1350.

Alloy 1060 is a high purity alloy with a 99.6% minimum aluminum content. Typical applications include chemical and food handling equipment, as well as containers for food, pharmaceuticals and liquids. Alloy 1100, slightly stronger, shares some of the same applications as alloy 1060, plus fin stock, spun hollowware, impacted fire extinguisher bottles and tubing. This alloy contains slight additions of silicon, iron, and copper for strength. Alloy 1350 is used primarily for electrical conductors, and -H111 temper exhibits the highest electrical conductivity of all extruded aluminum conductor grades, meeting or exceeding 61.0% IACS.

Consult the Material Safety Data Sheet (MSDS) for proper safety and handling precautions when using 1050, 1060, 1100 and 1350 alloys.

### Typical applications for alloy 1xxx include:

- Heat exchange tubing
- Impact stock
- Cable sheathing
- Food handling equipment
- Electrical conductors
- Medical and chemical instrumentation
- Pharmaceutical containers

## 1XXX TEMPER DESIGNATIONS AND DEFINITIONS

| Standard Tempers | Standard Temper Definitions*  |
|------------------|---|
| <b>F</b>         | As fabricated. There is no special control over thermal conditions and there are no mechanical property limits. |
| <b>O</b>         | Annealed. Applies to products that are annealed to obtain the lowest strength temper.                           |
| <b>H112</b>      | Strain hardened temper via the extrusion process to develop minimum property requirements.                      |
| <b>H111</b>      | Strain hardened temper via the extrusion process to develop minimum property requirements.                      |

\* For further details of definitions, see Aluminum Association's Aluminum Standards and Data manual and Tempers for Aluminum and Aluminum Alloy Products.

## CHEMICAL COMPOSITION Melting Temperature Range 1050, 1060, 1350: 1195-1215 °F Density: 0.0975 lb./in.<sup>3</sup> 1100: 1190-1215 °F Density: 0.098 lb./in.<sup>3</sup>

| Alloy       | Si           | Fe   | Cu        | Mn   | Mg   | Cr   | Zn   | Ti   | Others            |       | Aluminum (min.) |
|-------------|--------------|------|-----------|------|------|------|------|------|-------------------|-------|-----------------|
|             |              |      |           |      |      |      |      |      | Each              | Total |                 |
| <b>1050</b> | 0.25         | 0.40 | 0.05      | 0.05 | 0.05 | —    | 0.05 | 0.03 | 0.03 <sup>1</sup> | —     | 99.50           |
| <b>1060</b> | 0.25         | 0.35 | 0.05      | 0.03 | 0.03 | —    | 0.05 | 0.03 | 0.03 <sup>1</sup> | —     | 99.60           |
| <b>1100</b> | 0.95 Si + Fe |      | 0.05-0.20 | 0.05 | —    | —    | 0.10 | —    | 0.05              | 0.15  | 99.00           |
| <b>1350</b> | 0.10         | 0.40 | 0.05      | 0.01 | —    | 0.01 | 0.05 | —    | 0.03 <sup>2</sup> | 0.10  | 99.50           |

1. Vanadium 0.05 percent maximum.

2. Vanadium plus Titanium 0.02 percent maximum; Boron 0.05 percent maximum; Gallium 0.03 percent maximum

Chemical composition in weight percent maximum unless shown as a range or minimum.

Average Coefficient of Thermal Expansion 1050, 1060 and 1100: (68° to 212°F) =  $13.1 \times 10^{-6}$  (in./in.°F)  
1350: (68° to 212°F) =  $13.2 \times 10^{-6}$  (in./in.°F)

## FLATWISE BENDING RADIUS – 90° BENDS (BUS BAR ONLY)

| Alloy-Temper     | Thickness (inches) | Minimum Bend Radius  |
|------------------|--------------------|--|
| <b>1350-H111</b> | All thicknesses    | $1 \times \text{Thickness}^1 = \text{Minimum bend radius}$ |

1. Applicable to widths up through 12".

## 1XXX EXTRUDED MECHANICAL AND PHYSICAL PROPERTY LIMITS<sup>1</sup>

| Alloy | Standard Tempers | Wall Thickness <sup>2</sup><br>Inches (min.) | Tensile Strength<br>Ksi (min.) | Yield Strength<br>Ksi (min.) | Elongation <sup>3</sup><br>% (min.) | Typical Thermal<br>Conductivity, @77°F,<br>BTU-in./ft. <sup>2</sup> hr.°F | Typical Electrical<br>Conductivity,<br>@68°F, % IACS |
|-------|------------------|--|--------------------------------|------------------------------|-------------------------------------|---|--|
| 1050  | -F               | All  | No Properties Apply            |                              |                                     |   |  |
| 1060  | -F               | All  | No Properties Apply            |                              |                                     |   |  |
|       | -O               | All  | 8.5 -14.0                      | 2.5                          | 25.0                                | 1625  | 62   |
|       | -H112            | All  | 8.5                            | 2.5                          | 25.0                                | —   | —  |
| 1100  | -F               | All  | No Properties Apply            |                              |                                     |   |  |
|       | -O               | All  | 11.0 - 15.5                    | 3.0                          | 25.0                                | 1540  | 59   |
|       | -H112            | All  | 11.0                           | 3.0                          | —                                   | —   | —  |
| 1350  | -F               | All  | No Properties Apply            |                              |                                     |   |  |
|       | -H111            | All  | 8.5                            | 3.5                          | — <sup>4</sup>                      | 1625  | 62 (61.0 min.)                                       |

1. Minimum property levels unless shown as a range or indicated as a maximum (max.)
2. The thickness of the cross section from which the tension test specimen is taken determines the applicable mechanical properties.
3. For materials of such dimensions that a standard test specimen cannot be taken, or for shapes thinner than .062", the test for elongation is not required. Elongation percent is minimum in 2" or 4 times specimen diameter.
4. Elongation values are not required for this particular alloy.

## COMPARATIVE CHARACTERISTICS OF RELATED ALLOYS / TEMPERS<sup>1</sup>

| Alloy | Temper | Formability |   |   |   | Machinability |   |   |   | General Corrosion Resistance |   |   |   | Weldability |   |   |   | Brazeability |   |   |   | Anodizing Response |   |   |   |
|-------|--------|-------------|---|---|---|---------------|---|---|---|------------------------------|---|---|---|-------------|---|---|---|--------------|---|---|---|--------------------|---|---|---|
|       |        | D           | C | B | A | D             | C | B | A | D                            | C | B | A | D           | C | B | A | D            | C | B | A | D                  | C | B | A |
| 1060  | -O     | ██████████  |   |   |   | ██████████    |   |   |   | ██████████                   |   |   |   | ██████████  |   |   |   | ██████████   |   |   |   | ██████████         |   |   |   |
|       | -H112  | ██████████  |   |   |   | ██████████    |   |   |   | ██████████                   |   |   |   | ██████████  |   |   |   | ██████████   |   |   |   | ██████████         |   |   |   |
| 1100  | -O     | ██████████  |   |   |   | ██████████    |   |   |   | ██████████                   |   |   |   | ██████████  |   |   |   | ██████████   |   |   |   | ██████████         |   |   |   |
|       | -H112  | ██████████  |   |   |   | ██████████    |   |   |   | ██████████                   |   |   |   | ██████████  |   |   |   | ██████████   |   |   |   | ██████████         |   |   |   |
| 1350  | -H111  | ██████████  |   |   |   | ██████████    |   |   |   | ██████████                   |   |   |   | ██████████  |   |   |   | ██████████   |   |   |   | ██████████         |   |   |   |
| 6101  | -T6    | ██████████  |   |   |   | ██████████    |   |   |   | ██████████                   |   |   |   | ██████████  |   |   |   | ██████████   |   |   |   | ██████████         |   |   |   |
|       | -T63   | ██████████  |   |   |   | ██████████    |   |   |   | ██████████                   |   |   |   | ██████████  |   |   |   | ██████████   |   |   |   | ██████████         |   |   |   |
| 6101  | -T61   | ██████████  |   |   |   | ██████████    |   |   |   | ██████████                   |   |   |   | ██████████  |   |   |   | ██████████   |   |   |   | ██████████         |   |   |   |
|       | -T64   | ██████████  |   |   |   | ██████████    |   |   |   | ██████████                   |   |   |   | ██████████  |   |   |   | ██████████   |   |   |   | ██████████         |   |   |   |

1. Rating: A=Excellent B=Good C=Fair D=Poor

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