**COLMONOY®**

**TECH 1-K SURFACING ALLOYS SELECTOR CHART**

**TECH 1-K Surfacing Alloys Selector Chart**

**COLMONOY**

(nickel-based)

<table>
<thead>
<tr>
<th>ALLOY</th>
<th>NOMINAL COMPOSITION (%)</th>
<th>ROCKWELL HARDNESS</th>
<th>FUSING TEMPERATURE (APPROX.)</th>
<th>SUPPLIED AS</th>
<th>METHOD OF APPLICATION</th>
<th>DESCRIPTION AND GENERAL USES</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>0.6 14.0 3.0 4.2 4.0 Bal</td>
<td>56-63</td>
<td>1890 °F 1030 °C</td>
<td>Crushed Powder, Bare Rods, Ingot</td>
<td>Spraywelder, Fuseseeder, Oxyseeder, GTAW, MAW, GTA, Laser Cladding</td>
<td>The original, nickel-based hard-surfacing alloy, containing diamond-like chromium borides and carbides. Extremely resistant to wear, especially under corrosive conditions. Low coefficient-of-friction. Can be hot-formed. Finished by grinding. See spec. I.</td>
</tr>
<tr>
<td>56</td>
<td>0.5 13.0 2.6 3.8 4.0 Bal</td>
<td>50-55</td>
<td>1885 °F 1030 °C</td>
<td>Crushed Powder, Bare Rods, Ingot, Cored Wire</td>
<td>Spraywelder, Fuseseeder, Oxyseeder, GTAW, MAW, GTA, Laser Cladding</td>
<td>Better ductility and impact resistance than Colmonoy 6. Finished with carbide tools and grinding. Used for valve seats, ball valves, and marine engine valves.</td>
</tr>
<tr>
<td>5</td>
<td>0.5 13.8 2.3 3.4 4.0 Bal</td>
<td>45-50</td>
<td>1880 °F 1025 °C</td>
<td>Atomized Powder, Crushed Powder, Ingot</td>
<td>Spraywelder, Fuseseeder, Oxyseeder, GTAW, MAW, PTA*, Laser Cladding</td>
<td>Has greater ductility, better impact resistance and workability than Colmonoy 6. For wear rings, plungers, dies. Finished with carbide tools and grinding. See spec. II. When used with “salt bath” quenching is required to achieve a hardened base metal. Also used for glass mould press-n-blade plunger.</td>
</tr>
<tr>
<td>45</td>
<td>0.5 12.0 2.3 3.0 3.5 Bal</td>
<td>43-46</td>
<td>1910 °F 1045 °C</td>
<td>Atomized Powder, Crushed Powder, Ingot</td>
<td>Spraywelder, PTA*, Laser Cladding</td>
<td>Developed for the oil patch industry for the sole purpose of being able to be polymer quenched. This quenching process is more severe than “salt bath” quenching to achieve a deeper and more thorough hardening of the base metal. The polymer is held at around 150°F.</td>
</tr>
<tr>
<td>4</td>
<td>0.4 10.0 2.2 2.3 2.5 Bal</td>
<td>35-48</td>
<td>1925 °F 1050 °C</td>
<td>Atomized Powder, Crushed Powder, Ingot</td>
<td>Spraywelder, Fuseseeder, Oxyseeder, GTAW, MAW, PTA*, Laser Cladding</td>
<td>Has greater impact resistance and workability than Colmonoy 5. For dies, moulds, valves, and plungers. Finished with carbide tools and grinding. See spec. III. Used for glass mould press-n-blade plungers.</td>
</tr>
<tr>
<td>984</td>
<td>8.0 3.2 4.2 2.0 Bal</td>
<td>55-60</td>
<td>1860 °F 1015 °C</td>
<td>Atomized Powder</td>
<td>Spraywelder, Fuseseeder</td>
<td>Nickel-based alloy with superior resistance to corrosive liquids. Low coefficient-of-friction to reduce metal-to-metal adhesive wear.</td>
</tr>
<tr>
<td>882</td>
<td>0.6 15.0 3.0 4.0 3.5 Bal</td>
<td>59-64</td>
<td>2020 °F 1100 °C</td>
<td>Atomized Powder, Bare Rod, Cored Wire</td>
<td>Spraywelder, Fuseseeder, Oxyseeder, GTAW, MAW, (PTA*, SP 1015°F)</td>
<td>Unique alloy contains chromium and tungsten borides and carbides for maximum abrasion and corrosion resistance. For high-temperature, highly abrasive applications, glass mould plungers, pump plungers and sleeves, valve seats, plastics extrusion screws. Finished by grinding or CBN tools.</td>
</tr>
<tr>
<td>84</td>
<td>1.1 29.0 1.4 2.2 2.0 Bal</td>
<td>40-45</td>
<td>2000 °F 1095 °C</td>
<td>Atomized Powder, Ingot</td>
<td>Spraywelder, PTA*, Laser Cladding</td>
<td>A nickel-based alternative to cobalt surfacing alloys, for service temperatures up to 1500 °F. Boron and silicon content provide better weldability at lower application temperatures.</td>
</tr>
<tr>
<td>723</td>
<td>0.5 12.0 3.2 3.0 4.0 Bal</td>
<td>13.0</td>
<td>1940 °F 1065 °C</td>
<td>Atomized Powder, Bare Rod, Cored Wire</td>
<td>Spraywelder, Fuseseeder, Oxyseeder, GTAW, MAW (PTA*, SP 1015°F)</td>
<td>Tungsten content strengthens the nickel matrix, giving this alloy excellent resistance to low-stress abrasion and scoring action. Wear resistance often superior to Colmonoy 6. For pump parts. Finished by grinding.</td>
</tr>
<tr>
<td>69</td>
<td>0.5 16.5 3.5 5.1 3.0 Bal</td>
<td>57-63</td>
<td>1890 °F 1060 °C</td>
<td>Atomized Powder</td>
<td>Spraywelder (1651C, NO2), SP 1015°F</td>
<td>Additions of chromium and molybdenum for better corrosion resistance. Wide plastic range makes overlays easier to fuse without sagging. For marine and Petro-chemical applications. Finished by grinding.</td>
</tr>
<tr>
<td>62</td>
<td>0.6 14.0 3.0 4.2 4.0 Bal</td>
<td>56-63</td>
<td>1890 °F 1060 °C</td>
<td>Atomized Powder</td>
<td>Spraywelder (6254A, NO3), SP 1025°C</td>
<td>Hard nickel-chromium-boron alloy containing chromium carbides. Excellent abrasion and corrosion resistance. Recommended for hardfacing parts to resist wear, corrosion, heat and scaling. Typical applications: shafts, sleeves, pump plungers, sucker rod couplings, bed knives, camshafths, bushings, mill guides, mixer blades, seal rings, brick manufacturing equipment, and conveyor screws.</td>
</tr>
<tr>
<td>52</td>
<td>0.5 13.5 2.4 3.7 4.0 Bal</td>
<td>45-50</td>
<td>1950 °F 1065 °C</td>
<td>Atomized Powder</td>
<td>Spraywelder (5254A, NO3), SP 1025°C</td>
<td>Similar to Colmonoy 62, but has increased ductility with slightly lower abrasion resistance and similar corrosion resistance. Finished by grinding.</td>
</tr>
<tr>
<td>42</td>
<td>0.2 4.0 1.2 2.8 &lt;0.5 Bal</td>
<td>35-48</td>
<td>1800 °F 980 °C</td>
<td>Atomized Powder</td>
<td>Spraywelder (5254A, NO3), SP 1025°C</td>
<td>Better ductility and toughness than Colmonoy 52. Less hardness and slightly less abrasion and corrosion resistance. Addition of molybdenum improves malleability to shaping or sharp corners. Finished by carbide tools and grinding.</td>
</tr>
</tbody>
</table>

Note:
- 1 See WCC TECH-PTA/HPF Selector Chart
- Specification / MEL: D-77713C-1NC-C-5 & 1NC-C SSA: D-77713C-1NC-A ARS: D-77713C-1NC-A
- Specification / MEL: D-77713C-1NC-C-7 & 1NC-C SSA: D-77713C-1NC-A ARS: D-77713C-1NC-A
- Specification / MEL: D-77713C-1NC-B & 1NC-C SSA: D-77713C-1NC-A ARS: D-77713C-1NC-B
- Specification / MEL: D-77713C-1NC-A & 1NC-B SSA: D-77713C-1NC-A ARS: D-77713C-1NC-A
- Specification / MEL: D-77713C-1NC-A SSA: D-77713C-1NC-A ARS: D-77713C-1NC-A

* Specification & MEL: D-77713C-1NC-C-5 & 1NC-C SSA: D-77713C-1NC-A ARS: D-77713C-1NC-A

Contains chromium-boride crystals (hardness 3700 HV), made by a patented process, exclusive to certain Colmonoy alloys.

2 U.S. Patent No. 5,141,571
3 U.S. Patent No. 3,848,429
4 U.S. Patent No. 5,183,636

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## COLMONOY® Surfacing Alloys

### Alloy Nominal Composition (%)

<table>
<thead>
<tr>
<th>Alloy</th>
<th>C</th>
<th>Cr</th>
<th>B</th>
<th>Si</th>
<th>Fe</th>
<th>Ni</th>
<th>Mo</th>
<th>W</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>234</td>
<td>0.2</td>
<td>4.0</td>
<td>1.0</td>
<td>2.8</td>
<td>Bal</td>
<td>3.0</td>
<td>P: 2.1</td>
<td>32-36</td>
<td>1825 °F (995 °C)</td>
</tr>
<tr>
<td>229</td>
<td>3.0</td>
<td>1.0</td>
<td>2.7</td>
<td></td>
<td>Bal</td>
<td>2.0</td>
<td>P: 25-30</td>
<td>1680 °F (915 °C)</td>
<td></td>
</tr>
<tr>
<td>228</td>
<td>1.0</td>
<td>3.7</td>
<td></td>
<td></td>
<td>Bal</td>
<td>2.0</td>
<td>P: 28-33</td>
<td>1705 °F (930 °C)</td>
<td></td>
</tr>
<tr>
<td>227</td>
<td>0.9</td>
<td>2.7</td>
<td></td>
<td></td>
<td>Bal</td>
<td>2.1</td>
<td>P: 22-27</td>
<td>1680 °F (915 °C)</td>
<td></td>
</tr>
<tr>
<td>226</td>
<td>0.8</td>
<td>2.2</td>
<td></td>
<td></td>
<td>Bal</td>
<td>1.9</td>
<td>P: 18-21</td>
<td>1715 °F (935 °C)</td>
<td></td>
</tr>
<tr>
<td>225</td>
<td>0.5</td>
<td>2.2</td>
<td></td>
<td></td>
<td>Bal</td>
<td>1.9</td>
<td>P: 13-17</td>
<td>1650 °F (960 °C)</td>
<td></td>
</tr>
<tr>
<td>63</td>
<td>0.6</td>
<td>14.0</td>
<td>4.2</td>
<td>4.0</td>
<td>Bal</td>
<td></td>
<td>P: 56-63</td>
<td>1875 °F (1025 °C)</td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>0.5</td>
<td>13.5</td>
<td>2.4</td>
<td>3.7</td>
<td>4.0</td>
<td>Bal</td>
<td></td>
<td>45-53</td>
<td>1950 °F (1065 °C)</td>
</tr>
<tr>
<td>43</td>
<td>0.2</td>
<td>4.0</td>
<td>1.2</td>
<td>2.8</td>
<td>Bal</td>
<td>3.0</td>
<td>P: 2.2</td>
<td>35-40</td>
<td>1800 °F (980 °C)</td>
</tr>
<tr>
<td>23A/24</td>
<td>1.5</td>
<td>2.5</td>
<td></td>
<td></td>
<td>Bal</td>
<td>16-23</td>
<td>1950 °F (1065 °C)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>1.0</td>
<td>3.7</td>
<td></td>
<td></td>
<td>Bal</td>
<td>2.2</td>
<td>P: 28-33</td>
<td>1705 °F (930 °C)</td>
<td></td>
</tr>
</tbody>
</table>

### SUPPLIED AS

- **Atomized Powder**: Used for torch applications such as welding and surfacing. Supplied in a fine powder form for easy application and fusion.
- **Bare Rod**: Supplied in a solid rod form for manual application and alignment. Good for edge applications and precise placement.
- **Ingot**: Supplied in a cast form for large-scale applications. Suitable for high-volume manufacturing and industrial use.

### METHOD OF APPLICATION

- **Fusewelder**: Application using an electric arc to melt and fuse the alloy to the surface, suitable for a wide range of applications including repair, refurbishment, and wear protection.
- **HVOF**: High-velocity oxygen-fuel spraying, a method that accelerates the powder particles at high speeds to create a dense, hard coating. Suitable for high-speed wear applications.

### DESCRIPTION AND GENERAL USES

- **234**
  - Description: Atomized Powder, Fusewelder.
  - Application: Specifically designed to be used with the Colmonoy Fusewelder Torches for glass mould components. Slightly harder than Colmonoy 23A, with increased wear resistance and good corrosion resistance.

- **229**
  - Description: Atomized Powder, Fusewelder.
  - Application: Harder version of Colmonoy 23A and 24, for similar applications. Can be finished with a file, used by commercial mould shops to coat seams and finish moulds and blanks.

- **228**
  - Description: Atomized Powder, Fusewelder.
  - Application: Harder version of Colmonoy 23A and 24, for similar applications. Can be finished with a file, used by commercial mould shops to coat seams and finish moulds and blanks.

- **227**
  - Description: Atomized Powder, Bare Rod, Deposition, GTA.
  - Application: Harder version of Colmonoy 23A and 24, for similar applications. Can be finished with a file, used by commercial mould shops to coat seams and finish moulds and blanks.
  - Temperature: Fusing Temperature (Approx.) - 1680 °F (915 °C). Rockwell Hardness (C-scale) - P: 22-27.

- **226**
  - Description: Atomized Powder, Fusewelder.
  - Application: Harder version of Colmonoy 23A and 24, for similar applications. Can be finished with a file, used by commercial mould shops to coat seams and finish moulds and blanks.

- **225**
  - Description: Atomized Powder, Fusewelder.
  - Application: Harder version of Colmonoy 23A and 24, for similar applications. Can be finished with a file, used by commercial mould shops to coat seams and finish moulds and blanks.

- **63**
  - Description: Atomized Powder, Fusewelder, HV0.5.
  - Temperature: Fusing Temperature (Approx.) - 1875 °F (1025 °C). Rockwell Hardness (C-scale) - P: 56-63.

- **53**
  - Description: Atomized Powder, Fusewelder, HV0.5.
  - Application: Similar to Colmonoy 63, but has increased ductility with slightly lower abrasion and corrosion resistance. Finished by grinding.
  - Temperature: Fusing Temperature (Approx.) - 1950 °F (1065 °C). Rockwell Hardness (C-scale) - P: 45-53.

- **43**
  - Description: Atomized Powder, Fusewelder, HV0.5.
  - Application: Similar to Colmonoy 53, but better ductility, less hardness, and slightly less abrasion and corrosion resistance. Finished by carbide tools and grinding.

- **23A/24**
  - Description: Atomized Powder, Bare Rod, Ingot, Fusewelder, Deposition, GTA.
  - Application: Used to repair blow holes, flaws, chips, and cracks in cast iron parts. Colmonoy 23A works best in repairing surface flaws. Colmonoy 24 is recommended for working on edges or corners due to its minimal overspray. Finished by grinding or filing. Colmonoy 23A and 24 are used by commercial mould shops to coat seams of finish moulds and blanks.

### Notes

1. Contains tungsten-carbide particles (hardness 2400 HV)
2. U.S. Patent 5,234,510
3. European Patent 0498989

*See WCC_Tech-PTA/HVOF Selector Chart*
### Bare Rods

Oxyacetylene, GTAW

A nickel-chromium-boron matrix alloy rich in chromium boride is used to hold extremely hard tungsten-carbide particles. Produces rod-welded deposits with same chemistry as spray-applied Colmonoy 75 or 705. Finished by grinding.

### Composite Powder Spraywelder

A nickel-based composite powder for applications requiring high abrasion resistance. Contains a moderately high volume percent of extremely abrasion resistant tungsten-carbide particles (3500 DPH).

### Composite Powder Fusewelder


### Composite Powder Spraywelder


### Composite Powder Spraywelder

A tough nickel-chromium-tungsten matrix alloy is used to hold extremely hard tungsten-carbide particles. Best used for the most severe abrasive conditions. Finished by grinding.

### Atomized Powder, Ingot Spraywelder, Fusewelder

A cobalt-nickel alloy powder that forms deposits similar to those of Wallex 50, but softer. Finished with carbide tools and grinding. Developed as a lower temperature alternative for many cobalt-6 applications.

### Atomized Powder, Ingot Spraywelder, Fusewelder

Good corrosion resistance and low coefficient-of-friction provides good metal-to-metal wear protection (not involving much impact). For bushings, knives, and cams. Finished by grinding.

### WALLEX™ (cobalt-based)

<table>
<thead>
<tr>
<th>ALLOY</th>
<th>NOMINAL COMPOSITION (%)</th>
<th>ROCKWELL HARDNESS (C-scale)</th>
<th>FUSING TEMPERATURE (APPROX.)</th>
<th>SUPPLIED AS</th>
<th>METHOD OF APPLICATION</th>
<th>DESCRIPTION AND GENERAL USES</th>
</tr>
</thead>
<tbody>
<tr>
<td>ColTung™ 1</td>
<td>1.8 Cr 7.0 B 1.9 Si 2.7 Fe 22 Bal 38.5 Co 0.12 59-64</td>
<td>1900 °F 1049 °C</td>
<td>Bare Rods Oxyacetylene, GTA W</td>
<td>A nickel-chromium-boron matrix alloy rich in chromium boride is used to hold extremely hard tungsten-carbide particles. Produces rod-welded deposits with same chemistry as spray-applied Colmonoy 75 or 705. Finished by grinding.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>2.5 Cr 9.0 B 1.7 Si 2.9 Fe 22 Bal 33.0 Co 4.8 58 min 1550 °F 1066 °C</td>
<td>Composite Powder Spraywelder</td>
<td>A nickel-based composite powder for applications requiring high abrasion resistance. Contains a moderately high volume percent of extremely abrasion resistant tungsten-carbide particles (3500 DPH).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>2.9 Cr 7.5 B 1.4 Si 2.4 Fe 22 Bal 41.4 Co 6.0 57-63 1550 °F 1066 °C</td>
<td>Composite Powder Spraywelder</td>
<td>A nickel-chromium-boron matrix alloy holds extremely hard tungsten-carbide particles. Used primarily for protection from severe sliding abrasion. Finished by grinding.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>635</td>
<td>2.3 Cr 8.0 B 1.9 Si 3.0 Fe 22 Bal 30.8 Co 2.1 57-63 1530 °F 1055 °C</td>
<td>Composite Powder Spraywelder</td>
<td>A nickel-chromium-boron matrix alloy holds extremely hard tungsten-carbide particles. Provides excellent protection against abrasive wear.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>705</td>
<td>2.2 Cr 7.0 B 1.5 Si 2.1 Fe 22 Bal 48.1 56-63 1575 °F 1025 °C</td>
<td>Composite Powder Fusewelder</td>
<td>A tough nickel-chromium-boron matrix alloy holds extremely hard tungsten-carbide particles used for protection from severe sliding abrasion. Used on screw conveyors and augers. Finished by grinding.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>730</td>
<td>2.4 Cr 8.4 B 1.8 Si 2.4 Fe 22 Bal 39.2 Co 2.1 57-63 1540 °F 1063 °C</td>
<td>Composite Powder Spraywelder</td>
<td>A tough nickel-chromium-tungsten matrix alloy holds extremely hard tungsten-carbide particles. Finer mesh tungsten carbide than Colmonoy 750. Used on pump plungers and sleeves for protection from fine-particulate abrasive conditions. Minimizes packing wear. Finished by grinding.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>750</td>
<td>3.0 Cr 6.0 B 1.6 Si 1.5 Fe 22 Bal 46.8 Co 6.0 57-63 1560 °F 1070 °C</td>
<td>Composite Powder Spraywelder</td>
<td>A tough nickel-chromium-tungsten matrix alloy is used to hold extremely hard tungsten-carbide particles. Best used for the most severe abrasive conditions. Finished by grinding.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### TECH 1-K Surfacing Alloys Selector Chart

The information provided herein is given as a guideline to follow. It is the responsibility of the end user to establish the process information most suitable for their specific application(s). Wall Colmonoy Corporation assumes no responsibility for failure due to misuse or improper applications, or for any incidental damages arising out of the use of this material or process.

1. Contains tungsten-carbide particles (hardness 2600 HV)
2. U.S. Patent 5,236,510
3. European Patent 0498989

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